

This book has been reprinted from the original publication without revisions.
The Cincinnati Milling Machine Company, by change of name, now is Cincinnati Milacron Inc.

WARNING

In order to clearly show details of this machine, some covers, shields, doors, guards, or other protective devices have either been removed or shown in an "open" position. All such protective devices shall be installed in position before operating this machine. Failure to follow this instruction may result in damage to machine components and/or personal injury.

PARTS and SERVICE MANUAL

for
CINCINNATI MILACRON®
NOs. 2,3, and 4
PLAIN, UNIVERSAL & VERTICAL
DIAL TYPE MILLING MACHINES
MODEL (OM)
PUBLICATION NO. M-1790 & 1912

IMPORTANT

Carefully read the instructions and safety precautions given in this manual. Do not attempt to service this machine/equipment until you have read this manual thoroughly.

At the time of writing, the book was completely up-to-date. However, due to continual improvements in design, it is possible that descriptions contained herein may vary to a slight extent from the machine delivered to you. This merely implies that the machine has been improved to better fulfill your requirements. If there are any questions, you are encouraged to contact the nearest Cincinnati Milacron representative for clarification.

CINCINNATI MILACRON

Cincinnati, Ohio 45209

©1953 THE CINCINNATI MILLING MACHINE CO.
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SAFETY PRECAUTIONS

IMPORTANT

These safety precautions for this CINCINNATI MILACRON MACHINE TOOL have been prepared to assist the operator and maintenance personnel in the performance of good shop safety procedures in general.

Operator and maintenance personnel shall read and understand these precautions completely before operating, setting up, running, or performing maintenance on the machine. Failure to comply with instructions may result in serious or fatal injury. These precautions are to be used as a guide to supplement the following:

- a) All other manuals pertaining to the machine.
- b) Local, plant, and shop safety rules and codes.
- c) Federal and national safety laws and regulations.

NOTE: Emphasis should be placed on information set forth in the latest edition of the OCCUPATIONAL SAFETY AND HEALTH STANDARDS which is available from the DEPARTMENT OF LABOR, WASHINGTON, D.C. These standards contain the present occupational safety and health standards set forth by Federal regulations.

GENERAL SAFETY INSTRUCTIONS AND CONSIDERATIONS

PERSONAL SAFETY

Remember, machines do not cause accidents, injuries or death. People do! Careless . . . over-confident people. THINK . . . ACT Safety.

Know and respect your machinery. Read and practice the prescribed safety and checking procedures. Make sure that everyone who works for, with or near you fully understands – and more importantly – follows these safety precautions and procedures when operating machines.

Always be mentally alert on the job and keep in good physical condition. A person who is not alert can injure himself.

Avoid sudden movements, loud noises, etc. which can distract others who are working near you.

Be alert to conditions in your working area and throughout the plant. Observe "No Smoking", "High Voltage" and other warnings.

Accidents can occur that result in serious personal injury to yourself or others due to clothing and other articles becoming entangled in cutters, handwheels, levers, or moving machine elements. The following suggestions, if followed, will help you to avoid such accidents: Neckties, scarfs, loose hanging clothing, and jewelry such as watches, rings, or necklaces should not be worn around moving machinery. Wear a short sleeve shirt or roll your sleeves up past your elbow, and keep your shirt tucked in. If you have long hair restrain it with a cap or net. Wear proper gloves only when essential, such as for handling rough, sharp or hot parts. Never wear gloves when they can become entangled in the machine.

A number of types of protective equipment are available which can help you to avoid injury. Always wear approved eye or face protection and keep it clean. Wearing safety toe shoes with skid-proof soles will help to prevent injuries. Wear a safety hat if required by your company's safety standards. Keep your protective equipment in good condition and be sure it meets or exceeds any required or recommended standards.

YOUR WORK AREA

Always keep your working area clean. Dirty work areas with such hazards as oil or water on the floor may cause someone to fall to the floor, into the machine or onto another object resulting in serious personal injury.

Make sure your work area is free of hazardous obstructions and be aware of protruding machine members while working around the machine. Keep materials and equipment out of the aisles. Equipment should be returned to its proper storage place after use. Keep your workbench neat and clean; keep tools and workpieces in order.

Place oily rags in covered metal containers and throw all trash and scrap in the proper waste containers. Nails, broken glass, and chips are particularly dangerous. Always use a broom and pan; never pick them up with your bare hands or serious cuts can result. Remove nails from lumber or containers that must be handled by yourself or others.

If work platforms are used around the machine make sure they are sturdy with anti-slip surfaces. Report worn or broken flooring, stair treads, handrails or any other unsafe condition to your supervisor. When climbing, make sure ladders and scaffolds are strongly built and in good condition. Never climb on stock, machines or makeshift "ladders" built of skids, tote pans, boxes, etc.

Have proper lighting around the machine. A poorly lighted work area can lead to eyestrain or an accident. Light should not be directed into an operator's eyes.

YOUR TOOLS

Always handle cutting tools with gloves or a shop cloth as new or reground tools have very sharp edges and careful handling can prevent unnecessary cuts. Carefully inspect the tools for cracks or flaws and use only properly sharpened tools. Dull or improperly sharpened tools can break causing serious injury to yourself or others.

Use a cloth rag to wipe the tools free of grease, coolant or cutting fluids making certain the spindle is stopped and the machine is not in cycle. Maintain tooling in good condition by replacing worn adjusting nuts, clamp nuts, etc.

Store cutters and tools in a safe manner with cutting edges down or coated with plastic so that you will not be injured by accidentally striking them with a part of your body. Wrenches, tools and other miscellaneous parts should be kept off the machine table, and all moving units of the other machine. Avoid using the machine elements as a workbench.

When improperly used, compressed air can be dangerous and result in serious injury. Never use compressed air for cleaning the machine, the work area, workbench, tools, workpieces, measuring instruments or clothes. Use care to prevent air blast from air operated tools from carrying chips and dirt in your direction or toward others. Don't blow air toward other people or machines; the air nozzle itself may contain small chips.

LIFTING AND CARRYING

Improper lifting or carrying can result in serious injury, especially back injury. The following suggestions may help you to avoid injury:

Size up the load first for weight and size. Inspect the load for nails or other protrusions that might cause injury. Get help before you handle a large or very heavy object.

Make sure that your footing is secure. Crouch as close to the object as practical.

Get a good grip on the object. Lift slowly by straightening your legs. (Keep your back relatively straight. Your leg muscles, not your back, should do the work.) Keep the load close to your body as you come up.

Lift the load to the carrying position. If necessary to change your direction when in the upright position, turn your body with changes of foot positions. Be careful not to twist your body.

If you set the load on a bench or table, place it on the edge to make the table take part of the weight. Then push the load forward using the arms or, if necessary, part of the body.

If you must lift the object higher than your waist, first lift the load waist high (using the procedure just described), then rest it on a support while you change your grip. Now bend your knees again to give added leg-muscle power for the final lift.

When carrying an object, always have a clear vision over the load.

While carrying an object, do not try to change its position or adjust your grip while you are in motion. If the load interferes with normal walking, get help.

When putting the load down to the floor surface from a waist-high carrying position, bend the knees and, with a straight back and the load close to the body, lower the object with the arm and leg muscles.

Use power hoists or other mechanical lifting and carrying equipment for heavy objects that exceed weights set forth by safety standards or by your own physical limitations. Bulky or hard to handle objects should also be lifted or carried with the aid of mechanical devices rather than by hand. This can help to avoid injury. Use hookup methods recommended by your safety department and know the signals for safely directing a crane operator.

WARNING

Regularly inspect slings, chains, hoists, and other lifting devices. For frequency of inspection refer to the Williams-Steiger Occupational Safety and Health Act 1910.179, and any instructions applicable to the equipment. Any unsafe equipment should be repaired properly or discarded immediately. Use of unsafe lifting equipment can result in serious injury to yourself or others.

WARNING

Cranes, hoists, slings, eyebolts, and other lifting equipment have safety rated capacities which should never be exceeded. Be sure the equipment is adequate for the load and application. Refer to standards and instructions applicable to any lifting equipment you use. (For example ANSI Standard B18.15 available from The American National Standards Institute, Inc., 1430 Broadway, New York, New York 10018, contains information concerning safe lifting loads for different size eyebolts, for various angles of lift and application instructions for safe use of eyebolts.) Overloaded or unsafe lifting equipment can result in serious injury to yourself or others.

WARNING

Never place any part of your body under a suspended load or move a suspended load over any part of another person's body. Be certain that you have safe spot for depositing the load before lifting. A falling load, for whatever reason, can result in serious injury or death.

OCCUPATIONAL SAFETY AND HEALTH ACT (O.S.H.A.) COLOR CODING SYSTEM

The Occupational Safety and Health Act has designated a color coding system for the marking of various areas on machine tools. This color coding system is designed to point out the various areas on the machine tool which are shielded or guarded, the potential pinch points and the areas of other potential hazards. Since safety to the operator, as well as maximum productivity of the machine tool, is of the utmost concern, everyone who comes in contact with the machine should read and understand the color coding system which follows:

"Stop buttons or electrical switches used for emergency stopping of machinery shall be **red**."

"**Orange** shall be used as the basic color for designating dangerous parts of machines or energized equipment which may cut, crush, shock, or otherwise injure, to emphasize such hazards when enclosure doors are open or when gear belt, or other guards around moving equipment are open or removed, exposing unguarded hazards."

"**Yellow** shall be the basic color for designating caution and for marking physical hazards such as: Striking against, stumbling, falling, tripping, and 'caught in between'. Solid yellow, yellow and black stripes, yellow and black checkers (or yellow with suitable contrasting background) should be used interchangeably, using the combination which will attract the most attention in the particular environment."

"Colors shall meet the tests specified in section 3, Color Definitions, of ANSI Z53.1-1967. Safety Color Code for Marking Physical Hazards."

NOTE: The color **orange** should never be exposed when all safety guards and covers are properly in place.

When surfaces of the machine have been color coded for safety precautions, this identity should be maintained as well as the exact original color.

INSTALLATION AND RELOCATION

When your machine first arrives at your plant or when it is relocated certain safety precautions are in order.

Do not attempt to lift the machine before consulting the operator's instruction manual for proper methods and procedures. Read and completely understand the installation instructions in the machine service manual before attempting installation. Also refer to these instructions when relocating the machine. Be sure your lifting equipment is rated for safe lifting well above the machine weight.

Always check that all lubrication points on the machine have been filled with the proper amount and type of lubricant before attempting to run the machine. Refer to the lubrication chart and diagram in the service manual or operator's instruction manual for the location of lubrication points, frequency of attention, special instructions and type of lubricant.

Only a qualified electrician, designated to work on machine tool circuits, should be allowed to perform maintenance or "hook-up" of the electrical system. Read and completely understand the electrical schematics for the machine. After "hooking up" the machine you should test all aspects of the electrical system for proper functioning. Be sure the machine is grounded properly and check that all exposed electrical systems are covered properly. Place all selector switches in their "OFF" or neutral (disengaged) position; be sure that machine push buttons, manual limit switches or controls are set for a safe set-up; and check that the doors of the main electrical cabinet are closed and that the main disconnect switch is in the "OFF" position before you can consider the "hook up" job completed.

If, for any reason, the electrical work cannot be completed and the machine must be left unattended, always lock the main disconnect switch in the "OFF" position. Never bypass or wire around safety limit switches.

SAFETY IN SET-UP AND OPERATION

Do not attempt to set up or operate this machine or perform maintenance on it until you read, know and practice all the safety instructions in this manual. These include general safety instructions, safety instructions for set up, operation and maintenance, and the explanation of OSHA color coding. Know and practice safety rules set forth by your company. Failure to act in a "safety-minded" manner can result in serious injury to yourself and others.

When the machine is installed be sure that the motors rotate in the proper indicated direction.

WARNING

Operators and maintenance personnel shall carefully read, understand and fully comply with all machine mounted warning and instruction plates. Do not paint over, alter or deface these plates or remove them from the machine. Replace all plates which become unreadable. Replacement plates are available on request from Cincinnati Milacron. Certain safety guards, covers and protective devices have been provided for the machine. Do not operate the machine with these disconnected, removed or out of place. Additional guards may be necessary and it is the responsibility of the employer to furnish any additional protective devices required, including "point of operation" guarding. Failure to observe and abide by these warnings and instructions, or operation of a machine without necessary guards and protective equipment can result in serious injury to yourself and others.

Only qualified personnel, instructed in safety and all machine functions, should be entrusted to operate this machine. Use only the machines you are authorized and qualified to use.

Familiarize yourself with the machine before attempting to set up or operate it. Respect its power and capability. Know where all stop buttons are located in case of an emergency and be familiar with warning lights or signals that warn of a malfunction. Know the controls and all external moving parts of the machine. Read and understand the operator's instruction manual and operate the machine only as set forth in the manual.

WARNING

Safety disengagements or interlocks are provided on handwheels to keep them out of engagement when they are not in use. Do not remove these devices. Safety stop dogs, limit switches, interlocks, etc. are provided for the various slides. Do not remove them or bypass them in an effort to obtain more travel or take a "short cut". Serious damage to the machine or injury to the operator or others can result. If the job requires greater range, the work must be performed on a machine with greater travel.

Before setting up or operating a machine be sure all belt guards are in place. These guards are designed to protect not only the operator but anyone who might accidentally fall against the moving belts and sheaves. Be sure **all** guards are in place and properly adjusted; keep all doors on the machine closed; and be sure that all covers are in place on the machine. Be certain that all slide clamps are loosened before trying to move the slides by hand or power.

When setting up a workpiece or fixture be certain it is a safe distance away from the cutting tool and position it so that force does not have to be exerted toward the cutter. Also, retract the workpiece a safe distance from the cutting tool and stop the spindle when loading and unloading. Striking against a cutter, even when it is not in motion, can result in serious injury. When tightening or loosening a fastener, maintain secure footing in case the tool slips.

Mount your fixture or workpiece as close to the column side of the table as is possible. Use an arbor with the largest diameter and shortest length that can be used for the job and mount the cutter as close as possible to the spindle nose. Have the arbor support in position before tightening the arbor nut to prevent strain and bending of the arbor. Don't leave the knockout bar in the spindle when the machine is being run and don't disengage the drawbolt until the arbor or toolholder has been loosened from the taper.

Burr and clean workpieces. Clean vise jaws or locating surfaces before positioning work on them. Position the work correctly in the holding device and use consistent pressure when tightening.

When using clamps and "hold down" bolts, the "hold down" bolts must be placed closer to the work than to the clamp supports. When using flat clamps the clamp supports must be level with the work or fixture being clamped or slightly higher, never lower. For heavy cuts it is advisable to bolt a stop on the table against the fixture or workpiece to help absorb the thrust of the cut.

Never hammer or force any part of the machine to make it work. If it is necessary to strike the workpiece or fixture for adjustment use a babbit or soft hammer.

Perform only work for which you are authorized and qualified and only after having been instructed properly. Never try to do work to which you have not been assigned, such as making electrical repairs. No one but an authorized electrician should do this work.

Perform all set up work, including adjustment of coolant delivery pipes, with the spindle stopped and with power disconnected. Use correct machining procedures including appropriate feeds and spindle speeds for the job. When in **any** doubt consult with your supervisor before going any further.

Clean the spindle nose before mounting arbor or tools. Cutting tools are made for right or left hand rotation; be sure that the direction of spindle rotation is correct for the tool being used. Be sure all tools are firmly seated in the spindle and clamp all work and fixtures securely before starting the machine.

After the initial setup, carefully feed the work holding device (without part) past the cutter to test for correct positioning of the machine slides. When adjustments are necessary turn off the power and wait until the machine has come to a standstill. Do not attempt to brake or slow down moving machinery with your hand or with some makeshift device. Never attempt to use machine power to remove a nut from any shaft or arbor. Change tooling, spindle speeds and feedrates only when the spindle and slides are stopped. The same holds true for reversing the direction of rotation of the spindle (except for machines with tapping capability). The spindle and slides should be stopped when you measure workpieces or remove chips and grit. Chips and grit should be removed with a chip rake or brush, not with your hands.

Keep all parts of your body off the machine table, table edge, out of the path of moving units, trip dogs, trip plungers, and out of the "danger area" during machining operations. Never lean on a machine or reach over or through a machine – you can get caught in cutting tools and other moving elements or you may accidentally push start buttons, feed controls, rapid traverse controls or power work holding controls.

During operation be attentive to the machining process. Excessive vibration, unusual sounds, etc. can indicate problems requiring your immediate attention. Watch for conditions such as packed chips which can cause breakage or tools or machine elements.

Keep your machine in good operating condition at all times. It should be inspected regularly for parts that show wear or abuse. These should be replaced with authorized replacement parts only. Report any unusual sounds, smoke, heat, damaged components, etc. to your supervisor. Keep your coolant or cutting fluids clean; don't contaminate them with foreign matter.

Shut off the power to your machine if you leave the operating area; never leave a machine running unattended. Always turn the master disconnect switch to the OFF position before attempting to clean the machine at the end of the working day or if guards or covers are removed that would expose hazardous areas.

When starting a grinding machine, stand to one side away from the grinding wheel. Allow at least one minute warm-up time before truing or grinding with the grinding wheel. Always use coolant when truing the wheel or normal grinding. Never allow coolant to flow on a stationary grinding wheel; coolant may collect on one portion of the wheel, causing an unbalanced condition. While the machine is running, NEVER remove a guard fastener or guard. Do not touch any moving part of the machine or the rotating grinding wheel to determine its smoothness or condition. DO NOT attempt to physically operate a machine which is in its automatic mode.

Never alter or try to alter the machine, its wheel speed, or any of its safety equipment at any time. The guards are on the machine for the operator's safety, when removed, serious injuries to the operator or others may result.

MAINTENANCE SAFETY

WARNING _____

Do not attempt to perform maintenance on this machine until you read, know and practice all the safety instructions in this manual including general safety instructions; safety instructions for set up, operation and maintenance; and the explanation of OSHA color coding. Know and practice safety rules set forth by your company. Failure to act in a "safety-minded" manner can result in serious injury to yourself and others.

Only a qualified serviceman or maintenance man should perform maintenance and repair work on this machine. You should consult the service manual before attempting any service or repair work and when in any doubt contact a Cincinnati Milacron office. Use only Cincinnati Milacron replacement parts; others may impair the safety of the machine. Warning or danger signs should be placed conspicuously about the machine before performing maintenance or service work. Vertical sliding members should always be blocked before detaching counterweights or driving mechanisms.

Orange identifying markings on the inside of covers, guards, etc. indicate that they are to be remounted immediately after adjustments have been made to components under them. Always keep the electrical enclosure doors closed. These doors should be opened only by a qualified electrician.

When working on any component always be sure it is safely positioned on a sturdy workbench. Never work on a component while it is hanging from a crane or other lifting mechanism.

WARNING

Before removing or opening any electrical or mechanical guard, cover, plate or door, be sure that the main disconnect switch is in the OFF position. If any tool is required to remove a guard, cover, bracket or any basic part of this machine, place the main disconnect switch in the OFF position, lock it in the OFF position if possible, and post a sign at such disconnect switch indicating that maintenance is being performed.

Whenever work is to be performed in an area away from the disconnect and the disconnect is not locked, TAG it and ALL start buttons with an "OUT OF ORDER" or "DO NOT START" tag. Adequate precautions, such as locks on circuit breakers, warning notices or other equally effective means should be taken to prevent electrical equipment from being electrically charged when work is being performed.

Be sure all guards, covers, plates or doors are closed and securely fastened before power is reconnected.

Failure to follow any of the above instructions can result in serious personal injury.

Before attempting to adjust, repair or perform maintenance on electrical circuits connected with yellow wires, first find the source of power; turn it off; and LOCK IT IN THE OFF POSITION. Machine tool interlock control circuits connected with yellow wires may be powered from a source away from the machine. They may carry voltage even when the machine's main disconnect switch is turned to the OFF position.

Keep working space around electrical equipment clear of obstructions and so arranged as to give authorized persons ready access to all areas requiring attention. Adequate illumination should be provided to allow for proper operation and maintenance.

Keep all operating electrical equipment in safe and proper working condition. Defective equipment should either be put in good order or permanently disconnected. Thoroughly inspect infrequently used electrical equipment before use to determine its fitness for service.

Use tools for their intended use only. Check tools and equipment frequently. Never use worn tools, frayed extension cords, etc. Be sure that all electrical equipment is properly grounded. "Short-cuts" and "Safety-mindedness" are not compatible.

THIS CATALOG TO BE USED ONLY FOR MACHINES
WHOSE SERIAL NUMBER BEGINS WITH 2A OR 4A

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PATENT NOTICE: The machines and attachments illustrated and described in this book are protected by issued and pending United States and Foreign Patents.

The design and specifications of the machine and attachments illustrated and described herein are subject to change without notice.

FUNCTIONAL DIAGRAM

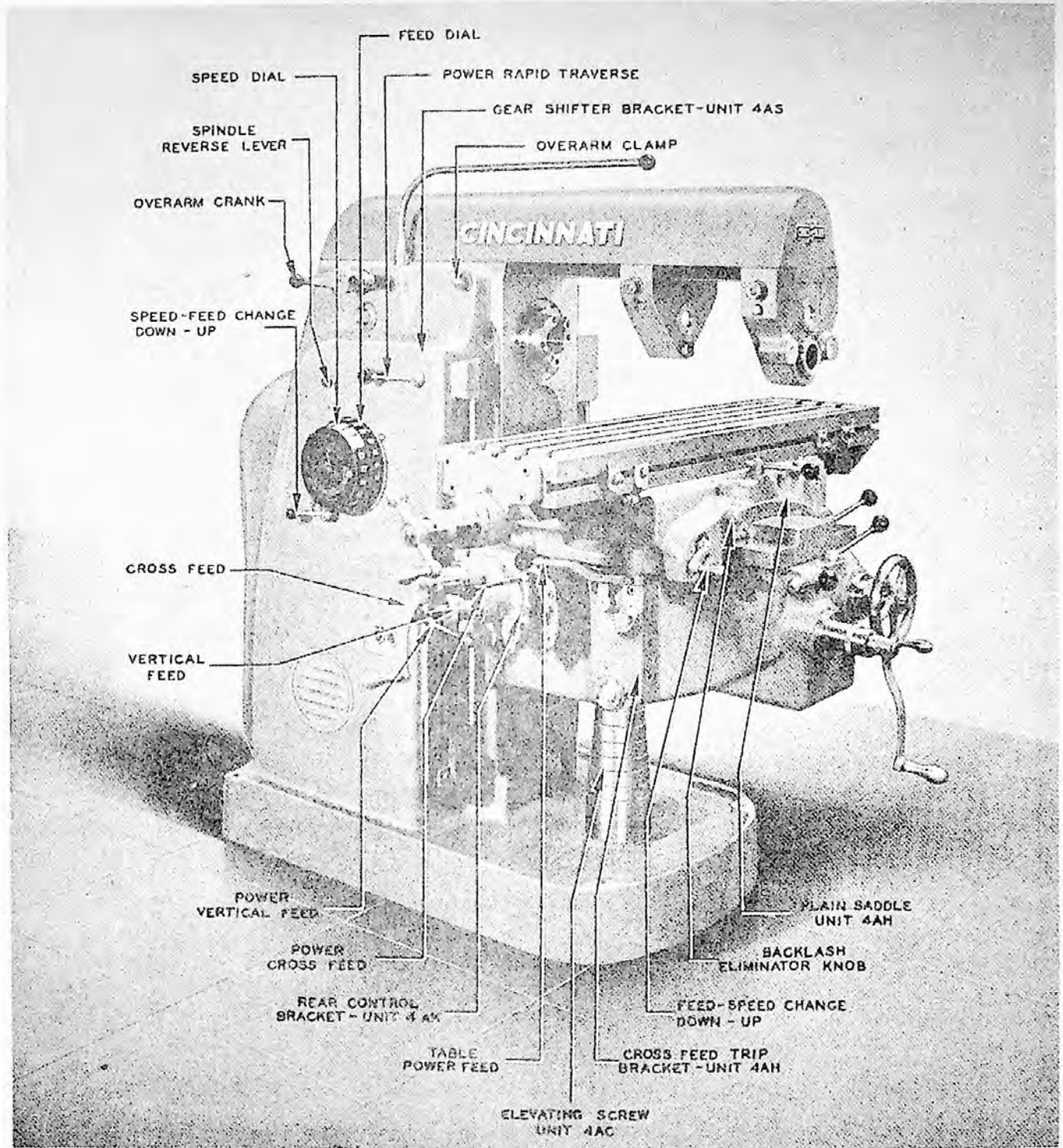


FIGURE 3A
No. 2 Plain Machine

FUNCTIONAL DIAGRAM

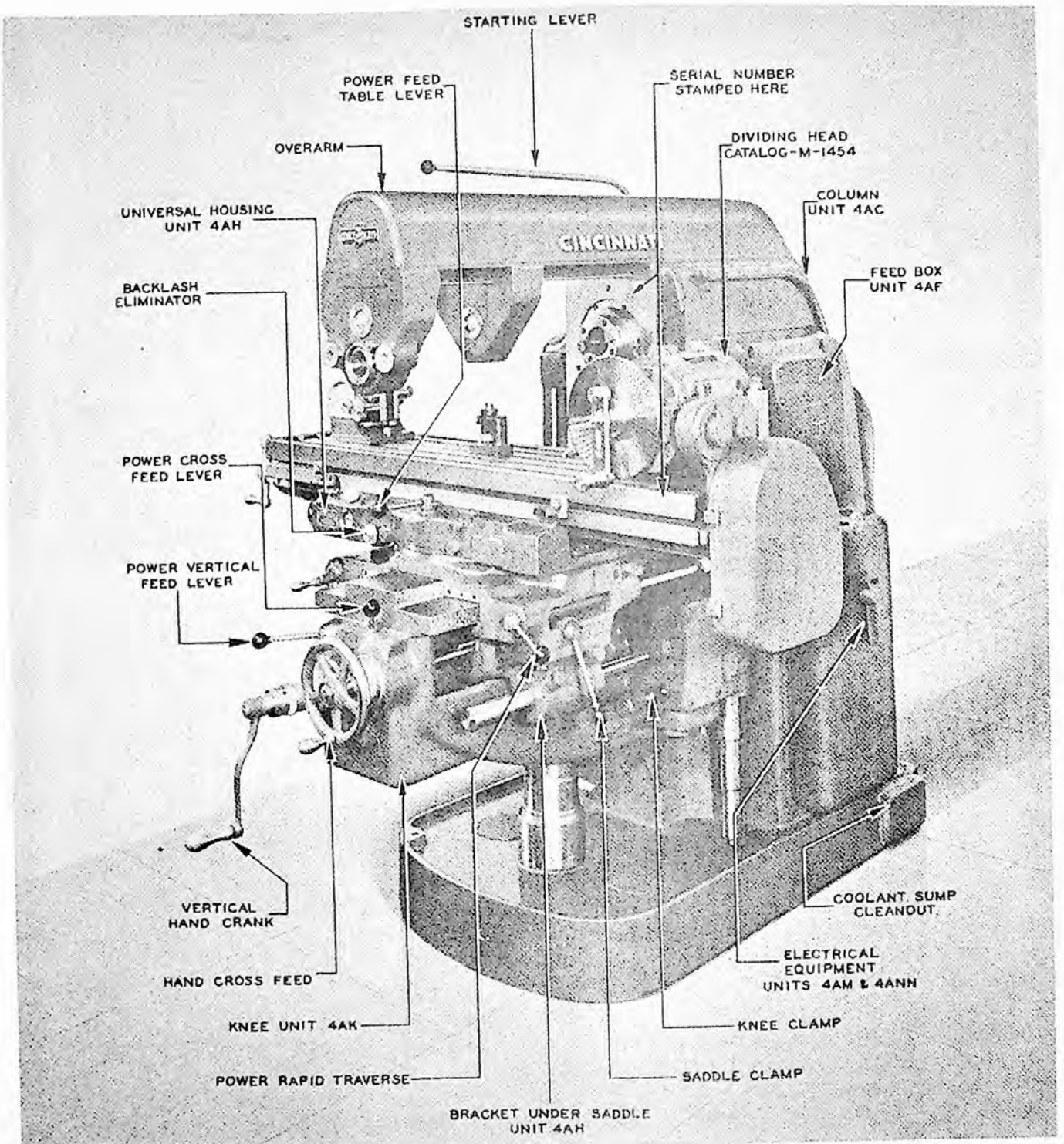


FIGURE 4A
No. 2 Universal Machine

FUNCTIONAL DIAGRAM

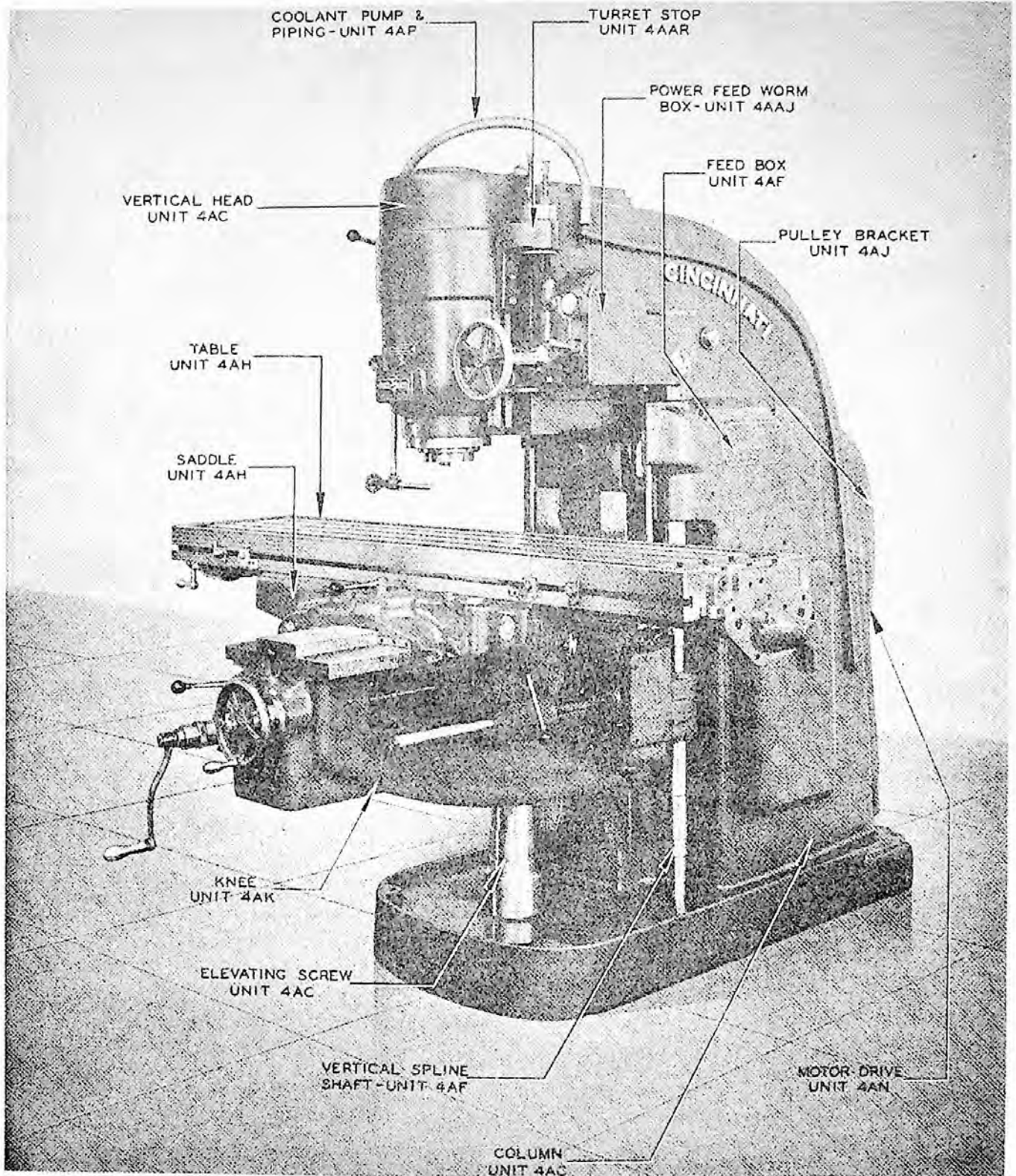
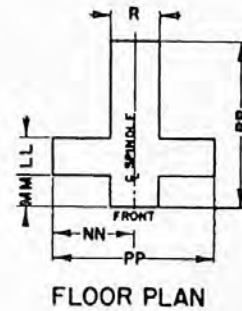
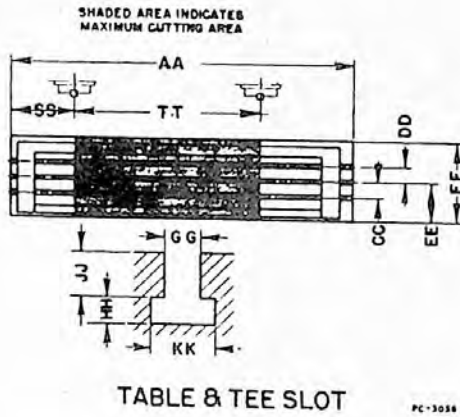
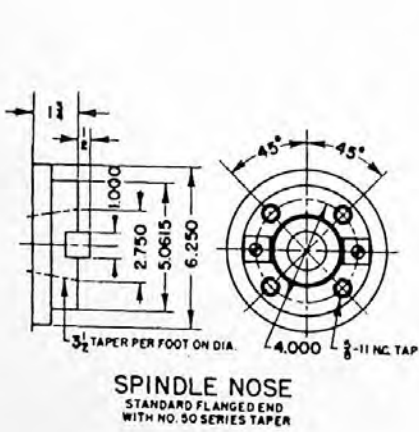
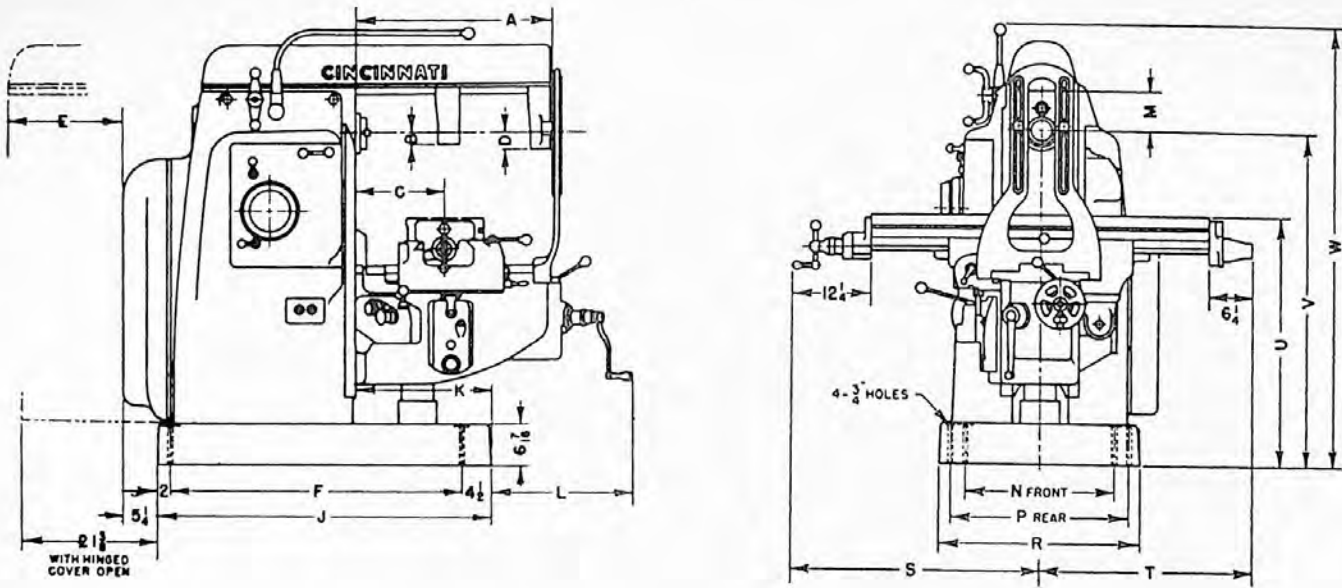


FIGURE 5A
No. 3 Vertical Machine

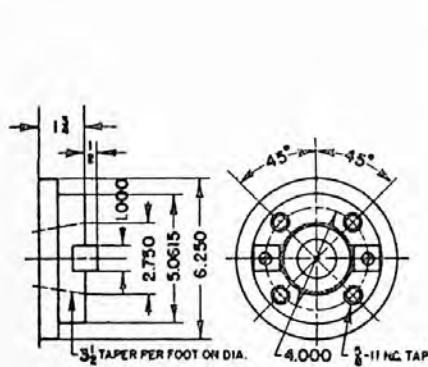
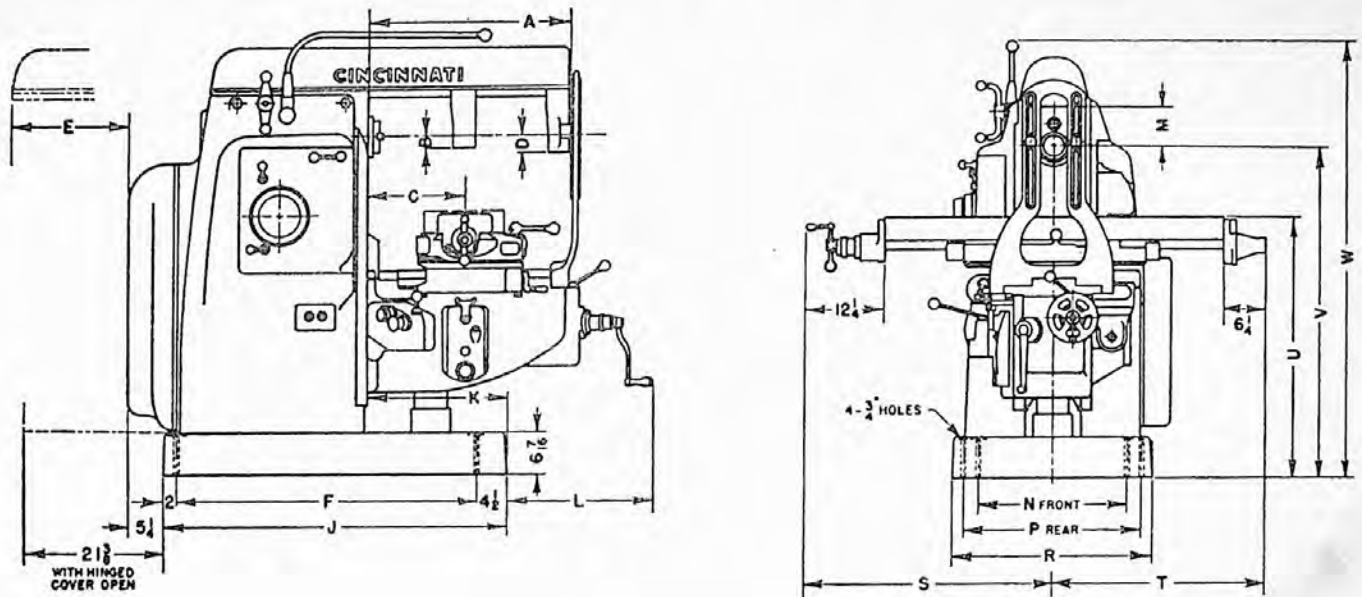
DIMENSIONAL DRAWING



Size of Machine	A	B	C		D	E	F	J	K	L	M	N	P	R	S		T		Size of Machine		
			Min.	Max.											Min.	Max.					
No. 2 Plain	30 3/4	7/8	9 1/4	19 3/4	2 1/2	18 1/2	45 3/4	52 3/4	21	23 1/2	6 1/4	23	27 1/2	30 1/2	22 1/4	50 1/4	21 3/4	50 1/4	No. 2 Plain		
No. 3 Plain	34	1 1/4	10 1/4	23 1/4	2 3/4	19 3/4	52 3/4	59 3/4	21	26 3/4	7 1/4	23	29 1/2	32 1/2	23 1/4	57 1/4	23 3/4	57 1/4	No. 3 Plain		
No. 4 Plain	38 3/4	1 1/2	11 1/4	26 3/4	2 3/4	23 1/2	52 3/4	59 3/4	21	31 1/4	7 3/4	23	29 1/2	32 1/2	27 1/4	69 3/4	27 3/4	69 3/4	No. 4 Plain		
Size of Machine	U		V	W	AA	CC	DD	EE	FF	GG	HH	JJ	KK	LL	MM	NN	PP	RR	SS	TT	Size of Machine
Min.	Max.	Min.																			Max.
No. 2 Plain	32 1/4	51 1/4	51 1/4	68 1/4	53 1/4	2 1/4	2 1/4	6	12 1/4	1 1/4	1 1/4	1 1/4	1 1/4	23	19	50 1/4	99 1/4	100	9 1/4	28	No. 2 Plain
No. 3 Plain	34	54 1/4	54 1/4	72 1/4	62 1/4	3 1/4	3 1/4	7 1/4	15 1/4	1 1/4	1 1/4	1 1/4	1 1/4	30	17	57 1/4	115 1/4	111	11	34	No. 3 Plain
No. 4 Plain	34	54 1/4	54 1/4	72 1/4	78 1/4	3 1/4	3 1/4	8	18 1/4	1 1/4	1 1/4	1 1/4	1 1/4	30 1/2	18 1/4	69 3/4	139 3/4	119	15	42	No. 4 Plain

FIGURE 6A
Plain Machines

DIMENSIONAL DRAWING



SPINDLE NOSE
STANDARD FLANGED END
WITH NO. 50 SERIES TAPER

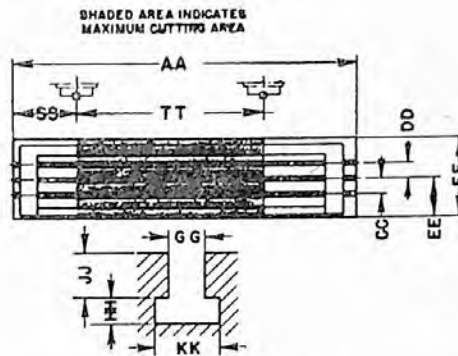
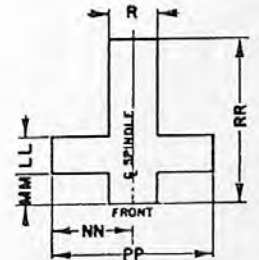


TABLE & TEE SLOT



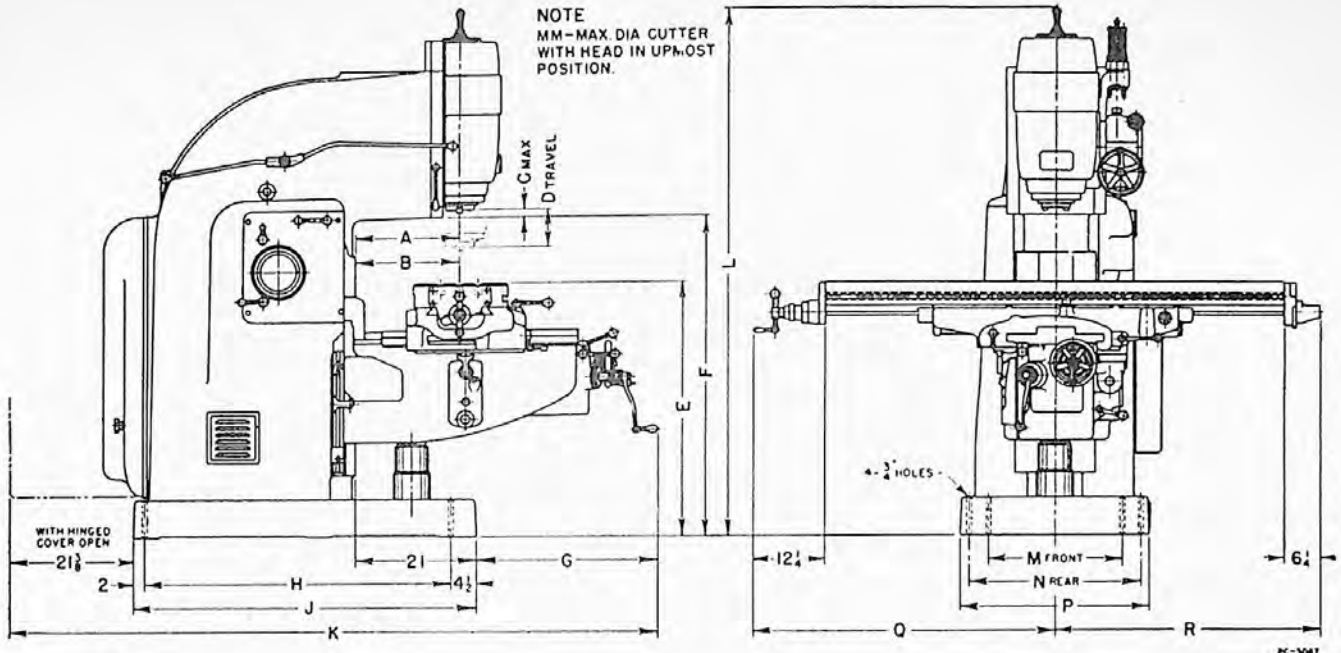
FLOOR PLAN

AC-1465

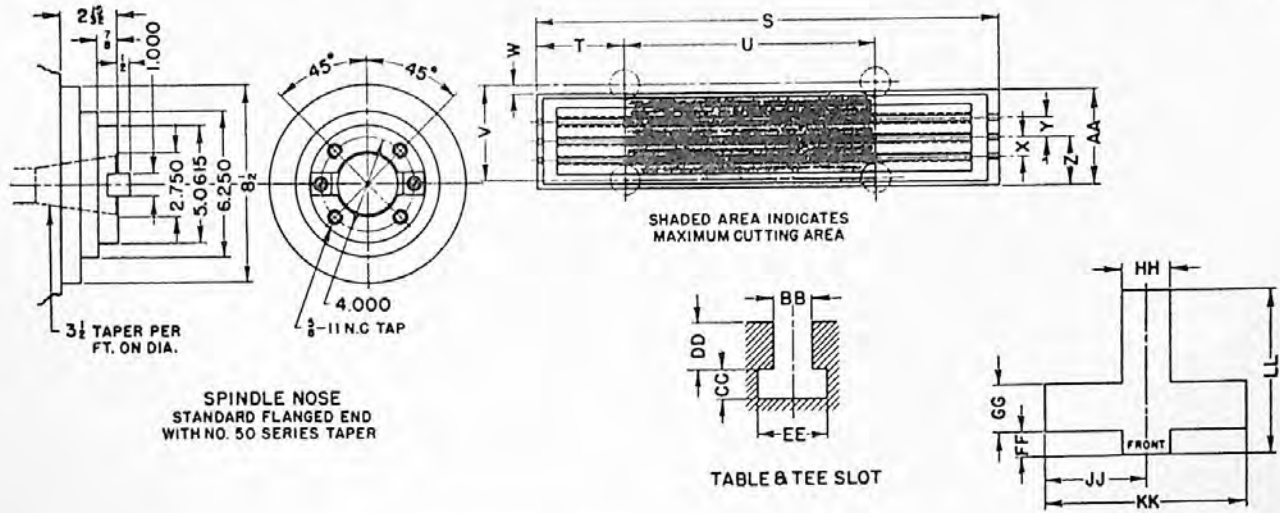
Size of Machine	A	B	C		D	E	F	J	K	L	M	N	P	R	S		T		Size of Machine		
			Min.	Max.											Min.	Max.	Min.	Max.			
No. 2 Univ.	30 3/4	7/8	9 1/4	19 1/4	2 1/2	18 1/4	46 3/4	52 1/4	21	23 1/2	6 1/2	23	27 1/2	30 1/2	22 1/4	60 1/4	21 1/4	49 1/4	No. 2 Univ.		
No. 3 Univ.	34	1 1/4	10 1/4	23 1/4	2 1/2	19 1/4	52 3/4	59 1/4	21	26 1/4	7 3/8	23	29 1/2	32 1/2	23 1/4	57 3/4	23 3/4	57 3/4	No. 3 Univ.		
No. 4 Univ.	38 3/4	1 1/4	11 1/4	26 1/4	2 1/2	23 1/4	52 3/4	59 1/4	21	31 1/4	7 3/8	23	29 1/2	32 1/2	27 1/4	69 3/4	27 1/4	69 3/4	No. 4 Univ.		
Size of Machine	U		V	W	AA	CC	DD	EE	FF	GG	HH	JJ	KK	LL	MM	NN	PP	RR	SS	TT	Size of Machine
	Min.	Max.																			
No. 2 Univ.	33 1/4	51 1/4	51 1/4	68 1/4	53 1/4	2 1/4	2 1/4	8	12 1/4	1 1/4	1 1/4	1/4	1 1/4	23	19	60 1/4	99 1/4	100	9 1/4	28	No. 2 Univ.
No. 3 Univ.	35	54 1/4	54 1/4	72 1/4	62 1/4	3 1/4	3 1/4	7 1/4	15 1/4	1 1/4	1/4	1	1 1/4	30	17	57 3/4	116 1/4	111	11	34	No. 3 Univ.
No. 4 Univ.	35	54 1/4	54 1/4	72 1/4	78 1/4	3 1/4	3 1/4	8	16 1/4	1 1/4	1/4	1	1 1/4	30 1/4	18 1/4	69 3/4	139 1/4	119	15	42	No. 4 Univ.

FIGURE 7A
Universal Machines

DIMENSIONAL DRAWING



PC-3047



SPINDLE NOSE
STANDARD FLANGED END
WITH NO. 50 SERIES TAPER

TABLE & TEE SLOT

FLOOR PLAN PC-3047

Size of Machine	A	B		C	D	E		F	G	H	J	K	L	M	N	P	Q		R		Size of Machine
		Min.	Max.			Min.	Max.										Min.	Max.	Min.	Max.	
No. 2 Vertical	14	9 1/4	21 1/2	1 1/2	6 1/4	31 1/2	45	49 1/2	23 1/2	45 3/4	52 1/4	90 1/2	83 1/2	23	27 1/2	30 1/2	22 1/2	50 1/2	21 1/2	50 1/2	No. 2 Vertical
No. 3 Vertical	18	10 1/2	27 1/2	1 1/2	6 1/4	33 1/2	49 1/2	54 1/2	31 1/2	52 3/4	59 1/2	111 1/2	89 1/2	23	32 1/2	32 1/2	23 1/2	57 1/2	23 1/2	57 1/2	No. 3 Vertical
No. 4 Vertical	18	11 1/2	27 1/2	1 1/2	6 1/4	33 1/2	49 1/2	54 1/2	31 1/2	52 3/4	59 1/2	111 1/2	89 1/2	23	32 1/2	32 1/2	27 1/2	69 1/2	27 1/2	69 1/2	No. 4 Vertical
Size of Machine	S	T	U	V	W	X	Y	Z	AA	BB	CC	DD	EE	FF	GG	HH	JJ	KK	LL	MM	Size of Machine
No. 2 Vertical	53 1/2	9 1/2	28 1/2	12 1/2	1 1/4	2 1/2	2 1/2	6	12 1/4	1 1/2	1 1/2	1 1/2	1 1/2	16 1/2	24 1/2	30 1/2	50 1/2	98 1/2	98 1/2	9 1/2	No. 2 Vertical
No. 3 Vertical	62 1/2	11	34 1/2	16 1/2	1 1/2	3 1/2	3 1/2	7 1/2	16 1/4	1 1/2	1 1/2	1	1 1/2	17 1/2	31 1/2	32 1/2	57 1/2	115 1/2	111 1/2	11 1/2	No. 3 Vertical
No. 4 Vertical	78 1/2	15	42 1/2	18 1/2	1 1/2	3 1/2	3 1/2	8	16 1/4	1 1/2	1 1/2	1	1 1/2	16 1/2	32 1/2	32 1/2	69 1/2	139 1/2	111 1/2	11 1/2	No. 4 Vertical

*Note—MM is maximum diameter cutter with head in uppermost position.

FIGURE 8A
Vertical Machines

KEY NUMBER INDEX

Unit Name	Drawing Name	Key No.	Page No.	Key Numbers of other Units
SHIFTER BRACKET 4AS	Shifter Bracket	1-49	13	
	Shifter Bracket	50-98	15	
	Shifter Bracket	99-166	17	
	Shifter Bracket	167-221	19	
	Shifter Bracket	222-265	21	
FEED BOX 4AF	Vertical Spline Shaft	1-61	23	4AAK-2 and 5, 4AAJ-2 and 5
	Rear Feed Box	62-119	25	
	Shifter Forks and Mechanisms	120-173	27	
	Control Cams	174-208	29	
	Feed Box Gearing	209-257	31	
	Feed Box Gearing	258-320	33	
PULLEY BRACKET 4AJ	Pulley Bracket	1-32	35	
COLUMN UNIT 4AC	Damper—Overarm— Arbor Support	1-65	37	
	Starting Lever—Clutch Control linkage	66-154	39	
	Column	155-180	41	4 ANN-181 through 196
	Column	202-227	43	4AP-197 through 201
	Column Assembly	228-289	45	
	Column—Gearing	290-346	47	
	Column—Gearing	347-401	49	
	Column—Gearing	402-446	51	
	Column—Gearing	447-494	53	
	Horizontal Spindle	495-523	55	
	Vertical Head	524-553	57	
	Vibration Damper Guides and Gibs	554-589	59	
	Starting Lever and Clutch Control Linkage	590-652	61	
	Column—Gearing	653-687	63	
	Vertical Spindle	688-721	65	
	Oil System	722-753	67	
Nos. 3 and 4 Oil System	754-789	69		
Vertical Machines Oil System	790-865	71		

PARTS LIST CATALOG

KEY NUMBER INDEX

Unit Name	Drawing Name	Key No.	Page No.	Key Numbers of other Units
SADDLE TABLE 4AH	Table-Aprons Lead Screw	1-65	73	
	Universal Saddle Housing	66-134	75	
	Universal Saddle Housing	135-213	77	
	Universal Saddle	214-251	79	4AK-515 and 516
	Universal Saddle	252-317	81	
	Saddle Plain and Vertical	318-384	83	4AK-517 and 518
	Saddle Plain and Vertical	385-435	85	
	Saddle Plain and Vertical	436-510	87	
	Backlash Eliminator	511-538	89	
KNEE 4AK	Vertical and Cross Shifter Rods	1-77	91	
	Front Cross Shaft	78-117	93	
	Front Elevating Shaft	118-161	95	
	Long Spline Shaft	162-202	97	
	Elevating and Cross Feed Shafts	203-288	99	
	Rear Control Bracket	289-366	101	
	Guide and Gibs Power Transfer Bracket	367-426	103	
	Cross Feed Trip Bracket	427-448	105	
	Elevating Screw	449-480	107	4AC-481 through 485
	Oil System	486-514	109	
MOTOR DRIVE 4AN	Motor Drive	1-42	111	
COOLANT PUMP AND PIPING 4AP	Coolant Pump and Piping	1-50	113	
	Coolant Pump and Piping	51-85	115	
POWER FEED WORM BOX 4AAJ	Power Feed Worm Box	1-46	117	
	Power Feed Worm Box	47-94	119	
TURRET STOP 4AAR and 4AAK	Turret Stop	1-49	121	4AAJ-115, 116, 117
HAND FEED WORM BOX 4AAK	Hand Feed Worm Box	1-43	123	4AAR-4, 6 and 10
TABLE HAND FEED ATTACHMENT 4AAS	Table Hand Feed Attachment	1-49	125	4AH-341, 342 and 346
ELECTRICAL EQUIPMENT 4AM 4ANN	Electrical Equipment	1-12	127	
INSTRUCTION PL.	Instruction Plates	1-22	129	

HOW TO ORDER REPAIR PARTS

You will receive quicker and better service when ordering repair parts if you will adhere to the following instructions when ordering such replacements.

These four requirements are essential:

1. State amount wanted.
2. Give catalog key number, part number and name of part. If ordering parts by part number, please advise where the number was obtained. (See paragraph A, below.)
3. Give complete serial number of machine. It is stamped on the column and the right front of table per figure 4A.
4. Specify how and where to ship. (See paragraph B, below.)

Paragraph A

When ordering parts by number, kindly advise how the number was obtained, namely:

Number stamped on part.

Prior Invoice.

Parts List Catalog. (Give identification and publication numbers on front cover.)

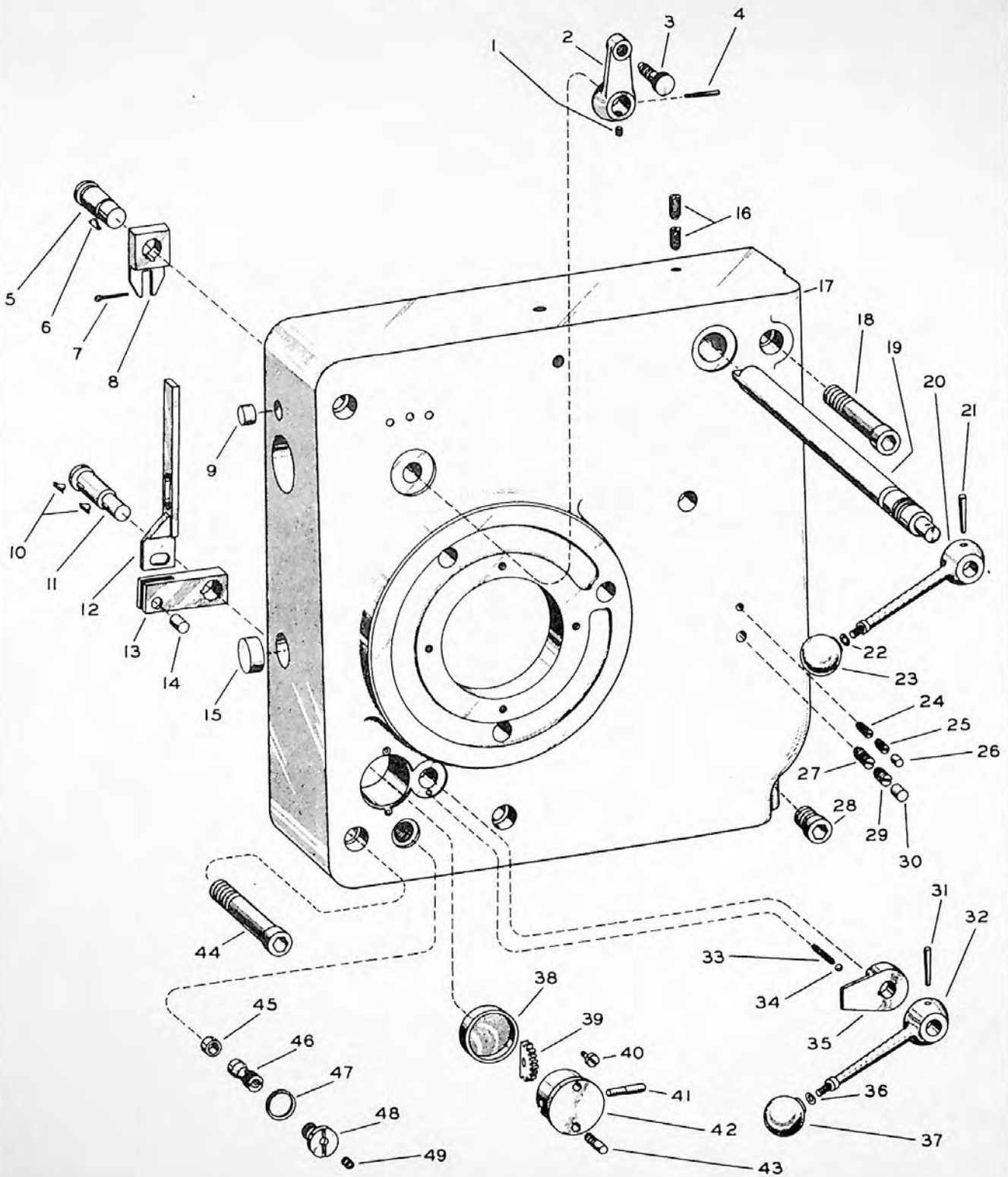
Paragraph B

Do not say, "Ship quickest way." Be definite and state agency desired, that is—Air Mail, Parcel Post (Special Delivery), Parcel Post (Regular), Express, Motor Freight, Rail Freight, etc.

Specify each individual piece that is required in the order. If only certain parts of a unit are required, never use the word "complete"; it always raises a question as to how much of a unit to supply.

However, in some cases, due to the nature of the part, it will be necessary and less costly to you, for us to supply additional related pieces, especially if part wanted is obsolete.

SHIFTER BRACKET



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

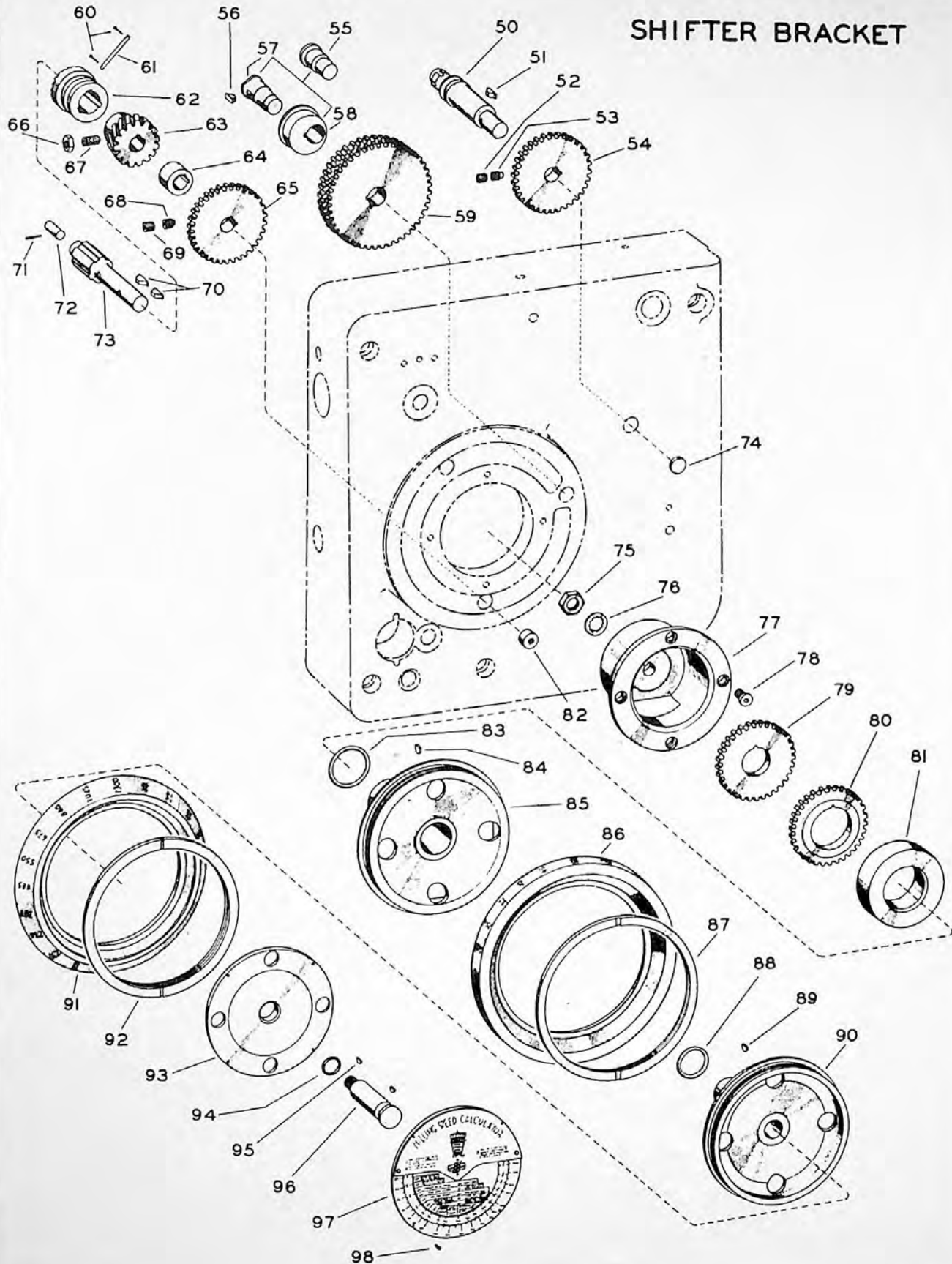
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

SHIFTER BRACKET—UNIT No. 4 AS

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AS -1	2332	Screw	1	4AS -26	1762	Plug	1
4AS -2	129162	Lever - Reverse	1	4AS -27	3457	Screw	1
4AS -3	121967	Screw	1	4AS -28	3408	Screw	1
4AS -4	642	Pin - Taper	1	4AS -29	2261	Screw	1
4AS -5	129163	Stud - Reverse Lever	1	4AS -30	698	Plug	1
4AS -6	3279	Key - Woodruff	1	4AS -31	642	Pin - Taper	1
4AS -7	3496	Pin - Cotter	1	4AS -32	99988	Lever	1
4AS -8	133592	Lever - Upper Reverse	1	4AS -33	63525	Spring - Detent	1
4AS -9	3530	Plug	1	4AS -34	13665	Ball	1
4AS -10	3279	Key - Hi-Pro	2	4AS -35	129168	Stop - Feed & Speed Control	1
4AS -11	130467	Stud - Speed & Feed Control	1	4AS -36	2135	Washer - Lock.	1
4AS -12	129168	Link - Rear Speed & Feed Control	1	4AS -37	115032	Ball	1
4AS -13	129170	Lever - Inner Speed & Feed Control	1	4AS -38	129167	Plug - Feed & Speed Control	1
4AS -14	111555	Pin - Shifter Fork.	1	4AS -39	66670	Pinion - Stop Pin	1
4AS -15	3830	Plug	1	4AS -40	1650	Screw	1
4AS -16	3453	Screw	2	4AS -41	1664	Pin	1
4AS -17	129061	Bracket - Gear Shifter	1	4AS -42	62728	Bearing	1
4AS -18	217761	Screw	2	4AS -43	14155	Pin - Stop	2
4AS -19	67119	Shaft - Quick Traverse	1	4AS -44	87339	Screw	2
4AS -20	99988	Lever - Control	1	4AS -45	66375	Packing - Stuffing Box	1
4AS -21	642	Pin - Taper	1	4AS -46	65186	Screw - Stuffing Box	1
4AS -22	2135	Washer - Lock	1	4AS -47	69201	Gasket	1
4AS -23	115032	Ball	1	4AS -48	129173	Plug - Screw	1
4AS -24	3456	Screw	1	4AS -49	76644	Plug - Pipe 1/4	1
4AS -25	3498	Screw	1				

SHIFTER BRACKET



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

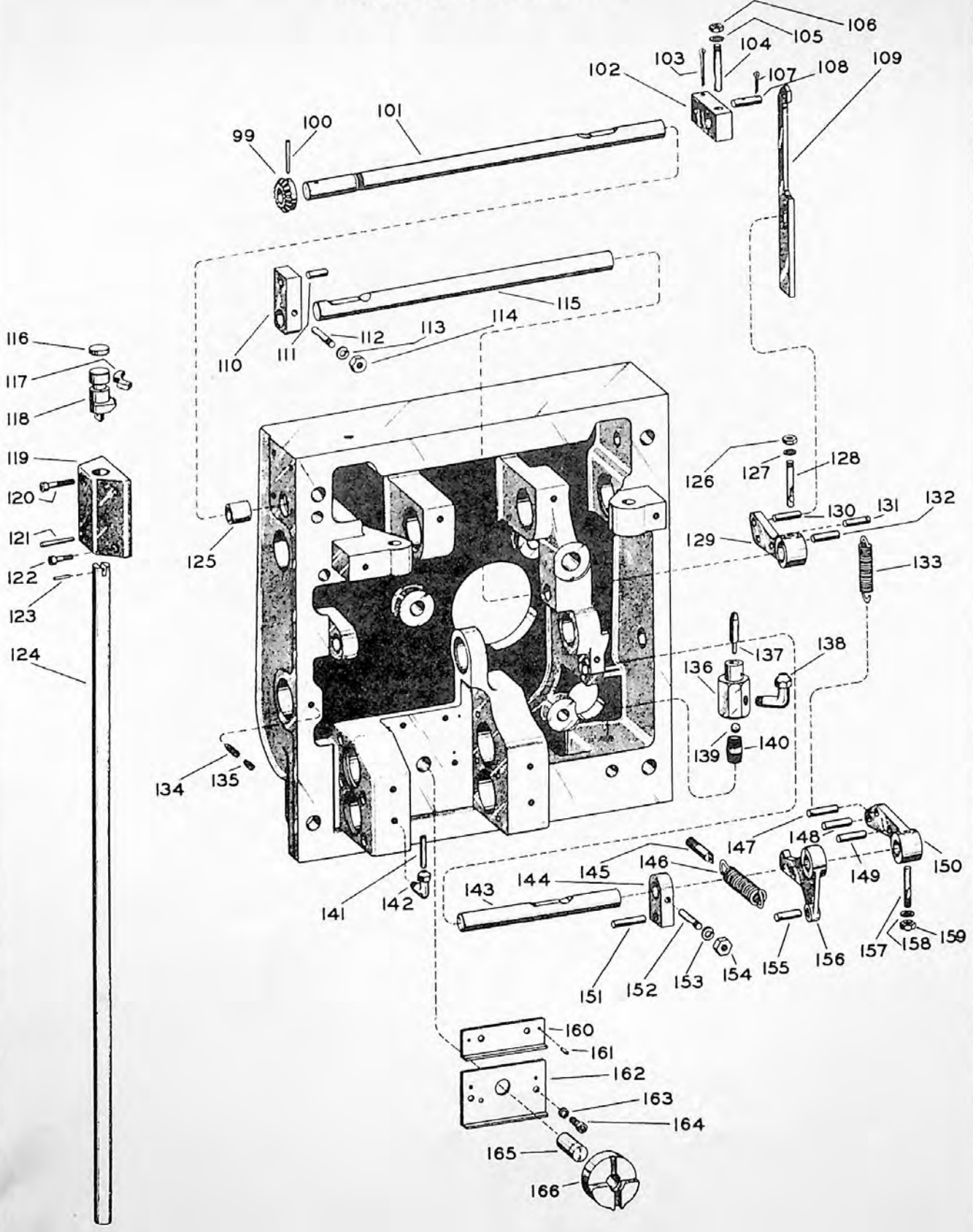
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

SHIFTER BRACKET—UNIT No. 4 AS (Continued)

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AS -50	130466	Shaft - Feed Clutch Shifter	1	4AS -78	3210	Screw	1
4AS -51	3280	Key	1	4AS -79	129183	Gear - Speed Dial	4
4AS -52	3232	Screw	1	4AS -80		Gear - Feed Dial	
4AS -53	1911	Screw	1		131371	16 - Speed	1
4AS -54		Gear - Dial Drive			129182	21 - Speed	1
	129184	21 - Speed	1	4AS -81	130457	Bushing - Dial Support	1
	131373	16 - Speed	1	4AS -82	3549	Plug	1
4AS -55	129174	Stud (21 - Speed)	1	4AS -83	244065	Ring "O"	1
4AS -56	3280	Key (16 - Speed)	1	4AS -84	1266	Key	1
4AS -57	131374	Stud - Dial Drive (16 - Speed)	1	4AS -85	131838	Flange - Feed Dial	1
4AS -58	131479	Bushing - Eccentric Inter. Stud (16 - Speed)	1	4AS -86		Dial - Feed	
4AS -59		Gear - Int. Dial			130461	5/16 to 10" (16 - Speed)	1
	131372	16 - Speed	1		130462	5/8 to 20" (16 - Speed)	1
	129181	21 - Speed	1		130463	1 to 30" (16 - Speed)	1
4AS -60	3329	Pin - Cotter	2		130460	5/16 to 60" (21 - Speed)	1
4AS -61	65919	Pin - Dial Engage	1	4AS -87	130452	Nut - Feed Dial	1
4AS -62	129097	Clutch - Speed Dial Engage	1	4AS -88	243945	Ring "O"	1
4AS -63	129092	Gear - Spiral For Speed Cam	1	4AS -89	1266	Key	1
4AS -64	65203	Collar - Spacing	1	4AS -90	131837	Flange - Speed Dial	1
4AS -65	129184	Gear - Dial Drive	1	4AS -91		Dial - Speed	
4AS -66	3473	Nut	1		130465	No. 2 P. U. V. (16 - Speed)	1
4AS -67	3233	Screw	1		130464	Nos. 3 & 4 P. U. V. (16 - Speed)	1
4AS -68	3232	Screw	1		130459	No. 2 P. U. V. (21 - Speed)	1
4AS -69	1911	Screw	1		130458	Nos. 3 & 4 P. U. V. (21 - Speed)	1
4AS -70	3280	Key	2	4AS -92	130450	Nut - Dial	1
4AS -71	140	Pin - Taper	1	4AS -93	130455	Flange - Speed Calculator	1
4AS -72	66211	Pin - Piston	1	4AS -94	129871	Ring "O"	1
4AS -73	66213	Shaft - Speed Dial Clutch	1	4AS -95	1266	Key	2
4AS -74	63529	Plug	1	4AS -96	131839	Stud - Dial Support	1
4AS -75	2026	Nut	1	4AS -97	105234	Calculator - Speed English	1
4AS -76	3254	Washer - Lock	1	4AS -98	232161	Screw	4
4AS -77	130456	Bracket - Dial Support	1				

SHIFTER BRACKET



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

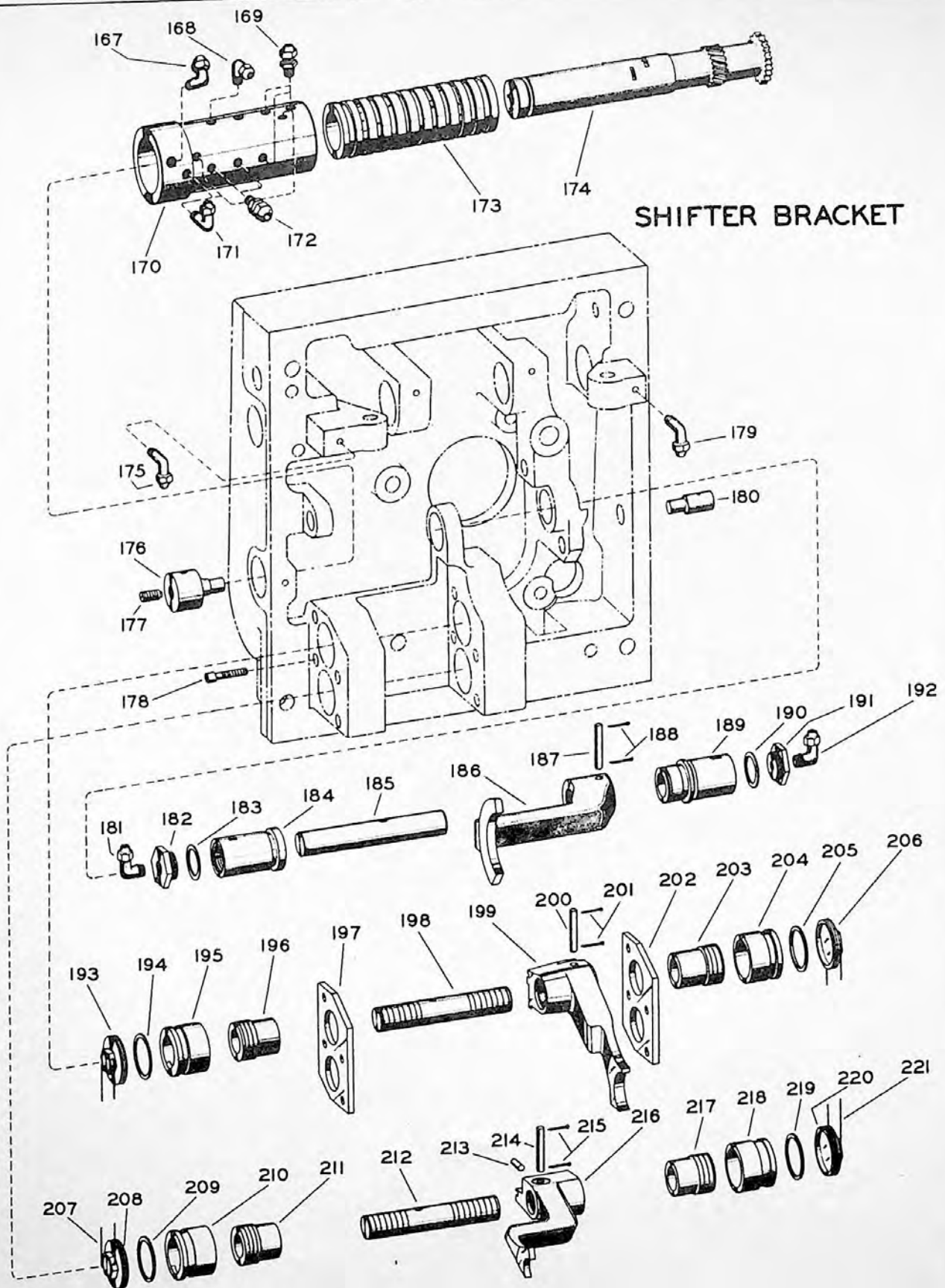
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

SHIFTER BRACKET—UNIT No. 4 AS (Continued)

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AS -99	67111	Gear - Mitre Dial Control	1	4AS -134	3498	Screw	1
4AS -100	663	Pin - Taper	1	4AS -135	3453	Screw	1
4AS -101	69310	Shaft - Dial Control	1	4AS -136	71973	Body - Relief Valve	1
4AS -102	67110	Lever - Dial Control Shaft	1	4AS -137	67813	Plunger	1
4AS -103	2036	Pin - Cotter	1	4AS -138	57286	Elbow - Comp.	1
4AS -104	33941	Pin - Lock	1	4AS -139	30154	Ball	1
4AS -105	2135	Washer - Lock	1	4AS -140	121185	Nipple - 1/4 x 1-1/8	1
4AS -106	3473	Nut	1	4AS -141		Tubing - Oil	
4AS -107	3496	Pin - Cotter	2		114548	16 Speed - 16 Feed	
4AS -108	65189	Pin - Dial Cont. Shaft	1		114549	21 Speed - 24 Feed	
4AS -109	66672	Link - Feed & Speed Cont.	1	4AS -142	4013	Fitting - Comp. Elbow	4
4AS -110	130468	Lever	1	4AS -143	129160	Shaft - Speed Control	1
4AS -111	65550	Pin	1	4AS -144	65195	Lever	1
4AS -112	33941	Pin - Lock	1	4AS -145	3376	Pin - Spring	1
4AS -113	2135	Washer - Lock	1	4AS -146	3959	Spring	1
4AS -114	3473	Nut	1	4AS -147	65550	Pin - Straight	1
4AS -115	65187	Shaft - Feed Drive Control	1	4AS -148	60154	Pin - Spring	1
4AS -116	69316	Plug - Sealing	1	4AS -149	65550	Pin - Straight	1
4AS -117	69319	Key	1	4AS -150	129161	Lever - Feed & Speed Actuating	1
4AS -118	69318	Segment - Feed & Speed Upper Bracket	1	4AS -151	65550	Pin - Straight	1
4AS -119	107566	Bracket - Upper Feed & Speed	1	4AS -152	33941	Pin - Lock	1
4AS -120	3217	Screw	2	4AS -153	2135	Washer - Lock	1
4AS -121	645	Pin - Taper	2	4AS -154	3473	Nut	1
4AS -122	3396	Screw	2	4AS -155	60154	Pin - Spring	1
4AS -123	3431	Pin	1	4AS -156	65088	Lever - Detent	1
4AS -124	69320	Shaft - Vertical Control	1	4AS -157	33941	Pin - Lock	1
4AS -125	69783	Bushing	1	4AS -158	2135	Washer - Lock	1
4AS -126	3473	Nut	1	4AS -159	3473	Nut	1
4AS -127	2135	Washer - Lock	1	4AS -160	74934	Guide - Upper	1
4AS -128	33941	Pin - Lock	1	4AS -161	424	Pin	4
4AS -129	129161	Lever - Feed & Speed Actuating	1	4AS -162	74935	Guide - Lower	1
4AS -130	65550	Pin - Straight	1	4AS -163	2135	Washer	4
4AS -131	60154	Pin - Spring	1	4AS -164	3399	Screw	4
4AS -132	65550	Pin - Straight	1	4AS -165	113549	Pin - Disc. Interlock	1
4AS -133	3967	Spring	1	4AS -166	65934	Disc - Interlocking	1

PARTS LIST CATALOG



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

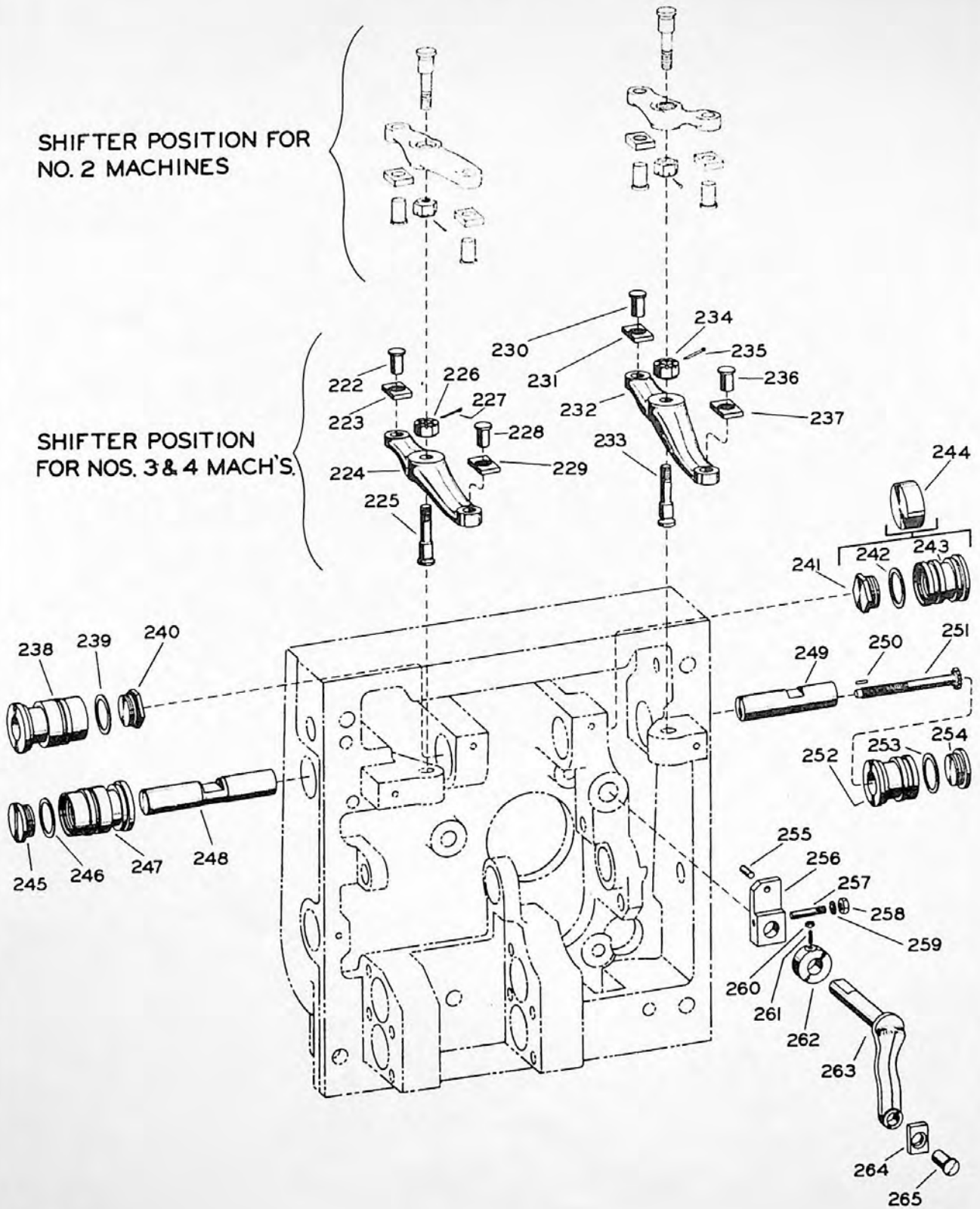
SHIFTER BRACKET—UNIT No. 4 AS (Continued)
Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AS -167	57286	Elbow - Compression	1	4AS -192	58152	Elbow - Comp.	1
4AS -168	4013	Fitting - Comp. Elbow	2	4AS -193	65935	Screw - Cylinder End	1
4AS -169	89866	Union - Compression	3	4AS -194	65125	Gasket	1
4AS -170		Sleeve - Outer Selector Valve		4AS -195	65939	Cylinder	1
	67763	16 - Speeds	1	4AS -196	68418	Sleeve - Gear Shifting Piston	1
	69779	21 - Speeds	1	4AS -197	68417	Plate - Abutment	1
4AS -171	58152	Elbow - Comp.	3	4AS -198	65937	Piston - Primary Gear Shifting	1
4AS -172	70382	Fitting - Comp. Coupling	2	4AS -199	74936	Lever - Front Primary Gear Shift	1
4AS -173		Bushing - Selector Valve		4AS -200	65172	Pin - Shifter Fork	1
	70248	21 - Speeds	1	4AS -201	3496	Pin - Cotter	2
	65087	16 - Speeds	1	4AS -202	68417	Plate - Abutment	1
4AS -174		Valve - Selector		4AS -203	68418	Sleeve - Gear Shifter Piston	1
	129098	21 - Speeds	1	4AS -204	65939	Cylinder	1
	129099	16 - Speeds	1	4AS -205	65125	Gasket	1
4AS -175	58152	Elbow - Comp. - 21 - Speeds	1	4AS -206	65935	Screw - Cylinder End	1
4AS -176	86275	Stud - Selector Valve - R. H.	1	4AS -207	3350	Wire	1
4AS -177	1215	Screw	1	4AS -208	65935	Screw - Cylinder End	1
4AS -178	3401	Screw	8	4AS -209	65125	Gasket	1
4AS -179	58152	Elbow - Comp. - 21 - Speeds	1	4AS -210	65939	Cylinder	1
4AS -180	85200	Stud - Selector Valve - L. H.	1	4AS -211	68418	Sleeve - Gear Shifter Piston	1
4AS -181	58152	Elbow - Comp.	1	4AS -212	65937	Piston - Primary Rear Shifter	1
4AS -182	69759	Plug - Cylinder	1	4AS -213	65246	Pin	1
4AS -183	65233	Gasket	1	4AS -214	65172	Pin - Shifter Fork	1
4AS -184	69760	Cylinder - Secondary Gear Shaft	1	4AS -215	3496	Pin - Cotter	2
4AS -185	98892	Piston - Secondary Gear Shifting	1	4AS -216	74937	Lever - Rear Primary Gear Shifter	1
4AS -186	107967	Shifter - Secondary	1	4AS -217	68418	Sleeve - Gear Shifter Piston	1
4AS -187	65172	Pin - Shifter Fork	1	4AS -218	65939	Cylinder	1
4AS -188	3496	Pin - Cotter	2	4AS -219	65125	Gasket	1
4AS -189	98893	Cylinder - Secondary	1	4AS -220	65935	Screw - Cylinder End	1
4AS -190	65233	Gasket	1	4AS -221	3350	Wire	1
4AS -191	69759	Plug - Cylinder	1				

SHIFTER BRACKET

SHIFTER POSITION FOR NO. 2 MACHINES

SHIFTER POSITION FOR NOS. 3 & 4 MACH'S.



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

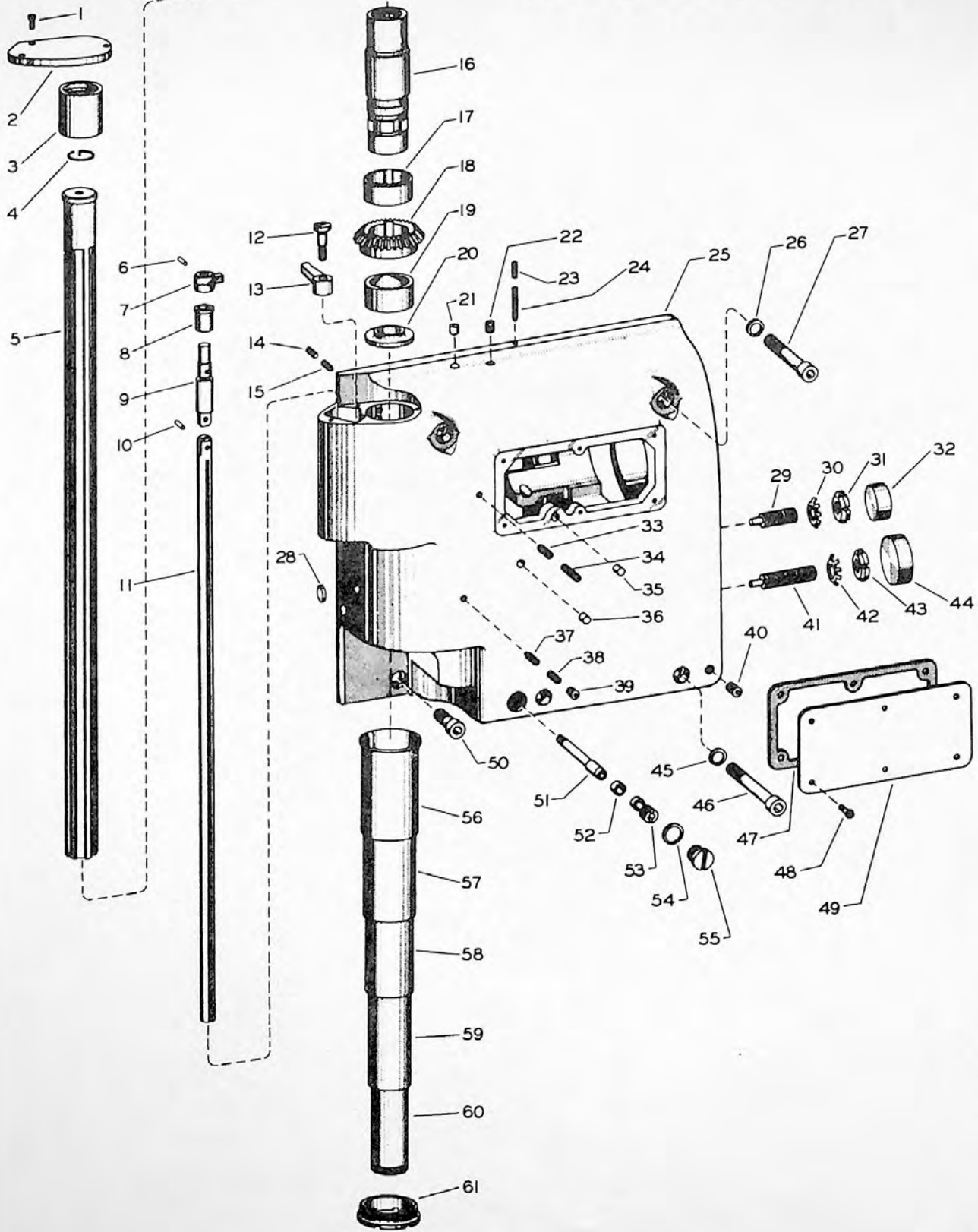
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

SHIFTER BRACKET—UNIT No. 4 AS (Concluded)

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AS -222	69301	Pin - Shoe	1	4AS -244	3562	Plug 16 - Speed Only	1
4AS -223	69300	Shoe	1	4AS -245	131443	Screw - Plug	1
4AS -224	69306	Lever - Rack Gear Shifter	1	4AS -246	61181	Gasket	1
4AS -225	69299	Bolt	1	4AS -247	69762	Cylinder - Back Gear & Shaft	1
4AS -226	2087	Nut	1	4AS -248	69298	Piston - Back Gear Shifter	1
4AS -227	3496	Pin - Cotter	1	4AS -249	70244	Piston - Clutch Shifter 21 - Speed Only	1
4AS -228	69301	Pin - Shoe	1	4AS -250	3636	Pin	1
4AS -229	69300	Shoe	1	4AS -251	70245	Screw - Piston Adjust. 21 - Speed Only	1
4AS -230	69301	Pin - Shoe 21 - Speed Only	1	4AS -252	69773	Cylinder - Clutch Shifter 21 - Speed Only	1
4AS -231	69300	Shoe 21 - Speed Only	1	4AS -253	61181	Gasket 21 - Speed Only	1
4AS -232	69307	Lever - Clutch Shifter 21 - Speed Only	1	4AS -254	131443	Screw - Plug 21 - Speed Only	1
4AS -233	69299	Bolt 21 - Speed Only	1	4AS -255	2066	Pin	1
4AS -234	2087	Nut 21 - Speed Only	1	4AS -256	133591	Lever - Reverse Lower	1
4AS -235	3496	Pin - Cotter 21 - Speed Only	1	4AS -257	33941	Pin - Lock	1
4AS -236	69301	Pin - Shoe 21 - Speed Only	1	4AS -258	3473	Nut	1
4AS -237	69300	Shoe 21 - Speed Only	1	4AS -259	2135	Washer	1
4AS -238	69762	Cylinder - Back Gear & Shaft	1	4AS -260	3472	Nut - 1/4 x 1/2	1
4AS -239	61181	Gasket	1	4AS -261	3454	Screw - 1/4-20 x 3/4	1
4AS -240	69774	Screw - Cyl.	1	4AS -262	3979	Collar	1
4AS -241	69774	Screw - Cyl. 21 - Speed Only	1	4AS -263	129165	Lever - Reverse Gear	1
4AS -242	61181	Gasket 21 - Speed Only	1	4AS -264	69300	Shoe	1
4AS -243	69773	Cylinder - Clutch Shifter 21 - Speed Only	1	4AS -265	69301	Pin - Shoe	1

VERTICAL SPLINE SHAFT



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

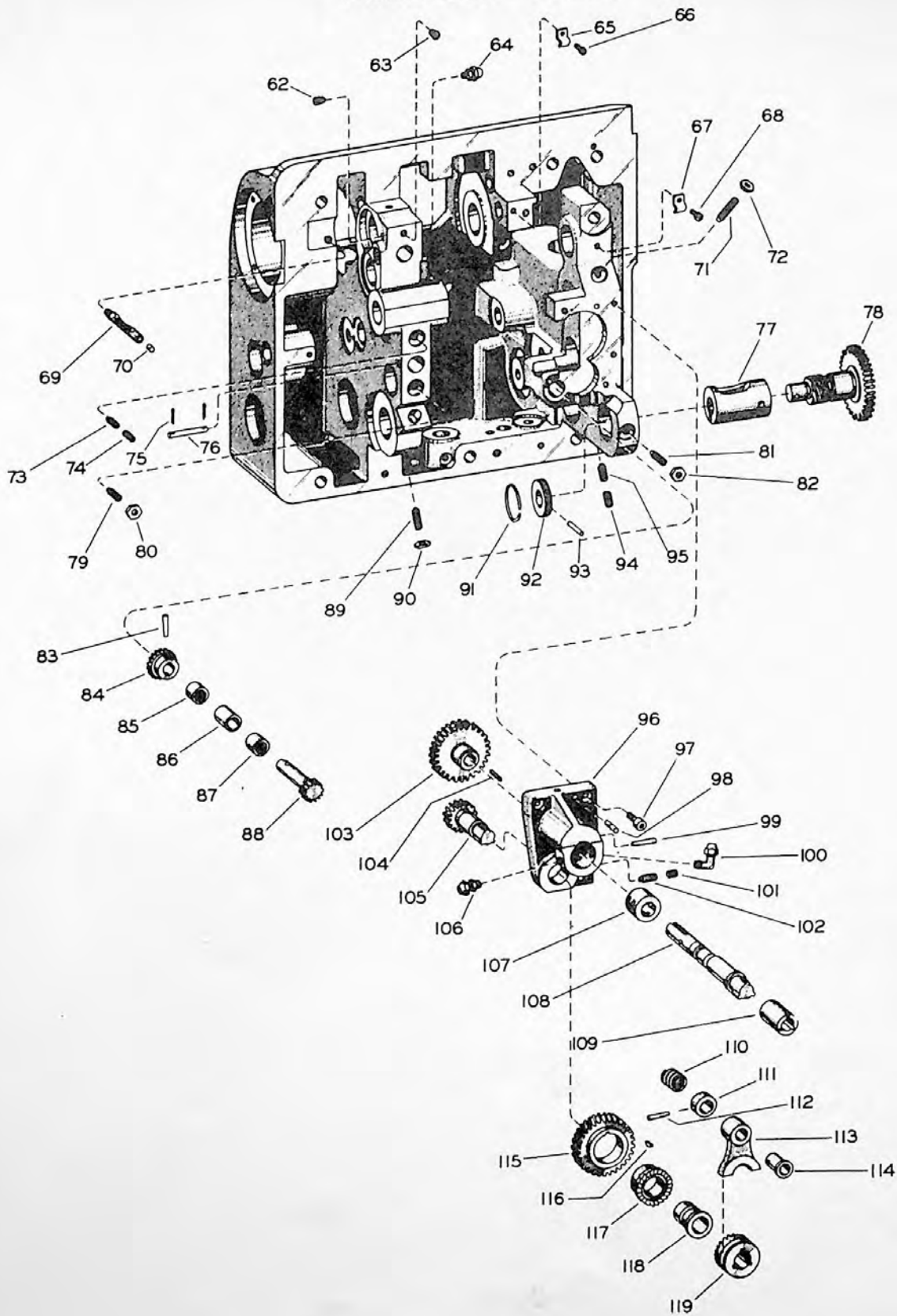
FEED BOX—UNIT No. 4 AF

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AF -1	3203	Screw	3	4AF -30	3805	Washer - Lock	1
2		Cover		4AF -31	3806	Nut - Lock	1
4AF -2	129148	Plain And Universal.	1	4AF -32	3554	Plug	1
4AAK -2	129148	Vertical (Hand feed to head)	1	4AF -33	3233	Screw	1
4AAJ -2	129485	Vertical (Power feed to head)	1	4AF -34	2286	Screw	1
4AF -3	129121	Bushing	1	4AF -35	3530	Plug - 16 Speed - 16 Feed only	1
4AF -4	132004	Ring - Spring Wire	1	4AF -36	3529	Plug - 16 Speed - 16 Feed only	1
5		Shaft - Vertical Spline		4AF -37	3233	Screw	1
4AF -5	129151	Plain and Universal.	1	4AF -38	3211	Screw	1
4AAJ -5	129491	No. 2 Vertical (Power feed to head)	1	4AF -39	76645	Plug - Pipe	1
4AAJ -5	129496	Nos. 3 & 4 Vertical (Power feed to head)	1	4AF -40	1910	Screw	1
4AAK -5	129520	No. 2 Vertical (Hand feed to head)	1	4AF -41	98983	Stud - Cam Shaft "B"	1
4AAK -5	129522	Nos. 3 & 4 Vertical (Hand feed to head)	1	4AF -42	3805	Washer - Lock	1
4AF -6	141	Pin.	1	4AF -43	3806	Nut - Lock	1
4AF -7	69321	Lever - Shifter	1	4AF -44	3557	Plug	1
4AF -8	69371	Bushing	1	4AF -45	222490	Gasket	2
4AF -9	69322	Shaft - Quick Traverse	1	4AF -46	228466	Screw	2
4AF -10	3431	Pin - Taper	1	4AF -47	129104	Gasket	1
4AF -11	69320	Shaft - Vertical Control.	1	4AF -48	3203	Screw	6
4AF -12	69372	Stud	1	4AF -49	130398	Plate - Cover	1
4AF -13	69373	Lever - Shifter	1	4AF -50	1360	Screw	1
4AF -14	3211	Screw	1	4AF -51	102309	Connection - Supply	1
4AF -15	3233	Screw	1	4AF -52	66375	Packing - Stuffing Box	1
4AF -16	129138	Sleeve - Vertical	1	4AF -53	102310	Stuffing Box	1
4AF -17	129120	Collar - Sleeve	1	4AF -54	79111	Gasket	1
4AF -18	129110	Gear - Bevel	1	4AF -55	229351	Screw	1
4AF -19	129106	Bushing	1	4AF -56		Tube - Telescopic Large	
4AF -20	129107	Retainer - Oil	1		129457	No. 2 Plain, Universal and Vertical	1
4AF -21	3529	Plug	1		129242	Nos. 3 & 4 Plain, Universal and Vertical	1
4AF -22	2248	Screw	1	4AF -57	129241	Tube - 4th Telescopic.	1
4AF -23	3211	Screw	1	4AF -58	129240	Tube - 3rd Telescopic.	1
4AF -24	3237	Screw	1	4AF -59	129239	Tube - 2nd Telescopic.	1
4AF -25	129100	Box - Feed	1	4AF -60		Tube - Telescopic Small	
4AF -26	222490	Gasket	2		129124	Plain and Universal	1
4AF -27	217761	Screw	2		131824	Vertical	1
4AF -28	69316	Plug	1	4AF -61	129146	Nut - Telescopic	1
4AF -29	98973	Stud - Cam Shaft "A"	1				

PARTS LIST CATALOG

FEED BOX - REAR



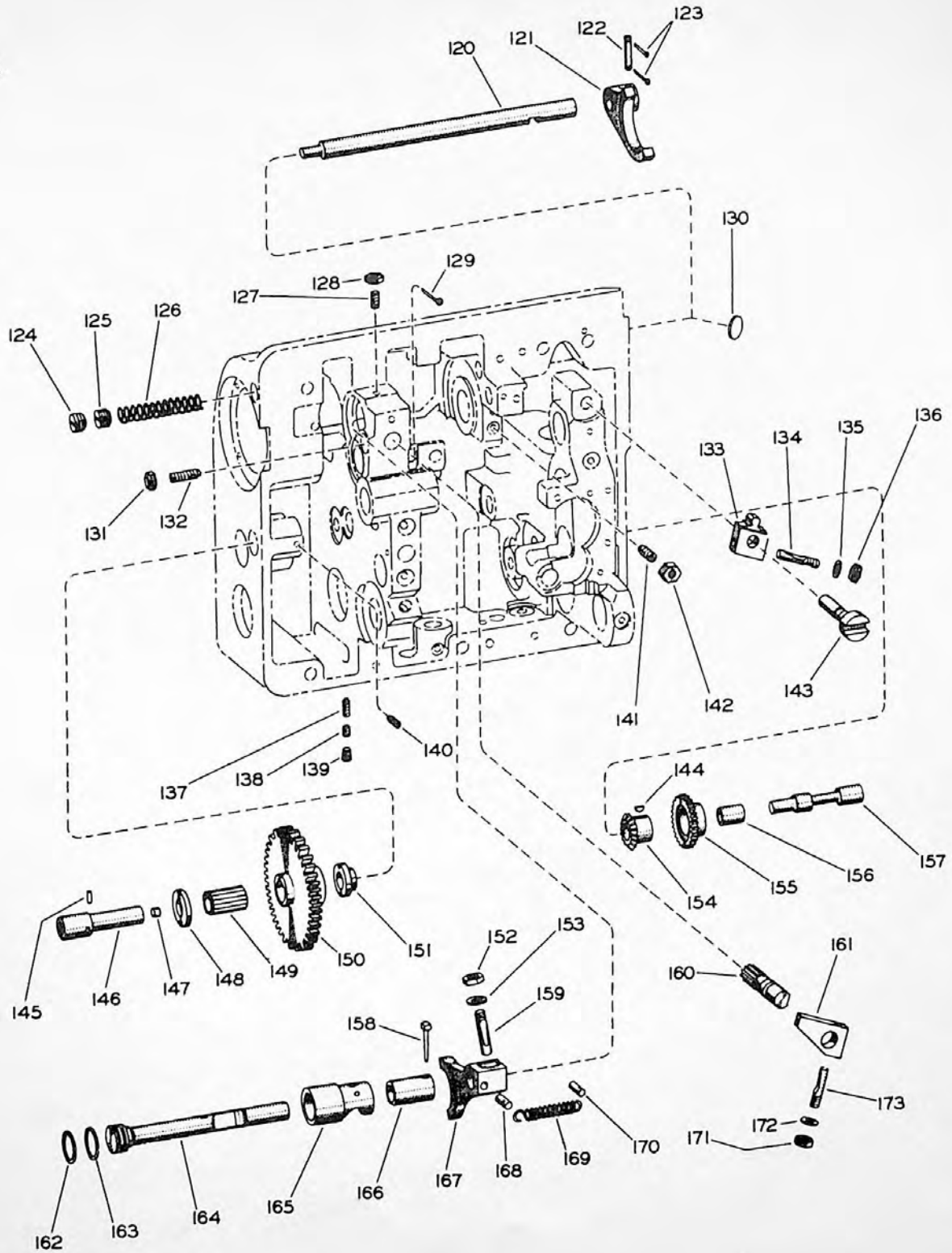
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

FEED BOX—UNIT No. 4 AF (Continued)
Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AF-62	76644	Plug - Pipe	1	4AF-91	45322	Spring - Ring	1
4AF-63	76644	Plug - Pipe	1	4AF-92	133563	Collar	1
4AF-64	89866	Fitting - Comp. Coupling	1	4AF-93	3277	Pin	1
4AF-65	4001	Clamp - Tube	1	4AF-94	3211	Screw	1
4AF-66	3198	Screw	1	4AF-95	3233	Screw	1
4AF-67	4001	Clamp - Tube	1	4AF-96	102487	Bracket - Clutch Feed Change	1
4AF-68	3198	Screw	1	4AF-97	3399	Screw	3
4AF-69	102320	Tubing - Supply	1	4AF-98	1421	Pin	2
4AF-70	2245	Plug	1	4AF-99	143	Pin - Taper	1
4AF-71	3236	Screw	1	4AF-100	58152	Fitting - Comp. Elbow	1
4AF-72	3473	Nut	1	4AF-101	1911	Screw	1
4AF-73	3233	Screw	1	4AF-102	3233	Screw	1
4AF-74	3211	Screw	1	4AF-103	102491	Gear - Speed Control	1
4AF-75	3329	Pin - Cotter	2	4AF-104	3447	Key	1
4AF-76	63630	Pin	1	4AF-105	102490	Gear - Stem	1
4AF-77	133564	Bushing - Worm Cam Drive	1	4AF-106	89866	Fitting - Comp. Coupling	1
4AF-78	102097	Gear - Driven Cam Drive	1	4AF-107	102747	Bushing - Valve	1
4AF-79	3234	Screw	1	4AF-108	102748	Shaft - Clutch Shifter	1
4AF-80	3473	Nut	1	4AF-109	98995	Coupling - Spline	1
4AF-81	3234	Screw	1	4AF-110	102745	Spring	1
4AF-82	3473	Nut	1	4AF-111	102312	Collar - Stop	1
4AF-83	663	Pin - Taper	1	4AF-112	141	Pin - Taper	1
4AF-84	102095	Gear - Bevel	1	4AF-113	102313	Fork - Shifter	1
4AF-85	94978	Bearing - Needle	1	4AF-114	102311	Bushing - Clutch Shifter	1
4AF-86	102100	Spacer - Needle Bearing	1	4AF-115	102096	Gear - Spiral Cam Drive	1
4AF-87	94978	Bearing - Needle	1	4AF-116	1266	Key	1
4AF-88	102093	Pinion	1	4AF-117	99103	Clutch - Driver Feed Control	1
4AF-89	3235	Screw	1	4AF-118	98998	Bearing - Sleeve Feed Control	1
4AF-90	3473	Nut	1	4AF-119	102308	Clutch - Driven Feed Control	1

SHIFTER FORKS AND MECHANISMS



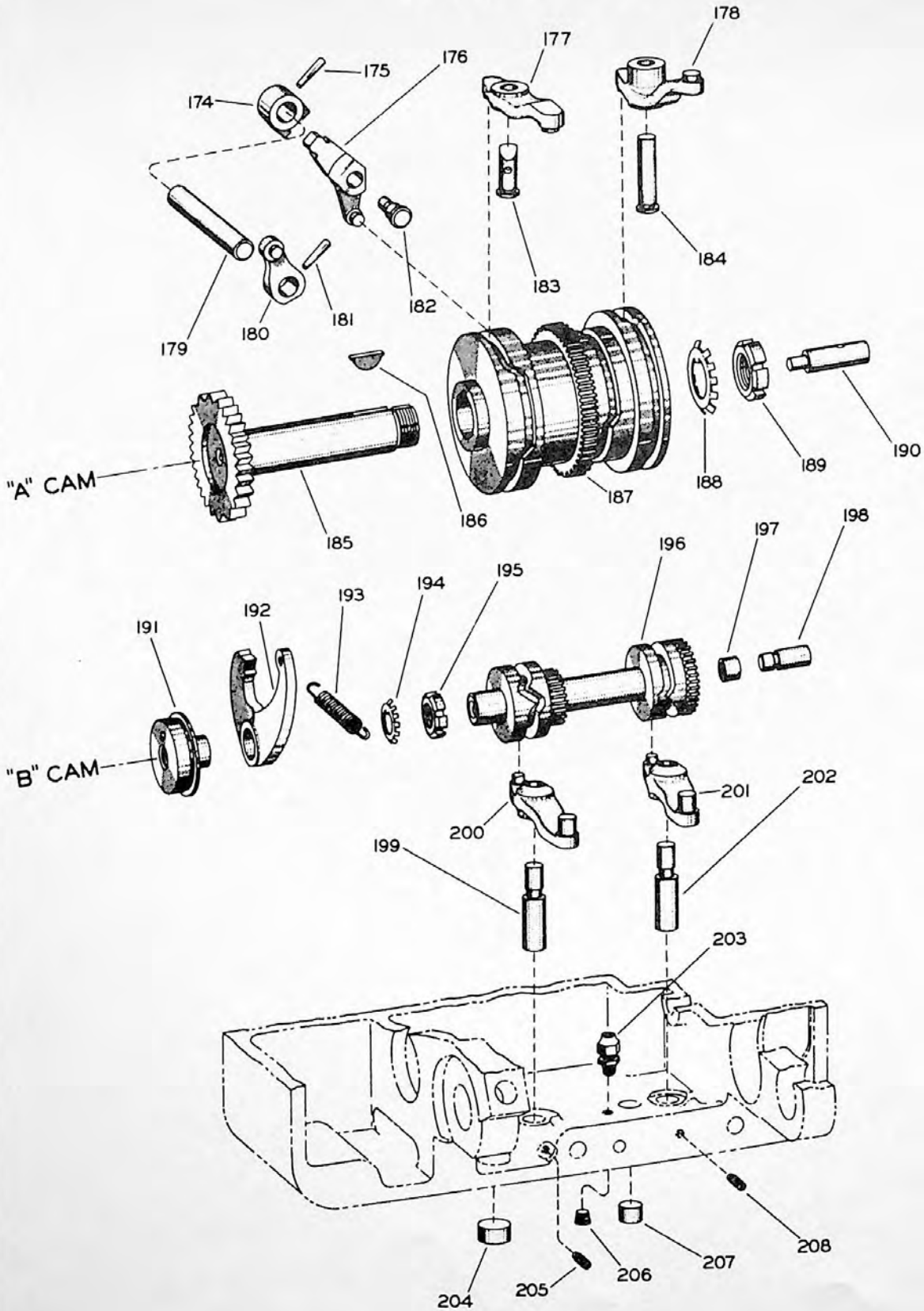
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

FEED BOX—UNIT No. 4 AF (Continued)
Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AF-120	129477	Rod - Shifter Q. T.	1	4AF-148	70908	Collar - Thrust	1
4AF-121	65728	Fork - Shifter Q. T.	1	4AF-149	70906	Bearing	1
4AF-122	63772	Pin - Straight Driving	1	4AF-150	73865	Gear - Quick Traverse	1
4AF-123	3329	Pin - Cotter	2	4AF-151	70907	Spacer - Idler Q. T.	1
4AF-124	1744	Screw	1	4AF-152	2143	Nut	1
4AF-125	1744	Screw	1	4AF-153	2038	Washer	1
4AF-126	66510	Spring	1	4AF-154	129450	Gear - Bevel	1
4AF-127	3233	Screw	1	4AF-155	129474	Gear	1
4AF-128	3473	Nut	1	4AF-156	129249	Bushing	1
4AF-129	2102	Pin - Cotter	1	4AF-157	129247	Stud - Bevel Gear	1
4AF-130	69448	Plug	1	4AF-158	14556	Pin - Taper	1
4AF-131	3473	Nut	1	4AF-159	48073	Pin - Lock	1
4AF-132	3236	Screw	1	4AF-160	99154	Pinion - Shifter Feed Clutch	1
4AF-133	62870	Lever - Q. T. Operating	1	4AF-161	99153	Lever - Clutch Feed Control	1
4AF-134	33951	Pin - Lock	1	4AF-162	210714	Ring - Piston	1
4AF-135	2135	Washer - Lock	1	4AF-163	210714	Ring - Piston	1
4AF-136	2144	Nut	1	4AF-164	102318	Piston - Feed Clutch	1
4AF-137	3233	Screw	1	4AF-165	102647	Cylinder - Feed Clutch	1
4AF-138	1911	Screw	1	4AF-166	102315	Stop - Feed	1
4AF-139	76645	Plug - Pipe	1	4AF-167	99061	Fork - Shifter Feed Clutch	1
4AF-140	3232	Screw	1	4AF-168	60263	Pin	1
4AF-141	3234	Screw	1	4AF-169	98981	Spring	1
4AF-142	3473	Nut	1	4AF-170	60263	Pin	1
4AF-143	62869	Shaft - Coupling Q. T.	1	4AF-171	2144	Nut	1
4AF-144	1266	Key	1	4AF-172	2135	Washer	1
4AF-145	3636	Pin	1	4AF-173	33951	Pin - Lock	1
4AF-146	70905	Stud - Idler	1			Q. T. = Quick (Rapid) Traverse	
4AF-147	1962	Plug	1				

CONTROL CAMS



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

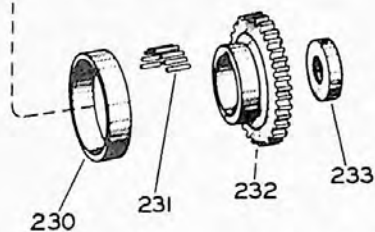
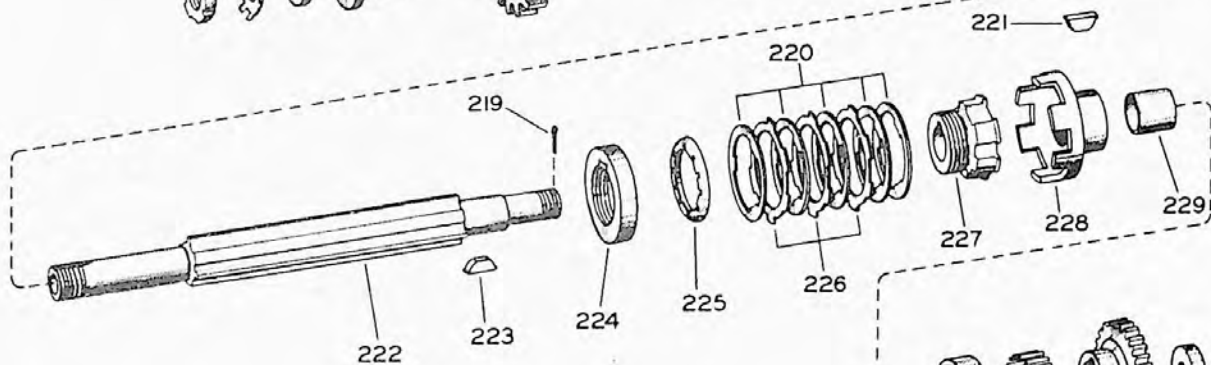
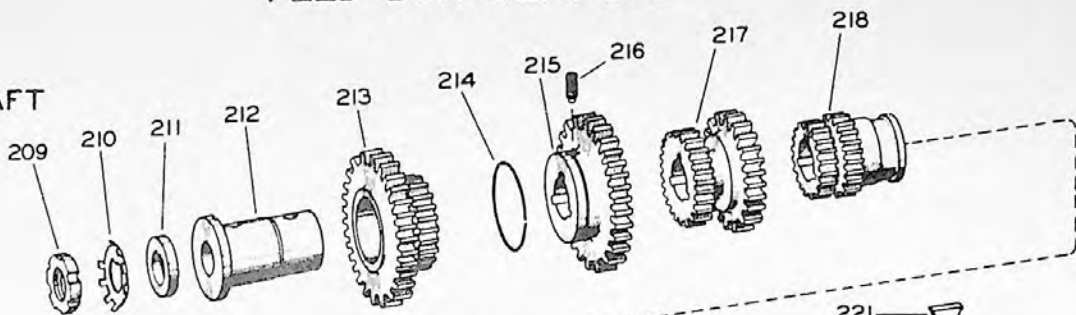
FEED BOX--UNIT No. 4 AF (Continued)

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

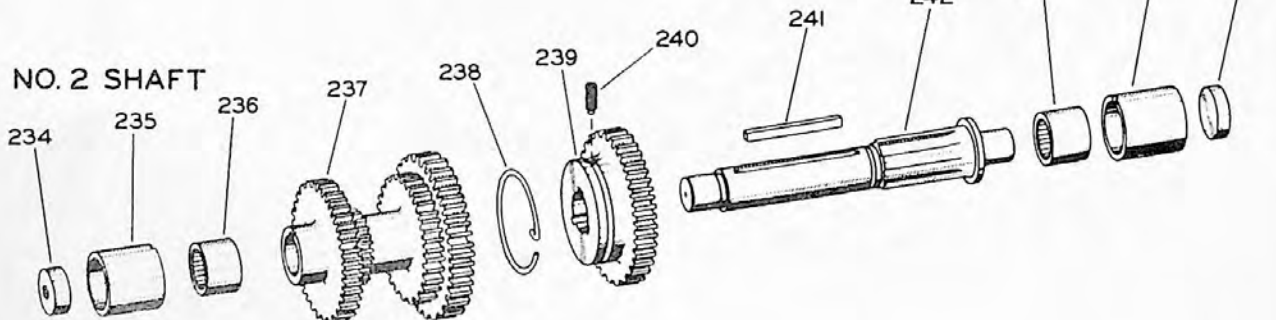
KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AF-174	99105	Lever - Shifter 21 Speed - 24 Feed only	1	4AF-191	129248	Bushing - Detent Lever	1
4AF-175	663	Pin - Taper 21 Speed - 24 Feed only	1	4AF-192	99012	Lever - Detent	1
4AF-176	129149	Lever - Gear Shifter 21 Speed - 24 Feed only	1	4AF-193	3959	Spring	1
4AF-177	99108	Lever - Gear Shifter	1	4AF-194	3805	Washer - Lock	1
4AF-178	99107	Lever - Gear Shifter	1	4AF-195	3806	Nut - Lock	1
4AF-179	129157	Shaft - Gear Shifter 21 Speed - 24 Feed only	1	4AF-196		Cam "B"	
4AF-180	99067	Lever - Gear Shifter 21 Speed - 24 Feed only	1		129244	21 Speed - 24 Feed	1
4AF-181	663	Pin - Taper 21 Speed - 24 Feed only	1		129139	16 Speed - 16 Feed	1
4AF-182	129158	Pin 21 Speed - 24 Feed only	1	4AF-197	79524	Bearing - Needle	1
4AF-183	62881	Pin	1	4AF-198	129243	Stud - Cam "B"	1
4AF-184	62885	Pin	1	4AF-199	131467	Stud - Gear Shifter	1
4AF-185		Shaft - Detent		4AF-200	99056	Lever - Gear Shifter	1
	99214	21 Speed - 24 Feed	1	4AF-201	129246	Lever - Gear Shifter	1
	129101	16 Speed - 16 Feed	1	4AF-202	131467	Stud - Gear Shifter	1
4AF-186	3261	Key	1	4AF-203	89866	Fitting - Comp, Coupling	1
4AF-187		Cam "A"		4AF-204	3551	Plug	1
	99212	21 Speed - 24 Feed	1	4AF-205	3233	Screw	1
	129140	16 Speed - 16 Feed	1	4AF-206	62733	Plug - Pipe 1/8	1
4AF-188	3936	Washer - Lock	1	4AF-207	3549	Plug	1
4AF-189	3937	Nut - Lock	1	4AF-208	3233	Screw	1
4AF-190	129245	Stud - Cam "A"	1				

FEED BOX-GEARING

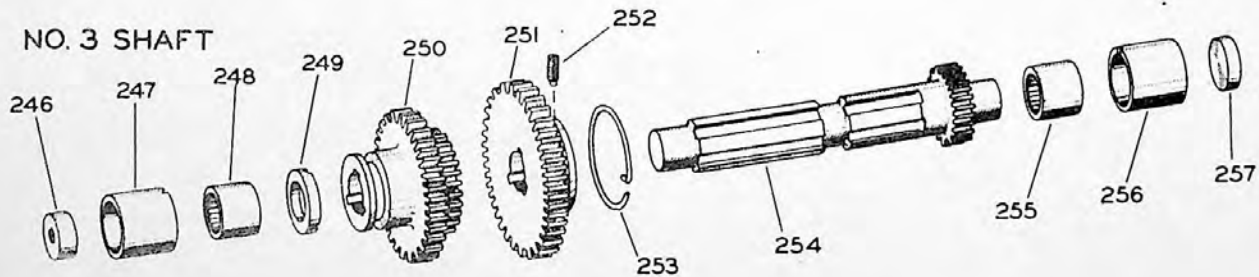
NO. 1 SHAFT



NO. 2 SHAFT



NO. 3 SHAFT



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

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FEED BOX—UNIT No. 4 AF (Continued)

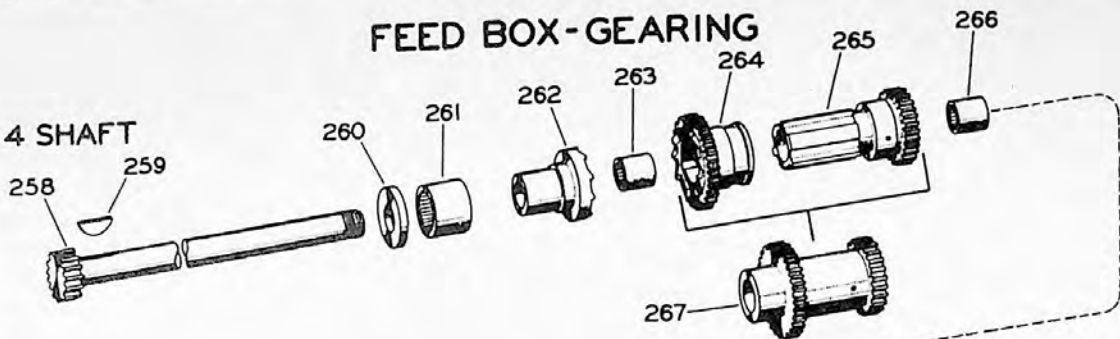
Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AF-209	3808	Nut - Lock	1	4AF-234	73411	Plug	1
4AF-210	3807	Washer - Lock	1	4AF-235	98986	Sleeve - Bearing	1
4AF-211	65761	Collar - Thrust	1	4AF-236	98985	Bearing - Needle	1
4AF-212	99104	Bushing	1	4AF-237	99051	Gear - Cluster	1
4AF-213	132514	Gear - Compound	1	4AF-238	62830	Spring - Wire Ring	1
4AF-214	62830	Spring - Wire Ring	1	4AF-239	99066	Gear	1
4AF-215	99065	Gear	1	4AF-240	3233	Screw	1
4AF-216	3233	Screw	1	4AF-241	1799	Key	1
4AF-217	99068	Gear - Large Sliding	1	4AF-242	99011	Shaft - 2nd Feed	1
4AF-218	99059	Gear - Small Sliding	1	4AF-242	98985	Bearing - Needle	1
4AF-219	2036	Pin - Cotter	1	4AF-244	98988	Sleeve - Bearing	1
4AF-220	75899	Plate - Driven	5	4AF-245	3830	Plug	1
4AF-221	3280	Key	1	4AF-246	73411	Plug	1
4AF-222	101245	Shaft - 1st Feed	1	4AF-247	98986	Sleeve - Bearing	1
4AF-223	3280	Key	1	4AF-248	98985	Bearing - Needle	1
4AF-224	101235	Nut - Adjusting	1	4AF-249	98978	Washer - Thrust	1
4AF-225	101236	Spring - Gear Collar	1	4AF-250	99069	Gear - Sliding	1
4AF-226	75898	Plate - Driving	3	4AF-251	99062	Gear - Pinned	1
4AF-227	101241	Hub - Safety Clutch	1	4AF-252	3233	Screw	1
4AF-228	101243	Clutch - Safety Drive	1	4AF-253	62830	Spring - Wire Ring	1
4AF-229	101240	Bushing - Safety Gear	1	4AF-254	99047	Shaft - 3rd Feed	1
4AF-230	101237	Cup - Roller Bearing	1	4AF-255	98985	Bearing - Needle	1
4AF-231	101238	Bearing - Roller	38	4AF-256	98987	Sleeve - Bearing	1
4AF-232	101242	Gear - Safety	1	4AF-257	3830	Plug	1
4AF-233	101239	Nut - Shaft Safety Clutch	1				

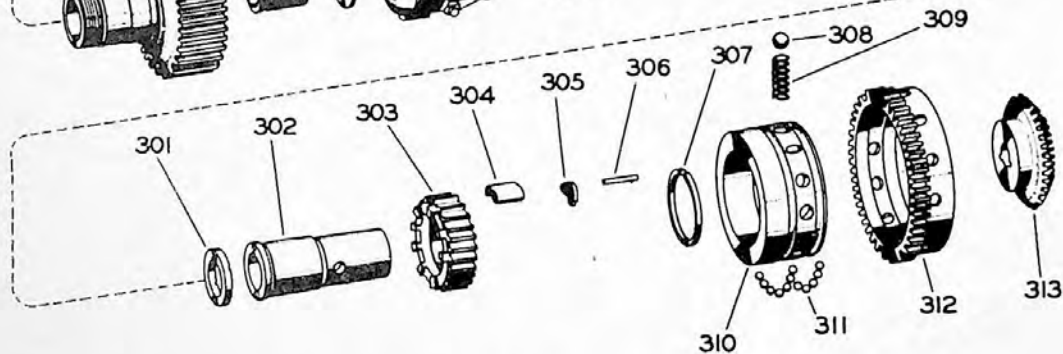
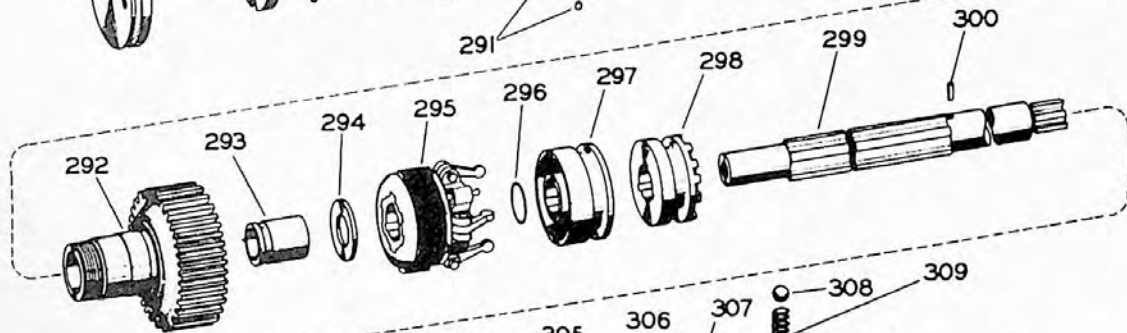
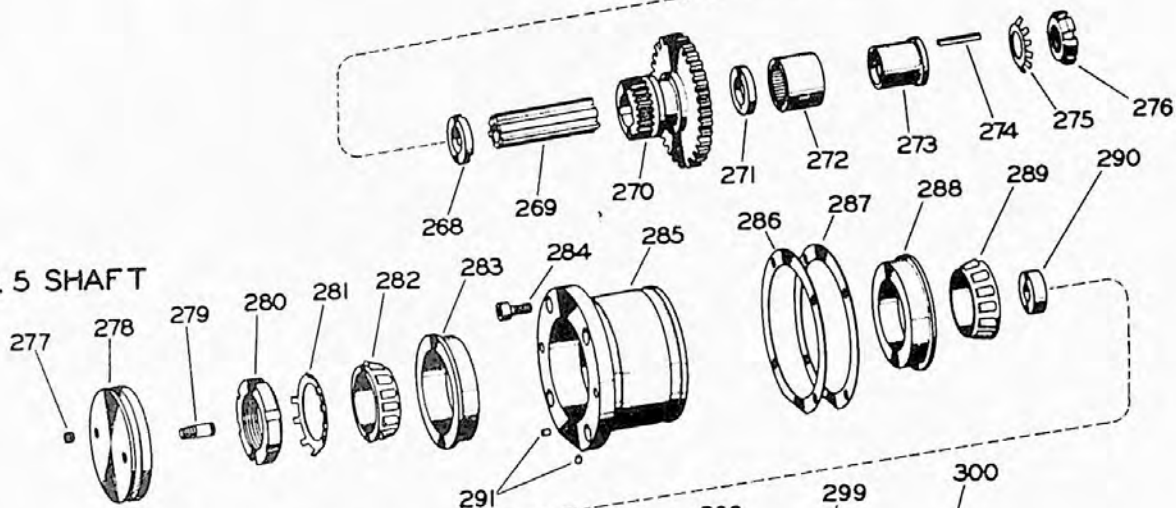
PARTS LIST CATALOG

FEED BOX-GEARING

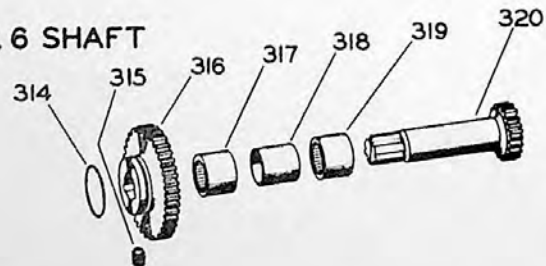
NO. 4 SHAFT



NO. 5 SHAFT



NO. 6 SHAFT



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

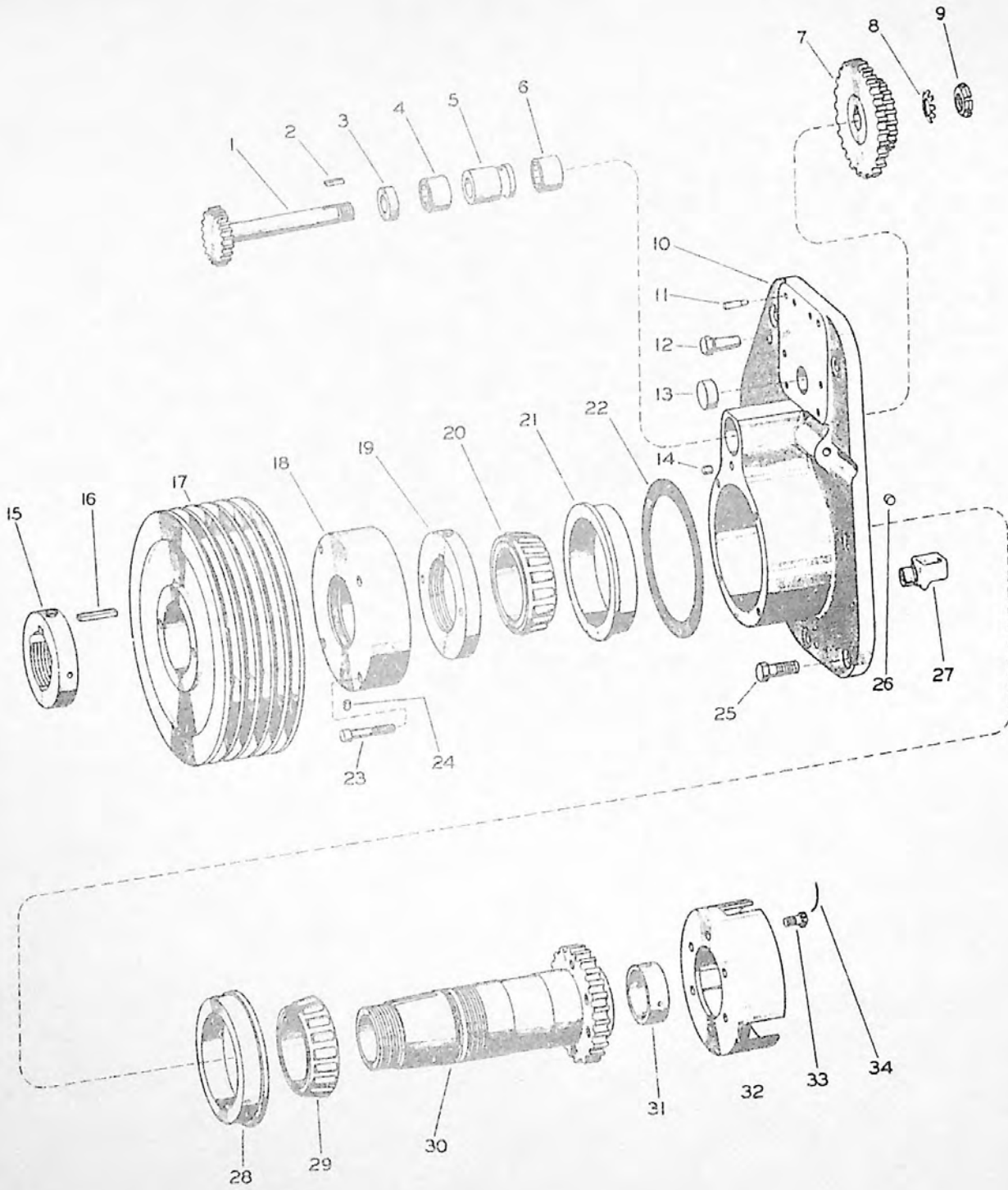
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FEED BOX—UNIT No. 4 AF (Concluded)

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AF-258		Shaft - 4th Drive					
	129154	5/8 to 20 Feed - 16 Speed - 16 Feed . . .	1	4AF-291	227467	Plug - Brass	2
	99048	5/16 to 10 Feed - 16 Speed - 16 Feed . .	1	4AF-292	66959	Sleeve - Clutch Feed Shaft	1
	99048	5/16 to 60 Feed - 21 Speed - 24 Feed . .	1	4AF-293	67454	Bushing	1
	129152	1 to 30 Feed - 16 Speed - 16 Feed	1	4AF-294	60681	Washer - Clutch.	1
4AF-259	3497	Key	1	4AF-295	69581	Clutch - Multiple Disc.	1
4AF-260	99152	Washer - Thrust.	1	4AF-296	30059	Spring - Wire Ring	1
4AF-261	98984	Bearing - Needle	1	4AF-297	65734	Spool - Sliding Q. T.	1
4AF-262	99055	Clutch - Drive	1	4AF-298	104999	Clutch - Sliding Feed	1
4AF-263	98985	Bearing - Needle	1	4AF-299	129150	Shaft - 5th Feed	1
4AF-264	99054	Clutch - Sliding Gear - 21 Speed - 24 Feed.	1	4AF-300	3636	Pin	1
4AF-265	99053	Gear - Sleeve - 21 Speed - 24 Feed	1	4AF-301	65725	Washer - Thrust.	1
4AF-266	98985	Bearing - Needle	1	4AF-302	65731	Sleeve	1
4AF-267	129202	Gear - Compound -16 Speed - 16 Feed . . .	1	4AF-303	104998	Ratchet	1
4AF-268	98978	Washer.	1	4AF-304	65726	Pawl	1
4AF-269	99064	Sleeve - Spline	1	4AF-305	65722	Lifter	1
4AF-270	99050	Gear	1	4AF-306	93367	Pin	2
4AF-271	65761	Collar - Thrust	1	4AF-307	65724	Spring - Ratchet.	1
4AF-272	98984	Bearing - Needle	1	4AF-308	36147	Ball	12
4AF-273	98990	Bushing	1	4AF-309		Spring	
4AF-274	1632	Key	1		106866	No. 2 Machine	12
4AF-275	3807	Washer - Lock	1		85431	Nos. 3 & 4 Machines	12
4AF-276	3803	Nut - Lock	1	4AF-310	67856	Hub.	1
4AF-277	76644	Plug - Pipe	1	4AF-311	30060	Ball	110
4AF-278	129145	Plug - Retainer	1	4AF-312	68007	Gear - Safety	1
4AF-279	129108	Tube - Oil	1	4AF-313	129109	Gear - Bevel.	1
4AF-280	3796	Nut - Lock.	1	4AF-314	45322	Spring	1
4AF-281	3795	Washer - Lock	1	4AF-315	3232	Screw	1
4AF-282	58040	Cone - Roller Bearing	1	4AF-316		Gear - Intermediate Drive	
4AF-283	58039	Cup - Roller Bearing	1		129155	5/8 to 20 Feed - 16 Feed	1
4AF-284	2320	Screw	4		99063	5/16 to 10 Feed - 16 Speed.	1
4AF-285	129147	Retainer - Bearing	1		129153	1 to 30 Feed - 16 Speed	1
4AF-286	129112	Shim - Retainer	1		99063	5/16 to 60 Feed - 21 Speed.	1
4AF-287	129112	Shim - Retainer	1	4AF-317	93421	Bearing - Needle	1
4AF-288	58039	Cup - Roller Bearing	1	4AF-318	129206	Spacer - Bearing	1
4AF-289	58040	Cone - Roller Bearing	1	4AF-319	93421	Bearing - Needle	1
4AF-290	129111	Plug	1	4AF-320	129207	Gear - Stem	1

PULLEY BRACKET



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

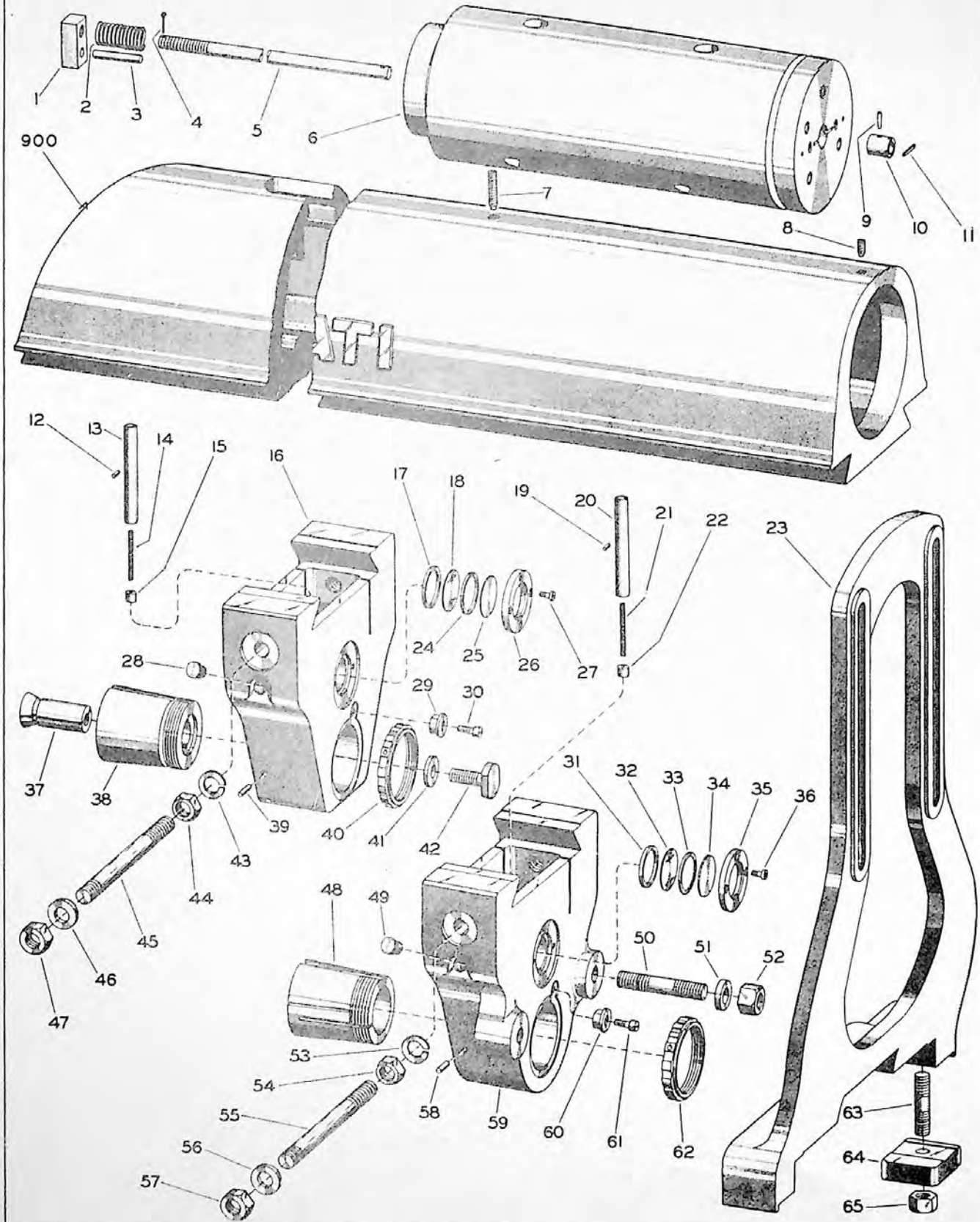
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

PULLEY BRACKET—UNIT No. 4 AJ

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AJ -1	115121	Gear - Pump Drive		4AJ -16	3450	Key	1
	129469	Plain and Universal Only.	1	4AJ -17		Sheave - (State serial number of machine)	1
		Vertical Only.	1	4AJ -18	98406	Retainer - Oil Brg.	1
4AJ -2	3447	Key.	1	4AJ -19	98419	Nut - Lock.	1
4AJ -3	65706	Collar - Oil Retainer	1	4AJ -20	57310	Cone - Roller Brg.	1
4AJ -4	65605	Bearing - Roller.	1	4AJ -21	64052	Cup - Roller Brg.	1
4AJ -5	65607	Spacer - Brg.	1	4AJ -22	98498	Gasket	1
4AJ -6	65605	Bearing - Roller.	1	4AJ -23	3402	Screw	4
4AJ -7		Gear - Pump Driving		4AJ -24	2190	Plug	1
	75949	Plain and Universal Only.	1	4AJ -25	3463	Screw	6
	129468	Vertical Only.	1	4AJ -26	1962	Plug	1
4AJ -8	3807	Washer - Lock	1	4AJ -27	65074	Catcher - Oil	1
4AJ -9	3808	Nut - Lock	1	4AJ -28	64052	Cup - Roller Brg.	1
4AJ -10	98119	Bracket - Pulley	1	4AJ -29	57310	Cone - Roller Brg.	1
4AJ -11	107162	Pin - Double Dia.	2	4AJ -30	98407	Sleeve - Gear	1
4AJ -12	3493	Pin - Taper Hex. Hd.	2	4AJ -31	68344	Bushing - Sleeve Gear.	1
4AJ -13	62581	Plug - 1-3/8 Dia.	1	4AJ -32	60996	Flange - Driving Disc.	1
4AJ -14	1962	Plug	1	4AJ -33	3440	Screw	1
4AJ -15	3853	Nut - Lock.	1	4AJ -32	3437	Wire	1

DAMPER-OVERARM-ARBOR SUPPORTS



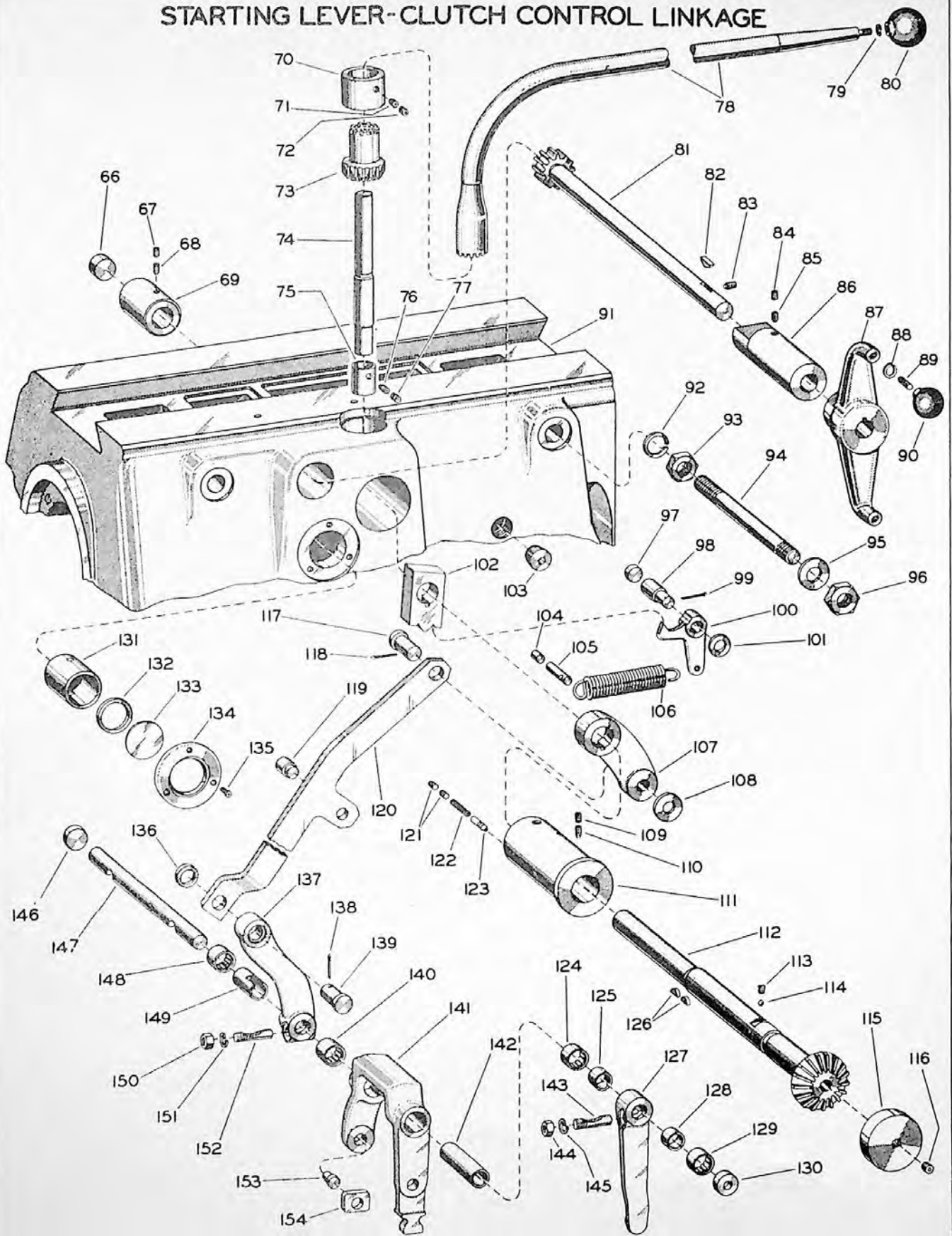
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

COLUMN-UNIT No. 4 AC
Nos. 2, 3, AND 4 PLAIN AND UNIVERSAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AC-1	131862	Nut - Tension	1	4AC-31	4086	Gasket	1
4AC-2	116970	Spring	1	4AC-32	3851	Dial - Oil Gage	1
4AC-3	3863	Pin	1	4AC-33	3850	Gasket - Oil Gage	1
4AC-4	703	Pin - Cotter	1	4AC-34	3849	Cover - Oil Gage	1
4AC-5		Rod - Adjusting		4AC-35	4075	Cover - Oil Gage	1
	138382	No. 2 P. U.	1	4AC-36	3213	Screw	4
	138384	Nos. 3 & 4 P. U.	1	4AC-37	3695	Bushing - Arbor Support	1
4AC-6		Damper - Vibration		4AC-38	3697	Bushing - Arbor	1
	138392	No. 2 P. U.	1	4AC-39	3543	Pin	1
	147095	Nos. 3 & 4 P. U.	1	4AC-40	3972	Nut - Adjusting	1
4AC-7	3235	Screw	1	4AC-41	128	Washer - Lock	1
4AC-8	3234	Screw	1	4AC-42	3692	Screw	1
4AC-9	140	Pin - Taper	1	4AC-43	2265	Washer	1
4AC-10	128297	Collar	1	4AC-44	666	Nut	1
4AC-11	128589	Key - Lock	1	4AC-45	129091	Stud	1
4AC-12	3539	Pin	1	4AC-46	764	Washer - Lock	1
4AC-13	66344	Tube - Oil	1	4AC-47	3481	Nut	1
4AC-14	61417	Wick	1	4AC-48	3697	Bushing	1
4AC-15	63561	Plug - Oil Tube	1	4AC-49	67608	Plug - Pipe 3/8	1
4AC-16		Support - Arbor		4AC-50	200741	Stud - Clamping	2
	129118	(Small Type "A") No. 2 P. U.	1	4AC-51	764	Washer	2
	129119	(Inner) No. 2 P. U.	1	4AC-52	3481	Nut	2
	129115	(Inner Type "B") Nos. 3 & 4 P. U.	1	4AC-53	2265	Washer	1
	129116	(Small Type "A") Nos. 3 & 4 P. U.	1	4AC-54	666	Nut	1
4AC-17	4086	Gasket	1	4AC-55	129091	Stud	1
4AC-18	3851	Dial - Oil Gage	1	4AC-56	764	Washer	1
4AC-19	3539	Pin	1	4AC-57	3481	Nut	1
4AC-20	66344	Tube - Oil	1	4AC-58	3543	Pin	1
4AC-21	61417	Wick	1	4AC-59		Support - Arbor	
4AC-22	63561	Plug - Oil Tube	1		129114	(Outer Type "B") No. 2 P. U.	1
4AC-23		Brace - Overarm			129117	(Outer Type "B") Nos. 3 & 4 P. U.	1
	100800	No. 2 P. U.	1	4AC-60	3974	Roller - Lock	1
	100699	Nos. 3 & 4 P. U.	1	4AC-61	3484	Screw	1
4AC-24	3850	Gasket - Oil Gage	1	4AC-62	3972	Nut - Adjusting	1
4AC-25	3849	Dial - Oil Gage	1	4AC-63	3970	Stud	2
4AC-26	4075	Cover - Oil Gage	1	4AC-64	98510	Clamp - Over Arm Brace	2
4AC-27	3213	Screw	4	4AC-65	3480	Nut	2
4AC-28	67608	Plug - Pipe 3/8	1	4AC-900		Arm - Over	
4AC-29	3974	Roller - Lock	1		129050	No. 2 P. U.	1
4AC-30	3484	Screw	1		129051	No. 3 P. U.	1
					129129	No. 4 P. U.	1

STARTING LEVER-CLUTCH CONTROL LINKAGE



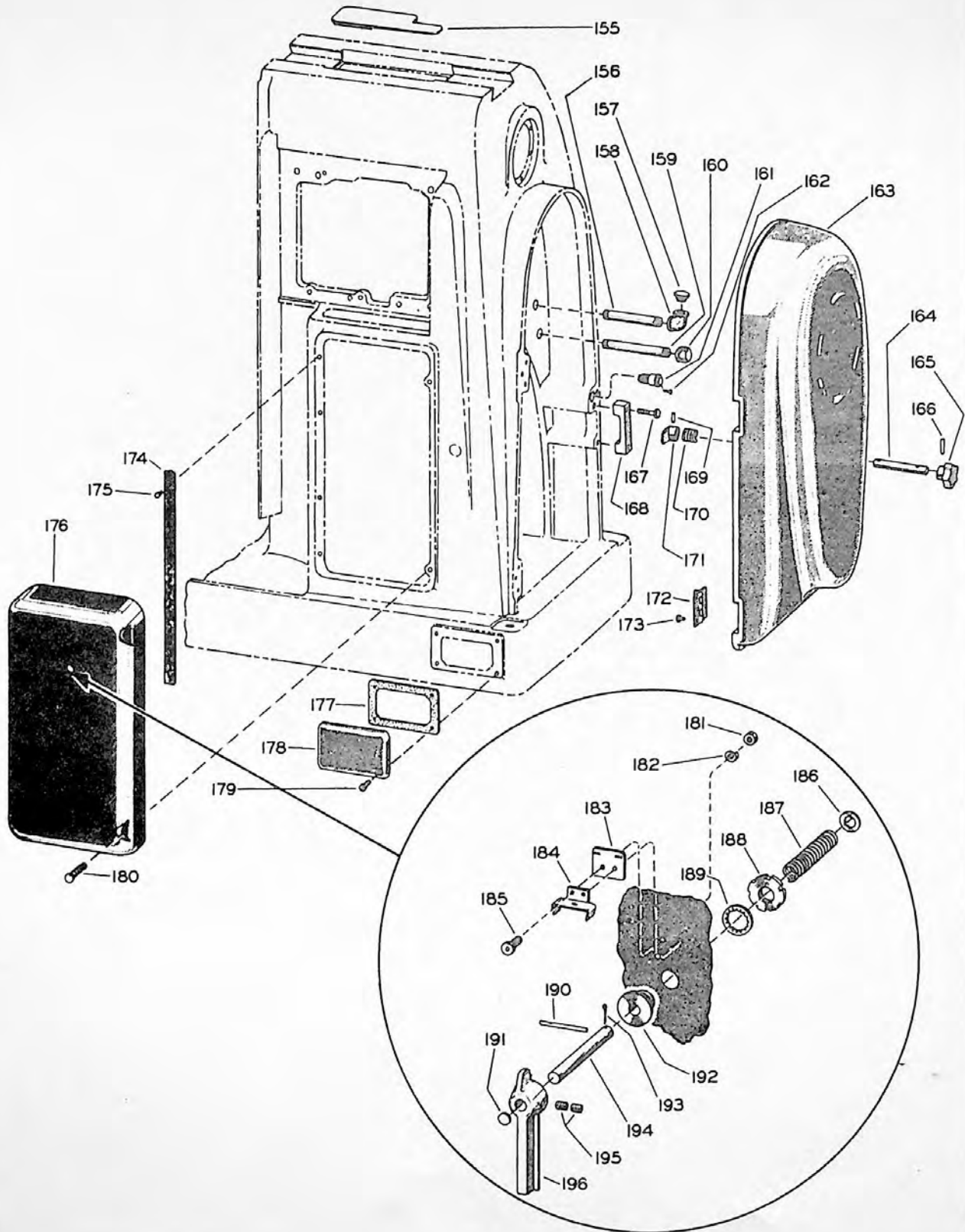
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

COLUMN-UNIT No. 4 AC (Continued)
Nos. 2, 3, AND 4 PLAIN AND UNIVERSAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AC-66	3551	Plug	1	4AC-111	129131	Sleeve - Starting Lever	1
4AC-67	1917	Screw	1	4AC-112	129134	Shaft - Starting Lever	1
4AC-68	3233	Screw	1	4AC-113	62733	Plug	1
4AC-69	129223	Bushing	1	4AC-114	30060	Ball	1
4AC-70	129130	Bushing	1	4AC-115	3558	Plug	1
4AC-71	1911	Screw	1	4AC-116	1917	Screw	1
4AC-72	3232	Screw	1	4AC-117	66429	Pin - Starting Lever	1
4AC-73	129128	Gear - Bevel Clutch	1	4AC-118	1959	Pin - Cotter	1
4AC-74	129132	Shaft - Bevel Gear	1	4AC-119	100695	Pin - Starting Lever Link	1
4AC-75	3564	Bushing	1	4AC-120		Link - Clutch Shifter	
4AC-76	1917	Screw	1		100326	No. 2 P. U.	1
4AC-77	3233	Screw	1		98763	Nos. 3 & 4 P. U.	1
4AC-78	129133	Lever - Starting	1	4AC-121	1917	Screw	2
4AC-79	2135	Washer	1	4AC-122	65916	Spring	1
4AC-80	115032	Ball	1	4AC-123	65913	Valve - Relief	1
4AC-81	99961	Pinion - Stem Pilot Wheel	1	4AC-124	79762	Bearing	1
4AC-82	3280	Key	1	4AC-125	99956	Spacer - L. H.	1
4AC-83	3232	Screw	1	4AC-126	3280	Key	2
4AC-84	1917	Screw	1	4AC-127	98681	Lever - Valve Shifter	1
4AC-85	3232	Screw	1	4AC-128	99956	Spacer - L. H.	1
4AC-86	99950	Bushing	1	4AC-129	79762	Bearing	1
4AC-87	129135	Hub - Handwheel O. A.	1	4AC-130	99953	Plug	1
4AC-88	2135	Washer	2	4AC-131	63015	Body - Oil Sight Gage	1
4AC-89	3860	Stud	2	4AC-132	3850	Gasket - Oil Gage	1
4AC-90	115032	Ball	2	4AC-133	3849	Disc - Oil Gage	1
4AC-91		Column		4AC-134	3848	Cover Oil Gage	1
	129136	No. 2 P. U.	1	4AC-135	3213	Screw	3
	129137	Nos. 3 & 4 P. U.	1	4AC-136	888	Washer	1
4AC-92	2265	Washer	2	4AC-137		Arm - Clutch Shifter	
4AC-93	666	Nut	2		99029	No. 2 P. U.	1
4AC-94		Stud - Short O. A. Clamp			98766	Nos. 3 & 4 P. U.	1
	66502	No. 2 P. U.	2	4AC-138	1959	Pin - Cotter	1
	71143	Nos. 3 & 4 P. U.	2	4AC-139	66429	Pin	1
4AC-95	764	Washer	2	4AC-140	79762	Bearing	1
4AC-96	3481	Nut	2	4AC-141	105109	Fork - Clutch Shifter	1
4AC-97	3530	Plug	1	4AC-142	99954	Spacer - Center	1
4AC-98	98755	Stud - Detent Lever	1	4AC-143	33941	Pin - Lock	1
4AC-99	3379	Pin - Cotter	1	4AC-144	3478	Nut	1
4AC-100	127598	Lever - Detent	1	4AC-145	2135	Washer	1
4AC-101	3442	Washer	1	4AC-146	99953	Plug	1
4AC-102	127597	Detent - Starting Lever	1	4AC-147	129224	Shaft - Clutch Shifter Fork	1
4AC-103	220231	Plug - Pipe	1	4AC-148	79762	Bearing	1
4AC-104	237588	Plug	1	4AC-149	99955	Spacer - L. H.	1
4AC-105	3382	Pin - Spring	1	4AC-150	3478	Nut	1
4AC-106	36057	Spring	1	4AC-151	2135	Washer	1
4AC-107	98669	Shifter - Starting Lever	1	4AC-152	33941	Pin - Lock	1
4AC-108	888	Washer	1	4AC-153	46855	Pin - Shifter	1
4AC-109	1917	Screw	1	4AC-154	64940	Shoe - Clutch Shifter	1
4AC-110	3238	Screw	1				

COLUMN



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

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COLUMN-UNIT No. 4 AC (Continued)

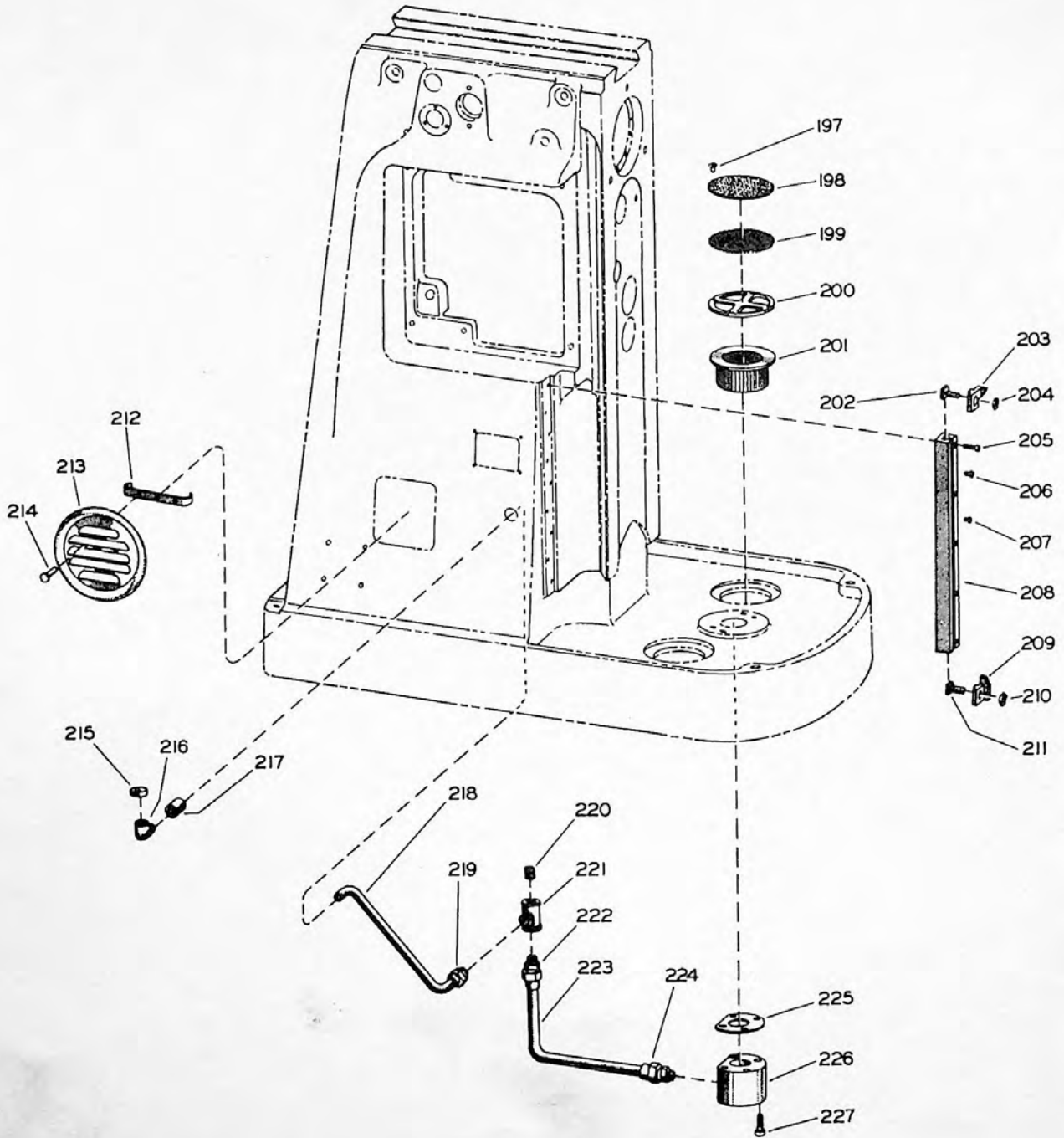
Nos. 2, 3, AND 4 PLAIN AND UNIVERSAL

ELECTRICAL EQUIPMENT-UNIT No. 4 ANN

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AC-155		Cover - Column Top		4AC-173	3218	Screw	12
	69802	No. 2 P. U.	1	4AC-174	129228	Hinge - Continuous	1
	69804	Nos. 3 & 4 P. U.	1	4AC-175	3202	Screw	4
4AC-156	129229	Pipe - List		4AC-176	129225	Cover - Electrical Compartment	1
4AC-157	3987	Plug - Oil Filler.	1	4AC-177	219931	Gasket - Base Cover	1
4AC-158	12814	Elbow - 90°	1	4AC-178	100026	Cover - Base Reservoir.	1
4AC-159	129229	Pipe - List		4AC-179	3403	Screw	4
4AC-160	200786	Cap - Pipe	1	4AC-180	129226	Screw	2
4AC-161	106991	Switch - Safety	1	4ANN-181	3472	Nut	2
4AC-162	1650	Screw	1	4ANN-182	2123	Washer	2
4AC-163		Cover - Motor Drive		4ANN-183	245702	Plate - Name Disconnect Switch	1
	129125	No. 2 P. U.	1	4ANN-184	129587	Guard - Disconnect Switch Lever	1
	129126	Nos. 3 & 4 P. U.	1	4ANN-185	3203	Screw	2
	129126	No. 2 Vertical	1	4ANN-186	93095	Washer - Plain	1
	129535	Nos. 3 & 4 Vertical	1	4ANN-187	245174	Spring - Disconnect Switch	1
4AC-164	74446	Stud - Motor Cover Latch.	1	4ANN-188	3812	Nut - Lock	1
4AC-165	3920	Knob - Star	1	4ANN-189	3253	Washer - Lock Shakeproof	1
4AC-166	642	Pin - Taper	1	4ANN-190	245175	Rod - Disconnect Switch	1
4AC-167	3464	Screw	2	4ANN-191	214034	Plug - Relief Valve Cover.	1
4AC-168	3921	Lock - For Latch	1	4ANN-192	245662	Bushing - Elect. Switch Lever	1
4AC-169	663	Pin - Taper	1	4ANN-193	1959	Pin - Cotter	1
4AC-170	3922	Spring	1	4ANN-194	248553	Shaft - Disconnect Mech.	1
4AC-171	3919	Latch.	1	4ANN-195	101782	Screw	2
4AC-172	128759	Hinge.	2	4ANN-196	253329	Lever - Disconnect Switch	1

COLUMN



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

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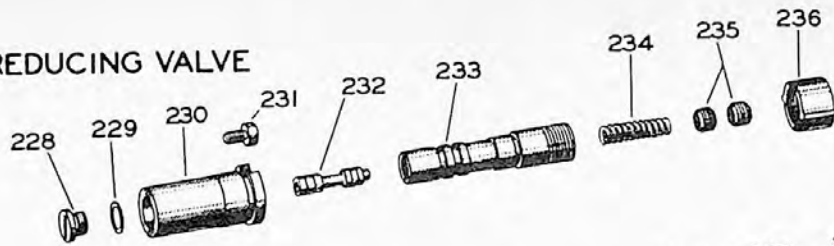
COLUMN-UNIT No. 4 AC (Continued)

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

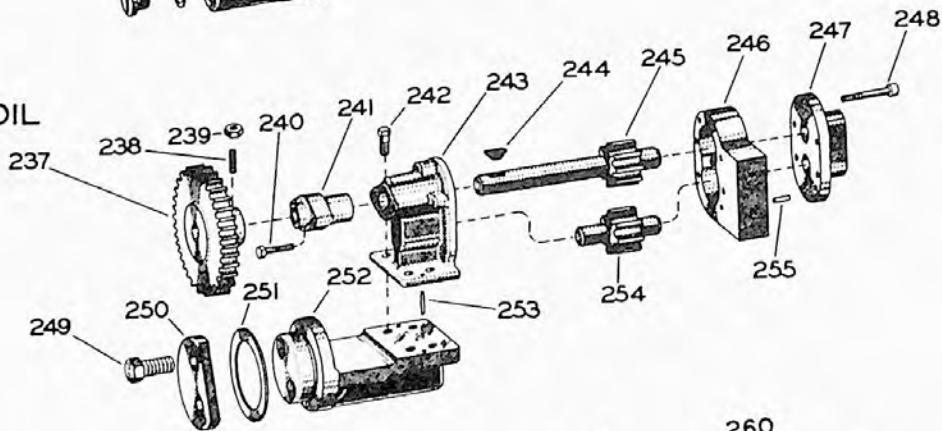
KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AP-197	3198	Screw	8	4AC-212	4172	Clip - Louver Cover.	1
4AP-198	95673	Strainer - Coarse Mesh.	2	4AC-213	130397	Louver - Column	1
4AP-199	95672	Screen - Fine Mesh	2	4AC-214	4173	Rivet - Flat Head.	2
4AP-200	95671	Frame - Strainer	2	4AC-215	3986	Cap - Oil Filler	1
4AP-201	124538	Strainer	2	4AC-216	211167	Elbow - Oil Filler.	1
4AC-202	3361	Bolt - Tee	1	4AC-217	129197	Sleeve - Oil Filler	1
4AC-203		Dog - Upper		4AC-218	141188	Tube - Oil Filler	1
	129210	No. 2 P. and U.	1	4AC-219	79730	Union - 3/4 Male Thread	1
	129213	Nos. 3 & 4 P. and U.	1	4AC-220		Nipple	
	129210	Nos. 2, 3, & 4 V.	1		26774	No. 2 V.	1
4AC-204	2057	Nut	1		244534	Nos. 3 & 4 V.	1
4AC-205	3397	Screw	5		24815	No. 2 P. and U.	1
4AC-206	3486	Screw	2		141592	Nos. 3 & 4 P. and U.	1
4AC-207	3218	Screw	4	4AC-221	89879	Tee.	1
4AC-208		Guide		4AC-222	79730	Union - 3/4 Male Thread	1
	129209	No. 2 P. and U.	1	4AC-223		Tubing - Sump	
	129212	Nos. 3 & 4 P. and U.	1		141198	No. 2 P. and U.	1
	129530	No. 2 V.	1		141197	No. 2 V.	1
	129531	Nos. 3 & 4 V.	1		141198	Nos. 3 & 4 P. and U.	1
4AC-209		Dog - Lower			141199	Nos. 3 & 4 V.	1
	129211	No. 2 P. and U.	1	4AC-224	79730	Union - 3/4 Male Thread	1
	129214	Nos. 3 & 4 P. and U.	1	4AC-225	108729	Gasket - Sump.	1
	129211	Nos. 2, 3, & 4 V.	1	4AC-226	108725	Sump - Elevating Screw.	1
4AC-210	2057	Nut	1	4AC-227	3404	Screw	4
4AC-211	3361	Bolt - Tee	1				

COLUMN ASSEMBLY

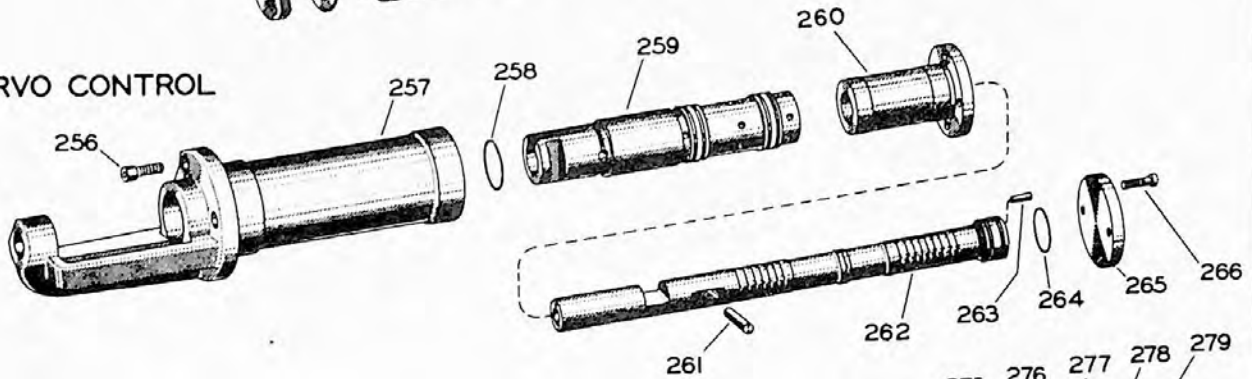
PRESSURE REDUCING VALVE



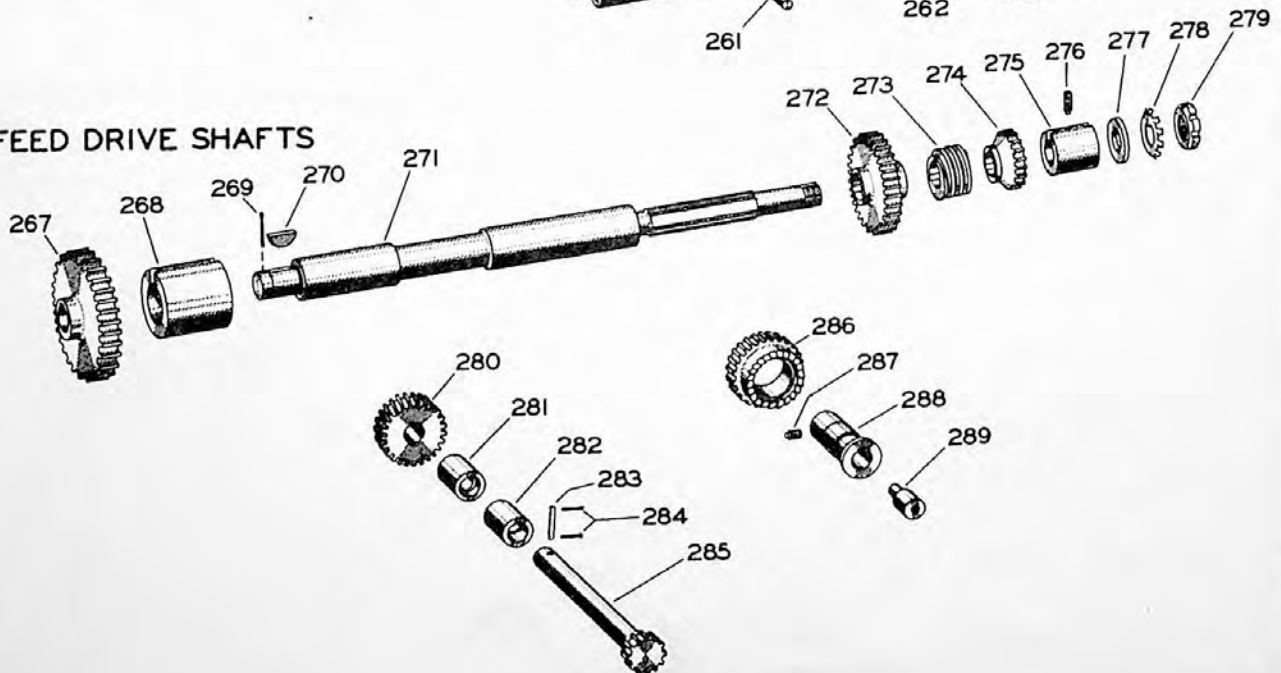
PUMP-OIL



SERVO CONTROL



FEED DRIVE SHAFTS



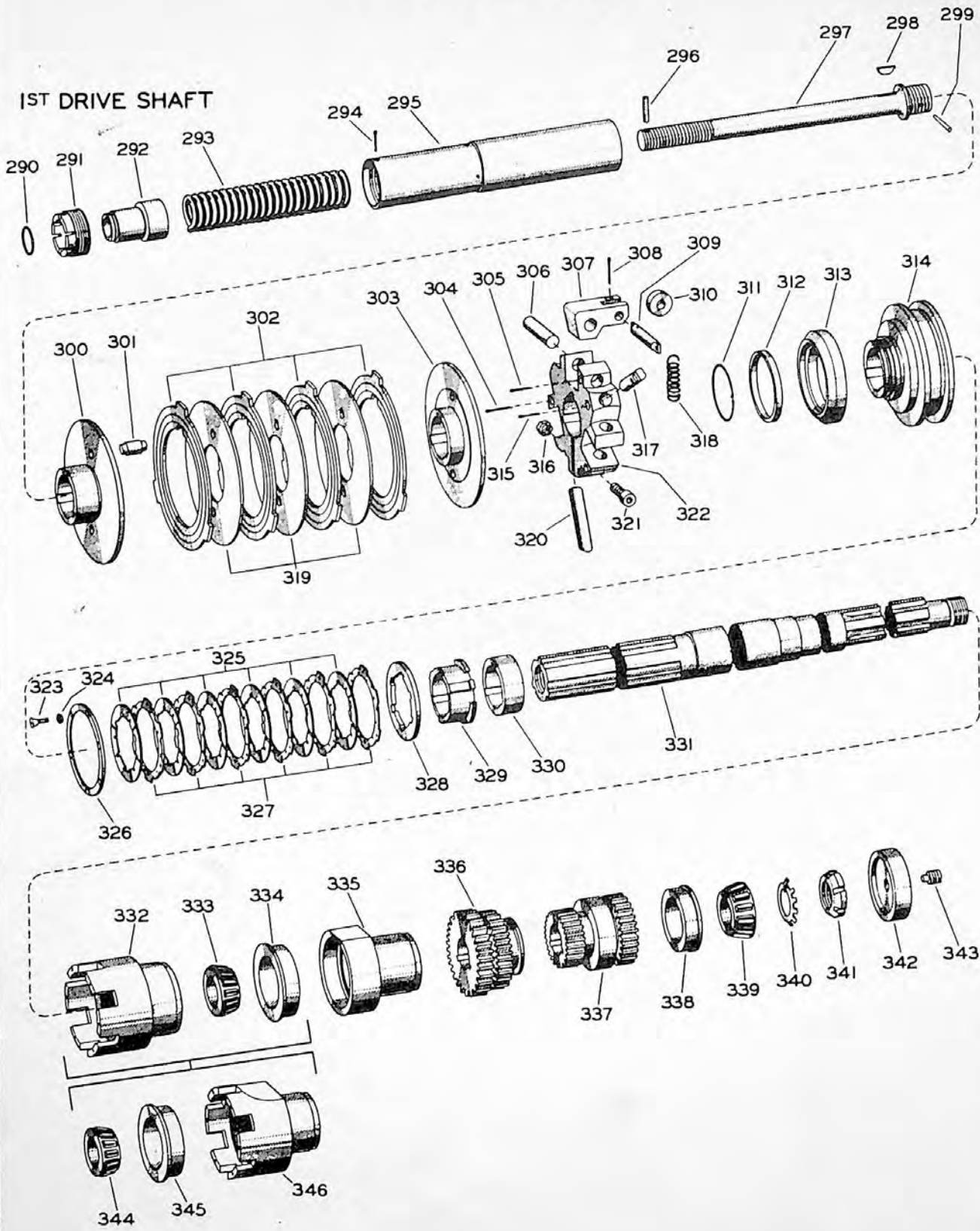
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

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COLUMN-UNIT No. 4 AC (Continued)
Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AC-228	95943	Plug - Nos. 2-3-4 V.	1	4AC-260	99959	Bushing	1
4AC-229	69203	Gasket - Nos. 2-3-4 V.	1	4AC-261	1384	Pin	1
4AC-230	130275	Body - Pressure Reducing Valve - Nos. 2-3-4 V.	1	4AC-262	129452	Piston - Valve	1
4AC-231	104202	Screw - Nos. 2-3-4 V.	1	4AC-263	3348	Pin	1
4AC-232	130276	Plunger - Pressure Reducing Valve - Nos. 2-3-4 V.	1	4AC-264	226074	Ring - Piston Backlash	2
4AC-233	130273	Bushing - Pressure Reducing Valve - Nos. 2-3-4 V.	1	4AC-265	99958	Cover - End.	1
4AC-234	72541	Spring - Nos. 2-3-4 V.	1	4AC-266	3227	Screw	4
4AC-235	236409	Screw - Nos. 2-3-4 V.	2	4AC-267		Gear	
4AC-236	13653	Cap - Pipe - Nos. 2-3-4 V.	1		75951	Nos. 2, 3, & 4 P. and U.	1
4AC-237		Gear - Pump			129472	Nos. 2, 3, & 4 V.	1
	75950	Nos. 2, 3, & 4 P. and U.	1	4AC-268		Bushing	
	129473	Nos. 2, 3, & 4 V.	1		99026	No. 2 P. U. and V.	1
4AC-238	3454	Screw	1		98756	Nos. 3 & 4 P. U. and V.	1
4AC-239	3472	Nut	1	4AC-269	1987	Pin - Cotter	1
4AC-240	57786	Screw	2	4AC-270	3497	Key	1
4AC-241	140223	Gland - Without Packing.	1	4AC-271		Shaft - Feed Drive	
4AC-242	2103	Screw	4		99038	No. 2 P. U. and V.	1
4AC-243	57772	Body - Pump.	1		98764	Nos. 3 & 4 P. U. and V.	1
4AC-244	3279	Key.	1	4AC-272	132511	Gear	1
4AC-245	111802	Pinion - Driving	1	4AC-273	129093	Worm	1
4AC-246	119908	Spacer - Pump Body.	1	4AC-274	98751	Pinion	1
4AC-247	58163	Cover - Pump	1	4AC-275	98754	Bushing	1
4AC-248	61356	Screw	6	4AC-276	3498	Screw	1
4AC-249	3381	Screw	2	4AC-277	96531	Washer - Thrust.	1
4AC-250	71365	Clamp - Pump Support	1	4AC-278	3805	Washer - Lock.	1
4AC-251	75167	Gasket	1	4AC-279	3806	Nut - Lock.	1
4AC-252	71794	Support - Pump	1	4AC-280	129094	Gear - Spiral	1
4AC-253	3541	Pin.	2	4AC-281	3832	Bushing	1
4AC-254	111601	Pinion - Driver	1	4AC-282	65905	Bushing	1
4AC-255	3636	Pin.	4	4AC-283	63630	Pin	1
4AC-256	3286	Screw	3	4AC-284	3329	Pin - Cotter	2
4AC-257	99965	Body - Seruo Valve	1	4AC-285	63320	Shaft - Speed Cam Clutch Drive	1
4AC-258	45322	Ring - Spring.	1	4AC-286	129096	Gear - Speed Dial Drive.	1
4AC-259	99963	Valve - Seruo.	1	4AC-287	3232	Screw	1
				4AC-288	66157	Cylinder - Dial Engagement Interlock	1
				4AC-289	66210	Piston - Dial Engagement Interlock	1

COLUMN-GEARING



CINCINNATI Nos 2, 3, AND 4 DIAL TYPE MILLING MACHINES

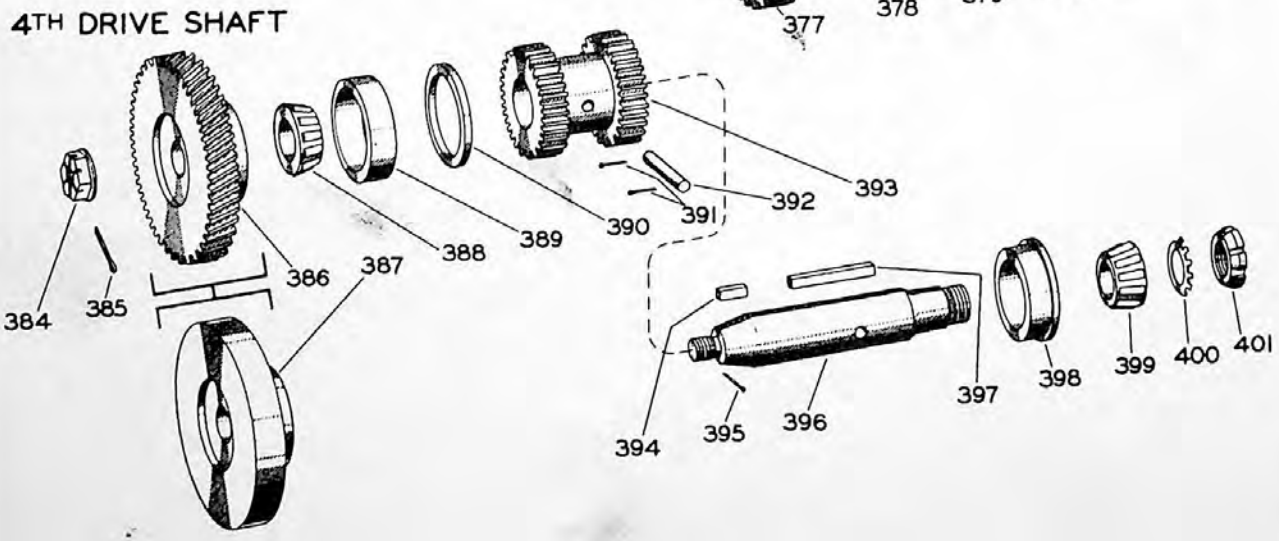
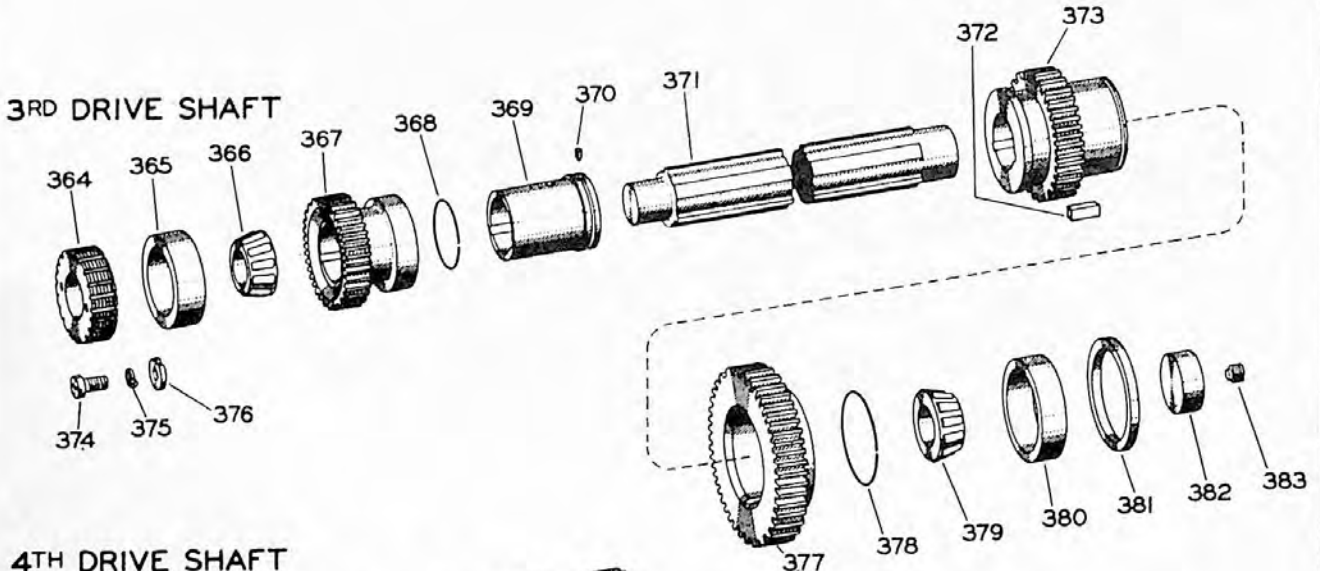
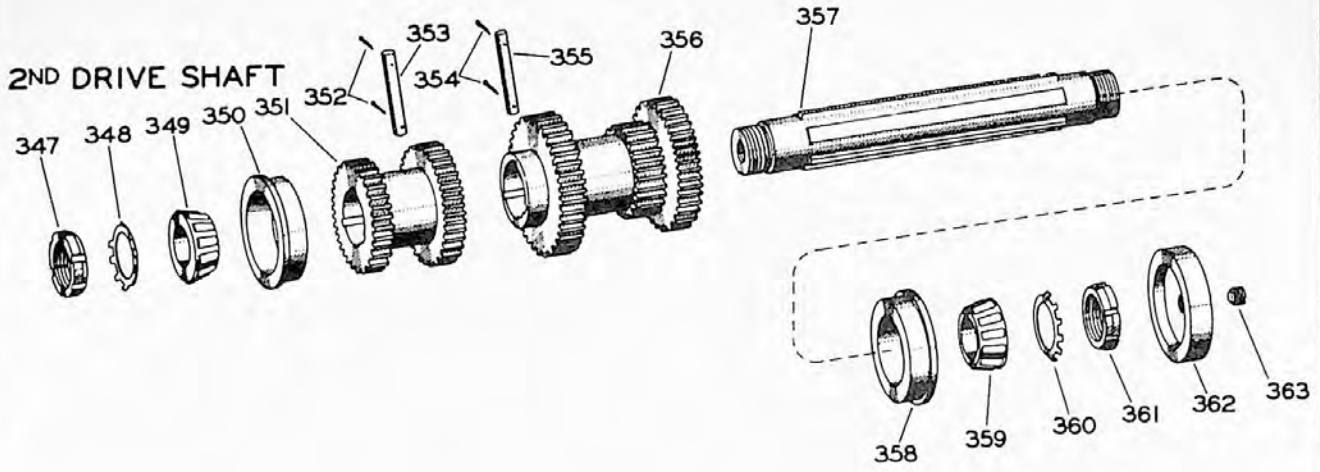
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

COLUMN-UNIT No. 4 AC (Continued)

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AC-290	30059	Spring	1	4AC-320	107766	Pin - Beveled	1
4AC-291	59060	Nut - Sleeve Outer.	1	4AC-321	3400	Screw	1
4AC-292	61285	Nut - Spring Adj.	1	4AC-322	98405	Carrier - Clutch Finger.	1
4AC-293	52502	Spring	1	4AC-323	3462	Screw	6
4AC-294	703	Pin - Cotter	1	4AC-324	3252	Washer.	6
4AC-295	98404	Sleeve - Clutch Spring.	1	4AC-325	73057	Plate - Driven.	6
4AC-296	68433	Pin - Straight	1	4AC-326	73055	Plate - Disc Retainer	1
4AC-297	98403	Rod - Clutch Spring	1	4AC-327	73058	Plate - Driving	6
4AC-298	3280	Key.	1	4AC-328	111740	Plate - Floating	1
4AC-299	1857	Pin - Taper	1	4AC-329	74830	Hub - Clutch Brake	1
4AC-300	127414	Hub - Driven Disc	1	4AC-330	73382	Spacer - Clutch Brake Nos. 3 & 4 P. U. V. Only	1
4AC-301	127416	Pin - Clutch Disc	2	4AC-331		Shaft - 1st Drive Nos. 3 & 4 P. U. and V.	1
4AC-302	98422	Disc - Driving	4		73381	No. 2 P. U. and V.	1
4AC-303	127415	Ring - Friction	1		62182	Hub - Disc Brake Nos. 3 & 4 P. U. V.	1
4AC-304	1987	Pin - Cotter	1	4AC-332	129237	Cone - Roller Bearing Nos. 3 & 4 P. U. V.	1
4AC-305	1959	Pin - Cotter	1	4AC-333	59687	Cup - Roller Bearing Nos. 3 & 4 P. U. V.	1
4AC-306	98416	Pin - Clutch Finger Carrier	2	4AC-334	59688	Adapter Nos. 3 & 4 P. U. V. Only.	1
4AC-307	37983	Finger - Clutch	3	4AC-335	62977	Gear - Large	1
4AC-308	1987	Pin - Cotter	1	4AC-336	65945	Gear - Small.	1
4AC-309	99952	Pin - Clutch Finger	3	4AC-337	65944	Cup - Roller Bearing	1
4AC-310	33273	Roller - Detent Lever.	3	4AC-338	62189	Cone - Roller Bearing.	1
4AC-311	57412	Spring - Locking.	1	4AC-339	62188	Washer - Lock.	1
4AC-312	57410	Washer - Clutch Spool.	1	4AC-340	3791	Nut - Lock.	1
4AC-313	67657	Ring - Clutch Spool	1	4AC-341	3792	Plug	1
4AC-314	73062	Clutch - Spool	1	4AC-342	63817	Screw	1
4AC-315	1959	Pin - Cotter	1	4AC-343	2261	Cone - Roller Bearing No. 2 P. U. V.	1
4AC-316	2135	Nut.	1	4AC-344	59687	Cup - Roller Bearing No. 2 P. U. V.	1
4AC-317	36861	Pin - Lock In Carrier	1	4AC-345	59688	Hub - Disc Brake No. 2 P. U. V.	1
4AC-318	99951	Spring - Clutch Finger.	3	4AC-346	129236		
4AC-319	98421	Disc - Driven Center	3				

COLUMN-GEARING



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

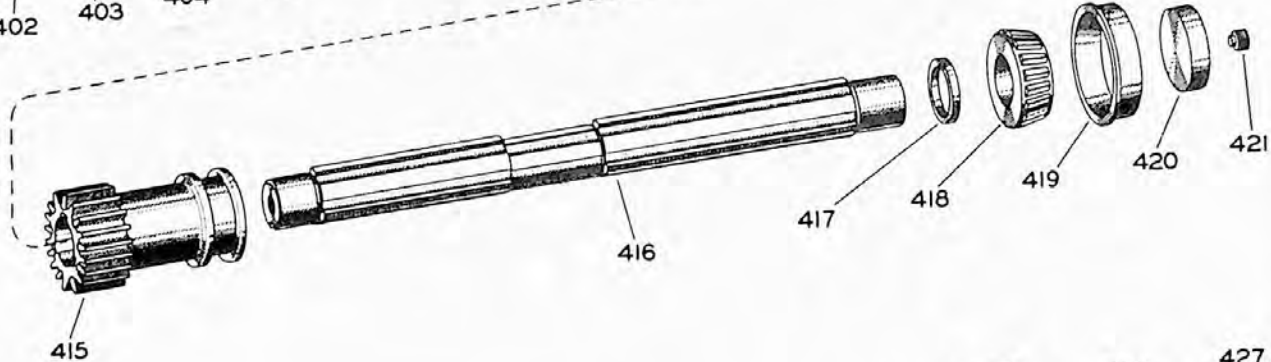
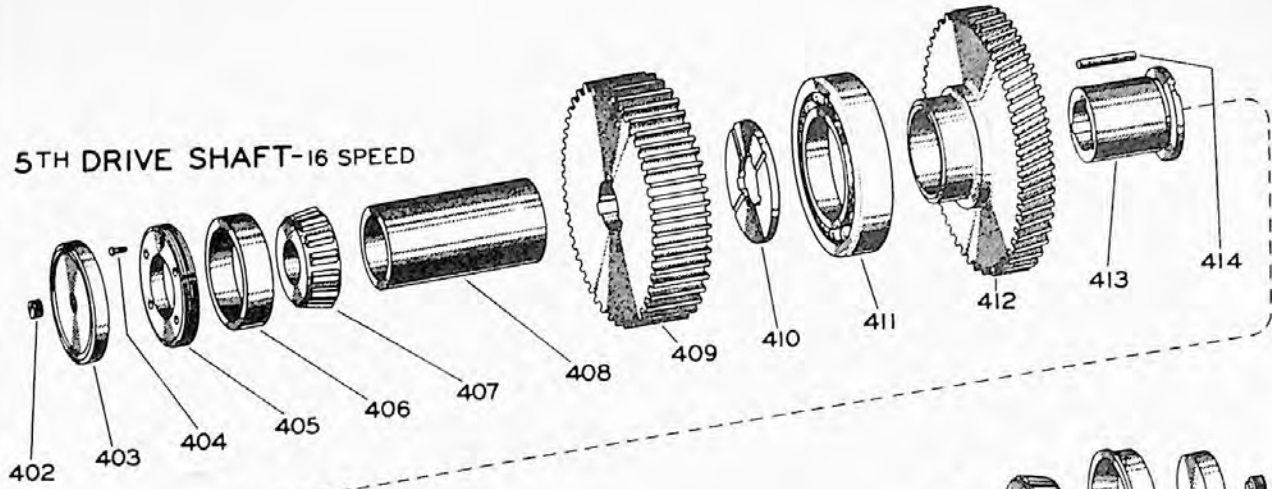
COLUMN-UNIT No. 4 AC (Continued)

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

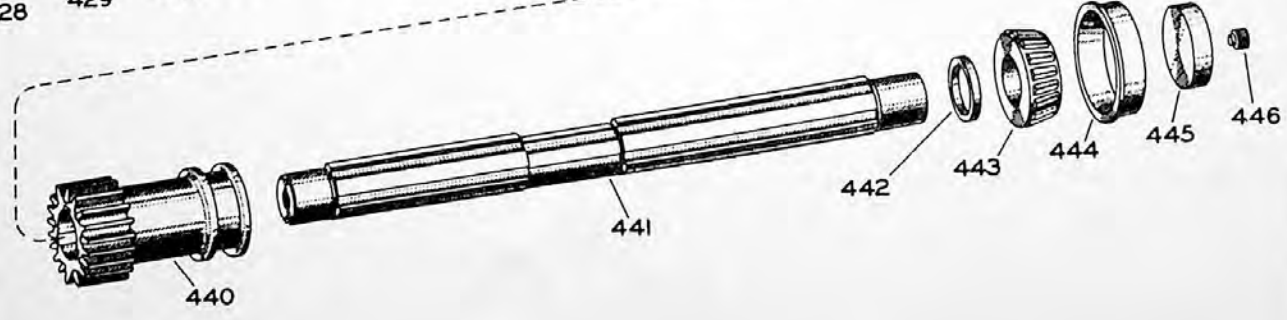
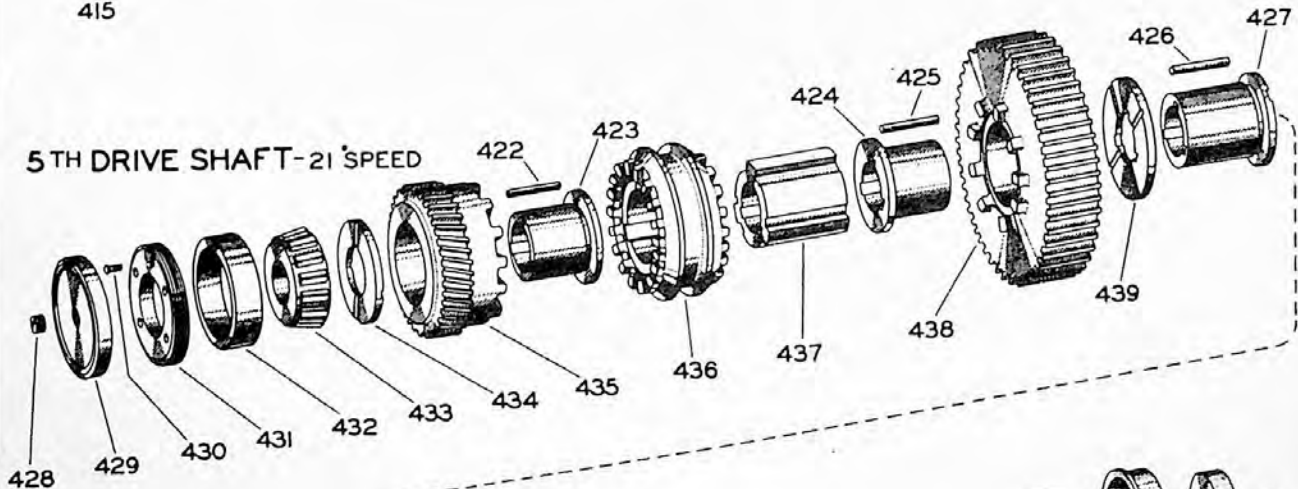
KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AC-347	3804	Nut - Lock	1	4AC-376	3445	Washer.	1
4AC-348	3803	Washer - Lock.	1	4AC-377	65943	Gear - On Sleeve Gear	1
4AC-349	62205	Cone - Roller Bearing.	1	4AC-378	89510	Spring	1
4AC-350	68118	Cup - Roller Bearing	1	4AC-379	62205	Cone - Roller Bearing.	1
4AC-351	65946	Gear - Small - 2nd Drive Shaft	1	4AC-380	3572	Cup - Roller Bearing	1
4AC-352	703	Pin - Cotter	2	4AC-381	3615	Spacer - Roller Bearing.	1
4AC-353	63193	Pin - Straight	1	4AC-382	3555	Plug	1
4AC-354	703	Pin - Cotter	2	4AC-383	1154	Screw	1
4AC-355	63193	Pin - Straight	1	4AC-384	70252	Nut	1
4AC-356	65942	Gear - Large - 2nd Drive Shaft	1	4AC-385	2036	Pin - Cotter	1
4AC-357	65949	Shaft - 2nd Drive	1	4AC-386		Gear - Reverse Shaft	
4AC-358	68118	Cup - Roller Bearing	1		70249	Nos. 3 & 4 - 21 Speed	1
4AC-359	62205	Cone - Roller Bearing.	1		70216	No. 2 - 21 Speed	1
4AC-360	3803	Washer - Lock.	1	4AC-387	113509	Spacer 16 Speed - 16 Feed Only.	1
4AC-361	3804	Nut - Lock	1	4AC-388	73228	Cone - Roller Bearing.	1
4AC-362	67265	Plug - Special	1	4AC-389	73227	Cup - Roller Bearing	1
4AC-363	1154	Screw	1	4AC-390	73229	Spacer - Roller Bearing	1
4AC-364	3592	Nut - Adjusting	1	4AC-391	703	Pin - Cotter	2
4AC-365	3570	Cup - Roller Bearing	1	4AC-392	63193	Pin - Straight	1
4AC-366	62200	Cone - Roller Bearing.	1	4AC-393	69362	Gear - Reverse Shaft	1
4AC-367	69366	Gear - Small - 3rd Drive Shaft	1	4AC-394	2212	Key - Square.	1
4AC-368	44085	Spring - Sleeve Driving	1	4AC-395	2036	Pin - Cotter	1
4AC-369	133551	Collar - Stop	1	4AC-396	70253	Shaft - Reverse	1
4AC-370	3228	Screw	1	4AC-397	1800	Key - Square.	1
4AC-371	69365	Shaft - 3rd Drive	1	4AC-398	62199	Cup - Roller Bearing	1
4AC-372	2212	Key.	1	4AC-399	62200	Cone - Roller Bearing.	1
4AC-373	66090	Gear - Sleeve - On 3rd Shaft	1	4AC-400	3791	Washer - Lock.	1
4AC-374	3318	Screw	1	4AC-401	3792	Nut - Lock	1
4AC-375	2135	Washer - Lock.	1				

**COLUMN-GEARING
NO. 2 MACHINE**

5TH DRIVE SHAFT-16 SPEED



5TH DRIVE SHAFT-21 SPEED



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

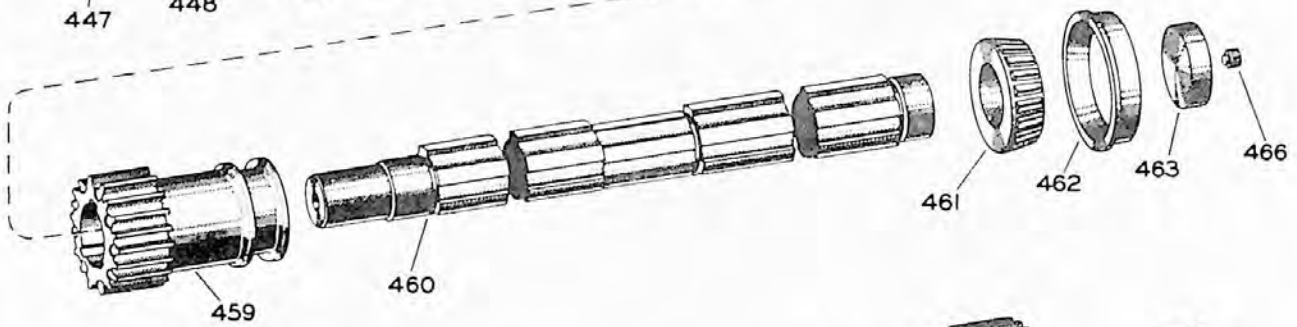
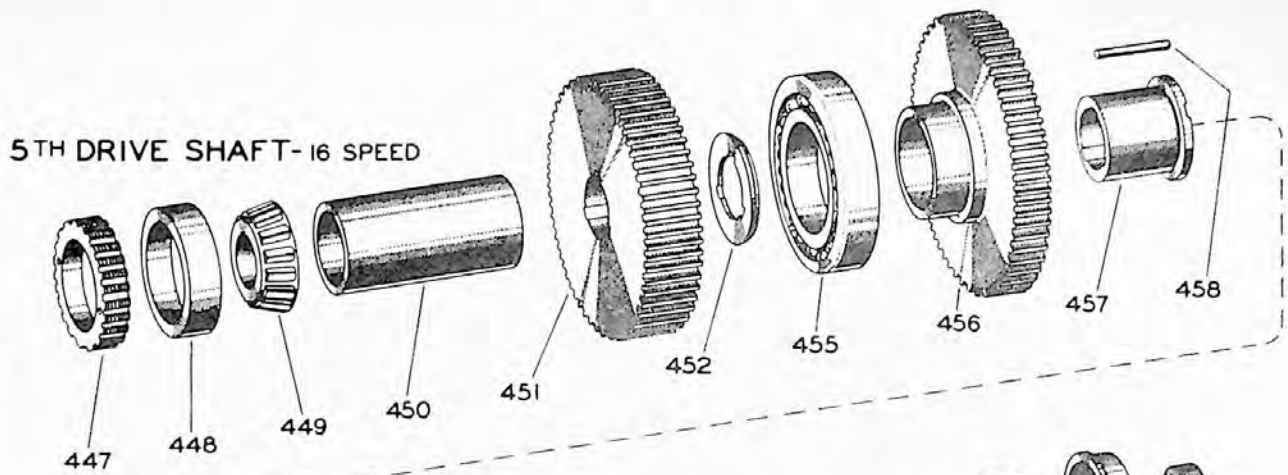
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

COLUMN-UNIT No. 4 AC (Continued)
No. 2 PLAIN, UNIVERSAL AND VERTICAL

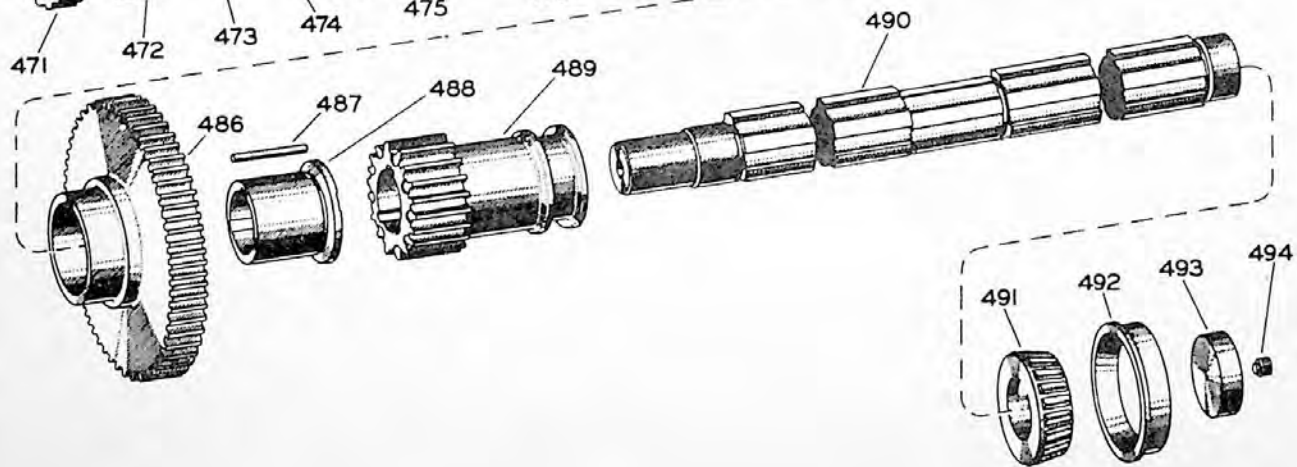
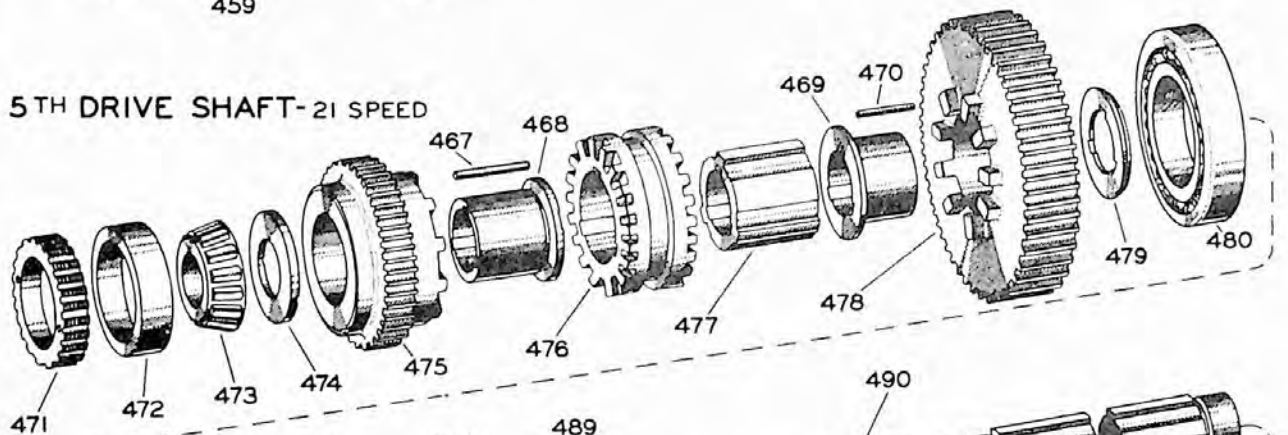
KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AC -402	1154	Screw (16 Speed)	1	4AC -425	69354	Roller - Bearing (21 Speed)	33
4AC -403	70196	Plug (16 Speed)	1	4AC -426	69349	Roller - Bearing (21 Speed)	33
4AC -404	3198	Screw (16 Speed)	1	4AC -427	70206	Hub - Roller Bearing (21 Speed)	1
4AC -405	70197	Nut - Adjusting (16 Speed)	1	4AC -428	1154	Screw (21 Speed)	1
4AC -406	73227	Cup - Roller Bearing (16 Speed)	1	4AC -429	70196	Plug (21 Speed)	1
4AC -407	73228	Cone - Roller Bearing (16 Speed)	1	4AC -430	3198	Screw (21 Speed)	1
4AC -408	70218	Spacer - Long (16 Speed)	1	4AC -431	70197	Nut - Adjusting (21 Speed)	1
4AC -409	73517	Gear - Large (16 Speed)	1	4AC -432	73227	Cup - Roller Bearing (21 Speed)	1
4AC -410	103151	Spacer (16 Speed)	1	4AC -433	73228	Cone - Roller Bearing (21 Speed)	1
4AC -411	70207	Bearing - Ball (16 Speed)	1	4AC -434	70199	Spacer (21 Speed)	1
4AC -412	70369	Gear - Back (16 Speed)	1	4AC -435	75007	Gear - Clutch Small (21 Speed)	1
4AC -413	70206	Hub - Roller Bearing (16 Speed)	1	4AC -436	75006	Clutch (21 Speed)	1
4AC -414	69349	Roller - Bearing (16 Speed)	33	4AC -437	70203	Sleeve - Clutch (21 Speed)	1
4AC -415	70212	Gear - Sliding Back (16 Speed)	1	4AC -438	75005	Gear - Clutch Large (21 Speed)	1
4AC -416	70213	Shaft - Back Gear (16 Speed)	1	4AC -439	103151	Spacer (21 Speed)	1
4AC -417	74944	Spacer (16 Speed)	1	4AC -440	70212	Gear - Sliding Back (21 Speed)	1
4AC -418	3576	Cone - Roller Bearing (16 Speed)	1	4AC -441	70213	Shaft - Back Gear (21 Speed)	1
4AC -419	204053	Cup - Roller Bearing (16 Speed)	1	4AC -442	74944	Spacer (21 Speed)	1
4AC -420	3558	Plug (16 Speed)	1	4AC -443	3576	Cone - Roller Bearing (21 Speed)	1
4AC -421	1154	Screw (16 Speed)	1	4AC -444	204053	Cup - Roller Bearing (21 Speed)	1
4AC -422	69354	Roller - Bearing (21 Speed)	33	4AC -445	3558	Plug (21 Speed)	1
4AC -423	70200	Hub - Bearing (21 Speed)	1	4AC -446	1154	Screw (21 Speed)	1
4AC -424	70200	Hub - Bearing (21 Speed)	1				

COLUMN - GEARING
NOS. 3 & 4 MACHINES

5TH DRIVE SHAFT-16 SPEED



5TH DRIVE SHAFT-21 SPEED



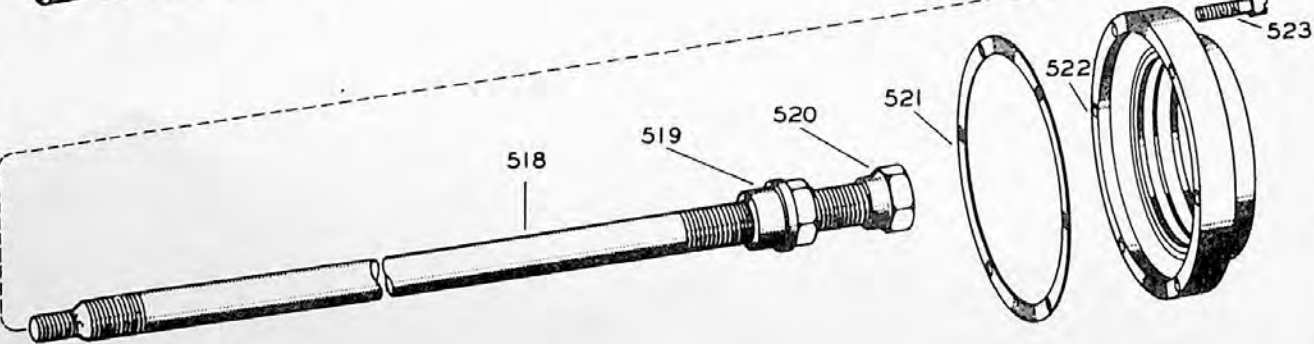
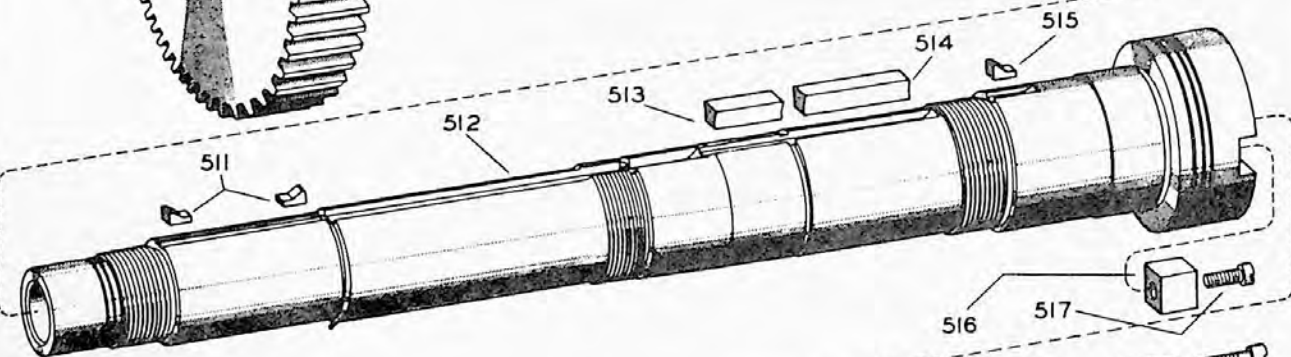
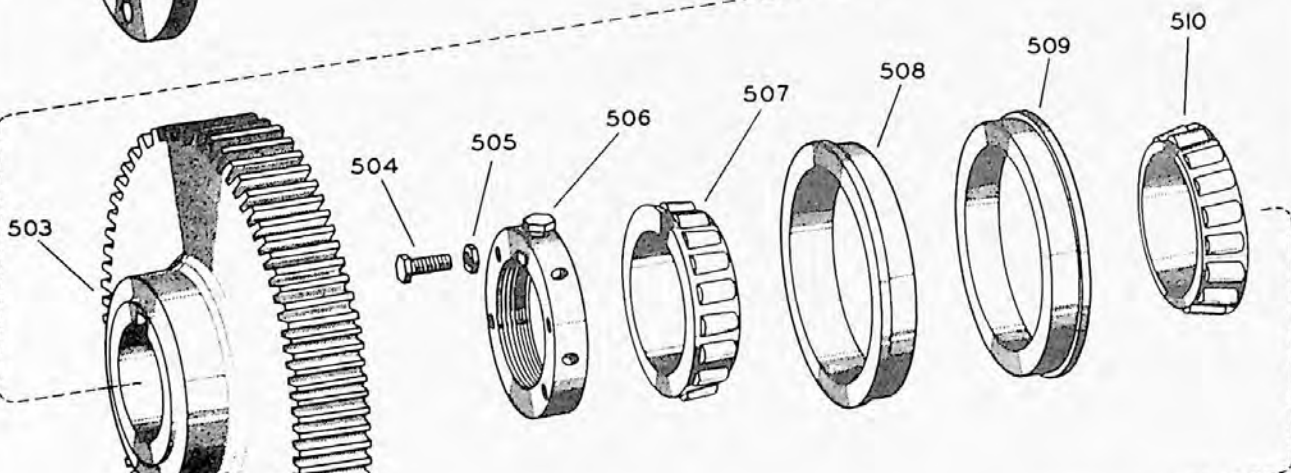
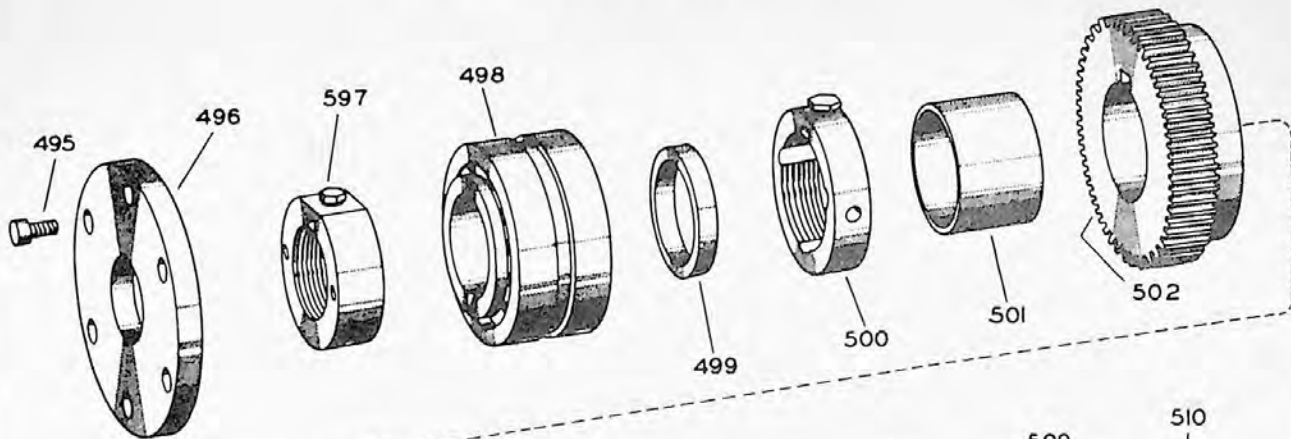
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

COLUMN-UNIT No. 4 AC (Continued)
Nos. 3 AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AC-447	3593	Nut (16 Speed)	1	4AC-471	3593	Nut (21 Speed)	1
4AC-448	59878	Cup - Roller Bearing (16 Speed)	1	4AC-472	59878	Cup - Roller Bearing (21 Speed)	1
4AC-449	3579	Cone - Roller Bearing (16 Speed)	1	4AC-473	3579	Cone - Roller Bearing (21 Speed)	1
4AC-450	70220	Spacer - Long (16 Speed)	1	4AC-474	69360	Spacer (21 Speed)	1
4AC-451	73524	Gear - Large (16 Speed)	1	4AC-475	75010	Gear - Clutch Small (21 Speed)	1
4AC-452	69351	Spacer (16 Speed)	1	4AC-476	75009	Clutch (21 Speed)	1
4AC-455	69348	Bearing - Ball (16 Speed)	1	4AC-477	69357	Sleeve - Clutch (21 Speed)	1
4AC-456	70368	Gear - Back (16 Speed)	1	4AC-478	75008	Gear - Clutch Large (21 Speed)	1
4AC-457	69349	Roller - Bearing (16 Speed)	38	4AC-479	69351	Spacer (21 Speed)	1
4AC-458	70367	Hub - Bearing (16 Speed)	1	4AC-480	69348	Bearing - Ball (21 Speed)	1
4AC-459	69343	Gear - Sliding Back (16 Speed)	1	4AC-486	70368	Gear - Back (21 Speed)	1
4AC-460	69342	Shaft - Back Gear (16 Speed)	1	4AC-487	69349	Roller - Bearing (21 Speed)	38
4AC-461	3579	Cone - Roller Bearing (16 Speed)	1	4AC-488	70367	Hub - Bearing (21 Speed)	1
4AC-462	63219	Cup - Roller Bearing (16 Speed)	1	4AC-489	69343	Gear - Sliding (21 Speed)	1
4AC-463	3558	Plug (16 Speed)	1	4AC-490	69342	Shaft - Back Gear (21 Speed)	1
4AC-466	1154	Screw (16 Speed)	1	4AC-491	3579	Cone - Roller Bearing (21 Speed)	1
4AC-467	69349	Roller - Bearing (21 Speed)	38	4AC-492	63219	Cup - Roller Bearing (21 Speed)	1
4AC-468	70367	Hub - Bearing (21 Speed)	1	4AC-493	3558	Plug (21 Speed)	1
4AC-469	69355	Hub - Bearing (21 Speed)	1	4AC-494	1154	Screw (21 Speed)	1
4AC-470	69354	Roller - Bearing (21 Speed)	38				

HORIZONTAL SPINDLE



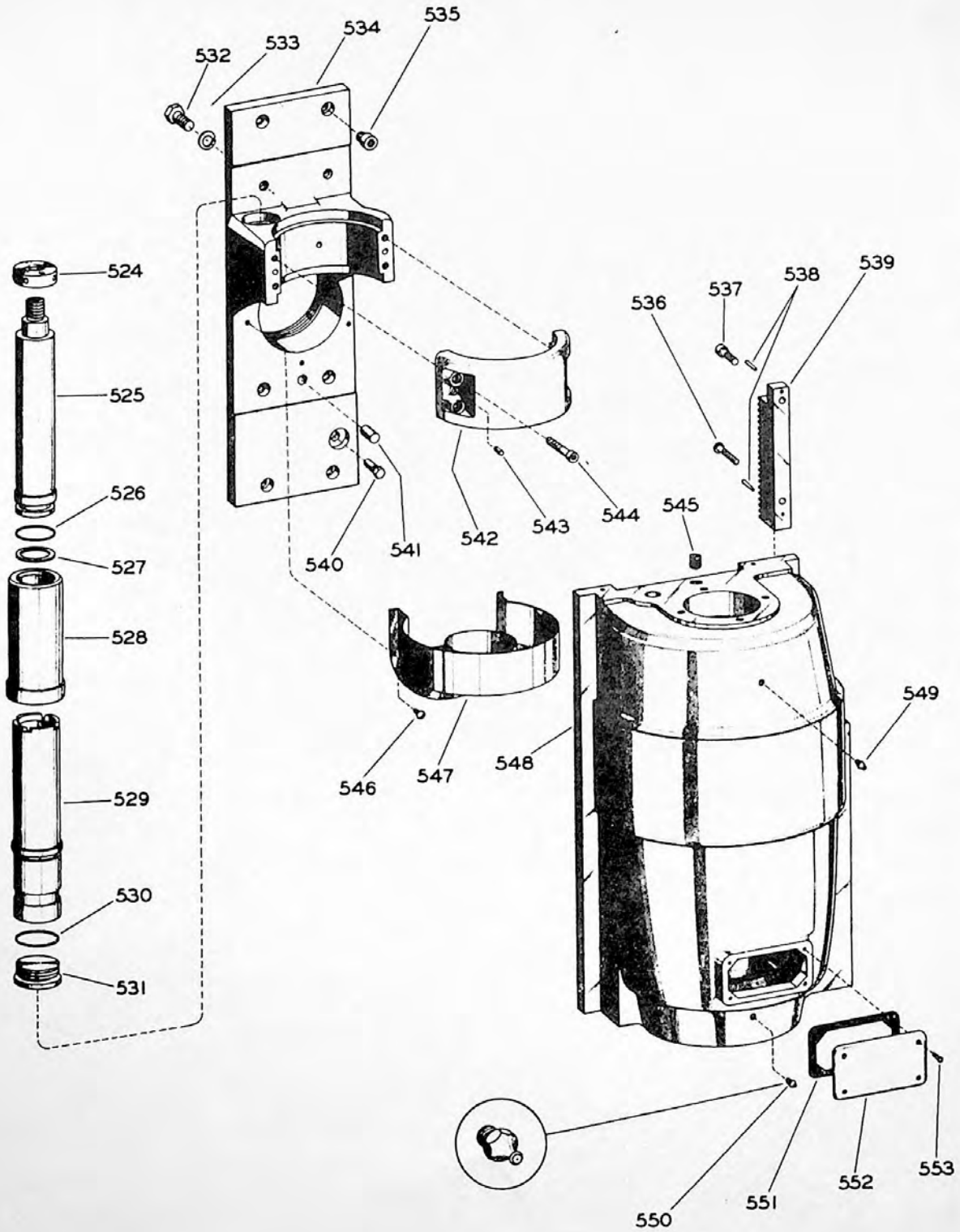
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

COLUMN-UNIT No. 4 AC (Continued)
Nos. 2, 3, AND 4 PLAIN AND UNIVERSAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AC -495	3399	Screw	6	4AC -510	56867	Cone - Roller Bearing.	1
4AC -496	69341	Cover	1	4AC -511	4004	Key.	2
4AC -497	3857	Nut - Lock Rear Spindle	1	4AC -512		Shaft - Spindle	
4AC -498	69023	Bearing - Double Roller.	1		99033	No. 2 P. U.	1
4AC -499	70987	Washer - Bearing	1		98666	Nos. 3 & 4 P. U.	1
4AC -500	3853	Nut - Lock.	1	4AC -513	74546	Key - Small Face Gear	1
4AC -501	70191	Spacer - Spindle.	1	4AC -514	2289	Key.	1
4AC -502		Gear - Face Small		4AC -515	4004	Key.	1
	70356	No. 2 P. U.	1	4AC -516	3687	Key.	2
	70358	Nos. 3 & 4 P. U.	1	4AC -517	1158	Screw	2
4AC -503		Gear - Face Large		4AC -518		Bolt - Arbor Draw In	
	70362	No. 2 P. U.	1		99031	No. 2 P. U.	1
	70365	Nos. 3 & 4 P. U.	1		98762	Nos. 3 & 4 P. U.	1
4AC -504	2283	Screw	4	4AC -519	3641	Nut - Arbor Draw In.	1
4AC -505	2284	Nut.	4	4AC -520	3639	Head - Bolt	1
4AC -506	3999	Nut - Lock.	1	4AC -521	66418	Gasket	1
4AC -507	56867	Cone - Roller Bearing.	1	4AC -522	62209	Cap - Spindle Front	1
4AC -508	62600	Cup - Roller Bearing	1	4AC -523	3422	Screw	6
4AC -509	62600	Cup - Roller Bearing	1				

VERTICAL HEAD



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

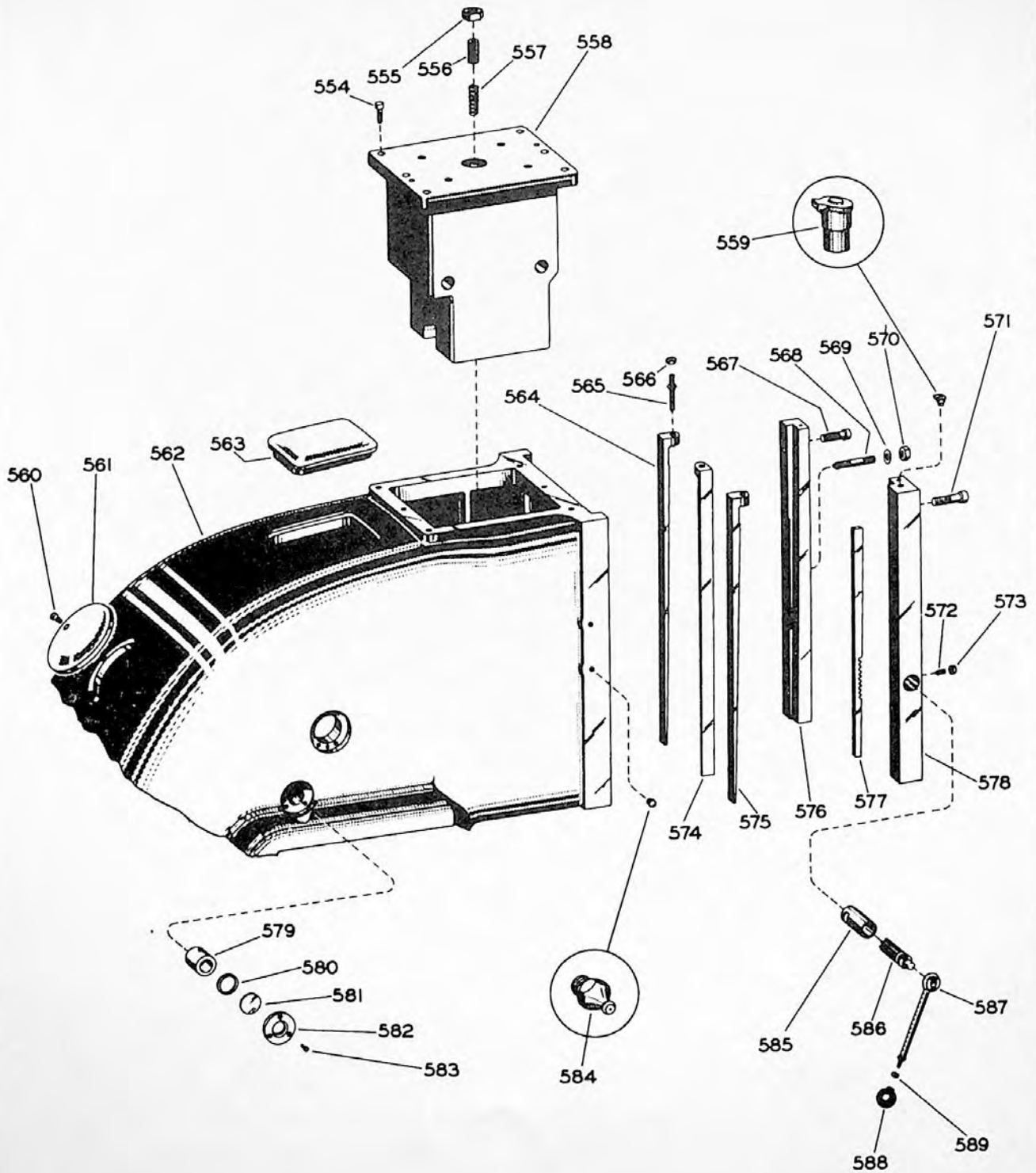
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COLUMN-UNIT No. 4 AC (Continued)

Nos. 2, 3, AND 4 VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AC -524	4184	Nut - Lock	1	4AC -535	3408	Screw	6
4AC -525		Piston		4AC -536	3262	Screw	1
	137526	No. 2 Machine.	1	4AC -537	3248	Screw	1
	137529	Nos. 3 & 4 Machines	1	4AC -538	642	Pin	2
4AC -526		Ring - O		4AC -539	131739	Rack	1
	247548	No. 2 Machine.	1	4AC -540	3494	Pin	1
	243945	Nos. 3 & 4 Machines	1	4AC -541	3375	Pin	1
4AC -527		Washer - O Ring Backup		4AC -542		Cap - Bearing	
	137530	No. 2 Machine.	1		63952	No. 2 Machine.	1
	137531	Nos. 3 & 4 Machines	1		133826	Nos. 3 & 4 Machines	1
4AC -528		Shield		4AC -543	1383	Pin	2
	132013	No. 2 Machine.	1	4AC -544	3408	Screw	4
	139998	Nos. 3 & 4 Machines	1	4AC -545	2145	Screw	1
4AC -529		Cylinder - Hydraulic Counterweight		4AC -546	1681	Screw	3
	137499	No. 2 Machine.	1	4AC -547		Retainer - Grease	
	137528	Nos. 3 & 4 Machines	1		135077	No. 2 Machine.	1
4AC -530		Ring - O			133833	Nos. 3 & 4 Machines	1
	243749	No. 2 Machine.	1	4AC -548		Head - Vertical	
	244791	Nos. 3 & 4 Machines	1		135083	No. 2 Machine.	1
4AC -531		Plug - Screw			130272	Nos. 3 & 4 Machines	1
	137498	No. 2 Machine.	1	4AC -549	3342	Fitting	1
	137527	Nos. 3 & 4 Machines	1	4AC -550	3342	Fitting	1
4AC -532		Screw		4AC -551	130253	Gasket	1
	183	No. 2 Machine.	2	4AC -552	130251	Cover	1
	111	Nos. 3 & 4 Machines	2	4AC -553	3484	Screw	4
4AC -533	2118	Washer - Lock.	2				
4AC -534		Bearing					
	135092	No. 2 Machine.	1				
	133832	Nos. 3 & 4 Machines	1				

VIBRATION DAMPER-GUIDES AND GIBS



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

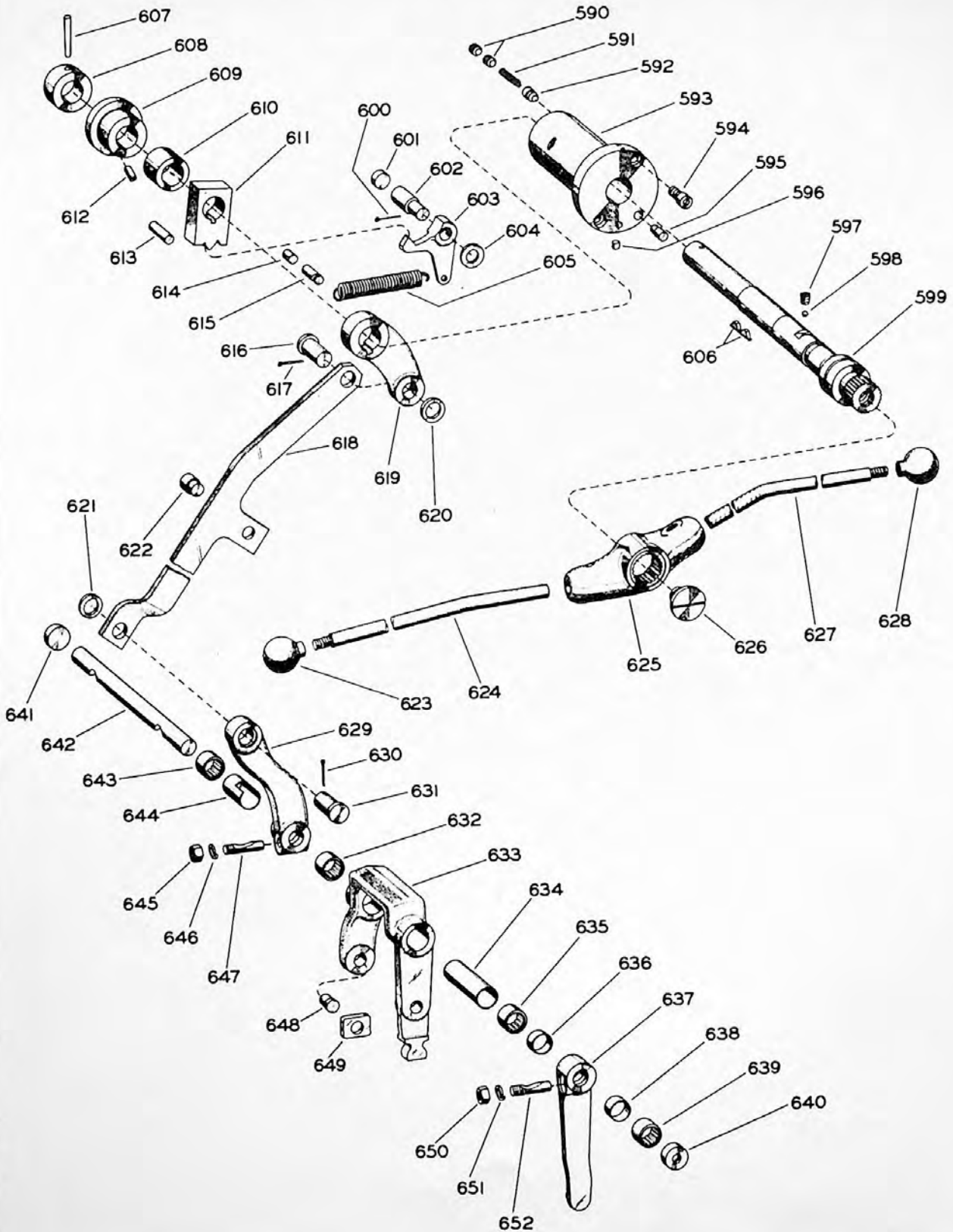
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COLUMN-UNIT No. 4 AC (Continued)

Nos. 2, 3, AND 4 VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AC-554	3343	Screw	6	4AC-573	3473	Nut	1
4AC-555	3353	Nut	1	4AC-574		Gib - Head	
4AC-556	130286	Screw - Set Hex	1		69824	No. 2 Machine.	1
4AC-557	73985	Spring	1		69685	Nos. 3 & 4 Machines	1
4AC-558		Dampener - Vibration		4AC-575		Gib - Head L. H.	
	130295	No. 2 Machine.	1		112513	No. 2 Machine.	1
	130294	Nos. 3 & 4 Machines	1		112514	Nos. 3 & 4 Machines	1
4AC-559	51737	Cup - Oil.	1	4AC-576		Guide - Head - R. H.	
4AC-560	1809	Screw	2		69825	No. 2 Machine.	1
4AC-561	141088	Cover	1		69827	Nos. 3 & 4 Machines	1
4AC-562		Column		4AC-577	69684	Wedge - Vertical Head	1
	135090	No. 2 Machine.	1	4AC-578		Guide - Head - L. H.	
	133694	Nos. 3 & 4 Machines	1		69826	No. 2 Machine.	1
4AC-563	67575	Cover Nos. 3 & 4 Machines	1		69828	Nos. 3 & 4 Machines	1
4AC-564		Gib - Head - R. H.		4AC-579	63015	Body - Oil Slight Gage	1
	63541	No. 2 Machine.	1	4AC-580	3850	Gasket - Oil Gage	1
	63954	Nos. 3 & 4 Machines	1	4AC-581	3849	Disc - Oil Gage	1
4AC-565	3989	Screw - Gib	3	4AC-582	3848	Cover - Oil Gage	1
4AC-566	3473	Nut	3	4AC-583	3213	Screw	3
4AC-567	3288	Screw	4	4AC-584	3342	Fitting	2
4AC-568	63617	Stud - Clamp.	1	4AC-585	69681	Bushing	1
4AC-569	1040	Washer.	1	4AC-586	100190	Pinion	1
4AC-570	3480	Nut	1	4AC-587	103232	Lever	1
4AC-571	1930	Screw	5	4AC-588	115032	Ball	1
4AC-572	3498	Screw	1	4AC-589	2135	Washer.	1

STARTING LEVER AND CLUTCH CONTROL LINKAGE



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

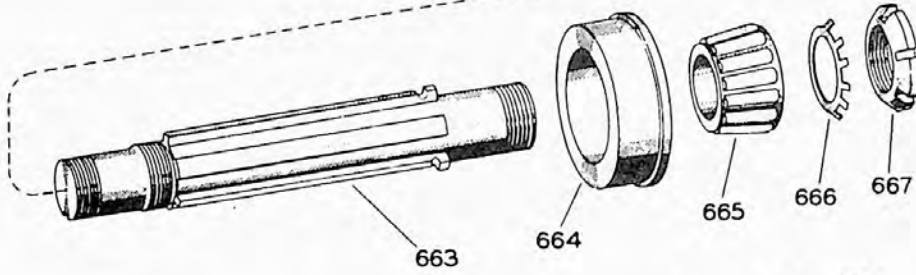
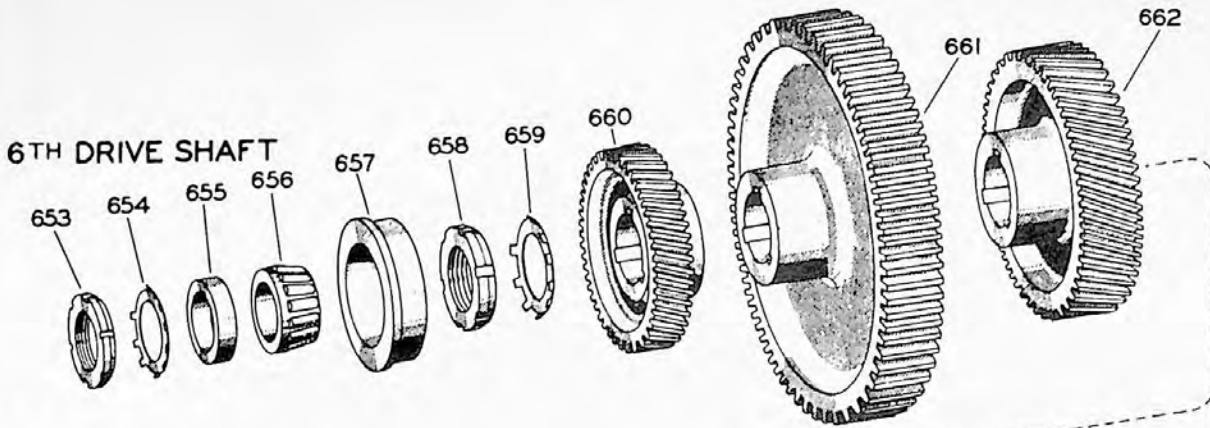
COLUMN-UNIT No. 4 AC (Continued)

Nos. 2, 3, AND 4 VERTICAL

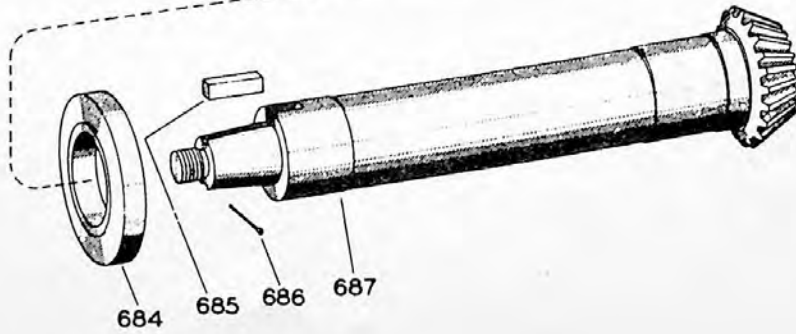
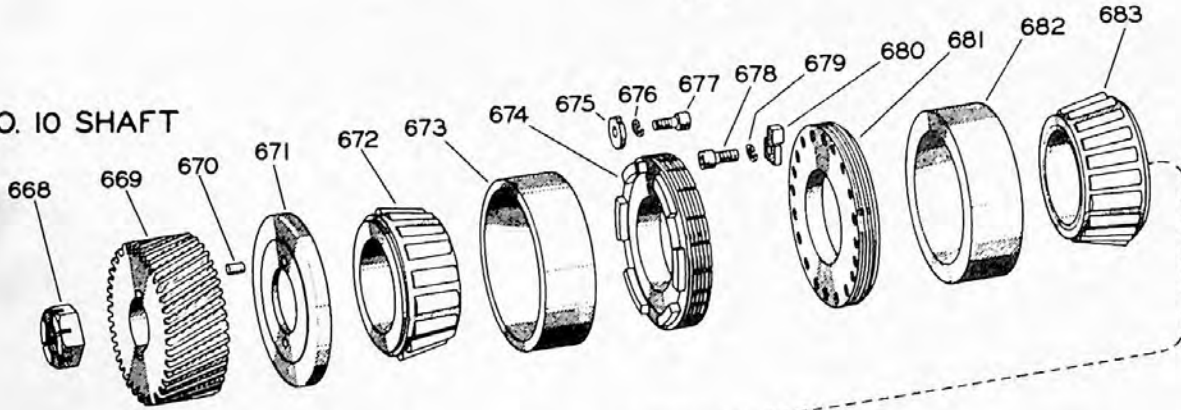
KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AC-590	1917	Screw	2	4AC-622	100695	Pin	1
4AC-591	65916	Spring	1	4AC-623	115032	Ball	1
4AC-592	65913	Valve - Relief	1	4AC-624	99985	Handle - Starting Lever	1
4AC-593	129516	Sleeve - Starting Lever	1	4AC-625	98759	Lever - Starting	1
4AC-594	3266	Screw	2	4AC-626	73643	Screw	1
4AC-595	1664	Pin	1	4AC-627		Handle - Starting Lever	
4AC-596	1844	Plug	1		99986	No. 2 Machine.	1
4AC-597	76644	Plug	1	101444		Nos. 3 & 4 Machines	1
4AC-598	30060	Ball	1	4AC-628	115032	Ball	1
4AC-599	129515	Shaft - Starting Lever	1	4AC-629		Arm - Clutch Shifter	
4AC-600	3379	Pin - Cotter	1		99029	No. 2 Machine.	1
4AC-601	3530	Plug	1		98766	Nos. 3 & 4 Machines	1
4AC-602	98755	Stud - Detent Lever	1	4AC-630	1959	Pin - Cotter	1
4AC-603	127598	Lever - Detent.	1	4AC-631	66429	Pin	1
4AC-604	3442	Washer.	1	4AC-632	79762	Bearing	1
4AC-605	36057	Spring	1	4AC-633	105109	Fork - Clutch Shifter	1
4AC-606	3280	Key	2	4AC-634	99954	Spacer - Center	1
4AC-607	1857	Pin - Taper	1	4AC-635	79762	Bearing	1
4AC-608	98670	Collar	1	4AC-636	99956	Spacer - L. H.	1
4AC-609	98671	Retainer - Oil	1	4AC-637	98681	Lever - Valve Shifter	1
4AC-610	129517	Spacer	1	4AC-638	99956	Spacer - L. H.	1
4AC-611	127597	Detent	1	4AC-639	79762	Bearing	1
4AC-612		Tubing - Oil		4AC-640	99953	Plug	1
	130255	No. 2 Machine.	1	4AC-641	99953	Plug	1
	130266	Nos. 3 & 4 Machines	1	4AC-642	129224	Shaft - Shifter Fork	1
4AC-613	1385	Pin	2	4AC-643	79762	Bearing	1
4AC-614	237588	Plug	1	4AC-644	99955	Spacer - L. H.	1
4AC-615	3382	Pin - Spring	1	4AC-645	3478	Nut	1
4AC-616	66429	Pin	1	4AC-646	2135	Washer.	1
4AC-617	1959	Pin - Cotter	1	4AC-647	33941	Pin - Lock.	1
4AC-618		Link - Clutch Shifter		4AC-648	46855	Pin - Shifter	1
	100326	No. 2 Machine.	1	4AC-649	64940	Shoe - Clutch Shifter	2
	98763	Nos. 3 & 4 Machines	1	4AC-650	3478	Nut	1
4AC-619	98669	Shifter	1	4AC-651	2135	Washer.	1
4AC-620	888	Washer	1	4AC-652	33941	Pin - Lock.	1
4AC-621	888	Washer	1				

COLUMN - GEARING

6TH DRIVE SHAFT



NO. 10 SHAFT



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

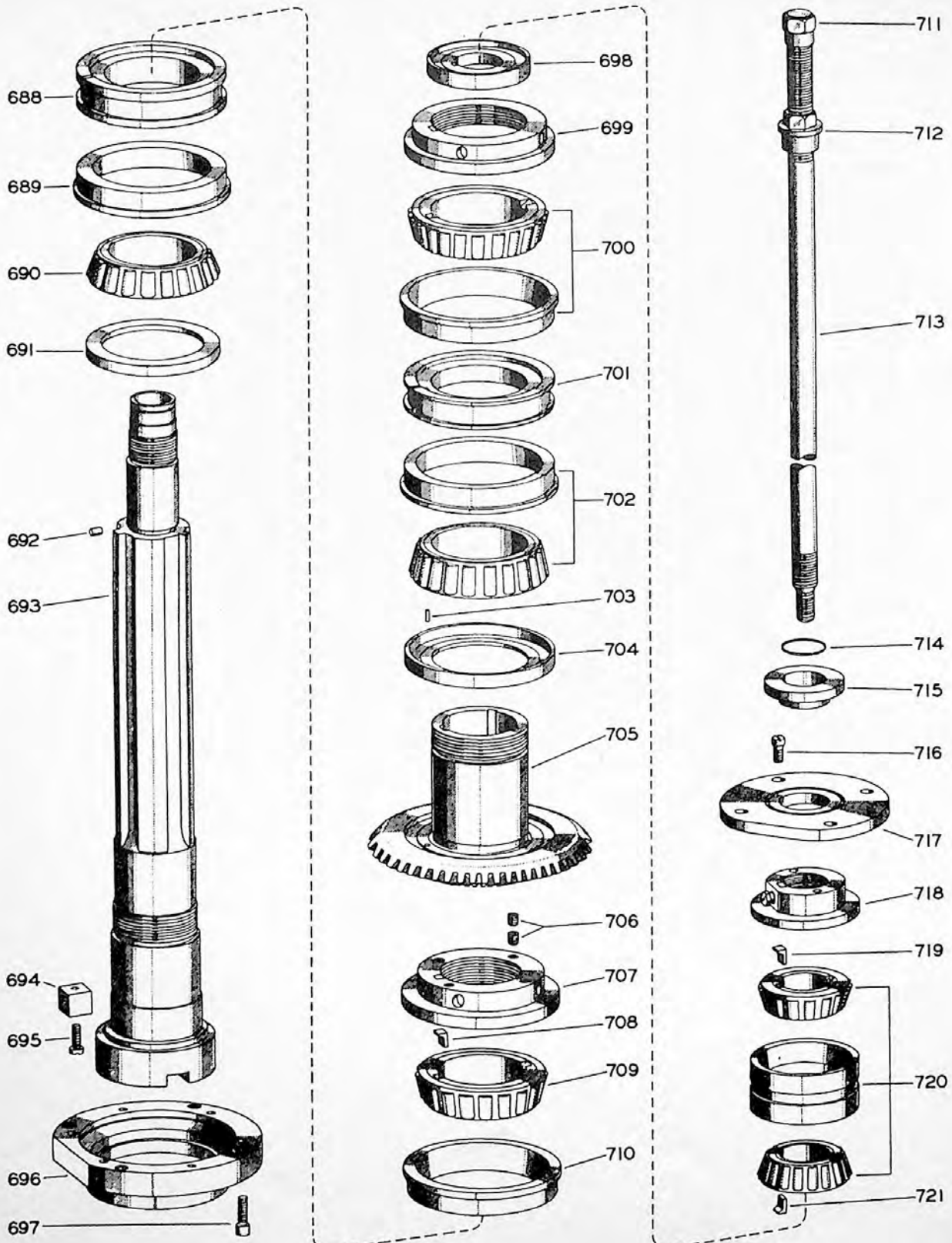
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

COLUMN-UNIT No. 4 AC (Continued)

Nos. 2, 3, AND 4 VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AC -653	3813	Nut - Lock	1	4AC -667	3789	Nut - Lock	1
4AC -654	3643	Washer - Lock	1	4AC -668	70223	Nut	1
4AC -655	109946	Spacer	1	4AC -669		Gear - On Spiral Bevel Stem	
4AC -656		Cone - Roller Bearing			130261	No. 2 Machine.	1
	3579	No. 2 Machine.	1		130268	Nos. 3 & 4 Machines	1
	83742	Nos. 3 & 4 Machines	1	4AC -670	3377	Pin.	2
4AC -657		Cup - Roller Bearing		4AC -671	133834	Retainer - Rear Grease.	1
	63219	No. 2 Machine.	1	4AC -672	133695	Cone - Roller Bearing.	1
	60194	Nos. 3 & 4 Machines	1	4AC -673	3588	Cup - Roller Bearing	1
4AC -658	3789	Nut - Lock	1	4AC -674	135084	Nut - Roller Bearing Adjusting - Rear	1
4AC -659	3790	Washer - Lock.	1	4AC -675	3445	Washer - Lock.	1
4AC -660		Gear - Small Face		4AC -676	2135	Washer.	1
	130258	No. 2 Machine.	1	4AC -677	3399	Screw	1
	130270	Nos. 3 & 4 Machines	1	4AC -678	3399	Screw	1
4AC -661		Gear - Large Face		4AC -679	2135	Washer.	1
	130260	No. 2 Machine.	1	4AC -680	133825	Key.	1
	130271	Nos. 3 & 4 Machine	1	4AC -681	133698	Nut - Roller Bearing Adjusting	1
4AC -662		Gear - Face Helical		4AC -682	3588	Cup - Roller Bearing	1
	130259	No. 2 Machine.	1	4AC -683	133695	Cone - Roller Bearing.	1
	130269	Nos. 3 & 4 Machines	1	4AC -684		Washer - Thrust	
4AC -663	70224	Shaft - 6th Drive.	1		135075	No. 2 Machine.	1
4AC -664		Cone - Roller Bearing			133697	Nos. 3 & 4 Machines	1
	60194	No. 2 Machine.	1	4AC -685	3452	Key.	2
	63133	Nos. 3 & 4 Machines	1	4AC -686	2082	Pin - Cotter	1
4AC -665		Cup - Roller Bearing		4AC -687		Pinion - Spiral Bevel Stem	
	63218	No. 2 Machine.	1		135080	No. 2 Machine.	1
	3584	Nos. 3 & 4 Machines	1		133829	Nos. 3 & 4 Machines	1
4AC -666	3790	Washer - Lock.	1				

VERTICAL SPINDLE



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

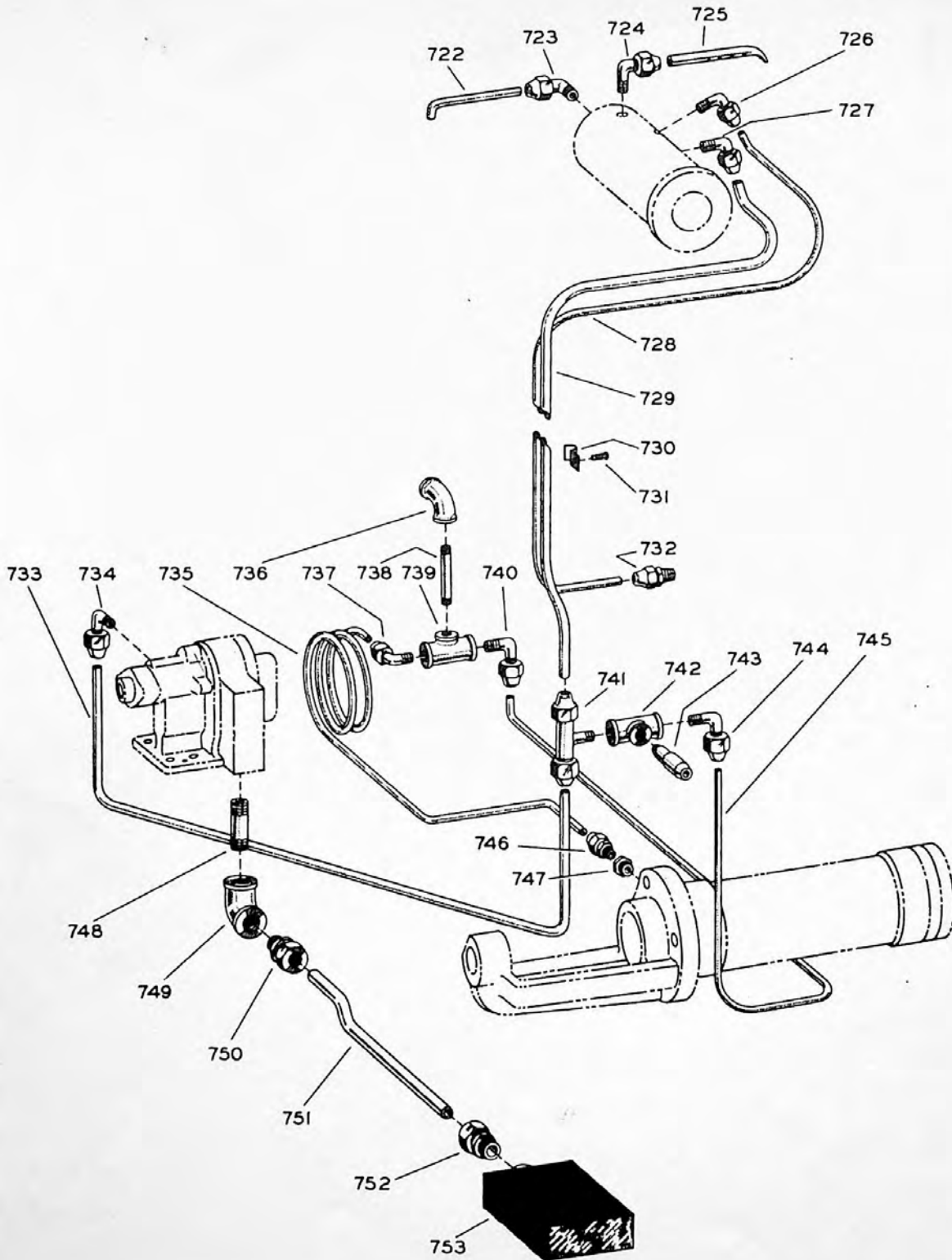
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

COLUMN-UNIT No. 4 AC (Continued)

Nos. 2, 3, AND 4 VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AC-688	109938	Distributor - Grease	1	4AC-704		Retainer - Grease	
4AC-689	62210	Cup - Roller Bearing	1		139148	No. 2 Machine.	1
4AC-690	56867	Cone - Roller Bearing.	1		133696	Nos. 3 & 4 Machines	1
4AC-691	63199	Guard - Dust.	1	4AC-705		Gear - Spiral Bevel	
4AC-692	3385	Pin.	1		139149	No. 2 Machine.	1
4AC-693		Spindle			133831	Nos. 3 & 4 Machines	1
	135078	No. 2 Machine.	1	4AC-706	2282	Screw	2
	133830	Nos. 3 & 4 Machines	1	4AC-707		Nut - Lock	
4AC-694	3687	Key.	2		73270	No. 2 Machine	1
4AC-695	1158	Screw	2		133828	Nos. 3 & 4 Machines	1
4AC-696	67734	Cap - Spindle	1	4AC-708	4004	Key.	1
4AC-697	3400	Screw	6	4AC-709	56867	Cone - Roller Bearing.	1
4AC-698	73245	Retainer - Grease.	1	4AC-710	62210	Cup - Roller Bearing	1
4AC-699		Nut - Adjusting		4AC-711	3639	Head - Draw In Bolt.	1
	74351	No. 2 Machine.	1	4AC-712	3641	Nut - Draw In Bolt.	1
	133827	Nos. 3 & 4 Machines	1	4AC-713		Bolt - Draw In	
4AC-700		Bearing - Roller			58547	No. 2 Machine.	1
	67350	No. 2 Machine.	1		63596	Nos. 3 & 4 Machines	1
	114885	Nos. 3 & 4 Machines	1	4AC-714	57072	Spring - Locking.	1
4AC-701		Distributor - Grease		4AC-715	64342	Cap - Spindle Dust.	1
	73450	No. 2 Machine.	1	4AC-716	3483	Screw	4
	133699	Nos. 3 & 4 Machines	1	4AC-717	130252	Cover	1
4AC-702		Bearing - Roller		4AC-718	73268	Nut - Adjusting	1
	67350	No. 2 Machine.	1	4AC-719	4004	Key.	1
	114885	Nos. 3 & 4 Machines	1	4AC-720	70279	Bearing - Roller.	1
4AC-703	3377	Pin.	1	4AC-721	4004	Key.	1

OIL SYSTEM NO. 2 PLAIN AND UNIVERSAL



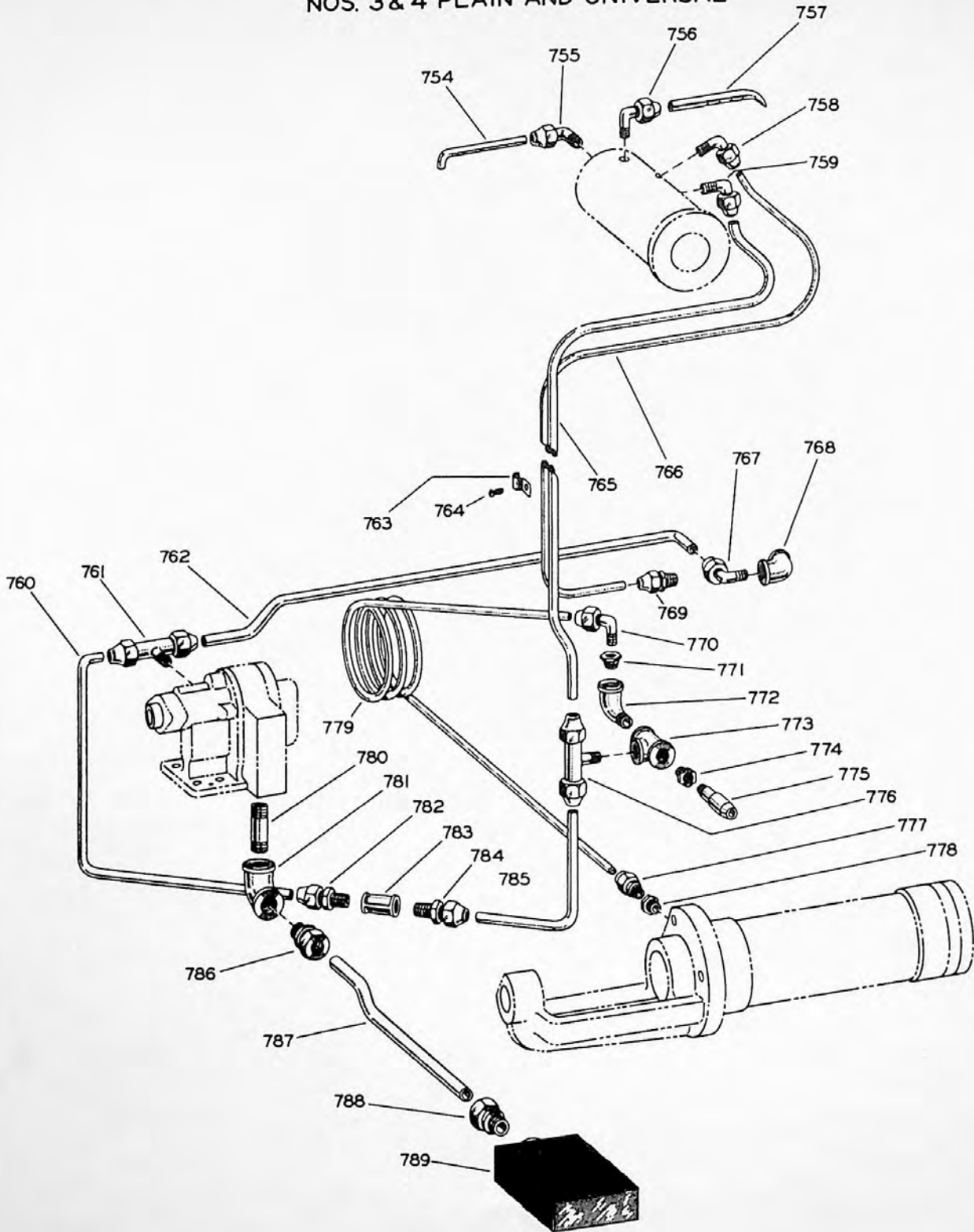
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

COLUMN-UNIT No. 4 AC (Continued)
No. 2 PLAIN AND UNIVERSAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AC-722	129230	Tubing - Oil 1/4" x 4"	1	4AC-728	129230	Tubing - Oil 1/8" x 2"	1
4AC-723	58152	Fitting - Elbow	1	4AC-729	222224	Tee.	1
4AC-724	57286	Fitting - Elbow	1	4AC-740	57286	Fitting - Elbow	1
4AC-725	70256	Tube - Oil Spray.	1	4AC-741	68950	Fitting - Compression.	1
4AC-726	58152	Fitting - Elbow	1	4AC-742	222224	Tee.	1
4AC-727	57286	Fitting - Elbow	1	4AC-743	65185	Pin - Dowel	1
4AC-728	129230	Tubing - Oil 1/4" x 3/4"	1	4AC-744	57286	Fitting - Elbow	1
4AC-729	129230	Tubing - Oil 3/8" x 28-1/2"	1	4AC-745	129230	Tubing - Oil 3/8" x 28-1/2"	1
4AC-730	4002	Clamp - Oil Tube	1	4AC-746	89866	Fitting - Compression Coupling	1
4AC-731	2209	Screw - Drive	1	4AC-747	58197	Bushing - Reducing	1
4AC-732	89866	Fitting - Compression Coupling	1	4AC-748	30434	Nipple	1
4AC-733	129230	Tubing - Oil 3/8" x 20"	1	4AC-749	24024	Elbow	1
4AC-734	57286	Fitting - Elbow	1	4AC-750	119140	Connection - Tubing	1
4AC-735	129230	Tubing - Oil 1/4" x 47"	1	4AC-751	129230	Tubing - Oil 1/2" x 12"	1
4AC-736	13711	Ell	1	4AC-752	119140	Connection - Tubing	1
4AC-737	58152	Fitting - Elbow	1	4AC-753	119142	Strainer - Spindle Carrier	1

OIL SYSTEM NOS. 3 & 4 PLAIN AND UNIVERSAL



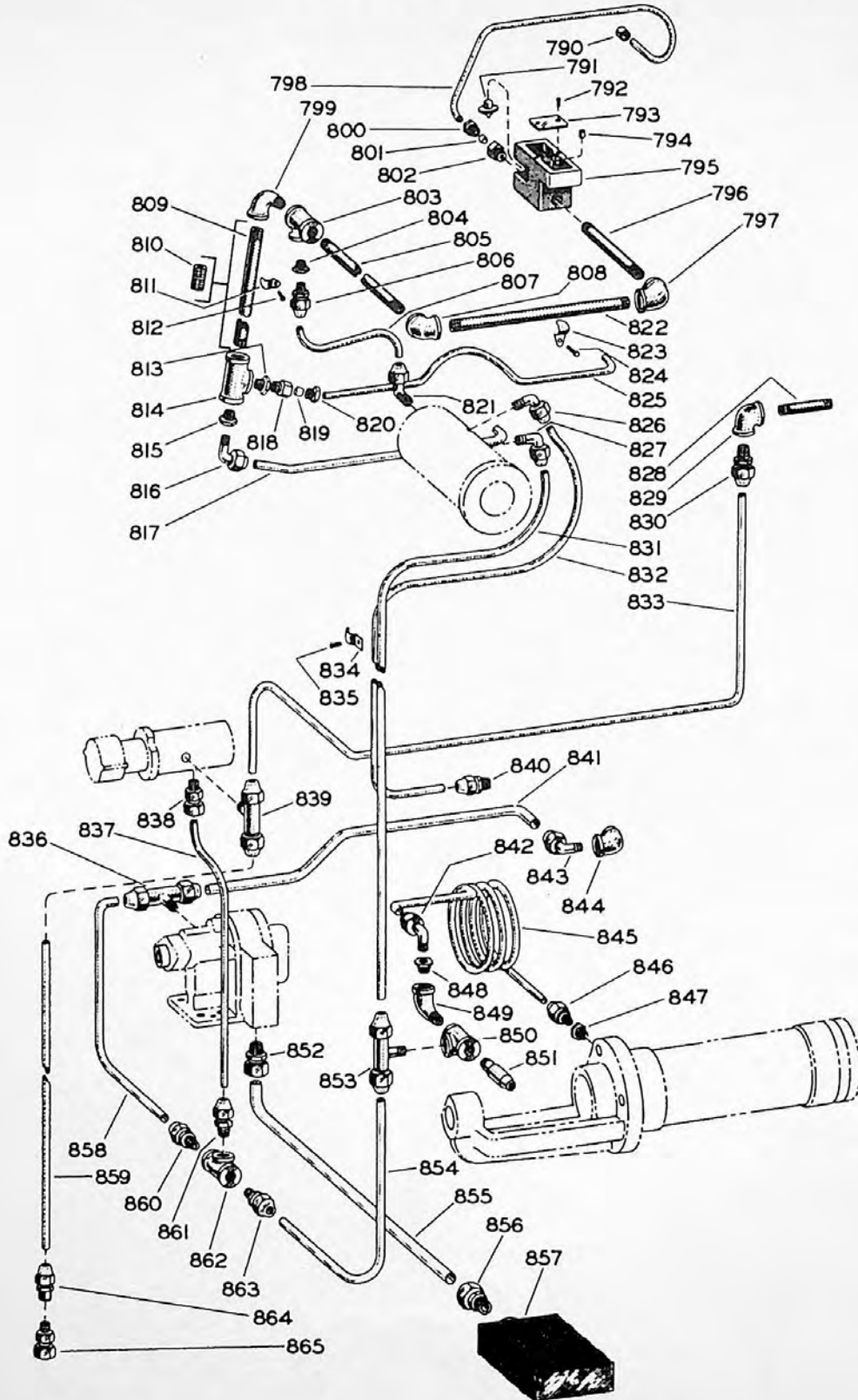
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

COLUMN—UNIT No. 4 AC (Continued)
Nos. 3 AND 4 PLAIN AND UNIVERSAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AC-754	129231	Tubing - Oil 1/4" x 4"	1	4AC-772	12838	Elbow	1
4AC-755	58152	Fitting - Elbow	1	4AC-773	13660	Tee	1
4AC-756	57286	Fitting - Elbow	1	4AC-774	58197	Bushing - Reducing	1
4AC-757	70256	Tube - Oil Spray	1	4AC-775	65185	Pin - Dowel	1
4AC-758	58152	Fitting - Elbow	1	4AC-776	68950	Fitting - Compression	1
4AC-759	57286	Fitting - Elbow	1	4AC-777	89866	Fitting - Compression Coupling	1
4AC-760	129231	Tubing - Oil 3/8" x 9-1/2"	1	4AC-778	58197	Bushing - Reducing	1
4AC-761	68950	Fitting - Compression	1	4AC-779	129231	Tubing - Oil 1/4" x 47"	1
4AC-762	129231	Tubing - Oil 3/8" x 18"	1	4AC-780	30434	Nipple	1
4AC-763	4002	Clamp - Oil Tube	1	4AC-781	24024	Elbow	1
4AC-764	2209	Screw - Drive	1	4AC-782	57287	Fitting - Compression Straight	1
4AC-765	129231	Tubing - Oil 3/8" x 32"	1	4AC-783	20606	Coupling	1
4AC-766	129231	Tubing - Oil 1/4" x 35"	1	4AC-784	57287	Fitting - Compression Straight	1
4AC-767	57286	Fitting - Elbow	1	4AC-785	129231	Tubing - Oil 3/8" x 20"	1
4AC-768	231133	Elbow - Street	1	4AC-786	119140	Connection - Tubing	1
4AC-769	89866	Fitting - Compression Coupling	1	4AC-787	129231	Tubing - Oil 1/2" x 12"	1
4AC-770	58152	Fitting - Elbow	1	4AC-788	119140	Connection - Tubing	1
4AC-771	58197	Bushing - Reducing	1	4AC-789	119142	Strainer - Spindle Carrier	1

OIL SYSTEM VERTICAL MACHINES



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

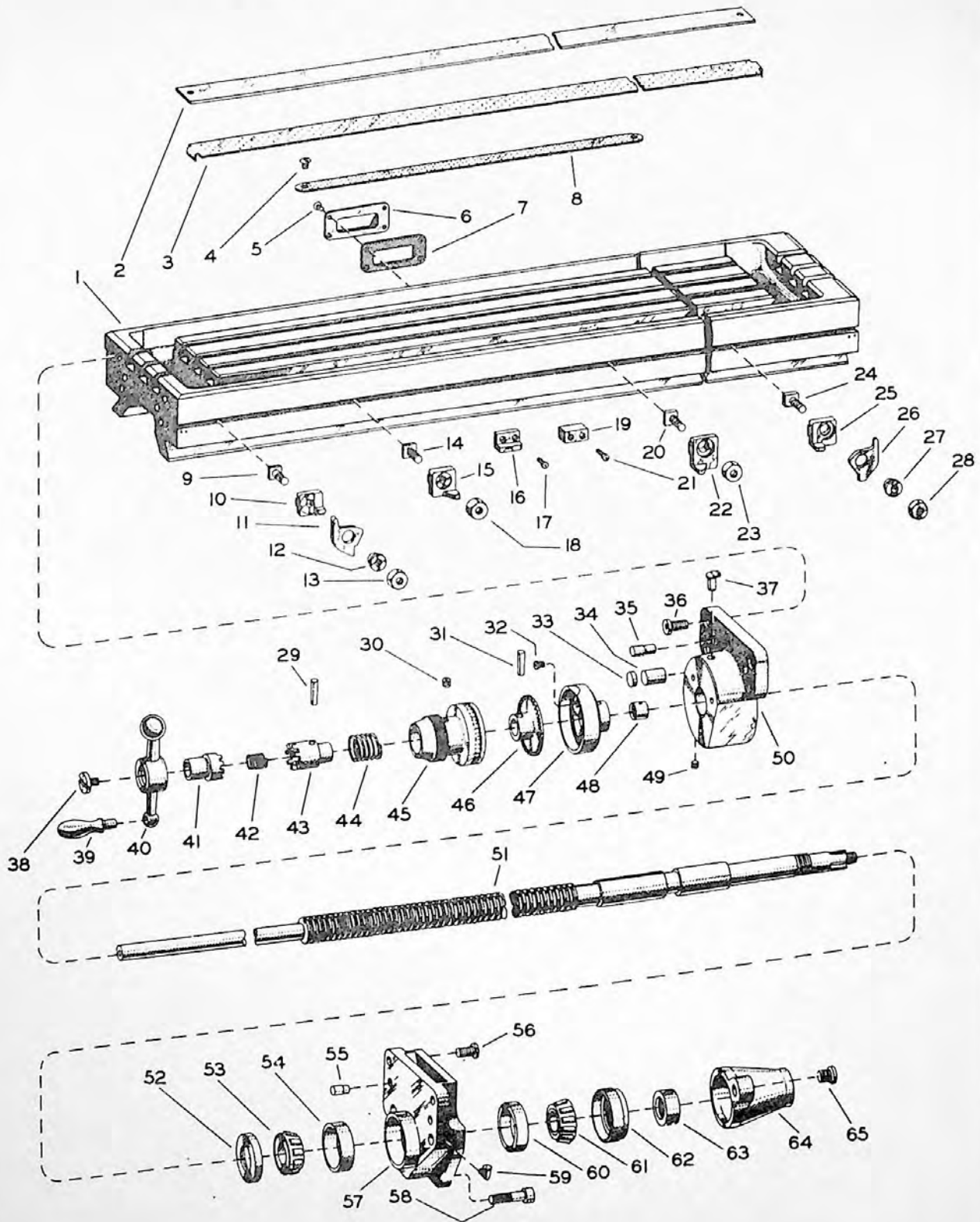
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

COLUMN—UNIT No. 4 AC (Concluded)

Nos. 2, 3, AND 4 VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AC-790	2237	Bushing	1	4AC-830	70382	Fitting - Compression.	1
4AC-791	30223	Sprayer	1	4AC-831		Tubing - Oil	
4AC-792	3460	Screw	2		130256	No. 2 Machine 3/8" x 28".	1
4AC-793	64219	Baffle - Spray Body	1		130267	Nos. 3 & 4 Machines 3/8" x 32"	1
4AC-794	2190	Bushing	3	4AC-832		Tubing - Oil	
4AC-795	64220	Body - Sprayer Oil Distributor	1		130255	No. 2 Machine 1/4" x 34".	1
4AC-796		Pipe			130266	Nos. 3 & 4 Machines 1/4" x 35"	1
	130257	No. 2 Machine 1/4" x 2"	1	4AC-833		Tubing - Oil	
	130265	Nos. 3 & 4 Machines 1/4" x 2"	1		130255	No. 2 Machine 5/16" x 48".	1
4AC-797	19284	Elbow	1		130266	Nos. 3 & 4 Machines 5/16" x 54".	1
4AC-798		Tubing - Oil		4AC-834	4002	Clamp - Oil Tube	1
	130255	No. 2 Machine 3/16" x 30"	1	4AC-835	2209	Screw	1
	130266	Nos. 3 & 4 Machines 3/16" x 36".	1	4AC-836	68950	Fitting - Compression Tee	1
4AC-799	12838	Elbow	1	4AC-837		Tubing - Oil	
4AC-800	60721	Nut - 3/16" Tubing	1		130255	No. 2 Machine 5/16" x 20".	1
4AC-801	60720	Sleeve - 3/16" Tubing	1		130266	Nos. 3 & 4 Machines 5/16" x 20".	1
4AC-802	60719	Adapter	1	4AC-838	234250	Fitting - Compression.	1
4AC-803	13660	Tee.	1	4AC-839	218928	Fitting - Compression Tee	1
4AC-804	58197	Bushing - Reducing	1	4AC-840	89866	Fitting - Compression.	1
4AC-805		Pipe		4AC-841		Tubing - Oil	
	130257	No. 2 Machine 1/4" x 10".	1		130256	No. 2 Machine 3/8" x 12".	1
	130265	Nos. 3 & 4 Machines 1/4" x 10".	1		130267	Nos. 3 & 4 Machines 3/8" x 15".	1
4AC-806	89866	Fitting - Compression Coupling.	1	4AC-842	58152	Fitting - Elbow	1
4AC-807		Tubing - Oil		4AC-843	57286	Fitting - Elbow	1
	130255	No. 2 Machine 1/4" x 13".	1	4AC-844	231133	Elbow	1
	130266	Nos. 3 & 4 Machines 1/4" x 15".	1	4AC-845		Tube - Oil	
4AC-808	19284	Elbow	1		130255	No. 2 Machine 1/4" x 41".	1
4AC-809	130265	Pipe - Nos. 3 & 4 Machines 1/4" x 8".	1		130266	Nos. 3 & 4 Machines 1/4" x 47".	1
4AC-810	10048	Nipple - No. 2 Machine	1	4AC-846	89866	Fitting - Compression.	1
4AC-811	3990	Clamp - Conduit.	1	4AC-847	58197	Bushing - Reducer.	1
4AC-812	3203	Screw	1	4AC-848	58197	Bushing - Reducer.	1
4AC-813	58197	Bushing - Reducing	1	4AC-849	12838	Elbow - Street.	1
4AC-814	13660	Tee.	1	4AC-850	13660	Tee.	1
4AC-815	58197	Bushing - Reducing	1	4AC-851	65185	Pin - Dowel	1
4AC-816	58152	Fitting - Elbow	1	4AC-852	119140	Connection - Tubing.	1
4AC-817		Tubing - Oil		4AC-853	68950	Fitting - Compression.	1
	130255	No. 2 Machine 1/4" x 20".	1	4AC-854		Tubing - Oil	
	130266	Nos. 3 & 4 Machines 1/4" x 20".	1		130256	No. 2 Machine 3/8" x 10".	1
4AC-818	60719	Adapter	1		130267	Nos. 3 & 4 Machines 3/8" x 13"	1
4AC-819	60720	Sleeve - 3/16" Tubing.	1	4AC-855		Tubing - Oil	
4AC-820	60721	Nut - 3/16" Tubing	1		130256	No. 2 Machine 1/2" x 12".	1
4AC-821	58152	Fitting - Elbow	1		130267	Nos. 3 & 4 Machines 1/2" x 12"	1
4AC-822		Pipe		4AC-856	119140	Connection - Tubing.	1
	130257	No. 2 Machine 1/4" x 6-1/2".	1	4AC-857	119142	Strainer	1
	130265	Nos. 3 & 4 Machines 1/4" x 7".	1	4AC-858		Tubing - Oil	
4AC-823	3990	Clamp - Conduit.	1		130256	No. 2 Machine 3/8" x 12".	1
4AC-824	3460	Screw	1		130267	Nos. 3 & 4 Machines 3/8" x 15"	1
4AC-825		Tubing - Oil		4AC-859		Tubing - Oil	
	130255	No. 2 Machine 3/16" x 23"	1		130255	No. 2 Machine 5/16" x 16".	1
	130266	Nos. 3 & 4 Machines 3/16" x 23".	1		130266	Nos. 3 & 4 Machines 5/16" x 16".	1
4AC-826	58152	Fitting - Elbow	1	4AC-860	57287	Fitting - Compression.	1
4AC-827	57286	Fitting - Elbow	1	4AC-861	70382	Fitting - Compression.	1
4AC-828		Nipple		4AC-862	222224	Tee.	1
	13461	No. 2 Machine.	1	4AC-863	57287	Fitting - Compression.	1
	30802	Nos. 3 & 4 Machines	1	4AC-864	93841	Fitting	1
4AC-829	13711	Elbow	1	4AC-865	234250	Fitting - Compression.	1

TABLE-LEAD SCREW-APRONS



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

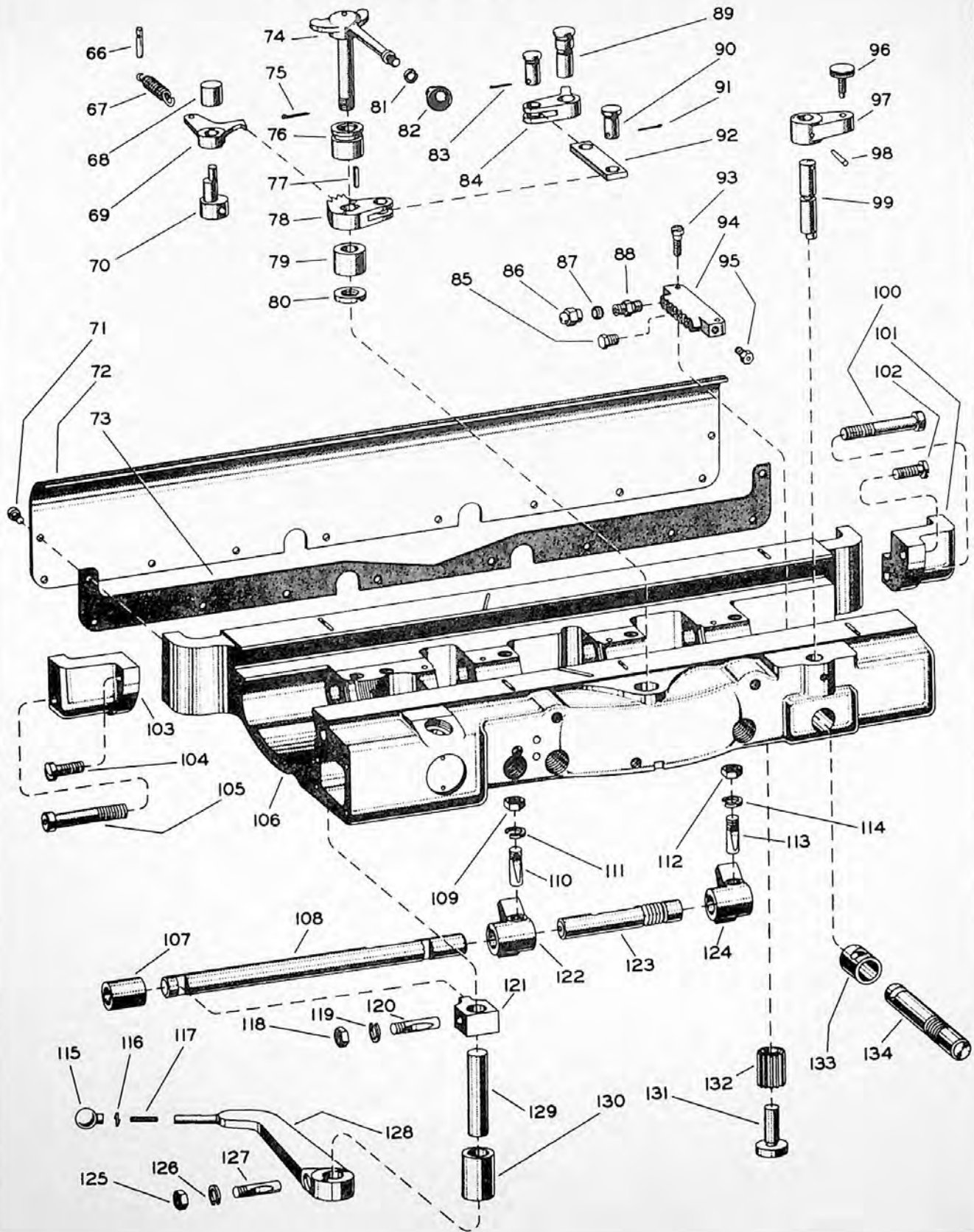
SADDLE TABLE—UNIT No. 4 AH

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AH-1		Table		4AH-40	3509	Crank - Ball.	1
	103219	No. 2 P. U. & V. 28" Table Travel	1	4AH-41	3506	Clutch - Ball Crank.	1
	103222	No. 2 P. & V. 36" Table Travel	1	4AH-42	33744	Spring	1
	69113	No. 3 P. U. & V. 34" Table Travel	1	4AH-43	102014	Clutch	1
	78447	No. 3 P. & V. 42" Table Travel	1	4AH-44	102184	Spring	1
	69114	No. 4 P. U. & V. 42" Table Travel	1	4AH-45	98610	Dial - English.	1
4AH-2		Cover - Strainer		4AH-46	98612	Clutch - Lead Screw Dial.	1
	102008	No. 2 P. & V. 36" Table Travel	1	4AH-47	100575	Sleeve - Retainer	1
	102006	No. 2 P. U. & V. 28" Table Travel	1	4AH-48	98840	Bearing - Needle	1
	63848	No. 3 P. U. & V. 34" Table Travel	1	4AH-49	1911	Screw	1
	63850	No. 4 P. U. & V. 42" Table Travel	1	4AH-50		Apron - Front	
	67057	No. 3 P. & V. 42" Table Travel	1		102062	No. 2 P. U. & V.	1
4AH-3		Strainer			100585	Nos. 3 & 4 P. U. & V.	1
	102007	No. 2 P. & V. 36" Table Travel	1	4AH-51		Screw - Lead	
	102005	No. 2 P. U. & V. 28" Table Travel	1		140701	No. 2 P. U. & V. - Std. 28" TT	
	63847	No. 3 P. U. & V. 34" Table Travel	1			- Without B/L	1
	63851	No. 4 P. U. & V. 42" Table Travel	1	140703		No. 2 P. & V. - 36" TT	
4AH-4	1681	Screw	2			- Without B/L	1
4AH-5	1681	Screw	4	144756		No. 2 P. U. & V. - Std. 28" TT	
4AH-6	109826	Spout - Coolant Return	1			- With B/L	1
4AH-7	66466	Gasket	1	101436		No. 2 P. & V. - 36" TT	
4AH-8		Strainer				- With B/L	1
	63389	No. 2 P. U. & V.	1	140706		No. 3 P. U. & V. - Std. 34" TT	
	63849	Nos. 3 & 4 P. U. & V.	1			- Without B/L	1
4AH-9	3292	Bolt - Tee Nos. 2, 3, & 4 P. & V..	1	140708		No. 3 P. & V. - 42" TT	
4AH-10	63861	Dog - Trip Nos. 2, 3, & 4 P. & V..	1			- Without B/L	1
4AH-11	63679	Trip - Dog Nos. 2, 3, & 4 P. & V..	1	144759		No. 3 P. U. & V. - Std. 34" TT	
4AH-12	63656	Bushing Nos. 2, 3, & 4 P. & V..	1			- With B/L	1
4AH-13	2057	Nut Nos. 2, 3, & 4 P. & V..	1	101442		No. 3 P. & V. - 42" TT	
4AH-14	3361	Bolt - Tee	1			- With B/L	1
4AH-15	104769	Dog - Feed - L. H.	1	140711		No. 4 P. U. & V. - Std. 42" TT	
4AH-16	104770	Dog - Pos. Table Stop - R. H.	1			- Without B/L	1
4AH-17	3204	Screw	2	101442		No. 4 P. U. & V. - Std. 42" TT	
4AH-18	2057	Nut	1			- With B/L	1
4AH-19	104771	Dog - Pos. Table Stop - L. H.	1	4AH-52	100574	Ring - Retainer	1
4AH-20	3361	Bolt - Tee	1	4AH-53	63695	Cone - Roller Bearing	1
4AH-21	3227	Screw	2	4AH-54	63696	Cup - Roller Bearing	1
4AH-22	104768	Dog - Feed - R. H.	1	4AH-55		Pin	
4AH-23	2057	Nut	1		1429	No. 2 P. U. & V.	2
4AH-24	3292	Bolt - Tee	1		1629	Nos. 3 & 4 P. U. & V.	2
4AH-25	63863	Dog - Trip - L. H. Nos. 2, 3, & 4 P. & V..	1	4AH-56		Screw	
4AH-26	63679	Trip - Dog Nos. 2, 3, & 4 P. & V..	1		3343	No. 2 P. U. & V.	2
4AH-27	63656	Bushing Nos. 2, 3, & 4 P. & V..	1		3408	Nos. 3 & 4 P. U. & V.	2
4AH-28	2057	Nut Nos. 2, 3, & 4 P. & V..	1	4AH-57		Apron - Rear	
4AH-29	642	Pin - Taper	1		102063	No. 2 P. U. & V.	1
4AH-30	224107	Plug	2		100586	Nos. 3 & 4 P. U. & V.	1
4AH-31	642	Pin - Taper	1	4AH-58		Screw	
4AH-32	3218	Screw	3		3163	No. 2 P. U. & V.	2
4AH-33	69316	Plug	1		3268	Nos. 3 & 4 P. U. & V.	2
4AH-34	3963	Bushing	1	4AH-59	44979	Oiler.	2
4AH-35	1429	Pin	2	4AH-60	63696	Cup - Roller Bearing	1
4AH-36		Screw		4AH-61	63695	Cone - Roller Bearing	1
	3343	No. 2 P. U. & V.	4	4AH-62	100572	Ring - Retainer	1
	3408	Nos. 3 & 4 P. U. & V.	4	4AH-63	100573	Nut - Lock	1
4AH-37	51737	Cup - Oil	1	4AH-64	78072	Cover - Rear Apron	1
4AH-38	3514	Screw	1	4AH-65	3417	Screw	1
4AH-39	3502	Handle	1				

TT - TABLE TRAVEL
B/L - BACKLASH ELIMINATOR

UNIVERSAL SADDLE HOUSING



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

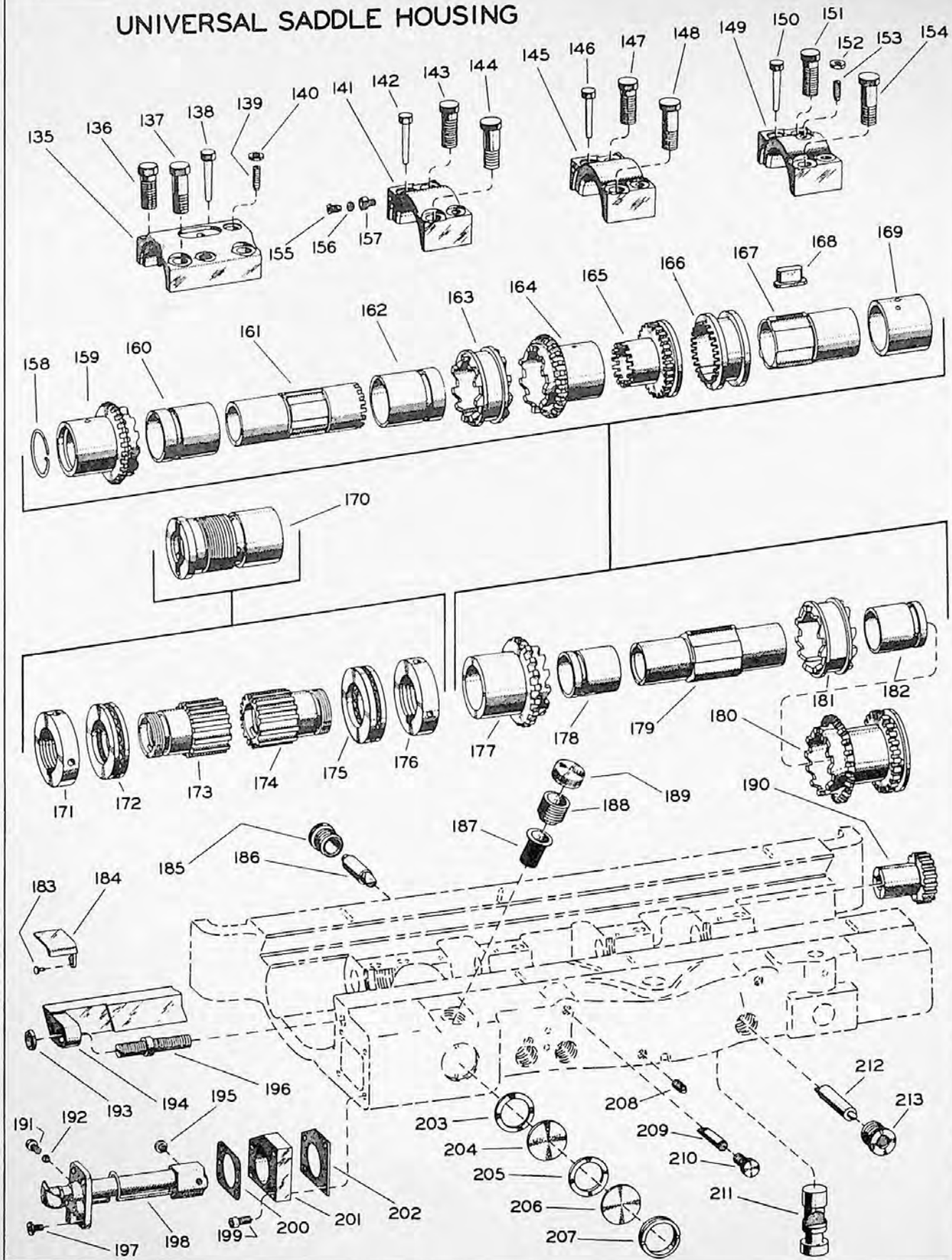
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

SADDLE TABLE—UNIT No. 4 AH (Continued)
Nos. 2, 3, AND 4 UNIVERSAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AH-66	3382	Pin	1	4AH-98	143	Pin - Taper (Long & Short Lead)	1
4AH-67		Spring		4AH-99	76744	Shaft - Eccentric (Long & Short Lead)	1
	65119	No. 2 Universal	1	4AH-100	87250	Screw No. 4 Machine Only	2
	34333	Nos. 3 & 4 Universal	1	4AH-101	65248	Extension - Housing - R. H.	
4AH-68	67020	Bushing	1			No. 4 Machine Only	1
4AH-69	127598	Lever - Detent	1	4AH-102	3482	Screw No. 4 Machine Only	1
4AH-70	67019	Stud - Eccentric	1	4AH-103	65249	Extension - Housing - L. H.	
4AH-71	3203	Screw (For Quantity State Size & Type Machine)				No. 4 Machine Only	1
4AH-72		Guard - Water		4AH-104	3482	Screw No. 4 Machine Only	1
	69132	No. 2 Without B/L	1	4AH-105	87250	Screw No. 4 Machine Only	1
	69133	No. 3 Without B/L	1	4AH-106		Housing - Universal	
	69134	No. 4 Without B/L	1		107246	No. 2 - Without B/L	1
	101986	No. 2 With B/L	1		101796	No. 2 - With B/L	1
	101991	No. 3 With B/L	1		107248	No. 3 - Without B/L	1
	101993	No. 4 With B/L	1		101801	No. 3 - With B/L	1
4AH-73		Gasket - Water Guard			107250	No. 4 - Without B/L	1
	66461	No. 2 Without B/L	1		101800	No. 4 - With B/L	1
	66463	No. 3 Without B/L	1	4AH-107	3832	Bushing	1
	66465	No. 4 Without B/L	1	4AH-108		Rod - Clutch Shifter	
	101985	No. 2 With B/L	1		73837	No. 2 Machine	1
	101992	No. 3 With B/L	1		75632	No. 3 Machine	1
	102001	No. 4 With B/L	1		76563	No. 4 Machine	1
4AH-74	99990	Lever - Table Feed Trip	1	4AH-109	842	Nut	1
4AH-75	1959	Pin - Cotter	1	4AH-110	38368	Pin - Lock	1
4AH-76	66503	Bushing	1	4AH-111	2038	Washer	1
4AH-77	3293	Key	1	4AH-112	842	Nut (Long & Short Lead)	1
4AH-78	63502	Detent - Feed Trip Lever	1	4AH-113	38368	Pin - Lock (Long & Short Lead)	1
4AH-79	63511	Bushing	1	4AH-114	2038	Washer (Long & Short Lead)	1
4AH-80	41319	Nut	1	4AH-115	115032	Ball	1
4AH-81	2135	Washer	1	4AH-116	2135	Washer	1
4AH-82	115032	Ball	1	4AH-117	3860	Stud	1
4AH-83	703	Pin - Cotter	1	4AH-118	2144	Nut	1
4AH-84	63512	Lever - Front Table Feed	1	4AH-119	2135	Washer	1
4AH-85	77411	Plug	3	4AH-120	33942	Pin - Lock	1
4AH-86	214294	Nut	12	4AH-121	63507	Lever - Rear Table Feed	1
4AH-87	214304	Sleeve	12	4AH-122	111585	Fork - Clutch	1
4AH-88		Plug - Drip		4AH-123	73830	Rod - Clutch Shifter (Long & Short Lead)	1
	220004	Plug No. - 0	3	4AH-124	111585	Fork - Clutch (Long & Short Lead)	1
	77196	Plug No. - 1	6	4AH-125	2144	Nut	1
	220003	Plug No. - 2	3	4AH-126	2135	Washer	1
4AH-89	63493	Stud	1	4AH-127	33942	Pin - Lock	1
4AH-90	63494	Pin - Control Link	2	4AH-128	99989	Lever - Clutch Shifter	1
4AH-91	703	Pin - Cotter	1	4AH-129		Shaft - Rear Control	
4AH-92		Link - Control			101407	No. 2 Machine	1
	63764	No. 2 Universal	1		64075	Nos. 3 & 4 Machines	1
	64001	No. 3 Universal	1	4AH-130	64074	Bushing	1
	64002	No. 4 Universal	1	4AH-131	73832	Stud (Long & Short Lead)	1
4AH-93	3485	Screw	2	4AH-132	73831	Pinion - Shifter (Long & Short Lead)	1
4AH-94	96183	Junction - 16 way	1	4AH-133	76761	Bushing - Rack (Long & Short Lead)	1
4AH-95	214300	Bushing	1	4AH-134		Rack	
4AH-96	75393	Screw (Long & Short Lead)	1		76748	No. 2 Machine (Long & Short Lead)	1
4AH-97	76745	Lever - Ecc. Shaft (Long & Short Lead)	1		76746	No. 3 Machine (Long & Short Lead)	1
					76747	No. 4 Machine (Long & Short Lead)	1

B/L - Backlash Eliminator

UNIVERSAL SADDLE HOUSING



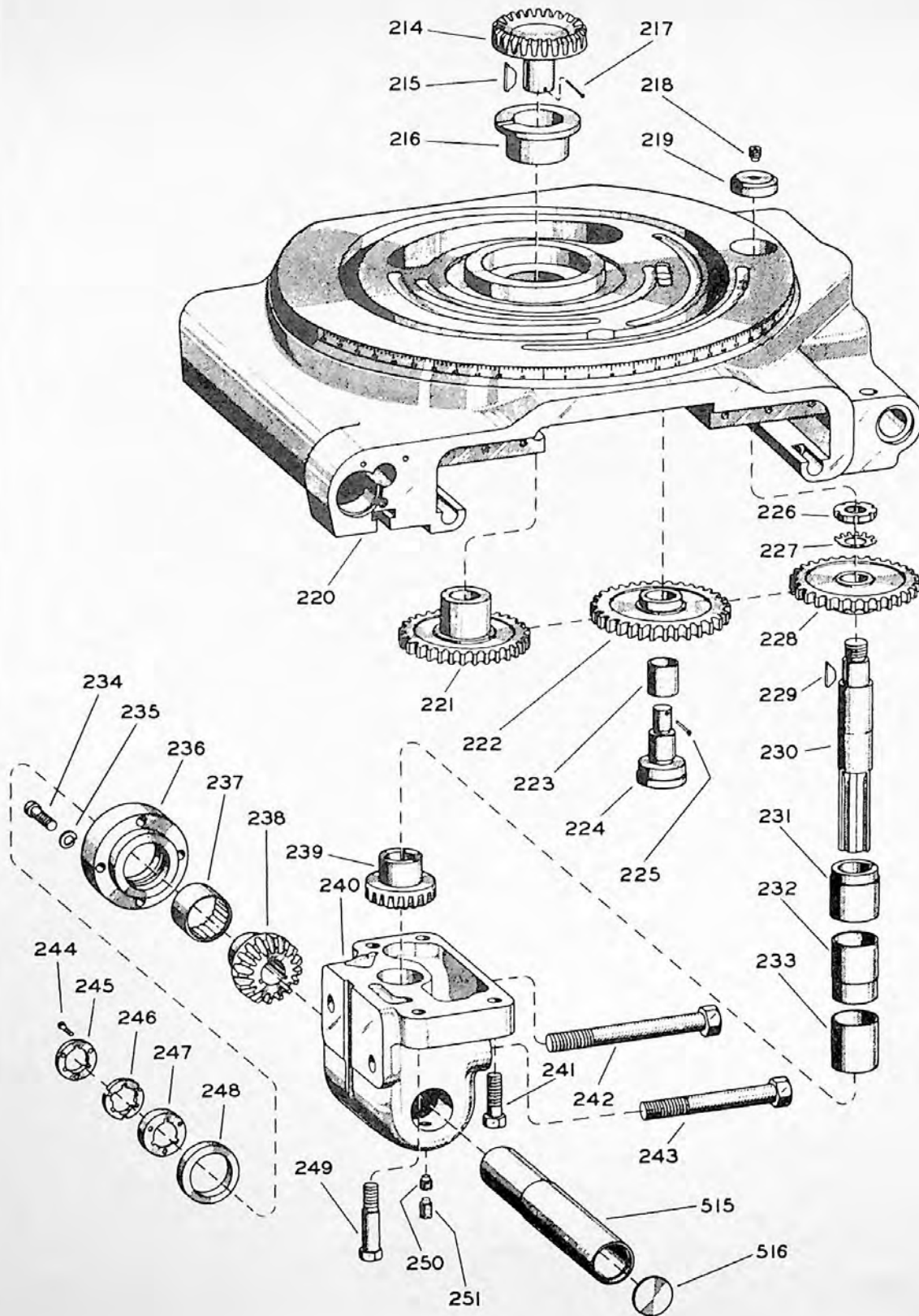
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

SADDLE TABLE—UNIT No. 4 AH (Continued)
Nos. 2, 3, AND 4 UNIVERSAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AH-135	107239	Cap - Lead Screw	1	4AH-182	63680	Bushing	1
4AH-136	3325	Screw	2	4AH-183	2209	Screw	2
4AH-137	3429	Screw	2	4AH-184	67741	Guard - Table Gib.	1
4AH-138	83432	Pin - Taper	2	4AH-185	65076	Screw - Clamp.	2
4AH-139	3234	Screw	1	4AH-186		Wedge - Clamp Rear	
4AH-140	3473	Nut.	1		63943	No. 2	2
4AH-141	63488	Cap - Lead Screw	1		65077	No. 3	2
4AH-142	83432	Pin - Taper	2		63945	No. 4	2
4AH-143	3325	Screw	1	4AH-187	65114	Screen	1
4AH-144	3429	Screw	1	4AH-188	3912	Nipple - Oil Filler.	1
4AH-145	63488	Cap - Lead Screw	1	4AH-189	3986	Cap - Oil Filler	1
4AH-146	83432	Pin - Taper	2	4AH-190	103444	Gear - Att. Driving	1
4AH-147	3325	Screw	1	4AH-191	214300	Bushing	1
4AH-148	3429	Screw	1	4AH-192	214304	Sleeve	1
4AH-149	73821	Cap - Lead Screw	1	4AH-193	3474	Nut.	1
4AH-150	83432	Pin - Taper	2	4AH-194		Gib - Table	
4AH-151	3325	Screw	1		66498	No. 2	1
4AH-152	3473	Nut (Long & Short Lead).	1		66497	No. 3	1
4AH-153	3498	Screw (Long & Short Lead).	1		66498	No. 4	1
4AH-154	3429	Screw	1	4AH-195	96267	Plug - Pump	1
4AH-155	214300	Bushing	3	4AH-196	3997	Screw - Gib	1
4AH-156	214304	Sleeve	3	4AH-197	3203	Screw	4
4AH-157	214303	Adapter	3	4AH-198	96257	Pump - Lubricator	1
4AH-158	76623	Ring - Spring (Long & Short Lead).	1	4AH-199	3227	Screw	4
4AH-159	76621	Gear - Bevel (Long & Short Lead).	1	4AH-200	96084	Gasket	1
4AH-160	76622	Bushing (Long & Short Lead).	1	4AH-201	96500	Plate - Adapter	1
4AH-161	73835	Sleeve - Clutch (Long & Short Lead).	1	4AH-202	96704	Gasket	1
4AH-162	76622	Bushing (Long & Short Lead).	1	4AH-203	3850	Gasket	1
4AH-163	63665	Clutch (Long & Short Lead).	1	4AH-204	60742	Dial - Oil Gauge.	1
4AH-164	76621	Gear - Bevel (Long & Short Lead).	1	4AH-205	4086	Gasket	1
4AH-165	73836	Gear - Driving (Long & Short Lead).	1	4AH-206	3849	Disc	1
4AH-166	73827	Clutch - Sleeve (Long & Short Lead).	1	4AH-207	63937	Cover - Oil Gauge.	1
4AH-167	115534	Sleeve (Long & Short Lead).	1	4AH-208	3498	Screw	1
4AH-168	115533	Key (Long & Short Lead).	1	4AH-209		Shoe - Gib Clamping	
4AH-169	76775	Bushing (Long & Short Lead).	1		65155	No. 2 - Left.	1
4AH-170	120536	Nut - On Lead Screw - Without B/L.	1		66436	No. 2 - Right.	1
4AH-171	98621	Nut - Lock - With B/L.	1		66436	No. 3 - Left.	1
4AH-172	98622	Bearing - Ball - With B/L.	1		66437	No. 3 - Right.	1
4AH-173	148108	Nut - Backlash Elim. - With B/L.	1		66437	No. 4 - Left.	1
4AH-174	148108	Nut - Backlash Elim. - With B/L.	1		66438	No. 4 - Right.	1
4AH-175	98622	Bearing - Ball - With B/L.	1	4AH-210	2260	Screw	2
4AH-176	98621	Nut - Lock - With B/L.	1	4AH-211	65075	Bolt - Wedge	4
4AH-177	63671	Gear - Bevel Left on Lead Screw.	1	4AH-212		Wedge - Clamp Front	
4AH-178	63680	Bushing	1		63939	No. 2	2
4AH-179	74124	Sleeve - On Lead Screw.	1		65078	No. 3	2
4AH-180	63670	Gear - Bevel Right on Lead Screw.	1		63946	No. 4	2
4AH-181	63665	Clutch	1	4AH-213	65076	Screw - Clamp.	2

UNIVERSAL SADDLE



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

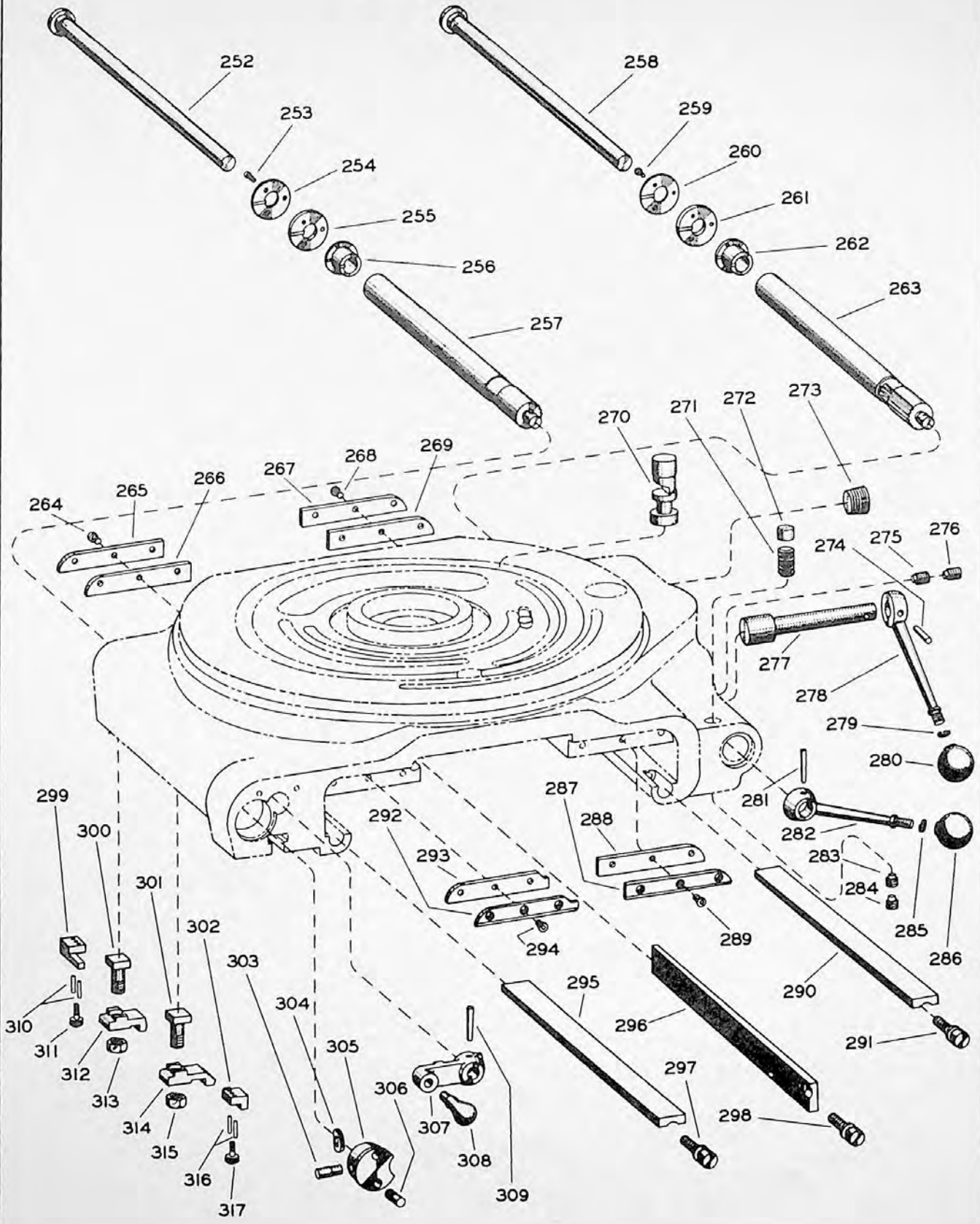
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SADDLE TABLE—UNIT No. 4 AH (Continued)

Nos. 2, 3, AND 4 UNIVERSAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AH-214	64026	Gear - Bevel	1	4AH-235	2135	Washer	4
4AH-215	3281	Key	1	4AH-236	104730	Bracket - Bearing	1
4AH-216	63795	Bushing - Stem Gear	1	4AH-237	94136	Bearing - Needle	1
4AH-217	2036	Pin - Cotter	1	4AH-238	104726	Gear - Bevel	1
4AH-218	3453	Screw	1	4AH-239	63800	Gear - Bevel Stem	1
4AH-219	63797	Plug	1	4AH-240	107037	Bracket - Under Saddle	1
4AH-220		Saddle		4AH-241	3325	Screw	2
	99795	No. 2	1	4AH-242	63658	Screw	1
	79034	Nos. 3 & 4	1	4AH-243	3300	Screw	1
4AH-221	63792	Gear - Stem	1	4AK-515		Cover - Spline Shaft	
4AH-222	65068	Gear - Intermediate	1		132606	No. 2 P. U. & V.	1
4AH-223	65069	Bushing	1		132606	No. 3 P & U.	1
4AH-224	65067	Stud	1		132607	No. 3 V.	1
4AH-225	1959	Pin - Cotter	1		132607	No. 4 P. U. & V.	1
4AH-226	3808	Nut - Lock	1	4AK-516	132594	Plug - Cover.	1
4AH-227	3807	Washer - Lock	1	4AH-244	3201	Screw	3
4AH-228	63793	Gear - Drive Shaft.	1	4AH-245	104733	Washer - Wiper	1
4AH-229	3281	Key	1	4AH-246	104732	Wiper	1
4AH-230	63799	Shaft - Drive	1	4AH-247	104731	Holder - Wiper	1
4AH-231	67698	Bushing	1	4AH-248	104734	Seal - Oil	1
4AH-232	102114	Stem - Locating	1	4AH-249	98358	Screw	2
4AH-233	63790	Bushing	1	4AH-250	3453	Screw	1
4AH-234	3401	Screw	4	4AH-251	3498	Screw	1

UNIVERSAL SADDLE



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

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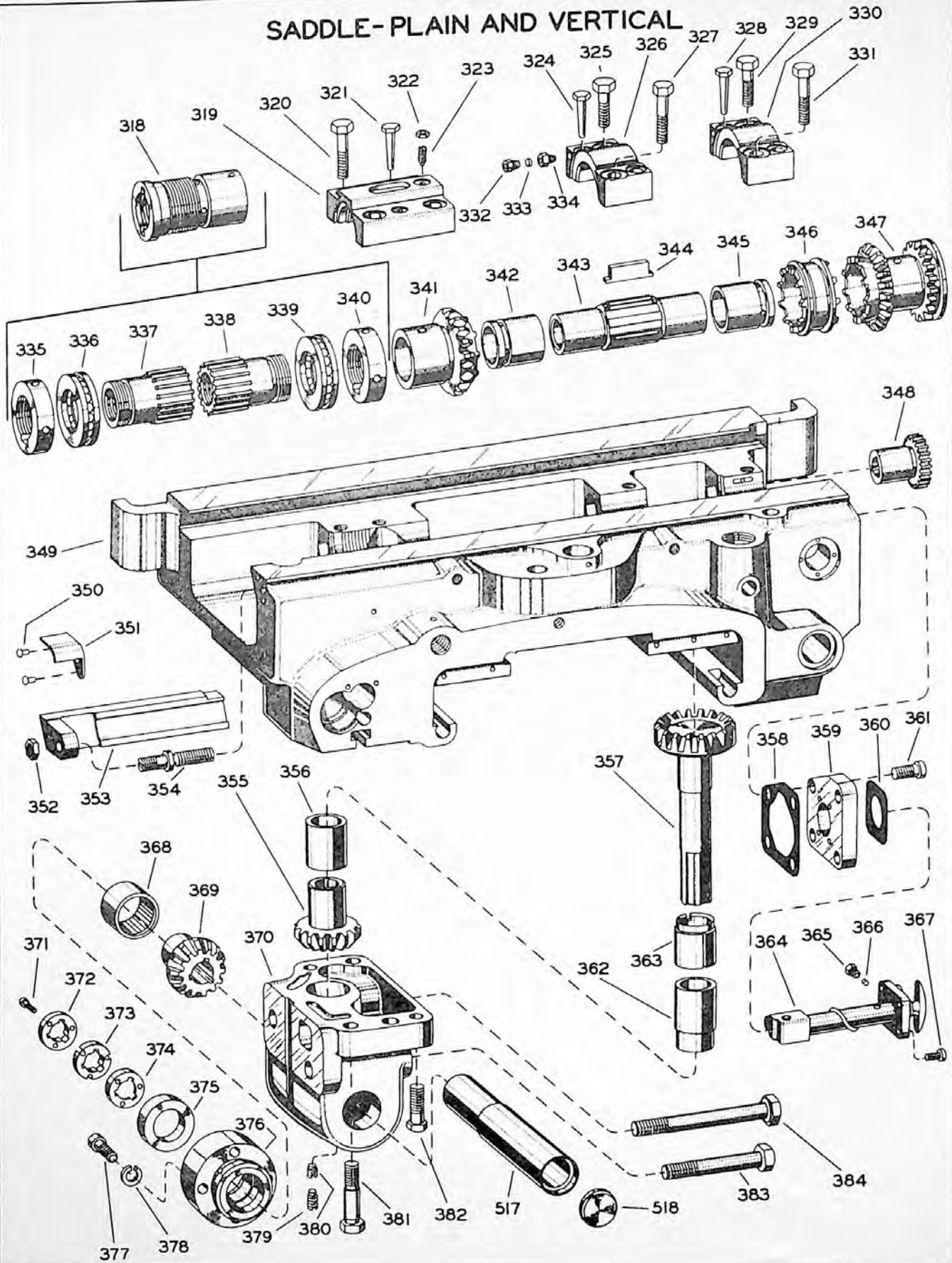
SADDLE TABLE—UNIT No. 4 AH (Continued)
Nos. 2, 3, AND 4 UNIVERSAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AH-252		Shaft - Horiz. Control		4AH-286	115032	Ball	1
	106799	No. 2	1	4AH-287		Clamp - Wiper Front Right	
	106800	Nos. 3 & 4	1		98541	No. 2	1
4AH-253	2271	Screw	3		94516	Nos. 3 & 4	1
4AH-254	104709	Retainer - Wiper	1	4AH-288		Wiper - Front Right	
4AH-255	104708	Wiper - Horiz. Control Shaft	1		98540	No. 2	1
4AH-256	104705	Driver - In Sleeve	1		94515	Nos. 3 & 4	1
4AH-257		Sleeve - Q. T. Control Shaft		4AH-289	3203	Screw	3
	104704	No. 2	1	4AH-290		Gib - Saddle Lower	
	104703	Nos. 3 & 4	1		63766	No. 2	1
4AH-258		Shaft - Horiz. Control			64028	Nos. 3 & 4	1
	106799	No. 2	1	4AH-291	63606	Screw - Gib	1
	106800	Nos. 3 & 4	1	4AH-292		Clamp - Wiper Front Left	
4AH-259	2271	Screw	3		98543	No. 2	1
4AH-260	104709	Retainer - Wiper	1		98617	Nos. 3 & 4	1
4AH-261	104708	Wiper - Horiz. Control Shaft	1	4AH-293		Wiper - Front Left	
4AH-262	104705	Driver - In Sleeve	1		98542	No. 2	1
4AH-263		Sleeve - Q. T. Control Shaft			98618	Nos. 3 & 4	1
	104704	No. 2	1	4AH-294		Screw	
	104703	Nos. 3 & 4	1		3203	No. 2	2
4AH-264	3203	Screw	3		3203	Nos. 3 & 4	3
4AH-265		Clamp - Wiper Rear Left		4AH-295		Gib - Saddle Lower	
	98546	No. 2	1		63766	No. 2	1
	94516	Nos. 3 & 4	1		64028	Nos. 3 & 4	1
4AH-266		Wiper - Rear Left		4AH-296		Gib - Saddle Upper	
	98545	No. 2	1		63765	No. 2	1
	94515	Nos. 3 & 4	1		64027	Nos. 3 & 4	1
4AH-267		Clamp - Wiper Rear Right		4AH-297	63606	Screw - Gib	1
	98544	No. 2	1	4AH-298	63606	Screw - Gib	1
	94514	Nos. 3 & 4	1	4AH-299		Dog - Positive Stop	
4AH-268	3203	Screw	3		77858	No. 2 U.	1
4AH-269		Wiper - Rear Right			95005	No. 3 U.	1
	98540	No. 2	1		95006	No. 4 U.	1
	94515	Nos. 3 & 4	1	4AH-300	3361	Bolt - Tee	1
4AH-270	65075	Bolt - Wedge	4	4AH-301	3361	Bolt - Tee	1
4AH-271	66527	Plunger - Q. T. Backlash	1	4AH-302	77858	Dog - Positive Stop	1
4AH-272	3549	Plug	1	4AH-303	1664	Pin	1
4AH-273	60955	Plug - Pipe	1	4AH-304	66870	Pinion - Stop Pin	1
4AH-274	642	Pin - Taper	1	4AH-305	67105	Bearing - Stop Pin.	1
4AH-275	3498	Screw	1	4AH-306	14155	Pin - Stop	2
4AH-276	3498	Screw	1	4AH-307	67604	Lever - Control Feed & Speed	1
4AH-277		Clamp - Eccentric		4AH-308	3501	Handle	1
	78968	No. 2	1	4AH-309	642	Pin - Taper	1
	78969	Nos. 3 & 4	1	4AH-310	3541	Pin	2
4AH-278	103230	Lever - Cross & Vertical Feed Shifter	1	4AH-311	2252	Screw	1
4AH-279	2135	Washer	1	4AH-312	63694	Dog - Small Cross Feed.	1
4AH-280	115032	Ball	1	4AH-313	2057	Nut	1
4AH-281	642	Pin - Taper	1	4AH-314	63693	Dog - Large Cross Feed	1
4AH-282	99988	Lever - Control Large	1	4AH-315	2057	Nut	1
4AH-283	3453	Screw	1	4AH-316	3541	Pin	2
4AH-284	3453	Screw	1	4AH-317	2252	Screw	1
4AH-285	2135	Washer	1				

Q. T. - Quick (Rapid) Traverse

PARTS LIST CATALOG

SADDLE-PLAIN AND VERTICAL



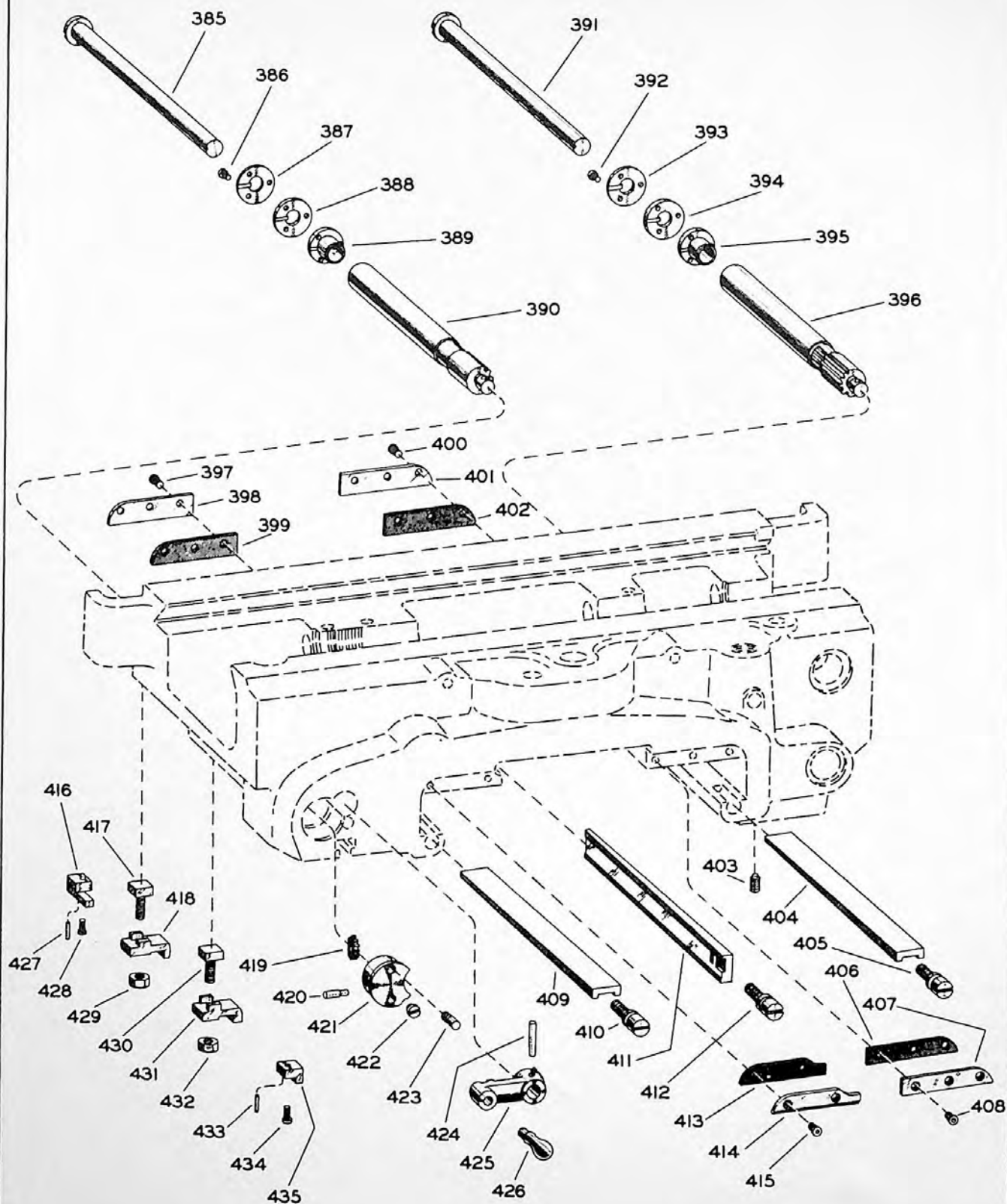
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

SADDLE TABLE—UNIT No. 4 AH (Continued)
Nos. 2, 3, AND 4 PLAIN AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AH-318	120536	Nut - On Lead Screw Without B/L	1	4AH-354	3997	Screw - Gib	1
4AH-319	107239	Cap - Lead Screw Nut	1	4AH-355		Gear - Bevel on Stem	
4AH-320	3429	Screw	4		63666	No. 2	1
4AH-321	83432	Pin - Taper	2		63800	Nos. 3 & 4	1
4AH-322	3473	Nut	1	4AH-356	63790	Bushing	1
4AH-323	3498	Screw	1	4AH-357	63668	Gear - Bevel Stem.	1
4AH-324	83432	Pin - Taper	2	4AH-358	64606	Gasket	1
4AH-325	3325	Screw	1	4AH-359		Plate - Adapter	
4AH-326	63488	Cap - On Lead Screw	1		96828	No. 2	1
4AH-327	3429	Screw	1		96083	Nos. 3 & 4	1
4AH-328	83432	Pin - Taper	2	4AH-360	96084	Gasket	1
4AH-329	3325	Screw	1	4AH-361	3400	Screw	4
4AH-330	63488	Cap - On Lead Screw	1	4AH-362	102114	Stem - Locating	1
4AH-331	3429	Screw	1	4AH-363	67698	Bushing	1
4AH-332	214300	Bushing	3	4AH-364	96257	Pump - Lubricator.	1
4AH-333	214304	Sleeve	3	4AH-365	214300	Bushing	1
4AH-334	214303	Adapter	3	4AH-366	214304	Sleeve	1
4AH-335	98621	Nut - Lock	1	4AH-367	3203	Screw	4
4AH-336	98622	Bearing - Ball	1	4AH-368	94136	Bearing - Needle	1
4AH-337	148108	Nut - Backlash Elim. With B/L	1	4AH-369		Gear - Bevel	
4AH-338	148108	Nut - Backlash Elim. With B/L	1		104727	No. 2	1
4AH-339	98622	Bearing - Ball	1		104726	Nos. 3 & 4	1
4AH-340	98621	Nut - Lock	1	4AH-370		Bracket - Under Saddle	
4AH-341	63671	Gear - Bevel Left on Lead Screw	1		107038	No. 2	1
4AH-342	63680	Bushing	1		107037	Nos. 3 & 4	1
4AH-343	74124	Sleeve - On Lead Screw	1	4AH-371	3201	Screw	3
4AH-344	74123	Key	1	4AH-372	104733	Washer - Wiper	1
4AH-345	63680	Bushing	1	4AH-373	104732	Wiper	1
4AH-346	63665	Clutch	1	4AH-374	104731	Holder - Wiper	1
4AH-347	63670	Gear - Bevel Right on Lead Screw	1	4AH-375	104734	Seal - Oil	1
4AH-348	103444	Gear - Att. Driving	1	4AH-376	104730	Bracket - Bearing.	1
4AH-349		Saddle		4AH-377	3401	Screw	4
	101282	No. 2	1	4AH-378	2135	Washer	4
	107241	No. 2	1	4AH-379	3498	Screw	1
	101283	No. 3	1	4AH-380	3453	Screw	1
	107242	No. 3	1	4AH-381	98358	Screw	2
	101284	No. 4	1	4AH-382	3325	Screw	2
	107244	No. 4	1	4AK-517		Cover - Spline Shaft	
4AH-350	2209	Screw	2		132606	No. 2 P. U. & V.	1
4AH-351	67741	Guard - Table Gib	1		132606	No. 3 P. & U.	1
4AH-352	3474	Nut	1		132607	No. 3 V.	1
4AH-353		Gib - Table			132607	No. 4 P. U. & V.	1
	66496	No. 2	1	4AK-518	132594	Plug - Cover	1
	66497	No. 3	1	4AH-383	3300	Screw	1
	66498	No. 4	1	4AH-384	63658	Screw	1

SADDLE-PLAIN AND VERTICAL



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

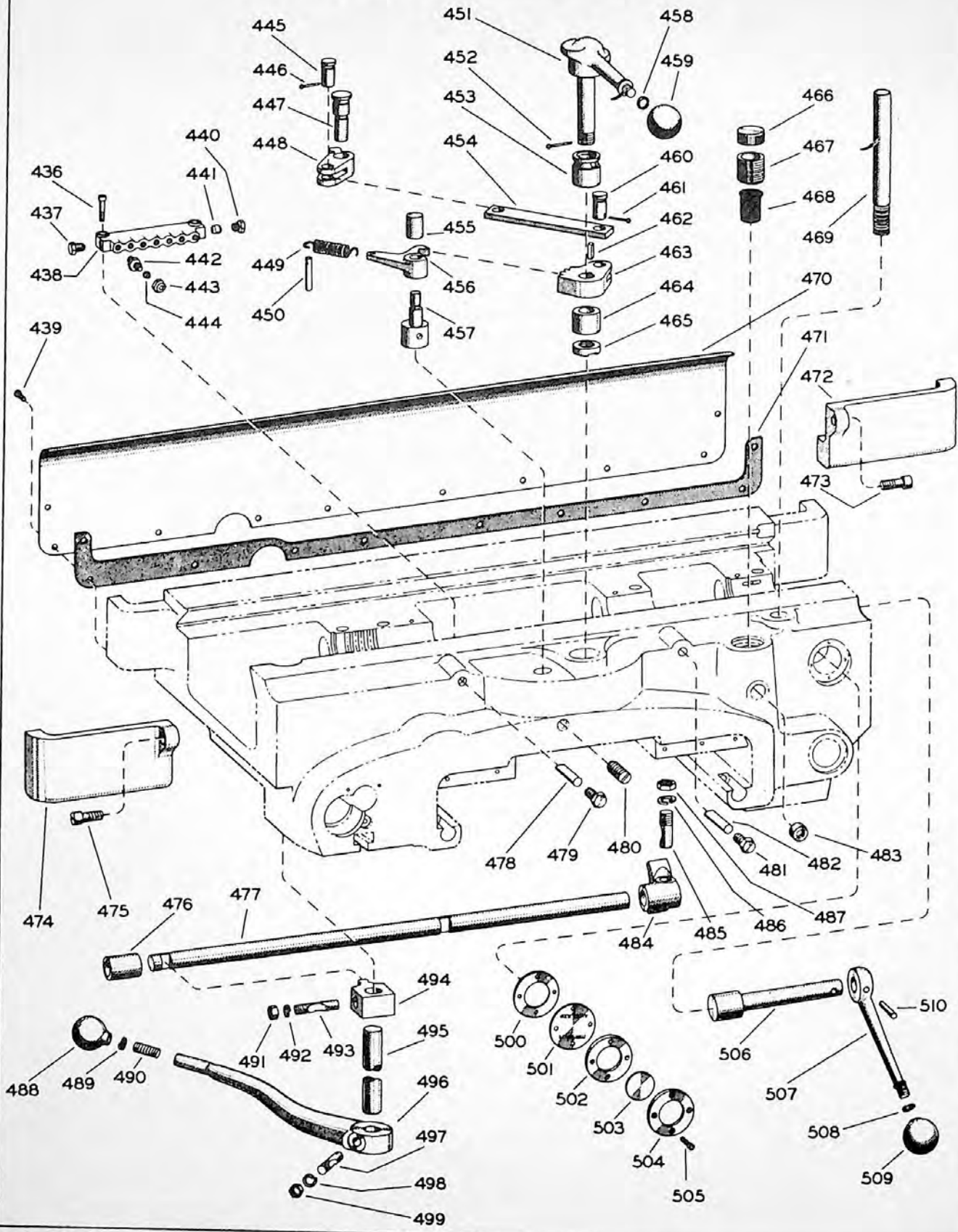
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

SADDLE TABLE—UNIT No. 4 AH (Continued)

Nos. 2, 3, AND 4 PLAIN AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AH-385	106799	Shaft - Horiz. Control	1	4AH-407	98541	Clamp - Wiper Front Right	1
	106800	No. 2	1		94516	No. 2	1
	2271	Nos. 3 & 4	3	4AH-408	3203	Nos. 3 & 4	3
4AH-386	104709	Screw	1	4AH-409	63766	Screw	1
4AH-387	104708	Retainer - Wiper	1		64028	Gib - Saddle Lower	1
4AH-388	104705	Wiper - Horiz. Control Shaft	1		63605	No. 2	1
4AH-389	104705	Driver - In Sleeve	1	4AH-410	63606	No. 3	1
4AH-390	104704	Sleeve - Q. T. Control Shaft	1		63605	No. 4	1
	104703	No. 2	1	4AH-411	63765	Screw - Gib	1
	106799	Nos. 3 & 4	1		64027	Gib - Saddle Upper	1
4AH-391	106800	Shaft - Horiz. Control	1		63603	No. 2	1
	2271	No. 2	1	4AH-412	63606	No. 3	1
4AH-392	104709	Nos. 3 & 4	3	4AH-413	98543	No. 4	1
4AH-393	104708	Screw	1		96617	Screw - Gib	1
4AH-394	104705	Retainer - Wiper	1	4AH-414	98542	Wiper - Front Left	1
4AH-395	104705	Wiper - Horiz. Control Shaft	1		98618	No. 2	1
4AH-396	104704	Driver - In Sleeve	1	4AH-415	3203	Nos. 3 & 4	1
	104703	Sleeve - Q. T. Control Shaft	1		3203	Screw	2
	3203	No. 2	3	4AH-416	77858	Nos. 3 & 4	3
4AH-397	98546	Clamp - Wiper Rear Left	1		95006	Dog - Positive Stop	1
4AH-398	94516	No. 2	1		3361	Nos. 2, 3, & 4 P.	1
	98545	Nos. 3 & 4	1	4AH-417	63694	Nos. 2, 3, & 4 V.	1
4AH-399	94515	Wiper - Rear Left	1	4AH-418	66670	Bolt - Tee	1
	3203	No. 2	3	4AH-419	1664	Dog - Small Cross Feed	1
4AH-400	98544	Nos. 3 & 4	1	4AH-420	67105	Pinton - Stop Pin	1
4AH-401	94514	Screw	1	4AH-421	1650	Pin	1
	98540	Clamp - Wiper Rear Right	1	4AH-422	14155	Bearing - Stop Pin	1
	94515	No. 2	1	4AH-423	642	Screw	1
	3498	Nos. 3 & 4	1	4AH-424	67604	Pin - Stop	2
4AH-402	63766	Wiper - Rear Right	1	4AH-425	3501	Pin - Taper	1
	64028	No. 2	1	4AH-426	3541	Lever - Control Feed & Speed	1
	63605	Nos. 3 & 4	1	4AH-427	2252	Handle	1
4AH-403	63606	Screw	1	4AH-428	2057	Pin	2
4AH-404	63606	Gib - Saddle Lower	1	4AH-429	3361	Nut	1
	63766	No. 2	1	4AH-430	63693	Bolt - Tee	1
	64028	No. 3	1	4AH-431	2057	Dog - Large Cross Feed	1
	63605	No. 4	1	4AH-432	3541	Nut	1
4AH-405	63606	Screw - Gib	1	4AH-433	2252	Pin	2
4AH-406	98540	Wiper - Front Right	1	4AH-434	2252	Screw	1
	94515	No. 2	1	4AH-435	77858	Dog - Positive Stop	1
		Nos. 3 & 4	1				

SADDLE-PLAIN AND VERTICAL



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

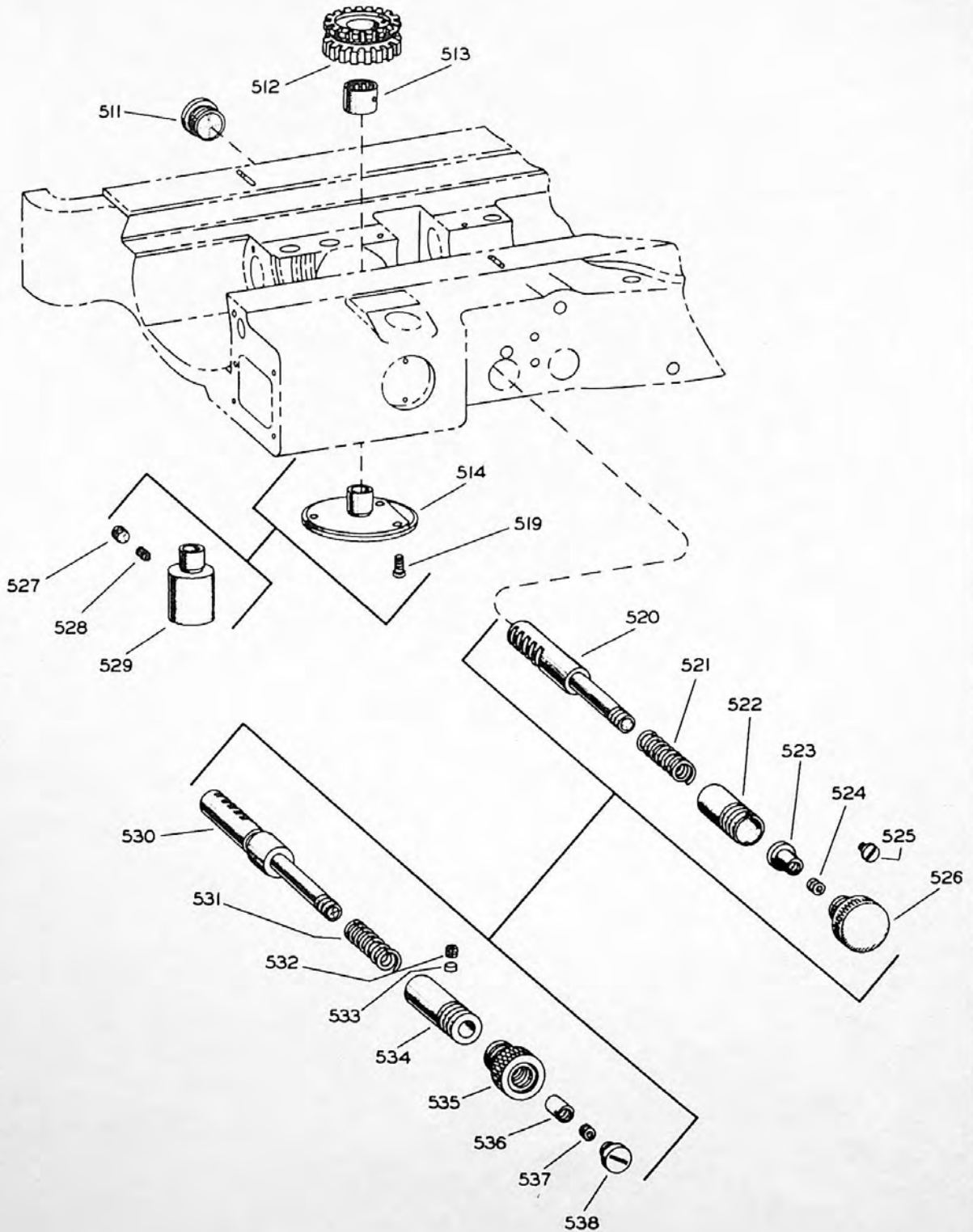
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

SADDLE TABLE—UNIT No. 4 AH (Continued)

Nos. 2, 3, AND 4 PLAIN AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AH-436	3227	Screw	2	4AH-472	66559	Extension - Right - No. 4 P. & V. Only . .	1
4AH-437	77411	Plug	1	4AH-473	3495	Screw	1
4AH-438	96183	Junction - 16 way		4AH-474	66558	Extension - Left - No. 4 P. & V. Only . .	1
4AH-439	3203	Screw (For quantity state size and type machine)		4AH-475	3495	Screw	1
4AH-440	214300	Bushing	1	4AH-476	3832	Bushing	1
4AH-441	214304	Sleeve	1	4AH-477	63504	Rod - Rear Feed Control	1
4AH-442		Plug - Drip		4AH-478		Shoe - Gib Clamping	
	220004	Plug No. 0.	6		64938	No. 2	1
	77196	Plug No. 1.	7		65134	No. 3	1
	220003	Plug No. 2.	1		65155	No. 4	1
4AH-443	214294	Nut	14	4AH-479		Screw	1
4AH-444	214304	Sleeve	14	4AH-480	3457	Screw	1
4AH-445	63494	Pin - Control Link.	1	4AH-481	2260	Screw	1
4AH-446	703	Pin - Cotter	1	4AH-482		Shoe - Gib Clamping	
4AH-447	63493	Stud	1		64939	No. 2	1
4AH-448	63512	Lever - Front Table Feed	1		65132	No. 3	1
4AH-449		Spring			66436	No. 4	1
	65119	No. 2	1	4AH-483	3530	Plug	1
	34333	Nos. 3 & 4	1	4AH-484	111585	Fork - Clutch	1
4AH-450	3382	Pin	1	4AH-485	38368	Pin - Lock.	1
4AH-451	99990	Lever - Table Feed Trip	1	4AH-486	2038	Washer.	1
4AH-452	1959	Pin - Cotter	1	4AH-487	842	Nut.	1
4AH-453	66503	Bushing	1	4AH-488	115032	Ball	1
4AH-454		Link - Control		4AH-489	2135	Washer.	1
	63764	No. 2	1	4AH-490	3860	Stud	1
	64001	No. 3	1	4AH-491	2144	Nut.	1
	64002	No. 4	1	4AH-492	2135	Washer.	1
4AH-455	67020	Bushing	1	4AH-493	33942	Pin - Lock.	1
4AH-456	127598	Lever - Detent.	1	4AH-494	63507	Lever - Rear Table Feed	1
4AH-457	67019	Stud - Eccentric	1	4AH-495	63506	Stud - Lever Feed Control	1
4AH-458	2135	Washer.	1	4AH-496	100066	Lever - Clutch Shifter.	1
4AH-459	115032	Ball	1	4AH-497	33942	Pin - Lock.	1
4AH-460	63494	Pin - Control Link.	1	4AH-498	2135	Washer.	1
4AH-461	703	Pin - Cotter	1	4AH-499	2144	Nut.	1
4AH-462	3293	Key.	1	4AH-500	4077	Gasket	1
4AH-463	63502	Detent - Feed Trip Lever	1	4AH-501	95387	Dial - Oil Gage	1
4AH-464	63511	Bushing	1	4AH-502	4087	Gasket	1
4AH-465	41319	Nut.	1	4AH-503	4078	Disc	1
4AH-466	3986	Cap - Oil Filler	1	4AH-504	4076	Cover - Oil Gage	1
4AH-467	3912	Nipple - Oil Filler.	1	4AH-505	3197	Screw	4
4AH-468	65114	Screen	1	4AH-506		Clamp - Eccentric	
4AH-469	67106	Plunger - Q. T.	1		78968	No. 2	1
4AH-470		Guard - Water Saddle			78969	Nos. 3 & 4.	1
	98626	No. 2	1	4AH-507	103230	Lever - Cross & Vert. Feed Shifter	1
	99413	No. 2 - 36" Table Travel.	1	4AH-508	2135	Washer.	1
	98628	No. 3	1	4AH-509	115032	Ball	1
	99415	No. 3 - 42" Table Travel.	1	4AH-510	642	Pin - Taper	1
	99316	No. 4	1				
4AH-471		Gasket - Water Guard					
	98627	No. 2	1				
	99414	No. 2 - 36" Table Travel.	1				
	98629	No. 3	1				
	99416	No. 3 - 42" Table Travel.	1				
	99315	No. 4	1				

BACKLASH ELIMINATOR



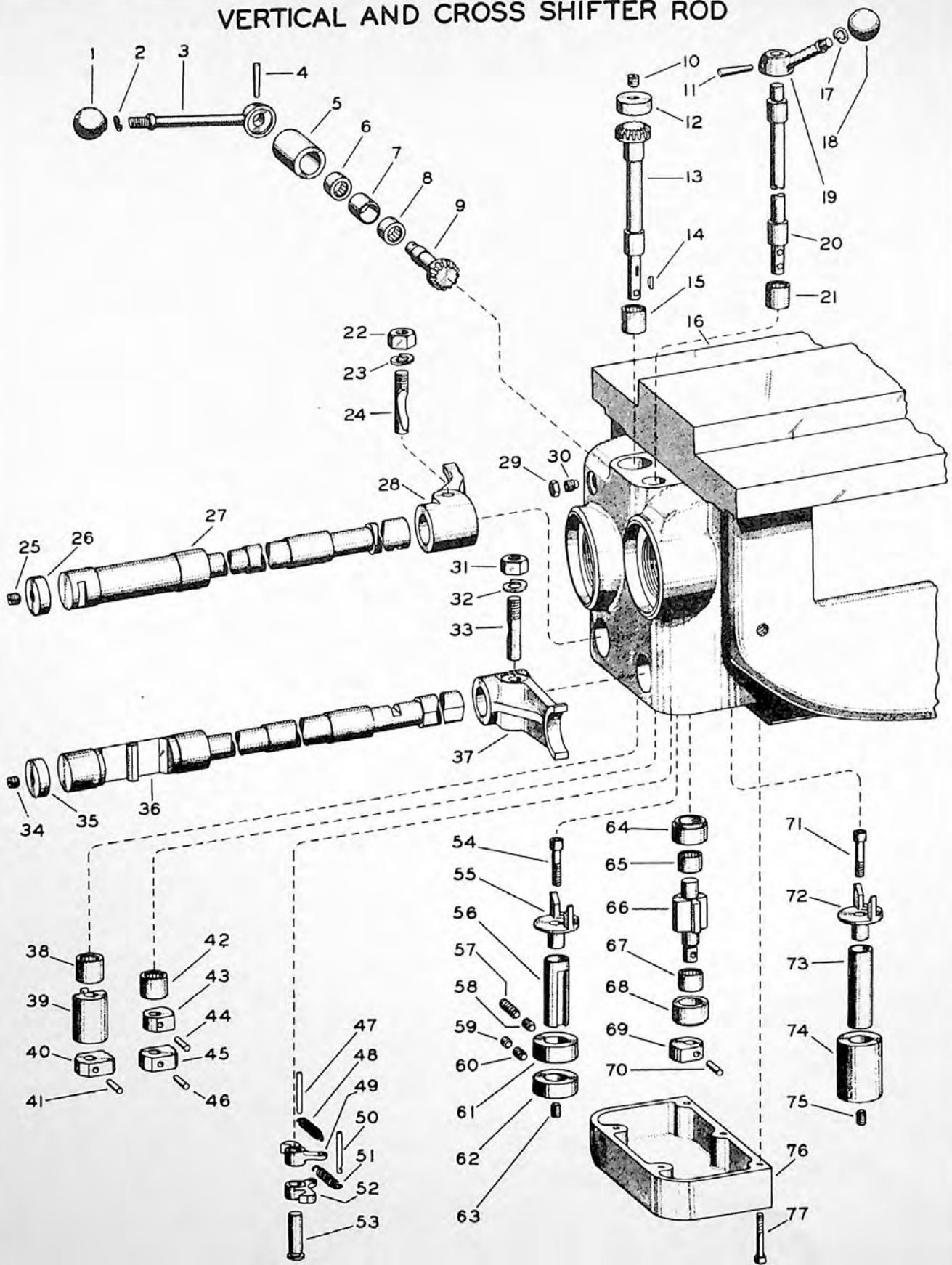
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

SADDLE TABLE—UNIT No. 4 AH (Concluded)
Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AH-511	104235	Cap - Bushing	1	4AH-532		Screw	
4AH-512	98184	Gear - Crown	1	1911		Nos. 2, 3, & 4 P. & V.	1
4AH-513	79762	Bearing - Needle	1	3239		Nos. 3 & 4 U.	1
4AH-514	102730	Support - Bearing Nos. 2, 3, & 4 Universal	1	4AH-533		Plug	
4AH-519	3203	Screw Nos. 2, 3, & 4 Universal	3	2268		Nos. 2, 3, & 4 P. & V.	1
4AH-520	104247	Rack No. 2 Universal	1	2268		Nos. 3 & 4 U.	1
4AH-521	3965	Spring No. 2 Universal	1	4AH-534		Cage - Spring	
4AH-522	104238	Cage - Spring No. 2 Universal	1	104243		Nos. 2, 3, & 4 P. & V.	1
4AH-523	104237	Stop - Bushing No. 2 Universal	1	104243		Nos. 3 & 4 U.	1
4AH-524	1917	Screw No. 2 Universal	1	4AH-535		Knob	
4AH-525	1650	Screw No. 2 Universal	1	108353		Nos. 2, 3, & 4 P. & V.	1
4AH-526	104236	Knob No. 2 Universal	1	108353		Nos. 3 & 4 U.	1
4AH-527	76645	Plug Nos. 2, 3, & 4 P. & V.	1	4AH-536		Stop - Bushing	
4AH-528	3236	Screw Nos. 2, 3, & 4 P. & V.	2	104242		Nos. 2, 3, & 4 P. & V.	1
4AH-529	98623	Support - Bearing Nos. 2, 3, & 4 P. & V.	1	104242		Nos. 3 & 4 U.	
4AH-530		Rack		4AH-537		Screw	
	104245	No. 2 P. & V.	1	1911		Nos. 2, 3, & 4 P. & V.	1
	104245	No. 3 U.	1	1911		Nos. 3 & 4 U.	1
	104246	No. 3 P. & V.	1	4AH-538		Screw	
	104246	No. 4 P., U. & V.	1	902		Nos. 2, 3, & 4 P. & V.	1
4AH-531		Spring		902		Nos. 3 & 4 U.	1
	3965	Nos. 2, 3, & 4 P. & V.	1				
	3965	Nos. 3 & 4 U.	1				

VERTICAL AND CROSS SHIFTER ROD



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

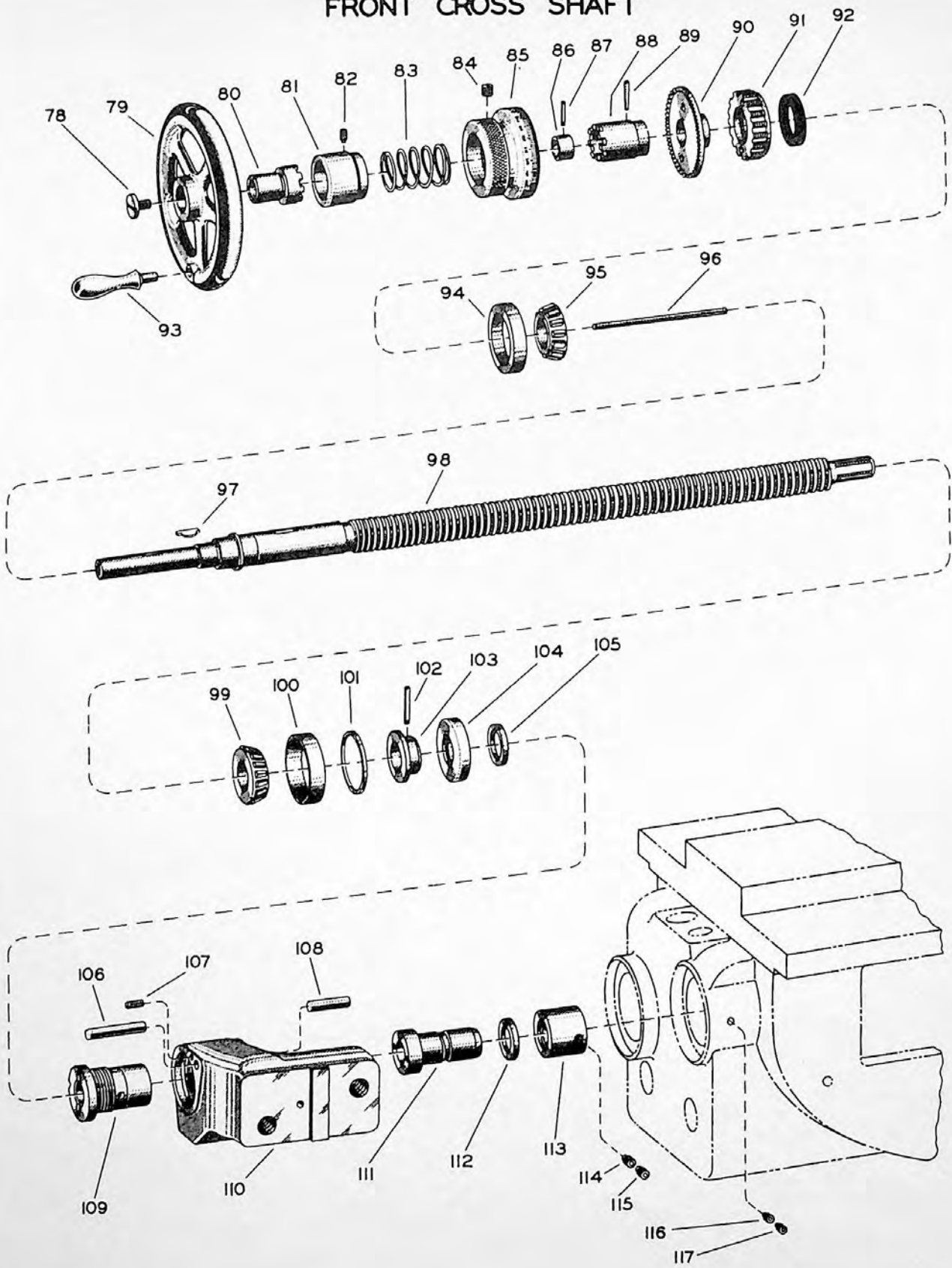
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KNEE—UNIT No. 4AK

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

Q.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AK -1	115032	Ball	1	4AK -37	108951	Fork - Cross Feed Clutch.	1
4AK -2	2135	Washer - Lock.	1	4AK -38	98840	Bearing - Control Shaft	1
4AK -3	103226	Lever - Control	1	4AK -39	99882	Shifter - Vertical Feed	1
4AK -4	642	Pin - Taper	1	4AK -40	99907	Detent	1
4AK -5	99746	Bushing - Vert.	1	4AK -41	663	Pin - Taper	1
4AK -6	79762	Bearing - Needle	1	4AK -42	98840	Bearing - Control Shaft	1
4AK -7	99880	Spacer - Vert. Feed	1	4AK -43	99719	Segment	1
4AK -8	79762	Bearing - Needle	1	4AK -44	663	Pin - Taper	1
4AK -9	99881	Gear - Bevel	1	4AK -45	99907	Detent	1
4AK -10	1215	Screw	1	4AK -46	663	Pin - Taper	1
4AK -11	642	Pin - Taper	1	4AK -47	98826	Pin - Spring	1
4AK -12	73812	Plug	1	4AK -48	72535	Spring	1
4AK -13	99885	Shaft - Front Vert. Feed Shifter	1	4AK -49	98832	Lever - Detent.	1
4AK -14	3279	Key.	1	4AK -50	98825	Pin - Spring	1
4AK -15	98840	Bearing - Control Shaft	1	4AK -51	72535	Spring	1
4AK -16		Knee		4AK -52	98832	Lever - Detent.	1
	137026	No. 2 P. U. and V.	1	4AK -53	98831	Pin - Lever Detent	1
	132519	No. 3 P. and U.	1	4AK -54	3401	Screw	1
	137027	Nos. 3 & 4 V.	1	4AK -55	74755	Knockout - Crank	1
	137027	No. 4 P. and U.	1	4AK -56	99910	Stem - Knockout Crank	1
4AK -17	2135	Washer - Lock.	1	4AK -57	3236	Screw	1
4AK -18	115032	Ball	1	4AK -58	3233	Screw	1
4AK -19	103226	Lever - Control	1	4AK -59	1917	Screw	1
4AK -20	98838	Shaft - Front Cross Feed Shifter	1	4AK -60	3233	Screw	1
4AK -21	98840	Bearing - Control Shaft	1	4AK -61	99912	Bushing - Long	1
4AK -22	3480	Nut	1	4AK -62	99911	Bushing - Short	1
4AK -23	2118	Washer - Lock.	1	4AK -63	1917	Screw	1
4AK -24	33938	Pin - Lock	1	4AK -64	98834	Bearing - Adapter Long.	1
4AK -25	1215	Screw	1	4AK -65	79762	Bearing - Needle	1
4AK -26	98820	Plug	1	4AK -66	98836	Stem - Reversing	1
4AK -27		Rod - Vert. Feed Shifter		4AK -67	79762	Bearing - Needle	1
	101521	No. 2 P. U. and V.	1	4AK -68	98834	Bearing - Adapter Long.	1
	101518	No. 3 P. and U.	1	4AK -69	99719	Segment	1
	101523	Nos. 3 & 4 V.	1	4AK -70	663	Pin - Taper	1
	101523	No. 4 P. and U.	1	4AK -71	3401	Screw	1
4AK -28	108950	Fork - Elevating Clutch.	1	4AK -72	74755	Knockout - Crank	1
4AK -29	3473	Nut	1	4AK -73	99909	Stem - Knockout Crank	1
4AK -30	3233	Screw	1	4AK -74	119996	Bushing - Cross Feed Control Shaft	1
4AK -31	3480	Nut	1	4AK -75	1917	Screw	1
4AK -32	2118	Washer - Lock.	1	4AK -76	99890	Cover - Feed Control Cross	1
4AK -33	33938	Pin - Lock	1	4AK -77	3398	Screw	5
4AK -34	1215	Screw	1				
4AK -35	98820	Plug	1				
4AK -36		Rod - Cross Feed Shifter					
	101520	No. 2 P. U. and V.	1				
	101519	No. 3 P. and U.	1				
	101522	Nos. 3 & 4 V.	1				
	101522	No. 4 P. and U.	1				

FRONT CROSS SHAFT



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

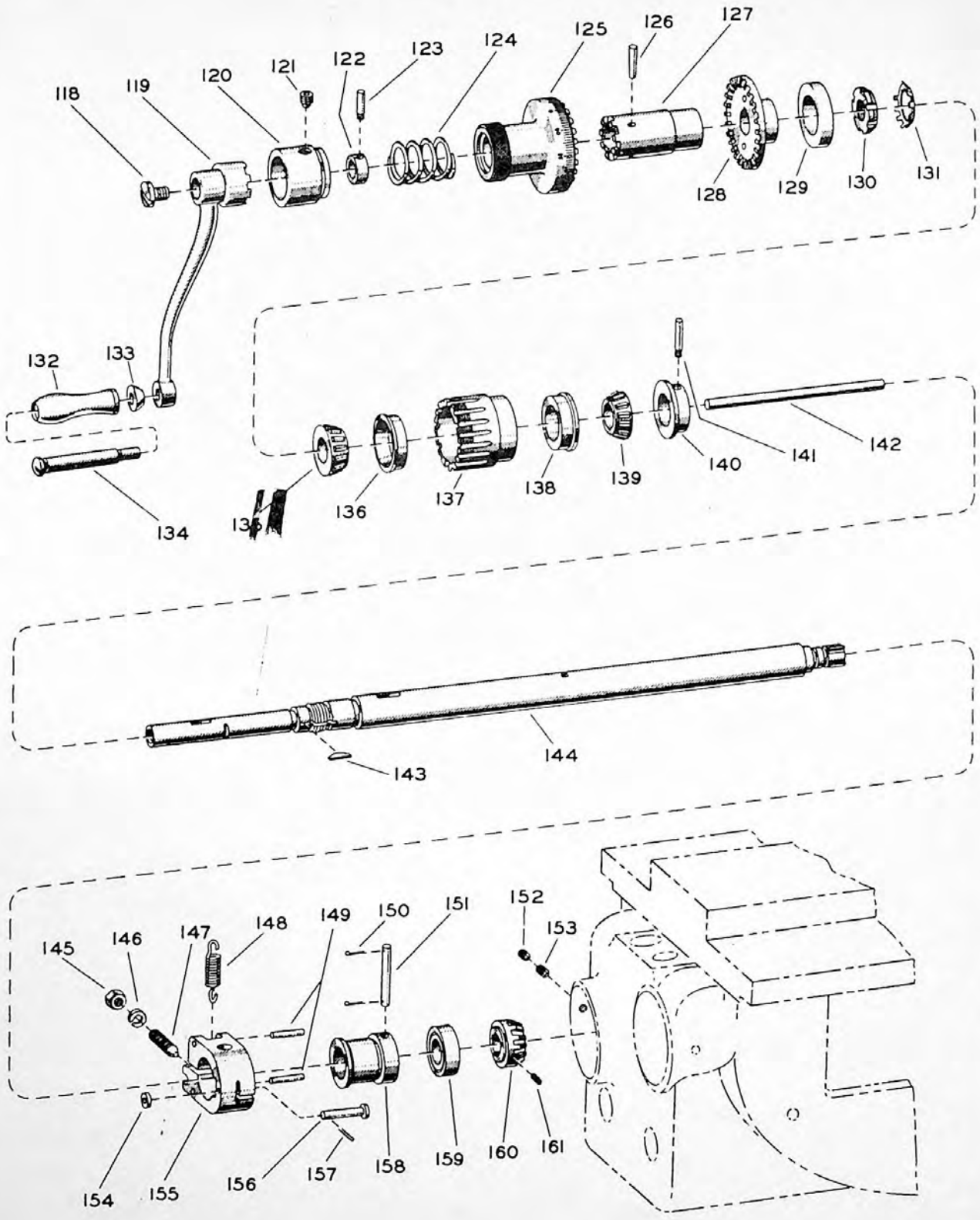
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KNEE-UNIT No. 4 AK (Continued)

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AK-78	3514	Screw	1	4AK-99	58871	Cone - Roller Bearing.	1
4AK-79	3511	Wheelhand 8"	1	4AK-100	58870	Cup - Roller Bearing	1
4AK-80	66244	Clutch - On Cross Feed Screw	1	4AK-101	73431	Spacer - Cross Screw Roller Bearing	1
4AK-81	109957	Bushing	1	4AK-102	66253	Pin	1
4AK-82	3232	Screw	1	4AK-103	66255	Collar - Flange	1
4AK-83	102083	Spring - Dial Front	1	4AK-104	66245	Collar - Dust Cross Feed Shaft	1
4AK-84	70434	Plug - Check.	1	4AK-105	3308	Washer	1
4AK-85	102168	Dial - Cross Feed	1	4AK-106		Pin - Stop	
4AK-86	66249	Collar - Small	1		69716	No. 2 P. and U.	1
4AK-87	66254	Pin	1		69715	No. 3 P. and U.	1
4AK-88	98788	Clutch - Cross Feed Shaft	1		69716	No. 4 U.	1
4AK-89	663	Pin - Taper	1	4AK-107	1174	Screw	1
4AK-90	98722	Clutch - Cross Feed	1	4AK-108		Pin - Stop Rear	
4AK-91	98721	Nut - Bearing Retainer	1		99072	No. 2 P.	1
4AK-92	3303	Washer - Felt	1		69715	Nos. 2 & 4 U.	1
4AK-93	3502	Handle	1		99242	Nos. 2 & 4 V.	1
4AK-94	58870	Cup - Roller Bearing	1		98784	No. 3 P. and V.	1
4AK-95	58871	Cone - Roller Bearing.	1		99242	No. 3 U.	1
4AK-96		Rod - Knockout Cross Feed			69717	No. 4 P.	1
	99073	No. 2 P. U. and V.	1	4AK-109	119351	Nut - Bracket Under Saddle.	1
	98787	Nos. 3 & 4 P. U. and V.	1	4AK-110	107046	Bracket - Nut Under Saddle.	1
4AK-97	3280	Key - Hy Pro	1	4AK-111	96951	Coupling - Cross Screw.	1
4AK-98		Screw - Cross		4AK-112	3308	Washer	1
	99096	No. 2 P. U. and V.	1	4AK-113	62721	Sleeve - Felt Retainer.	1
	98733	No. 3 P. and U.	1	4AK-114	3238	Screw	1
	99142	Nos. 3 & 4 V.	1	4AK-115	3238	Screw	1
	99142	No. 4 P. and U.	1	4AK-116	3239	Screw	1
				4AK-117	3228	Screw	1

FRONT ELEVATING SHAFT



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

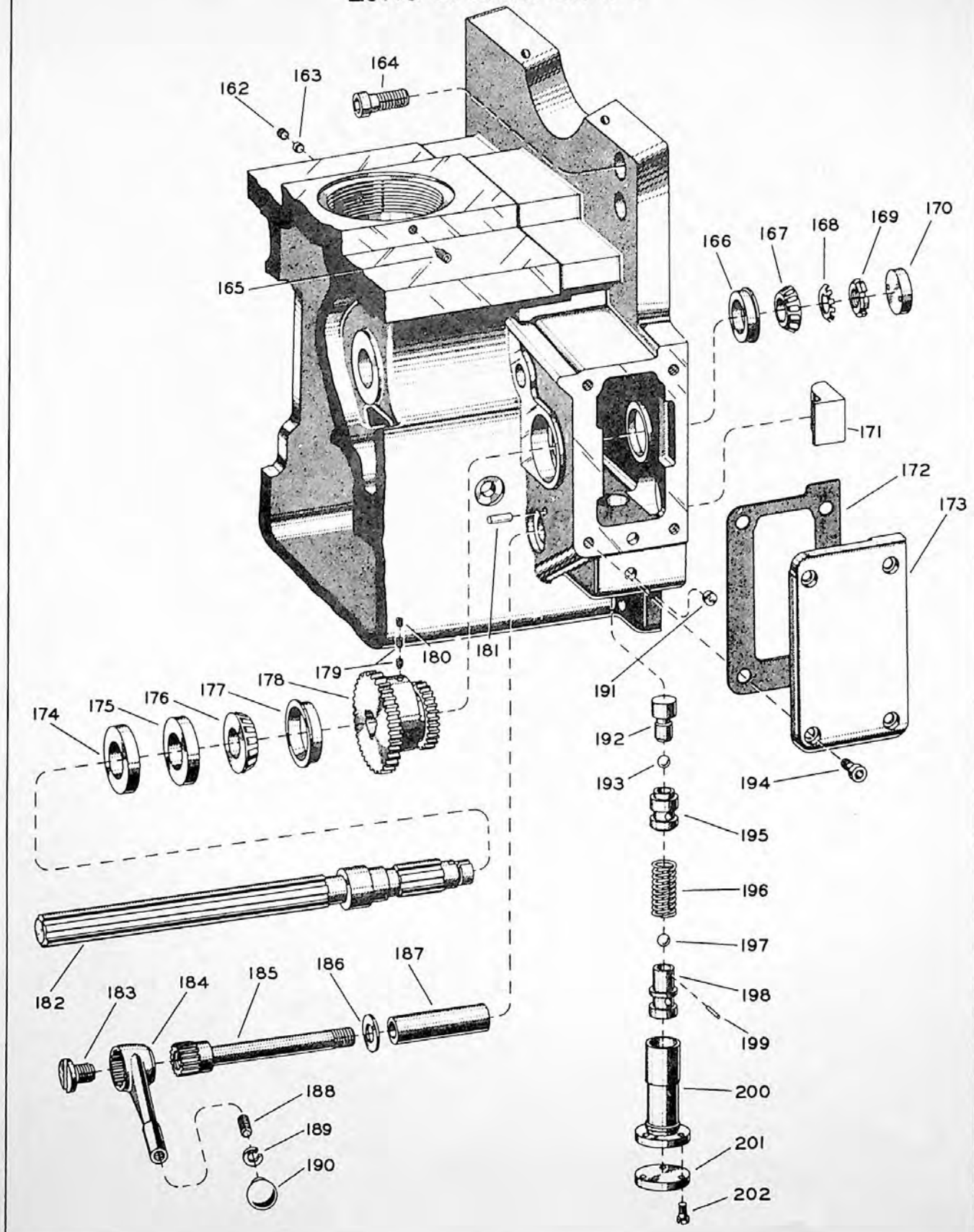
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

KNEE—UNIT No. 4 AK (Continued)

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AK-118	3514	Screw	1	4AK-143	3280	Key - Hy Pro	1
4AK-119	66262	Crank - Hand	1	4AK-144		Shaft - Elevating Front	
4AK-120	109957	Bushing	1		115523	No. 2 P. U. and V.	1
4AK-121	3232	Screw	1		115527	No. 3 P. and U.	1
4AK-122	66249	Collar - Small	1		115529	Nos. 3 & 4 V.	1
4AK-123	66254	Pin	1		115529	No. 4 P. and U.	1
4AK-124	102083	Spring - Dial Front	1	4AK-145	3479	Nut	1
4AK-125	102166	Dial - Vertical Feed	1	4AK-146	2038	Washer	1
4AK-126	663	Pin - Taper	1	4AK-147	115197	Screw	1
4AK-127	98704	Clutch - Elevating Shaft	1	4AK-148	72535	Spring	1
4AK-128	98794	Clutch - Vertical Feed	1	4AK-149	3277	Pin	2
4AK-129	225928	Seal - Oil	1	4AK-150	3329	Pin - Cotter	2
4AK-130	3810	Nut	1	4AK-151	115195	Pin	1
4AK-131	3809	Washer - Lock	1	4AK-152	3228	Screw	1
4AK-132	3505	Handle - Spool	1	4AK-153	3229	Screw	1
4AK-133	3504	Collar - Spool Handle	1	4AK-154	115196	Washer - On Pin In Brake	1
4AK-134	3503	Stud - For Spool	1	4AK-155	115199	Brake - On Elevating Shaft	1
4AK-135	75711	Cone - Roller Bearing	1	4AK-156	115194	Pin - In Brake	1
4AK-136	98776	Cup - Roller Bearing	1	4AK-157	3329	Pin - Cotter	1
4AK-137	98703	Nut - Bearing Adjusting	1	4AK-158	115198	Spool - Brake Elevating Shaft	1
4AK-138	98776	Cup - Roller Bearing	1	4AK-159	90981	Bearing - Ball	1
4AK-139	75711	Cone - Roller Bearing	1	4AK-160	98789	Gear - Bevel Elevating Shaft	1
4AK-140	66255	Collar - Flange	1	4AK-161	3232	Screw	1
4AK-141	66253	Pin	1				
4AK-142		Rod - Knockout Elev.					
	99074	No. 2 P. U. and V.	1				
	98706	No. 3 P. and U.	1				
	99138	Nos. 3 & 4 V.	1				
	99138	No. 4 P. and U.	1				

LONG SPLINE SHAFT



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

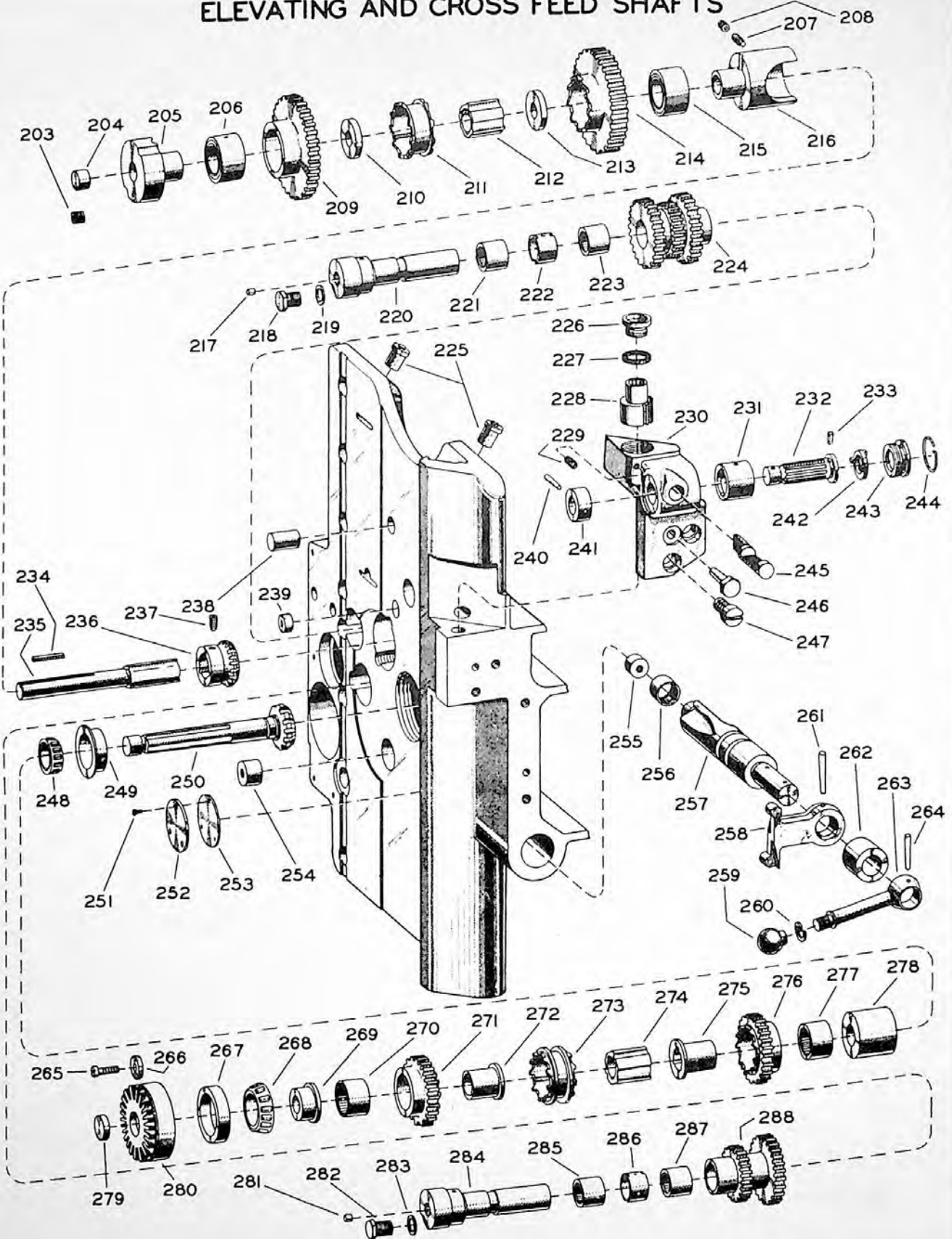
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

KNEE—UNIT No. 4 AK (Continued)

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME ¹	AMT. USED
4AK-162	1911	Screw	1	4AK-183	73643	Screw - Clamp Lever	1
4AK-163	2268	Plug	1	4AK-184	99931	Lever - Knee Clamping	1
4AK-164	3409	Screw	2	4AK-185	129506	Screw - Knee Clamp.	1
4AK-165	3229	Screw	1	4AK-186	764	Washer.	1
4AK-166	202877	Cup - Roller Bearing	1	4AK-187	68345	Sleeve - Clamp Screw.	1
4AK-167	212356	Cone - Roller Bearing.	1	4AK-188	3860	Screw	1
4AK-168	3805	Washer - Lock.	1	4AK-189	2135	Washer Lock	1
4AK-169	3806	Nut - Lock.	1	4AK-190	115032	Ball	1
4AK-170	129511	Cap - Over Spline Shaft.	1	4AK-191	3550	Plug	1
4AK-171		Clamp - Knee Guide		4AK-192	98114	Plug	1
	129508	No. 2 Machine.	1	4AK-193	20919	Ball	1
	129514	Nos. 3 & 4 Machines	1	4AK-194	3215	Screw	4
4AK-172	129143	Gasket - Cover Side of Knee	1	4AK-195	98113	Plunger - Oil Pump	1
4AK-173	129142	Cover - Side of Knee	1	4AK-196	52672	Spring	1
4AK-174	99902	Seal - Roller Bearing Oil	1	4AK-197	20919	Ball	1
4AK-175	99902	Seal - Roller Bearing Oil	1	4AK-198	53777	Valve - Oil Pump	1
4AK-176	93684	Cone - Roller Bearing.	1	4AK-199	53754	Stop - Oil Pump Ball	1
4AK-177	93686	Cup - Roller Bearing	1	4AK-200	53778	Sleeve - Oil Pump.	1
4AK-178	132517	Gear - Eccentric	1	4AK-201	53848	Cap - Oil Pump	1
4AK-179	3232	Screw	2	4AK-202	15	Screw	3
4AK-180	1911	Screw	1				
4AK-181	1383	Pin.	1				
4AK-182		Shaft - Long Spline					
	131489	No. 2 P. U. and V.	1				
	131489	No. 3 P. and U.	1				
	131490	No. 3 V.	1				
	131490	No. 4 P. U. and V.	1				

ELEVATING AND CROSS FEED SHAFTS



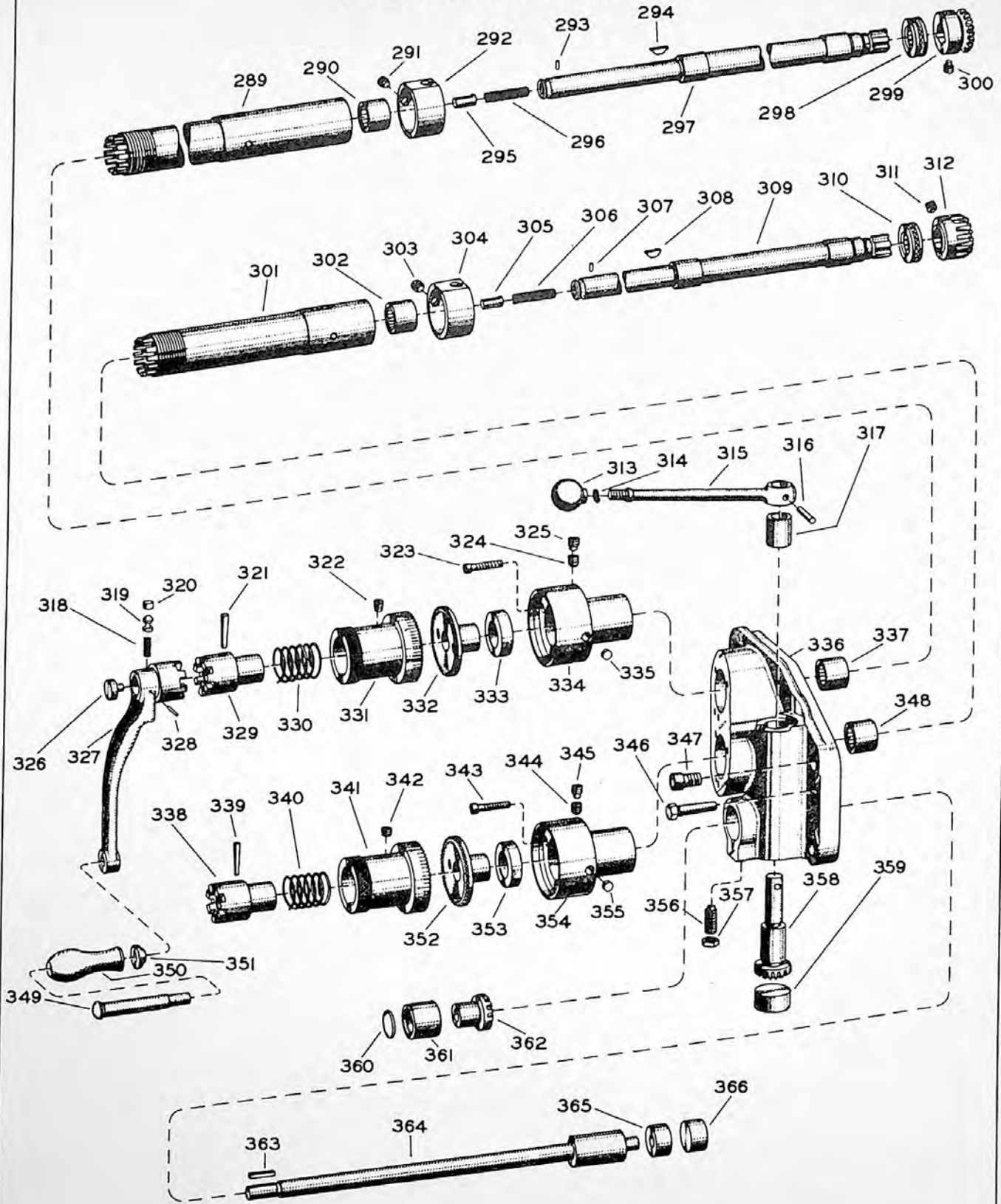
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

KNEE—UNIT No. 4 AK (Continued)
Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

K	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AK-203	1917	Screw	2	4AK-246	83432	Pin - Taper	1
4AK-204	3550	Plug	1	4AK-247	3482	Screw	2
4AK-205	98716	Bearing - Cross Feed Shaft	1	4AK-248	212905	Cone - Roller Bearing	1
4AK-206	98717	Bearing - Clutch	1	4AK-249	212429	Cup - Roller Bearing	1
4AK-207	3233	Screw	1	4AK-250	98735	Gear - Elevating Stem Bevel	1
4AK-208	1977	Screw	1	4AK-251	3462	Screw	3
4AK-209	132516	Gear - Clutch	1	4AK-252	99883	Cover - Vertical Feed Rod	1
4AK-210	98719	Collar - Thrust	1	4AK-253	99884	Gasket - Vertical Feed Rod Gasket	1
4AK-211	101040	Clutch - Cross	1	4AK-254	3827	Plug	1
4AK-212	62915	Sleeve - Cross and Elevating Clutch	1	4AK-255	98701	Plug - Bearing Remover	1
4AK-213	98719	Collar - Thrust	1	4AK-256	79762	Bearing - Needle	1
4AK-214	132516	Gear - Clutch	1	4AK-257		Shaft - Elevating Trip	
4AK-215	98717	Bearing - Clutch	1		98818	Without Rear Control Unit	1
4AK-216	98718	Bushing - Cross Feed Shaft	1		98819	With Rear Control Unit	1
4AK-217	1844	Plug	1	4AK-258	71784	Lever - Trip Cross Feed	1
4AK-218	2154	Screw	1	4AK-259	115032	Ball (With Rear Control Unit Only)	1
4AK-219	3442	Washer	1	4AK-260	2135	Washer (With Rear Control Unit Only)	1
4AK-220	98702	Shaft - Cross Feed	1	4AK-261	519	Pin - Taper	1
4AK-221	93421	Bearing - Needle	1	4AK-262	64328	Spacer - Elev. Trip Shaft	
4AK-222	96412	Spacer	1			(With Rear Control Only)	1
4AK-223	93421	Bearing - Needle	1	4AK-263	99905	Lever - Vertical Rear	
4AK-224	132512	Gear - Cross Feed Elevating	1			(With Rear Control Only)	1
4AK-225	891	Cup - Oil	2	4AK-264	642	Pin - Taper	
4AK-226	67099	Screw - Pinion R. C.	1			(With Rear Control Only)	1
4AK-227	66455	Ring - Felt Q. T.	1	4AK-265	3318	Screw	1
4AK-228	67098	Pinion - Vertical	1	4AK-266	3445	Washer - Lock Bearing Adjusting Nut	1
4AK-229	1201	Screw	1	4AK-267	69188	Cup - Roller Bearing	1
4AK-230	74134	Bracket - Feed and Speed Control	1	4AK-268	69189	Cone - Roller Bearing	1
4AK-231	67102	Sleeve - Coupling	1	4AK-269	69181	Sleeve - On Elevating Shaft	1
4AK-232	67101	Pinion - Horizontal	1	4AK-270	79763	Bearing - Needle	1
4AK-233	1406	Pin	1	4AK-271	132515	Gear - Clutch Elevating Shaft	1
4AK-234	1632	Key - Square	1	4AK-272	98720	Sleeve - Stem	1
4AK-235	65766	Shaft - Cross Feed	1	4AK-273	98714	Clutch - Elevating	1
4AK-236	67973	Gear - Cross Elevating Feed	1	4AK-274	62915	Sleeve - Cross and Elevating Clutch	1
4AK-237	3232	Screw	1	4AK-275	78720	Sleeve - Stem	1
4AK-238		Pin - Stop		4AK-276	132515	Gear - Clutch Elevating Shaft	1
	68999	Nos. 2, 3 & 4 P. U. - (Upper Hole)	1	4AK-277	79763	Bearing - Needle	1
	68999	Nos 2 V. - (Lower Hole)	1	4AK-278	98785	Spacer - Stem Bevel Gear	1
	101317	Nos. 3 & 4 V. - (Lower Hole)	1	4AK-279	88082	Plug	1
4AK-239		Plug		4AK-280	132510	Nut - Bearing Lock	1
	3549	Nos. 2, 3, & 4 P. U. - (Lower Hole)	1	4AK-281	1844	Plug	1
	3549	Nos. 2, 3, & 4 V. - (Upper Hole)	1	4AK-282	2154	Screw	1
4AK-240	642	Pin - Taper	1	4AK-283	3442	Washer	1
4AK-241	3982	Collar	1	4AK-284	98702	Shaft - Cross Feed	1
4AK-242	67108	Coupling - Shaft	1	4AK-285	93421	Bearing - Needle	1
4AK-243	67109	Plug	1	4AK-286	96412	Spacer	1
4AK-244	67620	Spring - Ring	1	4AK-287	93421	Bearing - Needle	1
4AK-245	67096	Rack - Rear Control	1	4AK-288	132513	Gear - Cluster Cross Feed	1

REAR CONTROL BRACKET



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

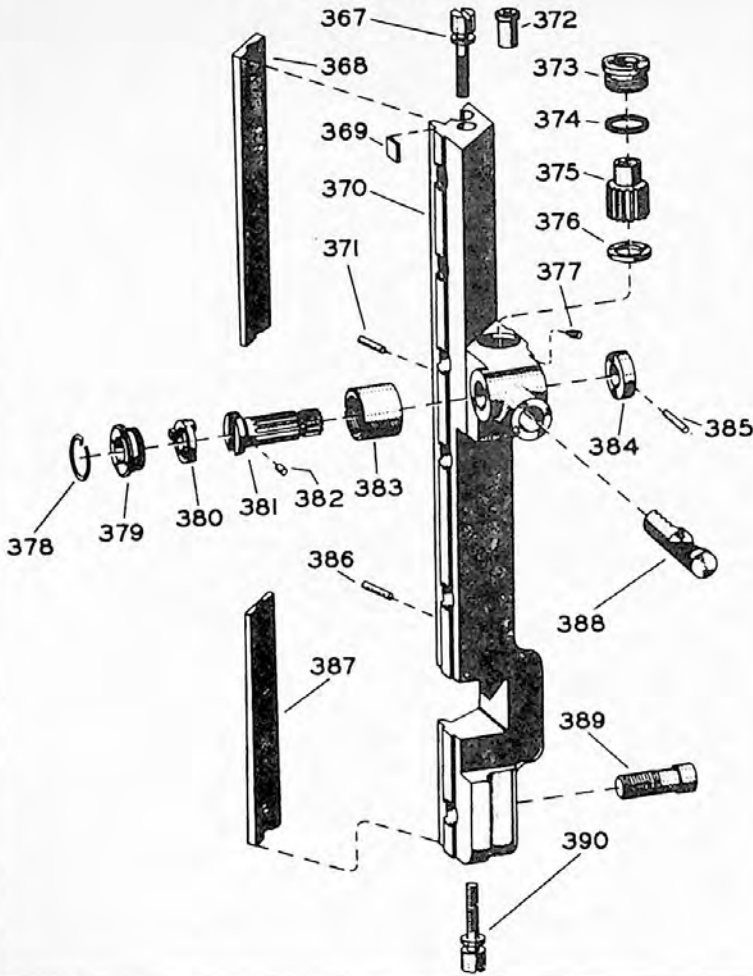
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

KNEE—UNIT No. 4 AK (Continued)

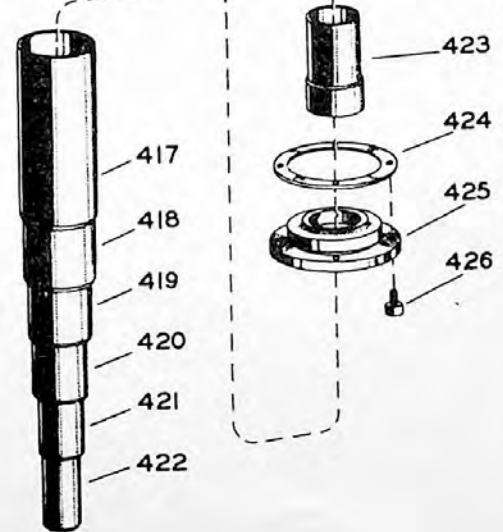
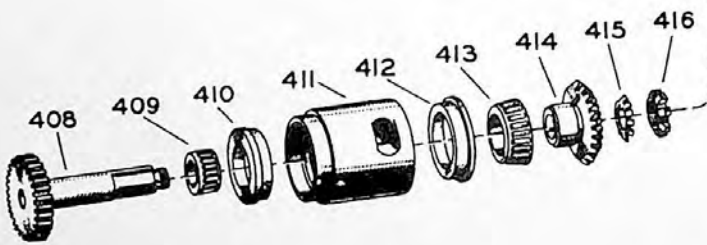
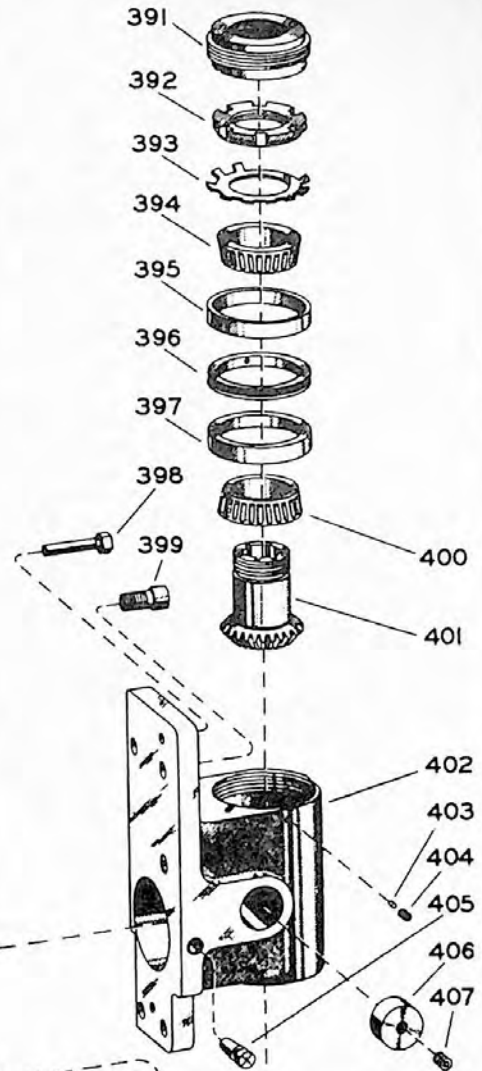
Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AK-289	98710	Sleeve - Cross Shaft	1	4AK-329	102016	Clutch - Cross Elevating	1
4AK-290	94618	Bearing - Needle	1	4AK-330	102084	Spring	1
4AK-291	3232	Screw	1	4AK-331	98705	Dial - Cross	1
4AK-292	99781	Collar - Oil Retainer	1	4AK-332	98697	Clutch - Dial Cross Feed	1
4AK-293	63067	Pin - Cross Elevating Shaft	1	4AK-333	99786	Seal - Oil	1
4AK-294	3280	Key	1	4AK-334	98696	Collar - Dial Rear Control	1
4AK-295	63079	Pin - Crank Handle	1	4AK-335	1962	Plug	1
4AK-296	102462	Spring	1	4AK-336	98713	Bracket - Rear	
4AK-297	98707	Shaft - Cross Rear Control	1		98712	Cover (Without Rear Control Replaces Bracket)	1
4AK-298	3842	Bearing - Ball	1	4AK-337	94618	Bearing - Needle	1
4AK-299	67973	Gear - Cross Elevating Feed	1	4AK-338	102016	Clutch - Cross Elevating	1
4AK-300	3232	Screw	1	4AK-339	642	Pin Taper	1
4AK-301	98709	Sleeve - Elevating	1	4AK-340	102084	Spring	1
4AK-302	94618	Bearing - Needle	1	4AK-341	98731	Dial - Elevating	1
4AK-303	3232	Screw	1	4AK-342	224107	Plug - Pipe	1
4AK-304	99781	Collar - Oil Retainer	1	4AK-343	3217	Screw	3
4AK-305	63079	Pin - Crank Handle	1	4AK-344	1911	Screw	1
4AK-306	102462	Spring	1	4AK-345	3232	Screw	1
4AK-307	63067	Pin - Cross Elevating Feed	1	4AK-346	83432	Pin - Headstock Locating	2
4AK-308	3280	Key	1	4AK-347	3343	Screw	4
4AK-309	98708	Shaft - Elevating	1	4AK-348	94618	Bearing - Needle	1
4AK-310	3842	Bearing - Ball	1	4AK-349	3503	Stud	1
4AK-311	3232	Screw	1	4AK-350	3505	Handle - Spool	1
4AK-312	98789	Gear - Bevel Elevating Shaft	1	4AK-351	3504	Collar - Spool	1
4AK-313	115032	Ball	1	4AK-352	98699	Clutch - Dial Elevating	1
4AK-314	2135	Washer - Lock	1	4AK-353	99786	Seal - Oil	1
4AK-315	99906	Lever - Cross Feed	1	4AK-354	98696	Collar - Dial Rear Control	1
4AK-316	642	Pin - Taper	1	4AK-355	1962	Plug	1
4AK-317	3564	Bushing	1	4AK-356	3235	Screw	1
4AK-318	1349	Spring	1	4AK-357	3473	Nut	1
4AK-319	63068	Plunger - In Crank	1	4AK-358	74332	Gear - Mitre Rear Cross	1
4AK-320	63070	Plug	1	4AK-359	3553	Plug	1
4AK-321	642	Pin - Taper	1	4AK-360	69448	Plug - Expansion	1
4AK-322	224107	Plug - Pipe	1	4AK-361	77693	Bushing - Mitre Gear	1
4AK-323	3217	Screw	3	4AK-362	69574	Gear - Mitre Rear Cross Shaft	1
4AK-324	1911	Screw	1	4AK-363	345	Key	1
4AK-325	3232	Screw	1	4AK-364	69575	Shaft - Cross Feed Hand Control	1
4AK-326	63074	Plug	1	4AK-365	68364	Bushing	1
4AK-327	63065	Crank - Handle	1	4AK-366	3827	Plug	1
4AK-328	2293	Pin	1				

GUIDE AND GIBS



POWER TRANSFER BRACKET



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

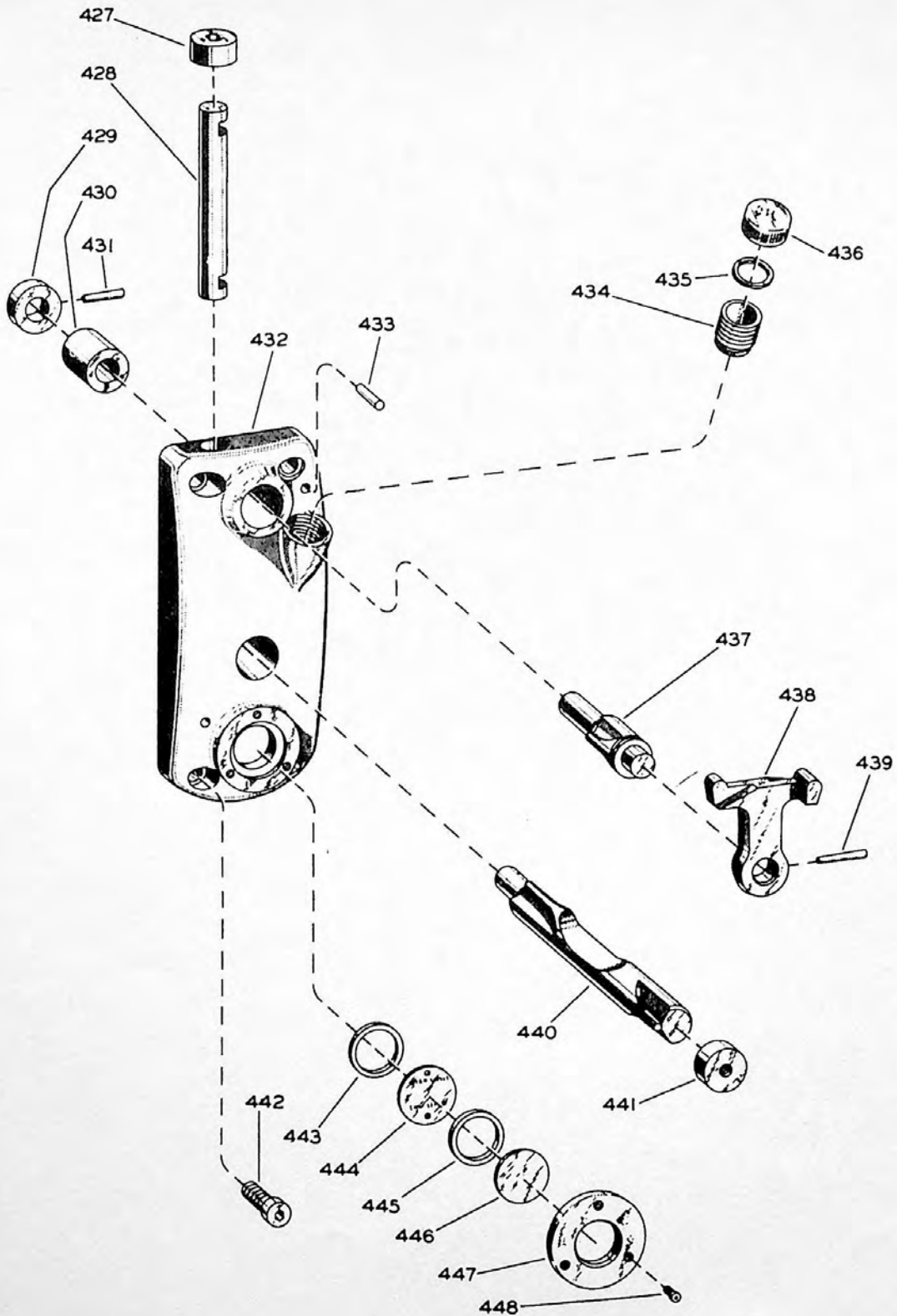
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KNEE-UNIT No. 4 AK (Continued)

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AK-367	63606	Screw - Gib	1	4AK-395	93675	Cup - Roller Bearing	1
4AK-368		Gib - Top		4AK-396	93672	Spacer - Roller Bearing	1
	137296	No. 2 Machine.	1	4AK-397	93675	Cup - Roller Bearing	1
	137295	Nos. 3 & 4 Machines	1	4AK-398	83432	Pin - Taper	1
4AK-369	66972	Gasket - Guide on Knee	1	4AK-399	3403	Screw	1
4AK-370		Guide - Knee		4AK-400	93673	Cone - Roller Bearing.	1
	129507	No. 2 Machine.	1	4AK-401	129141	Gear - Bevel Sleeve.	1
	129509	Nos. 3 & 4 Machines	1	4AK-402	129510	Bracket - Drive to Knee	1
4AK-371	1966	Pin.	1	4AK-403	1550	Plug	1
4AK-372	891	Cup - Oil.	1	4AK-404	217781	Screw	1
4AK-373	67099	Screw - Pinion Rear Control	1	4AK-405	3493	Pin.	1
4AK-374	66455	Ring - Felt.	1	4AK-406	3553	Plug	1
4AK-375	67098	Pinion - Vertical	1	4AK-407	1911	Screw	1
4AK-376	67100	Washer - Thrust	1	4AK-408	129065	Pinion - Knee Guide	1
4AK-377	3229	Screw	1	4AK-409	90367	Cone - Roller Bearing.	1
4AK-378	67620	Spring	1	4AK-410	108004	Cup - Roller Bearing	1
4AK-379	67109	Plug	1	4AK-411	129064	Sleeve - Knee Guide Gear	1
4AK-380	67108	Coupling - Shaft	1	4AK-412	108271	Cup - Roller Bearing	1
4AK-381	67101	Pinion - Horizontal	1	4AK-413	69189	Cone - Roller Bearing.	1
4AK-382	1406	Pin.	1	4AK-414	129201	Gear - Bevel Splined	1
4AK-383	67102	Sleeve - Coupling	1	4AK-415	3805	Washer - Lock.	1
4AK-384	3982	Collar	1	4AK-416	93682	Nut - Lock.	1
4AK-385	642	Pin - Taper	1	4AK-417		Tube - Telescopic 6th	
4AK-386	1966	Pin.	1		129456	No. 2 Machine.	1
4AK-387		Gib - Bottom			129454	Nos. 3 & 4 Machines	1
	69532	No. 2 Machine.	1	4AK-418	129240	Tube - Telescopic	1
	69178	Nos. 3 & 4 Machines	1	4AK-419	129239	Tube - Telescopic	1
4AK-388	67096	Rack - Rear Control.	1	4AK-420	129459	Tube - Telescopic 3rd	1
4AK-389	3283	Screw	4	4AK-421	129458	Tube - Telescopic 2nd	1
4AK-390	63606	Screw - Gib	1	4AK-422	129455	Tube	1
4AK-391	93669	Nut - Tube Holder Top	1	4AK-423	129222	Guard - Tubing	1
4AK-392	3813	Nut - Lock.	1	4AK-424	93670	Gasket - Nut.	1
4AK-393	3643	Washer - Lock.	1	4AK-425	129221	Nut - Tube Holder Bottom	1
4AK-394	93673	Cone - Roller Bearing.	1	4AK-426	1145	Screw	4

CROSS FEED TRIP BRACKET



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

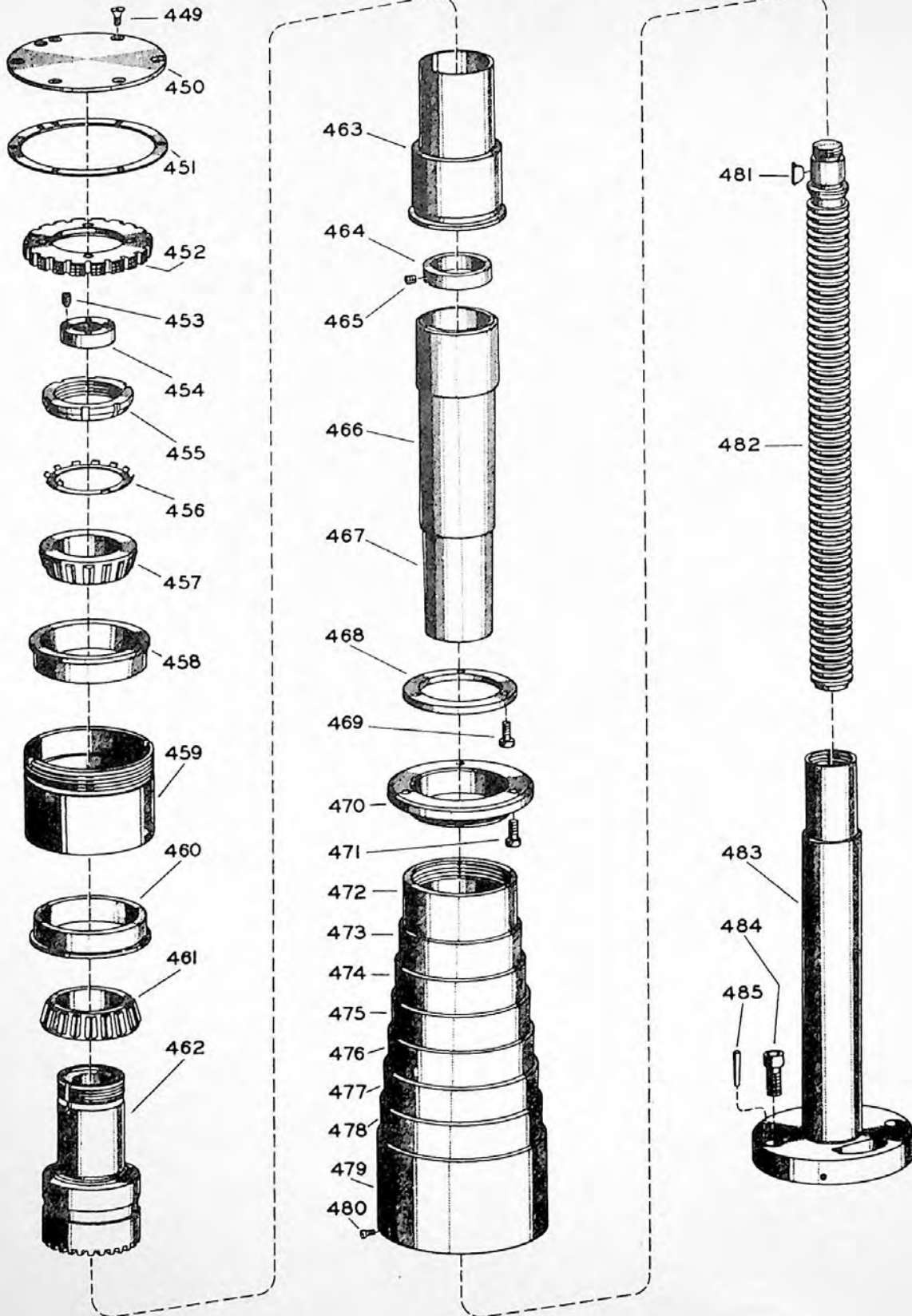
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KNEE-UNIT No. 4 AK (Continued)

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AK-427	3549	Plug	1	4AK-438	71784	Lever - Trip Cross Feed	1
4AK-428	63291	Rod - Bracket Trip	1	4AK-439	519	Pin	1
4AK-429	3982	Collar	1	4AK-440	67344	Shaft - Cross Feed Trip	1
4AK-430	67336	Bushing	1	4AK-441	3827	Plug	1
4AK-431	642	Pin - Taper	1	4AK-442	3243	Screw	4
4AK-432	67345	Bracket - Trip Cross Feed	1	4AK-443	3850	Gasket	1
4AK-433	482	Pin	2	4AK-444	60956	Dial - On Gage	1
4AK-434	3912	Nipple	1	4AK-445	4086	Gasket - Oil Gage	1
4AK-435	77845	Gasket	1	4AK-446	3849	Disc - Oil Gage	1
4AK-436	3986	Cap - Oil Filler	1	4AK-447	3848	Cover	1
4AK-437	67335	Shaft - Cross Feed Trip Lever	1	4AK-448	3213	Screw	3

ELEVATING SCREW



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

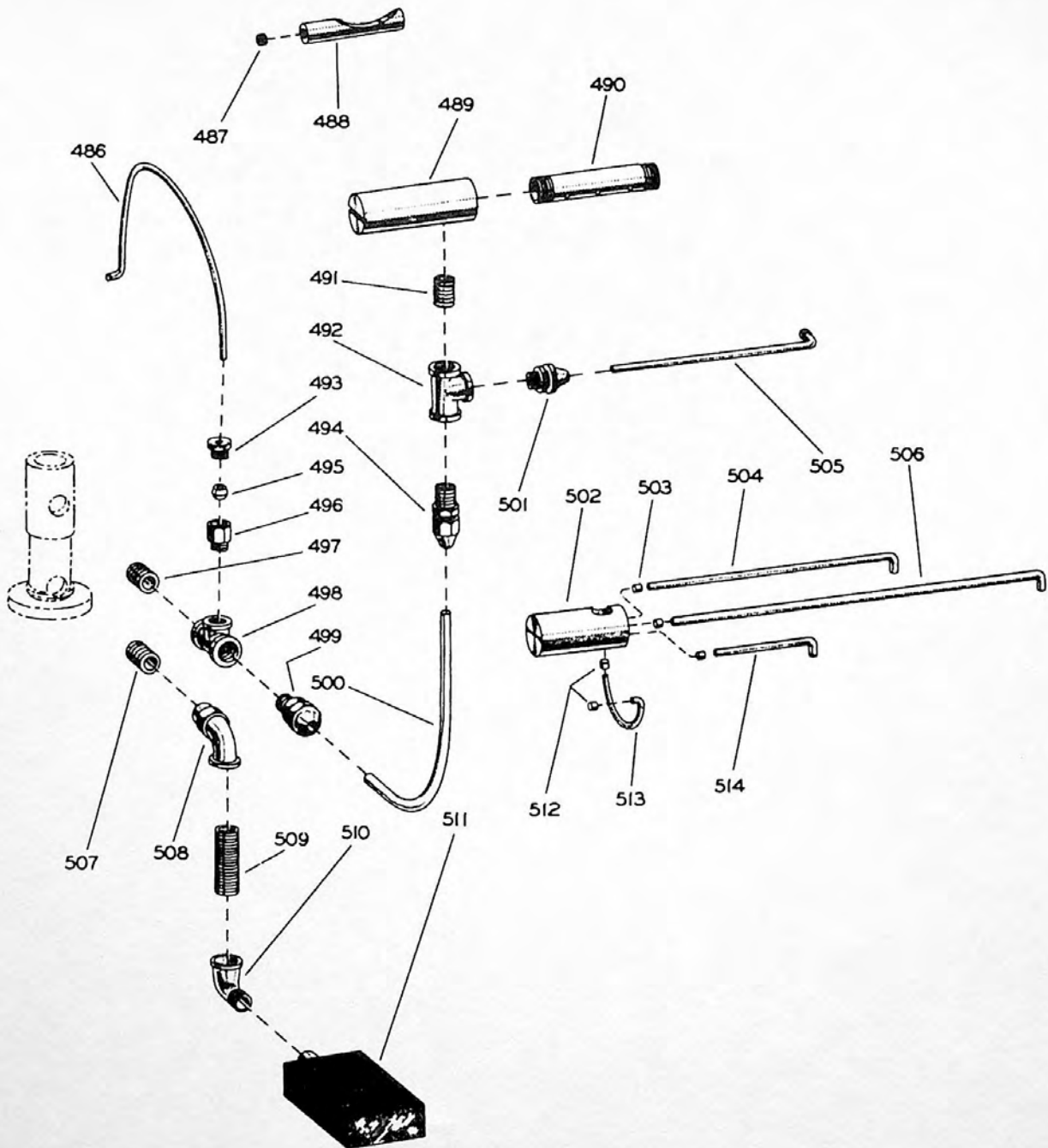
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KNEE—UNIT No. 4 AK (Continued)

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AK-449	3482	Screw	7	4AK-470	129144	Flange - Lower Tube	1
4AK-450	73378	Cover - Vertical Shaft	1	4AK-471	3218	Screw	3
4AK-451	86468	Gasket - Vertical Screw Cover	1	4AK-472		Sleeve - Telescopic Tube	
4AK-452	63187	Nut - Roller Bearing Adjusting	1		134551	No. 2 P.	1
4AC-453	3229	Screw	2		129083	No. 2 U. & V.	1
4AK-454	63185	Nut - On Elevating Screw	1		129081	Nos. 3 & 4 P.	1
4AK-455	3798	Nut - Lock	1		129080	Nos. 3 & 4 U. & V.	1
4AK-456	3797	Washer - Lock	1	4AK-473		Tube - Telescopic 1st	
4AK-457	63168	Cone - Roller Bearing	1		129079	No. 2 P. U. V.	1
4AK-458	63169	Cup - Roller Bearing	1		129208	Nos. 3 & 4 P. U. V.	1
4AK-459	63187	Retainer - Roller Bearing	1	4AK-474	129078	Tube - Telescopic 2nd.	1
4AK-460	63169	Cup - Roller Bearing	1	4AK-475	129077	Tube - Telescopic 3rd.	1
4AK-461	63168	Cone - Roller Bearing	1	4AK-476	129076	Tube - Telescopic 4th.	1
4AK-462	98816	Gear - Bevel Vertical Screw	1	4AK-477	129075	Tube - Telescopic 5th.	1
4AK-463	129087	Sleeve - Oil Retainer	1	4AK-478	129074	Tube - Telescopic 6th.	1
4AK-464	129205	Collar - Elevating Nut	1	4AK-479	129084	Tube - Telescopic 7th.	1
4AK-465	2398	Screw	1	4AK-480	70198	Screw	2
4AK-466		Tube - Upper		4AK-481	3281	Key	1
	134552	No. 2 P.	1	4AC-482		Screw - Elevating	
	129086	No. 2 U. & V.	1		144789	No. 2 P. U. V.	1
	129088	Nos. 3 & 4 P. U. V.	1		144792	Nos. 3 & 4 P.	1
4AK-467		Tube - Upper Inter			144789	Nos. 3 & 4 U. & V.	1
	134553	No. 2 P.	1	4AC-483		Nut - Elevating	
	129159	No. 2 U. & V.	1		144924	No. 2 P. U. V.	1
	131719	Nos. 3 & 4 P.	1		144927	Nos. 3 & 4 P. U. V.	1
	129085	Nos. 3 & 4 U. & V.	1	4AC-484	3343	Screw	2
4AK-468	129073	Plate - Upper Tube Retainer	1	4AC-485	642	Pin - Taper	1
4AK-469	3218	Screw	3				

OIL SYSTEM



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

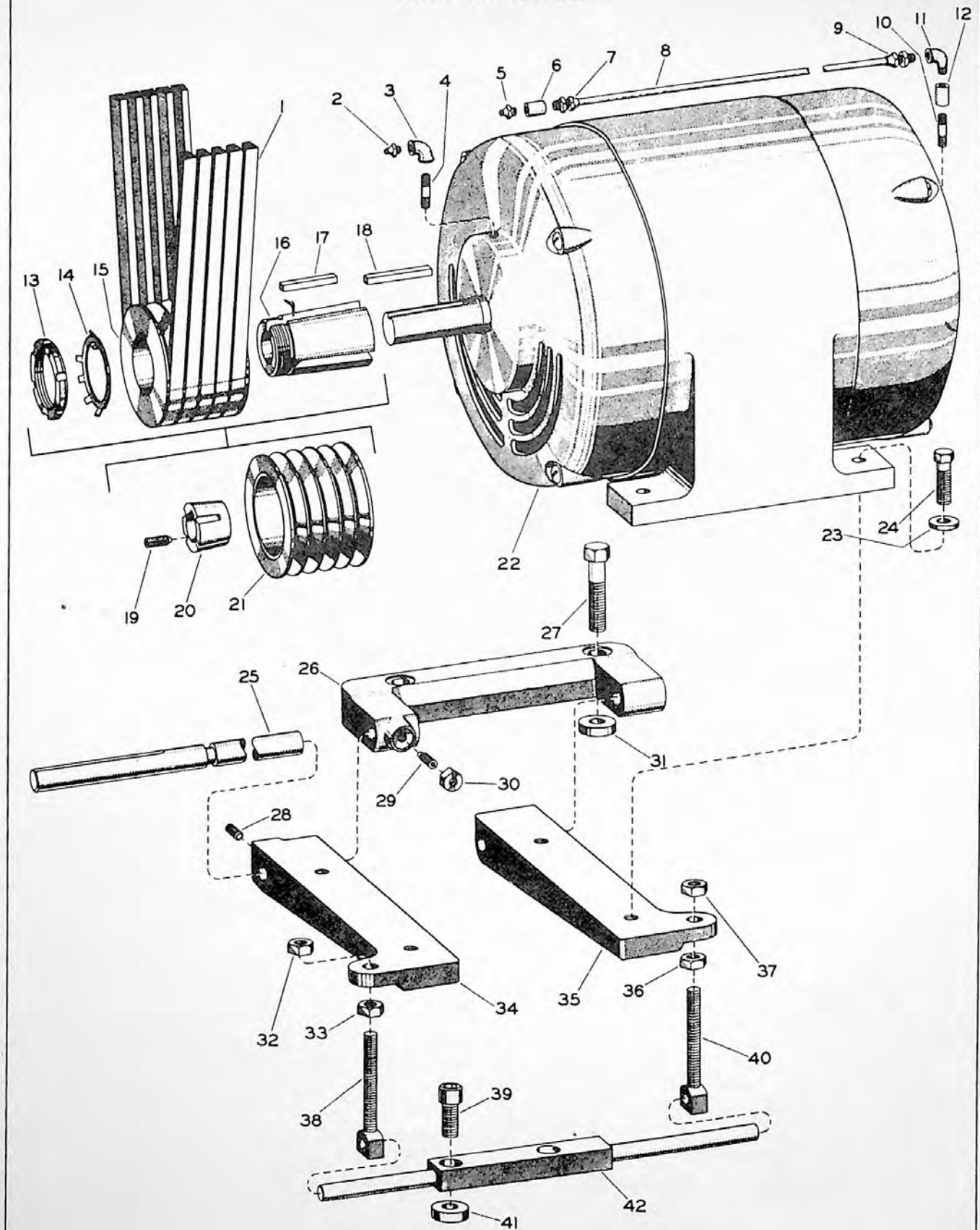
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11. "How to Order Repair Parts."

KNEE-UNIT No. 4 AK (Concluded)

Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AK-486		Tubing - Oil		4AK-505		Tubing Oil	
	130305	No. 2 P. U. and V. 3/16" x 16"	1		130305	No. 2 P. U. and V. 1/4" x 13"	1
	130306	No. 3 P. and U. 3/16" x 16"	1		130306	No. 3 P. and U. 1/4" x 13"	1
	130307	No. 3 V. 3/16" x 16"	1		130307	No. 3 V. 1/4" x 13"	1
	130307	No. 4 P. U. and V. 3/16" x 16"	1		130307	No. 4 P. U. and V. 1/4" x 13"	1
4AK-487	3306	Plug - Felt.	1	4AK-506		Tubing - Oil	
4AK-488	75465	Plug - Oil Slotted	1		130305	No. 2 P. U. and V. 1/4" x 29-1/2"	1
4AK-489	69494	Plug	1		130306	No. 3 P. and U. 1/4" x 33-1/4"	1
4AK-490	69493	Pipe - Oil Spray	1		130307	No. 3 V. 1/4" x 37-3/4"	1
4AK-491	10048	Nipple	1		130307	No. 4 P. U. and V. 1/4" x 37-3/4"	1
4AK-492	222224	Tee.	1	4AK-507	10048	Nipple	1
4AK-493	60721	Nut	1	4AK-508	61678	Elbow - Union	1
4AK-494	57287	Fitting - Compression.	1	4AK-509		Nipple	
4AK-495	60720	Sleeve	1		10048	No. 2 P. U. and V.	1
4AK-496	60719	Adapter	1		202240	Nos. 3 & 4 P. U. and V.	1
4AK-497	10048	Nipple	1	4AK-510	12838	Elbow - Street.	1
4AK-498	222224	Tee.	1	4AK-511	65540	Strainer	1
4AK-499	57287	Fitting - Compression.	1	4AK-512	2190	Bushing	2
4AK-500		Tubing - Oil		4AK-513		Tubing - Oil	
	130305	No. 2 P. U. and V. 3/8" x 11-3/4"	1		130505	No. 2 P. U. and V. 1/4" x 5"	1
	130306	No. 3 P. and U. 3/8" x 11-3/4"	1		130506	No. 3 P. and U. 1/4" x 5"	1
	130307	No. 3 V 3/8" x 11-3/4"	1		130507	No. 3 V. 1/4" x 5"	1
	130307	No. 4 P. U. and V. 3/8" x 11-3/4"	1		130507	No. 4 P. U. and V. 1/4" x 5"	1
4AK-501	89866	Fitting - Compression Coupling.	1	4AK-514		Tubing - Oil	
4AK-502	63072	Plug - Oil	1		130505	No. 2 P. U. and V. 1/4" x 7"	1
4AK-503	2190	Bushing	3		130506	No. 3 P. and U. 1/4" x 7"	1
4AK-504		Tubing - Oil			130507	No. 3 V. 1/4" x 7"	1
	130305	No. 2 P. U. and V. 1/4" x 21"	1		130507	No. 4 P. U. and V. 1/4" x 7"	1
	130306	No. 3 P. and U. 1/4" x 23"	1				
	130307	No. 3 V 1/4" x 25"	1				
	130307	No. 4 P. U. and V. 1/4" x 25"	1				

MOTOR DRIVE



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

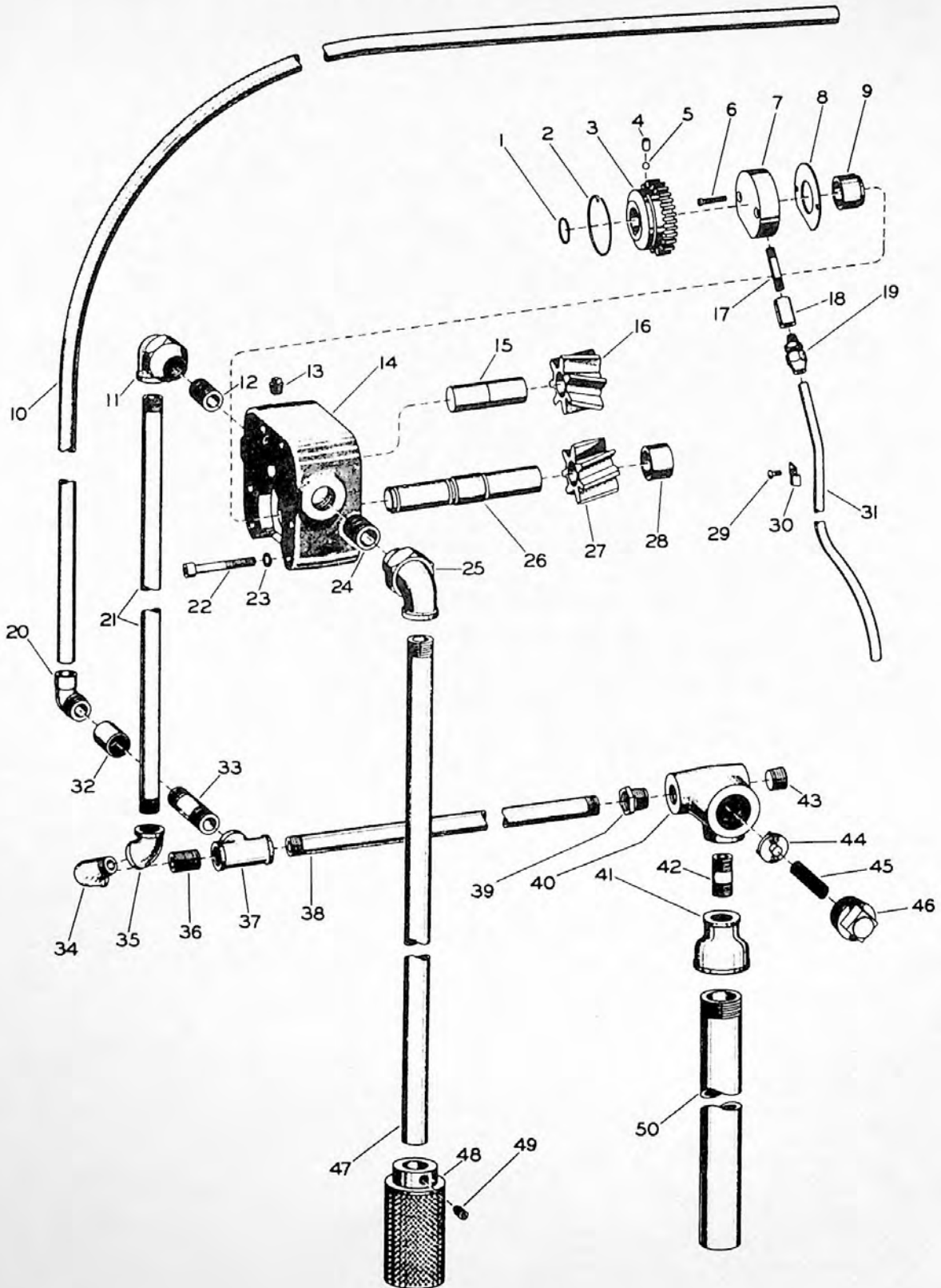
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

MOTOR DRIVE—UNIT No. 4 AN Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AN-1	Example	* Belt "V"		4AN-25		Shaft - Motor Rail	
4AN-2	Example	* Fitting - Alemite			99397	No. 2 Machine	1
4AN-3	Example	* Elbow			99168	Nos. 3 & 4 Machines	1
4AN-4	Example	* Nipple		4AN-26		Bracket - Motor Rail	
4AN-5	Example	* Fitting - Alemite			99398	No. 2 Machine	1
4AN-6	Example	* Coupling			99169	Nos. 3 & 4 Machines	1
4AN-7	Example	* Fitting - Compression Coupling.		4AN-27	3426	Screw	2
4AN-8	Example	* Tubing - Oil		4AN-28	3247	Screw	1
4AN-9	Example	* Fitting - Compression Coupling.		4AN-29	1641	Screw	1
4AN-10	Example	* Nipple		4AN-30	3474	Nut	1
4AN-11	Example	* Elbow		4AN-31	67328	Washer	2
4AN-12	Example	* Coupling		4AN-32	3475	Nut	1
4AN-13	Example	* Nut - Lock	1	4AN-33	3475	Nut	1
4AN-14	Example	* Washer - Lock	1	4AN-34		Rail - Front	
4AN-15	Example	* Sheave - Driver	1		70496	No. 2 Machine	1
4AN-16	Example	* Sleeve - Motor.	1		73550	Nos. 3 & 4 Machines	1
4AN-17	Example	* Key.	1	4AN-35		Rail - Back	
4AN-18	Example	Key (Supplied by motor manufacturer)	1		70497	No. 2 Machine	1
4AN-19	Example	Screw - Expansion (Supplied with sleeve)	2		73551	Nos. 3 & 4 Machines	1
4AN-20	Example	* Sleeve - Taper Lock	1	4AN-36	3475	Nut	1
4AN-21	Example	* Sheave - Taper Lock	1	4AN-37	3475	Nut	1
4AN-22	Example	* Motor - Main Drive 1500/1800 R. P. M. Specify H. P., Frame Size, Voltage & Cycle	1	4AN-38	73564	Bolt - Eye	1
4AN-23		Washer		4AN-39		Screw	
	3442	No. 2 Machine	4		3409	No. 2 Machine	1
	1040	Nos. 3 & 4 Machines	4	4AN-40	73564	Nos. 3 & 4 Machines	2
4AN-24		Screw		4AN-41	67328	Bolt - Eye	1
	3463	No. 2 Machine	4	4AN-42		Washer	1
	111	Nos. 3 & 4 Machines	4		99399	Bracket - Eye Bolt	
					99170	No. 2 Machine	1
						Nos. 3 & 4 Machines	1

* State Serial Number of Machine When Ordering Parts by Name

COOLANT PUMP AND PIPING



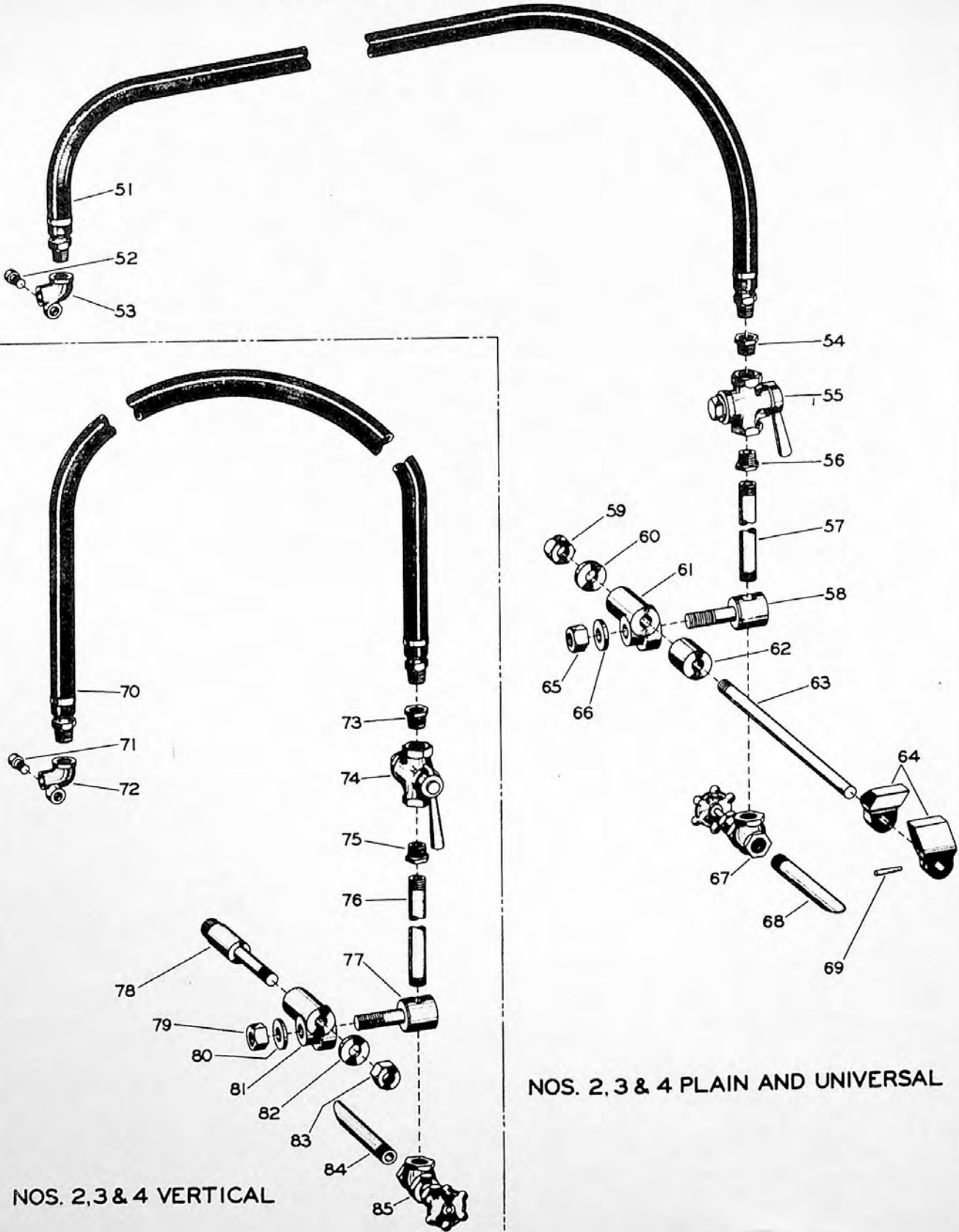
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

COOLANT PUMP AND PIPING—UNIT No. 4 AP
Nos. 2, 3, AND 4 PLAIN, UNIVERSAL AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AP -1	45300	Spring - Drive Shaft Retainer	1	4AP -30	4002	Clamp - Tube	1
4AP -2	68523	Ring - Wire	1	4AP -31		Tubing - Oil	
4AP -3		Gear - Pump Driven			133112	Plain and Universal	1
	96985	Plain and Universal	1		71803	Vertical	1
	129471	Vertical	1	4AP -32	4066	Coupling - Pipe	1
4AP -4	68522	Pin - Detent	1	4AP -33		Pipe	
4AP -5	13665	Ball	1		129216	1/2 x 3-3/4 No. 2 Plain and Universal	1
4AP -6	3205	Screw	1		129492	1/2 x 3-3/8 No. 2 Vertical	1
4AP -7	106615	Cover - Pump Shaft	1		129218	1/2 x 3-1/8 Nos. 3 & 4 Plain and Universal	1
4AP -8	71787	Gasket	1		129500	1/2 x 3-1/2 Nos. 3 & 4 Vertical	1
4AP -9	107353	Bushing	1	4AP -34	38853	Elbow - Street	1
4AP -10		Tubing - Oil		4AP -35	66086	Elbow - 1/2 x 45°	1
	129217	No. 2 Plain and Universal	1	4AP -36	203424	Nipple - 1/2	1
	129497	No. 2 Vertical	1	4AP -37	129215	Tee - Service 1/2	1
	129219	Nos. 3 & 4 Plain and Universal	1	4AP -38		Pipe	
	129499	Nos. 3 & 4 Vertical	1		129216	1/2 x 14-1/8 No. 2 Plain and Universal	1
4AP -11	50935	Union - 1/2 Elbow	1		129492	1/2 x 14 No. 2 Vertical	1
4AP -12	24799	Nipple	1		129218	1/2 x 20-7/16 Nos. 3 & 4 Plain and Universal	1
4AP -13	1073	Plug	1		129500	1/2 x 21-1/2 Nos. 3 & 4 Vertical	1
4AP -14	71791	Body Pump	1	4AP -39	89138	Bushing - Reducing	1
4AP -15	106617	Stud - Pump Driven Gr.	1	4AP -40	67837	Body - Relief Valve	1
4AP -16	75218	Gear - Pump R. H. Helical	1	4AP -41	68427	Coupling - Red.	1
4AP -17	202240	Pipe	1	4AP -42	24815	Nipple	1
4AP -18	4064	Coupling - Pipe	1	4AP -43	57726	Plug - Pipe	1
4AP -19	57287	Fitting - Comp. Coupling	1	4AP -44	30712	Valve - Relief	1
4AP -20	79731	Fitting - Comp. Elbow	1	4AP -45	30731	Spring	1
4AP -21		Pipe		4AP -46	30717	Plug - Body	1
	129216	1/2 x 18 No. 2 Plain and Universal	1	4AP -47		Pipe	
	129492	1/2 x 20 No. 2 Vertical	1		129216	3/4 x 39-1/2 No. 2 Plain and Universal	1
	129218	1/2 x 14-3/4 Nos. 3 & 4 Plain and Universal	1		129492	3/4 x 41-1/2 No. 2 Vertical	1
	129500	1/2 x 16-3/4 Nos. 3 & 4 Vertical	1		129218	3/4 x 40-1/2 Nos. 3 & 4 Plain and Universal	1
4AP -22	3346	Screw	6		129500	3/4 x 45-1/2 Nos. 3 & 4 Vertical	1
4AP -23	2135	Washer	6	4AP -48	69577	Strainer	1
4AP -24	24815	Nipple	1	4AP -49	1911	Screw	1
4AP -25	29475	Union - 3/4 Elbow	1	4AP -50		Pipe	
4AP -26	107354	Shaft - Pump Drive	1		129216	1-1/4 x 17 No. 2 Plain and Universal	1
4AP -27	75219	Gear - Pump L. H. Helical	1		129492	1-1/4 x 17 No. 2 Vertical	1
4AP -28	106614	Bushing	1		129218	1-1/4 x 19-1/2 Nos. 3 & 4 Plain and Universal	1
4AP -29	3460	Screw	1		129500	1-1/4 x 19-1/2 Nos. 3 & 4 Vertical	1

COOLANT PUMP AND PIPING



NOS. 2, 3 & 4 VERTICAL

NOS. 2, 3 & 4 PLAIN AND UNIVERSAL

CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

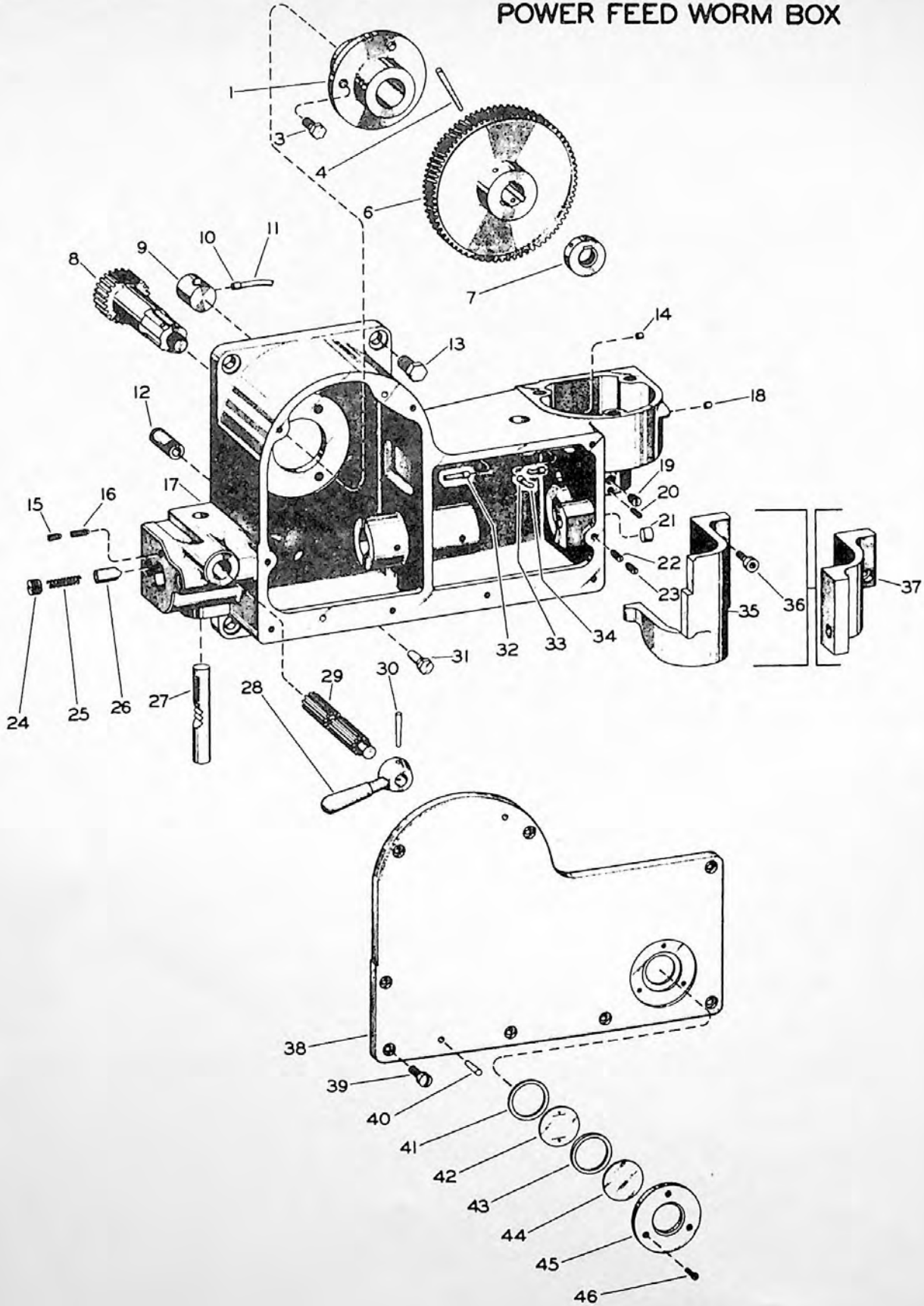
COOLANT PUMP AND PIPING—UNIT No. 4 AP (Continued)
PLAIN AND UNIVERSAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AP -51	133121	Hose - Coolant.	1	4AP -62	108188	Spacer - Clamp Stud.	1
4AP -52	3399	Screw	1	4AP -63		Stud - Overarm Clamp	
4AP -53	104578	Elbow - 90°	1		108187	No. 2 Plain and Universal	1
4AP -54	213032	Bushing - Reducing	1		129220	Nos. 3 & 4 Plain and Universal.	1
4AP -55	103779	Valve.	1	4AP -64	100083	Clamp - Overarm	1
4AP -56	213032	Bushing - Reducing	1	4AP -65	3480	Nut.	1
4AP -57	100454	Pipe	1	4AP -66	1040	Washer	1
4AP -58	100622	Holder - Supply Pipe	1	4AP -67	100450	Valve - 3/8 Angle.	1
4AP -59	3480	Nut.	1	4AP -68	100455	Nozzle	1
4AP -60	1040	Washer	1	4AP -69	663	Pin - Taper	1
4AP -61	100620	Clamp - Supply Pipe Holder	1				

COOLANT PUMP AND PIPING—UNIT No. 4 AP (Concluded)
VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AP -70	133121	Hose - Coolant.	1	4AP -78	100673	Stud - Pipe Holder Clamp.	1
4AP -71	3399	Screw	1	4AP -79	3480	Nut.	1
4AP -72	104579	Elbow - 90°	1	4AP -80	1040	Washer.	1
4AP -73	213032	Bushing - Reducing	1	4AP -81	100620	Clamp - Supply Pipe Holder	1
4AP -74	103779	Valve.	1	4AP -82	1040	Washer.	1
4AP -75	213032	Bushing - Reducing	1	4AP -83	3480	Nut.	1
4AP -76	100671	Pipe	1	4AP -84	100455	Nozzle	1
4AP -77	100622	Holder - Supply Pipe	1	4AP -85	100450	Valve - 3/8 Angle.	1

POWER FEED WORM BOX



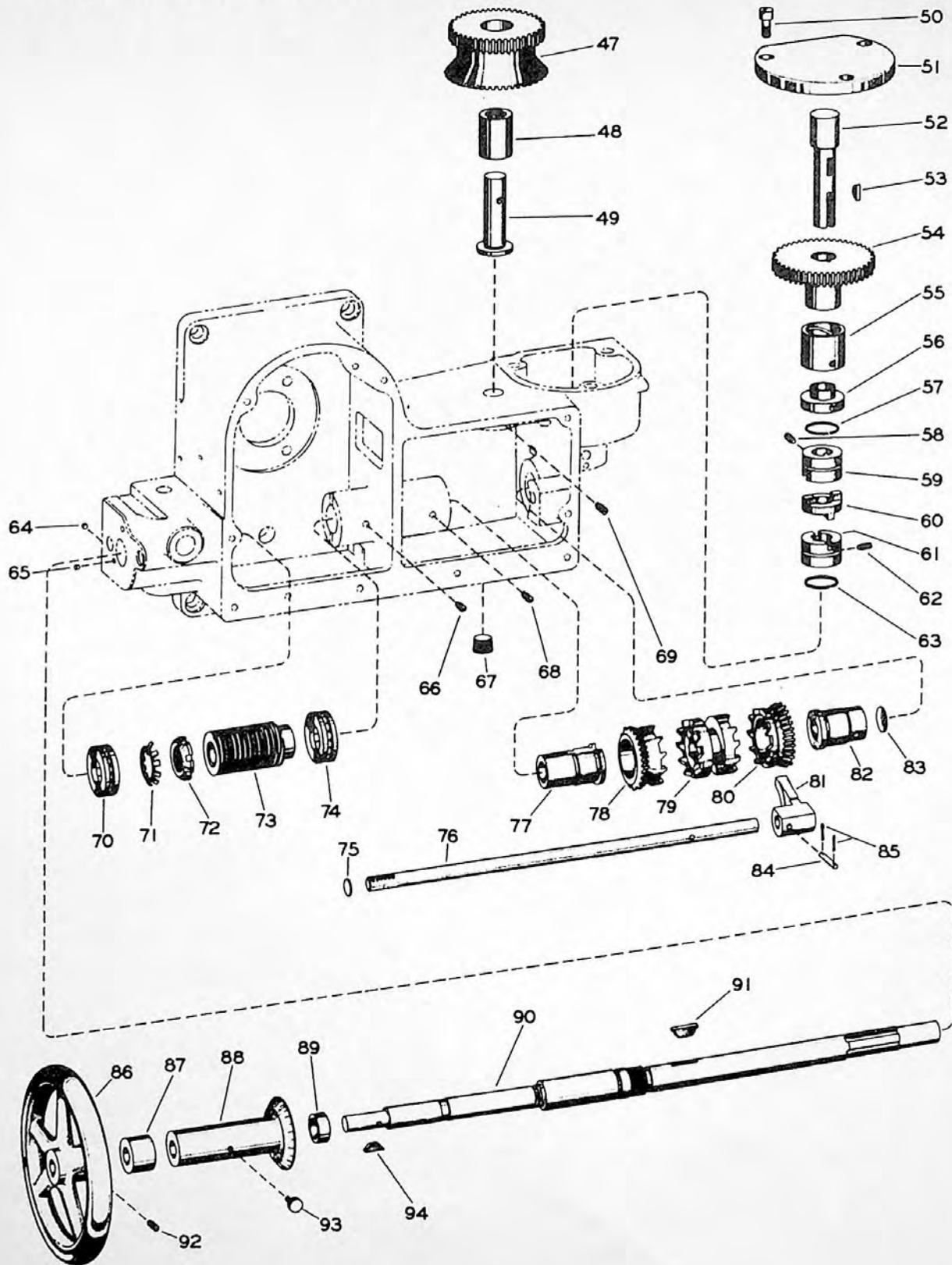
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

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POWER FEED WORM BOX—UNIT No. 4 AAJ
Nos. 2, 3, AND 4 VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AAJ -1	129482	Bushing - Shaft Worm Wheel	1	4AAJ -24	1203	Screw	1
4AAJ -3	49	Screw - Hex Head	3	4AAJ -25	1975	Spring	1
4AAJ -4	2267	Pin - Taper	1	4AAJ -26	53144	Plunger - Head Feed Trip	1
4AAJ -6	132551	Wheel - Worm	1	4AAJ -27	69459	Rack - Feed Trip	1
4AAJ -7	4184	Nut - Lock	1	4AAJ -28	3516	Lever	1
4AAJ -8	132552	Shaft - Worm Wheel	1	4AAJ -29	63386	Pinion - Trip Lever	1
4AAJ -9	67433	Distributor - Oil	1	4AAJ -30	642	Pin - Taper	1
4AAJ -10	2190	Bushing	1	4AAJ -31	3493	Pin - Taper Hexagon Head	1
4AAJ -11		Tubing - Oil		4AAJ -32	2190	Bushing	1
	67438	Nos. 3 & 4	1	4AAJ -33	2237	Bushing	2
	67439	No. 2	1	4AAJ -34		Tubing - Oil	
4AAJ -12	67432	Pipe - Oil Drain	1		67438	Nos. 3 & 4	1
4AAJ -13	3463	Screw - Hex Head	5		67439	No. 2	1
4AAJ -14	1962	Plug	1	4AAJ -35	129494	Cover - Lower Drive Shaft - Nos. 3 & 4	1
4AAJ -15	3453	Screw	1	4AAJ -36	3266	Screw - Socket Head Cap	2
4AAJ -16	3498	Screw	1	4AAJ -37	129490	Cover - Lower Drive Shaft - No. 2	1
4AAJ -17		Box - Worm		4AAJ -38		Cover - Front Worm Box	
	78106	Nos. 3 & 4	1		129493	Nos. 3 & 4	1
	78084	No. 2	1		129480	No. 2	1
4AAJ -18	1962	Plug	1	4AAJ -39		Screw - Fillister Head Cap	
4AAJ -19	3453	Screw	1		3495	Nos. 3 & 4	8
4AAJ -20	3454	Screw	1		3495	No. 2	7
4AAJ -21	3530	Plug	1	4AAJ -40	739	Pin - Taper	2
4AAJ -22		Screw		4AAJ -41	3850	Gasket - Oil Gage	1
	3454	Nos. 3 & 4	1	4AAJ -42	70641	Dial - Oil Gage	1
	3498	No. 2	1	4AAJ -43	4086	Gasket - Oil	1
4AAJ -23		Screw		4AAJ -44	3849	Disk - Oil Gage	1
	3454	Nos. 3 & 4	1	4AAJ -45	3848	Cover - Oil Gage	1
	3453	No. 2	1	4AAJ -46	3213	Screw - Cover Oil Gage	3

POWER FEED WORM BOX



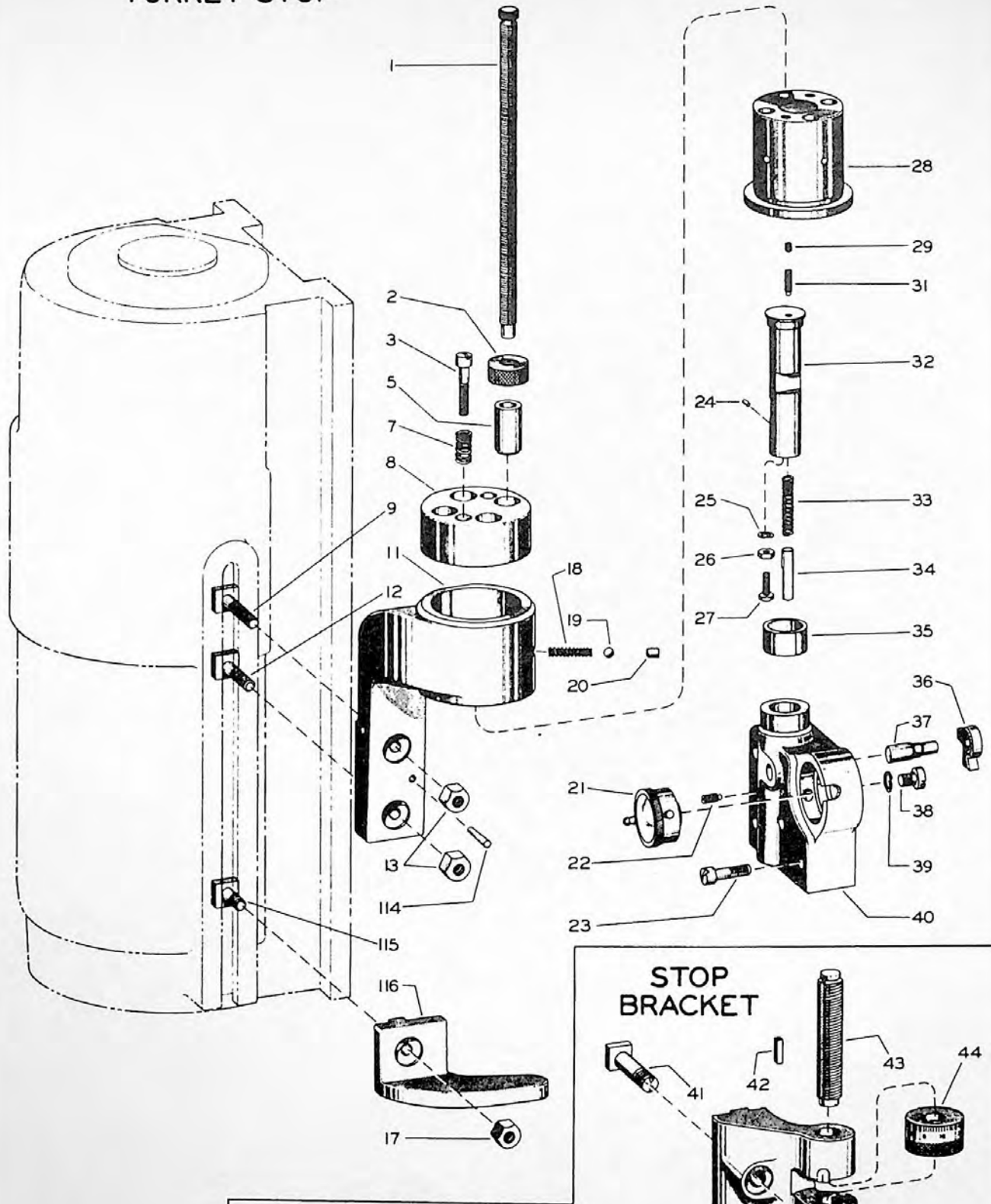
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

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POWER FEED WORM BOX—UNIT No. 4 AAJ (Concluded)
Nos. 2, 3, AND 4 VERTICAL

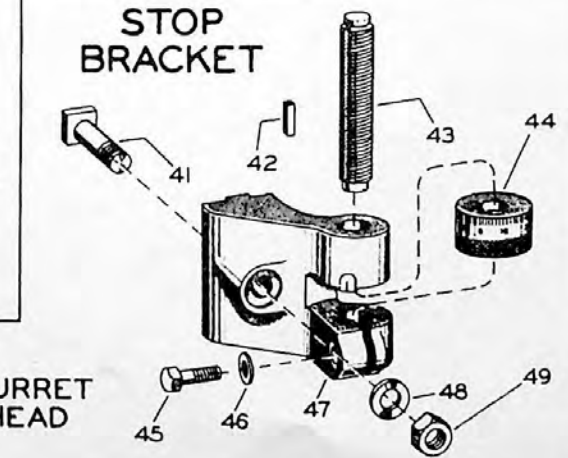
KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AAJ -47	71928	Gear - Driven Reverse	1	4AAJ -73	71251	Worm	1
4AAJ -48	3597	Bushing	1	4AAJ -74	89008	Bearing - Ball	1
4AAJ -49	63382	Stud - Reverse Miter Gear	1	4AAJ -75	81429	Plug - 3/4 Expansion	1
4AAJ -50	3483	Screw - Fillister Head Cap.	3	4AAJ -76		Rack - Fork Shifter	
4AAJ -51	63372	Cover - Drive Box	1		63726	Nos. 3 & 4	1
4AAJ -52	63365	Shaft - Drive	1		63384	No. 2	1
4AAJ -53	679	Key - Woodruff	1	4AAJ -77	71924	Bushing - Large Worm Shaft	1
4AAJ -54	71927	Gear - Drive	1	4AAJ -78	71929	Gear - Miter Clutch	1
4AAJ -55	63367	Bushing - Drive Gear	1	4AAJ -79	69462	Clutch - Reverse	1
4AAJ -56	69628	Retainer - Oil Drive	1	4AAJ -80	71929	Gear - Miter Clutch	1
4AAJ -57	63370	Ring - Spring	1	4AAJ -81	71926	Fork - Reverse Shifter	1
4AAJ -58	3453	Screw	1	4AAJ -82	71925	Bushing - Small Worm Shaft	1
4AAJ -59	69460	Coupling - Drive Shaft	1	4AAJ -83	203828	Plug - Expansion	1
4AAJ -60	69830	Coupling - Intermediate Drive Shaft	1	4AAJ -84	66444	Pin	1
4AAJ -61	69460	Coupling - Drive Shaft	1	4AAJ -85	3329	Pin - Cotter	2
4AAJ -62	3453	Screw	1	4AAJ -86	78062	Hand Wheel	1
4AAJ -63	63370	Ring - Spring	1	4AAJ -87	131449	Spacer - Dial Nos. 3 & 4	1
4AAJ -64	1844	Plug	1	4AAJ -88	129487	Dial - On Worm Shaft	1
4AAJ -65	1844	Plug	1	4AAJ -89	63629	Retainer - Oil	1
4AAJ -66	3453	Screw No. 2	1	4AAJ -90		Shaft - Worm	
4AAJ -67	221981	Plug	1		131450	Nos. 3 & 4	1
4AAJ -68	3453	Screw Nos. 3 & 4	1		129489	No. 2	1
4AAJ -69	3498	Screw	1	4AAJ -91	3281	Key - Woodruff	1
4AAJ -70	54028	Bearing - Ball Thrust	1	4AAJ -92	3453	Screw	1
4AAJ -71	3809	Washer - Lock	1	4AAJ -93	2253	Screw - Thumb	1
4AAJ -72	69563	Nut - Lock	1	4AAJ -94	3280	Key - Woodruff	1

TURRET STOP



USE AS ALTERNATE TO TURRET STOP ON HAND FEED TO HEAD

STOP BRACKET



CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

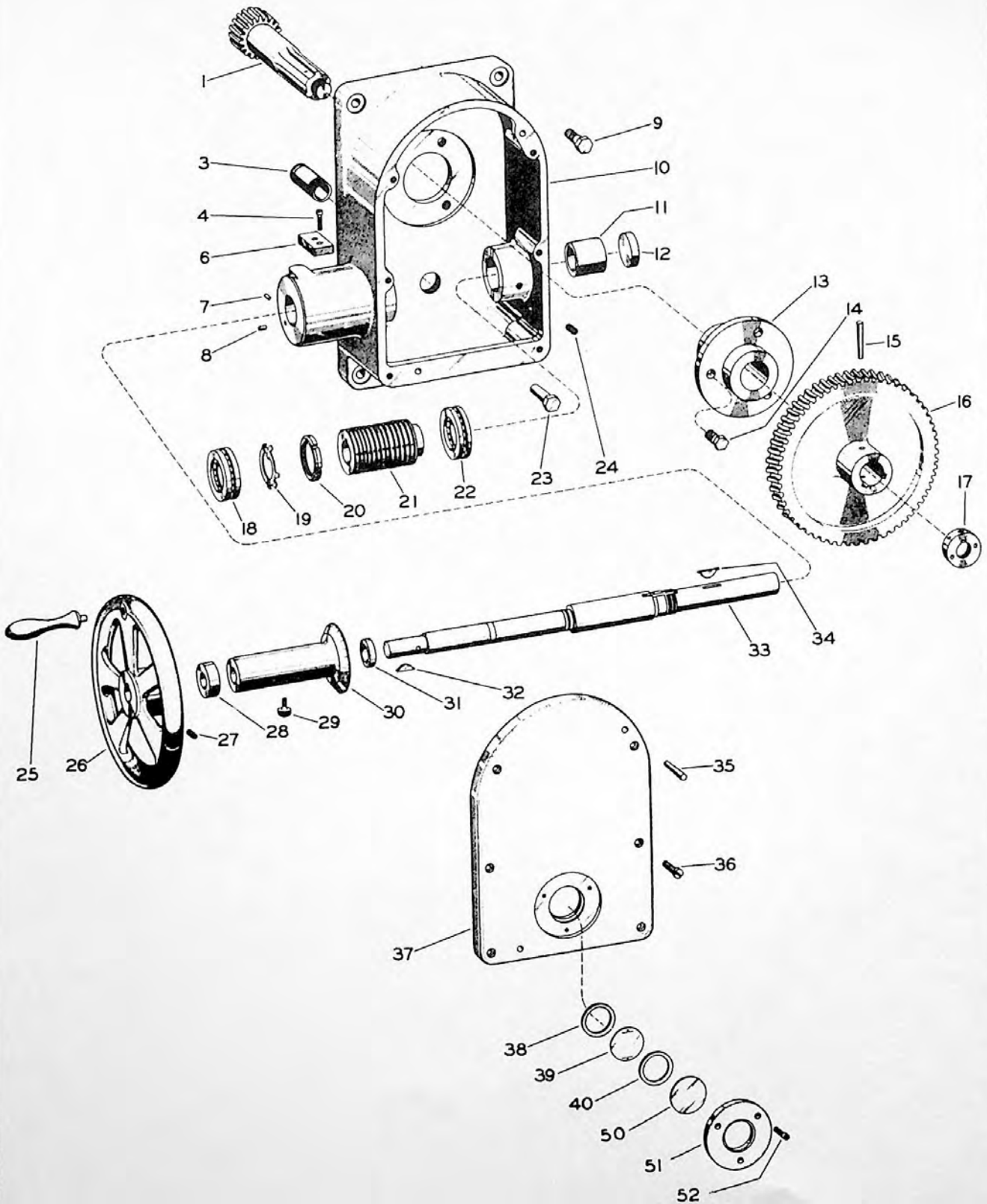
WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

TURRET STOP AND STOP BRKT.—UNIT Nos. 4 AAR AND 4 AAK

Nos. 2, 3, AND 4 VERTICAL—POWER AND HAND FEED

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AAR -1	70313	Screw - Stop Adjusting	4	4AAR -28	70311	Turret	1
4AAR -2	70320	Nut - Adjusting Screw Lock.	4	4AAR -29	1205	Screw	1
4AAR -3	3288	Screw	2	4AAR -31	1709	Screw	1
4AAR -5	70319	Spacer	4	4AAR -32		Plunger	
4AAR -7	70321	Spring - Comp.	2		79294	(Use with power feed worm box)	1
4AAR -8	70312	Housing - Stop	1		104572	(Use with hand feed worm box)	1
4AAR -9	3274	Bolt - Tee	1	4AAR -33	263	Spring	1
4AAR -11	129518	Housing - Turret	1	4AAR -34	70315	Pin - Plunger	1
4AAR -12	3311	Bolt - Tee	1	4AAR -35	70316	Cover - Plunger	1
4AAR -13	3479	Nut - Hex	2	4AAR -36	70317	Lever - Indicator Operating	1
4AAR -14	645	Pin - Taper	1	4AAR -37	70318	Pin - Lever	1
4AAJ -115	3361	Bolt - Tee (Used with power feed worm box)	1	4AAR -38	68271	Screw - Indicator Fastening	1
4AAJ -116	129484	Dog - Stop (Used with power feed worm box)	1	4AAR -39	2135	Washer - Lock.	1
4AAJ -117	3479	Nut - Hex (Used with power feed worm box)	1	4AAR -40	103025	Housing - Indicator	1
4AAR -18	3942	Spring	1	4AAK -41	3313	Bolt - Tee (Use with stop bracket).	1
4AAR -19	30154	Ball	1	4AAK -42	342	Key. . . . (Use with stop bracket).	1
4AAR -20	2257	Plug	1	4AAK -43	37427	Screw . . . (Use with stop bracket).	1
4AAR -21	99764	Dial - Indicator	1	4AAK -44	37430	Dial - Head Adj. (Use with stop bracket)	1
4AAR -22	3453	Screw	1	4AAK -45	1062	Screw . . . (Use with stop bracket).	1
4AAR -23	3288	Screw	4	4AAK -46	3441	Washer. . . (Use with stop bracket).	1
4AAR -24	3383	Pin. . . . (Use with hand feed to head)	1	4AAK -47	63774	Bracket - Stop (Use with stop bracket).	1
4AAR -25	2123	Washer	1	4AAK -48	3442	Washer. . . (Use with stop bracket).	1
4AAR -26	3472	Nut	1	4AAK -49	3479	Nut. . . . (Use with stop bracket).	1
4AAR -27	216863	Screw - Adjusting	1				

HAND FEED WORM BOX



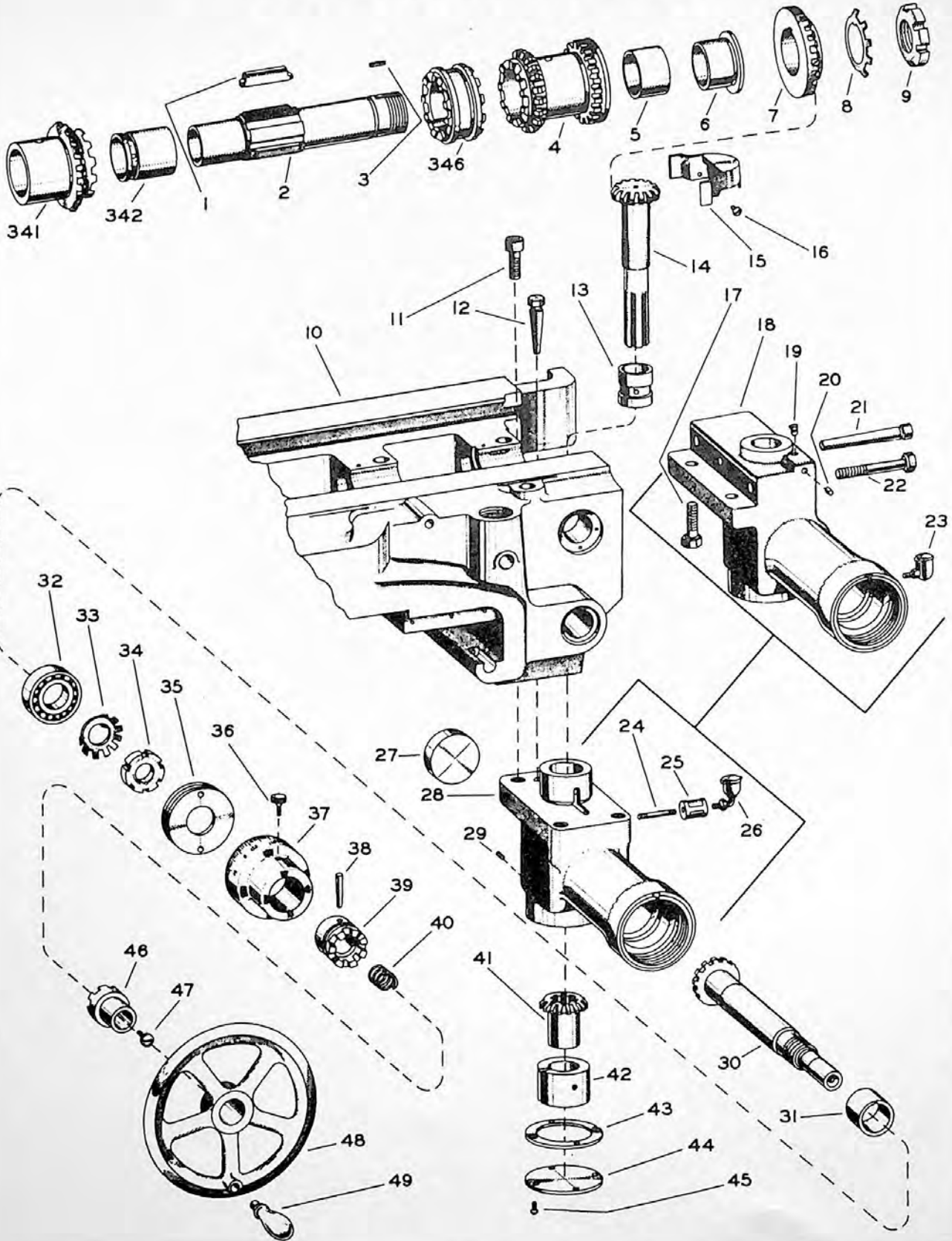
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

HAND FEED WORM BOX—UNIT No. 4 AAK, ALSO 4 AAR—TURRET STOP
Nos. 2, 3, AND 4 VERTICAL DIAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AAK-1	132552	Shaft - Worm Wheel	1	4AAK-25	3502	Handle	1
4AAK-3	67432	Pipe - Oil Drain	1	4AAK-26	3510	Handwheel - 8"	1
4AAR-4	3486	Screw (With Turret Stop) . .	2	4AAK-27	3498	Screw	1
4AAR-6	104570	Stop - Plunger (With Turret Stop) . .	1	4AAK-28	131449	Spacer - Dial (Nos. 3 & 4 Vert. Machines)	1
4AAK-7	1844	Plug	1	4AAK-29	2253	Screw	1
4AAK-8	1844	Plug	1	4AAK-30	129487	Dial - Worm Shaft	1
4AAK-9	3463	Screw	4	4AAR-30	130303	Dial - Worm Shaft (With Turret Stop) . . .	1
4AAK-10	63758	Box - Worm	1	4AAK-31	63629	Retainer - Oil	1
4AAR-10	104569	Box - Worm (With Turret Stop) . .	1	4AAK-32	3280	Key.	1
4AAK-11	3603	Bushing	1	4AAK-33		Shaft - Worm	
4AAK-12	62581	Plug	1		131451	Nos. 3 & 4 Vert. Machines	1
4AAK-13	129482	Bushing	1		129519	No. 2 Vert. Machine	1
4AAK-14	49	Screw	3	4AAK-34	3281	Key.	1
4AAK-15	2267	Pin - Taper	1	4AAK-35	739	Pin - Taper	2
4AAK-16	132551	Wheel - Worm	1	4AAK-36	3495	Screw	6
4AAK-17	4184	Nut - Lock	1	4AAK-37	129479	Cover - Worm Box	1
4AAK-18	54028	Bearing - Ball Thrust	1	4AAK-38	3850	Gasket	1
4AAK-19	3809	Washer - Lock	1	4AAK-39	70641	Dial - Oil Gage	1
4AAK-20	69563	Nut - Lock	1	4AAK-40	4086	Gasket	1
4AAK-21	71251	Worm	1	4AAK-50	3849	Dial - Oil Gage	1
4AAK-22	54028	Bearing - Ball Thrust	1	4AAK-51	3848	Cover - Oil Gage	1
4AAK-23	3493	Pin - Taper	1	4AAK-52	3213	Screw	3
4AAK-24	3453	Screw	1				

TABLE HAND FEED ATTACHMENT



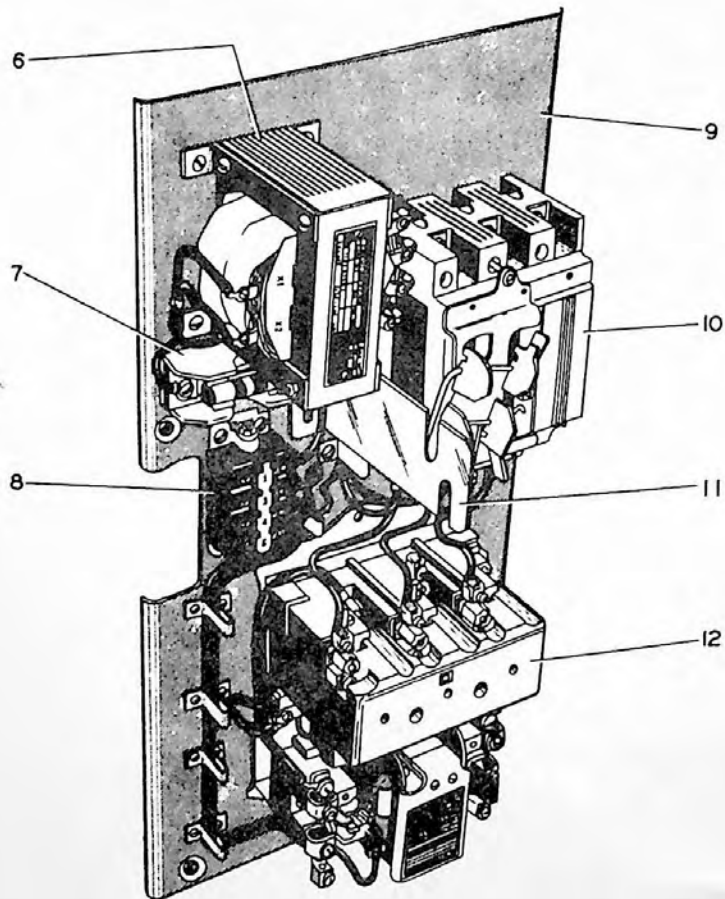
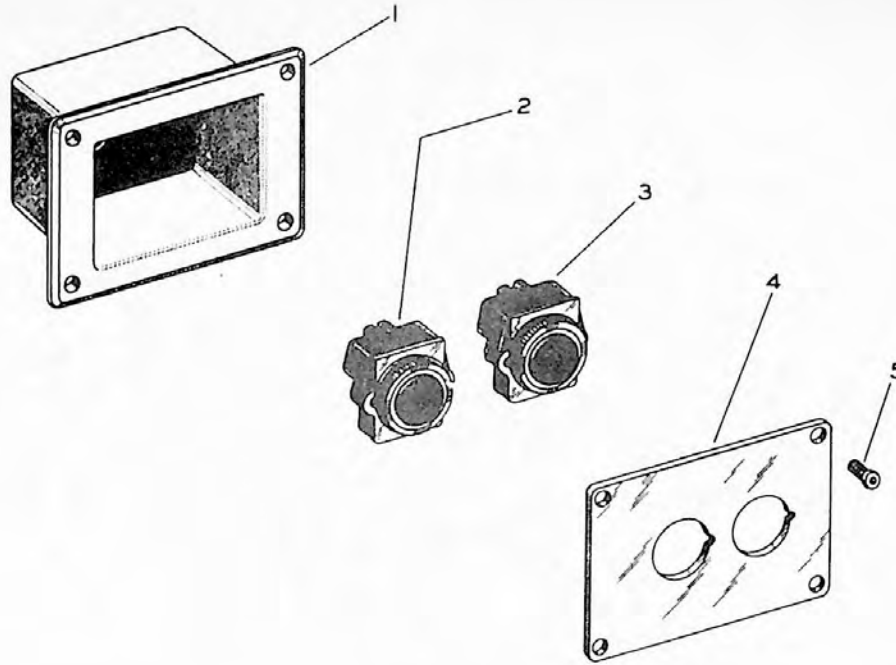
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

TABLE HAND FEED ATTACHMENT—UNIT No. 4 AAS Nos. 2, 3, AND 4 PLAIN AND VERTICAL

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AH -341	63671	Gear - Bevel Left on Lead Screw	1	4AAS -22	2221	Screw No. 2 P. & V.	2
4AH -342	63680	Bushing	1	4AAS -23	44979	Oiler No. 2 P. & V.	1
4AAS -1	74123	Key.	1	4AAS -24	67383	Nipple No. 4 P. & V.	1
4AAS -2	65802	Sleeve	1	4AAS -25	21494	Coupling No. 4 P. & V.	1
4AAS -3	3293	Key.	1	4AAS -26	65810	Oiler Nos. 3 & 4 P. & V.	1
4AH -346	63665	Clutch	1	4AAS -27	3556	Plug	1
4AAS -4	63803	Gear - Bevel - R. H. Feed	1	4AAS -28	65804	Bracket - Table Hand Feed	
4AAS -5	65797	Bushing	1			Nos. 3 & 4 P. & V.	1
4AAS -6	75166	Bushing	1	4AAS -29	1786	Screw Nos. 3 & 4 P. & V.	1
4AAS -7	65790	Gear - Bevel	1	4AAS -30	102482	Gear - Stem	1
4AAS -8	3795	Washer - Lock.	1	4AAS -31	65795	Bushing	1
4AAS -9	3796	Nut - Lock.	1	4AAS -32	65813	Bearing - Ball.	1
4AAS -10		Saddle - Alternation		4AAS -33	3809	Washer - Lock.	1
	73790	No. 2	1	4AAS -34	3810	Nut - Lock.	1
	65805	No. 3	1	4AAS -35	65789	Nut - Bearing Adjusting	1
	67384	No. 4	1	4AAS -36	2253	Screw	1
4AAS -11	3343	Screw Nos. 3 & 4	4	4AAS -37	102116	Dial - Hand Control	1
4AAS -12	2239	Pin - Taper Hex. Nos. 3 & 4	1	4AAS -38	642	Pin - Taper	1
4AAS -13	65792	Bushing	1	4AAS -39	38125	Clutch	1
4AAS -14	65801	Pinion - Stem Bevel Gear	1	4AAS -40	33744	Spring	1
4AAS -15	75131	Guard - Bevel Gear	1	4AAS -41	65799	Gear - Bevel.	1
4AAS -16	3460	Screw	2	4AAS -42	65791	Bushing - Bevel Gear	1
4AAS -17	3463	Screw No. 2 P. & V.	2	4AAS -43	65793	Gasket	1
4AAS -18	73789	Bracket - Table Hand Feed		4AAS -44	65794	Cover.	1
		No. 2 P. & V.	1	4AAS -45	3460	Screw	4
4AAS -19	44980	Oiler No. 2 P. & V.	1	4AAS -46	3506	Clutch	1
4AAS -20	1962	Plug No. 2 P. & V.	1	4AAS -47	3514	Screw	1
4AAS -21	39616	Pin - Taper - Hex. Head		4AAS -48	3511	Handwheel	1
		No. 2 P. & V.	1	4AAS -49	3502	Handle	1

ELECTRICAL EQUIPMENT



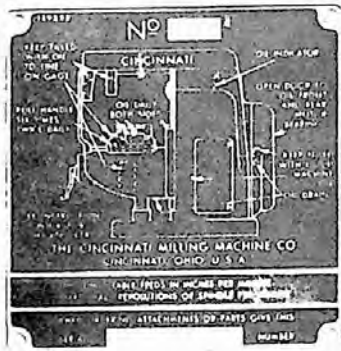
CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

ELECTRICAL EQUIPMENT—UNIT No. 4 AM AND 4 ANN

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
4AM -1	139260	Box - Junction	1	4AM -8	234671	Block - Terminal - 25 Amp.	1
4ANN -2	123173	Button - Push, Start	1	4ANN -9	129233	Plate - Starter Mounting	1
4ANN -3	123170	Button - Push, Stop.	1	4AM -10	---	Switch - Disconnect. 3 or 4 Pole (Specify exact data from switch on machine.)	1
4AM -4	119743	Plate - Mounting, Push Button.	1	4ANN -11	245650	Catch - Disconnect Mechanism.	1
4AM -5	3204	Screw	4	4AM -12	---	Starter - Main Drive (Open magnetic, 3 or 4 pole, Size 1, 2, 3 or 4. Specify coil voltage, cycles, and exact data from starter on machine.)	1
4ANN -6	---	Transformer - Control (Give line voltage at 25, 50 or 60 cycle, secondary voltage 110, VA rating of 100, 150, 200 or 250. Specify exact data from transformer on machine.) .	1				
4AM -7	243817	Block - Fuse	1				

PARTS LIST CATALOG



1 UP MILLING
TURN KNOB OUT UNTIL TIGHT
DOWN MILLING
TURN KNOB IN UNTIL TIGHT

4 NORMAL MILLING SPECIAL MILLING
IN OUT
TABLE SCREW CLUTCH
VERY IMPORTANT
LEVER MUST ALWAYS BE IN "OUT"
POSITION WHEN LONG AND SHORT
LEAD NORMAL ATTACHMENTS ARE USED

3 SPINDLE RUNS
LEFT RIGHT

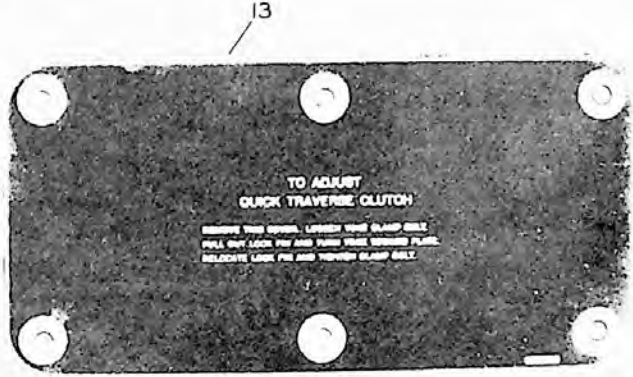
5 SPEED FEED

7 ONE SHOT OF GREASE WEEKLY

9 W.G.H. R.P.M.



12 PULLEY MUST RUN
600 R.P.M.



15 FEED SPEED

14 WHEN USING "TURBET STOP"
DO NOT TRIP OUT
WITH QUICK TRAVERSE

16 NUMBERS ON DIAL MUST
LINE UP WITH
INDICATOR BEFORE
STARTING SPINDLE

17 FEEDS FOR HEAD ARE
0.5 OF THOSE SHOWN
ON FEED DIAL



19 TO MAINTAIN
ACCURACY DO
NOT USE RA-
PID TRAVERSE
THROUGH DI-
VIDING HEAD

21 UP MILLING
TURN KNOB IN UNTIL TIGHT
DOWN MILLING
TURN KNOB OUT UNTIL TIGHT

20 LOOSEN HEAD CLAMP
BEFORE ENGAGING FEED

22 ELECTRICAL CONTROL

AC POWER VOLTS	PH	LY
AC CONTROL VOLTS	DC VOLTS	
MACHINE SERIAL NO.		
WIRING DIAGRAM NO.		

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI, OHIO, U.S.A.

CINCINNATI Nos. 2, 3, AND 4 DIAL TYPE MILLING MACHINES

WHEN ORDERING PARTS, give key number, part name and part number. Be sure to give complete serial number for your machine. For complete instructions, see Page 11, "How to Order Repair Parts."

MACHINE INSTRUCTION PLATES

KEY NO.	PART NO.	PART NAME	AMT. USED	KEY NO.	PART NO.	PART NAME	AMT. USED
1	129232	Plate - Instruction, Oiling	1	12	3889	Plate - Direction, Pulley	1
2	104244	Plate - Back Lash Eliminator.	1	13	130398	Plate - Instruction, Cover, Box, Feed . . .	1
3	129176	Plate - Direction	1	14	111570	Plate - Instructions, Turret Stop	1
4	76647	Plate - Caution, Driving Mechanism, Dividing Head	1	15	67385	Plate - Feed & Speed	1
5	129177	Plate - Control Feed & Speed.	1	16	71167	Plate - Instruction, Dial	1
6	118025C	Ring - Plate, Start (GE).	1	17	78136	Plate - Head Feed - Standard Series	1
7	101234	Plate - Grease.	1	18	130282	Plate - Instruction, Oiling	1
8	3966	Trademark - Cincinnati	1	19	79261	Plate - Caution, Driving Mechanism	1
9	4007	Plate - Direction & Speed.	1	20	69631	Plate - Caution, Head Feed Engaging. . . .	1
10	118025D	Ring - Plate, Stop (GE)	1	21	104239	Plate - Back Lash Eliminator.	1
11	128296	Plate - Patent	1	22	4180	Plate - Name, Control, Electrical	1

SERVICE MANUAL

FOR

Cincinnati

NOS. 2, 3 and 4

**PLAIN, UNIVERSAL and VERTICAL
DIAL TYPE MILLING MACHINES**

MODEL OM



THIS manual has been compiled to present to maintenance personnel the correct method of servicing these machines.

THE CINCINNATI MILLING MACHINE CO.

CINCINNATI 9, OHIO, U. S. A.

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THIS CATALOG TO BE USED ONLY FOR MACHINES WHOSE
SERIAL NUMBER BEGINS WITH 2A OR 4A

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SERVICE MANUAL

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NOTE: As a reference aid, figure numbers are the same as the page numbers on which they appear. As an example Figures 140A and 140B, appear on page 140.

The design and specifications of these machine and attachments illus-
trated and described herein are subject to change without notice.

FUNCTIONAL DIAGRAMS

FIGURE 134A
Power Feed to Vertical Head

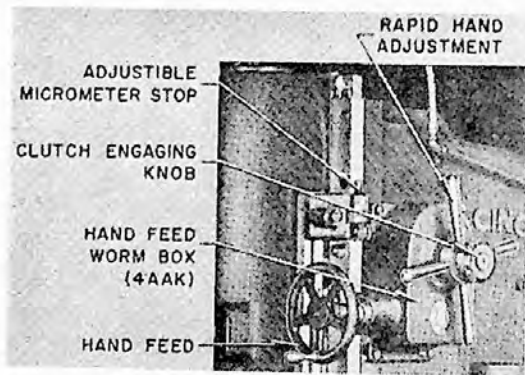
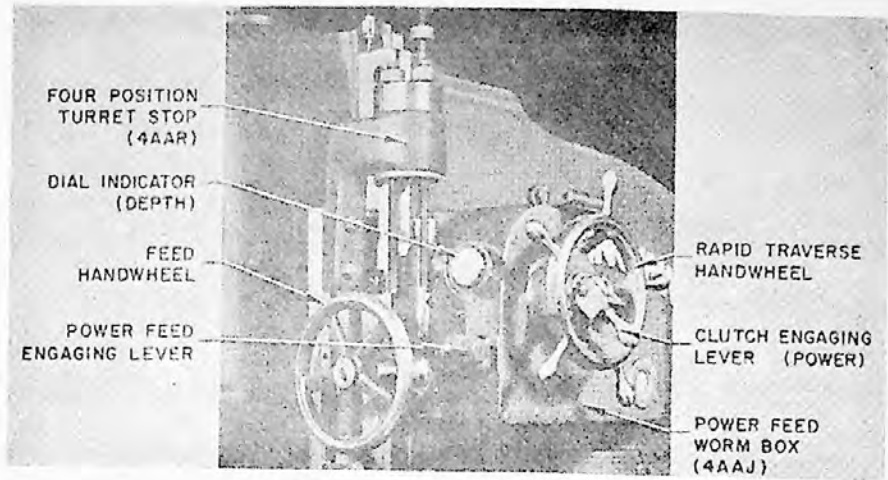
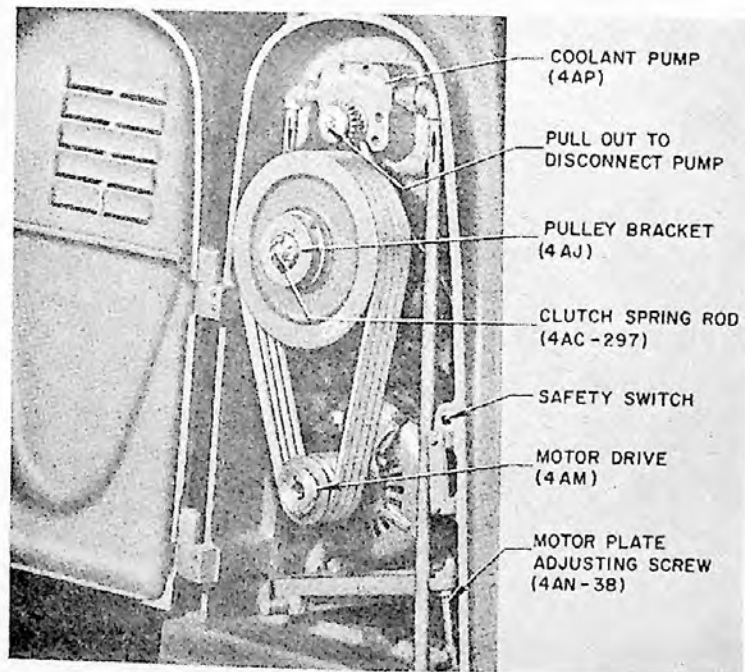


FIGURE 134B
Hand Feed to Vertical Head

FIGURE 134C
View Into Rear of Column



FUNCTIONAL DIAGRAM

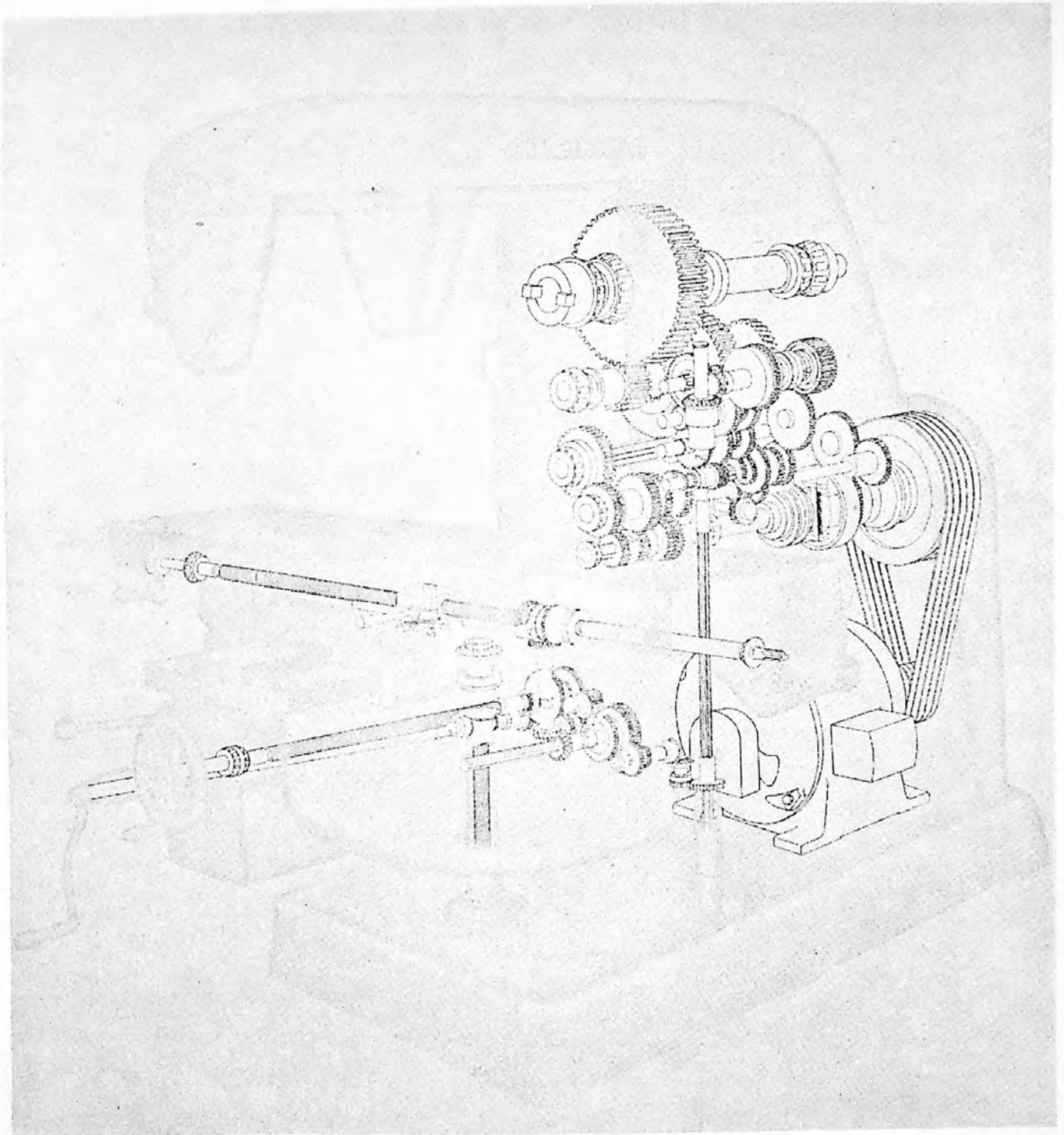
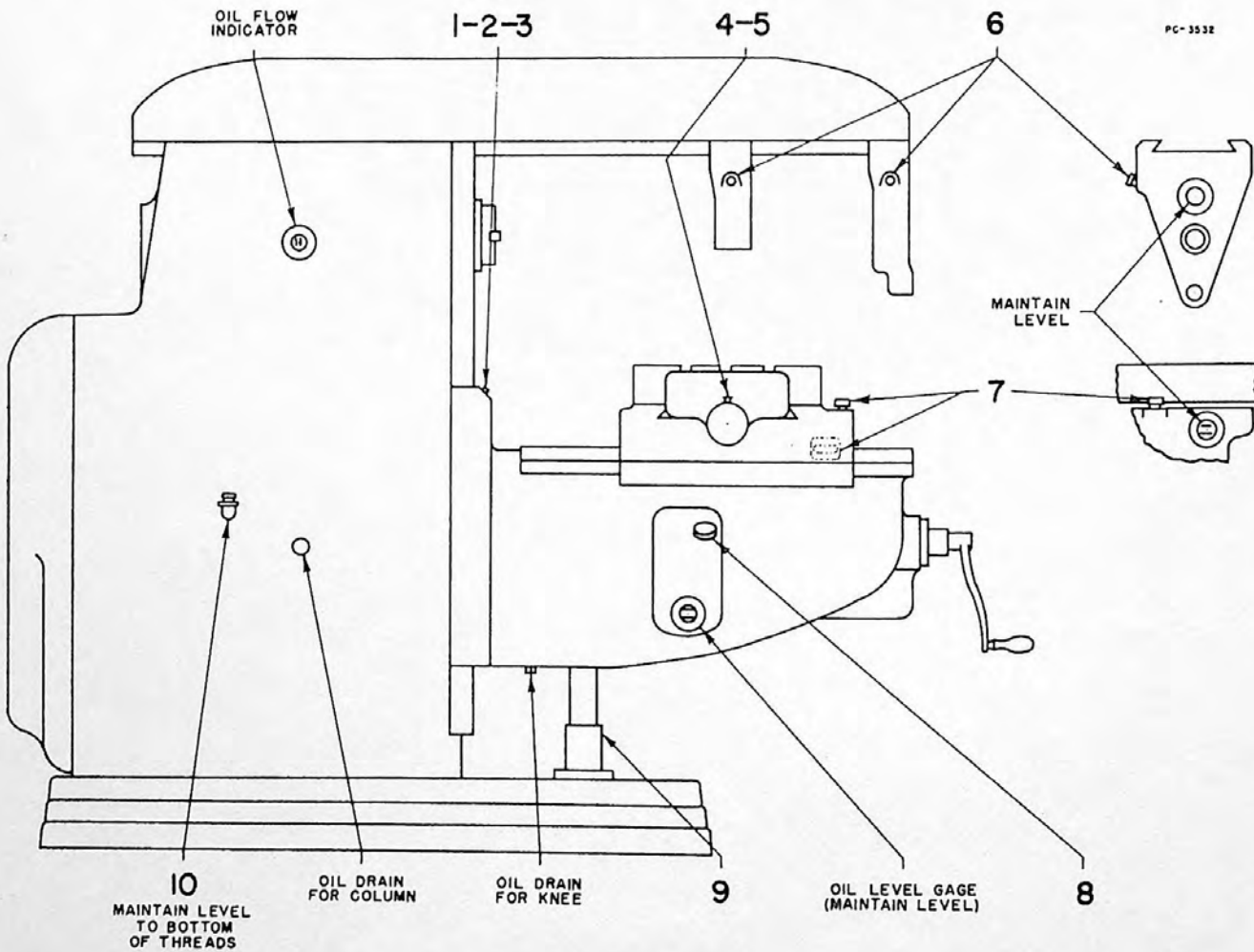
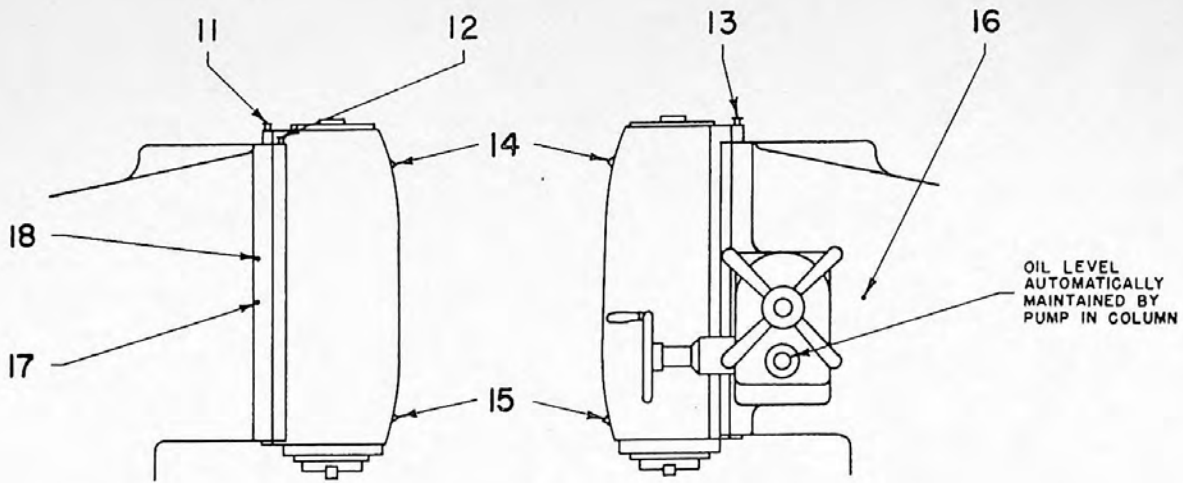


FIGURE 135A

Phantom View of Machine Showing Gear Train



Lubrication Diagram
FIGURE 136A

LUBRICATION INSTRUCTIONS and SPECIFICATIONS

Thoroughly oil all moving parts as they are installed, then lubricate all principal points as listed below before starting motor. Periodic and thorough lubrication with correct lubricant, as specified, will help to maintain the long life and accuracy built into each machine. The intervals listed are based on a normal 8 hour day.

PURCHASE LUBRICANTS FROM RELIABLE DEALERS

Interval	Station No. and Part Lubricated	Lubricating Instructions	Lubricant Specifications
Daily (8 hours)	1, 2, 3	Knee and column bearing surfaces	A few squirts of oil in capped oilers.
	4, 5	Lead screw bearings in aprons.	
	11, 12, 13	Vertical head and column bearing surfaces.	
	7	Saddle parts, knee ways and table ways.	
Check oil level daily	6	Arbor bearing when used	Cap.: ½pt. Fill to high level when oil drops to low limit.
	8	All gears and bearings in knee.	Cap.: See Note 1 Fill knee reservoir to high level when oil drops to low limit.
	10	All parts in column shifter bracket and feed box, (See Note 2)	Maintain oil level in column. Drain at end of first 30 days and every 6 to 9 months thereafter.
Weekly (48 hours)	14, 15	Upper and lower spindle bearings	Inject 1-2 shots of grease in stations 15 and 16 and 2-3 shots in stations 14, 17 and 18.
	16, 17	Spiral bevel pinion bearings	
	18	Spiral bevel gear	
6 Months	9	Elevating screw and nut.	Replace pipe plug in screw base with a grease nipple and inject oil with grease gun. Run knee to bottom once or twice daily to insure thorough lubrication.
Periodically	Main drive motor.	Lubricate according to motor manufacturer's instructions. DO NOT OVER LUBRICATE.	

CMMCo. No. P-55
Rust and oxidation inhibited paraffin base oil.
Viscosity 200-220 SUS at 100°F.

CMMCo. No. P-37
Calcium base grease having a consistency of NLGI No. 2 or 3.

CMMCo. No. P-50
E.P. Lubricant viscosity 850-950 SUS at 100°F.
Approx. 20% noncorrosive sulphur base and 1% tacky additive.

Note 1 Machine	Capacity - Gals.	
	Column	Knee
No. 2 Horizontal	3¼	1¼
Nos. 3 & 4 Horizontal	4½	2½
No. 2 Vertical	6	1¼
Nos. 3 & 4 Vertical	11	2½

Note 2

If the machine is operated continuously at the higher range of speed (above 1000 r.p.m.) use CMMCo. No. P-38 (Viscosity 148-155 SUS at 100°F.) — R. O. type oil in column.

Coolant tank capacities: No. 2 P., U., V. — 16 gals. (61 liters); Nos. 3 and 4 P., U., V. — 21 gals. (80 liters).

INSTALLATION INSTRUCTIONS

Foundation

Foundation requirements depend upon so many factors, such as speed of machine, rate of metal removal, etc., that it is not feasible to specify exact requirements to fit each condition.

We recommend a reinforced concrete slab foundation at least 6" thick and extending approximately 6" outside machine base. If the ground floor is of timber construction and the distance from solid ground to floor line is not too great, best practice is to cut a hole through wood floor and install a reinforced concrete base from ground to floor line. If floor is concrete covered with wood blocks or other insulating material, the usual practice is to remove this material and fill in with concrete to floor line.

If machine is to be located on an upper floor, place it directly over a supporting beam or girder. Such placing minimizes possibility of vibrations being transmitted to it from other machines.

We also recommend the use of grouted in hold down bolts. Fill pipes around bolts with dry sand before grouting-in bolt. Anchoring a machine helps maintain accurate alignment and level. (Figure 138A)

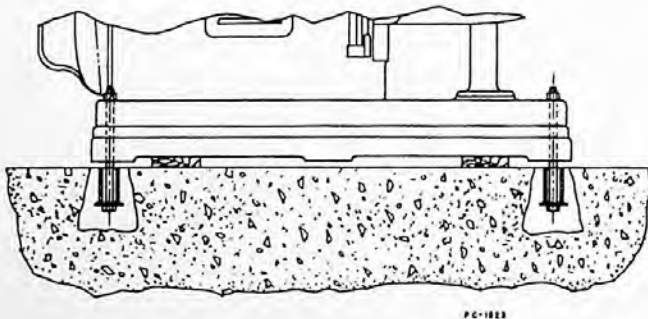


FIGURE 138A
Bolting to Concrete Floor

Lifting Machine (Figure 138B)

The plain or universal machine may be lifted with a rope or cable sling around the overarm. (No. 2 machine weighs from 6250 to 7100 lbs., No. 3 machine from 8380 to 9300 lbs., No. 4 machine from 9050 to 10,100 lbs. depending on whether they are plain, universal or vertical types). The vertical machine should be lifted with a sling around column, back of vertical head.

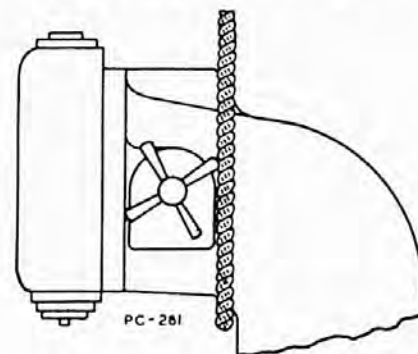
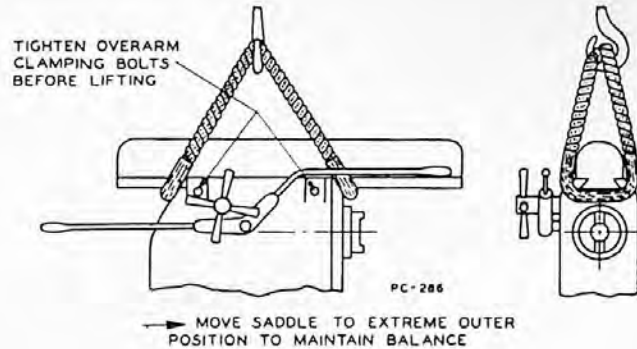


FIGURE 138B

Lifting Horizontal and Vertical Machines

Tighten overarm clamping bolts before lifting. If a cable is used, protect dovetails with a leather strap or wood blocks.

Leveling

For leveling machine tools, a sensitive, graduated tube spirit level, reading to 10 seconds per graduation (0.005" per foot) and provided with screw adjustment, is required. A carpenter's level or the bulb in a machinist's combination square is not good enough. Length of a level frame has no bearing on its accuracy. The glass tube alone determines its sensitiveness. A short level with a long arced tube is best.

Insert laminated shims under corners of base until table is level in all directions. Then place additional shims under base to distribute machine weight evenly, and recheck for level. Machine table and spirit level must be absolutely clean to obtain accurate results.

Do not try to level machine that has just been brought into a shop. Give it 24 hours to take on room temperature. Do not expect a machine to remain level permanently. Buildings settle and floors warp. A periodic check-up is necessary to maintain utmost precision.

Cleaning

Do not move any machine slides before cleaning

thoroughly and oiling. Use a good clean grease solvent. Do not use an air hose for cleaning as it will drive grit and dirt into holes and under bearings. Use a stiff bristle brush to get into corners. When machine is thoroughly clean, rub machine oil over all ways and make sure there is no grit left. Prevent formation of permanent stain by periodic cleaning after installation.

ADJUSTMENTS

To Adjust Gibs (Figures 139A, 139B)

Head type taper gibs are used between table and saddle to compensate for possible wear. They are also used between vertical head and column on the vertical machine.

Headless type taper gibs are used between saddle and knee as well as between knee and column — one at top and one at bottom to compensate for possible wear.

Do not adjust gibs as a cure-all for vibration. Also check cutter design — rake and clearance angles, etc. — nature of work, cutter rpm and feed.

When necessary to adjust head type gib, proceed as follows:

1. Loosen Lock Nut. Turn Adjusting Screw clockwise and follow with lock nut to force gib in until hand movement of slide is snug but not locked. Loosen lock nut sufficiently to allow adjusting screw to be backed out one full turn, pulling gib free this amount. Such a setting should cause a slight drag to movement of slide, and normally should not be tighter.
2. Tighten lock nut in this position.
3. Adjustment of headless type gib is the same, only no lock nut is required.

CAUTION: Tight adjustment of gibs squeezes out oil film, causing scoring and early wear. Loose gibs will destroy accuracy and allow chatter.

To Adjust Main Drive Clutch (Figure 140A)

The main drive clutch is self-compensating within certain limits, thereby eliminating any necessity of adjustment until the wear exceeds these limits. The Outer Sleeve Nut regulates allowance for this self-compensating effect or wear; 0.020" when clutch is

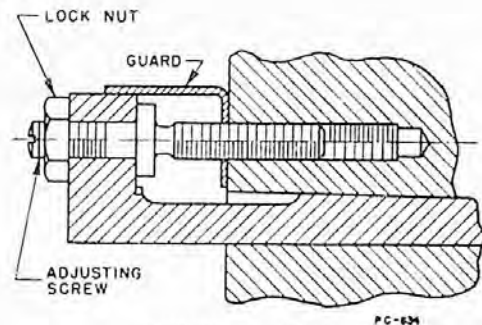


FIGURE 139A

Section Through Head Type Gib

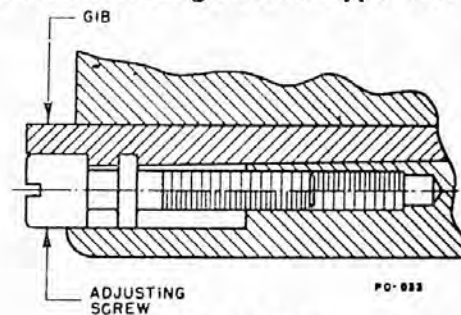


FIGURE 139B

Section Through Headless Type Gib

new or after it is adjusted.

The Spring Adjusting Nut position determines force transmitted by main spring to clutch plates, and therefore determines load which clutch will carry. This design is factory set to obtain full capacity of main spring. The outer end of nut is factory set approximately $\frac{3}{16}$ " to $\frac{1}{8}$ " in from end of 1st drive shaft extension.

If the cutter won't maintain its set speed under a normal load, the main clutch is slipping and needs adjustment. If, when the starting lever is engaged, with the spindle set for high speed, the spindle hesitates in coming up to full rpm, the clutch is slipping and needs adjustment.

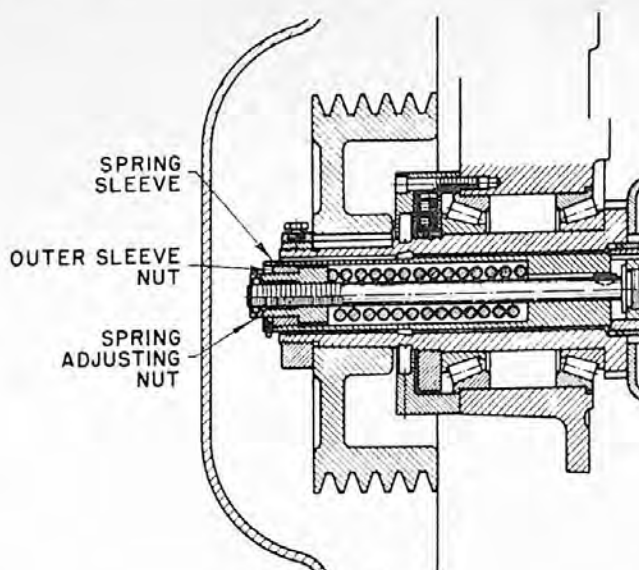


FIGURE 140A
Main Drive Clutch

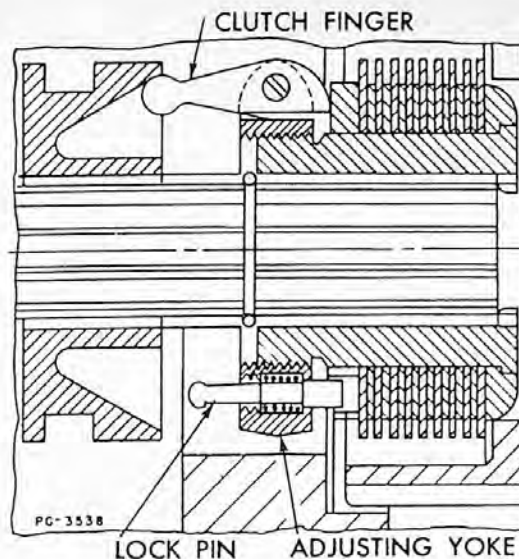


FIGURE 140B
Rapid Traverse Clutch

Such slippage could be prevented if the correct adjustment would be checked periodically, depending on machine usage. To adjust proceed as follows:

1. Push up (engage) starting lever.
2. Open rear cover door and remove cotter pin through Outer Sleeve Nut.
3. Turn outer sleeve nut clockwise until it bottoms on Spring Adjusting Nut, then back off approximately two notches. Replace cotter pin.

This setting allows 0.020" movement of Clutch Spring Sleeve between engaged and disengaged clutch positions and consequently 0.020" separation of clutch plates when disengaged.

If outer sleeve nut is backed off too far, the spring sleeve will have too much movement, clutch plates will not separate when lever is in disengaged position and the spindle continues a slow rotation.

If outer sleeve nut cannot be rotated clockwise, then pins and rollers or clutch plates are worn excessively and should be replaced with new parts.

To Adjust Rapid Traverse Clutch (Figure 140B)

The rapid traverse clutch in feed box should be so set that table, knee, and saddle can be rapid traversed simultaneously. This should be checked periodically and the clutch adjusted, if necessary, so there is never any slippage. Evidence of extreme wear in a rapid traverse clutch manifests itself in amount that rapid traverse trip plunger extends out of the right front top

of saddle on a plain machine. (It is raised by a pinion on rapid traverse lever shaft). If this plunger raises to a height more than $\frac{5}{8}$ " above saddle then clutch should be adjusted. After clutch adjustment, if plunger still projects too far, remove actuating lever shaft and drop plunger one notch before re-engaging pinions. A slipping clutch causes undue wear or even buckled plates if slippage is too severe.

To adjust, proceed as follows:

1. Remove brass plate at top rear of feed box on right side of machine. (Clutch adjustment instructions are engraved on the outside of this plate.)
2. Rotate clutch fingers until filister head screw through clutch finger is accessible. Loosen this lock screw to adjust yoke.
3. Pull out and hold Lock Pin long enough to rotate Adjusting Yoke clockwise (as viewed from front) a fraction of a turn. Release lock pin and continue rotating yoke slowly by prying with a screw driver until pin drops into next hole in plate.
4. Tighten lock screw, replace cover, check setting and, if necessary, tighten clutch another hole.

However, if clutch is tightened several holes and still slips, dismantle and renew clutch fingers, pins, and clutch shoes. All fingers should be exactly alike. It is rare that clutch plates have to be renewed unless they are burned and buckled.

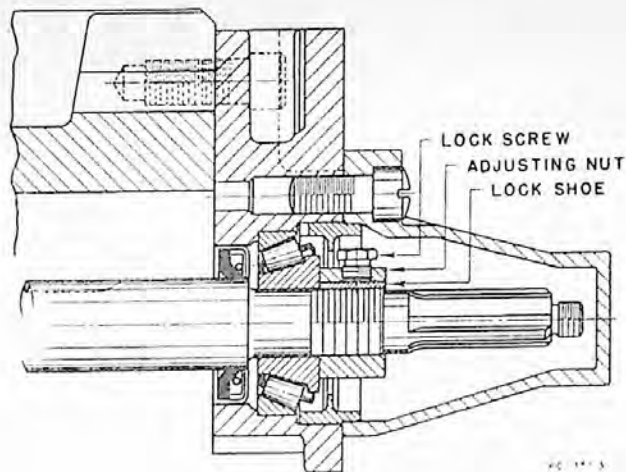


FIGURE 141A

Table Feed Screw Bearing

To Adjust Table Feed Screw Bearings
(Figure 141A)

When machine leaves our factory the clearance between feed screw and nut, at gibs and in bearings is such that dial at handwheel has approximately 0.005" rotary play. This backlash will increase if bearings become loose or feed screw nut wears.

Increased play that develops in the bearings should be removed as follows:

1. Loosen gib by backing off adjusting screw a few turns.
2. Remove bell cover from right table apron. Loosen screw through Adjusting Nut, tap to loosen lock shoe underneath and pull up nut until it is snug. Back off adjusting nut approximately 1/6 turn and lock. (Some machines have two tapered roller bearings in right apron and a needle bearing in left apron.)
3. Readjust gib.

Excessive play is indicative of a worn lead screw nut that should be replaced by a new nut. Any feeling of binding over the "Play" movement of handwheel indicates too tight a bearing setting.

To Adjust Cross Feed Screw Bearings
(Figure 141B)

The cross feed screw rotates at front end in two tapered roller bearings. The splined coupling at rear end rotates in a bronze bushing that merely acts as a support to prevent misalignment of drive shafts.

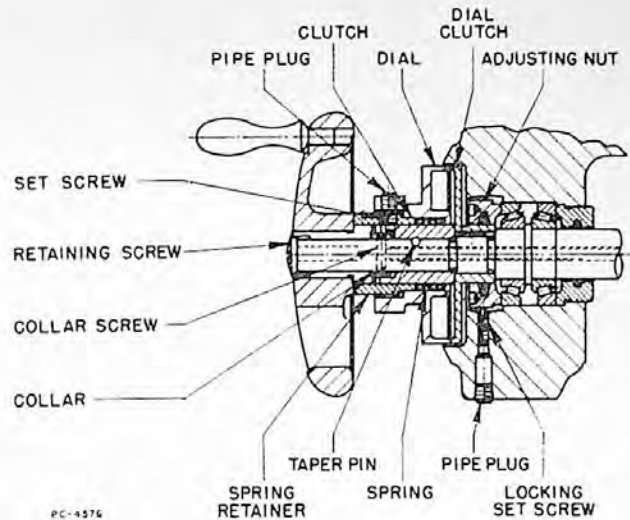


FIGURE 141B

Cross Feed Screw Bearings

When machine leaves our plant, the clearances between feed screw and nut, at gibs and in bearings, is such that dial at handwheel has approximately 0.005" rotary play.

Increased play that develops in the bearings should be removed as follows:

1. Loosen gibs by backing off adjusting screws a few turns.
2. Remove Retaining Screw at end of cross screw and lift off handwheel. Remove Pipe Plug from end of Dial and through this hole remove set screw from Spring Retainer. Slip dial, spring retainer and spring from end of cross feed screw.
3. Tap taper pin from Clutch, remove slotted headless screw through knockout collar and slip collar and clutch off screw. Use two 3/8" jack screws through tapped holes of Dial Clutch to force it off cross screw.
4. Unscrew two dog point set screws, that lock Adjusting Nut, from right side of knee in line with grooves in nut. With a face spanner wrench, pull up on adjusting nut until it is tight, then loosen nut about 1/6 turn.

Replace all parts in reverse order and turn cross feed screw by hand to feel setting. There should be no more than 0.005" rotary play but it should not be hard to move crank.

Excessive play is indicative of a worn cross feed nut

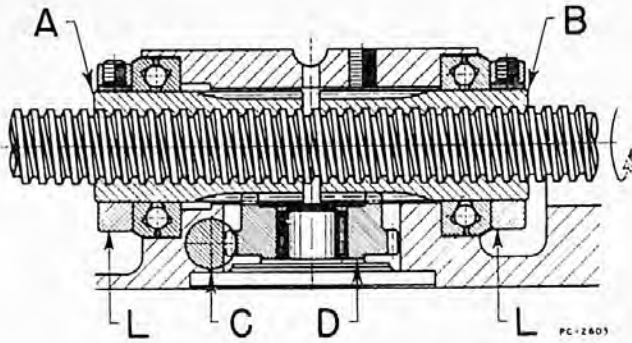


FIGURE 142A
Backlash Eliminator Nuts

that should be replaced with a new one. Any feeling of binding over the "play" movement indicates too tight a bearing setting.

To Adjust Backlash Eliminator (Figure 142A)

Normally the mechanism is self compensating for wear so should not require adjustment for many months.

Any need for adjustment of the backlash eliminator will be indicated by:

- (a) Lunging table movements while climb milling indicates that the backlash (B/L) eliminator nuts are loose or worn and need adjusting. Normally, the knurled actuating knob at front of saddle should turn rather easily over most of approximately 5 turns from fully engaged to fully disengaged. If it turns stiffly through the entire range, this is another indication that B/L mechanism needs adjusting.
- (b) Difficult manual operation of table might indicate too tight an adjustment.

The backlash (B/L) eliminator should be adjusted as follows:

1. Remove right and left aprons from table per paragraphs 1 and 2 on page 158 under To Remove Table and Lead Screw. Pencil mark location of table gib, (for ease in resetting) loosen it slightly and slide table to right far enough to uncover backlash nuts. Support outer end of table as it is being moved to right.
2. Set B/L actuating knurled knob at front of saddle in disengaged (fully out) position. (There are approximately 5 turns from fully engaged to fully disengaged.)

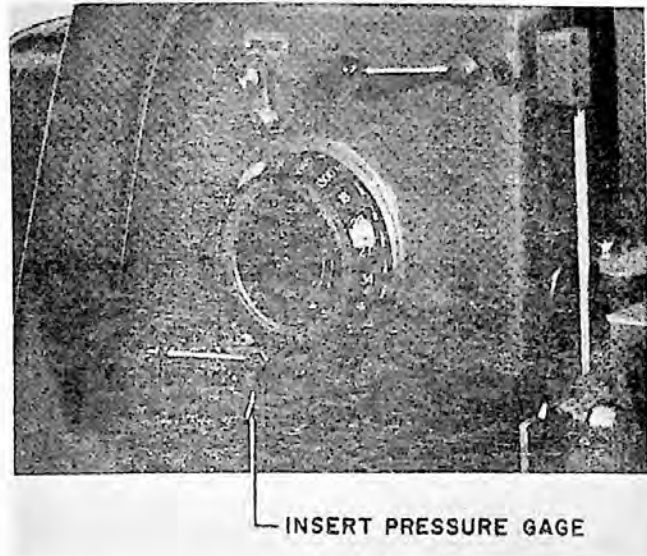


FIGURE 142B
Hydraulic Pressure Gage Location

Loosen set screws, tap to loosen lock shoes under screws and tighten backlash nuts (L) so they are snug against their thrust bearings. Normally, only a fractional turn of nuts is sufficient. With a rag around leadscrew, it should be possible to rotate screw by hand. When knurled knob is turned in 2 to 2½ turns it should be impossible to turn lead-screw by hand but it should be possible to turn knurled knob in another 2 to 2½ turns to make backlash fully effective.

It may be necessary to further tighten or slightly loosen backlash nuts (L) to obtain correct setting. Tighten set screws to lock nuts.

3. Slide table back into position, mount both aprons, adjust table lead screw bearings and reset table gib.

To Adjust Hydraulic Oil Pressure in Column (Figures 143A, 142B)

Too low an oil pressure will manifest itself by sluggish action of the servo valve when engaging main drive clutch. If pressure is very low, the shifter bracket changes will be so slow that gearing will be damaged.

Too high an oil pressure (rather improbable) will show up by oil leaks.

Best practice is to check this pressure periodically,

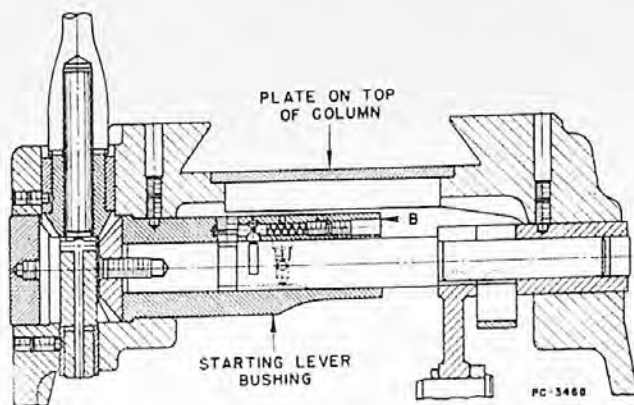


FIGURE 143A

Adjusting Column Hydraulic Pressure

every few months. A simple preventative may save a lengthy shutdown.

To adjust, proceed as follows:

1. Remove $\frac{3}{8}$ " pipe plug from $\frac{3}{4}$ " straight plug at bottom rear corner of gear shifter bracket, left side of column. (Figure 142B) Insert a 500 lb. gage.
2. Pull overarm forward and remove steel plate from top of column between ways. (Figure 143A)
3. Place a clean rag under Starting Lever Bushing and unscrew first of two $\frac{3}{8}$ " hollow headless set screws at B in the end of bushing. Use a short wrench attached to a string to prevent dropping it into column.
4. Start machine, note gage reading and turn in second set screw in bushing to raise oil pressure.

Set gage pressure at 300 to 325 lb. for all machines equipped with servo-valve for actuating main drive clutch. Earlier machines not equipped with servo-valve used a gage pressure between 290 to 310 lb.

All machines equipped with a servo-valve had a starting lever tipped with ball handles. Machines without the servo-valve had a plain starting lever. Also the clutch engagement of a servo-valve equipped machine is much smoother and easier.

To Adjust Main Driving Belts (Figure 143B)

Make certain that driving and driven sheaves are in vertical alignment when motor shaft is at middle of end play. Accessible when rear column door is opened.

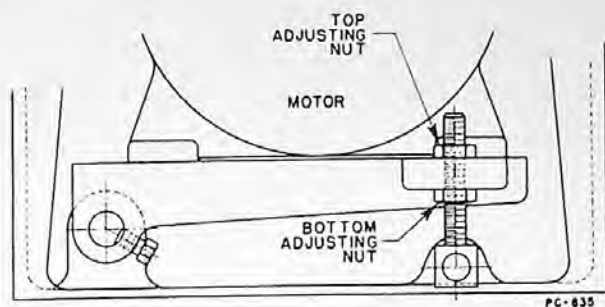


FIGURE 143B
Main Drive Motor

A V-belt drives through side contact between belt and sheave so need not be excessively tight. Check belt setting frequently, every few days, until new belts are set to machine and occasionally thereafter. If V-belts slip due to stretch or wear, they can be tightened as follows:

1. Loosen Bottom Adjusting Nuts, tap base plate to make certain it is free on adjusting screw, and allow weight of motor to rest on belts.
2. Set Top and Bottom Adjusting Nuts to lock motor plate in position.

When renewing belts, best results are obtained by using matched belts and installing a completely new set.

To Adjust Spindle Bearings (Figure 144A)

If, when face milling, the work piece shows steps between cuts, it would indicate excessive spindle end play provided the cutter is sharp and true. Excessive end play might also be indicated if it is impossible to mill a straight slot. (Before adjusting spindle bearings, make certain that gibs are correctly adjusted as loose gibs could cause these same milling errors.) Too tight a spindle bearing adjustment would manifest itself by overheating of the bearings. Normally, this temperature, as measured with a thermometer in a spindle cap screw hole, should not exceed 145° F., after four hours continuous running at highest speed. Spindles in medium speed machines are factory set for an end play between 0.001" to 0.0015" while those for high speed machines are set 0.0015" to 0.002". For continuous operation at the highest speeds, it may be necessary to further increase the end play to prevent excessive heating.

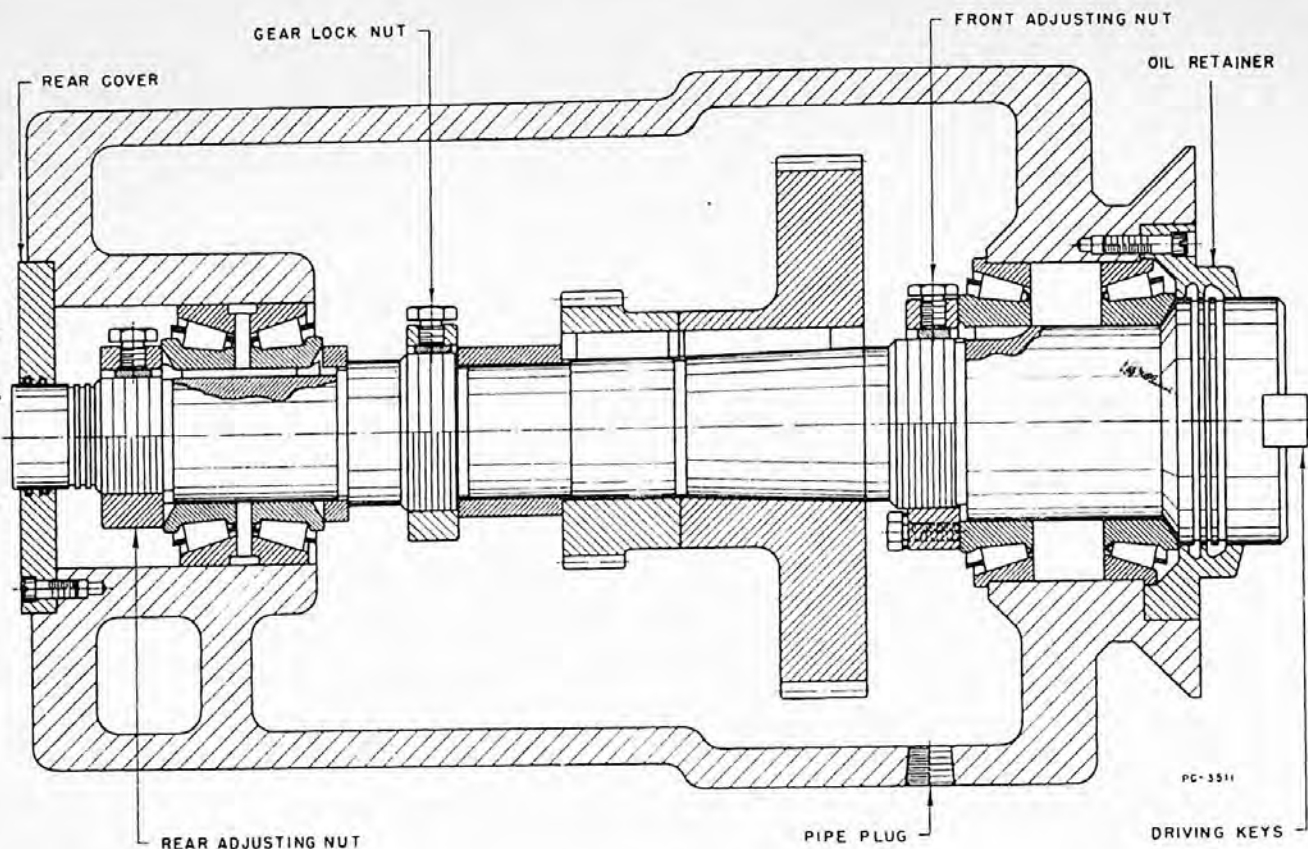


FIGURE 144A
Section Through Horizontal Spindle

Proceed as follows to adjust bearings:

1. Remove pipe plug from left side of column in line with spindle nut on horizontal machines. Remove rectangular plate from front of vertical head on vertical machines. Set spindle reverse lever in neutral position.
2. Remove two keys from spindle nose and insert a 1" square steel bar approximately 14" long in slots.
3. Loosen hexagon head screw in forward (lower in vertical machine) Adjusting Nut and tap to loosen lock shoe under screw.
4. Insert a $\frac{3}{8}$ " diameter steel bar approximately 10" long into a radially drilled hole in adjusting nut. With the square bar in spindle nose, rotate spindle clockwise to tighten bearing and counter-clockwise to loosen.

Remove holding bar from nut and rotate spindle to properly seat bearings.

5. Mount a 1/10,000 indicator on machine with its spindle in contact with machine spindle nose. Tap spindle lightly from front end, then rear end and read indicator. The setting should be as given above.
6. Tighten lock screw in adjusting nut, replace pipe plug in column or plate on vertical head, also drive keys in spindle nose.

The rear spindle bearings will only need adjustment in case the spindle was dismantled for repairs. These should be set first in a similar manner to above and final adjustments made on front bearings.

Adjust Dynapoise Overarm (See page 36)

The dynapoise overarm used with this machine has been set at our factory to prevent cutter chatter under most conditions. However, under very adverse conditions, if chatter occurs, the overarm should be readjusted as follows:

(Before changing overarm setting make certain gibs, clamps, fixtures, and lead screw bearings are set correctly. Also see that speeds, feeds and cutters are correct for the cut — sometimes a heavier chip per tooth will help.)

1. Remove screw from name plate at front of overarm and swing plate down on pin at opposite end. Remove lock key (11) from central collar (10) under plate. (See page 36).
2. While machine is running in cut, tighten or loosen, by rotational increments of $\frac{1}{4}$ turn, central screw (5), in overarm until chatter disappears. Replace lock key and name plate.

CAUTION — Never leave adjusting screw locked tightly against internal compression spring. Screw must, at all times, be free enough to be rotated a few turns in either direction.

To Adjust Arbor Support Bushings (See page 36)

Looseness, that would cause unevenness of finish, or

possibly chatter, would indicate necessity for bearing adjustment. An overly hot arbor would indicate too tight a bearing that should be relieved.

The bushing, mounted in a tapered bore, is closed around arbor journal as it is pulled into arbor support by a nut or screw.

1. Start machine, set highest spindle speed at gear shifter bracket and set reversing lever under speed dial in neutral (center) position. Place starting lever in stop position.
2. Rotate spindle and arbor by hand to feel torque required. Turn lock roller (29) until flat on roller faces arbor bushing adjusting nut (40). (See page 36) Tighten adjusting nut, while rotating spindle by hand, until a slight drag is felt as bushing is squeezed around shaft. Lock adjusting nut by rotating lock roller to engage a serration on nut.
3. Make certain that arbor reservoir contains sufficient oil.

DISMANTLING INSTRUCTIONS

Parenthetical Numbers refer to key numbers of parts list section

To Remove Pulley Bracket (4AJ-10) (See Figure 134C and pages 112, 46, 34)

1. Drain oil from column. Raise motor bracket and lift off V-belts. Break elbow unions in coolant pump lines, lift out inlet line (4AP-47) and turn discharge line (4AP-21) out.
2. Engage spindle starting lever and leave engaged until pulley bracket is returned to column. If 1st drive shaft is dismantled, make certain that clutch plates (4AC-302) are realigned and centrally located on friction disc (4AC-303) before engaging starting lever to clamp clutch. This precaution must be observed so driving disc flange (4AJ-32) will slip over tangs on clutch plates as pulley bracket is replaced into column.
3. Remove cotter key (4AC-294). Remove two taper pins (4AJ-11), six cap screws (25), support bracket with a crane, rap flange to break seal and pull it off clutch spring sleeve (4AC-295).

Clean the mating surfaces on bracket and column before assembling and paint with a sealing compound to prevent oil leaks. Grease sleeve gear bushing (31) before installing pulley bracket into column.

To Remove and Dismantle Feed Box (4AF-25) (See Figure 147A and pages, 22-33)

1. Remove cover (4AF-2) from top of feed box and pick out spring ring (4). (On vertical machines equipped with power feed to head it is necessary to first remove power feed worm box). Unscrew telescopic tube (60) from bracket (4AK-402) page 102, pick out vertical spline shaft (4AF-5) and wire telescopic tubes up close to feed box.

Push Vertical control shaft (4AF-11) with shaft (9) and lever (7) up out of feed box.

2. Unscrew $\frac{1}{2}$ " headless set screw from top center of feed box, insert an eyebolt and attach to a crane. Remove cap screws, pry straight out to clear two $\frac{1}{2}$ " double diameter pins and lay box face down on a bench.

Before replacing feed box on column, clean mating faces and paint with a sealing compound. Have spindle starting lever in engaged position, before placing box into column, so starting linkage will clear clutch feed control lever (4AF-161).

Line up clutch shifter shaft (108) with coupling

on drive from shifter bracket by rotating cams with a pry on gear teeth. Hold rapid traverse lever (4AS-20, page 12) in a horizontal position so it will engage rapid traverse coupling shaft (4AF-143).

3. Numbers 1, 2, 3, and 4 feed shafts can be removed from feed box independently of each other. To remove 5 shaft it is necessary to first remove number 4 shaft but to remove cam shafts all the other shafts must be out of the box. Remove hydraulic tubing and sealing plug (234,246) from left ends (rear view) of 2nd and 3rd shafts as well as sealing plugs (32, 34) from left side of box in line with cams if they are to be removed.

Remove set screws that lock right (viewed from rear) bearing sleeves in casting. Bearings on each end of shafts are factory set to allow a few thousandths end play of shafts.

1st Feed Shaft (4AF-222)

4. Remove cam drive driven gear (78). Remove set screws from feed shaft gear (215) and from over compound gear bushing (212). Unscrew capstan lock nut (209) and shoe type lock nut (233). Tap 1st feed shaft (222) to left, viewed from rear, approximately $\frac{3}{8}$ " to free safety drive clutch assembly (228) from shaft. Remove clutch assembly and tap shaft to right out of feed box.

Nut on safety clutch assembly is pulled up to allow 120 inch pounds of torque before it slips. The set screw hole in shaft under feed shaft gear (215) is drilled to allow running clearance between gear and side of box.

2nd Feed Shaft (4AF-242)

5. Remove clutch feed change bracket (96). Take out set screw from 2nd Feed Shaft Gear (239) and the two set screws that are angled into bearing sleeve (244). Tap shaft toward right out of feed box.

When assembled, there should be $\frac{1}{32}$ " clearance between 2nd shaft cluster gear (237) and 1st feed shaft gear (213). There should also be $\frac{1}{32}$ " clearance on sides of 3rd pinned gear as it lies between 2nd feed shaft gear (239) and cluster gear (237).

3rd Feed Shaft (4AF-254)

6. Remove set screw (140), pull idler stud (146)

and lift out idler gear (150). (Outer end of stud is tapped $\frac{3}{8}$ -16 as aid in removing). Remove set screw through pinned gear (251). Remove set screw that locks right sleeve (viewed from rear) in side of box. Tap shaft to right out of feed box.

4th Feed Shaft (4AF-258)

7. Extract spring ring and set screw and remove intermediate gear (316) from stem gear (320). Remove capstan type lock nut (276) from right end and tap shaft (258) to left out of box.

When assembling, make certain that inner face of thrust washer (268) engages splines of spline sleeve (269). Sides of sleeve gear (265) should be aligned with sides of safety gear (312).

5th Feed Shaft

8. Remove 4th feed shaft as above. Remove tubing from feed clutch cylinder (165) to clutch feed change bracket (96). Lift out feed clutch control lever (161) and feed clutch shifter pinion (160). Unhook tension spring (169). Loosen lock nut on wedge bolt (159) and tap nut to free bolt. Remove square headed taper pin (158) and slip out feed clutch piston (164).

When assembling, replace shifter pinion (160) so that control lever (161) lines up with scribe marks on box in both positions of piston (164).

Unscrew two set screws (124, 125) from left side of feed box. (When assembling, run screw (125) in far enough so that locking screw is approximately $\frac{1}{2}$ " below side face to get correct compression of spring Rapid Traverse rod.) Loosen lock nut on wedge bolt R.T. operating lever (133), tap nut to loosen bolt and remove coupling shaft (143) and lever (133). Remove straight pin through R.T. shifter fork (121) and slip R.T. shifter rod (120) out right side of box.

Remove four cap screws from bearing retainer (285) at left end of 5th shaft and use two $\frac{3}{8}$ " — 16 x 4" screws as jack screws to force retainer assembly out of box. Remove clutch (295), sliding spool (297), sliding clutch (298) and 5th feed shaft (299).

When assembling, it is easier to place 5th shaft bevel gear (313) on splines if vertical sleeve (16) with top bushing (17) are out of box. (Use a long bolt with a horse shoe washer to pull sleeve)

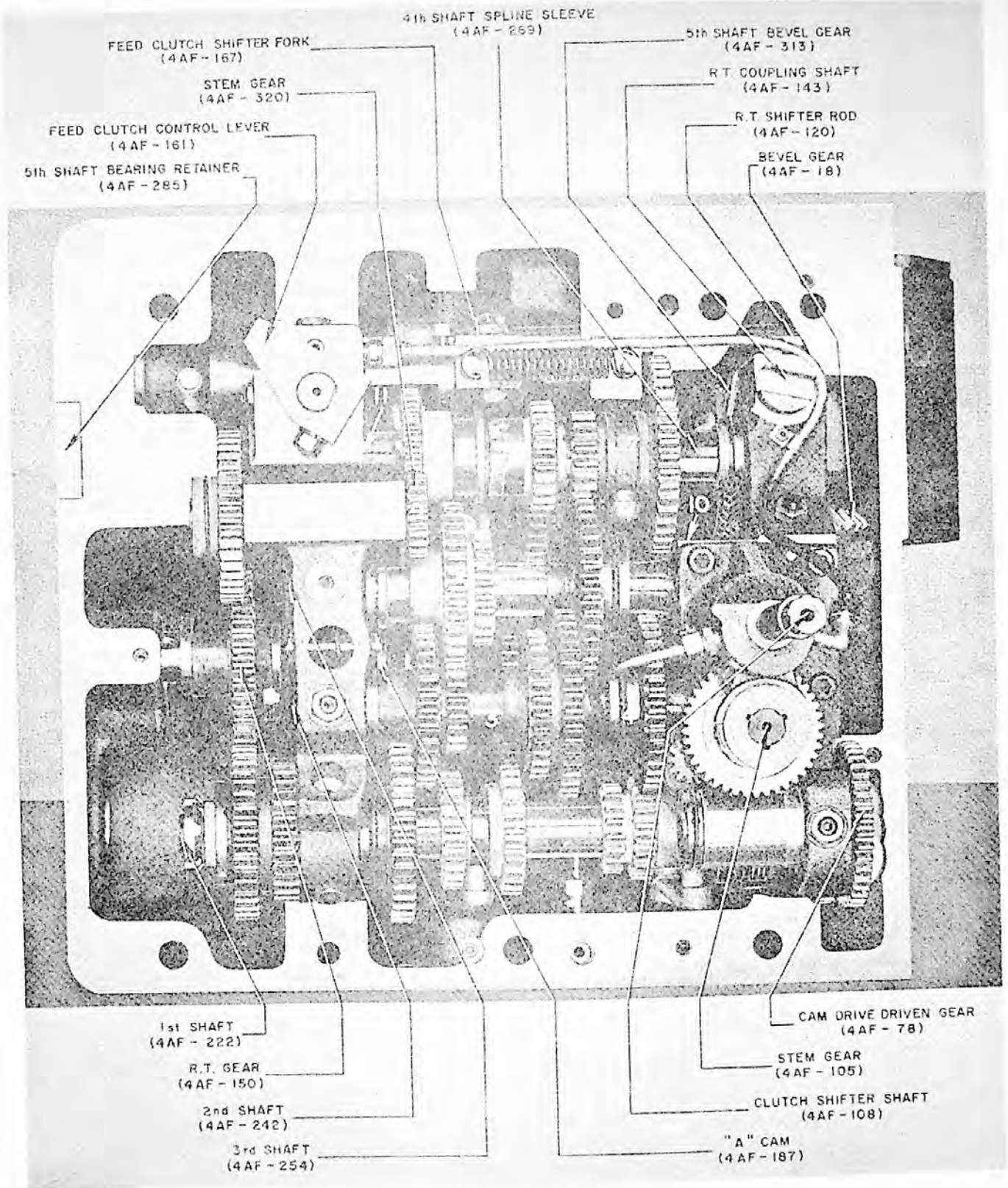


FIGURE 147A
Rear of Feed Box

Mesh marked teeth on bevel gears (18 and 313).

To remove safety gear (312) assembly, unscrew two set screws (33 and 34) that are 3- $\frac{3}{4}$ " from left side (front view), and pull out safety gear sleeve (302).

Feed Cams — A and B

9. Remove all shafts as above and remove telescopic tubing by unscrewing nut (61). Remove set screws (205 and 208) pull studs (199 and 202) and remove gear shifter levers (200 and 201). Studs are tapped $\frac{3}{8}$ " -16 as aid for removal and are eccentric to set 1st. shaft sliding gears correctly. Mark levers so they can be returned to their respective side.

Drive compound gear sleeve (212) with gear (213) out of feed box. (Sleeve locking screw (89) was removed when 1st. shaft was taken out). Remove top pin (76) from spring (193) to relieve tension on detent lever (192).

Loosen lock washers and nuts and unscrew threaded studs (29, 41) at left side (rear view) of box. Drive sealing plugs (32, 44) in line with cam shafts, into right side of box. Remove locking set screws and pull straight studs (190, 198) from right side of box. Stud for large cam "A" is locked by a set screw through face of feed box.

Cams "A" and "B" must be lifted out and inserted together. Installation is made easier if feed box is resting on left side (rear view). The single marked tooth of small cam "B" must be meshed between two marked teeth of gear on cam "A".

When assembling, start threaded stud, (41) with lock washer (194) and nut (195) on inner end, well into cam "B"; then drive straight stud (198) into right end. Continue screwing in on stud (41) until cam can be turned easily but has only a few thousandths end play. Tighten and lock nuts on each end of stud (41). Detent lever (192) must be free on its bushing (191).

Run threaded stud (29) into cam "A" until approximately $\frac{1}{2}$ " of stud protrudes from left side of box partition. Drive straight stud (190) into right side of box until it is about flush with side of box. Assemble 1st, 2nd, 3rd, 5th, 4th and 6th shafts into box and install studs into shifter levers (200 and 201) with enough stud protruding below box so they can be turned. Adjust A cam

with its end studs (29,190) and "B" cam with eccentric studs (199, 202).

Rotate cams with a pry, against bottom of box, on teeth of "A" cam gear until 1st shaft small sliding gear 1, in left position, meshes 2nd shaft cluster gear 3; 1st shaft large sliding gear 2, is neutral between gears of 2nd shaft cluster gear 3; 3rd shaft sliding gear 5, in left position, meshed with 2nd shaft cluster gear 3; 4th shaft gear 7, in right position, meshes with small gear 10 of 3rd feed shaft; 4th shaft sliding gear clutch 8, in right position, meshed with intermediate stem gear 9 — Figure 147A. (Box viewed from rear facing bottom).

Reverse direction of rotation of cams, by prying on teeth of "B" cam gear until gear 2, in right position, meshes 3; gear 1 neutral between 3 and 4; gear 5, in right position, meshes 3; gear 8 in left position, meshes 11; gear 7, in left position, meshes 6.

Rotate cams back and forth between the settings above. Set "A" cam by means of studs at each end so that gears 2, 5, and 7 move into neutral position simultaneously on first part of cam rotation, and as rotation continues gear 1 should be $\frac{1}{8}$ " engaged with gear 3 as gears 5, 7 and 8 are just starting to engage their respective gears.

On other gear changes the cams are cut and should be so set that engaged gear on 1st drive shaft is shifted to neutral on the first part of cam rotation and other gear on 1st shaft is moved to $\frac{1}{8}$ " engagement with 2nd shaft gears before any other gears are engaged. Each shift engages a new notch on ratchet at left end of "A" cam.

When gears are in neutral position they should be centrally located between the gears on either side. Rotate eccentric studs, on which 1st shaft gear shifter levers are mounted, to locate 1st shaft gears correctly.

Lock all studs and pins after correct setting is obtained.

CONVERSION CHART

(Based on 25.4mm = 1")

Inches into Millimeters

Inches	M/M	Inches	M/M	Inches	M/M	Inches	M/M	Inches	M/M
1/64	.0156	0.3969	49/64	.7656	19.4469	34	863.600	82	2082.80
1/32	.0313	0.7937	25/32	.7813	19.8437	35	889.000	83	2108.20
3/64	.0469	1.1906	51/64	.7969	20.2406	36	914.400	84	2133.60
1/16	.0625	1.5875	13/16	.8125	20.6375	37	939.800	85	2159.00
5/64	.0781	1.9844	53/64	.8281	21.0344	38	965.200	86	2184.40
3/32	.0938	2.3812	27/32	.8438	21.4312	39	990.600	87	2209.80
7/64	.1094	2.7781	55/64	.8594	21.8281	40	1016.00	88	2235.20
1/8	.1250	3.1750	7/8	.8750	22.2250	41	1041.40	89	2260.60
9/64	.1406	3.5719	57/64	.8906	22.6219	42	1066.80	90	2286.00
5/32	.1563	3.9687	29/32	.9063	23.0187	43	1092.20	91	2311.40
11/64	.1719	4.3656	59/64	.9219	23.4156	44	1117.60	92	2336.80
3/16	.1875	4.7625	15/16	.9375	23.8125	45	1143.00	93	2362.20
13/64	.2031	5.1594	61/64	.9531	24.2094	46	1168.40	94	2387.60
7/32	.2188	5.5562	31/32	.9688	24.6062	47	1193.80	95	2413.00
15/64	.2344	5.9531	63/64	.9844	25.0031	48	1219.20	96	2438.40
1/4	.2500	6.3500	1		25.4000	49	1244.60	97	2463.80
17/64	.2656	6.7469	2		50.8000	50	1270.00	98	2489.20
9/32	.2813	7.1437	3		76.2000	51	1295.40	99	2514.60
19/64	.2969	7.5406	4		101.6000	52	1320.80	100	2540.00
5/16	.3125	7.9375	5		127.0000	53	1346.20	101	2565.40
21/64	.3281	8.3344	6		152.4000	54	1371.60	102	2590.80
11/32	.3438	8.7312	7		177.8000	55	1397.00	103	2616.20
23/64	.3594	9.1281	8		203.2000	56	1422.00	104	2641.60
3/8	.3750	9.5250	9		228.6000	57	1447.80	105	2667.00
25/64	.3906	9.9219	10		254.0000	58	1473.20	106	2692.40
13/32	.4063	10.3187	11		279.4000	59	1498.60	107	2717.80
27/64	.4219	10.7156	12		304.8000	60	1524.00	108	2743.20
7/16	.4375	11.1125	13		330.2000	61	1549.40	109	2768.60
29/64	.4531	11.5094	14		355.6000	62	1574.80	110	2794.00
15/32	.4688	11.9062	15		381.0000	63	1600.20	111	2819.40
31/64	.4844	12.3031	16		406.4000	64	1625.60	112	2844.80
1/2	.5000	12.7000	17		431.8000	65	1651.00	113	2870.20
33/64	.5156	13.0969	18		457.2000	66	1676.40	114	2895.60
17/32	.5313	13.4937	19		482.6000	67	1701.80	115	2921.00
35/64	.5469	13.8906	20		508.0000	68	1727.20	116	2946.40
9/16	.5625	14.2875	21		533.4000	69	1752.60	117	2971.80
37/64	.5781	14.6844	22		558.8000	70	1778.00	118	2997.20
19/32	.5938	15.0812	23		584.2000	71	1803.40	119	3022.60
39/64	.6094	15.4781	24		609.6000	72	1828.80	120	3048.00
5/8	.6250	15.8750	25		635.0000	73	1854.20	121	3073.40
41/64	.6406	16.2719	26		660.4000	74	1879.60	122	3098.80
21/32	.6563	16.6687	27		685.8000	75	1905.00	123	3124.20
43/64	.6719	17.0656	28		711.2000	76	1930.40	124	3149.60
11/16	.6875	17.4625	29		736.6000	77	1955.80	125	3175.00
45/64	.7031	17.8594	30		762.0000	78	1981.20	126	3200.40
23/32	.7188	18.2562	31		787.4000	79	2006.60	127	3225.80
47/64	.7344	18.6531	32		812.8000	80	2032.00	128	3251.20
3/4	.7500	19.0500	33		838.2000	81	2057.40	129	3276.60

0.001" = .0254 mm

0.001 mm = 0.00004"

To Remove and Dismantle Gear Shifter Bracket (4AS-17) (See Figure 151A and pages 12-21)

1. Proceed as per paragraphs 1 and 2, page 145, under To Remove and Dismantle Feed Box.

After feed box is removed — pencil mark clutch shifter shaft (4AF-108) of feed box and speed dial clutch shaft (4AS-73) of shifter bracket in line so they can be reassembled to original setting.

After assembling, check table feeds and spindle speeds against dial readings. Locate highest and lowest feeds and speeds — they are next to each other — set machine on lowest and stop it. If speed or feed does not check with the dial reading, loosen capstan nuts that lock dials and turn dials to lowest reading. It is necessary to remove speed dial to adjust feed dial.

Remove four screws, pry off and lift upper speed and feed bracket (4AS-119) off vertical control shaft at top front of bracket.

2. Unscrew cap screws from shifter bracket and work it straight out from column until ½" tapped hole in top of feed box is out far enough to receive an eyebolt. Attach eyebolt to a crane and swing bracket away from column. Before assembling clean and seal mating surfaces.

3. The following units can be removed from shifter bracket without disturbing any others:

- (a) Clutch shifter piston (249) after clutch shifter lever (232) and plugs (241, 254) have been removed. (21 speed machines only.)
- (b) Secondary gear shifter piston (185) after removal of plugs (182, 191) and pin through secondary shifter (186).
- (c) Speed control shaft (143) after removing actuating lever (150), loosening lever (144) and unhooking spring (146). Lever (150) is clamped to shaft by a wedge bolt — loosen nut and tap to loosen bolt.
- (d) Feed drive control shaft (115) after removal of feed actuating lever (129) and clutch shifter lever (110).
- (e) Back gear shifter piston (248) after removal of shifter lever (224) as well as screw plugs (240, 245).

4. Loosen control link (144) and lift out speed clutch shaft (73). Remove plugs (193, 206, 207,

220), pins (200, 214) and slide out primary shifter pistons (198, 212). Mark pistons and sleeves (196, 203, 211, 217) so they can be returned to original positions. Cylinders (195, 204, 210, 218) are driven into bracket so oil inlet hole is aligned with hydraulic tubing fitting. (It is not necessary to remove these pistons to work on any other section of bracket.)

5. Remove all items listed in paragraph 3 above. Disconnect tubing K and L (Figure 151A), set screw (52), back off set screw (53) and remove shaft (50) and dial drive gear (54). (When assembling, bottom set screw (53) then back off ¼ turn to be sure gear (54) can turn on shaft.
6. Remove speed calculator (97), align four holes through feed (85) and speed (90) dial flanges so four cap screws (78) can be removed. Tap dial support bracket (77) assembly out of shifter bracket. Drive stud (55 or 57) into bracket and remove intermediate dial gear (59). (In 16 speed brackets the intermediate stud eccentric bushing allows for proper spacing of gears (54) and (59) before stud is driven home).

Disconnect all copper tubing. Remove it without bending to minimize difficulties when reassembling. Assembly of tubes is facilitated if they are connected in order A, B, C, D, E, etc. as labeled on Figure 151A. As each tube is connected the selector valve (174) should be rotated to make certain that it stays free.

Remove lead plugs (26, 30) and set screws (24, 25, 27, 29), that bear against flat on outer sleeve (170), from face of bracket. Remove set screws (134, 135, 135A) that lock R.H. (176) and L.H. (180) selector valve studs and remove studs. Insert a threaded rod mounted with a slidable weight and having a nut at outer end into studs to hammer them out. Remove plug (15) to reach L.H. stud. Lift out selector valve assembly. (Selector valve (174), bushing (173) and outer sleeve (170) are always furnished as a unit because outer sleeve is shrunk onto bushing before valve is lapped to bushing.)

When assembling, selector valve assembly is first unit inserted after removal of fitting (172) at hole "O" in outer sleeve (170) that is directly under key number (172). Insert selector valve R.H. stud (176) then L.H. Stud (180) and screws (24,27), sighting through "O" hole in outer

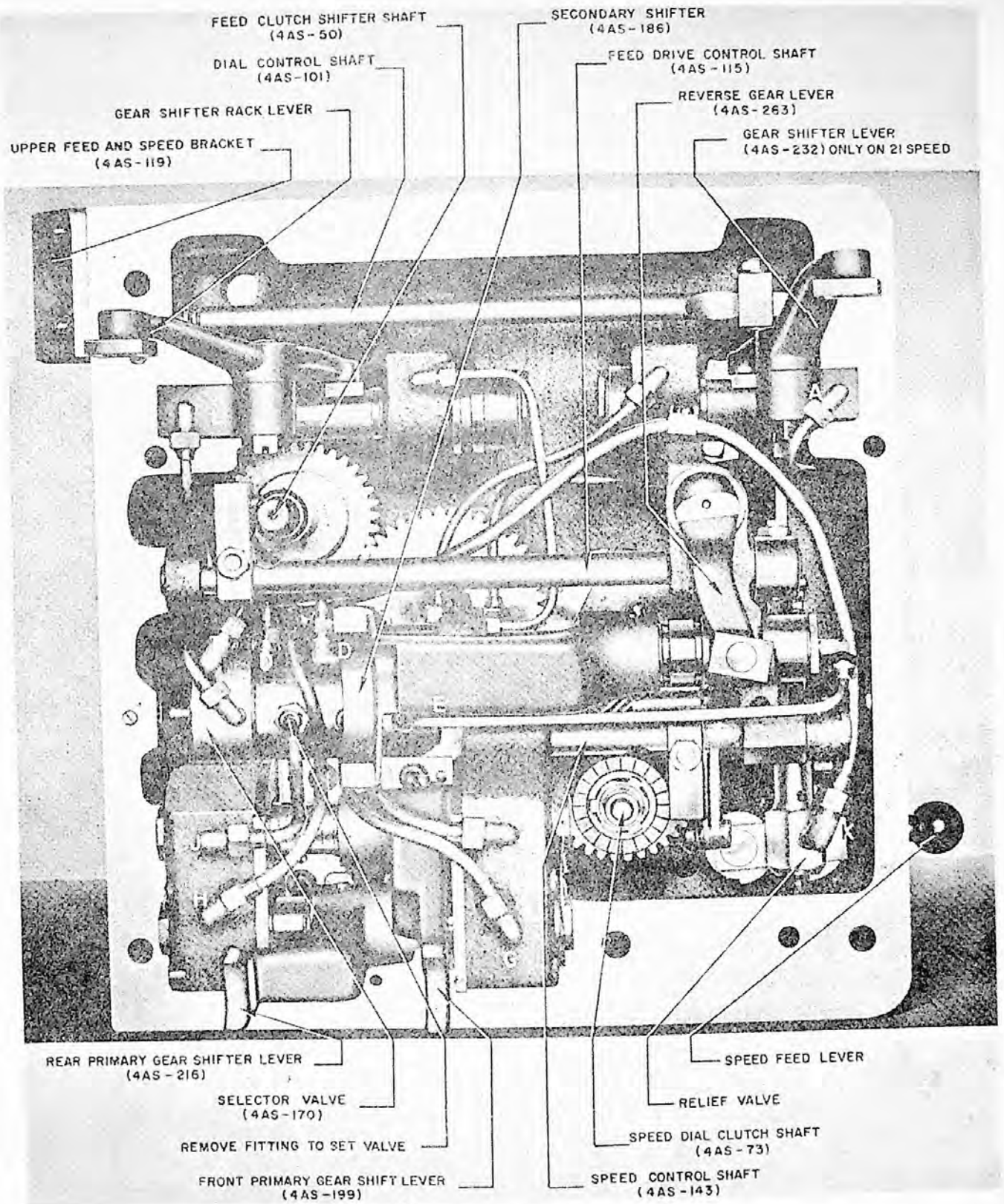


FIGURE 151A
Rear of Shifter Bracket

sleeve position selector valve so correct hole in valve is centrally located. (In 16 speed brackets the correct hole is middle one of three adjacent holes. In 21 speed brackets the correct hole is flanked on each side — about $\frac{1}{8}$ " away — by a wide groove.) Move valve lengthwise with studs and rotate it with set screws (24, 27) to attain alignment. At correct setting, a notch of detent wheel on selector valve should be fully engaged by detent lever (156). Allow $\frac{1}{32}$ " end play of valve on its studs then lock studs in place with set screws.

Spiral gear (63) must mesh perfectly with gear on selector valve and clutch (62) must rotate freely. If there is any tendency to bind, the shifting mechanism is liable to skip.

CAUTION

If the machine is set for a production job that maintains constant spindle speed for weeks at a time the shifter pistons and selector valve may freeze in their positions. To prevent such sticking, run machine through its full range of speeds — stopping dial momentarily at each speed — at least twice a week. Such a procedure consumes less than a minutes time but is a sure preventative of costly down time while shifter bracket is being repaired.

To Remove Starting Lever Shaft (4AC-112) (See page 38)

1. Proceed as per paragraphs 1 and 2, page 145, under To Remove Feed Box; as per paragraphs 1 and 2, page 150, under To Remove Shifter Bracket; as per instructions on page 145, under To Remove Pulley Bracket. Slide overarm back far enough to remove steel plate between ways at top of column — on horizontal machines. Remove steel plate (563) on vertical machines.
2. Rotate starting lever — to rear on horizontal machines, upward on vertical machines — until detent block (102 or 611) on starting lever shaft is free from detent lever (100 or 603). This position relieves spring pressure on block so valve shaft can be withdrawn easily.
3. On horizontal machines, lift off starting lever (78), unscrew $\frac{1}{2}$ " set screw (116) from $\frac{3}{4}$ " diameter plug (115) in left side of column, in line with starting valve shaft, and pull plug out of

column. Remove two set screws (71, 72) and tap bevel clutch gear (73) with bushing (70) up out of column.

On vertical machines, remove starting lever (625) and collar (608).

4. Screw a $\frac{1}{2}$ "-13 threaded rod, mounted with a slidable weight and having a nut on outer end, into starting valve shaft and hammer shaft out of column. Detent block (102 or 611) and detent lever (100 or 603) are keyed to shaft and it may be necessary to tap these off through opening as shaft is withdrawn.

Break lines and remove fittings from starting lever sleeve (111 or 593) before removing it. On horizontal machines sleeve is locked in place by two set screws (109, 110) while on vertical machines sleeve is held by two cap screws (594).

When assembling, tighten set screws (71, 109) that lock bevel gear bushing and valve sleeve respectively, only sufficiently to hold. Excessive tightening will cause a binding action.

To Remove Column Drive Shafts — Plain and Universal Machines (See Figures 153A and 154A and pages 44 through 55)

1. Proceed as per instructions on page 145, under To Remove Feed Box; as per instructions on page 150, under To Remove Shifter Bracket; as per instructions on page 145, under To Remove Pulley Bracket. It is best and safest to remove overarm before starting work on column gearing.

The 1st, 2nd and 4th drive shafts can be removed without disturbing any other shafts or linkage.

The 4th drive shaft must be out of column before 3rd or 5th shafts can be taken out and 5th shaft must be out of column before 6th shaft can be removed.

1st Drive Shaft (4AC-331)

2. Slip locking ring (290) from rear end of shaft, remove straight pin (296), unscrew sleeve outer nut (291) and clutch spring adjusting nut (292). Slip clutch spring (293), sleeve (295) and clutch assembly (300, 301, 303) off 1st drive shaft (331) and clutch spring rod (297).

When assembling, set spring adjusting nut (292)

so its outer face is approximately flush with end of clutch spring rod (297). Always align clutch plates and engage main clutch to hold plate alignment before putting pulley bracket in place.

3. Remove cotter pin (315) and lock pin (317), loosen clamping screw (321) and slide clutch finger carrier (322) and clutch spool (314) off shaft. Unscrew six flat head screws (323) and remove brake plates (325, 327) and disc hub (332).
5. Run saddle out on knee and knee down on column. Remove $\frac{1}{2}$ " set screw (343), screw a threaded bar, mounted with a slidable weight and having a nut on outer end, into sealing plug (342) and hammer it out of front of column. Remove lock nut (341) and first drive shaft (331) out rear of knee.

2nd Drive shaft (4AC-357)

Remove straight pins (353, 355) from cluster gears (351, 356) and remove lock nut (347) from rear of 2nd drive shaft (357). Screw a $\frac{3}{8}$ " threaded bar into rear end of shaft and tap it out front of column. Sealing plug (362) will be driven out of column with shaft.

4th Drive (Reverse) Shaft (4AC-396)

Remove lock nut (384) and adjusting nut (401) from each end of 4th drive shaft (396). Remove straight pin (392) from reverse shaft gear (393) and tap shaft out rear of machine. (On No. 2 size machine it is first necessary to drive shaft forward far enough to loosen gear (386) and remove it before driving out shaft.)

3rd Drive Shaft (4AC-371)

Remove 4th drive shaft as above. Release spring ring (368) and remove set screw (370) from stop collar (369). This collar prevents small gear (367) from engaging reverse gear (393) when small gear (367) has been shifted into its forward position on shaft.

Unscrew set screw, insert a $\frac{1}{2}$ " threaded rod — mounted with a slidable weight and having a nut on its outer end — into sealing plug (382) and hammer plug out of column face. Remove adjusting screw (364), screw a $\frac{5}{8}$ " threaded bar into forward end of drive shaft (371) and tap shaft out rear of column.

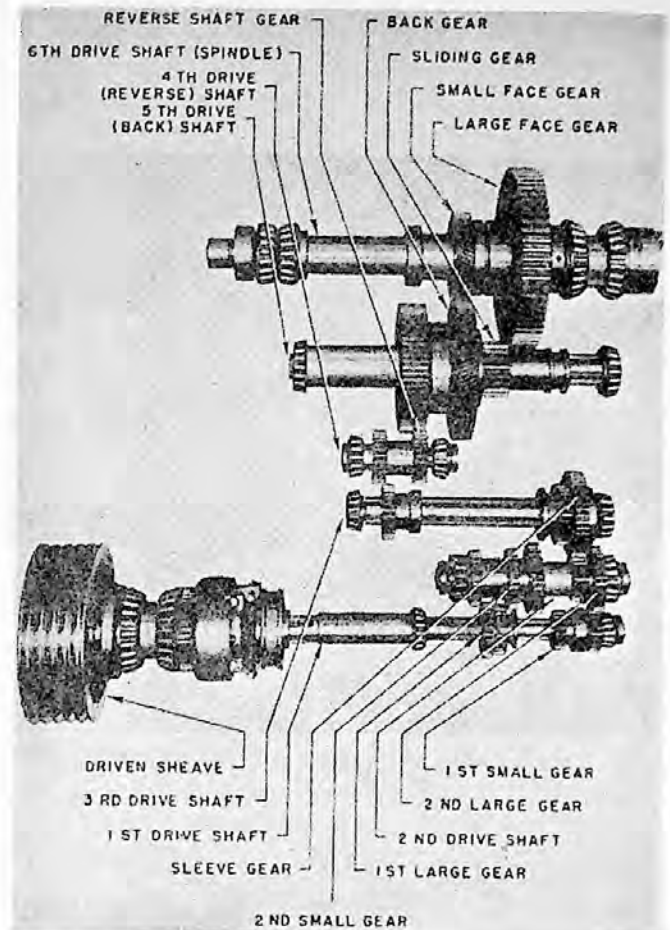


FIGURE 153A

Column Gearing — Medium Speed

5th Drive Shaft (4AC-416)

1. Remove 4th drive shaft as above. Remove clutch shifter link (120). Remove sealing plugs (403, 420) from rear and front faces of column. Loosen locking screw and remove adjusting nut (405) from rear end of shaft.
2. Tap 5th drive shaft (416) to rear until back gear (412) is against column rib. Place a steel bar or wedge between column and front face of large gear (409) and tap shaft forward slightly to free roller bearing hub (413) and spacer (410) from ends of shaft splines. Turn hub and spacer to align internal grooves with splines on shaft. Tap shaft to rear until roller bearing (411) is out of column rib. Tap front roller bearing cone (418) from shaft.

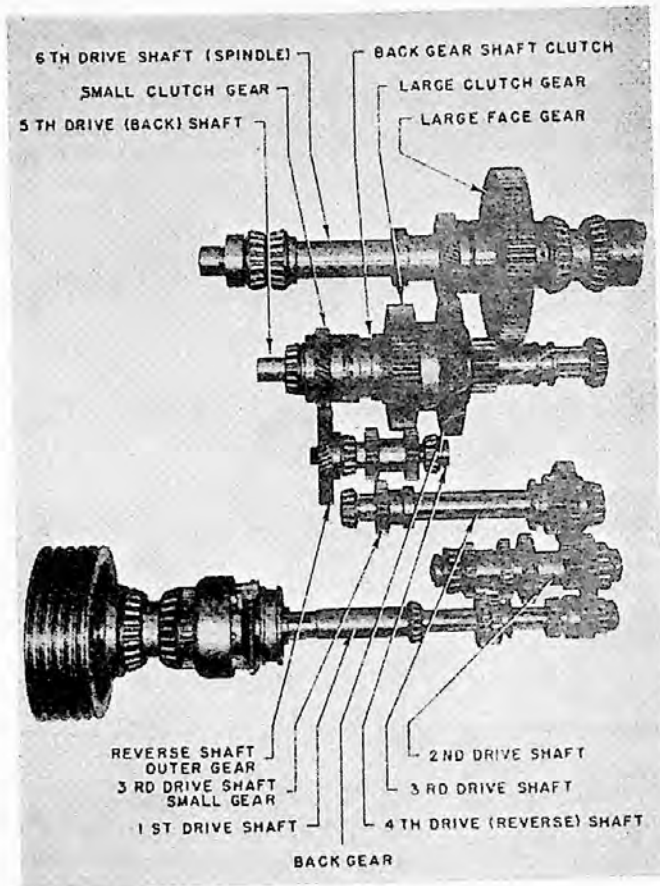


FIGURE 154
Column Gearing — High Speed

Using a brass rod, that will catch gears, etc., continue tapping shaft to rear and out of column. It is also necessary to align grooves in clutch sleeve (437), hub (423), etc., on a 21 speed machine as shaft is driven out.

6th Drive Shaft — Spindle (4AC-512)

1. Remove 5th drive shaft as above. Remove rear cover (496) and spindle front cap (522) from column. Remove two driving keys (516) and fasten a 1" x 24" steel bar into slots of spindle nose.
2. Loosen lock screws in three adjusting nuts on spindle (497, 500, 506) and tap screws to loosen lock shoes in nuts. Insert a socket wrench through pipe plug hole in left side of column to reach nut (506).

Unscrew rear (497) and center (500) adjusting nuts.

With socket wrench in place, rotate spindle with square bar in nose to unscrew nut (506). Tap spindle forward and back until bearing keys (511, 515) can be removed.

Continue to unscrew nut (506) until it puts pressure on large face gear (503) then rap gear smartly to rear to break it loose from taper on shaft. If gear is tight on spindle it may be necessary to clamp it between steel bars with the front bar against column. Using a brass bar drive spindle forward out of large gear. Finish unscrewing front nut from spindle, remove bearing key, and tap spindle out of column while supporting weight of large face gear (503). (It is always necessary to support weight of large gear while inserting or removing spindle).

**Feed Drive Shafts (4AC-271, 285);
Servo Control Valve (4AC-257)**

Proceed as per paragraphs 1 through 4, under 1st Drive Shaft above. It is necessary to remove rear part of 1st drive shaft to gain access to drive shafts and servo valve.

To Remove Column Drive shafts — Vertical Machines (see pages 56 through 65)

To remove 1st, 2nd, 3rd, 4th or 5th drive shafts proceed as per instructions on pages 152 through 154 for the same shafts on plain and universal machines.

The 6th (663) and 7th (687) shafts, spindle (693) and spindle spiral bevel gear (705) should be removed in the sequence given below.

Vertical Spindle

It is best to have table on machine when spindle is to be removed.

1. Remove lock ring (714) and lift off spindle dust cap (715). Remove bearing cover (717). Loosen lock screw — tap to loosen lock shoe under it — and remove adjusting nut (718). Remove top bearing key (719).
2. Move vertical head to its top most position and clamp. Remove front cover (552) and spindle cap (696). Place a wood block on table $\frac{1}{4}$ " under spindle nose.

Through front opening, loosen lock screw—tap to loosen lock shoe under it — and unscrew lock nut (707). Tap bearing cone (709) lightly and lift out bearing key (708).

3. Tap spindle (693) down onto wood block, lower knee and repeat until spindle is free of top-most bearing cone then lift cup and upper cone (720) out of head. Continue tapping down spindle until lower cone (720) has reached threaded portion of spindle. Tap grease retainer (698) down shaft until two $\frac{3}{8}$ " x $\frac{5}{8}$ " x $\frac{3}{4}$ " steel blocks can be placed between bearing cone and grease retainer (698). Spindle can now be driven out of bearing cone and key (721) will drop onto grease retainer (698). (If cone and retainer are not separated to release this key, it would be forced into top threads on shaft.)

Lightly punch mark a spline of spindle and a corresponding keyway in bevel gear (705) so spindle can be reassembled in its original relation. Continue dropping knee and tapping down spindle until spindle is free of lower bearings. Support spindle, drop knee to lowest position, run saddle fully forward and remove spindle from head.

Vertical Head (Hydraulic Counterweight) (4AC-548)

1. Move vertical head to lowest position, make cer-

tain that hydraulic pressure is off and remove lock nut (524) from hydraulic counterweight piston (525). Remove turret stop (4AAR-11, page 120) from right side of head and raise head sufficiently to clear counterweight piston (4AC-525).

2. Screw two $\frac{3}{8}$ " eyebolts into top of head and suspend from a crane. Loosen lock nuts and remove three head type gibs (564, 574, 575) from between column and vertical head. Remove cap screws and lift off right (576) and left (578) head guides. (Mark gibs and guides as they are removed so they can be returned to original positions.) Raise vertical head and pull it straight out from column.

Vertical Head (Lead Counterweighted) (Early Machines)

Remove cover from column over counterweight. Lower vertical head until two 2" x 4" wood blocks 6" long can be placed on edge under lead weights. Raise head until there is sufficient slack in counterweight chains to remove pins through chains at top of weights. (A wood block should be on table under the clamped vertical head.) Lay chains down front of head.

Drive taper pins from chain sprockets and tap sprocket shaft out of head. Remove pins, insert $\frac{3}{8}$ " eyebolts into top of weights and lift them out of column. Counterweights in No. 2 machine weigh 160 lbs., while in Nos. 3 and 4 machines, they weigh 192 lbs.

Counterweights can be left blocked up in column if vertical head only is to be removed. However, if Nos. 6 and 7 drive shafts are to be removed, it will be necessary to remove counterweights from column.

Spindle Spiral Bevel Gear (4AC-705) (See Figure 156A and page 64)

1. Remove sheet metal guard (547) from around gear. Remove bearing cap (542) and lift off bevel gear (705) assembly.
2. To remove bearing cone (702) from bevel gear, heat them in oil and chill gear. Bearing is shrunk onto gear shank.

Etched on face of each bevel gear is the dimension from gear cone apex to thrust surface on back of gear.

If bearings are good and only gears are to be changed, the difference between etched dimensions on old and

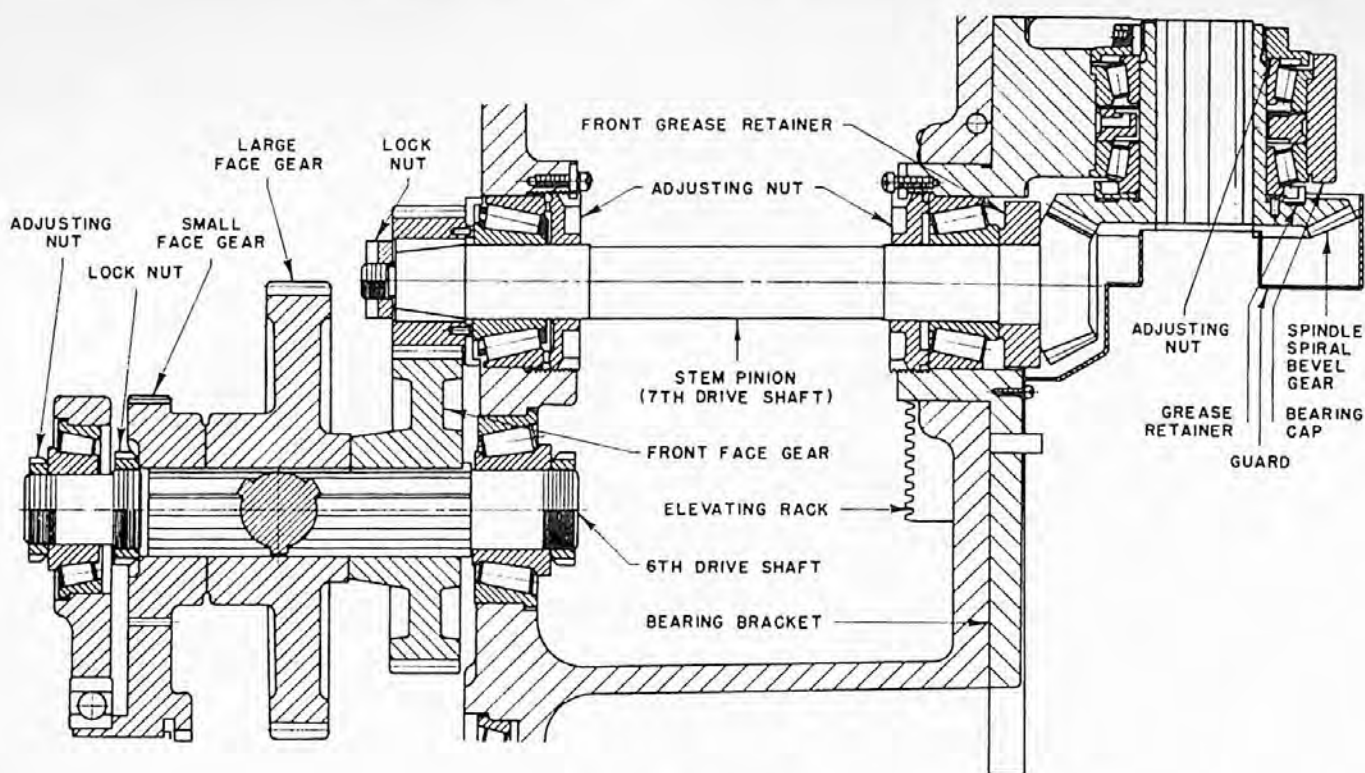


FIGURE 156A
Vertical Spindle Drive

new gears gives the amount in thousandths of an inch that thickness of grease retainer must be varied to establish the gear cone apex on centerline of stem pinion (687) — No. 7 shaft. Measure thickness of original grease retainer (704), add or subtract the difference between etched dimensions and grind new retainer to resulting figure.

If both bearings and gears have to be replaced by new ones, it will be necessary to obtain a second dimension differential. Assemble original bearings with grease distributor (702) between them and clamp together with a bolt through a steel strip over each cone. Place assembled bearings into bearing cap and bolt cap to bevel gear bearing (534).

Raise knee to topmost position and have table directly under head. (Table will be approximately 15" under bevel gear cones.) If necessary, build up on table until an inside micrometer will measure the vertical distance to bottom of lower bearing cone and record this dimension. Assemble new bearings in a similar manner to above, fasten them in bearing (534) and check the height to lower bearing cone from the same

spot on table or blocks. (Figure 157A) The difference between these measurements gives a figure that must be added to or subtracted from thickness of old grease retainer to compensate for any variation in bearing setting to maintain apex of bevel gear cone on centerline of number 7 shaft.

The differential between the differences of etched dimension on gears and measured heights to bearing cones, when added to or subtracted from original grease retainer thickness will give required thickness of new retainer according to the formula:

$$B' = B + X = \text{Thickness of new grease retainer}$$

Where:

$$X = (A - A') - (C - C') = \text{differential}$$

A = etched dimension on original gear

A' = etched dimension on new gear

B = Thickness of original grease retainer

B' = Thickness of new grease retainer

C = Height to bottom of old bearing cone

C' = Height to bottom of new bearing cone

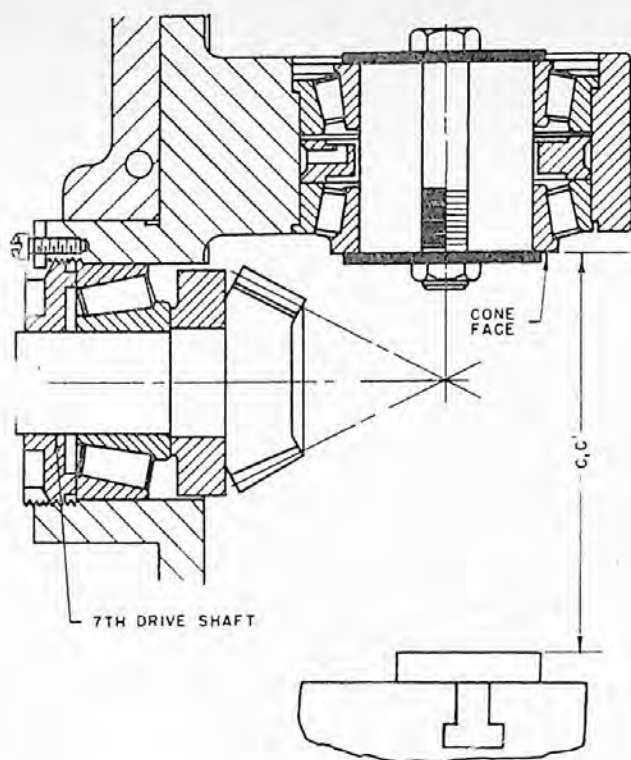


FIGURE 157A
Establishing Gear Apex Centerlines

When C' is greater than C , the difference must be added to B .

When A' is greater than A , the difference must be subtracted from B , and vice versa.

Stem Pinion (7th Drive Shaft) (4AC-687)

1. Crayon mark adjusting nuts (674, 681) on stem pinion (687) and inside of column face to record original pinion setting. Also record distance from front face of column to front face of bevel stem pinion.
2. Remove top covers (561, 563) from column. Unscrew castellated nut (668) from rear end of 7th drive shaft (687). Remove locks and unscrew adjusting nuts (674, 681) from each end of shaft. Using a brass bar thru rear opening drive 7th shaft out front of machine.

When assembling, the pinion setting will vary according to gear setting. Make certain that marked tooth on pinion engages marked valley on gear. Make an approximate setting by aligning backs of gears, lightly

red lead gears and rotate them in mesh. If loading is heavy at back of gears — move pinion back and lower gear; if loading is heavy at front of gears — raise gear and move pinion forward. The line of contact between tooth faces should be all along the pitch line with heaviest contact at center of tooth.

6th Drive Shaft (4AC-663)

1. Remove 5th drive shaft per instructions on page 153.
2. Remove set screw, insert a $\frac{3}{8}$ " threaded rod — mounted with a slidible weight and having a nut on outer end — into $5\frac{1}{2}$ " diameter sealing plug at rear of column and hammer it out of column. Through this opening unscrew lock nut (653).
3. On No. 2 machine, partially unscrew lock nut (658) immediately behind small face gear (660) after releasing tang on lock washer (659). On Nos. 3 and 4 machines, because nut enters a recess in small face gear it is necessary to shear tang off lock washer. Place a bar against groove of capstan nut and hammer nut counter-clockwise until it is partially unscrewed.

Tap drive shaft forward, unscrew lock nut (658), continue tapping it forward into column and lift it out through hole of 7th drive shaft. On Nos. 3 and 4 machines especially it is necessary to support large face gear (661) in order to slide shaft out of column.

When assembling this shaft, it is necessary to place gears on splines, lock them together with nuts (658 and 667) and cinch tang on lock washer (659) before placing rear bearing cone (656) on end of shaft.

Feed Drive Shafts (4AC-271, 285); Servo Control Valve (4AC-257)

Proceed as per paragraphs 1 through 4, under 1st Drive Shaft on page 152. It is necessary to remove rear part of 1st drive shaft to gain access to drive shafts and servo valve.

To Remove Column Hydraulic Oil Pump (4AC-243) (See page 44)

The hydraulic pump is located inside column at right rear.

1. Proceed as per instructions on page 152, under To Remove Column Drive Shafts in paragraphs 1 through 4 on No. 2 machine and in paragraphs 1 through 5 on Nos. 3 and 4 machines.
2. Disconnect inlet line at pump and discharge line on opposite side of column. Unscrew two cap screws (249) and tap pump bracket into column.

When assembling, make certain that pump driving gear is properly meshed before cap screws are cinched up.

To Remove Cross Screw (4AK-98) (See page 92)

1. Remove screw (78) and slip off handwheel assembly (79, 80). Take out screws (84) and (82) and slip off retaining bushing (81) and dial (85). Take out headless set screw (87), taper pin (89) and slip off knockout collar (86) and shaft clutch (88). Slide cross feed clutch (90) off key — or if necessary force it off with two $\frac{3}{8}$ " screws through tapped holes.
2. Take out two set screws (117, 116) and remove right hand spanner type bearing retainer nut (91). Replace and pin shaft clutch (88). Using handwheel (79) turn cross screw counter-clockwise and remove it from knee. Screw may be hard to move until front bearings are free.

When assembling cross screw, have saddle in position at front of knee. Run screw part way into knee, place cross screw coupling on splines and continue rotating screw until coupling engages splines of cross feed shaft (235). Make certain that spacer (101) is on shaft.

To Remove Cross Screw Nut Bracket (Under Saddle) (4AK-110) (See page 92)

1. Remove cross screw per instructions directly above.
2. Unscrew two hexagon head screws (4AH383, 384 — page 82) and tap nut bracket (4AK-110) into drain compartment. Push saddle toward column to remove nut bracket.

When assembling, leave screws (4AH-383, 384) slightly loose until saddle has been run fully forward and back. Cinch down these two screws while rotating cross screw to insure central location of nut on cross screw.

To Remove Table and Lead Screw (4AH-1 and 51) (See page 72)

1. Remove rear apron cover (64). Loosen lock screw — tap to loosen lock shoe under it — and remove lock nut (63). Remove four screws (56), rap apron (57) to break sealed joint and slide apron with bearings, off lead screw.
2. Remove slotted center screw and slip ball crank (40, 41) with spring (42) from left end of lead screw. Remove two slotted screws from opposite sides of dial (45), drive out taper pins (29, 31) and slip off dog clutch (43), dial (45) and dial clutch (46). Remove four screws, rap apron (50) to break sealed joint and slide apron with its needle bearing (48) off screw. (This apron could be left on table as lead screw will enter it easily when assembling.)
3. Run feed screw (51) either by hand or power, out of nut (170) in saddle (349) [housing (106) in universal machines] from left to right. Support lead screw as it is removed.

If machine is equipped with a backlash eliminator it is necessary to remove table before lead screw. When assembling, always have lead screw in place in backlash nuts (173, 174) before sliding table into place. Backlash nuts must be correctly aligned and held in place as lead screw enters them.

4. Loosen lock nut and remove head type gib (194) by unscrewing gib adjusting screw (196). If gib setting had been correct it would facilitate assembly to pencil mark gib at edge of table before removing it.

Fasten an eye clamp to center slot of table, relieve weight of table with a crane and slide it either right or left out of V-ways. Entire length of table must be supported as it is removed if no crane is available.

When assembling, run lead screw into place from right to left until end of screw projects $3\frac{1}{8}$ " from outer face of right apron.

To Remove and Dismantle Plain Saddle (4AH-349) (See page 82)

1. Proceed as per instructions on page 158 under to Remove Cross Screw and Cross Screw Nut Bracket. (The table can be removed with saddle or can be removed first.)

Drive out taper pin and remove control lever (4AK-19, page 90). The top of this lever would be struck as saddle is slid off knee.

Remove two set screws (4AH-379, 380—page 82) and pull spline shaft cover (4AK-517) from bracket. It is not necessary to remove this cover except as it will aid in aligning splines of long spline shaft (4AK-182) with key ways in level gear (4AH-369) when assembling.

Remove four wipers (4AH-266, 269, 293, 288 — page 80) from over knee ways.

3. Remove three headless type gibs (295, marked LL; 296, marked CL; 290, unmarked) from front of saddle. If gib settings had been correct it would be wise to pencil mark the gibs before removed to aid resetting when assembling.

Always adjust center gib (296) before lower gibs.

4. Support saddle with a crane sling so it is balanced and slide it off knee. If table had been removed a rope sling over a 1" steel bar through drive gears and lead screw nut can be used to support saddle.

The horizontal control shafts (4AH-252, 258) will slip out of control shaft sleeves (257, 263) as saddle is removed. By removing spring rings (4AK-244, 378 — pages 98, 102) and unscrewing internal nuts (4AK-243, 379) to break couplings at column ends the control shafts can be slipped into sleeves and removed with saddle.

Drive out taper pins from control shaft levers (4AH-307, 282 page 80) and tap sleeves (257, 263) out back of saddle. The sleeves are interchangeable but only the quadrant at front of rapid traverse sleeve (right side) engages a plunger (4AH-469, page 86). This plunger should project approximately $\frac{1}{16}$ " above face of saddle when rapid traverse is in neutral and approximately $\frac{5}{8}$ " when rapid traverse is engaged.

5. If backlash eliminator (page 88) is removed it should be reassembled as follows:

Insert rack (520) so its end projects $\frac{1}{4}$ " to $\frac{5}{8}$ "

from front face of saddle. Engage crown gear (512) with rack (520) and clamp gear so it holds rack fixed. Insert spring, bottom the spring cage (522) against shoulder on rack then back off 1 to $1\frac{1}{2}$ turns. Bottom the bushing stop (523) against spring cage then back off $2\frac{3}{4}$ to 3 turns. The end of $\frac{3}{8}$ " lock screw (524) will be almost flush with end of bushing stop when in place. This setting will allow 3 to 5 turns of knob (526) when changing from backlash on to backlash off.

6. Clutch (346) should be centrally located when in neutral position and should not bottom against either bevel gear when shifted into engagement.

To remove detent lever (456), loosen set screw (480), drill a hole through plug (455) and with a bar through this hole drive eccentric stud (457) down out of saddle.

7. Remove two dowel screws (381), two cap screws (382), tap saddle bracket (370) to break seal and lift it off.

To Remove Drive to Knee Bracket (4AK-402) (See page 102)

1. Remove cover (4AF-2, page 22), spring ring (4) and lift out vertical spline shaft (5). Unscrew small telescopic tube 60, collapse and wire tubes up to feed box.

2. Unscrew telescopic tube (4AK-422, page 102) from base, collapse and wire tubes to bracket (402).

Remove two hexagon head taper pins (398), four cap screws (399), tap bracket (402) to break seal and lift it off right rear of knee.

Before assembling, clean mating surfaces and paint with a sealing compound.

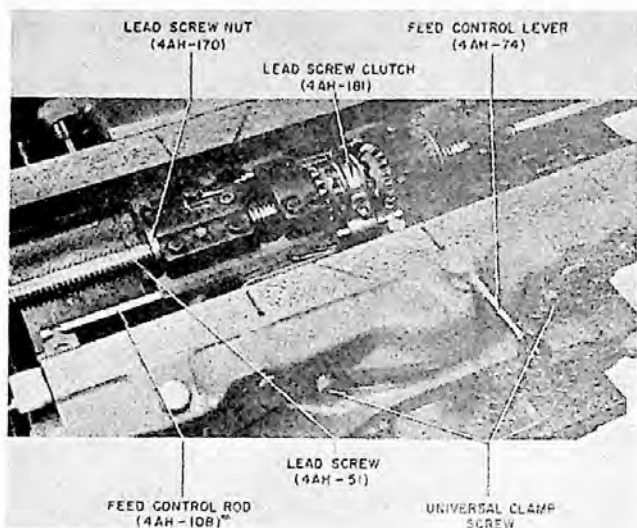


FIGURE 160A
Universal Housing on Saddle

To Remove Universal Housing (4AH-106 and Saddle (4AH-220)

(See Figures 160A, 160B and pages 74, 78)

1. Proceed as per instructions on page 158, under To Remove Table.

Remove two clamps screws (4AH-185) from rear and two clamp screws (213) from front of saddle and pull out rear (186) and front (212) wedges.

2. Place a steel bar through lead screw nut and bevel driving gears at top of housing. With a rope sling around bar hoist housing straight up off wedge bolts (211) in saddle.

When assembling it is necessary that housing be aligned exactly with saddle before it is lowered into place. Clearance between wedge bolts and bores in housing is .003". Center boss on saddle is a nice slip fit in housing bore.

3. Proceed as per instructions in items 1, 2, 3 and 4 under to Remove and Dismantle Plain Saddle above, page 159. The universal saddle with housing and table in position can be removed as a unit in a similar manner.

To Remove Knee (4AK-16)

1. Proceed as per instructions on page 158, under To Remove Cross Screw; on page 158 under To

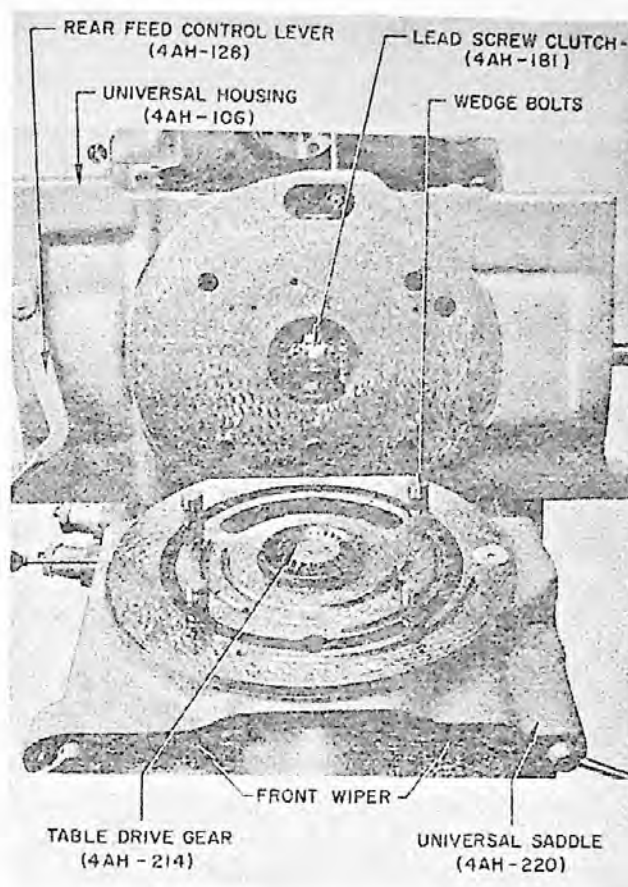


FIGURE 160B
Universal Housing and Saddle

Remove Cross Screw Nut Bracket; on page 159, under To Remove Drive to Knee Bracket.

Remove four screws, tap to free upper feed and speed bracket (4AS-119, page 17) with its two taper pins from front of shifter bracket, then lift it and vertical control shaft (4AS-124) out of vertical pinion (4AK-228, page 99) on left rear of knee.

2. Remove two headless type gibs (4AK-368, 387 — page 103) from right rear of knee — one at top and one at bottom. If setting had been correct it would be well to mark gibs before removing so they can be returned to original settings.

Loosen and remove knee clamp screw (4AK-185) from knee.

3. Run Knee up near its top position. With a long T handle on a 1/4" Allen wrench remove three screws (4AK-471) to drop outer telescopic tubes

and three screws (469) to drop inner telescopic tubes.

With saddle forward on knee remove flat head screws (449), rap cover (450) smartly and pick it off knee. Loosen set screw (453) and remove lock nut (454). Place a rope sling around table, saddle or knee and with a crane hoist knee up off elevating screw.

Remove two screws (4AK-164) from right rear of knee and four screws (4AK-389) from knee guide (370) and tap guide away from knee. Handle guide carefully to prevent breakage at clamping saw slots. Swing knee to left and forward off column.

When assembling, make certain that the guide key is fully engaged in way at back of knee before cinching down screws. The two shorter screws are screwed into the top of guide. (On early machines a short screw was used in line with knee pump eccentric gear to prevent any chance of locking this gear).

4. If knee is to be dismantled it is most easily handled if table and saddle are removed before knee is taken off column. It also simplifies assembly if elevating nut (4AK-483, page 107) with screw (482) and telescopic tubes are left attached to knee until knee is taken off column. It is then a simple matter to remove or replace elevating nut and screw.

With knee near mid position remove screw (480), tap around bottom telescopic tube to break seal, raise and block up outer telescopic tubes. Remove two screws (484), block up under knee, put a strain on elevating crank and rap base of elevating nut (483) to break seal until elevating nut rises from base. Run elevating nut partially up into knee and proceed to remove knee from column as described above.

To Remove Elevating Screw and Nut (4AK-482, 483) (See page 107)

1. Raise knee to within approximately 2" of its top-most position and place a block under knee.

Remove screw (480), tap around bottom telescopic tube to break seal, raise and block outer telescopic tubes. Remove two screws (484), put a strain on elevating crank and rap base of elevating nut (483) until nut rises from base. Drop

outer telescopic tubes back onto elevating nut.

2. With a long T handled Allen wrench remove $\frac{1}{4}$ " screws from flange (470) and plate (468) to release outer and inner telescopic tubes from knee. Raise elevating nut up into knee with elevating crank.
3. Remove vertical shaft cover (450) from top of knee, loosen screw (453) and remove capstan type nut (454) from top of elevating screw (482). Hold elevating nut and with a brass bar tap elevating screw down out of knee.

To Remove Rear Control Bracket (4AK-336) (See page 101)

1. Drill a small hole through expansion plug (360) and pull it from miter gear bushing (361). With a brass rod tap cross feed hand control shaft out right side of knee with bushing (365) and sealing plug (366). Paint plug with a sealing compound when assembling.
2. Remove two hexagon head taper pins (346), four cap screws (347), tap flange to break seal and pull bracket (336) assembly from knee.

To Remove Cross Feed Trip Bracket (4AK-432) (See page 105)

Remove four cap screws, tap around flange to break seal and pull cross feed trip bracket with two taper pins away from left side of knee.

To Remove Front Elevating Shaft (4AK-144) (See page 95)

1. Remove four cap screws, tap around flange to break seal and pull off cross feed trip bracket (4AK-432).
2. Unscrew $\frac{1}{2}$ " x $2\text{-}\frac{3}{4}$ " set screw (4AK-147) from left side of knee. Remove cotter key (150), straight pin (151), and slide brake spool (158) toward rear of elevating shaft (144). Extract pin (156), open up and lift brake (155) off shaft. When assembling brake onto shaft make certain that set screw engaging slot is down.
3. Remove crank (119) from shaft. Remove set screw (121) and slip bushing (120), spring and dial (125) from shaft. Drive out taper pin (126) and remove elevating clutch (127). Screw two $\frac{3}{8}$ " jack screws through dial clutch to force it off key shaft.

- Remove two set screws (152, 153) from left side of knee and unscrew adjusting nut (137). Screw a $\frac{3}{8}$ " rod, mounted with a slideable weight and having a nut on its outer end, into end of elevating shaft and hammer shaft out of knee.

To Remove Knee Lubricating Oil Pump (4AK-200) (See page 97)

Remove side cover (173). Remove three cap screws (202) through cap and pump body. Tap or turn pump body (200) to break seal; then through side opening, pry pump assembly down out of knee.

To Remove Vertical Screw Bevel Gear (4AK-462) (See page 107)

- Proceed as per paragraphs 1 through 4 on page 160, under To Remove Saddle.
- Remove flat head screws from circular plate (450) and rap it smartly to lift from knee.
Run knee to a low position, loosen lock screw and unscrew elevating screw nut (454). With a crane lift knee until key in elevating screw is clear of bevel gear. Block up under knee.
- Remove set screw (4AK-165) from right side of knee and unscrew adjusting nut (452). Remove set screw (162) and brass plug (163) from left side of knee and remove roller bearing retainer (459) assembly.

To Remove Long Spline Shaft (4AK-182) (See page 97)

- Proceed as per instructions on page 160, under To Remove Knee and place knee on a bench in an upright position.
- Screw a $\frac{1}{2}$ " threaded rod, mounted with a slideable weight and having a nut on outer end, into sealing plug (170) at back of knee and hammer out plug.

Remove set screws (179, 180) from eccentric gear (178). Remove lock nut (169) and tap long spline shaft forward out of knee.

When assembling, have inner roller bearing oil seal (175) in knee before spline shaft is inserted. Outer seal (174) should be tapped into place after shaft is installed.

To Remove Vertical and Cross Feed Shifter Rods (4AK-27, 36) (See page 91)

- Proceed as per instructions on page 160, under To Remove Knee; on page 161, under To Remove Rear Control Bracket.
- Remove feed control cross cover (76) from knee. Unhook detent springs (48, 51). Drive out taper pin (11) and tap cross feed shifter shaft (20) down out of knee.
Unscrew set screw (30) and pull bevel gear (9) assembly from left front of knee. Drive out taper pin (41), remove detent (40) and tap vertical feed shifter shaft (13) up out of knee.
- Through rear opening loosen nuts (22, 31) and tap them to loosen lock pins (24, 33) so forks (28) and (37) can be slid off rods. Screw a $\frac{3}{8}$ " threaded rod, mounted with a slidable weight, and having a nut on outer end, into sealing plugs (25, 35) and hammer them out of knee. Vertical and cross feed shifter rods (27, 36) can now be slid out front of knee after knock-out crank stems (56, 73) have been lifted out.

To Remove Cross Feed Shaft (4AK-235) (See page 99)

- Proceed as per instruction on page 162, under To Remove Vertical and Cross Feed Shifter Rods but leave cross feed shifter rod and fork in position; on page 162, under To Remove Long Spline Shaft.
- Remove two lock screws (203) from back of knee. Drill and tap ($\frac{1}{4}$ - 20 hole) the bronze shaft bearing (205), screw in threaded rod mounted with a slidable weight and having a nut on outer end, and hammer bearing out of knee. Tap steel plug (204) from this bearing before assembling so key (234) in feed shaft can be sighted and guided through keyway thrust collars (210, 213) and clutch sleeve (212).
- Extract two set screws (4AK-114, 115) from right side of knee that lock felt retainer sleeve (113) in place. Tap cross feed shaft (235) forward into knee. Coupling (111), washer (112) and sleeve (113) will be driven out ahead of shaft. Gears, clutch, etc., can be lifted out of knee. Remove cross feed shifter rod (36) and fork (37).
- Remove lock screws (218, 282). Screw a $\frac{1}{2}$ " threaded bar mounted with a slideable weight and

having a nut on outer end, into feed shafts (220, 284) and hammer them out of knee.

To Remove Elevating Stem Bevel Gear (4AK-250) (See page 99)

1. Proceed as per instructions on page 162, under To Remove Cross Feed Shaft.

2. Remove lock (266), unscrew bearing lock nut (280) and tap elevating stem bevel gear (250) assembly out the back of knee.

When assembling have this shaft and clutch assembly in position before engaging shifter fork (4AK-28).

MAINTENANCE HINTS

1. Make certain that all stations are kept properly lubricated in accordance with lubricating instructions.
2. Keep your machine as clean as possible: it pays. Use a brush to remove chips rather than compressed air. An air blast may drive dirt into bearings to cause needless wear. Also, flying chips can be dangerous to fellow workers.
3. Safety dogs are provided to disengage power drive to all sliding units. DO NOT remove these dogs in an effort to obtain more travel. Serious damage to the machine may result if a unit is being power driven when it strikes another unit.
4. Be certain there is a pumpable quantity of coolant in reservoir before engaging coolant pump gear. Always disengage (pull out) this gear if machine is to be run without coolant.
5. The electrical compartment door should never be opened except by an experienced electrician.
6. Manual handwheels and cranks are provided with springs and positive knockouts to disengage dog clutches during power feed. DO NOT tamper with disengaging mechanisms in order to keep a handwheel in engagement, as it may result in serious injury to operator or fellow worker.
7. DO NOT try to reverse the direction of spindle rotation while it is in motion.
8. Check oil supply in arbor support before using. When storing away, invert arbor support and place on a non-metallic surface. If stored, or placed on back of overarm, in an upright position, the oil in reservoir continues to seep out.

Below in capital letters are listed problems that may be encountered. Under each are listed — in italics — probable causes and, below, the corrections.

LOW HYDRAULIC OIL PRESSURE

— a —

Oil level too low.

Fill and maintain oil level.

— b —

Incorrect relief valve setting in column.

See instructions on page 142 and adjust pressure to 300 to 325 psi for machines equipped with servo valve for shifting main drive clutch (starter lever tipped with black balls) and 290 to 310 psi for older machines without servo-valve.

— c —

Clogged suction line strainer.

Drain column, remove pulley bracket per instructions on page 145, clean strainer and replace.

— d —

Worn pump gears or broken housing.

Remove pump per instructions on page 158, and renew necessary parts.

— e —

Relief valve in column is sticking or relief valve spring is broken.

See instructions on page 152 and remove starting lever sleeve (4AK-111). Relief valve and spring are accessible after locking and adjusting screws are removed. After reassembling, adjust column hydraulic pressure.

FEED OR SPEED VARIATION FROM ACTUAL DIAL READING

— a —

Low hydraulic oil pressure.

See instructions above under Low Hydraulic Oil Pressure.

— b —

Dials loose on drums.

Start machine and run spindle at lowest rpm and table at lowest feed. (Lowest and highest speeds and feeds are adjacent on dials.) Loosen spanner type lock nut and turn dial until it indicates actual speed or feed. Tighten nut.

SPEED GEARS SHIFT ERRATICALLY OR FAIL TO SHIFT

— a —

Low hydraulic oil pressure.

See instructions on page 142 for setting correct pressure.

— b —

Dirt in oil, or a poor grade of oil, that in breaking down, has lodged under or gummed relief valve in shifter bracket and caused it to stick open.

Remove 1/8" pipe plug from rear lower corner of gear shifter bracket (plug removed when testing column hydraulic pressure) and direct a strong blast of air into hole to blow out dirt. If this does not clear obstruction take off shifter bracket per instructions on page 150, remove relief valve and clean.

Flush column and lines, then keep column reservoir filled only with oil of specifications listed on page 137.

— c —

Sheared drive pin through bronze worm gear in cross shaft that drives shifter bracket.

Remove feed box and shifter bracket per instructions on pages 145 and 150. Renew pin through gear.

— d —

Machine has been running for too long a period of time at the same speed. Oil has gummed around selector valve so badly it will not rotate to produce other speeds. Operating pistons may also be stuck for the same reason.

Remove shifter bracket per instructions on page 150, dismantle and clean selector valve. Such a condition can be prevented by running machine through its range of speeds every few days.

— e —

Nicks and burrs on gears cause clashing and jumpy engagement. Remove and dismantle shifter bracket and dress burrs from gear teeth or install new gears. This condition results from the bad practice of starting spindle as gears start to mesh. Full load thrown repeatedly onto the first portion of a gear tooth will burr it and prevent smooth engagement.

Always pause long enough after shifting speed to make certain that all gearing is fully meshed before starting spindle at new speed and you will prevent this trouble.

SPEED DIAL ROTATES WITH CHANGE LEVER IN NEUTRAL

— a —

Broken spring on detent that engages and disengages clutch on speed change mechanism in shifter bracket.

Remove shifter bracket per instructions on page 150, and install new spring—item 146 on page 16.

FEED DIAL FAILS TO ROTATE

— a —

Broken spring at clutch feed control lever or broken shifter fork — items 169 and 167 on page 26.

Remove feed box per instructions on page 145, and install new spring or fork.

— b —

Safety clutch in feed box is worn and slipping.

Remove feed box, dismantle safety clutch, check setting and install new parts where necessary. (On No. 2 machines the safety clutch should withstand 120 inch pounds of torque without slipping; on Nos. 3 and 4 machines 160 inch pounds of torque.)

— c —

Pin between cam drive worm wheel and cam drive clutch is sheared.

Remove feed box and install new key. Item 112 on page 24.

— d —

Sheared drive pin through gear shifter cams in feed box.

Remove feed box and install new pins or levers. Item 200 and 201 on page 28.

RAPID TRAVERSE TABLE MOVEMENTS — ERRATIC OR STALLED

— a —

Rapid traverse clutch slipping.

See instructions, page 140, to adjust rapid traverse clutch.

— b —

Gib settings too tight.

See instructions, page 139, to adjust table gibs.

— c —

Operating linkage sticking.

Remove cover from top front of feed box. Pick up vertical operating shaft until it is disengaged from horizontal actuating shaft, then move shift lever on knee to ascertain any binding action on linkage. Also check rapid traverse lever at gear shifter bracket.

RAPID TRAVERSE CLUTCH ENGAGED CONTINUOUSLY — NO FEED POSSIBLE

— a —

Rapid traverse clutch adjusted too tightly, the plates are stuck together or clutch fingers are broken and lodged so clutch is held in engaged position.

See instructions on page 140, and reset clutch. If plates are gummy and stuck together it will be necessary to remove feed box and clean clutch. Inspect fingers and pins — install new ones if necessary.

— b —

Broken spring at end of rapid traverse shifter rod in top of feed box.

Remove feed box then remove slotted screw from top of feed box and renew spring at end of rod — item 126 on page 26.

FAULTY OPERATION OF MAIN CLUTCH AND BRAKE

— a —

Improper adjustment of main clutch.

See instructions on page 139, and correct setting of clutch.

— b —

Low oil pressure at servo valve for shifting clutch.

See instructions on page 163, under Low Hydraulic Oil Pressure.

— c —

Driving belts worn out and slipping.

Raise main motor on its hinged base plate so belts can be lifted out of sheaves and replace with a new set of matched belts.

Adjust belts per instructions on page 143.

Check tension on new belts frequently until they are run in, then periodically.

— d —

Clutch finger carrier loose on 1st drive shaft; worn clutch fingers; worn, glazed or warped plates; worn bronze shoes on shifter fork; broken finger carrier springs; worn shoe on servo shifter; worn and leaky servo valve.

Remove pulley bracket per instruction on page 145, and check over various items above for possible repairs.

— e —

Outer sleeve nut is binding on spring adjusting nut at end of 1st drive shaft. This impairs the free 0.020" movement of sleeve and thus engagement of clutch.

Remove both nuts and make certain they are free before replacing. (Items 291, 292—page 47.) Normally there is 0.005" to .010" diametral clearance between the nuts.

— f —

Braking action on spindle is ineffective

This may be due to low oil pressure — see page 163; incorrect clutch adjustment — see page 139; or worn plates. In the latter case remove pulley bracket per instructions on page 145, and install new plates.

MAIN DRIVE CLUTCH SLIPS WHEN MILLING WITH CARBIDE CUTTER — OLDER STYLE MACHINES ONLY

The high feed rates and speeds used when milling with carbide cutters impose an excessive impact load on clutch plates to induce slipping on old type machines equipped with two clutch plates. Such slippage may never occur when using "high speed" cutters because the load build up is comparatively gradual.

To eliminate this trouble alter the clutch to provide four driving plates and three driven plates as follows: Remove and dismantle main clutch on 1st drive shaft per instructions on page 152. Install one new Driven Disc Hub (127414), one new Friction Ring (127415), two new Clutch Disc Pins (127416), three new Center Driven Disc (98421), four new Driving Disc (98422) and one new Driving Disc Flange (60996). (Part numbers are CMM Co. numbers).

KNEE OR TABLE MOVEMENTS DO NOT AGREE WITH MOVEMENT INDICATED ON MICROMETER DIALS

Gib setting too tight.

Set gibs per instructions on page 139.

EXCESSIVE VIBRATION

It would be well to investigate the following numbered items before checking the following lettered possible causes:

- (1) Reducing length of cutting edge in contact with work; reducing cutting speed; reducing clearance angle to minimum required for the job will reduce chatter. (Cutter speed can be reduced by lowering spindle speed or reducing size of cutter.)
- (2) Check with cutter manufacturer in regard to number of teeth in cutter, speed, shape, etc. Many times the substitution of a spiral milling cutter in place of straight cutter will reduce chatter. The addition of a .002" - .003" circular land at edge of tooth after grinding primary land will often help reduce chatter. The substitution of a cutter with less teeth will many times eliminate chatter, particularly if close to maximum horsepower of machine is being used.
- (3) When milling with a gang of cutters and extended overarm where overarm braces are used it might

help to tighten or slightly loosen in various combinations the knee, saddle, table or overarm brace clamping screws.

— a —

Loose table aprons or lead screw bearings.

Tighten aprons, then proceed per instructions on page 141, and adjust table feed screw bearings.

— b —

Loose cross feed screw bearings.

Proceed per instructions on page 141, and adjust table lead screw bearings.

— c —

Loose gibs.

Proceed per instructions on page 139, and adjust gibs. (Do not tighten gibs more than a normal amount in an effort to eliminate vibrations.)

— d —

Incorrect setting of dynapoise overarm.

Proceed per instructions on page 144, and adjust dynapoise overarm.

— e —

Loose spindle bearings.

Proceed per instructions on page 143, and adjust spindle bearings. (Check all other causes of chatter before readjusting these bearings.)

TABLE, VERTICAL OR CROSS FEEDS DO NOT FUNCTION

— a —

Loose shifter forks or broken taper pins in actuating mechanism.

Shifter forks are accessible through left side of knee after removal of rear control bracket or cover. (See pages 90 and 98.) Relocate forks so clutches are midway between gears when neutral. See instructions on page 162.

It may be necessary to remove knee to replace some broken taper pins in shafts. See instructions to remove and dismantle knee on page 160. Whenever knee is opened or removed use the opportunity to flush and clean inside.

— b —

NOTES

Safety clutch in feed box slipping.

Remove feed box per instructions on page 145, dismantle safety clutch and check setting. On No. 2 machine it should withstand 120 inch pounds of torque without slipping; on Nos. 3 and 4 machines 160 inch pounds of torque.

COOLANT FLOW SLOWS DOWN OR STOPS

— a —

Suction line strainer is clogged.

Remove from pump of suction line, wash and blow out.

— b —

Relief Valve spring is broken or valve is stuck open, pump requires constant priming through pipe plug at top of pump.

It is necessary to remove main motor to work on valve. (Item 40, page 112). Clean valve and re-new spring (45) if necessary.

CMM. Co. RECOMMENDED LUBRICANTS

The following lubricants have been tested by The Cincinnati Milling Machine Co., and are recommended for use in their machines.

CMMCo. No. P-37

<i>Source</i>	<i>Lubricant</i>
Esso Standard Oil Co.	Cazar Lubricant #1
Gulf Oil Co.	Supreme Cup Grease #3
Pure Oil Co.	Tiolene #3
Shell Oil Co.	Alvania #2
Sinclair Refining Co.	Durolube 22
Sinclair Refining Co.	Bearing Grease A. F. 2
Socony-Mobil Oil Co.	Sovarex #1
Standard Oil Co. (Ind.)	Stanolith 57
Standard Oil Co. (Ind.)	Superla 57
Sun Oil Co.	Cup Grease LB. #2
Texas Oil Co.	Regal-Starfak #2

CMMCo. No. P-50

Richfield Oil Co.	Richway Oil #9
Shell Oil Co.	Tonna #72
Socony-Mobil Oil Co.	Vactra #4
Standard Oil Co. (Ind.)	Stanway Industrial Oil #95
Sun Oil Co.	Sunoco Way Lubricant S.A.E. 90
Texas Oil Co.	Lubricant "G"

CMMCo. No. P-55

Cities Service Oil Co.	Pacemaker #2
Cities Service Oil Co.	Pacemaker #200-T
Esso Standard Oil Co.	Esstic 45
Gulf Oil Co.	Crest "B" & Harmony "B"
Mid-Continent Oil Co.	DX-Cherokee Oil ("M" R & O)
The Pennzoil Co.	Pennzoil Turbine Oil Medium
Richfield Oil Co.	Eagle Oil R & O X-Light
Shell Oil Co.	Tellus 29
Sinclair Refining Co.	Duro 200
Socony-Mobil Oil Co.	D.T.E. Medium
Standard Oil Co. (Calif.)	Calol O.C. Turbine Oil 11
Standard Oil Co. (Ind.)	STANOIL Industrial Oil #21
Standard Oil Co. (Ohio)	Sohivis 47
Standard Oil Co. (Ohio)	Limax 47
Sun Oil Co.	Sunvis 921
Swan-Finch Oil Corp.	Safco Dytac B
Swan-Finch Oil Corp.	Saf-Drive B-10
Texas Oil Co.	Regal Oil "B" (R & O Type)
Tidewater Assoc. Oil Co.	Tycol Aturbrio 58