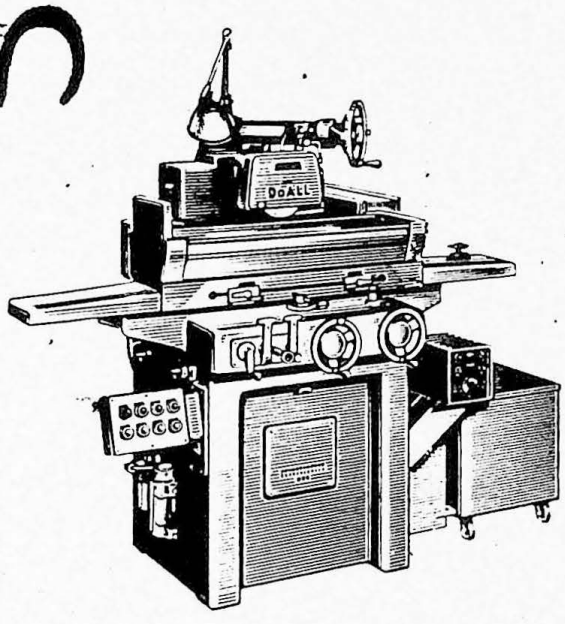
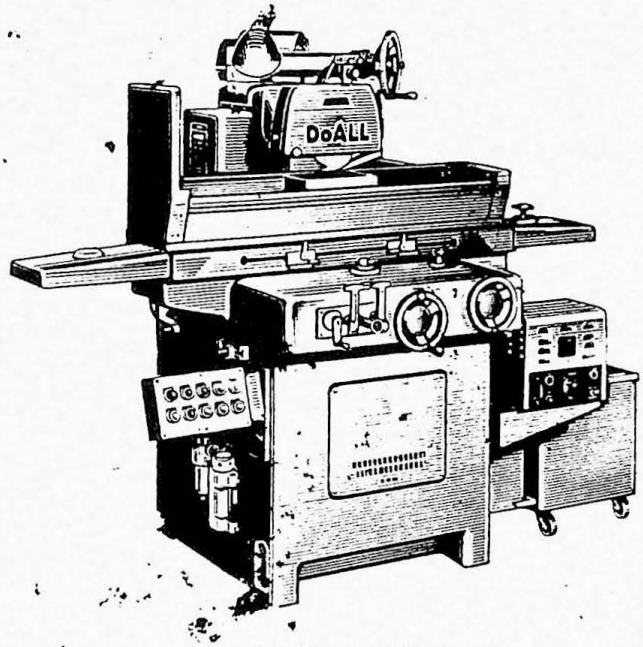
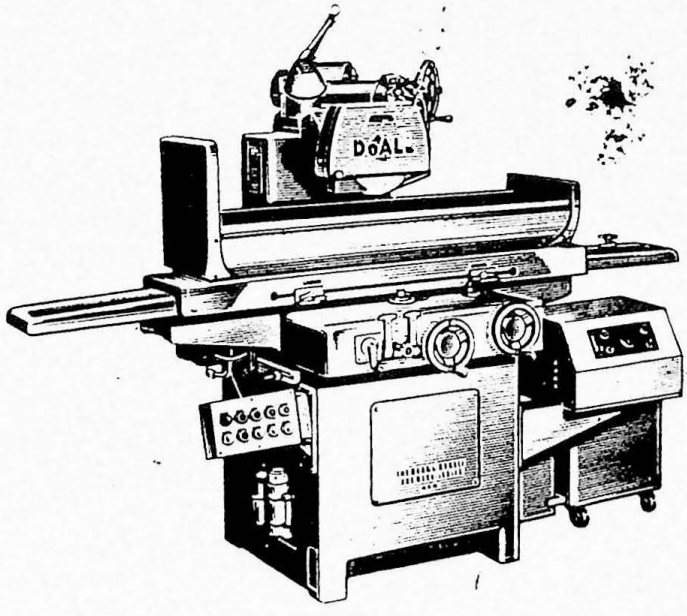
INSTRUCTION MANUAL



MODEL D618-7
MODEL D624-8



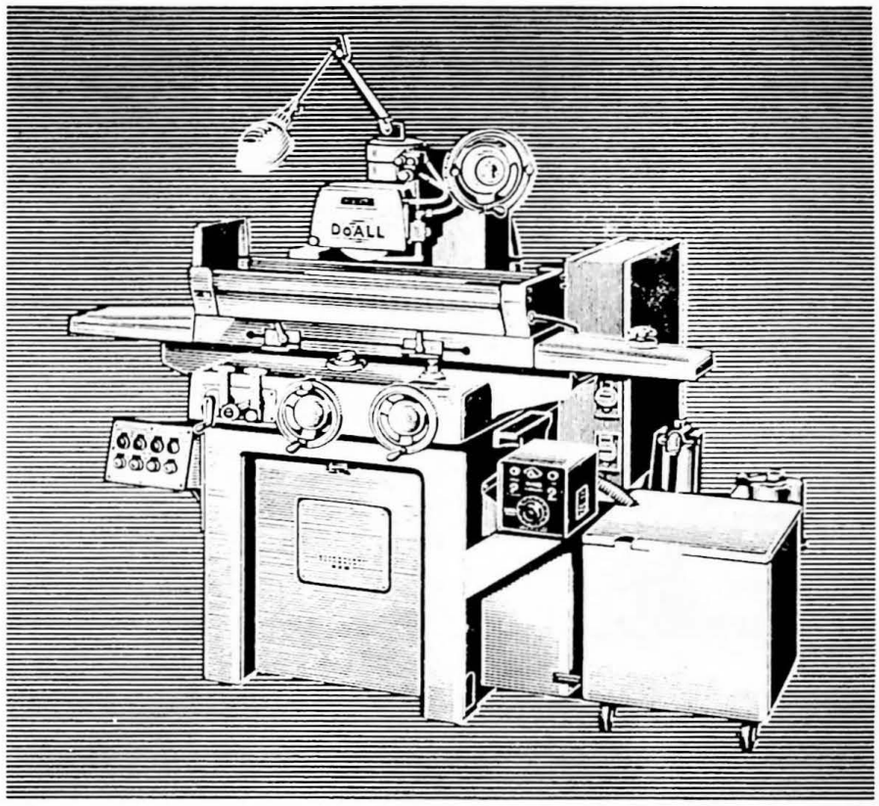
MODEL D824-10
MODEL D824-12



MODEL D1024-12
MODEL D1024-14
MODEL D1030-12
MODEL D1030-14

SURFACE GRINDER

OPERATOR'S
INSTRUCTION MANUAL

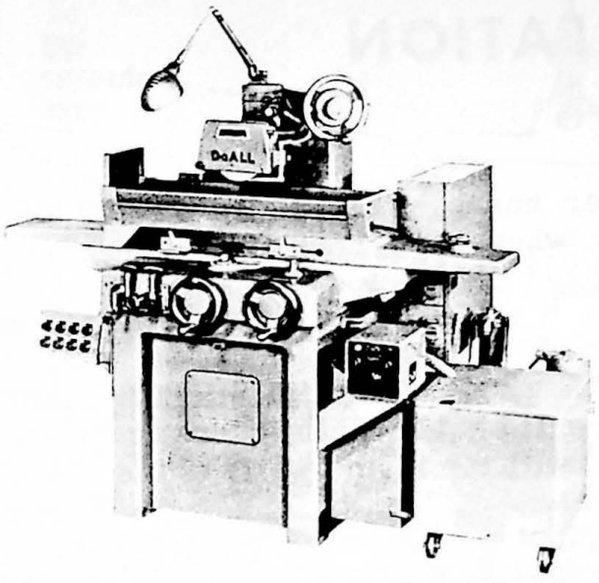


Precision SURFACE GRINDERS

DoALL COMPANY
254 NORTH LAUREL AVENUE
DES PLAINES, ILLINOIS 60016

TABLE OF CONTENTS

This manual covers the following DoALL Surface Grinders...

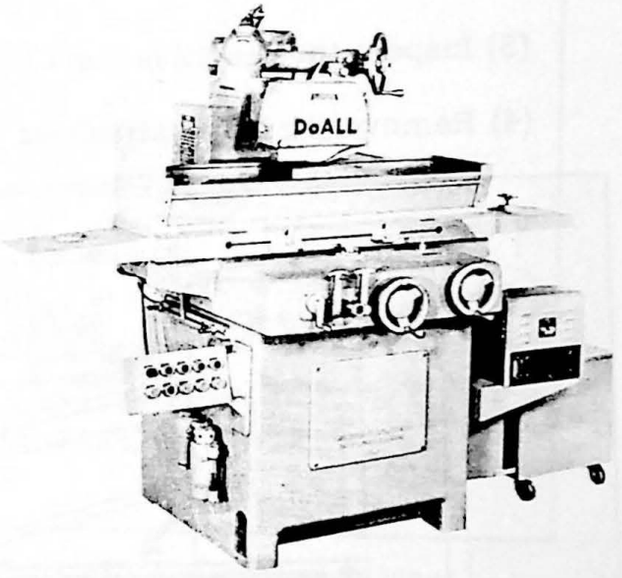


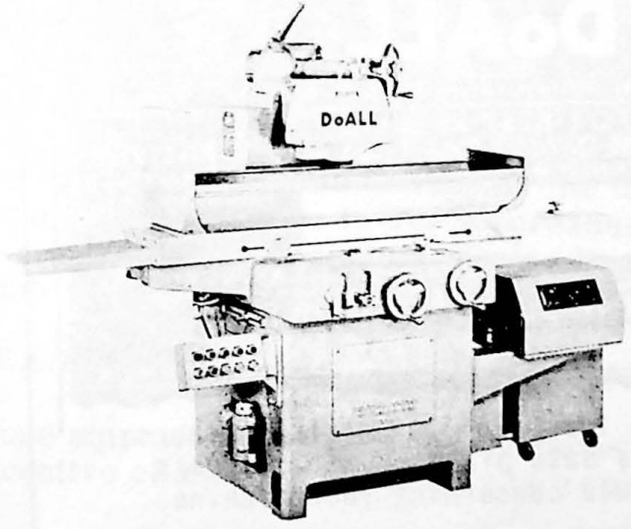
The D-6 Series

Models D618-7 & D624-8
and previous D-6 models

The D-8 Series

Models D824-10 & D824-12
and previous D-8 models





The D-10 Series

Models D1024-12, D1030-12
D1024-14 and D1030-14
and previous D-10 models

CHAPTER 1
INSTALLATION

UNCRATING

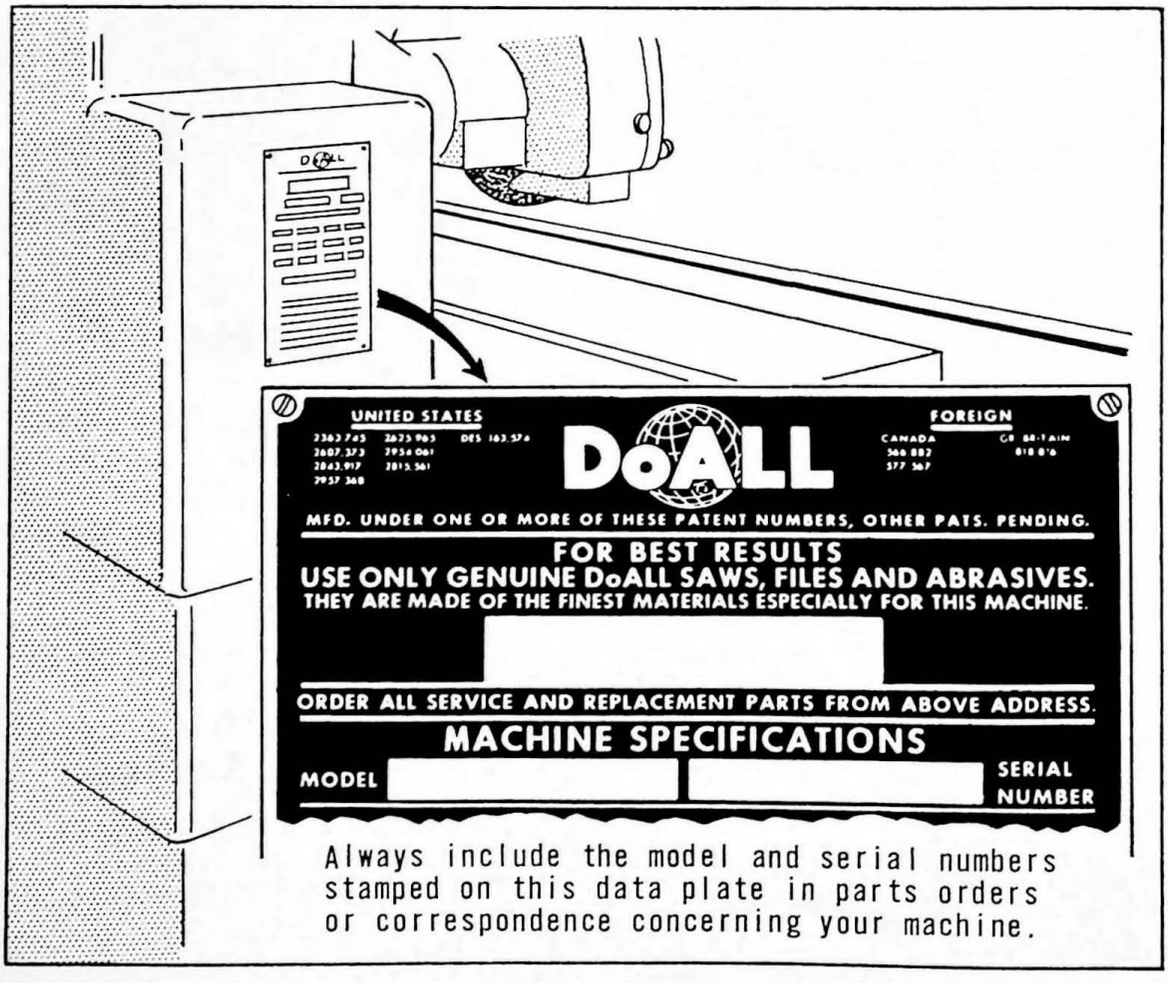
Your DoALL Surface Grinder has been carefully crated for shipment to insure its accuracy when it reaches your plant. It is important that the crate be removed carefully so as not to damage the machine.

(1) Remove all crating, blocking, strapping, plastic bag, etc. Be sure to remove any strapping used to hold hydraulic tank in place. The tank must be free from contact with the inside walls of the base.

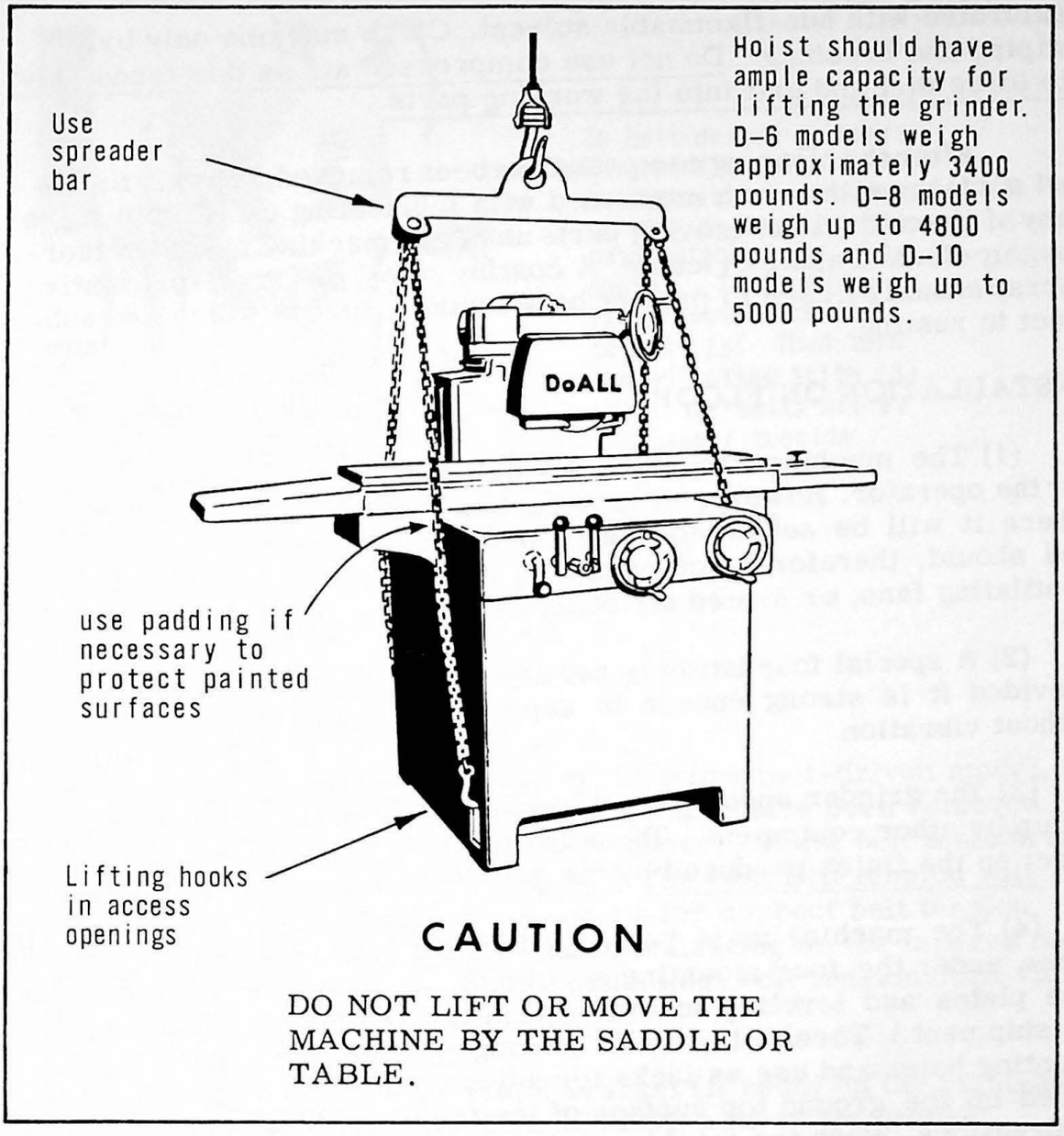
(2) Remove drive motor, coolant tank, SELECTRON, electro-magnetic chuck and any other accessories which have been attached to skid.

(3) Inspect the machine for broken or damaged parts.

(4) Remove the bolts attaching the machine base to the skids.



Always include the model and serial numbers stamped on this data plate in parts orders or correspondence concerning your machine.



This is the correct method of lifting the grinder.

LIFTING INSTRUCTIONS

If a hoist is available, the machine can be raised bodily from the floor and the skids removed. When using a hoist, a suitable sling or chain should be used to support the machine at the base, as shown above. Be sure to use a spreader bar so that the sling or chain does not press against the saddle. CAUTION: Do not attempt to lift or move machine by saddle or table.

CLEANING

Before shipment, all unpainted surfaces were coated with a rust preventive compound. This may be removed by wiping with rags

saturated with non-flammable solvent. Clean machine only by wiping and brushing. Do not use compressed air as this tends only to force dirt and grit into the working parts.

After the cleaning compound has been removed, wipe all finished surfaces with a cloth moistened with lubricating oil. Do not move any of the controls or moving parts until the machine has been thoroughly cleaned and lubricated. A coating of oil or a rust-preventive spray should be used to protect bare metal surfaces which are subject to rusting.

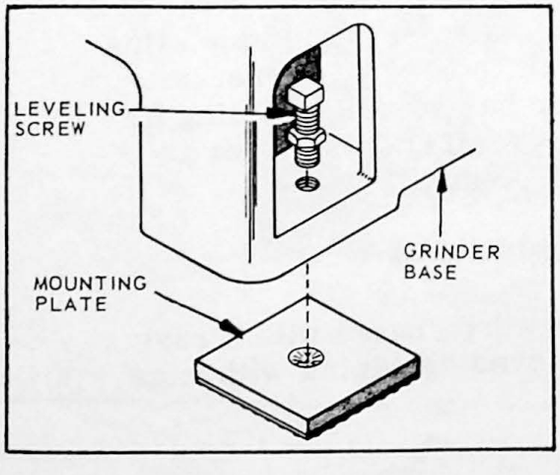
INSTALLATION ON FLOOR

(1) The machine should be located so as to provide good light for the operator. However, it is important that the machine be placed where it will be subjected to a minimum of temperature variation and should, therefore, not be placed too close to outside windows, ventilating fans, or forced air blowers.

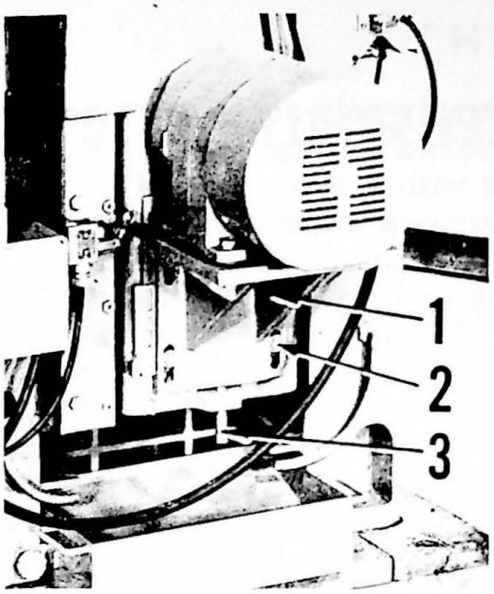
(2) A special foundation is not necessary. Any floor is suitable provided it is strong enough to support the weight of the machine without vibration.

(3) The grinder should be as free as possible from vibrations set up by other equipment. These outside vibrations have a definite effect on the finish produced by the grinder.

(4) The machine must be leveled by placing the supplied steel plates under the four mounting screws on the base of the machine. (The plates and leveling screws are usually packed with the tools for shipment.) Thread the four leveling screws down through the mounting holes and use as jacks for adjustment. With a spirit level placed on the ground top surface of the table, level the machine in all directions. When the machine is level tighten the leveling screw locknuts. The machine weight must bear evenly on all four pads. The leveling screws must bear on the metal surface of the mounting pads - not on the vibration absorbing material which should contact the floor.



Install the mounting plates so that the vibration absorbing material is contacting the floor.



On belt-driven grinders, the spindle drive belt tension is adjusted by raising or lowering the motor bracket (No. 1 in photo). To do this, first loosen the four screws (2). Then turn the adjusting screw (3), until the belts are at the proper tension.

ASSEMBLY

(1) Belt tensioning: If the grinder is a belt-driven model, the spindle drive motor, belts and bracket may have been removed for shipment. Install as shown in photo above. Adjust belt tension by turning the adjusting screw. NOTE: The best belt tension will produce the least vibration. To check for correct belt tension, place a tenth indicator on the chuck, indicating on the tapered nose of the spindle. Start the spindle and adjust belt tension until vibration has been reduced to a minimum.

(2) Install the SELECTRON bracket (if used) on the right-hand side of the base. Mount the SELECTRON unit on the bracket.

NOTE: BE SURE TO REMOVE PACKING AROUND TUBES.

(3) Uncrate the electromagnetic chuck (if used) and degrease. Install the chuck as described under "Grinding in the Chuck" in the Chapter on Preparation for Operation.

(4) Position the coolant tank (if used) so that the drain hose from the saddle can be inserted in the tank cover. The tank must not obstruct air intake through the base air filter. Remove any extra parts or tools which have been packed in the tank.

ELECTRICAL CONNECTIONS

The DoALL Surface Grinder is an entirely self-contained machine. The standard machine is completely wired and equipped with push button controls and magnetic starters with overload-reset switches. Other electrical control systems are available as special equipment. Depending on the grinder's electrical system, it may be necessary to connect a fused disconnect switch. See the wiring diagram furnished with the machine. Wire so that the spindle revolves clockwise when facing the shaft before mounting a grinding wheel. The coolant pump motor must rotate clockwise when viewed from above.

WARNING

Check to be sure that the spindle (without grinding wheel) rotates clockwise. The spindle nose nut has a left-hand thread and clockwise rotation will tend to tighten it. However, if the spindle motor rotates counterclockwise, the nose nut will rapidly loosen and the grinding wheel may be thrown from the spindle.

INITIAL LUBRICATION AND CHECK-UP

(1) Check the hydraulic oil level and fill if necessary. Use seven gallons of DoALL "ESL" Hydraulic Fluid (see hyd. oil specifications in Lubrication Chapter). Since a certain amount of oil is used to fill the hydraulic system, it will be necessary to refill the tank after starting the machine.

(2) Check the automatic oiler for the saddle and table ways and fill if necessary with DoALL Way Lubricant. Adjust as described in Lubrication Chapter. Check to be sure that oil is actually being delivered to the ways.

(3) NEW GRINDERS: It is important that all the base access panels be kept in place during operation. The air filter should be cleaned when necessary and kept in place.

(4) Study the chapter on Operation of Controls carefully. Start the machine and operate each control. Run the saddle and table to the extremes of their travel in order to remove any air trapped in the cylinders.

(5) Fill the coolant tank (if used) with Kleen-Kool coolant made by DoALL. Mix the coolant as instructed on the container label.

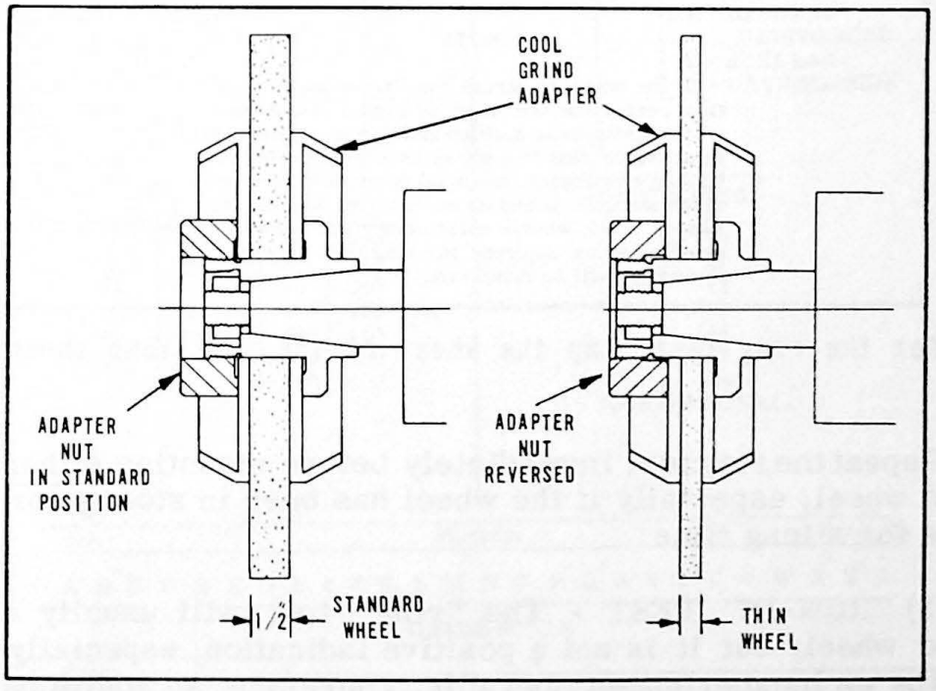
CHAPTER 2

SELECTING GRINDING WHEELS

SELECTION OF WHEEL SIZE

Each model grinder is designed to use only one particular size of wheel, as listed below:

GRINDER MODEL	DIAMETER	WIDTH	HOLE DIAMETER
D618-7 (previous model D6-1)	7	1/2	1-1/4
D624-8 (previous models D6-3,D8-0)	8	3/4	1-1/4
D824-10 (previous model D8-0-10)	10	3/4	3
D824-12,D1024-12,D1030-12 (previous models D8-3,D10-0 & D10-3)	12	1	3
D1024-14, D1030-14 (previous models D10-1, D10-4)	14	1	3

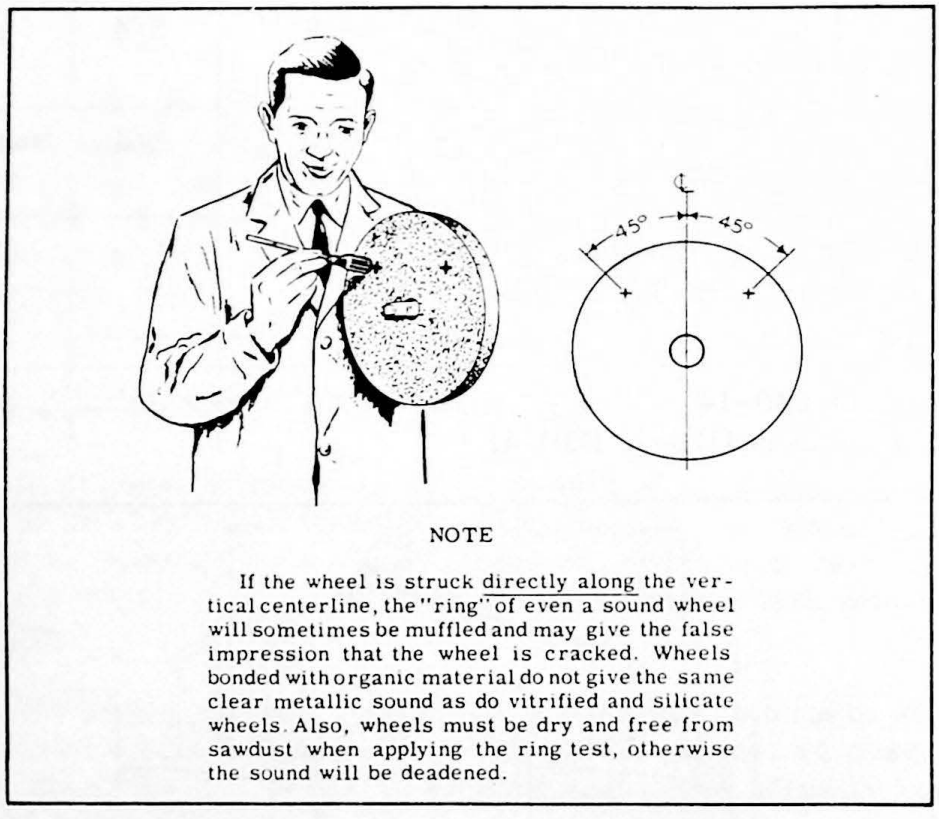


Wheels thinner than 1/2 inch can be used, but the cool grind adapter must be used with the nut reversed as shown in the sketch.

GRINDING WHEEL INSPECTION

(1) VISUAL INSPECTION - Examine the wheel carefully immediately after it has been unpacked. Look for cracks or chips which would indicate damage during shipping.

(2) "RING" TEST - Next give the wheel the "ring" test. This is done by suspending the wheel from its center hole on a small bar or finger. Tap the wheel gently with a nonmetallic implement such as a wooden screwdriver handle. The best spot to tap a wheel is about 45° on either side of the vertical centerline and about 1 or 2 inches from the outside edge of the wheel. Rotate the wheel about 45° and repeat the test. A sound and undamaged wheel will give a clear metallic tone. If it is cracked, there will be a "dead" sound.



NOTE

If the wheel is struck directly along the vertical centerline, the "ring" of even a sound wheel will sometimes be muffled and may give the false impression that the wheel is cracked. Wheels bonded with organic material do not give the same clear metallic sound as do vitrified and silicate wheels. Also, wheels must be dry and free from sawdust when applying the ring test, otherwise the sound will be deadened.

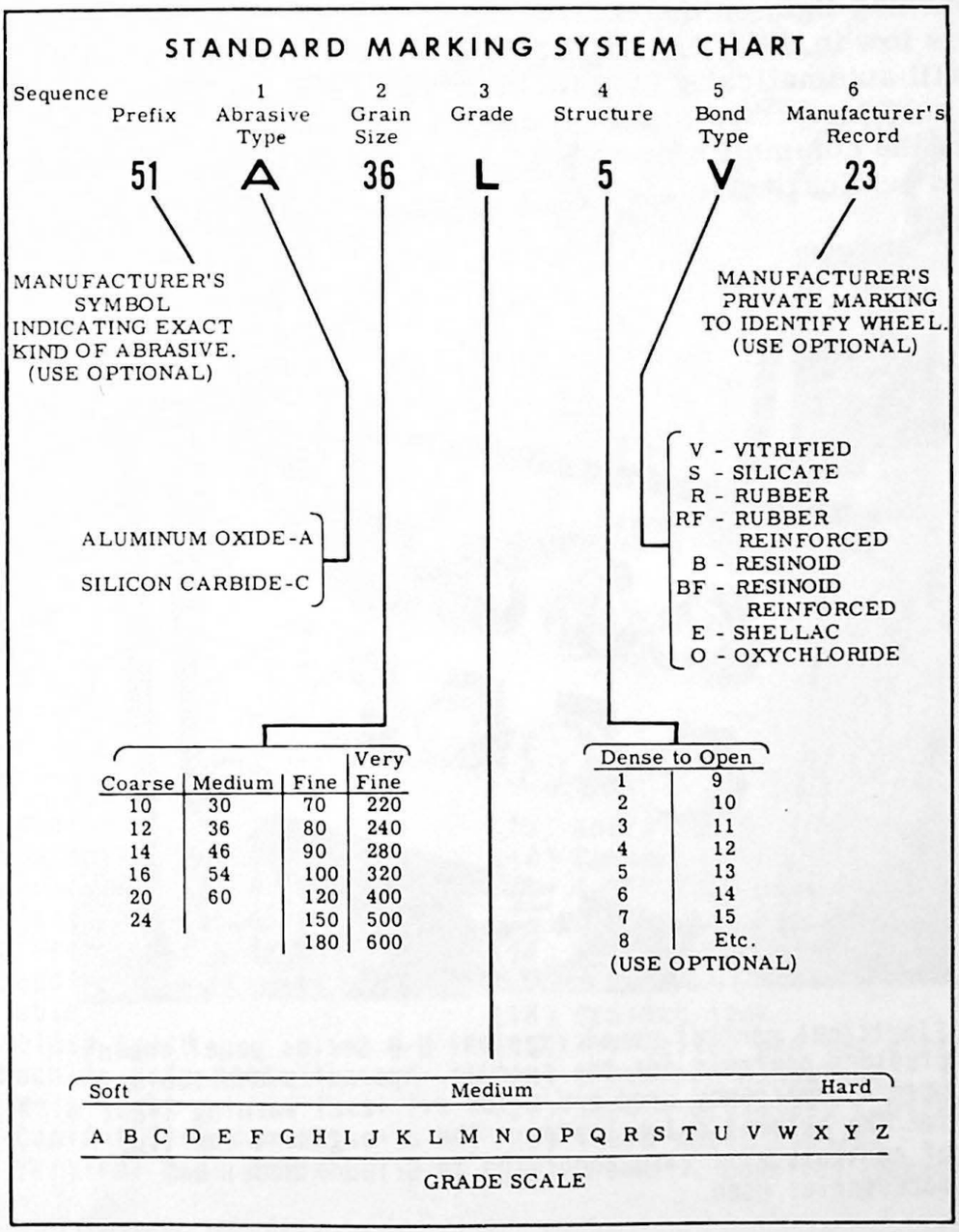
For the ring test, tap the wheel at the locations shown.

Repeat the ring test immediately before mounting either a new or used wheel, especially if the wheel has been in storage or out of service for a long time.

(3) "RUN-IN" TEST - The "ring" test will usually detect a cracked wheel; but it is not a positive indication, especially if performed by an inexperienced operator. Therefore, an additional "run-in" test is essential.

Mount the new wheel that has passed the ring test on the correct adapter as described elsewhere in Chapter 4. Close wheel guard securely. Stand back from the machine and run the spindle for at least one minute before starting grinding.

(4) GRINDING WHEEL STORAGE - Grinding wheels must be stored in a dry area. Some bond types may be seriously affected by dampness and temperature changes. Wheels should be supported on edge in racks which provide two-point cradle support. The wheels must be protected from damage.



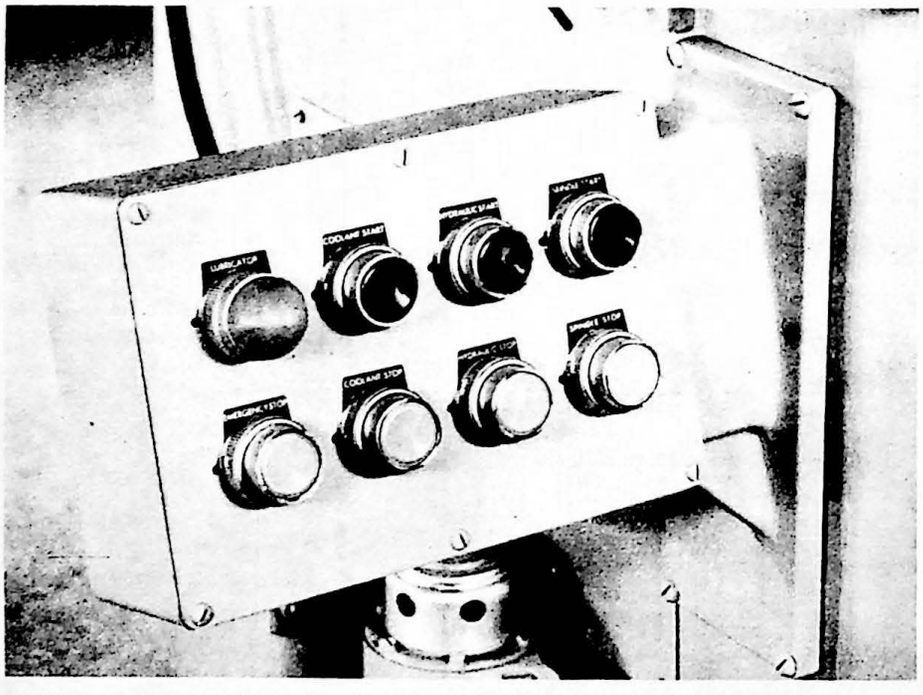
Standard grinding wheel marking system chart.

CHAPTER 3

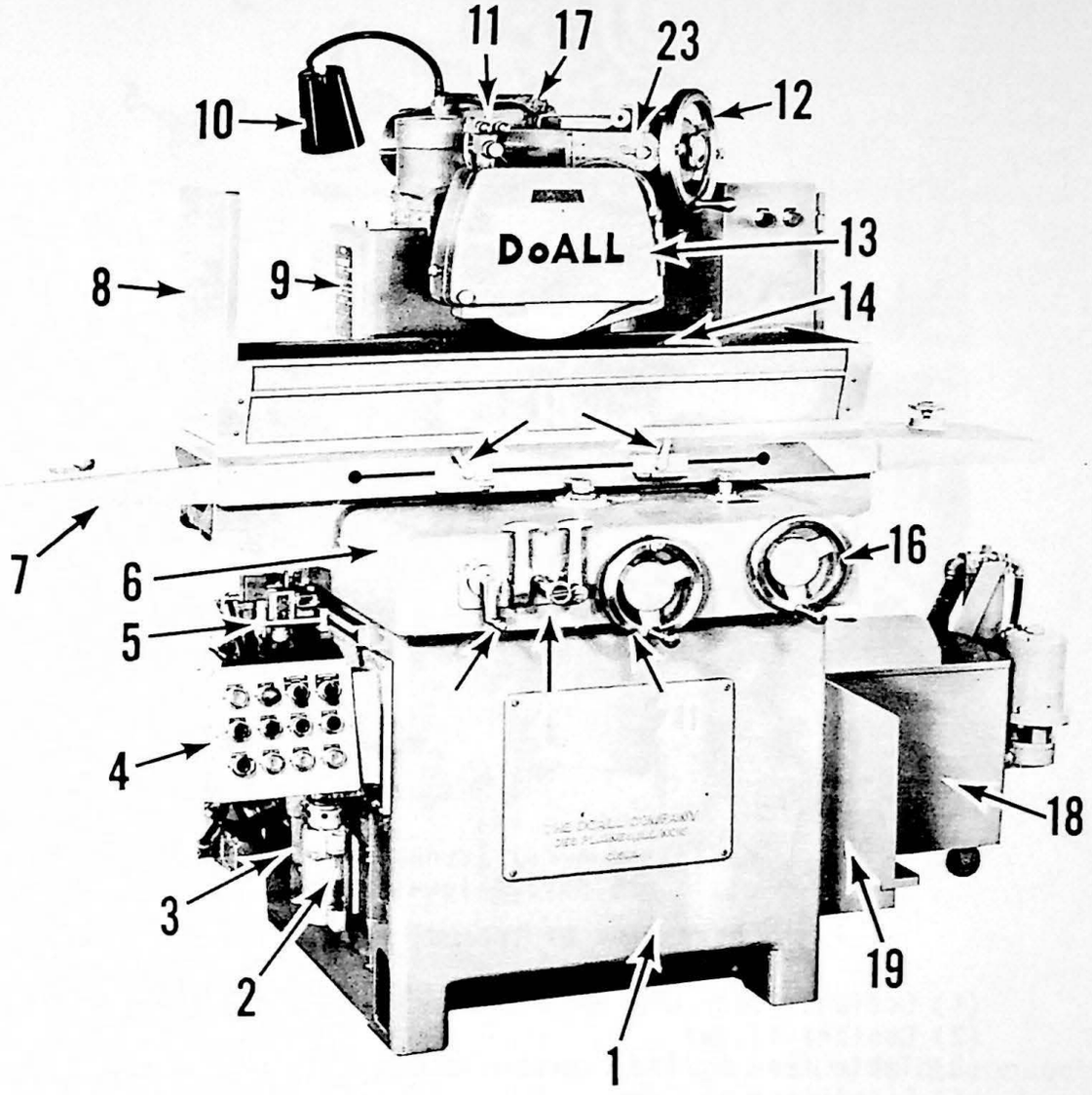
OPERATION OF CONTROLS

ELECTRICAL CONTROLS

Pushbutton controls (see photo) are provided for starting and stopping the spindle drive motor, hydraulic pump and coolant pump motors and column raising motor (standard on large grinders, optional on others). In addition, an emergency stop pushbutton is provided on some models for the immediate stopping of all motors. A red warning light on the control panel lights up just before the oil level is low in the automatic lubricator tank. A float switch in the tank will automatically stop the machine when the oil level is low. If the column raising motor is used, a limit switch, mounted on the back of the column, is provided to stop the spindle at the upper limit of its vertical travel.



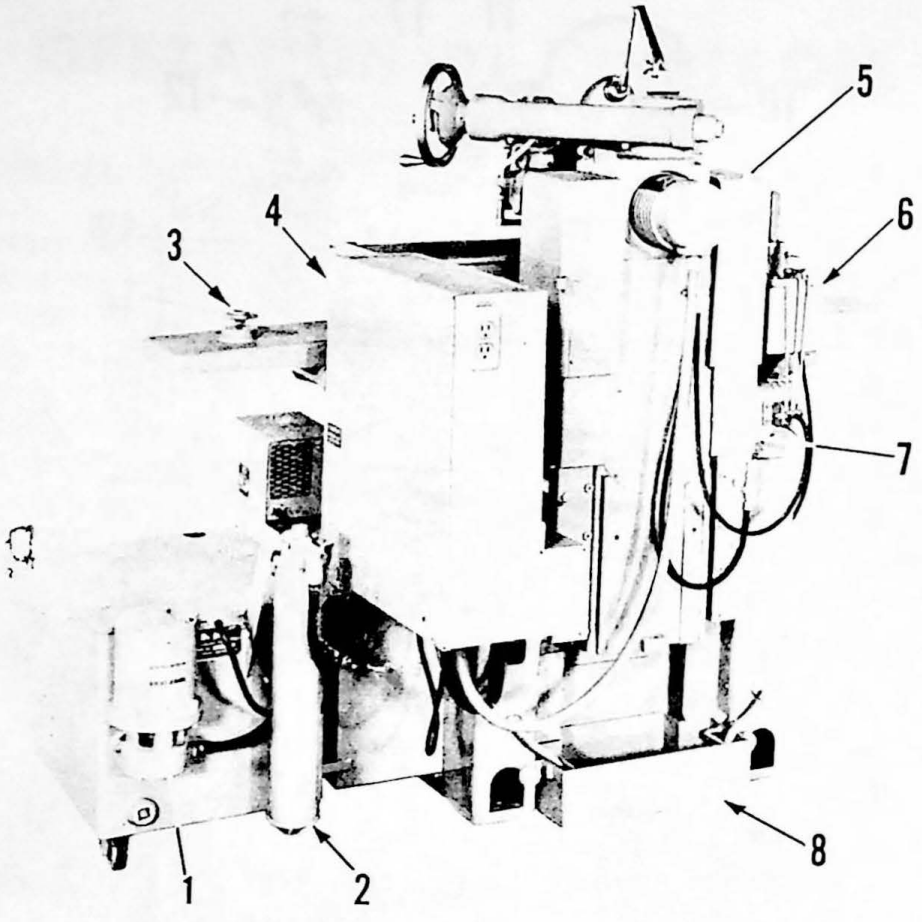
Electrical control panel (typical D-6 Series panel shown) provides controls for the spindle, hydraulic and coolant motors, emergency stop and a low oil level warning light for the automatic lubricator. The arrangement and type of controls will vary according to Grinder model and accessories used.



Front view of typical grinder.

(1) Base
(2) Hydraulic tank oil level gage
(3) Hydraulic oil filter
(4) Electrical controls
(5) Crossfeed trip dogs
(6) Saddle
(7) Table
(8) Splash guard
(9) Machine data plate
(10) Work light
(11) Coolant flow controls
(12) Vertical feed handwheel
(13) Wheel guard
(14) Chuck
(15) Table trip dogs
(16) Table feed handwheel
(17) Motorized wheel elevation (accessory).
(18) Coolant tank
(19) Air filter and fan enclosure
(20) Crossfeed handwheel
(21) Saddle crossfeed controls
(22) Table speed control
(23) Automatic Downfeed (accessory).

NOTE: SELECTRON chuck control (accessory) not shown.



Rear view of typical grinder.

(1) Coolant motor and pump mounted on portable coolant tank
(2) Coolant filter
(3) Table feed cylinder disconnect knob
(4) Electrical cabinet
(5) Motorized spindle
(6) Automatic way lubricator
(7) Machine column
(8) Removable drip pan for spent way oil

TABLE SPEED CONTROL

Table speed is regulated with the control shown on page 13. It has an "off" position and is graduated with reference numbers so that the table speed setting can be noted and repeated. ALWAYS ADVANCE THE TABLE SPEED CONTROL SLOWLY, ALLOWING THE TABLE TO MAKE SEVERAL REVERSALS BEFORE REACHING MAXIMUM SPEED. This will allow the relatively cold oil in the combination valve to be replaced by warmer oil from the tank. If the machine is cold, maximum table speed may not be obtained until the hydraulic oil has reached operating temperature. This may take about 30 minutes, unless a tank heater (accessory) is used. When the table speed control is in the "stop" position, the table remains stationary.

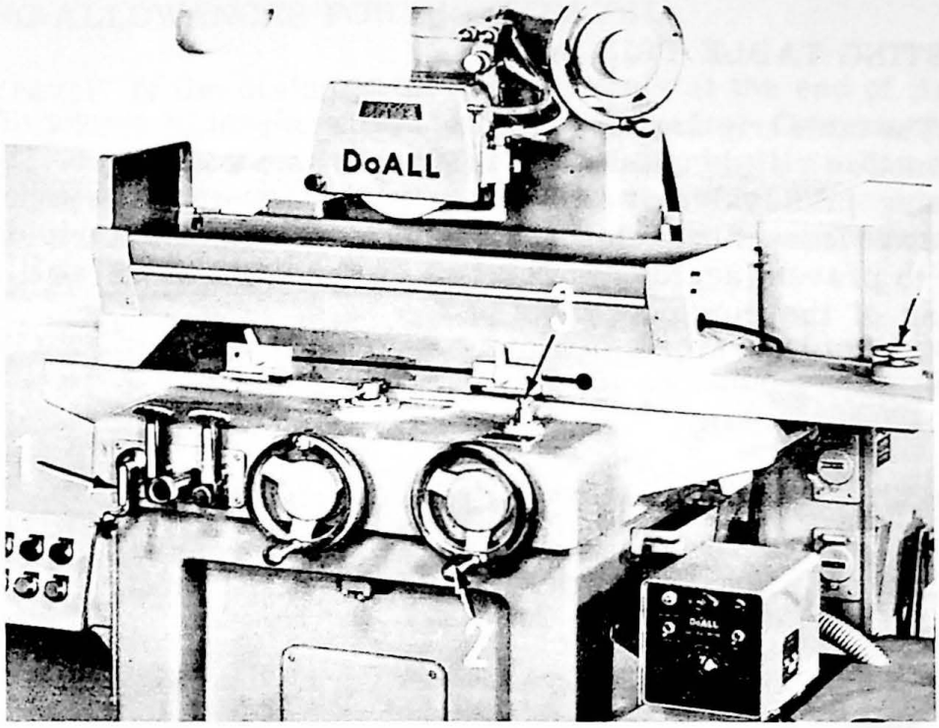


Table and saddle controls.

(1) Table speed control
(2) Manual table feed handwheel
(3) Knob for manual table operation
(4) Table cylinder piston rod disconnect

MANUAL TABLE FEED HANDWHEEL

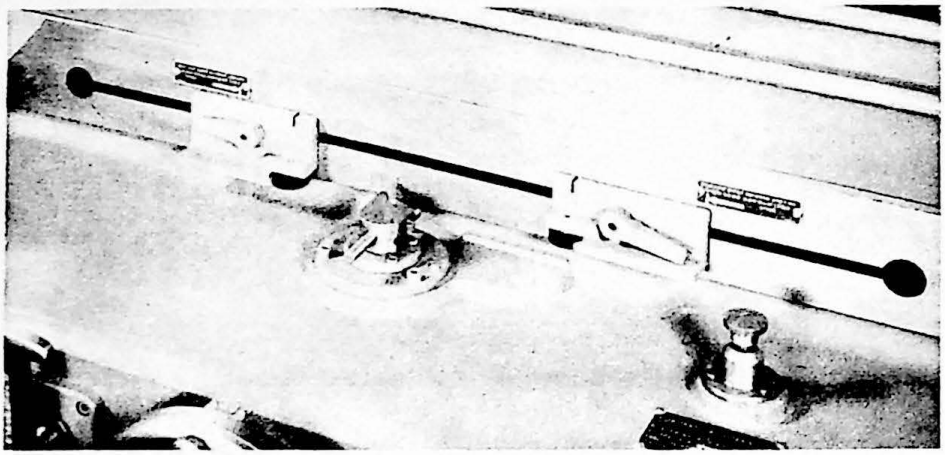
If manual table travel is desired, it is first necessary to disconnect the table from the table feed cylinder. This is done by moving the table (hydraulically) to the extreme left and pulling up the manual table release knob (see photo above). Then disconnect the table cylinder piston rod from the table by unscrewing the knob located on top of the right-hand table apron. The table is then ready for manual operation by means of the manual handwheel. It is not necessary to use manual table control very often---usually only for set-up purposes.

NOTE

Operating the table manually with table cylinder connected may allow air to enter the table feed cylinder. This will cause a jerking table hydraulic feed. To eliminate the air from the cylinder, run the table slowly to its full extent of travel several times.

ADJUSTING TABLE TRIP DOGS

The table trip dogs control the maximum table stroke. They are positioned on a slide and locked in place by a small lever. The table-reversing pilot valve is contacted by rollers on the trip dogs. Stop screws are located in such a position at each end of the trip dog track so as to prevent accidental removal of the dogs, while still allowing grinding of the complete table pad.



The spacing of the trip dogs determines the length of table travel. Adjust the position of each dog by loosening the locking lever and sliding the dog along its track. Locate the trip dogs so that the grinding wheel will contact all of the work surface.

To Adjust Trip Dogs:

Use the table speed control to slowly position the table at the end of each stroke, then lock trip dogs in place by clamping the hand lever.

WARNING

NEVER ADJUST TABLE TRIP DOGS WHILE TABLE IS MOVING. FINGERS CAN BE CAUGHT BETWEEN TRIP DOG AND PILOT VALVE.

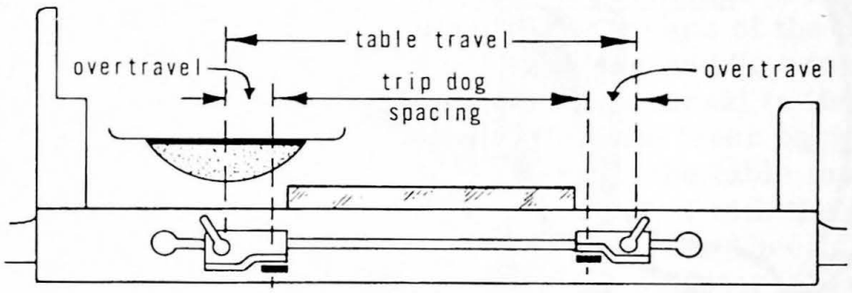
Adjust the dogs so that the wheel just clears the work, but do not allow excess table travel (see drawing). Loosen each trip dog locking lever and move the trip dogs on the slide so that one is to the left and the other is to the right of the workpiece. Line up the trip dogs visually and tighten the locking levers. NOTE: Newer machines have nameplates which indicate correct trip dog spacing.

MAKING ALLOWANCES FOR OVERTRAVEL

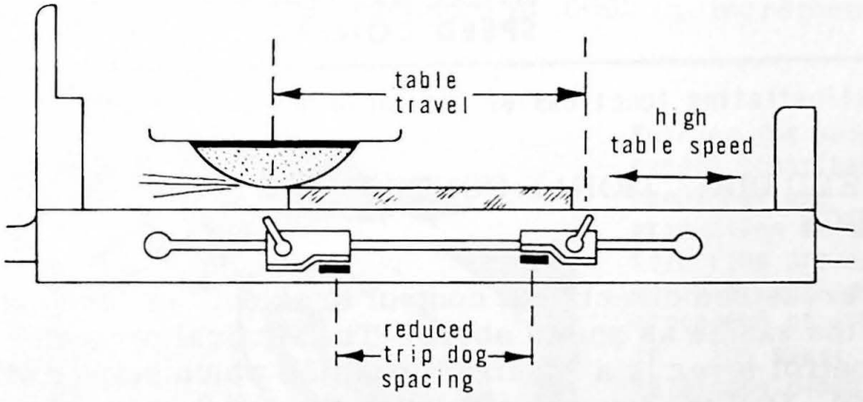
"Overtravel" is the distance the table travels at the end of its stroke AFTER the dog has tripped the pilot valve. Overtravel will be greatest on a cold machine when the hydraulic oil is about 68° F. Overtravel will also be great when the machine is operated at higher table speeds (up to 125 fpm) after it has been warmed up. Therefore, remember these notes:

(1) The table trip dogs on a "cold" grinder should be positioned closer together in order to compensate for increased overtravel (see drawing below).

(2) Trip dog spacing should also be reduced when table speed is between 70 and 125 fpm.

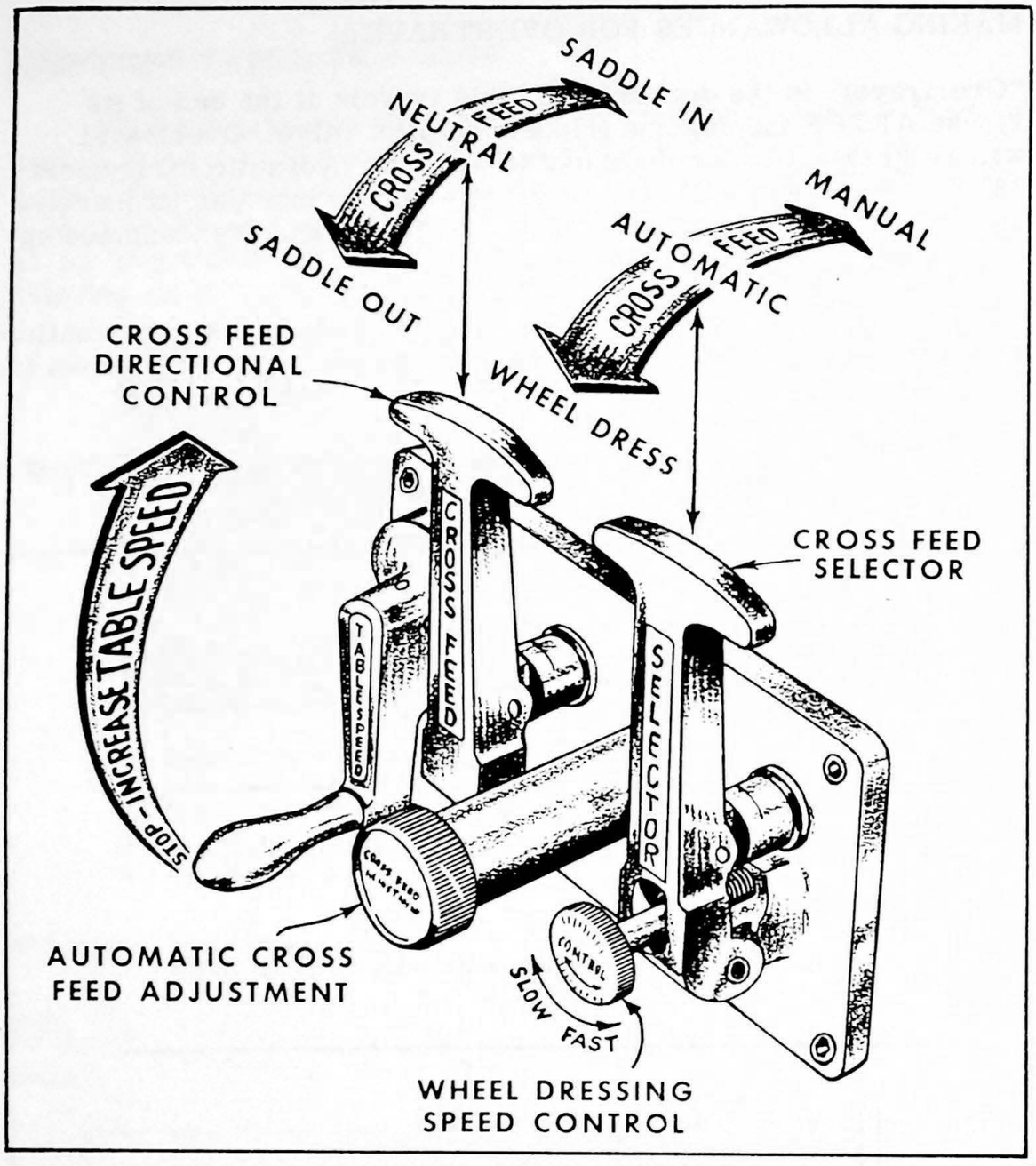


Overtravel is distance table travels after dog has tripped pilot valve. Table overtravel will be greater at high table speeds (up to 125 fpm) and when machine is cold.



Reduce trip dog spacing when operating at high table speeds and when machine is cold. This will compensate for the increased over-travel. As the machine warms up, be sure to check over-travel and increase trip dog spacing if necessary.

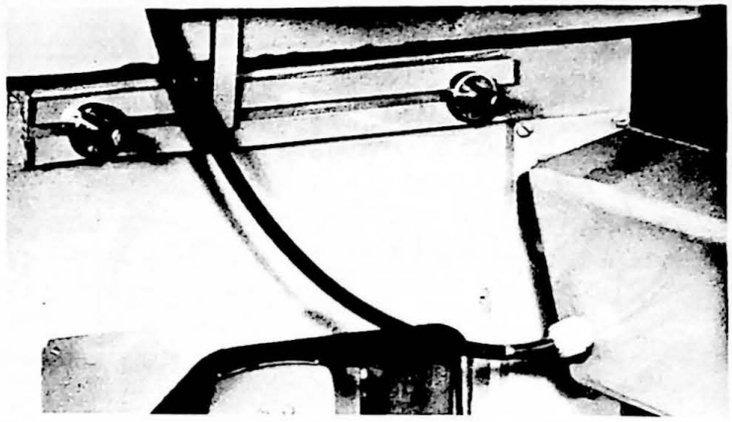
Be sure to allow for overtravel of the table.



Illustrating functions of the table and saddle controls.

CROSSFEED DIRECTIONAL CONTROL LEVER and CROSSFEED TRIP DOGS

Use the crossfeed directional control to select "in" or "out" movement of the saddle as shown above. The vertical or center position of the control lever is a "neutral" position which stops saddle crossfeed. Pull the lever out to bring the saddle toward you, push the lever in for crossfeed travel away from you. This control is also activated by the trip arm under the left-hand end of the saddle. Adjust the crossfeed trip dogs (see photo, next page) to provide an automatic stop at the end of either in or out saddle travel.



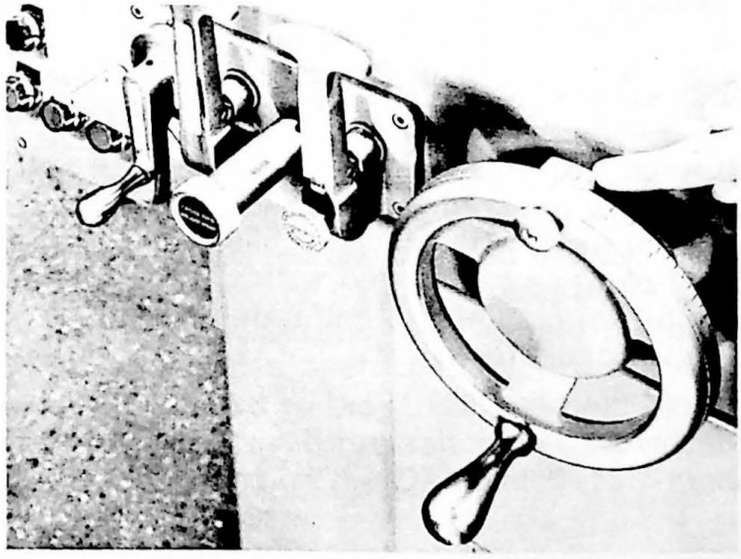
Set the crossfeed trip dogs for the desired total saddle travel in each direction. The saddle will automatically stop when the trip lever contacts the trip dog.

CROSSFEED SELECTOR LEVER WITH WHEEL DRESSING SPEED CONTROL

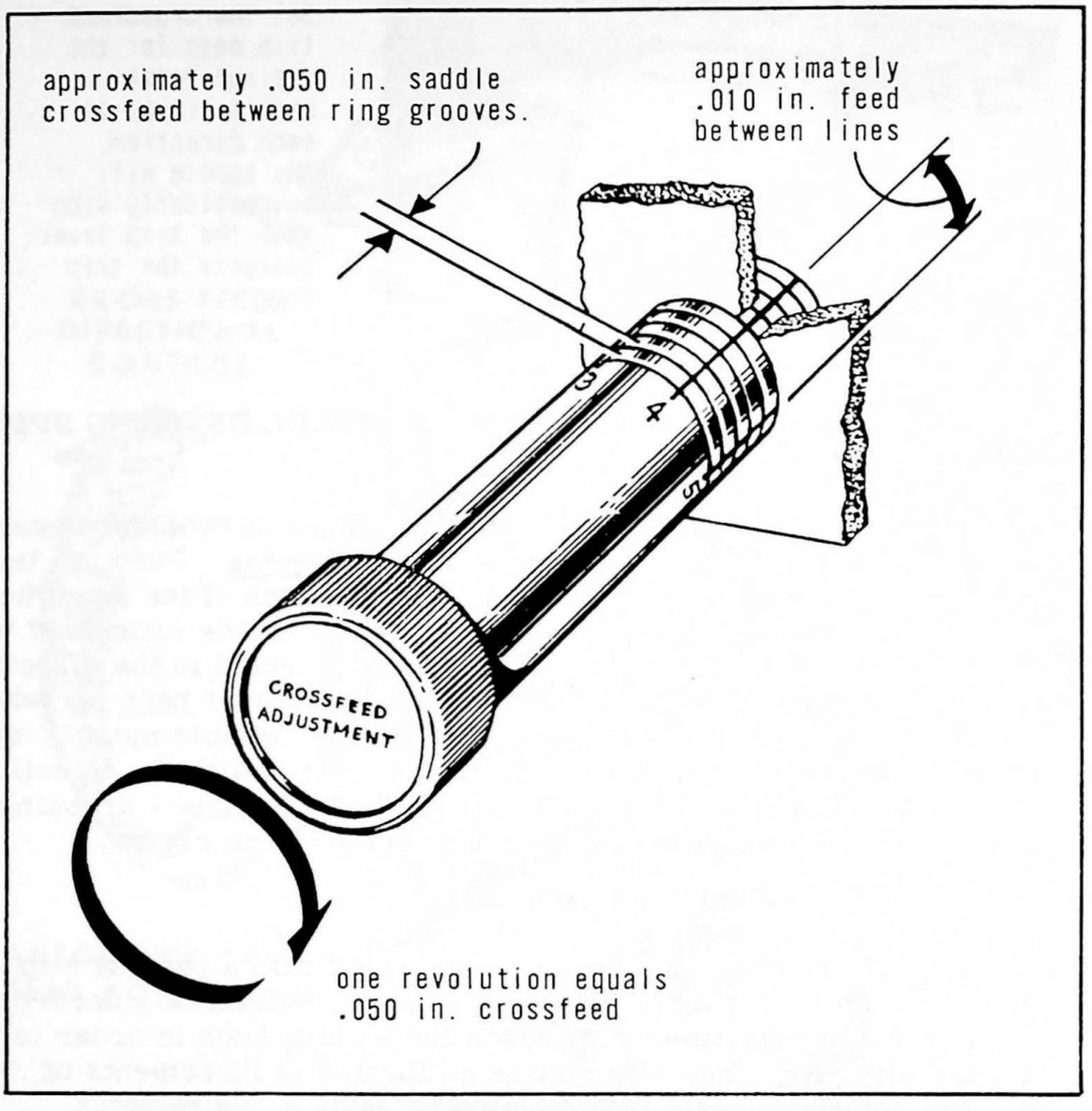
Use the crossfeed selector to select the type of crossfeed operation desired: manual, automatic or wheel dressing. Push the lever forward for manual operation of the saddle by means of the handwheel. When the lever is in the vertical position, the saddle crossfeed will take place automatically at each table travel reversal in the direction selected with the directional control. Pull the lever back for wheel dressing operations. During wheel dressing, the table must be stationary and the saddle moves in or out as selected with the directional control. The rate of crossfeed travel during wheel dressing is adjusted with the small knob in the center of the selector lever.

MANUAL CROSSFEED HANDWHEEL

The manual crossfeed handwheel is provided with a zeroing slip ring. Use the slip ring to establish a "zero" reference point from which to make adjustments. Loosen the locking knob in order to adjust the slip ring. The slip ring is calibrated in increments of .001 in. The reference plate is graduated in .0002 in. increments.



Turning the manual saddle crossfeed handwheel one graduation on the slip ring provides an in or out saddle crossfeed of .001 in. The small reference plate divides each slip ring graduation into five parts, providing crossfeed increments of .0002 in.



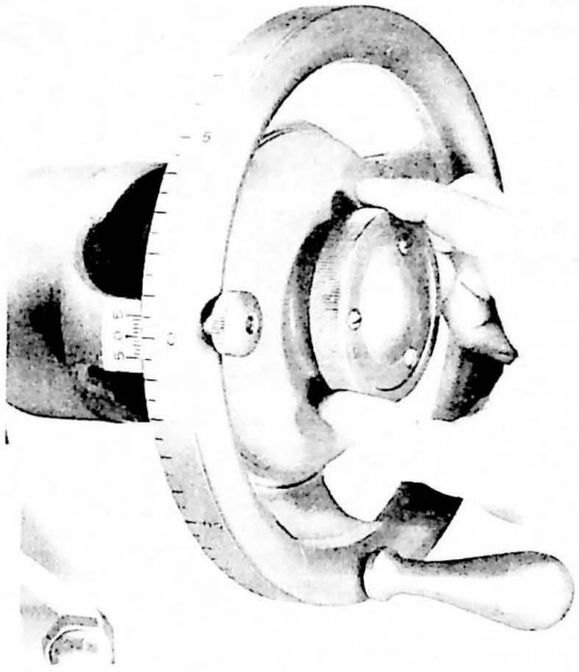
This control is used to adjust the increment of saddle crossfeed desired during automatic operation of the grinder.

AUTOMATIC CROSSFEED ADJUSTMENT CONTROL

Use the crossfeed adjustment control to select the amount of automatic saddle crossfeed which is desired at each table reversal. Each revolution of the control knob will produce .050 in. crossfeed (see drawing). The control shaft is calibrated with ring grooves (each groove represents .050 in. crossfeed) and numbered lines (each line represents .010 in. crossfeed).

PILOT VALVE

The pilot valve is operated by the table trip dogs during automatic operation. It controls the direction of table travel and requires no adjustment. If it is desired for set-up purposes to run the table beyond the trip dogs, the pilot valve reversing lever can be turned far enough to allow the table to pass the lever. (CAUTION: Move the table very slowly).



The manual vertical feed (downfeed) handwheel. The zeroing slip ring is provided with locking knobs. The large handwheel is used for coarse adjustment down to the workpiece. Each slip ring graduation provides a vertical travel of .0005 in. Then the center fine feed knob is used for fine adjustments down to .0001 in. as indicated on the graduated reference plate, which divides each slip ring graduation into five parts.

VERTICAL FEED ("downfeed") HANDWHEEL

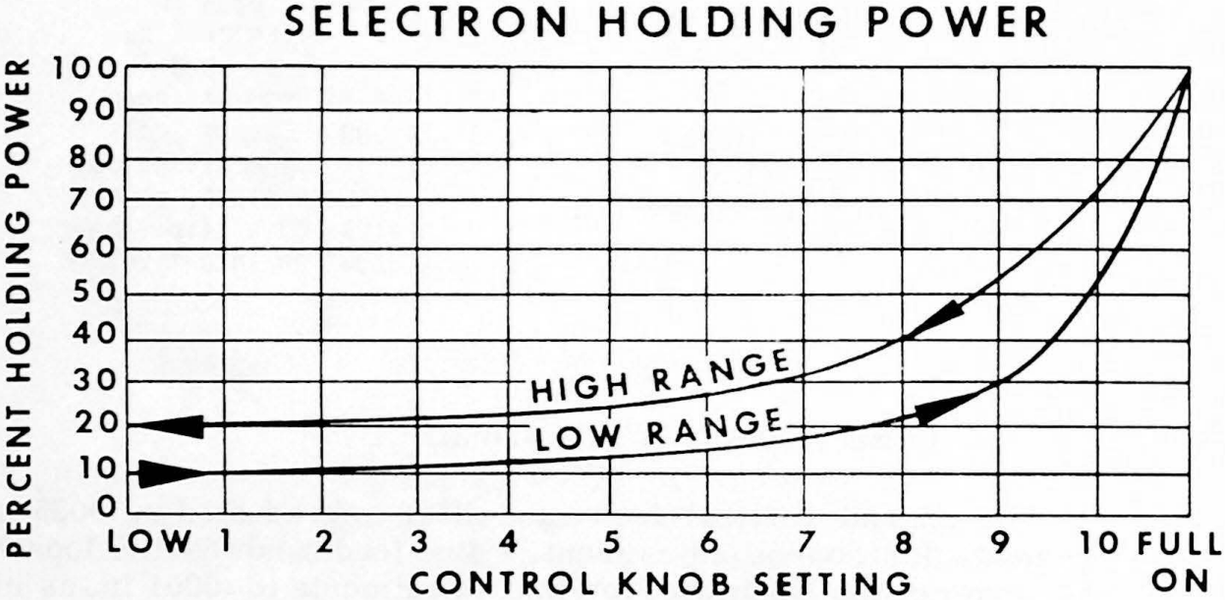
The manual vertical feed handwheel is graduated in .0005 in. increments for coarse adjustment. A fine feed handwheel is located in the center of the handwheel for fine adjustments to .0001 in. as indicated on the reference plate. A zeroing slip ring is provided on the large handwheel.

The advantage in using a zeroing slip ring is that it eliminates the need to do mental arithmetic, a potential source of grinding error. For example, suppose that you wished to grind a step in a workpiece so that it is exactly .0125 inch below the top surface of the workpiece. The slip ring is simply set so that the handwheel reading is at zero. Then, to grind a step .0125 below the workpiece surface, the handwheel is turned to the .0125 reading. No mental calculations are required. NOTE: Motorized wheel elevation, controlled by pushbutton, is standard on the D-8 and D-10 Grinders, and an accessory on the D-6 Models.

USING THE SELECTRON (accessory control for electromagnetic chuck).

Description - The SELECTRON made by DoALL combines a rectifier and demagnetizer into one compact unit, for operating electromagnetic chucks, and has the additional advantage of providing variable holding power. This is an important feature in the grinding of thin work pieces which may be warped by full power. The holding power can be reduced by merely turning the control knob to a setting which will hold the work without distorting it. Work is demagnetized in about 15 seconds by flipping the toggle switch.

The operator is constantly informed as to the condition of the chuck by a neon light which shows when the magnetic power is on. It varies in intensity to indicate the relative holding power of the chuck. A flashing red light signals the demagnetizing cycle and stops when the cycle is completed.



Illustrating the holding power provided by each setting of the control knob.

SELECTRON Holding Power - Starting from a fully demagnetized condition, the holding power of the SELECTRON increases as shown on the chart (above) from minimum of 10% at "low" dial setting to 100% at "Full On". There are two curves on the chart--the first showing the low range and the second the high range showing the curve as the control knob is turned down from the "Full On" setting without demagnetizing to the "Low" dial setting. Note that the holding power follows a new and considerable higher curve

This phenomenon is called magnetic hysteresis and becomes more pronounced with the harder steels. It actually provides a dual range of holding power for the work piece. When grinding very hard

steel work pieces, and if the holding power is insufficient at low range control knob settings, the holding power in some instances can be more than doubled by turning from the zero setting to the "Full On" position and then down again to the desired setting.

CAUTION

Keep unit dry---coolant or moisture will short circuit the SELECTRON.

Operation -

(1) Turn control knob to desired holding power.

(2) Set toggle switch to "Magnetize" position.

(3) Set circuit breaker at "On" position. 50 and 100 watt SELECTRONS are not equipped with a circuit breaker.

(4) Turn power switch on. In a few seconds the magnetic circuit will be in operation.

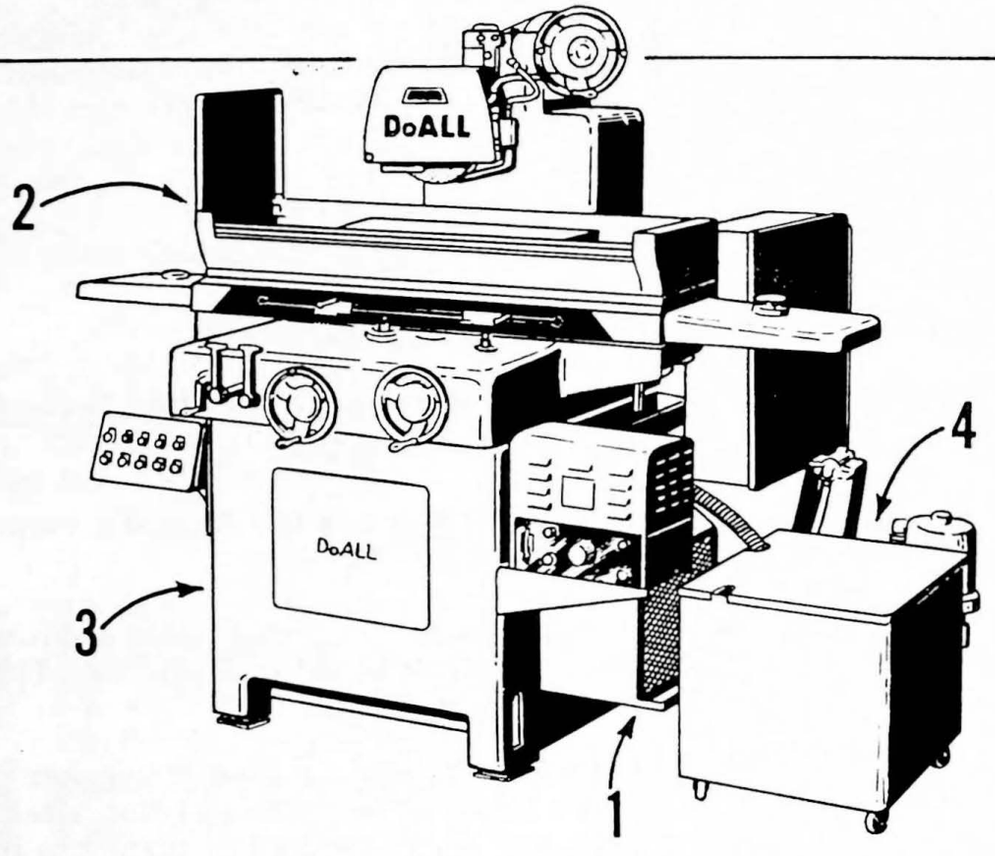
(5) To demagnetize flip toggle switch to demagnetize position. In about 15 seconds the work can be removed from the chuck (CAUTION Remove work very carefully to avoid scratches).

The SELECTRON is equipped with either a circuit breaker or fuse in the A.C. line. If the circuit trips to the "Off" position after a few seconds the circuit breaker will reset and can be turned to the "On" position. If it trips "Off" again check the tubes and the power terminal strip in the SELECTRON. If either one is shorted out, it will short circuit the unit, causing the circuit breaker to trip. If the unit is equipped with a fuse and the unit can not be energized the fuse is probably defective.

There are several models of SELECTRONS used on the DoALL grinders. This model is used on the D-8 series of machines.

CHAPTER 4

PREPARATION FOR OPERATION



Check these points each day before operation.

(1) Models with air filter in base - Check air filter daily. Remove filter for cleaning by first sliding up, then pulling out on bottom. Check to see if fan is operating by pressing hydraulic start button. Make sure that all base panels are in place---this is very important for proper base ventilation.

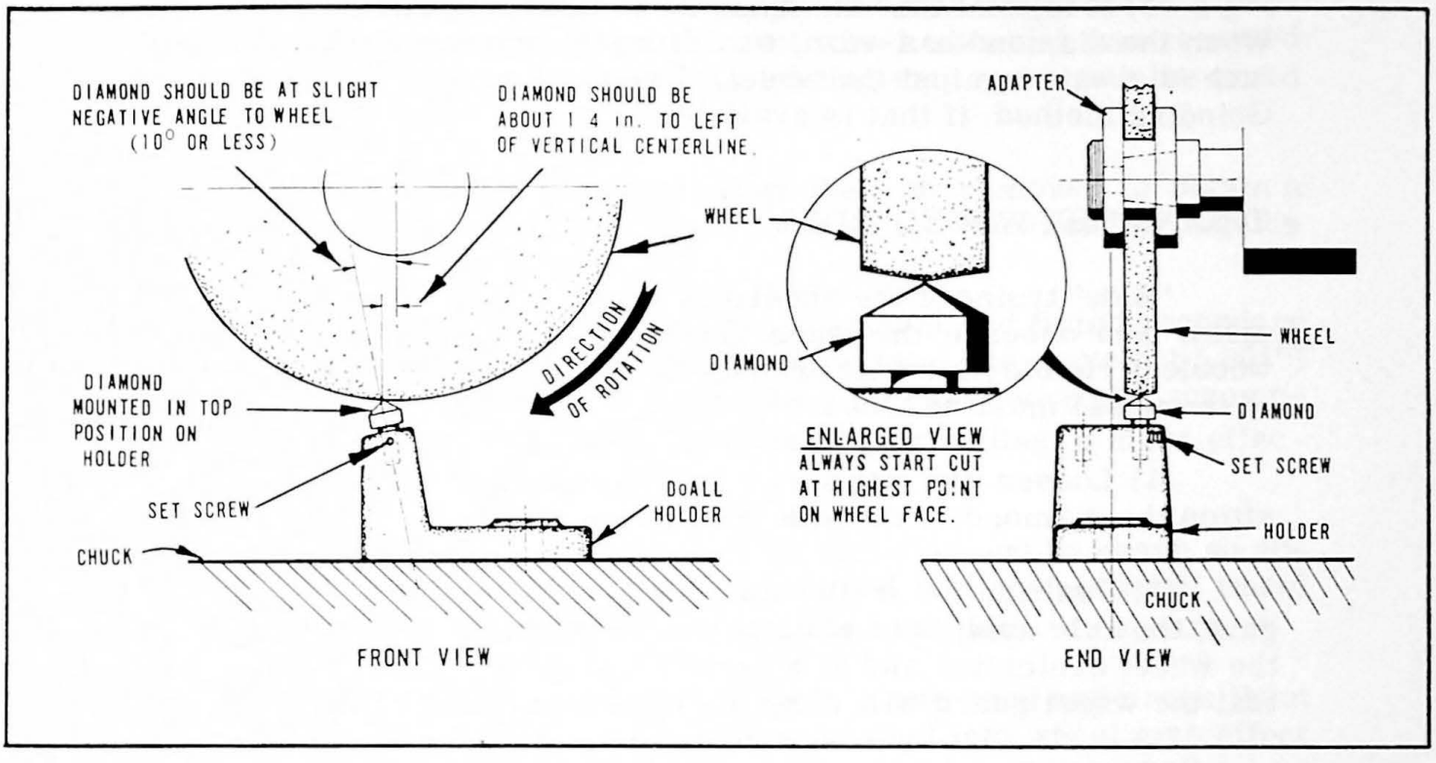
(2) Check oil level in automatic lubricator tank (sight gage on side) and fill if necessary with DoALL Way Lubricant. Check to see if column, table and saddle ways are being lubricated by looking or feeling for fresh oil on the ways.

(3) Check hydraulic tank oil level (sight gage at left side of base) and fill if necessary with DoALL hydraulic fluid. Mix with one gallon of EP-90 Hypoid oil at each refill. Keep tank full at all times.

(4) Check coolant tank fluid level and condition of coolant. Change coolant and filter or fill tank if necessary. Use Kleen Kool made by DoALL and mix per instructions on container label.

TRUING THE WHEEL FACE

(1) The position of the diamond on the table with respect to the grinding wheel is important for proper truing. The diamond point should be located slightly to the left of the wheel centerline (about 1/4 in.) as shown below. This is a safety precaution to prevent the diamond from digging into the wheel.



This is the correct position of a chuck-mounted diamond dresser when used for truing and dressing the wheel. (DoALL Dresser shown).

NOTE

Use coolant if at all possible during truing procedures. This will prevent the diamond from overheating.

The diamond should also be canted at a negative rake angle of 15° to the direction of wheel travel. In this way the diamond will be worn at a bevel. Then, in order to present a sharp cutting surface to the wheel, all that is necessary is to turn the diamond in the holder (15° or 20°) so that the high, sharp edge of the bevel encounters the wheel. This should be done regularly. The DoALL diamond holder (available as accessory) has an arrow that indicates the direction in which the holder should be placed on the table with respect to wheel rotation. The arrow on the holder should point in the direction of wheel rotation as observed at the bottom of the wheel. This holder locates the diamond at the desired 15° angle.

(2) Start the spindle motor. Position the grinder saddle and adjust the wheel height so that the cutting edge of the diamond will just contact the highest point on the wheel periphery (usually at the center). The precaution is necessary to prevent the diamond from taking too deep a cut in the wheel with subsequent damage to the diamond and the wheel.

(3) It is vital that the diamond be sharp, particularly for truing. When the diamond has worn, turn it a few degrees so that a sharp face is always against the wheel. Use Coolant (especially the Cool Grinding method, if that is available.)

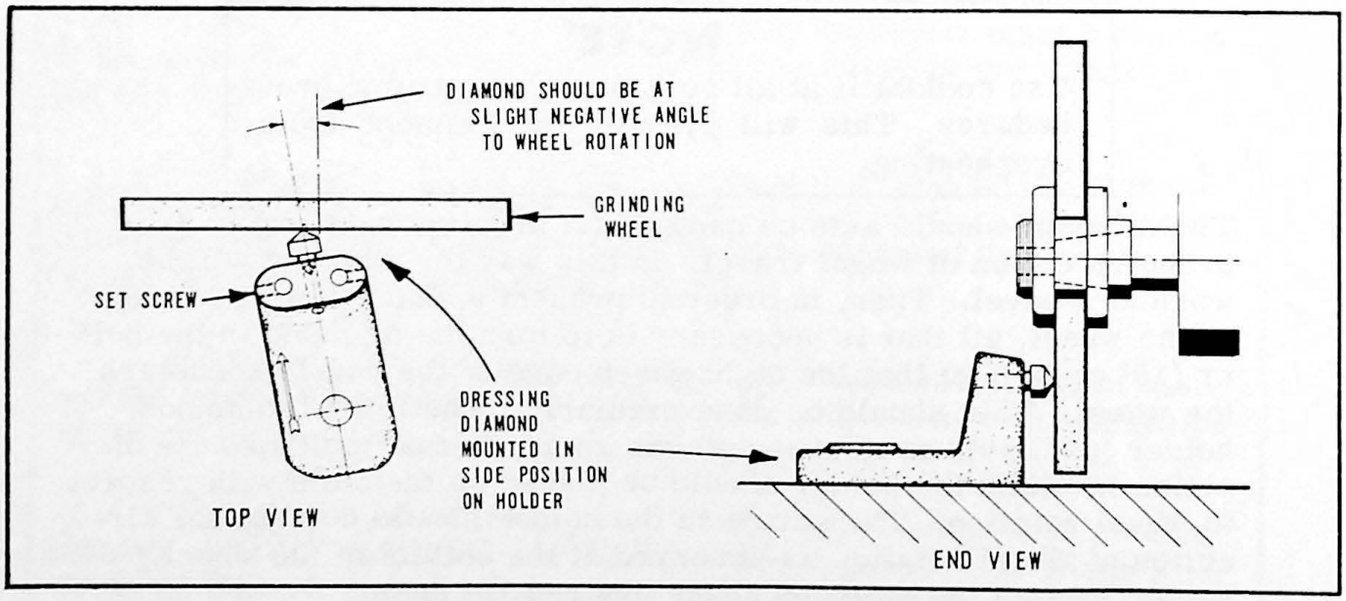
TRUING THE WHEEL SIDES

"Side" truing of the wheel may be necessary. Turn off the spindle motor and observe the wheel from its edge as it slows down. If any wobble is visible (this will produce lines in the work piece), the sides of the wheel must be trued.

(1) Loosen the set screw holding the diamond in place and position the diamond in the side position on the holder.

(2) Position the holder as shown in drawing below. Once again, the rule applies of placing the diamond slightly to the left of the wheel centerline and at a negative rake angle of 15°. Make sure that the wheel guard will clear the diamond during table traverse.

(3) Feed the diamond across the side of the wheel (using manual table control) at a very slow table speed and a cut of about .002 in. Then adjust the crossfeed handwheel for another cut and make another pass in the opposite direction.



Side truing the grinding wheel, using the DoALL Diamond Dresser.

DRESSING THE WHEEL*

After a wheel has been properly "flat trued" it may or may not have the desired "dress". If the wheel is to be dressed for removal of material at a moderate rate and a fine finish is also desired, its face should be as even and flat as possible. This may have been accomplished in the truing process, but in general, a wheel should be purposely dressed for the finish desired. Sometimes, however, the wheel will be heavily "loaded", i.e., glutted with chips from a previous grinding operation. If insufficient wheel material was removed in the truing operation, some of this loading may remain in the trued wheel.

Additional wheel material must then be removed to obtain a clean, sharp wheel. Consistent clean color of the wheel can be a guide to this.

If rapid removal of material is paramount and finish secondary omit the finish cut when truing the wheel or take one more cut (.001") at a fairly rapid crossfeed. This leaves a spiral groove and accompanying spiral ridge in the wheel face, thereby providing a more effective cutting surface.

For good dressing it is essential that diamond be sharp so abrasive grains will be completely fractured and project from wheel bond. Turn the diamond in its holder 15° or 20° when necessary.

A dull diamond tends to crush grains into bond and crack them without producing a clean break. Grains mashed into wheel give effect of wheel loading while cracked grains come out while grinding and produce scratch lines in work.

For fine finishes on flat grinding jobs, wheel edges should be rounded off with a hand stone or precision tool after dressing. This will prevent chipped wheel edges and will keep feed lines on the work at a minimum. Shoulder grinding will necessitate a true 90° wheel edge.

CAUTION

Care should be taken to avoid burning the diamond. Coolant applied to a hot diamond may cause it to crack.

*Instructions for the use of the "Over-the-Wheel" Dresser Accessory are given in the Accessories Chapter.

BALANCING THE GRINDING WHEEL

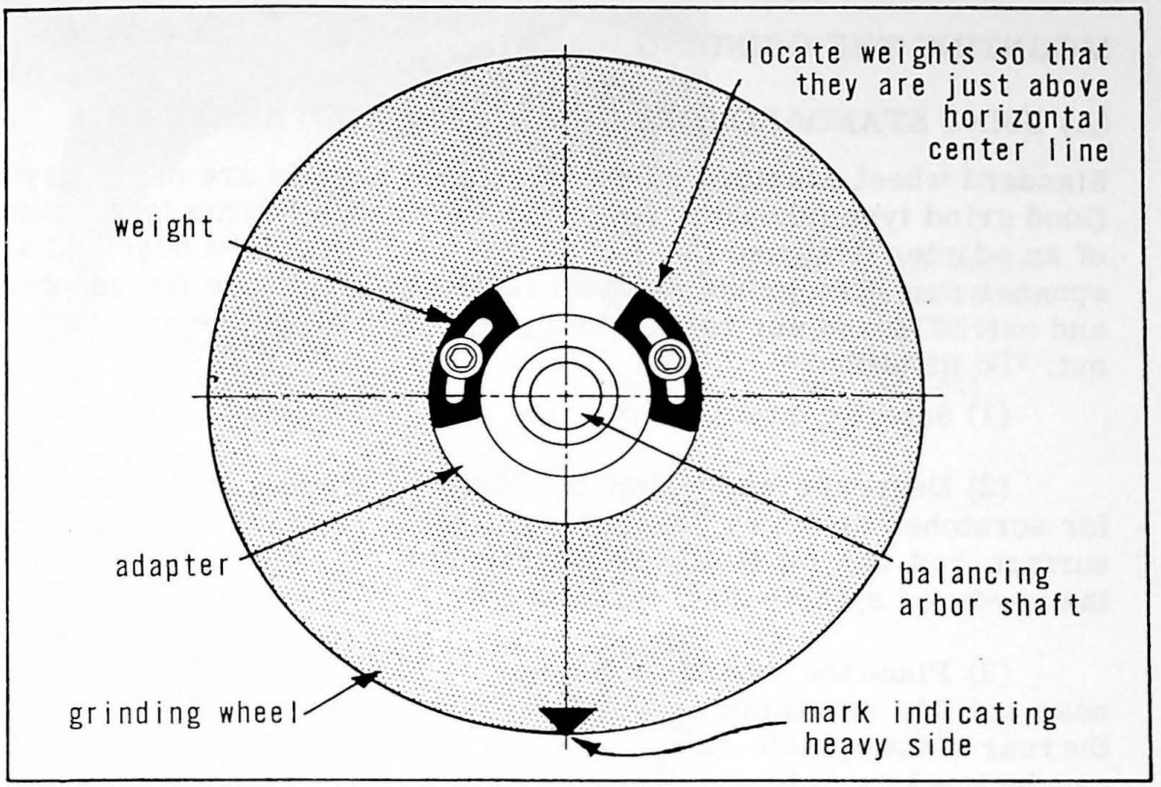
For accurate grinding, it is essential that a grinding wheel be in good balance. All advantages of well conditioned equipment, skillful set-up and operation are sacrificed if the grinding wheel is out of balance. The pounding or vibration of an unbalanced wheel, no matter how slight, will result in poor grinding.

The DoAll Balancing Arbor and Stand.

The balancing arbor and stand consist of an arbor shaft which supports the wheel and adapter upon two V's formed by overlapping disks. To avoid false indication, the arbor and stand must be kept clean, in good condition and level. Before balancing, the wheel should be run several minutes without coolant to sling out excess water. Follow this procedure to balance a wheel:

(1) Mount the wheel on the grinder and true the wheel. Mount the assembled wheel adapter on the tapered nose of the arbor shaft. Then place on the stand disks.

(2) When the wheel is placed on the stand, it will oscillate for a moment before coming to rest. Mark the exact bottom of the wheel with chalk, rotate it 90° and allow it to come to rest again. If the chalk mark is again at the bottom, the wheel is out of balance and the chalk mark indicates the heavy side.



How to locate the weights on a balancing-type wheel adapter.

(3) The heavy side of the wheel is offset by moving balancing weights incorporated in the adapter. Adjust the weights so that they are located on each side of the wheel just above the horizontal dia. when the heavy spot is centered at the bottom (see drawing above).

(4) Then move each weight upward slightly and rotate the wheel. If it comes to rest with the heavy spot down, move the weights higher. If the chalk mark is uppermost, lower them slightly. Continue until the wheel is in balance when set in any position.

(5) It is important that the wheel be trued on its own adapter before balancing, and again after it is balanced. Make sure the balance weights are tight before placing the balanced wheel on the machine.

(6) If original heavy spot is so heavy that no arrangement of counterweights will balance the heavy side, check arbor and adapter for run-out and all corrective measures set forth in mounting wheel.

CAUTION

If the unbalanced condition still persists, do not operate the wheel. Contact the supplier concerned for instructions, as wheel may be damaged and unsafe to operate.

MOUNTING THE GRINDING WHEEL

(A) USING STANDARD (DRY or FLOOD GRIND) ADAPTERS

Standard wheel adapters supplied with all models are of the dry or flood grind type (shown in photos and drawings). This type consists of an adapter designed to fit over the spindle tapered nose, and a spanner nut. The grinding wheel is clamped between the adapter and nut. The adapter is attached to the spindle by the spindle nose nut. To install:

(1) Select correct adapter for the wheel size.

(2) Degrease and clean the adapter. Inspect adapter carefully for scratches or burrs. The I.D. bore of the adapter is not a hardened surface and can be easily scratched if it is carelessly placed over the hardened spindle nose threads.

(3) Place the adapter on the spindle nose. Lightly tighten spindle nose nut (do not tighten nut excessively). An opening is provided at the rear of the spindle on belt-driven grinders so that a socket wrench can be used to hold the spindle stationary while removing the nose nut.

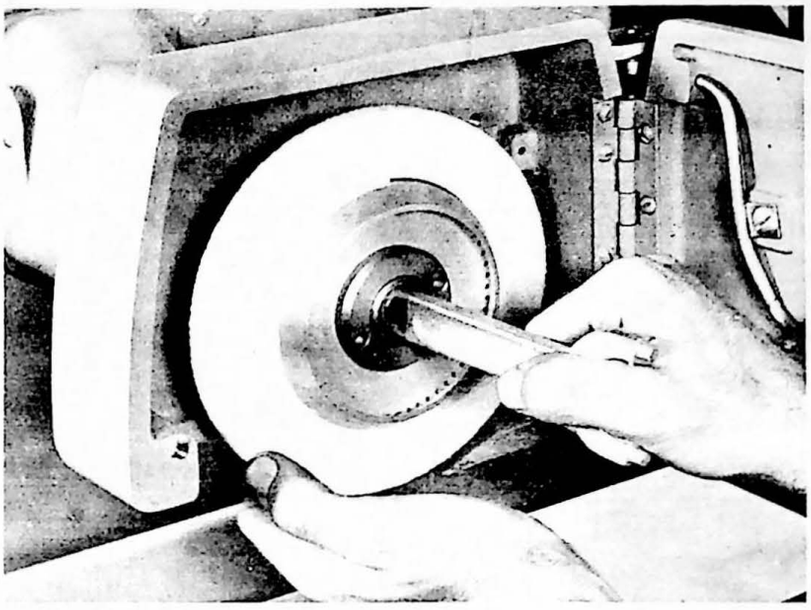
(4) Place wheel on adapter (do not remove wheel blotters. DoALL perforated wheel blotters must be used with "Cool grinding" adapters). Install spanner nut using spanner wrench furnished with machine. Do not tighten excessively or wheel may crack.

(5) Dress face of grinding wheel, then dress wheel sides as described under "wheel dressing".

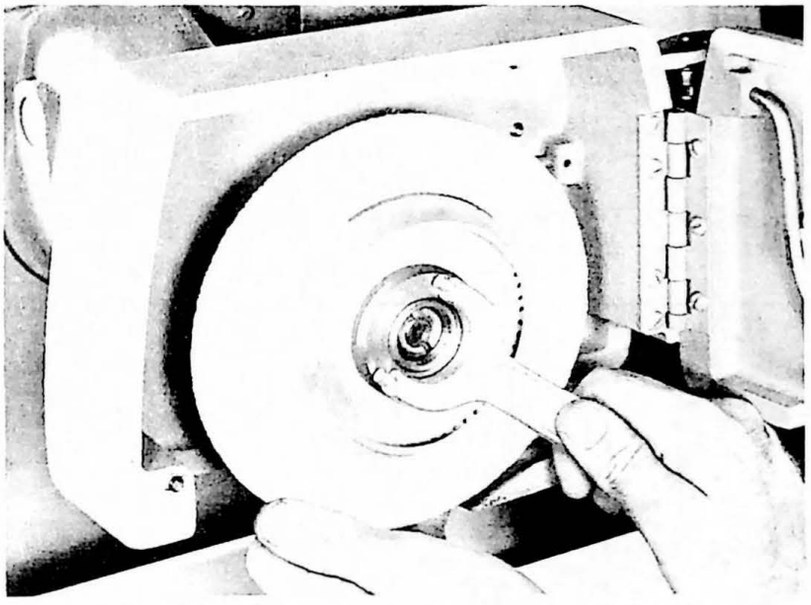
(6) Remove wheel and adapter as unit. Use wheel puller furnished with machine; remove spindle nose nut, screw puller into adapter and turn puller screw in until it contacts spindle and forces adapter off.

(B) USING "COOL GRIND" ADAPTERS (WITH OR WITHOUT BALANCING LUGS).

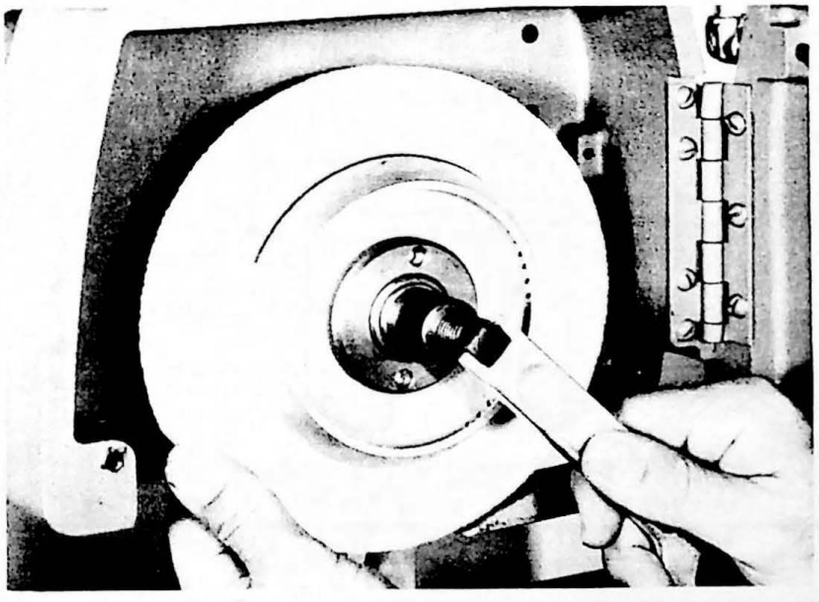
"Cool grind" adapters are identical to dry or flood grind adapters except for the addition of coolant collector flanges (see photos). Note that the adapters for the small wheels (7 and 8 in. dia.) have separate flanges, adapters and nuts while the large wheel (10, 12 & 14 in. dia.) adapters are two-piece units with rear flange combined with the adapter and front flange attached by screws. Assemble the adapters and wheels in the same manner as the dry or flood type. Balance the adapters with balancing lugs as described in "Wheel Balancing".



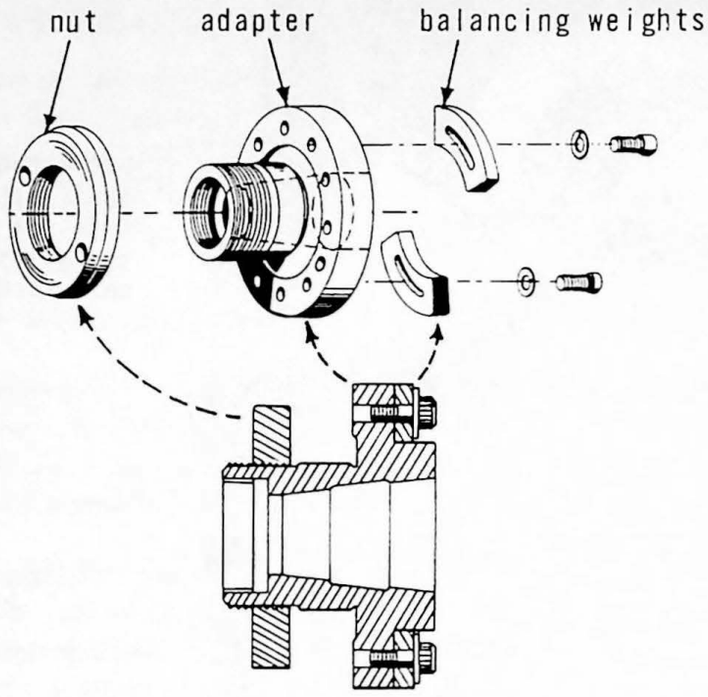
Use wrench handle to tighten spindle nose nut (NOTE: spindle has left-hand threads).



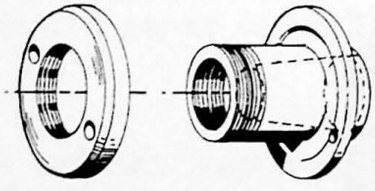
Using spanner wrench to tighten adapter nut.



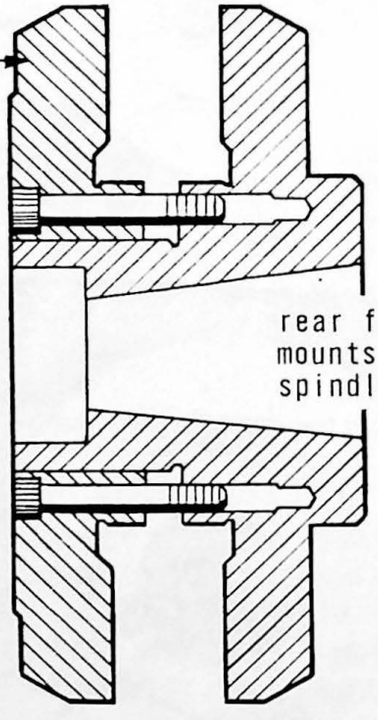
Use wheel puller to remove wheel and adapter (cool grind adapter shown).



Dry or flood type with balancing weights for 7 & 8 in. diameter wheels.

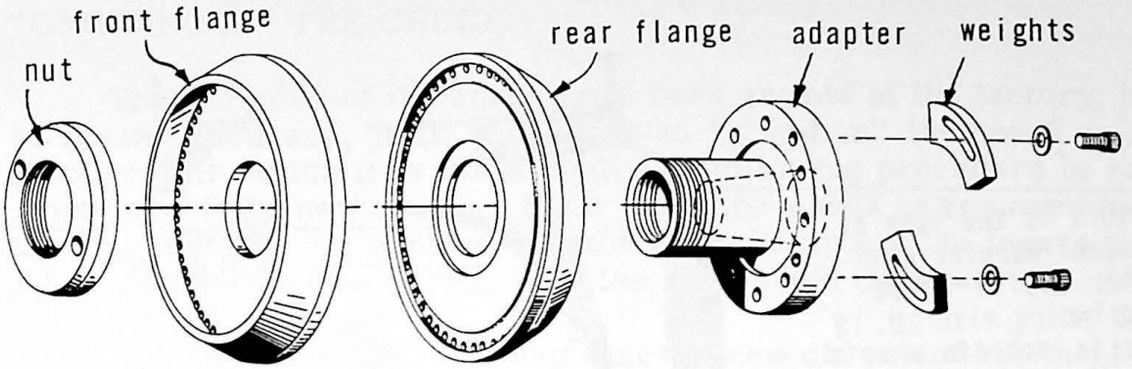


Adapter without balancing weights for 7 & 8 in. diameter wheels.

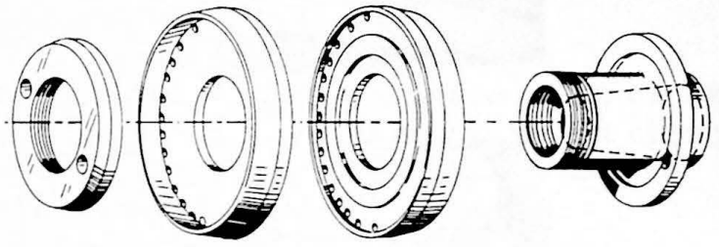


Dry or flood type without balancing weights for 10, 12 & 14 in. diameter wheels,(for balanced type, use cool grind adapter).

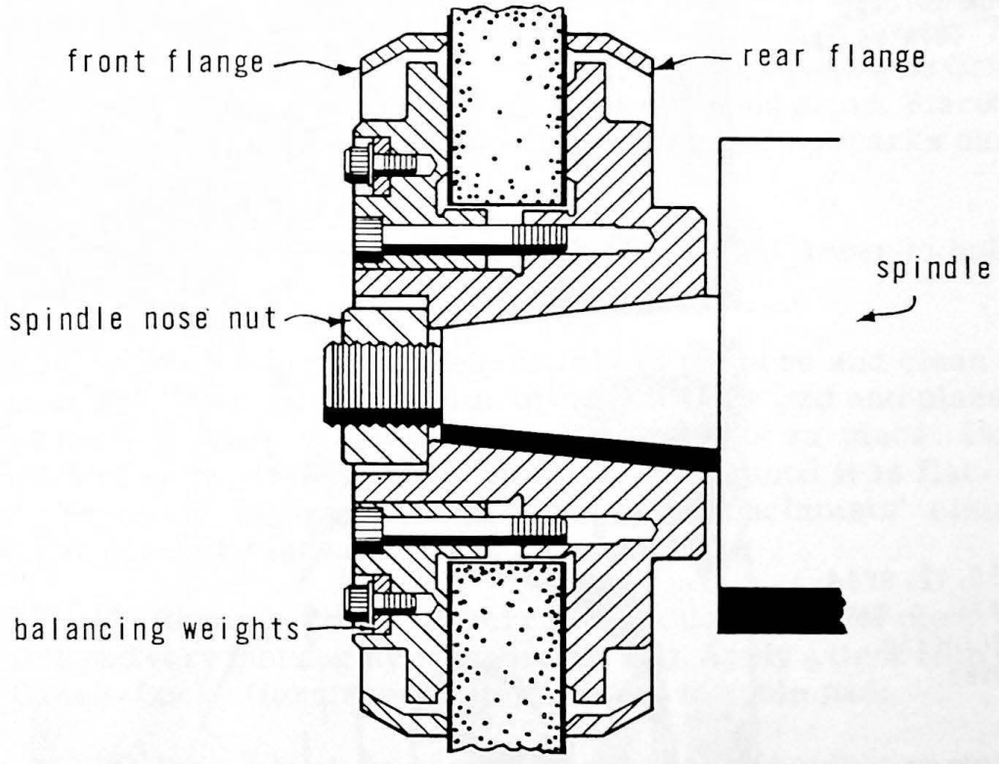
Dry or flood grinding adapters.



Cool grind type with balancing weights for 7 & 8 in. diameter wheels.



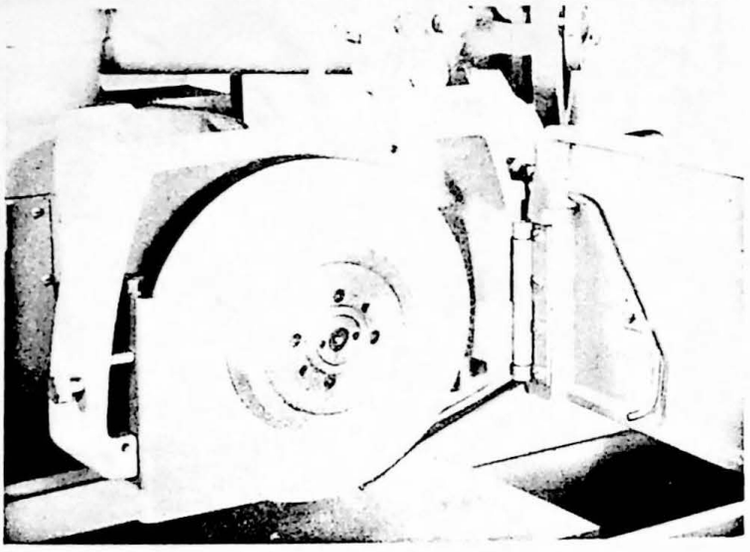
Cool grind type without balancing weights for 7 & 8 in. diameter wheels.



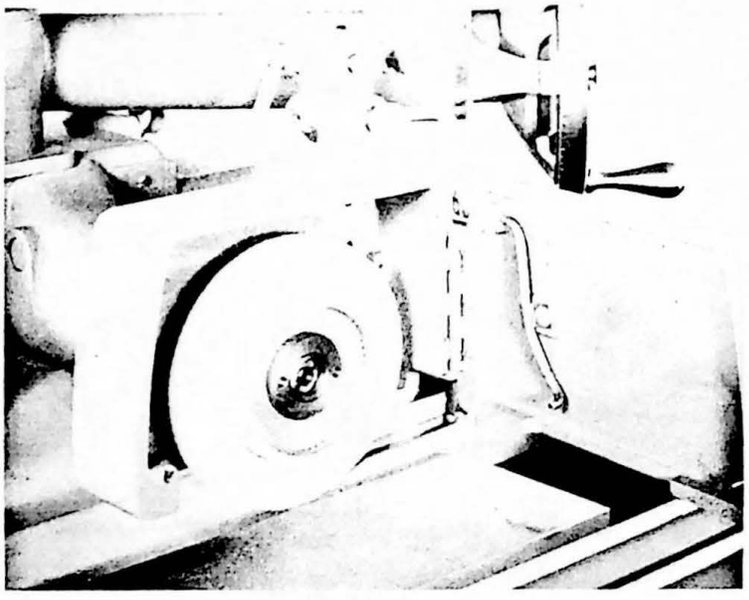
Cool grind type with balancing weights for 10, 12 & 14 in. wheels.

Three types of wheel adapters used for cool grinding.

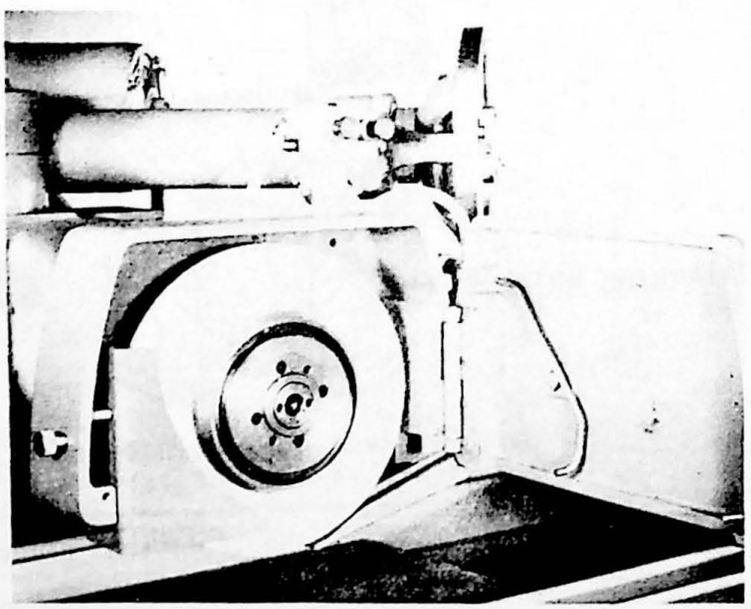
This is the type of wheel adapter used for dry or flood grinding with 10, 12 or 14 inch dia. wheels.



''Cool Grinding'' type of wheel adapters have perforated flanges for coolant flow through the wheel. This is the adapter for 7 or 8 in. dia. wheels.



For larger, 10, 12, or 14 in. dia. wheels, a two-piece cool grinding adapter is used.



"GRINDING IN" THE CHUCK

The surfaces of the chuck have been ground at the factory, but, to insure accuracy, it is necessary to "grind in" the chuck on the grinder with which it is to be used. The following procedure is recommended for a new chuck: Each time the chuck is removed from the machine, the top surface should again be ground, to insure parallelism between this surface and the saddle and table ways.

(1) Carefully clean and degrease the new chuck and the machine table pad. A "46 -I" or "J" wheel is recommended.

(2) Use a file or deburring tool to break the outside edges of the bottom side. Check the bottom surface for burrs. Apply a light film of oil to table pad.

(3) Grind the top (holding) surface of the chuck first. Place the chuck on the table and block in place Do not clamp the chuck down (this will provide a true, undistorted surface for grinding). Use a coarse dressed grinding wheel.

(4) Take .0005 in. deep cuts, using .030 in. crossfeed and 75 fpm table speed. Use coolant. Do not turn chuck power on. Grinding should start with the high side of the chuck. This is located by finding the high point at back side of chuck, setting downfeed slip ring to 0, raising wheel and locating highest point of front side of chuck. Then compare the two sides and start grinding at highest side. Grind in both directions, reducing downfeed a little on second grind. Start with 1/8th wheel contact (if coolant is not used for first pass, sparks can be more easily seen).

(5) Dress the wheel (using SELECTRON power to hold the diamond dresser).

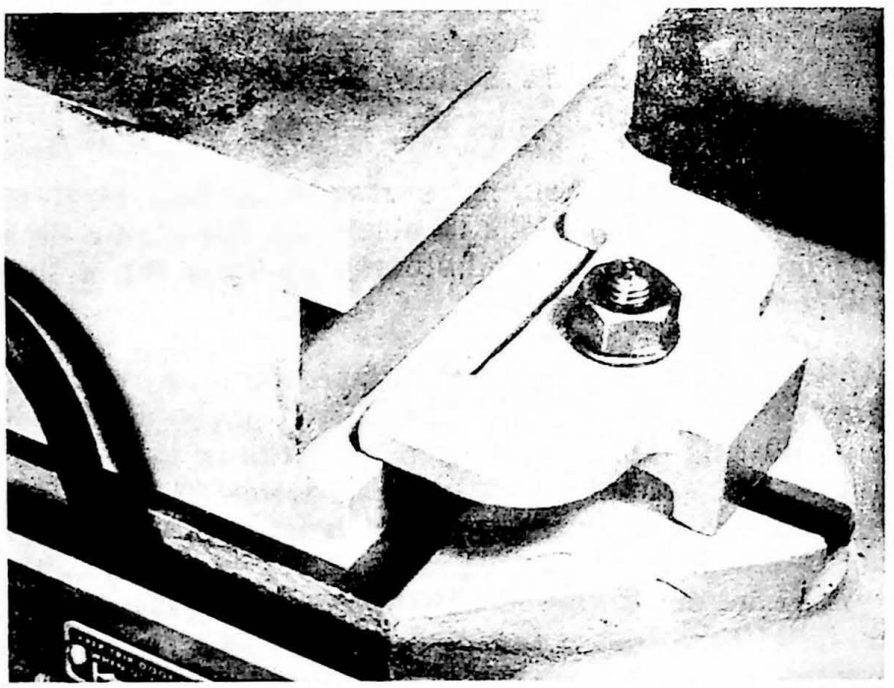
(6) Remove chuck, deburr, break corners and clean chuck and table pad. Place a light film of oil on table pad and place chuck on pad with holding surface down. Block chuck in place. Do not use SELECTRON power. Grind bottom of chuck until it is flat. Note: If it is necessary to dress wheel again, use machinists' clamp to hold wheel dresser on chuck.

(7) Remove chuck, deburr, break corners and clean chuck and table pad very thoroughly (remove all oil). Apply a light film of DoALL "Chuck-Lock" (furnished with machine) to table pad.

(8) Place chuck in normal position with holding surface up. Use table clamps this time, tighten both clamps finger tight first. Adjust chuck so that it is parallel to table travel, use a .001 in. indicator.

Tighten left hand clamp. Tighten right-hand clamp tight, then back off slightly. When chuck is correctly positioned, tighten right-hand clamp nut slightly more than finger tight. This will allow the chuck to expand in a horizontal plane without buckling. Dress wheel.

(9) Grind top surface (with full SELECTRON power on) until it is flat. The final cut should be at .0002 in. downfeed and .030 in. cross-feed with 75 fpm table speed.



This type of heavy-duty chuck clamp must be used on all high-speed (125 fpm) grinders.

SELECTING and MIXING COOLANT

DoALL Kleen-Kool is a nontoxic, chemical type coolant developed specifically for precision "Cool Grinding". When mixed with water it instantly forms a true chemical solution without the danger of inverting or separating in the machine. The solution is transparent, allowing the operator a clear view of the workpiece.

Kleen-Kool has the distinct advantage of not attacking aluminum or copper as do some of the cheaper synthetics. This allows its use over a wide range of materials.

Any evaporative product of Kleen-Kool is readily redissolvable in water, resulting in a clean wheel. Solvent type cleaners are not recommended. Their use may create a film which is extremely messy to remove.

Frequently hard water precipitates are mistakenly identified as Kleen-Kool residue. They naturally won't redissolve in water. A solution of dilute hydrochloric acid and water will be of use in removing these products.

Kleen-Kool was formulated to be used in dilutions of from 1:20 to 1:100 as indicated on the container. Using in a more concentrated form than 1:20 does not materially improve the performance. Using in a more dilute form than 1:100 may result in rusting.

Two other types of cutting fluids may be used in grinding operations under certain conditions.

(1) DoALL No. 470 Soluble Oil is recommended for grinding high-alloy steels where premature wheel breakdown is to be avoided and better surface finishes are desired. Being a water "soluble oil" or emulsion type cutting fluid, Number 470 exhibits heat conductivity between that of water and of oil alone.

(2) DoALL No. 150 Cutting Oil is recommended for grinding high-chrome, high-nickel materials to super-fine finishes. It is also recommended for machining active metals such as zinc, magnesium, etc.

Wherever a fine spray or mist is created, action should be taken to confine the mist to as small an area as possible.

WARNING

Prolonged continued contact of the hands with cutting fluids may lead to difficulty. Water soluble cutting fluids tend to remove the natural oils from the skin. The hands become dry and may crack, exposing the body to attack by bacteria. Individual susceptibility varies greatly.

Therefore, care in personal and shop hygiene is important. A mild soap should be used rather than harsh or abrasive types. A soft paper wipe may be used to keep the hands dry. Should the skin become excessively dry a good quality hand cream is recommended. Clothing should be changed frequently enough to prevent their becoming soaked with cutting fluid.

Most important, contaminents must be kept out of cutting fluid systems. Food particles, cigarettes, and spitting will introduce external bacteria to the system and contaminate the fluid. This will contaminate the fluid so that it can not do its job and also encourages the growth of bacteria and mold. The best protection the operator has is his own observation of good, regular hygiene habits. A clean cutting fluid, a clean machine and a clean operator are a perfect combination.

CHAPTER 5

OPERATION

GRINDER WARM-UP TIME

For precision work, the grinder should be started about 30 minutes before actual grinding. This will allow the hydraulic oil to reach the correct operating temperature required for maximum table speed. Press the hydraulic and spindle start buttons, set trip dogs for medium length table stroke, and slowly increase table speed.

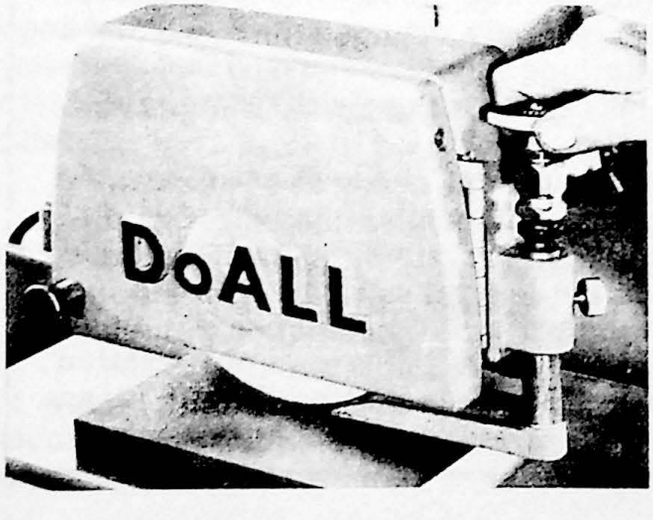
> **CAUTION**
>
> Remember that overtravel is greatest on a cold machine and at higher table speeds. This will require a closer trip dog spacing than usual until the hydraulic oil reaches operating temperature.

A thermostatically-controlled, immersion-type, tank heater is available as an accessory. The use of this heater will greatly reduce warm-up time (oil will reach operating temperature in about 5 minutes).

COOLANT APPLICATION

There are two different coolant systems available as accessories; one is a flood coolant system and the other is a combination flood and "Cool Grinding" system. Adjustment is as follows:

(1) Flood grinding adjustment - The flood coolant volume control is located on the right-hand side of the wheel guard. The flood applicator nozzle can be positioned vertically by loosening the locking knob. The splash and dust guard at the left side of the wheel is adjusted by loosening the knob.

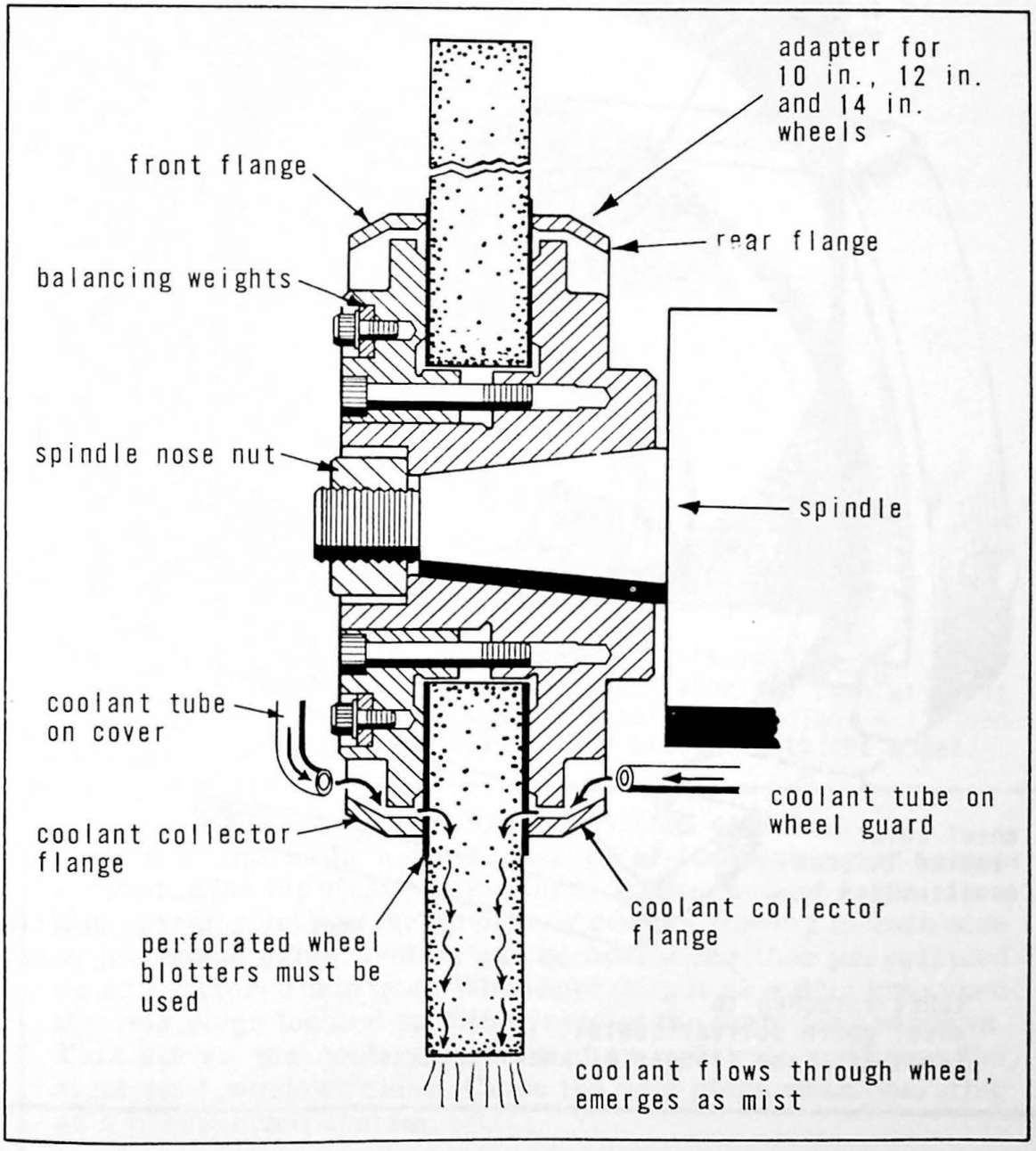


Adjust flood coolant flow with the valve as shown.

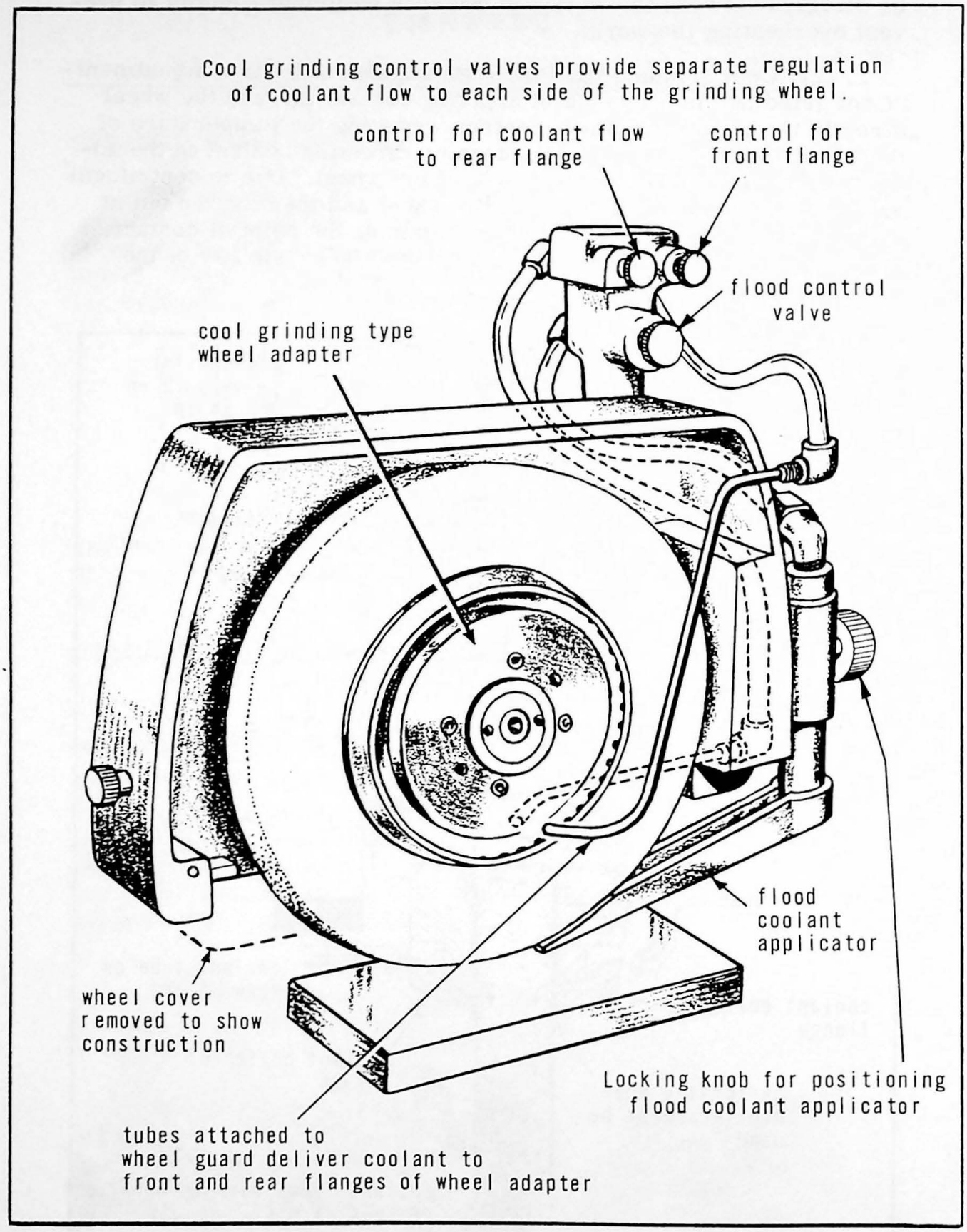
COOLANT APPLICATION CONTINUED . . .

The coolant serves both as a lubricant and a coolant. It should be directed between the work and wheel in sufficient quantity to prevent overheating the work.

(2) "Cool grinding" and flood grinding combination adjustment- "Cool grinding" is a method of applying coolant through the wheel directly to the point of wheel contact, reducing the temperature of the work being ground. This is done by directing coolant to the adapter collector rings on either side of the wheel. Due to centrifugal action, the coolant is sucked into the wheel and then thrown out at the face of the wheel. By applying coolant at the point of contact, much less coolant is required. This gives 100% visibility of the work and the wheel.

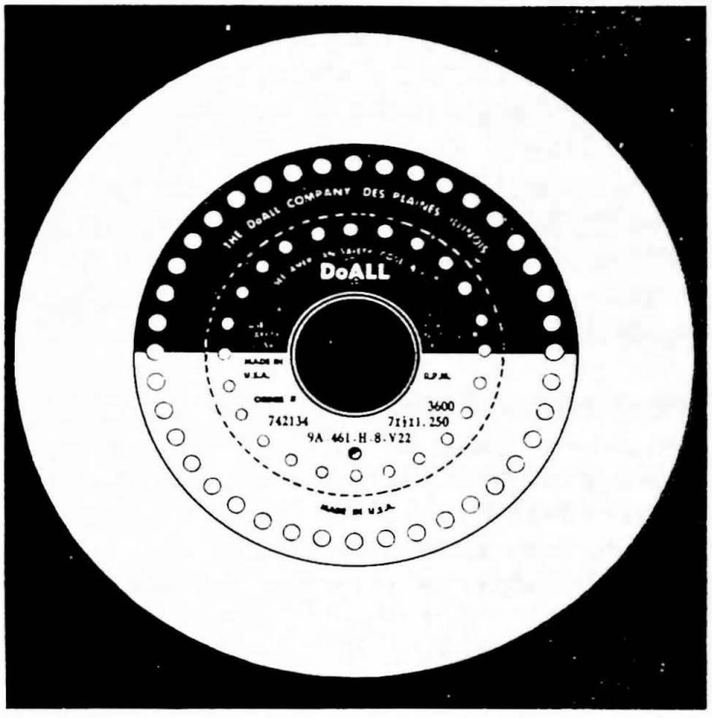


Section drawing of a cool grinding wheel adapter.



The combination flood and cool grinding system.

Cool grinding volume controls are located above the wheel guard. Maximum cooling effect can be obtained by applying a light mist through the wheel. Adjust the two control valves so that the flow is even to both sides of the wheel. Always have spindle running during "cool grinding" adjustment. Make sure the application tubes are positioned correctly for directing coolant into the adapter collector rings. Perforated wheel blotters must be used with the cool grinding adapters. If both systems are used, always make the cool grinding coolant adjustments first, then the flood adjustments last. After grinding, always run the wheel for a few seconds without coolant flowing. This will "spin-off" any excess coolant which could unbalance the wheel.



For cool grinding, perforated wheel blotters such as on the DoALL wheel shown above, must be used. When the cool grinding adapter flanges are installed on the wheel, the coolant will then be able to flow through the adapter and blotter into the wheel.

SPECIAL NOTE FOR PREVIOUS MODELS

D-6, D-8 and D-10 models have sight-feed gages and valves located on the top of the wheel guard. The sight-feed gages allow the operator to see the amount of coolant flowing to each side of the wheel. This system can be operated either pressurized or as a metered drip type. When operating it as a drip type open the vent plugs located on either side of the sight feed windows. This allows the coolant to flow at an even rate and keeps the sight feed windows clear. Close the vent plugs when operating as a pressurized system.

TYPICAL GRINDING OPERATION

(1) Start by selecting the best wheel available for the job, taking into account the flatness and finish desired.

(2) Mount the wheel as described in Chapter 4.

(3) True and dress the wheel as described in Chapter 4. Balance the wheel and adapter next, then true again.

(4) Check the smoothness and flatness of the chuck. Stone it off frequently. Regrind if necessary. Clear away all loose abrasive particles and metal chips. Finally, check the coolant and hydraulic fluid levels. The filters (both air and coolant) must be clean. All loose articles must be removed from the table before high speed table operations.

(5) Place the work piece on the chuck, turn on the SELECTRON, and try moving the work to see if it is being held securely.

(6) Adjust the table trip dogs and crossfeed dogs.

(7) Turn on spindle and hydraulic motors. Turn on coolant motor.

(8) Make the crossfeed adjustments: The crossfeed directional control should be in either the "in" or "out" position, as desired. The crossfeed selector control should be in the "automatic" position. Adjust the automatic crossfeed control to the desired increment of crossfeed.

(9) Downfeed until highest spot in work is just touched. Set downfeed zeroing slip ring and make desired downfeed adjustment with handwheel and fine feed control (down to .0001 in. adjustment).

(10) Start table traverse, adjust table speed slowly.

(11) Adjust coolant flow.

(12) Begin rough cut. Check progress of cut. Check condition of wheel by sight and sound.

(13) Saddle will stop crossfeeding when cut is finished. If another cut is to be made adjust downfeed. Move crossfeed directional lever in opposite direction. Dress wheel if necessary before finish cut.

(14) Machine should be left with the saddle in and table centered.

SELECTING TABLE SPEED

Faster table speed reduces the tendency of heat-sensitive steels to burn under severe grinding conditions. Heat problems in large work can be reduced by using the highest table speed possible, cool grinding coolant application and a coarse-dressed wheel. High table speeds also give a better surface finish on brass.

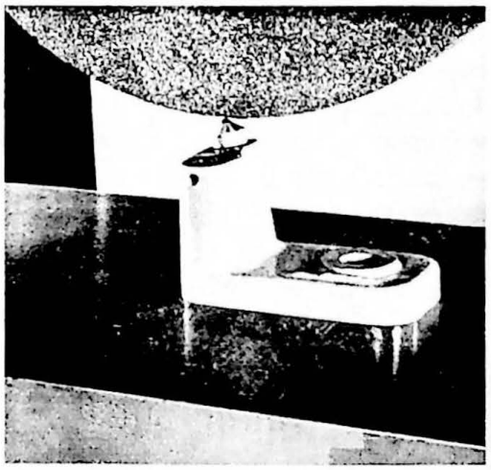
IMPORTANCE OF CORRECT WHEEL DRESSING

It is very important that the portion of the diamond dressing the wheel have a sharp edge, rather than a point, or, worse yet, a dull, rounded edge.

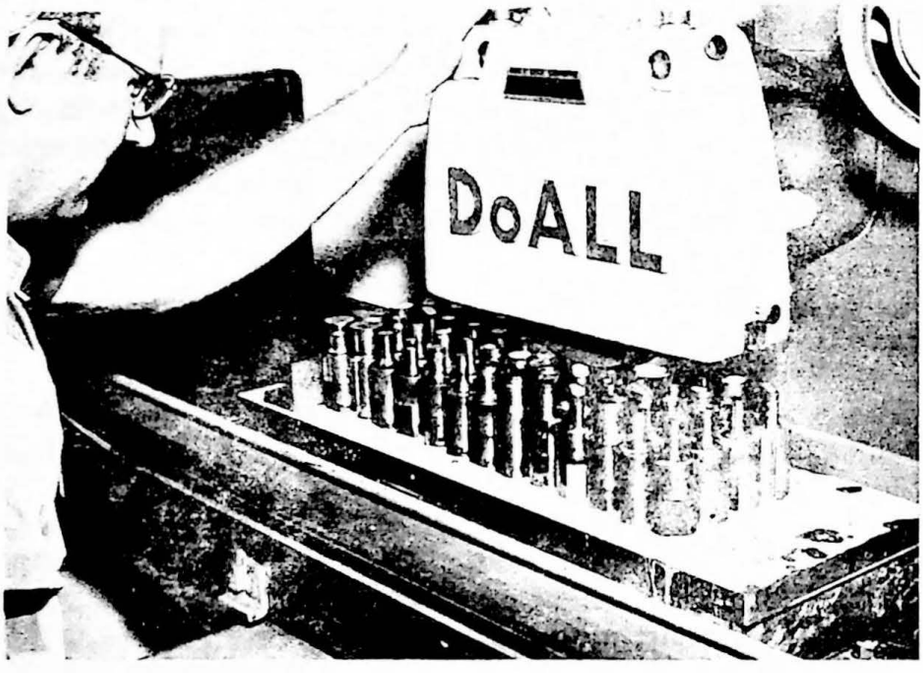
Where dull diamonds are used to dress wheels, the grits are either broken out of the wheel or are burnished by the diamond with the result that their cutting edges are made ineffective. The friction created by the dulled grits in the wheel can therefore generate great heat and is one of the common causes of so called "burnt" work. If care is taken to present an edge of the diamond rather than the point to the wheel, this "dulling" of the wheel can be overcome.

One of the easist ways to accomplish this is to rotate the diamond 15 or 20 degrees with each dressing; and it thereby tends to keep itself sharp in the same way that a pencil keeps sharp when it is rotated in use.

Where heavy, deep cuts are to be taken the wheel should be dressed coarsely enough to provide space for the increased chip load. A loaded wheel acts more as a burnishing wheel and can generate enough heat to melt the material and wipe it off rather than cut it off in the form of minute chips.



The diamond wheel dresser is available as an accessory.



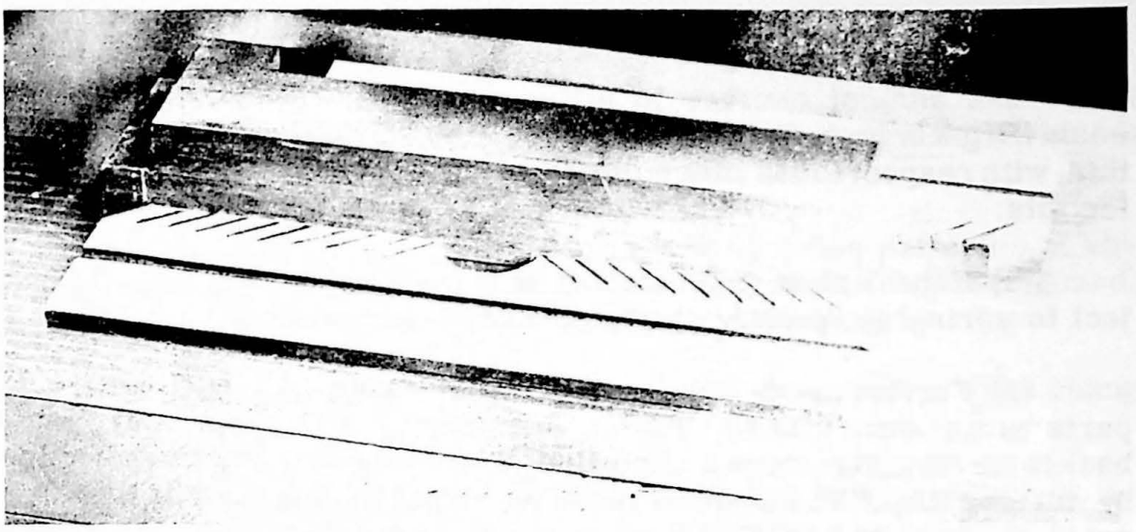
Grinding a chuck load of small parts requires a well dressed sharp wheel and light cuts.

GRINDING NON-MAGNETIC MATERIALS

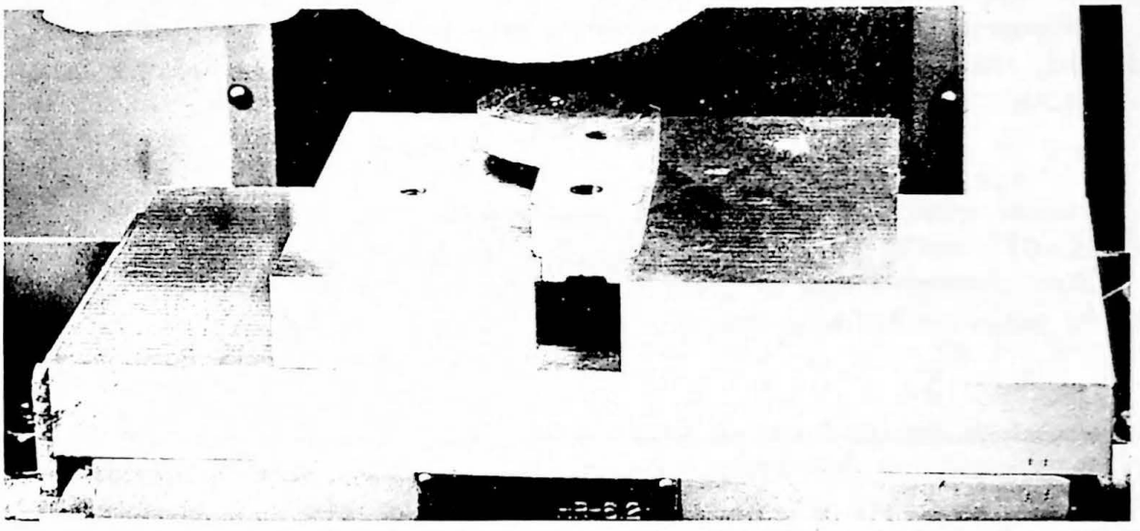
Non-magnetic parts can be held on the electromagnetic chuck by several means. One of the simplest methods for small parts is using double-sided tape between the work and chuck. The pressure of the grinding wheel on the work is so light that this method will work in many cases.

DoALL magnetically-actuated clamps are designed to hold non-magnetic materials such as brass, copper, plastic, glass, hard rubber, aluminum, stainless steel, etc. (see photo, opposite page).

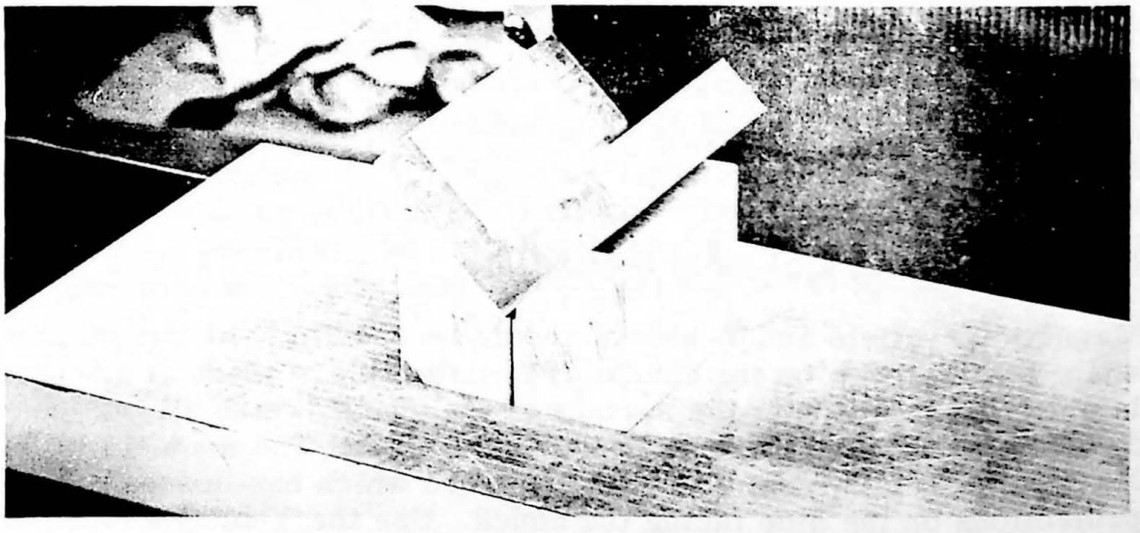
Work is placed on magnetic chuck surface between clamps so toothed edge of each clamp is in contact with work. A backing plate, against which back edge of one clamp should be placed, is available for most magnetic chucks. Each clamp is composed of two steel sections connected to each other by preset spring steel strip. Angle of spring is such that these sections will be 5° to each other. When chuck is energized, jaws of clamps are forcibly drawn to horizontal position by chuck, exerting a powerful lateral thrust against work piece. Wedging action of jaws against workpiece holds it securely in place against face of chuck.



Using DoALL Magnetically-Actuated Clamps to hold non magnetic work.



Use DoALL Magnetic Parallels to hold oddly-shaped workpieces on chuck.



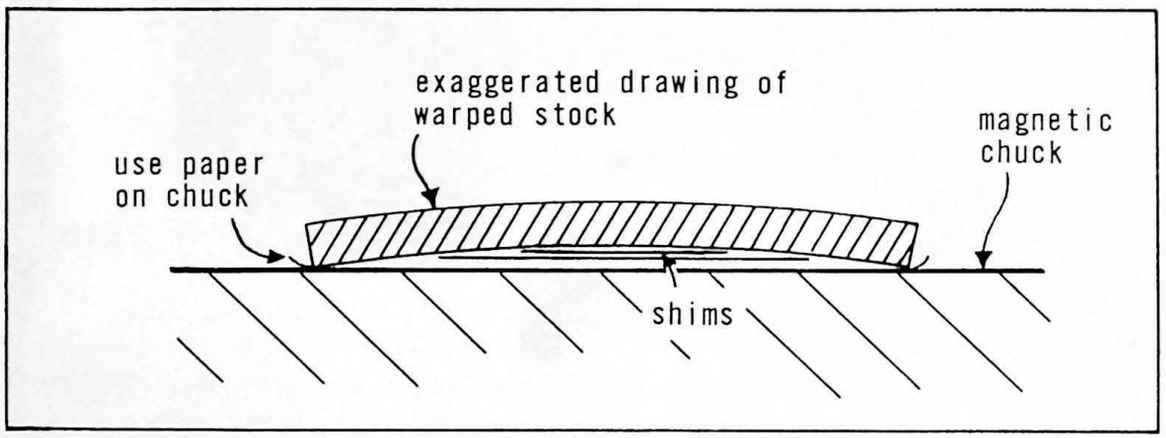
The DoALL V-Blocks transmit chuck holding force to the workpiece.

GRINDING THIN PARTS

To get a high degree of flatness, the workpiece must not be too thin, with respect to its other dimensions. There are several reasons for this:

(1) If the part is quite thin, it heats up faster, and is more subject to springing (bending) under the load of the grinding wheel.

(2) Furthermore, the magnetic chuck force may pull down some parts more than others. Then, when removed, the part may spring back to its original warped condition. You can overcome this problem by turning the SELECTRON down to 10% holding power. If this does not work, turn SELECTRON current off, and simply block the part at each end, so that it doesn't slide while being ground.



Grinding warped stock.

GRINDING WARPED STOCK

Warped stock should be placed on the chuck with the bowed ends down as shown in drawing. If the bowed ends are up, the work will rock. Shim under the stock to prevent distorting it when applying holding power.

MAGNETIC PARALLELS & V-BLOCKS

Magnetic parallels and V-blocks should be used to hold irregularly shaped workpieces on the chuck. The fixtures are made of alternate laminations, similar to the surface of the chuck, which allows the flow of magnetic holding power from the chuck. The magnetic parallels are especially useful in grinding work which has bosses or projections on the side facing the chuck. Use the V-blocks for holding round, square, etc. pieces for light grinding.

SURFACE FINISH PROBLEMS

(A) Irregular Scratches - Scratches of various lengths and widths, having no noticeable pattern, are considered irregular scratches. Sometimes they are called "fish tail" scratches.

Such scratches are commonly caused by loose particles of abrasive falling down onto the work from underneath the wheel guard, or carried by the coolant. The solution is obvious:

(1) Flush out the inside surfaces of the wheel guard when changing wheels.

(2) Clean the coolant tank, and keep level of liquid up.

It may, however, be that the grinding wheel is too soft and dislodged abrasive grains cause the irregular scratches, by rolling around between the wheel and the work piece. As the grit is in addition to wheel size, it must go somewhere. The metal is softer than the wheel, so the loose particles are dragged through the work piece surface, causing the scratches.

A wheel that is too coarse may also cause irregular scratches, caused by the random nature of the grains in the wheel. Dress the wheel "finer", using a diamond, and allow it to spark out carefully. If it still can't develop the desired surface finish, the wheel must be exchanged for one having finer grit.

(B) Patterned Scratches - If the scratch pattern seems to repeat itself, the wheel may not have been dressed properly, due to a defective diamond. Such "diamond marks" may have been caused by a diamond that was cracked, or whose mounting loosened. The amount of abrasive material cut off of the wheel depends on how much of the diamond bears into the wheel at any instant. So if the diamond wobbles for any reason, the wheel surface will also show such variations, and will then transfer them to the work piece.

Check the diamond mounting for tightness, and be sure the diamond is slanted about 15° toward the direction of wheel rotation. Turn the diamond 15° every few dressings. When using, pass the diamond across the wheel as slowly and evenly as you can, to clear up patterned "diamond mark" scratches. Side dress the wheel for better finish.

(C) Feed Lines - Feed lines may be caused by too deep a cut, too fast a crossfeed, or both. This can be minimized by rounding off the wheel edge with an abrasive stick.

(D) Vibration Marks - Vibration or "Chatter" marks may be caused by a "stick-slip" action between the grinding wheel and work piece.

If the wheel becomes dull and glazed, it may then slip a section of a revolution without grinding. Then, because it doesn't load up while slipping, some of the loading dislodges, and it begins cutting once again. This can happen several times a second, leaving the stick-slip (grinding, then just rubbing) marks on the work piece.

The answer is to redress the glazed wheel with a sharp diamond, and to do the job in the least number of passes that will develop the surface finish and flatness required.

Conditions which may cause such vibration chatter marks are:

(1) Wheel far out of balance or not dressed "true" on the spindle, or soaked with coolant on one side.

(2) "Outside" vibrations, such as from a punch press or other impact machinery, or craneways, or railroad tracks.

(3) Inadequate foundation - either not solid enough, or not properly cushion insulated.

(4) Defective wheel spindle - bad bearings, poorly lubricated, or worn out.

(5) Defective table drive or crossfeed drive mechanism, such as a "rough spot" caused by a damaged lead screw or nut (in manual only).

(E) Discolored Surface - Discoloration, "checking" and burning are due to overheating. Even when plenty of coolant is used, it is possible to overheat a part if metal is being removed from a small area too fast. The solution is to use a softer cutting wheel, or to change the operating conditions of the wheel being used to make it act "softer". Try increasing table speed, dressing the wheel coarser, and taking lighter cuts. Use generous coolant flow, directed onto both the work piece and wheel.

(F) Burnished Surfaces - A "burnished" surface is one made smooth and shiny by rubbing. Broad surfaces that have been ground sometimes show an irregular, burnished "patchy" surface. What likely brought this about is that the wheel is glazed and requires dressing. Or, it may be too fine or too hard. Reducing downfeed may help. The answer here is to use a softer wheel that cuts freer.

(G) Slide Scratches - Sometimes a perfect grinding job is ruined while taking the workpiece off of the chuck. Never slide the work piece off of the magnetic chuck, or the work piece, and the chuck face may be scratched. Since the whole chuck is covered with particles or grit, sliding a work piece is very likely to develop long deep scratches.

Even when the chuck current is turned off, it may be difficult to immediately lift off the work piece, due to residual (remaining) magnetic force. Also coolant may hold the part down by suction.

Here are a few tricks for solving the work piece removal problem: When the work piece is thin, shoot a blast of air under it, to lift it from the chuck face. By all means observe the safety rules on using an air hose and wear safety glasses.

For very fine work, to avoid scratching the work piece against the chuck, some operators place a thin piece of paper on the chuck. If no grit falls on the paper, the part can then be slid off without scratching. Sometimes oil paper strips are used to protect finely ground surfaces.

(H) "Grinding Shift" Scratches - "Grinding shift" scratches are caused by the work sliding on the chuck during operation. If it isn't held tightly, or (if work is not magnetic) if firm ferrous (containing iron) blocks or clamps don't hold it securely "fore and aft", the work piece may shift slightly every time a pass is made in a different direction. "Grinding shift" scratches can be detected because all of the scratches are fairly broad, and of equal length.

SAFETY PRECAUTIONS

Do

(1) Do always HANDLE AND STORE wheels in a CAREFUL manner.
(2) DO VISUALLY INSPECT all wheels before mounting for possible damage in transit.
(3) DO CHECK MAXIMUM OPERATING SPEED established for wheel against machine speed.
(4) DO CHECK MOUNTING FLANGES for equal and correct diameter. (Should be at least 1/3 diameter of the wheel and relieved around hole.)
(5) DO USE MOUNTING BLOTTERS supplied with wheels.
(6) DO CHECK WHEEL ROTATION (should be clockwise) if machine has been disconnected from electric power.
(7) DO always CHECK to see if WORK IS HELD SECURELY ON CHUCK before grinding.
(8) DO allow NEWLY MOUNTED WHEELS to run at operating speed, with guard in place, for at least one minute before grinding.
(9) DO always WEAR SAFETY GLASSES or some type of eye protection when grinding.
(10) DO TURN OFF COOLANT before stopping wheel to avoid creating an out-of-balance condition.
(11) DO always start cut at HIGH POINT on work. When wheel truing or dressing always pick-up cut at wheel face high point.
(12) DO DISCONNECT POWER SUPPLY before opening electrical cabinet to make repairs.

Don't

(1) DON'T use a wheel that HAS BEEN DROPPED.
(2) DON'T FORCE a wheel onto the machine OR ALTER the size of the mounting hole—if wheel won't fit the machine, get one that will.
(3) DON'T ever EXCEED MAXIMUM OPERATING SPEED established for the wheel. Check maximum speed printed on wheel blotter.
(4) DON'T use mounting adapters on which the bearing surfaces ARE NOT CLEAN AND FLAT.
(5) DON'T TIGHTEN the spindle nose or adapter nut EXCESSIVELY.
(6) DON'T grind on the SIDE OF THE WHEEL unless wheel is specifically designed for that purpose.
(7) DON'T start the machine until the WHEEL GUARD IS CLOSED.
(8) DON'T LEAVE LOOSE ITEMS ON TABLE.
(9) DON'T STAND to left of grinding wheel when the grinder is started.
(10) DON'T grind material for which the WHEEL IS NOT DESIGNED.
(11) DON'T POSITION OR CHECK WORK NEAR ROTATING WHEEL.
(12) DON'T ATTEMPT TO ADJUST TABLE TRIP DOGS while table is moving.

CHAPTER 6
TROUBLE SHOOTING

MOTORS WILL NOT START

(1) Check overload relays on magnetic starters in electrical cabinet. Press reset buttons, if they have been tripped.

(2) Check main fuses.

(3) Check line for incoming power.

(4) Check oil level in automatic lubricator tank.

(5) Check control circuit fuse.

ELECTRICAL CONTROLS WILL NOT WORK

(1) Low oil level in automatic lubricator tank will activate float switch, stopping machine.

(2) Check control circuit 110-V. fuse in electrical cabinet.

(3) Check control circuit transformer in electrical cabinet.

TABLE MOVEMENT TOO SLOW

(1) Cold hydraulic system. Allow about 30 minutes for system to warm up. Start table travel very gradually.

(2) Inadequate or no table way lubrication. Check lubricator tank and pump. Check ways for oil delivery to see if oil lines are clogged.

(3) Hydraulic system filter is clogged.

(4) Low hydraulic system pressure or volume resulting from improperly adjusted or badly worn pump. Check for oil leaks in system.

(5) Table cylinder piston rings or piston rod packing worn or damaged.

CANNOT GRIND CHUCK FLAT

(1) Using wrong type wheels or coolant application incorrect.

(2) Wheel not dressed correctly.

(3) Not following correct "grinding-in" procedure, see Preparation for Operation, Chapter 4.

(4) Burrs on chuck or foreign matter between chuck and table pad.

(5) Table to saddle ways have too much oil, adjust lubricator.

(6) Table-to-saddle ways are dry and dirty, clean and check oil lines from lubricator.

(7) Uneven heat expansion in saddle, resulting from base ventilation system (if used) failure or incorrect operation (clogged filter, base panels not in place, etc.).

(8) Table ways are worn and must be rescraped.

MACHINE NOT GRINDING PARTS FLAT

(1) Excessive heat expands work - adjust coolant application. Check for dirty coolant, clogged filter or lines.

(2) Table speed too slow, allowing excessive heat build-up in center and resulting in low spot.

(3) Wheel dressed too smooth, wheel loads up and does not grind flat.

(4) Chuck may not be flat. If not, it should be reground. Coarse dress wheel must be used in grinding chuck.

(5) Base ventilating fan not operating (on machines so equipped) or air filter clogged, or base panels not in place, resulting in uneven saddle distortion from heat.

(6) Too much oil on table ways, causing table to lift at center of stroke. Adjust automatic lubricator as described in Chapter 7.

(7) Chuck may not be working properly. Check SELECTRON controls and chuck.

WAVY TRAVERSE LINES ON WORK

(1) Faulty wheel dressing leaves ragged wheel edges.

DEEP, IRREGULAR MARKS ON WORK

(1) Caused by loose wheel.

GRAIN MARKS ON WORK

(1) Wheel too soft or too coarse.

CHATTER (VIBRATION) MARKS ON WORK

(1) "Outside" vibrations from other machinery. Use vibration-absorbing pads under base. Make sure mounting screws are adjusted properly.

(2) Grinding wheel not balanced.

(3) Grinding wheel not trued.

(4) Glazed wheel has "stick-slip" action on work. Dress wheel.

(5) Burned or cracked wheel-dressing diamond leaves marks on wheel.

(6) Loose wheel adapter.

(7) Spindle bearings are bad.

(8) Spindle drive belts too tight.

DISCOLORED SPOTS ON WORK FROM OVERHEATING

(1) Table speed too slow.

(2) Not enough coolant or coolant not applied properly.

(3) Wheel too hard.

(4) Wheel dressed too fine.

(5) Downfeed excessive.

(6) Wheel dressing diamond is dull.

TEAR MARKS IN WORK

(1) Coarse grains or foreign matter in wheel face, dress wheel.

(2) Foreign matter drops on work from out of wheel guard. Clean guard thoroughly.

"BURNISHED" WORK

(1) Grinding wheel may be glazed, dress wheel.

(2) Grinding wheel is too hard.

(3) Grinding wheel is too fine.

"SLIDE" SCRATCHES ON WORK AND CHUCK

(1) Caused by removing work carelessly or not waiting for chuck to demagnetize. Do not slide work off chuck.

"GRINDING SHIFT" SCRATCHES

(1) Caused by work not being held securely on chuck. Check holding power of chuck.

"CROSS-HATCHED" PATTERN ON WORK

(1) Table trip-dog rollers (if used on your machine) are not rotating.

RIPPLE OR WAVE PATTERN ON WORK

(1) Grinding wheel not balanced or trued.

(2) Vibration from outside machine.

(3) Hydraulic tank is contacting base, causing vibration.

(4) Grinder is not bearing evenly on all pads.

"HERRING BONE" SURFACE FINISH

(1) Caused by wheel wobble. Check wheel mounting. Sides of wheel must be trued.

(2) Trip dog cams may not be rotating freely. Remove and clean.

CHAPTER 7

LUBRICATION & MAINTENANCE

AUTOMATIC LUBRICATOR

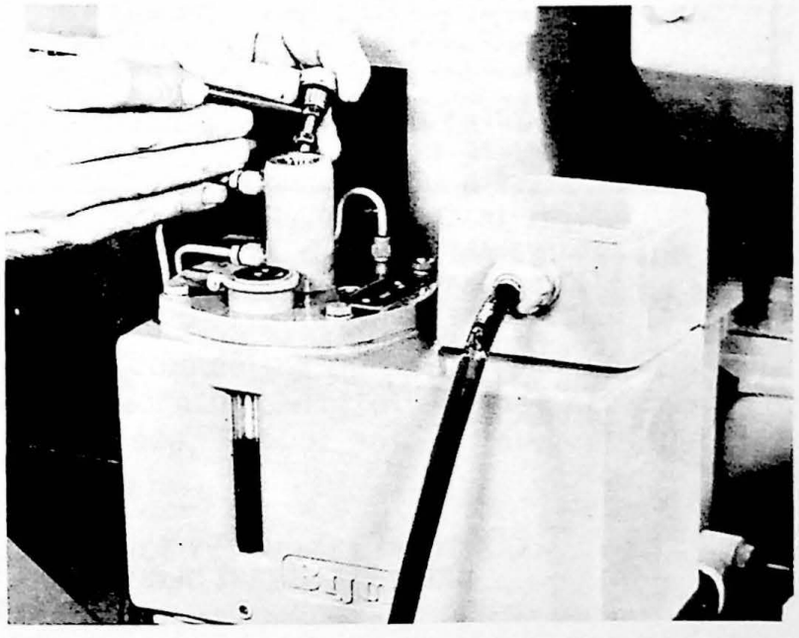
Incorporated in the tank assembly is a float-operated mercury switch which automatically stops the entire machine when the oil level is low. A red indicator light located on the push button control panel gives adequate warning before the control circuit switch opens. Refilling the tank returns the switch to normal operating position. An oil level window is located in the side of the tank.

B. Adjustment - The piston stroke, which controls the delivery of oil, is easily adjustable by removing the hex cap nut at the top of the pump assembly.

To adjust oil flow:

(1) Shut off hydraulic pump motor.
(2) Manually operate pilot valve to relieve pressure in lines.
(3) Remove adjustment assembly (see photo below).
(4) Loosen lock nut (shown in photo below).
(5) Turn adjustment screw clockwise for more lubrication, counterclockwise for less. Correct adjustment is about 1 drop of oil delivered per 10 table reversals (check by disconnecting feeder lines). Tighten lock nut and replace adjustment assembly.

NOTE: A filter is located in the inlet at the bottom of the pump. Replace the filter yearly, or more often if necessary.



To regulate the flow of the automatic lubricator, adjust the screw shown here. Check the oil level sight gage daily. Use DoALL Way Lubricant.

AUTOMATIC LUBRICATOR CONTINUED . . .

Flow of oil to each point of lubrication is controlled by a flow control fitting which is properly set at the factory and should need no further adjustment.

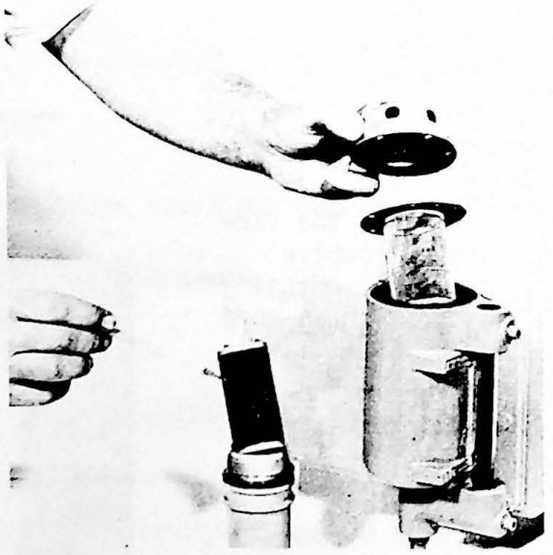
All used oil drains into an easily removed drain pan under the column. Discard spent oil and replenish oil supply in reservoir with fresh DoALL Way Lubricant.

Too much oil on the ways will cause the table to "float", resulting in grinding out of tolerance. Too little oil will cause slow, rough operation and will result in badly worn ways.

HYDRAULIC SYSTEM

The hydraulic tank, located in the base, is fitted with a baffle plate that permits the settling of any grit before oil is allowed to pass through the suction pipe of the pump. The filter is mounted on the outside of the machine and has a removable cartridge. To clean and flush the tank, disconnect the steel tubing and remove the clean-out cover.

The tank has a capacity of 7 gallons. Change oil and filter cartridge every four months. Refill the reservoir with DoALL "ESL" Hydraulic Fluid. NOTE: DoALL Hydraulic Oil is recommended. If some other type of oil is used, mix one gallon of EP-90 (hypoid) oil with six gallons of the hydraulic oil.



The hydraulic oil filter is shown disassembled at right in the photo. Change oil and filter cartridge every four months. Keep the screen in the oil filler pipe clean.

When changing the oil always replace the cartridge in the filter. Before placing cartridge in filter, wash out all dirt that has accumulated in the base of the filter.

The tank filler pipe and screen extend through the base on the left hand side of the machine. A tubular screen, extending into the mouth of the filler pipe, filters the oil as it is poured into the system. It should be cleaned often. Keep tank full at all times.

The sight gage shows the amount of oil in tank. If oil should be found leaking out of bottom of this sight gage, replace the washer at the bottom of the tube.

HYDRAULIC OIL SPECIFICATIONS

The hydraulic fluid used in this machine (DoALL Hydraulic Fluid is recommended) must have the following specifications:

Gravity, °API	30/32
Flash °F.	410 Min.
Fire °F.	460 Min.
Viscosity, S.U.S. at100°F.	200/220
Viscosity Index, Min.	95
ASTM Pour, °F. Max.	-20
Neutralization No. ASTM D974	.10
Carbon Residue, % Max.	.10
Corrosion -3 Hrs. at 212°F.	Nil.
* Aniline Point	215/230°F.
ASTM Rust Test, D665 (1)	Pass

CAUTION

***The seals and cups used in DoALL hydraulic systems are compatible ONLY with hydraulic oil having an aniline point between 215°F. and 230°F. If hydraulic oil is used which has an aniline point not falling within this range, the seals may either swell or shrink and harden, causing machine malfunctions, and leakage. DoALL hydraulic oil, with an aniline point of approximately 221°F., will not cause deterioration of component seals.**

Remove the tank cover, filter and filler assembly and clean inside of tank thoroughly once a year. Fill with fresh oil as above.

The high-pressure hoses connecting the reservoir to the saddle are of synthetic rubber and are not affected by oil. If they are damaged, do not replace with rubber hoses. Rubber will disintegrate and clog the hydraulic system.

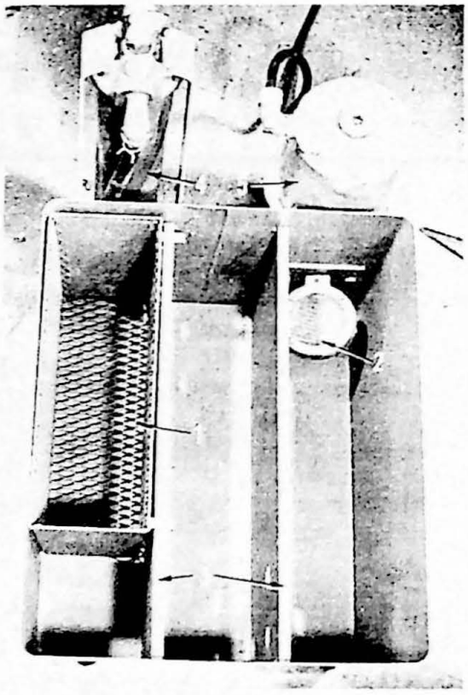
NOTE: PLEASE CONSULT YOUR DoALL SERVICEMAN FOR CORRECT HYDRAULIC SYSTEM PRESSURE ADJUSTMENT.

COOLANT SYSTEM

(1) Capacity of the coolant tank is 17 gallons.

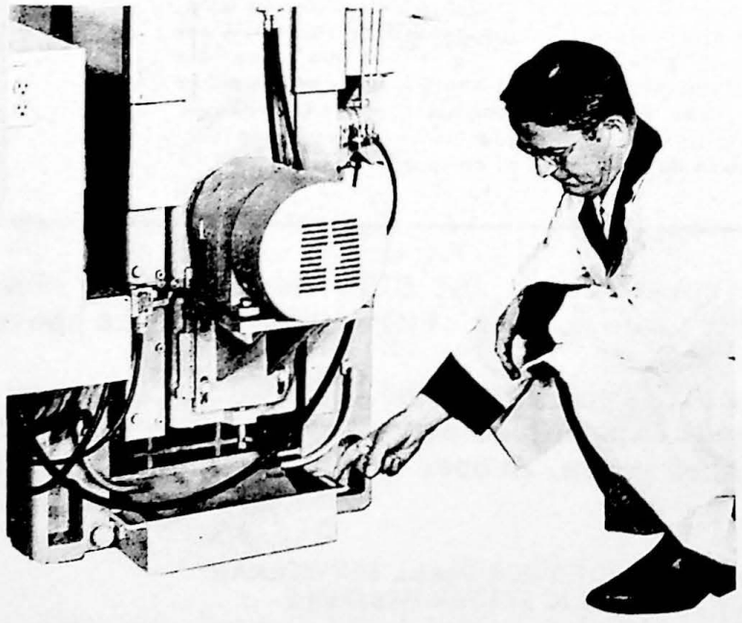
(2) Drain, clean and refill the tank whenever the coolant becomes dirty. Change filter (if used) at this time, also.

(3) Use Kleen Kool made by DoALL mixed with water as directed on container label, (add 1 ounce of Kleen Flush per 5 gal.). The mixture will vary according to the hardness of your water.



Top view of coolant tank with cover removed.

(1) Removable chip basket
(2) Pump intake screen
(3) Baffles
(4) Coolant filter provided with cool grinding system
(5) Integral motor and coolant pump



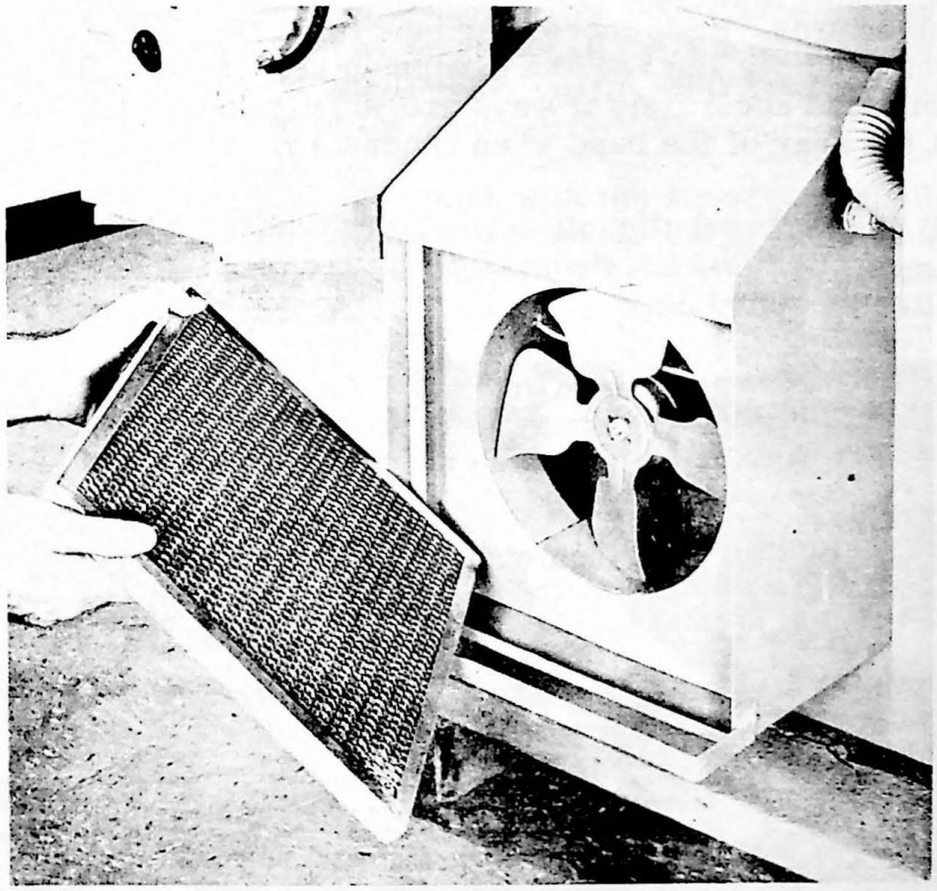
The catch pan shown is provided for waste oil from the ways. Empty when necessary.

BASE VENTILATION SYSTEM

The fan forces air through a washable filter into the hydraulic power compartment, thus pressurizing the entire base with clean air. Besides holding the hydraulic oil temperature down (less than 50 deg. above room temperature), it excludes dust and grit from the hydraulic system and way areas. If full benefit is to be achieved from this feature:

(1) The air filter should be washed in plain water or a mild detergent solution once a month. The fan blades should be kept clean. Check to see if fan is operating by pressing the hydraulic start button.

(2) The filter as well as all base panels and drip pans must be in place when the machine is operating. The hydraulic tank should be kept full at all times.



Remove the air filter and clean when it becomes clogged with dust. Check filter and fan operation daily.

YEARLY DOWNFEED GEAR LUBRICATION

Once a year remove the cover on the downfeed gear box and lubricate the gears with No. 2 POCO medium heavy Fibre gear Grease.

ELECTRIC MOTOR LUBRICATION

Follow manufacturer's instructions for motor lubrication. These are usually found on a nameplate or tag attached to the motor.

CAUTION

KEEP YOUR GRINDER CLEAN

(1) Check table saddle and column ways DAILY for adequate lubrication. Keep lubricator tank full. Dry, dirty ways will wear rapidly and require expensive rescraping. Grinder will not grind accurately if ways are worn. Empty the catch pan at the rear of the base when necessary.

(2) Check hydraulic oil level DAILY. Keep tank full at all times. Use DoALL Hydraulic Fluid. Drain tank and replace filter on schedule.

(3) Check coolant level in tank DAILY. Use DoALL Kleen Kool and mix as instructed on container label Keep tank clean and change filter when necessary.

(4) Keep table and chuck clean. Use squeegee to clean coolant from chuck.

(5) Keep wheel guard and wheel adapters clean. Grit from dirty wheel guard can scratch work. Holes in flange of cool grinding adapters must be kept open.

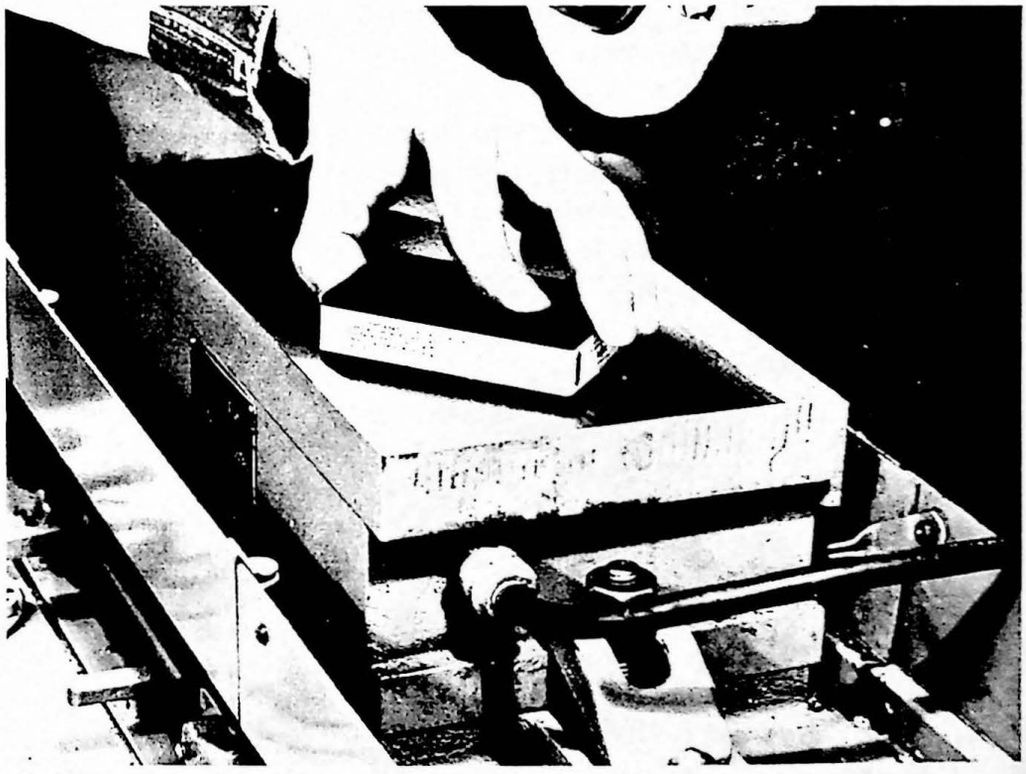
CHUCK MAINTENANCE

It is essential on a precision surface grinding machine that the surface of the chuck be parallel with the table and saddle ways. This is why top and bottom chuck surfaces, even though ground flat in the factory before shipment, must be "ground in" again after mounting on the table. In addition, the top surface of the chuck must be reground each time the chuck is removed from the machine and replaced. The correct procedure for grinding in the chuck is given in the "Preparation for Operation" Chapter.

It is important, if available, that coolant be plentifully used while grinding the chuck. This helps prevent heat and distortion. Light downfeeds, fast table speed and light crossfeeds are marks of good chuck grinding procedure. Don't remove any more stock than is necessary for a clean, true surface.

The magnetic chuck must be smooth and flat for accurate grinding. Some scratching, denting and wear of the chuck face, however, is inevitable. Light burrs may be removed by handstoning with a fine granite deburring stone or oilstone. When wear becomes serious, regrind the top surface of the chuck.

After each load, wipe off the chuck with the squeegee supplied, in order to remove grinding swarf (workpiece chips and abrasive grains) and grit. When the magnetic chuck is not in use, thoroughly clean and grease it.



A DoALL Black Granite Deburring Stone can be used to remove small burrs from the chuck.

CHAPTER 8
ACCESSORIES

FLOOD COOLANT SYSTEM

The flood coolant system consists of a 20-gal. coolant tank with motor and pump mounted on the side of the tank. Also included are a flood coolant applicator and control valve mounted on the wheel guard, table splash guards, strainer assembly, and a chuck squeegee. Operation of the flood coolant system is described in the preceding chapters.

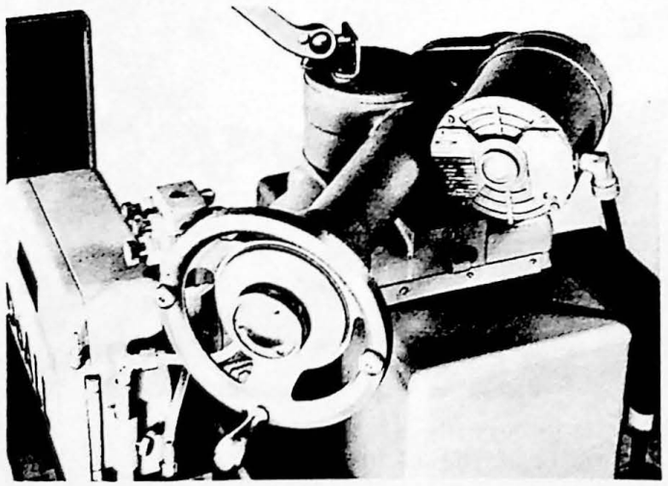
COMBINATION COOL GRINDING & FLOOD COOLANT SYSTEM

The combination system consists of a 20-gal. tank with motor, pump and filter, strainer and splash guards, a manifold with controls mounted on the wheel guard and a special wheel adapter. Cool grinding delivers a fine coolant mist through the wheel directly to the point of wheel contact.

Coolant is directed from tubes mounted on the wheel guard to collector rings on the special wheel adapters. Centrifugal action of the wheel draws the coolant through the wheel to its outside face where the coolant emerges as a mist. Instructions for the operation of the system are included in the preceding chapters.

MOTORIZED WHEEL ELEVATION (Standard on D-8 and D-10 Models)

This assembly consists of the standard vertical feed handwheel coupled through a gear box to a motor. Powered vertical wheel travel is controlled by pushbuttons on the control panel. Use the pushbutton to roughly position the wheel, then make fine adjustments manually with the vertical feed handwheel.



Motorized Wheel Elevation Accessory.

DUST COLLECTOR

The dust collector is recommended for dry grinding jobs. It is easily installed by attaching flexible exhaust tubing to the grinder wheel guard.

"SELECTRON" CHUCK CONTROL UNIT

This is an electromagnetic chuck control unit which mounts on the grinder. It combines a rectifier and demagnetizer in one unit. Controls are provided for infinite variation of chuck holding power. Parts on the chuck are demagnetized in 15 seconds. Operation of the unit is described in Chapter 3.

MAGNETIC CHUCKS

Two types of magnetic chucks are available: (1) Electromagnetic chuck with clamps, T-bolts and nuts. This chuck requires a SELECTRON control unit. (2) Permanent magnet type chuck which includes an on-off control lever. The operation of both types of chucks is described in Chapter 3.

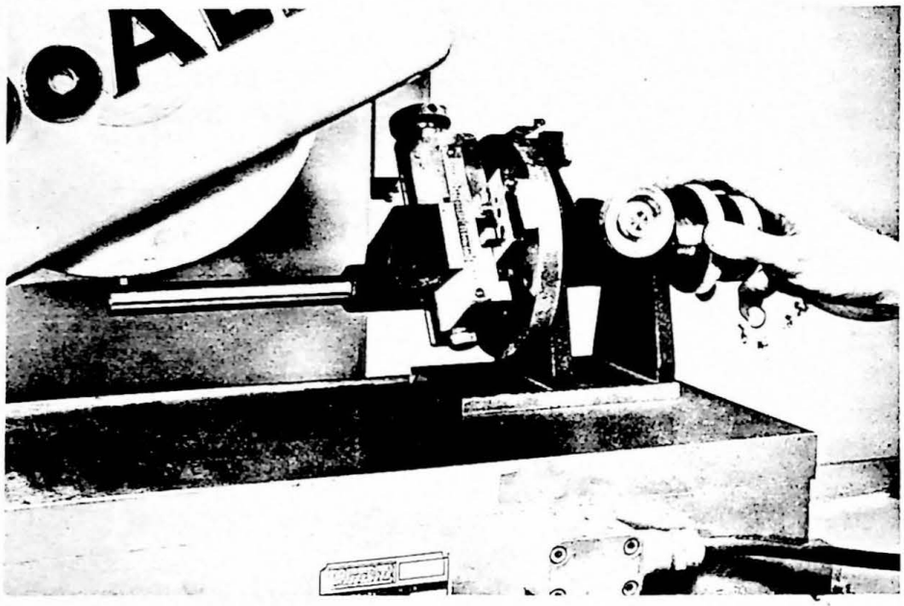
SADDLE LOCKS

Saddle Locks are used to lock the saddle in place during work such as crush form grinding, slot grinding, single-pass production grinding with fixture, etc. One version of the accessory is locked in place mechanically. The other Saddle Lock is a hydraulic brake which automatically locks the saddle in place during the grinding stroke. A bleeding screw for removing trapped air in the system is provided on the hydraulic brake cylinder.

WHEEL BALANCING STAND AND ARBOR

For accurate grinding, it is essential that a grinding wheel be in good balance. All advantages of well conditioned equipment, skillful set-up and operation are sacrificed if the grinding wheel is out of balance. The pounding or vibration of an unbalanced wheel, no matter how slight, will result in poor grinding.

The balancing arbor and stand consist of an arbor shaft which supports the wheel and adapter upon two V's formed by overlapping disks. Special grinding wheel adapters with balancing weights are required for balancing the wheel. Wheel balancing procedure is described in the "Preparation for Operation" chapter.



The ''Tangi-matic'' Wheel Dresser.

TANGI-MATIC WHEEL DRESSER

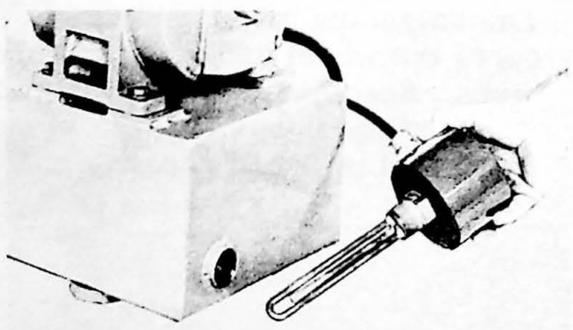
The "Tangi-matic" unit is a radius and angle wheel dresser which produces a convex or concave form on the periphery of a grinding wheel. The diamond pivots in an arc or radius to form the shape on the grinding wheel face. Angles may also be dressed by means of the cross slide action in this dresser.

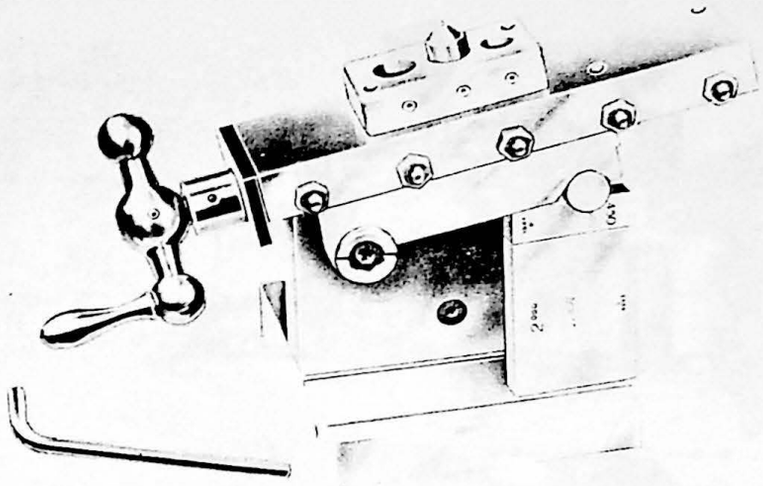
All wearing surfaces are hardened, ground and lapped. The unit is equipped with the following: micrometer radius adjustment screw, setting master, small radii attachment, two diamonds, arm for dressing up to 10 in. diameter wheel, wrenches and carrying case.

HYDRAULIC FLUID HEATER

This is a thermostatically-controlled, immersion-type heater which is factory installed in the hydraulic tank. The heater maintains the hydraulic fluid at 110 degree temperature when the grinder is not being used, thus reducing warm-up time. An interlock switch turns the heater off when the machine is in operation.

The Hydraulic Fluid Heater shown removed from the tank.





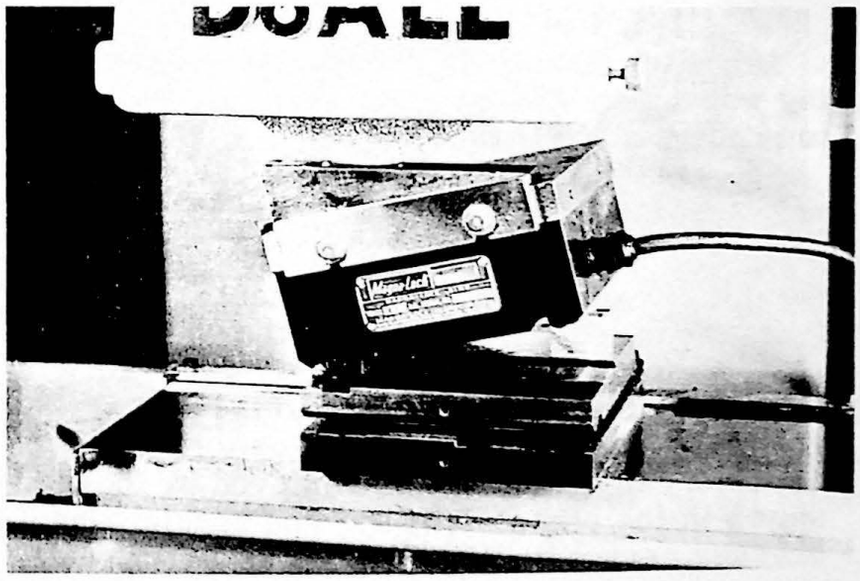
The Sine Wheel Dresser. Gage blocks are used for an accurate angle adjustment.

SINE WHEEL DRESSER

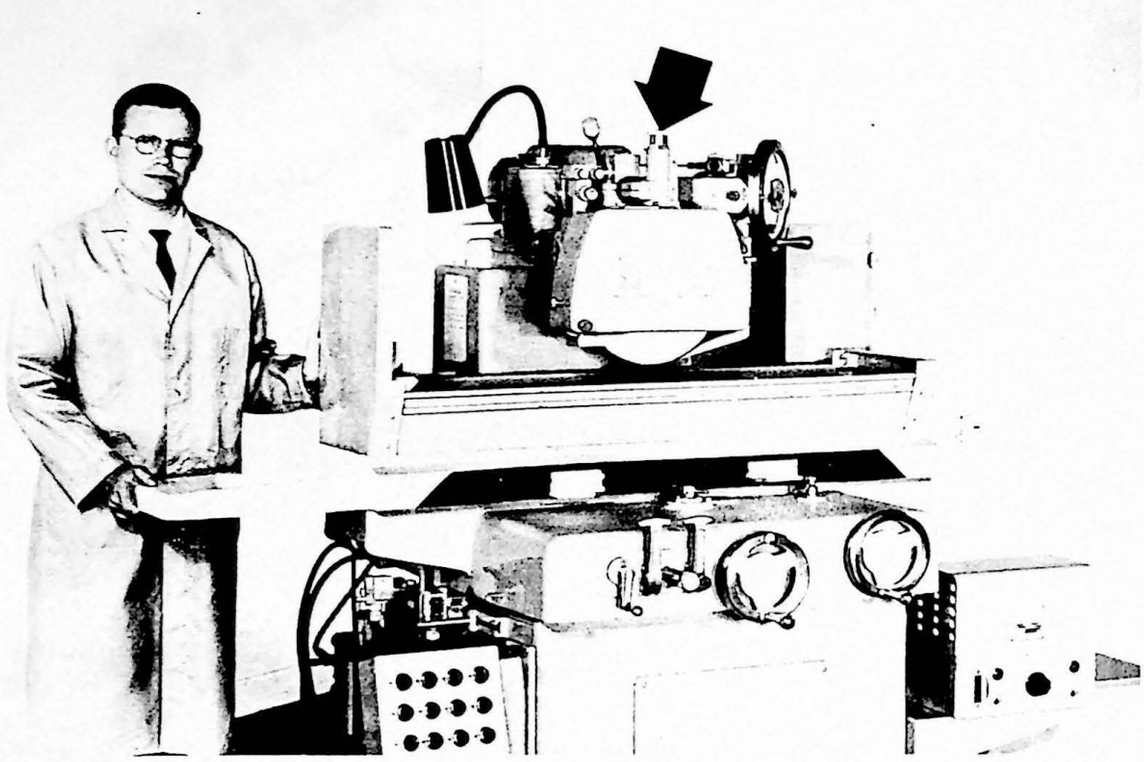
The sine dresser is used to produce a flat, angular surface on the grinding face of a wheel. The dresser inclines, permitting the diamond tool mounted on it to cut across the wheel face at an angle to the side of the wheel. Standard gage blocks are placed between the base and top plate of the dresser to provide the desired angle. The wheel-dressing diamond and case are included with the unit.

SINE CHUCKS

Like the standard machine chucks, the sine chucks are available in either the permanent magnet type or the electromagnetic type which requires a rectifier control unit. Two models are available: the single angle type or the compound angle type. The sine chuck makes possible single or compound angle grinding set-ups, using standard gage blocks between the base plate and top plate to provide the desired angle.



An electromagnetic Sine Chuck. This is the compound-angle type which can be adjusted in two planes.



The ''Over-the-Wheel'' Dresser (arrow) installed on a D-8 Series Grinder.

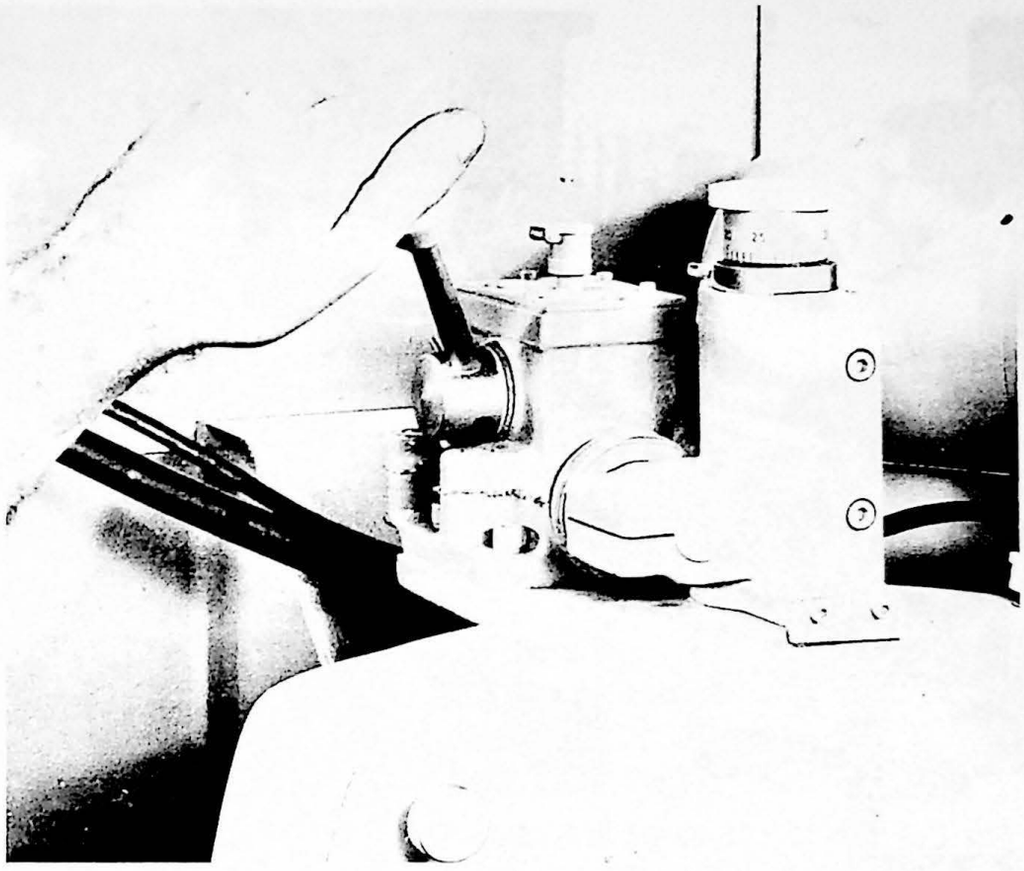
OVER-THE-WHEEL DRESSER

The over-the-wheel dresser is mounted on top of the wheel guard and permits dressing of the wheel without removing the work from the chuck. This device is very useful on production grinding applications.

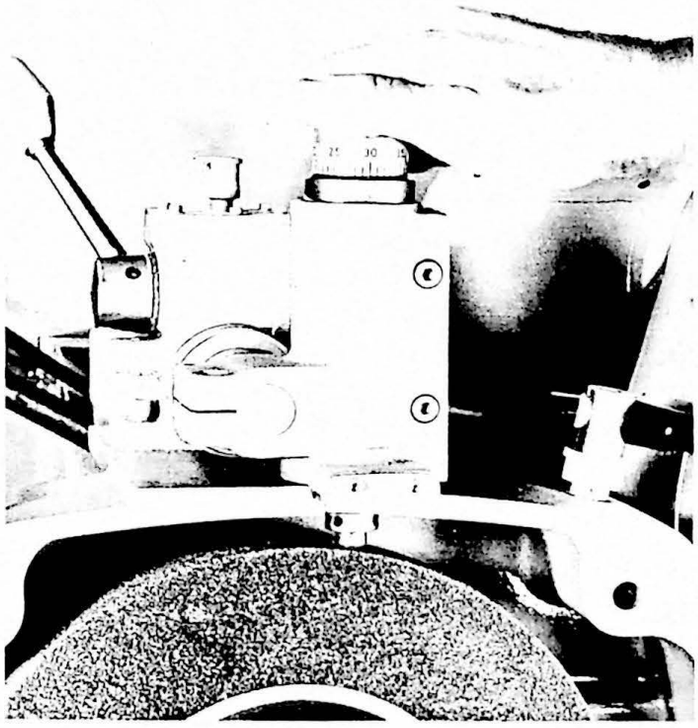
The diamond is fed down vertically by means of a knob graduated in thousandths so that wheel loss can be controlled and relative wheel-to-work position maintained by adjusting the grinder down-feed handwheel. A handle operating a shielded rack and pinion produces a 1-1/4 in. traverse across the wheel. Total vertical feed of 1-1/4 in. makes the dresser useful throughout life of the grinding wheel. As the diamond wears, it can be rotated in its holder to present a sharp face.

HOW TO USE THE "OVER-THE-WHEEL" DRESSER:

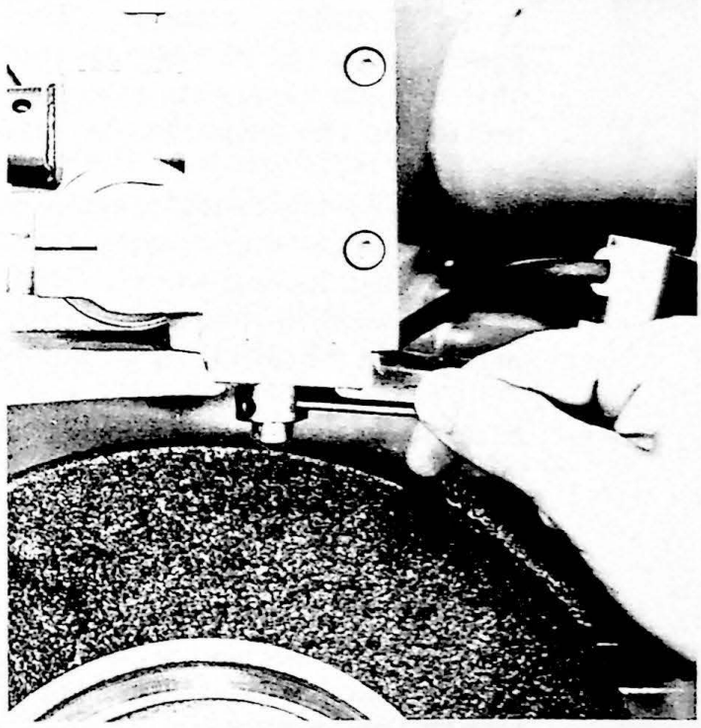
Feed the diamond across the wheel face by moving the hand lever. It is not necessary to remove the wheel guard cover. The same general instructions regarding depth of cut given for the chuck-mounted wheel dresser apply to the over-the-wheel dresser. The vertical feed adjusting knob is calibrated in .001 increments. The diamond can be rotated or removed by loosening the set screws as shown in the photo. NOTE: The special wheel guard used with the dresser cannot be tilted.



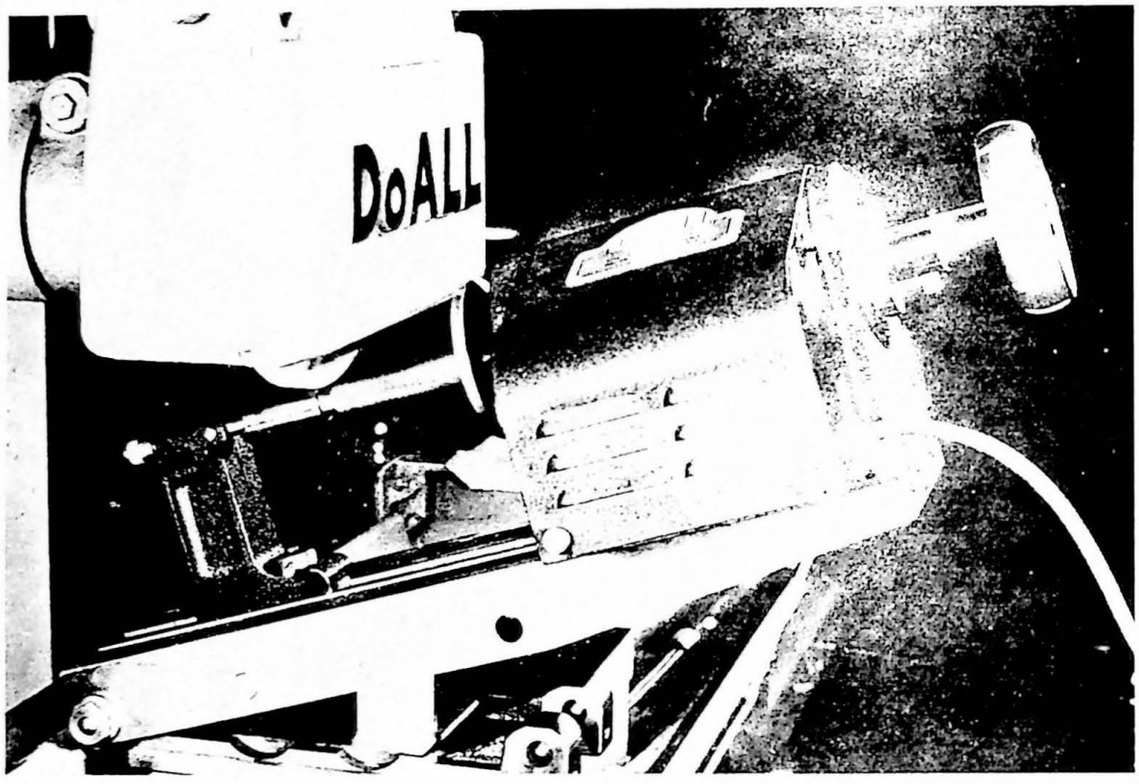
The ''Over-the-Wheel'' Dresser Accessory. Use the hand lever to feed the diamond across the top edge of the wheel.



The vertical feed adjusting knob is calibrated in .001 inch increments (wheel guard cover removed in this photo).



To rotate or replace the dressing diamond, loosen the set screws with an Allen wrench.



The Cylindrical Grinding Accessory has a separate motorized spindle.

CYLINDRICAL GRINDING ACCESSORY

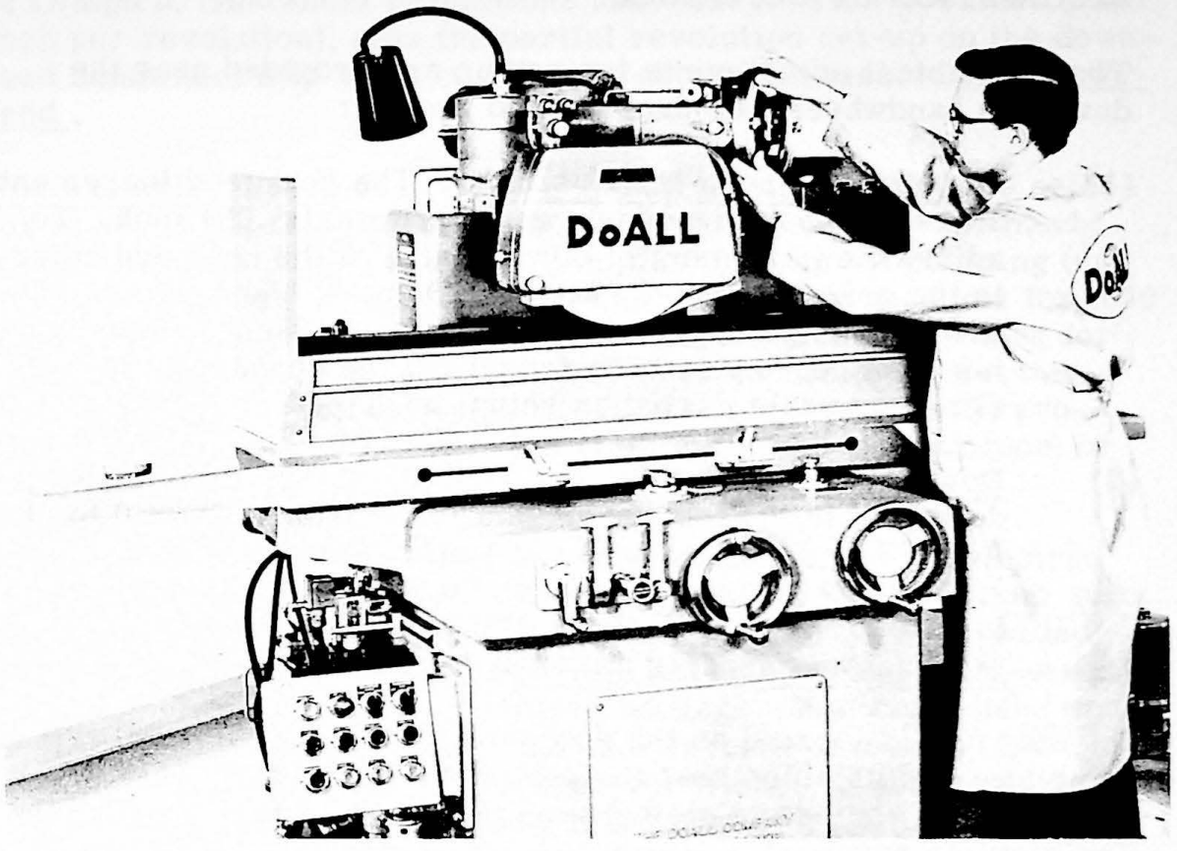
The cylindrical grinding accessory converts the surface grinder to a cylindrical grinder. The attachment is basically a workholder resembling the headstock and tailstock assembly of a lathe. The unit mounts crosswise on the chuck or table so that its traverse motion is the same as the chuck or table's crossfeed motion.

Centers in the attachment's headstock and tailstock support the workpiece, which is normally a rod or shaft. The workpiece revolves as does the grinding wheel. Each traverses in respect to the other. When mounted lengthwise on the table and not rotating, the attachment may be used for grinding slots in a shaft held between centers.

A step pulley provides spindle speeds of 200, 400 and 700 rpm. The unit has 24 index divisions and a two-way sine bar. Maximum part size capacity is 7-1/2 in. long by 6-1/2 in. diameter.

CHUCK-MOUNTED WHEEL DRESSER

The chuck-mounted dresser is described in the "Preparation for Operation" chapter.



The Automatic Downfeed Attachment on a D-8 Series Grinder.

AUTOMATIC DOWNFEED

GENERAL DESCRIPTION

The automatic downfeed attachment provides single or double downfeed for form or plunge grinding, plus automatic crossfeed reversal for automatic surface grinding.

The downfeed is accomplished through a self-releasing clutch driven by a hydraulic cylinder. The hydraulic cylinder is controlled electrically by switches which sense the pressure changes in the pilot valve circuit at table reversal, and limit switches at saddle reversal. Automatic downfeed may be set up for either form grinding or surface grinding. When the total downfeed is complete, the downfeed will stop. All other normal functions of the grinder will continue.

Downfeed can be caused to occur through selector switches at either or both table reversals, or at either or both automatic crossfeed reversals and continue at predeterminded increments to a preselected downfeed stop.

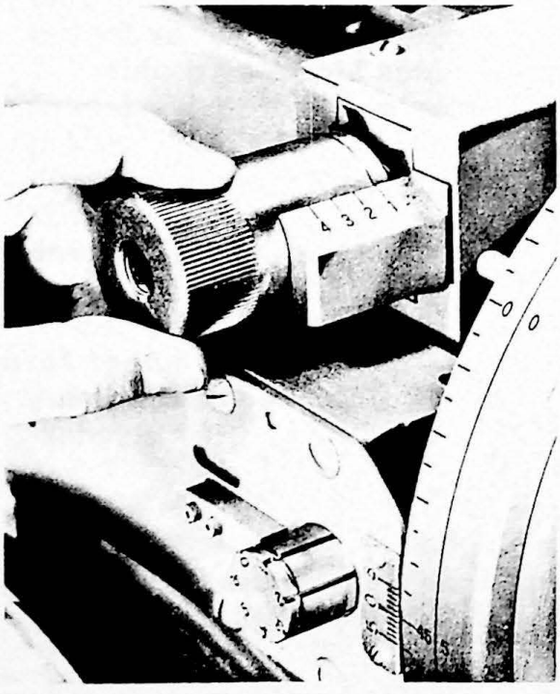
DESCRIPTION OF CONTROLS

The mechanical adjustments for set-up are provided near the downfeed handwheel (see drawing and photos):

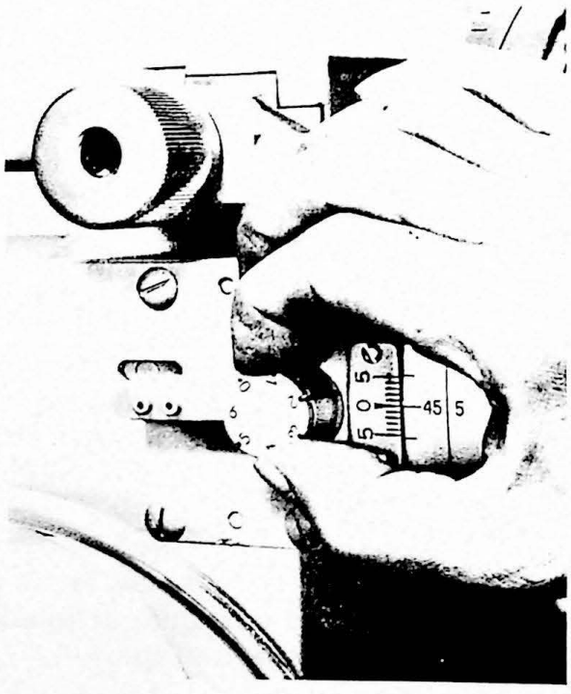
(1) Downfeed increment adjustment. The downfeed increment adjusting knob provides a range from 0 to .004 inch. To adjust the increment of downfeed, turn the knob and refer to the scale next to the knob as shown in the drawing. This setting will be approximate and should be checked and adjusted if necessary by referring to the downfeed handwheel slip-ring scale during an actual downfeed.

(2) Downfeed stop adjustment. The total range of automatic downfeed in preset increments is adjustable from 0 to .348 inch. The downfeed stop prevents further downfeed of the grinding wheel into the work and allows all other grinder functions to continue normally. The engagement of this stop mechanism prevents powered column elevation.

The stop dog is located on the downfeed handwheel slip-ring. It is completely adjustable about the periphery of the handwheel. When this stop dog contacts a stop pin, no further downfeed will occur. The stop pin is a part of the multiple revolution selector. When the selector is pushed in, normal manual grinder operation is achieved. When the selector is pulled out, the stop pin is engaged, as well as the safety feature which prevents powered column elevation.



The downfeed increment adjusting knob provides a range of 0 to .004 inch.



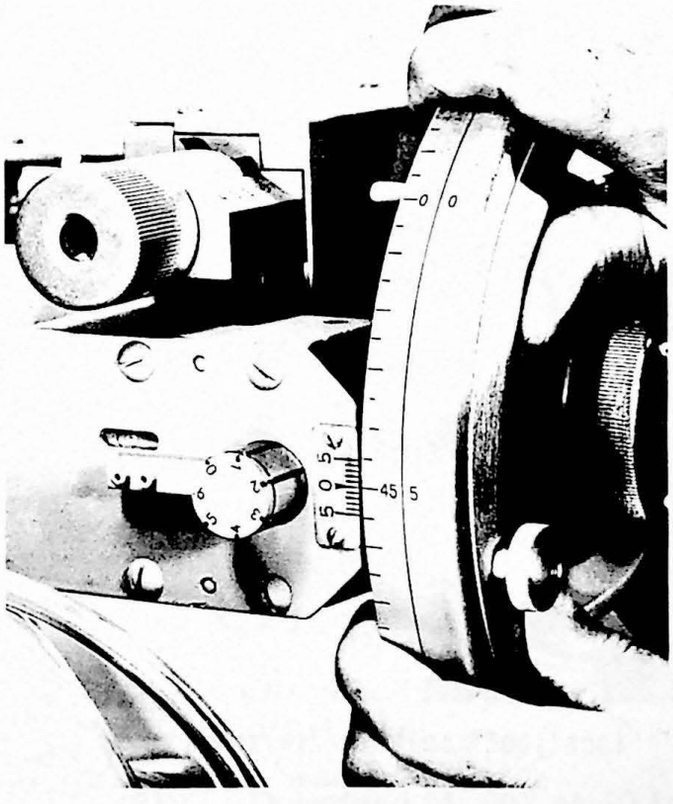
The multiple revolution selector sets the total range of automatic downfeed.

DESCRIPTION OF CONTROLS CONTINUED . . .

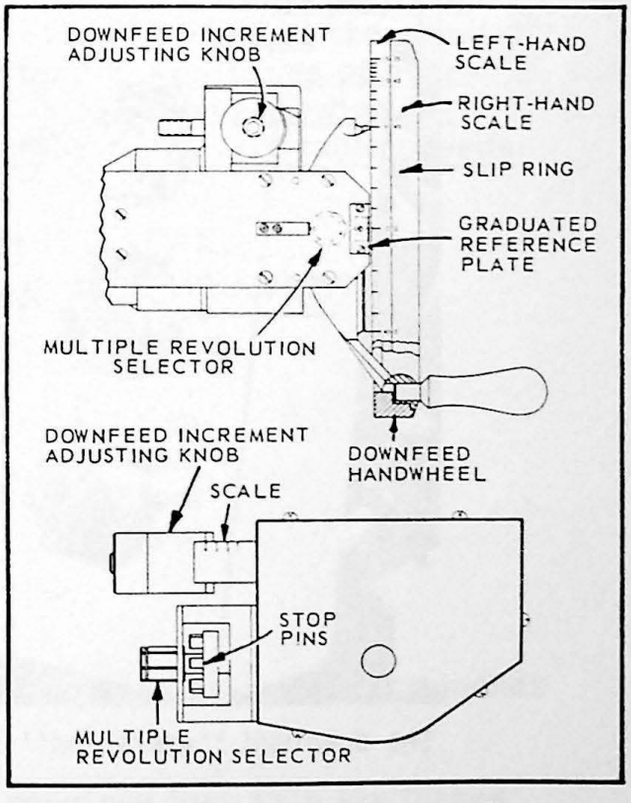
The multiple revolution selector is used to preselect the number of complete handwheel revolutions necessary. This downfeed (.050 inch per revolution), plus the partial revolution set-up on the downfeed handwheel slip-ring, combine to obtain the desired total downfeed.

For example, if it is desired to grind off a total of .090, the selector is set at #1, this positions the stop pin which stops the handwheel after one complete revolution plus the slip-ring setting (up to .048). The first downfeed handwheel revolution accounts for .050 stock removal, and the amount set on the handwheel slip-ring for the remaining .040. If less than .050 is to be removed, set the knob at "0". The selector can be set to allow from 0 to 6 revolutions (plus the slip-ring setting of up to .048 for a maximum of .348).

When the downfeed handwheel slip-ring is preset for the desired total automatic downfeed, it is actually turned backward from zero. To make this adjustment easier, a special slip-ring is provided which has two graduated scales. The left-hand scale is the standard scale used for manual downfeed settings. The right-hand scale is graduated at .005 intervals, but in a reverse direction (see drawing). For example: if the operator wishes to set the handwheel for an automatic downfeed of .035, he merely turns the slip-ring directly to 35 on the right-hand scale, instead of subtracting 35 from 50 and then setting the slip ring at 15 on the left-hand scale.



Downfeed handwheel and special slip ring.



Automatic downfeed controls.

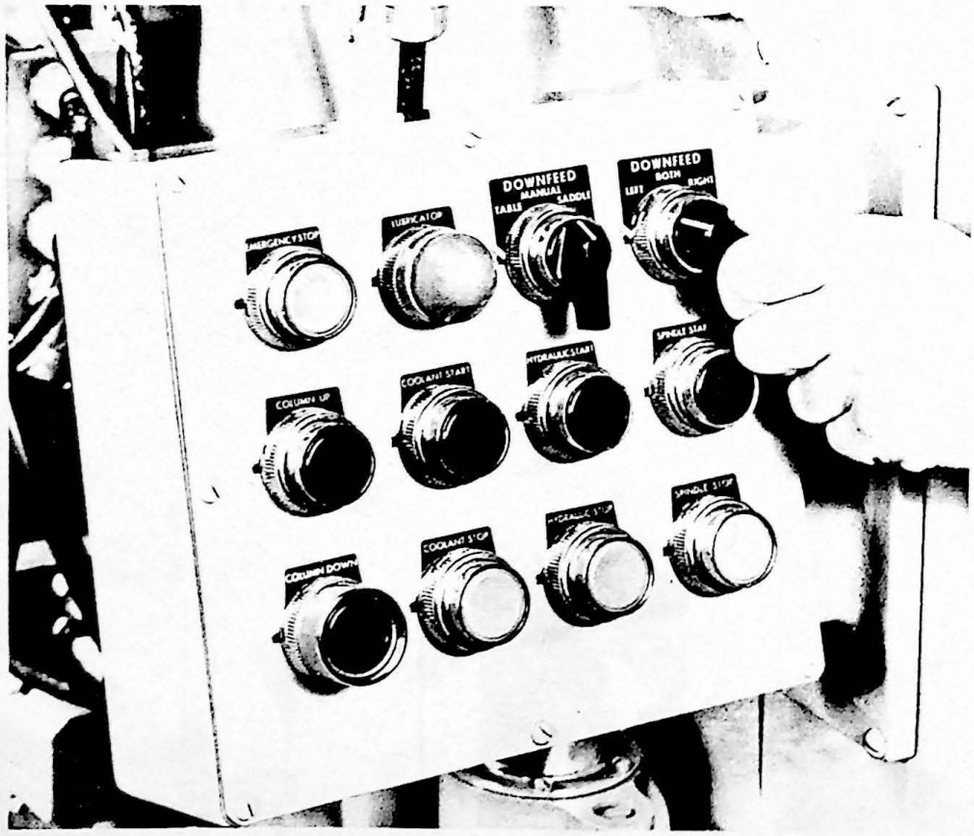
ELECTRICAL CONTROLS

(1) Downfeed operation selector switch:

(a) "Table" - automatic downfeed with table reversal.
(b) "Manual" - normal manual operation without automatic downfeed.
(c) "Saddle" - automatic downfeed with saddle reversal.

(2) Downfeed location selector switch: After selecting either table or saddle downfeed with the operation selector, use this selector to determine at what point automatic downfeed will occur. (This switch, of course, will not function if the operation selector is set on "manual").

(a) "out-left" - automatic downfeed at saddle "out" reversal or table "left" reversal.
(b) "in-right" - automatic downfeed at saddle "in" reversal or table "right" reversal.
(c) "both" - automatic downfeed at both saddle in and out reversals or at both table left and right reversals.

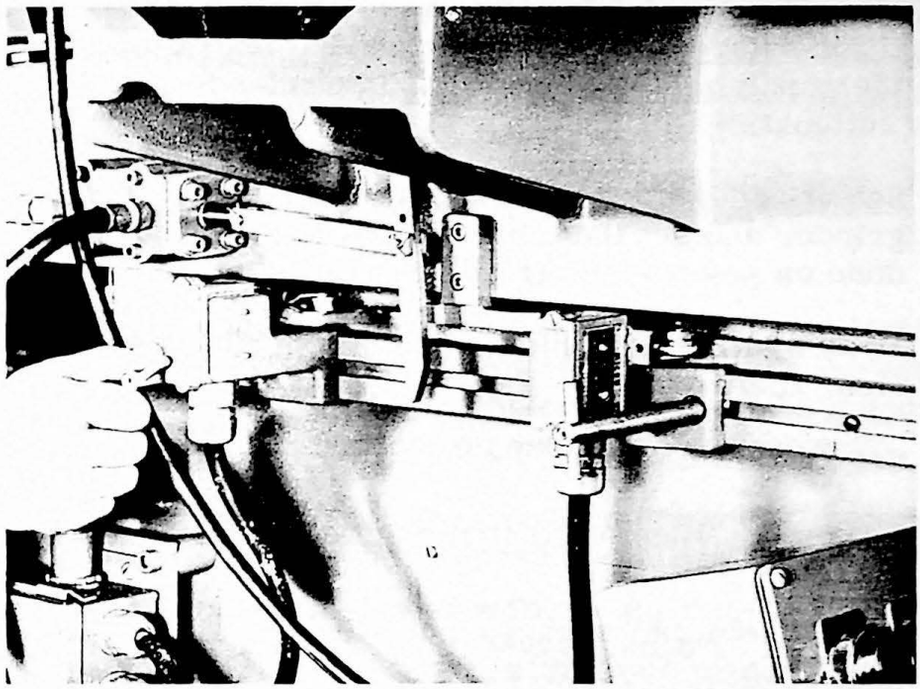


The downfeed ''operation'' and ''location'' selector switches.

ADJUSTMENT OF TABLE AND SADDLE TRIP DOGS

Surface Grinding:

Table trip dogs and saddle dogs are located so that the grinding wheel will clear the workpiece for automatic surface grinding.



Adjusting the saddle trip dogs.

Plunge or Form Grinding:

When setting up for form or plunge grinding, the table trip dogs must be adjusted so the downfeed is completed before the grinding wheel contacts the work. For example, six inches of overtravel at each table reversal is required for the following increments of automatic downfeed at these respective table speeds:

DOWNFEED AND TABLE SPEED
WHICH REQUIRE 6 INCHES OVERTRAVEL

Downfeed	Table Speed
up to .001 in.	125 fpm
up to .002 in	120 fpm
up to .003 in.	65 fpm
up to .004 in.	40 fpm

EXAMPLE:

(1) Downfeed of .003 at 125 fpm requires more than six inches overtravel.

(2) Downfeed of .002 at 40 fpm requires less than six inches overtravel.

TYPICAL AUTOMATIC DOWNFEED OPERATING PROCEDURE

For example, if .080 is to be removed, follow these steps:
CAUTION - The downfeed selector switch must always be in "manual" position before attempting any manual operation of the grinder (if not, the result can be an additional downfeed when reverting back to automatic).

(1) Select and dress a grinding wheel, locate work on the grinder and set the table and saddle trip dogs as would be done on any normal grinding operation.

(2) Push multiple revolution selector in and raise the wheel to clear the work.

(3) Set the downfeed increment knob.

(4) Lower the wheel until it contacts the work ("spark out").

(5) Pull out multiple revolution selector knob and set at #1. It is set at #1 because one complete revolution of the downfeed handwheel (.050) is required in addition to the handwheel setting.

(6) Zero the downfeed slip-ring, then set it back clockwise, to 30 on the right hand scale (this handwheel setting accounts for the remaining .030 of the total .080).

(7) (a) For surface grinding - Make sure the wheel is off one end of the work. Set the saddle dogs so the wheel clears the front and back edges of the work. Then set the table dogs to just clear the left and right ends of the work. Set the increment of crossfeed.

(b) For plunge or form grinding - Set the table trip dogs so the downfeed will be complete before the wheel is on the work as indicated by the table giving the relationship between downfeed and table speed. Position the saddle, place the crossfeed selector control in "manual" and lock the saddle (if the machine is equipped with a saddle lock attachment).

(8) Start the table and begin grinding.
Note: For surface grinding only - if the saddle is located so either trip dog limit switch is engaged, a downfeed will occur, as desired when starting the grinding operation. If either saddle trip dog limit switch is not engaged, downfeed will not occur until a complete pass has been made across the work. It may be desirable to manually downfeed for this first pass.

(9) Check downfeed increment by referring to the handwheel scale during an actual downfeed and make adjustment, if necessary.

(10) When .080 has been removed, the downfeed handwheel stop dog will contact the stop pin on the multiple revolution selector and automatic downfeed will stop. All other normal functions of the grinder (except power elevation) will continue.

(11) Return the downfeed selector to "manual" position.

MANUAL TABLE OPERATION

Grinders equipped with Automatic Downfeed require a slightly different procedure for manual table operation. Follow the instructions for the standard grinder for the operation of the manual table feed handwheel; and, in addition, please note the following:

(1) Crossfeed selector lever must be in "manual" before the table handwheel can be engaged by pulling the knob upward.

(2) The table handwheel will disengage immediately when the crossfeed selector lever is moved into either "auto" or "wheel dress."

MAINTENANCE

Apply several drops of #10 oil daily at the oil cap on top of the unit. Apply #10 oil weekly at the Multiple Revolution Selector, pins and detents.

Should the downfeed mechanism have a tendency to "hang-up" or malfunction it is recommended that the unit be cleaned and lubricated:

(1) Remove the roll pin and drive out the vernier shaft from the rear of the machine.

(2) Remove the handwheel, noting the orientation of the retainer and shims.

(3) Wash cage, pawl, hub, linkage and associated parts with clean solvent and allow to dry.

(4) Lubricate with #10 oil.

(5) Reassemble and adjust for correct operation if necessary.

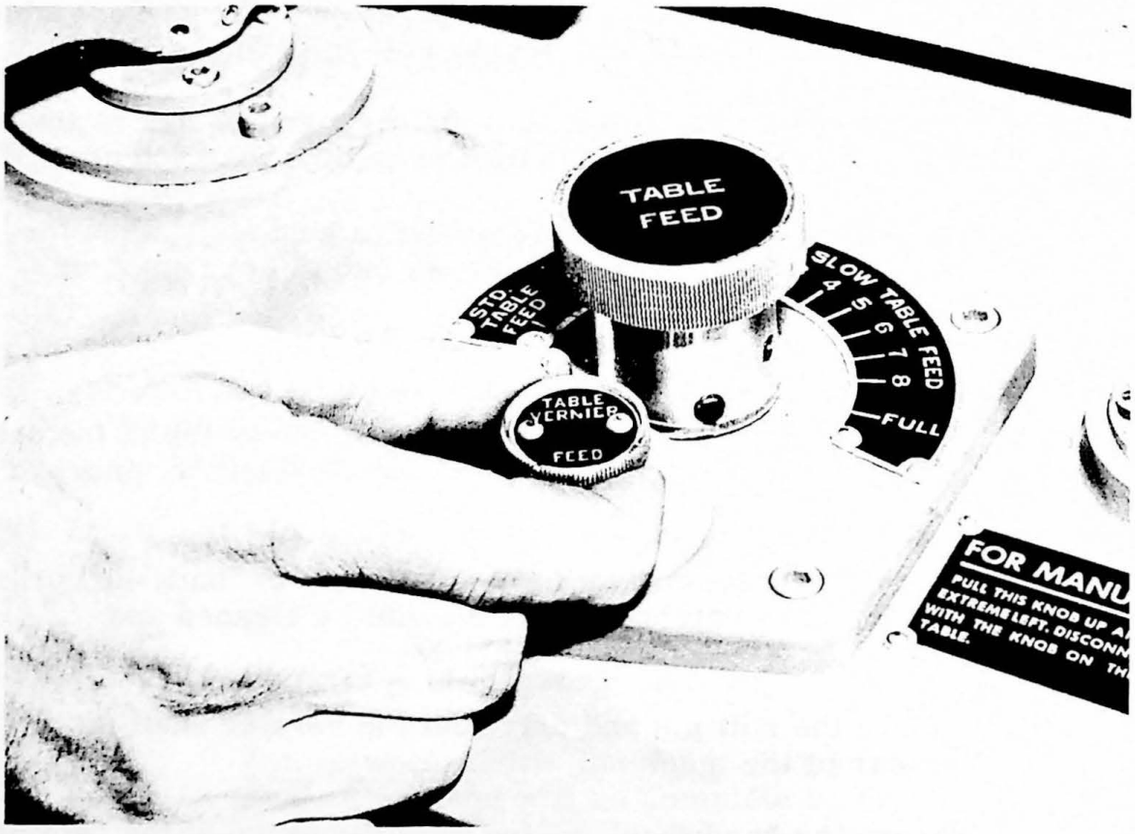
NOTE
A DETAILED "ADJUSTMENT PROCEDURE" IS AVAILABLE FOR THE AUTOMATIC DOWNFEED ATTACHMENT.

CRUSH FORM TABLE SPEED CONTROL

This control, located on the saddle, allows adjustment of table speed in the right-to-left direction only, with a quick return stroke. A reference scale is provided next to the control knob. The "standard" position on the scale allows full table speed; however, the use of this accessory will reduce the maximum table speed as follows:

D-6 Series Models --------50 fpm max. table speed.
D-8 Series Models --------75 fpm max. table speed.
D-10 Series Models--------75 fpm max. table speed.

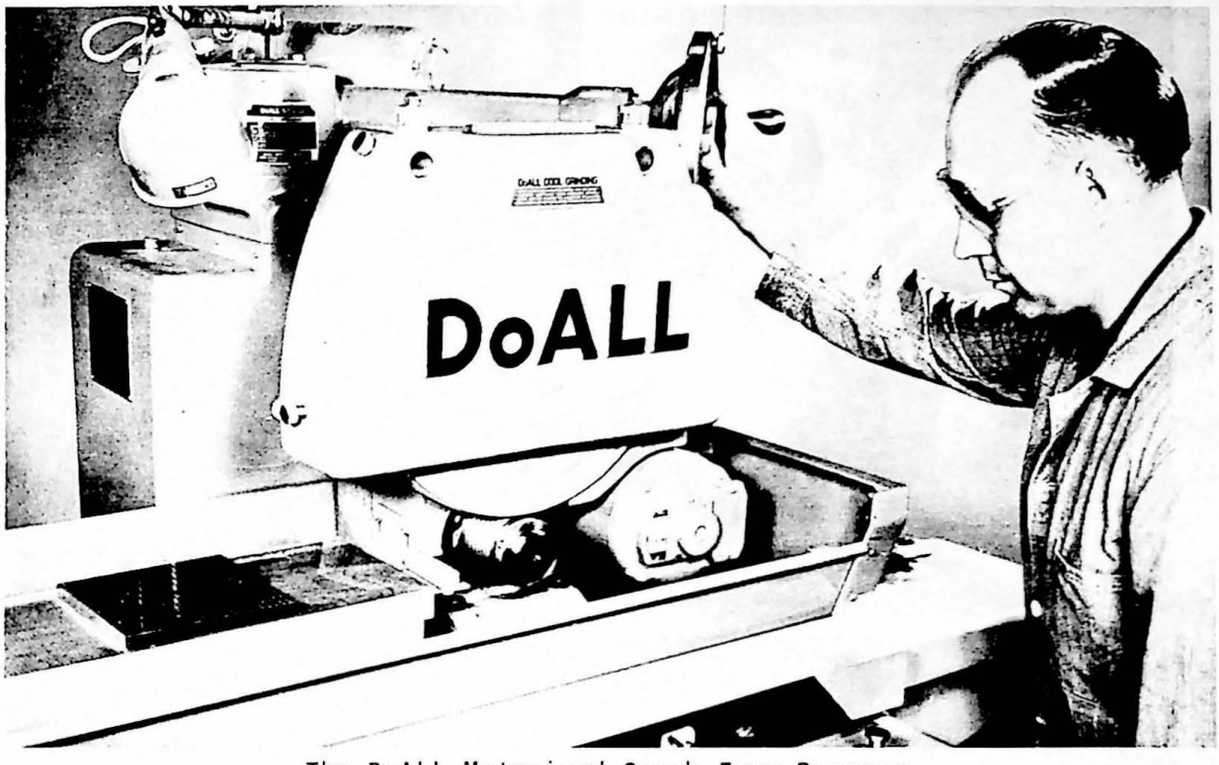
A vernier adjustment knob is provided for making fine adjustments.



The Crush Grind Table Speed Control with fine feed vernier adjustment.

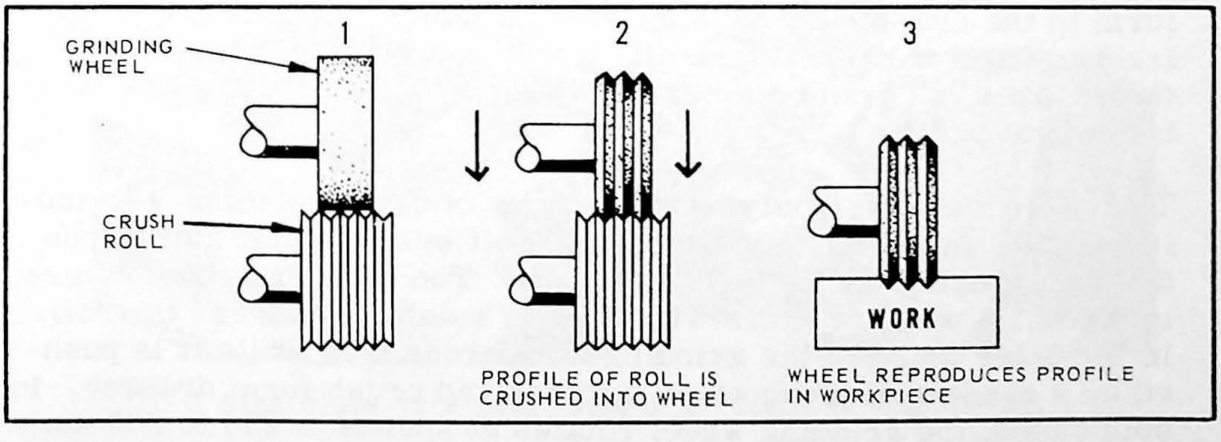
CRUSH FORM GRINDING

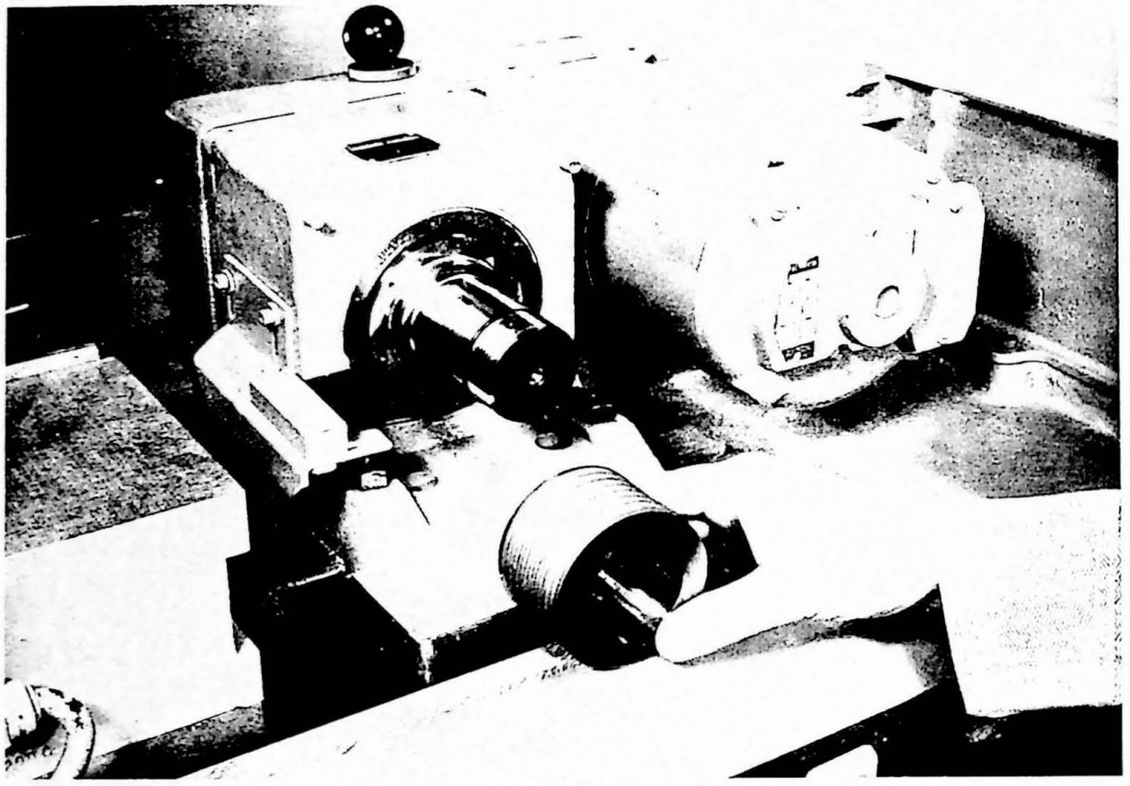
In crush forming, the profile desired on the workpiece is first ground or machined onto the surface of a metal roll. This roll is usually three to six inches in diameter and slightly wider than the face of the grinding wheel.



The DoALL Motorized Crush Form Dresser.

The ground roll is rigidly mounted on a crush form dresser attachment so that its shaft is parallel to the spindle of the grinding wheel. The wheel and the roll are then brought into contact while both members are at rest. Pressure is applied at the point of contact, and drive for either the wheel or the formed metal roll is engaged to produce low rpm. The wheel is then downfed until the profile of the metal roll is completely reproduced or "crushed" in the face of the wheel. The drawing shows three stages of a typical profile grinding operation using a crush-formed wheel.





Absence of an outboard bearing support makes it easy to change crush rolls. This is the motorized type of crush roll dresser.

Although the abrasive grains in the wheel are very hard, the bond which holds these grains in place is relatively soft in comparison to the metal crush roll. This makes crush forming possible.

Crush dressing of the grinding wheel requires repeating from time to time because of wear in the wheel. This redressing eventually causes wear in the crush roll itself.

This necessitates regrinding the crush roll occasionally. To do this, the crush roll may be reground on a cylindrical profile grinder or a master crush roll is used to reform the grinding wheel on the surface grinder. The wheel is then used to regrind the proper form in the crush roll. In high production applications requiring frequent use of the master roll, it too, may begin to wear. In these cases, a "grand master" roll facilitates regrinding the master roll to proper form.

There are two commonly-used methods of crush forming a grinding wheel. In one method, the crush roll mounts on an idler-type dresser which permits the roll to idle. The grinding wheel comes into contact with the roll. The wheel's rotation "drives" the roll. In the other method, the grinding wheel runs free while it is pushed by a crush roll mounted on a motorized crush form dresser. In both cases, the grinding wheel rotates at speeds of 250 to 300 surface feet per minute.

There are five simple steps in crush-forming a wheel:

(1) Bring wheel and roll into contact with both at rest.

(2) Move the wheel down four or five thousandths more to create enough pressure for the forming action and to prevent slippage. Slippage causes a flat spot on the roll.

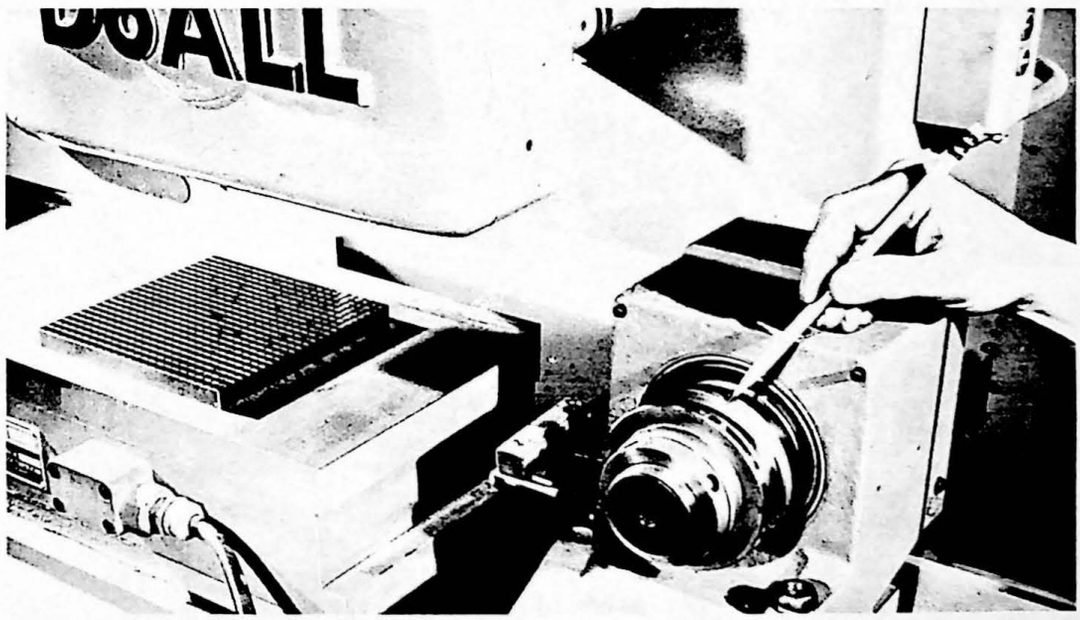
(3) The grinding wheel should rotate slowly, usually at a speed of 250 to 300 sfpm.

(4) Downfeed the wheel into the formed roll fast enough to prevent slippage and slowly enough to avoid overloading the wheel. After a few experiences, you develop a "feel" for the proper rate of downfeed just as in operating any other type of manual machine tool.

(5) At the end of the cycle, bring the wheel down to the full depth of the metal roll profile plus two or three thousandths and then back it out without letting it stay in position long enough to "roll out."

Generally, only vitrified-bonded wheels are crush-formed. Organic-bonded wheels are too resilient to accept this type of forming well. Oil is generally the preferred coolant, both during crush forming of the wheel and in subsequent use in grinding.

Both aluminum oxide and silicon carbide wheels can be crush formed. Abrasive grains may range from 120 to 440 grit. The smallest radius that must be formed usually determines grain size.

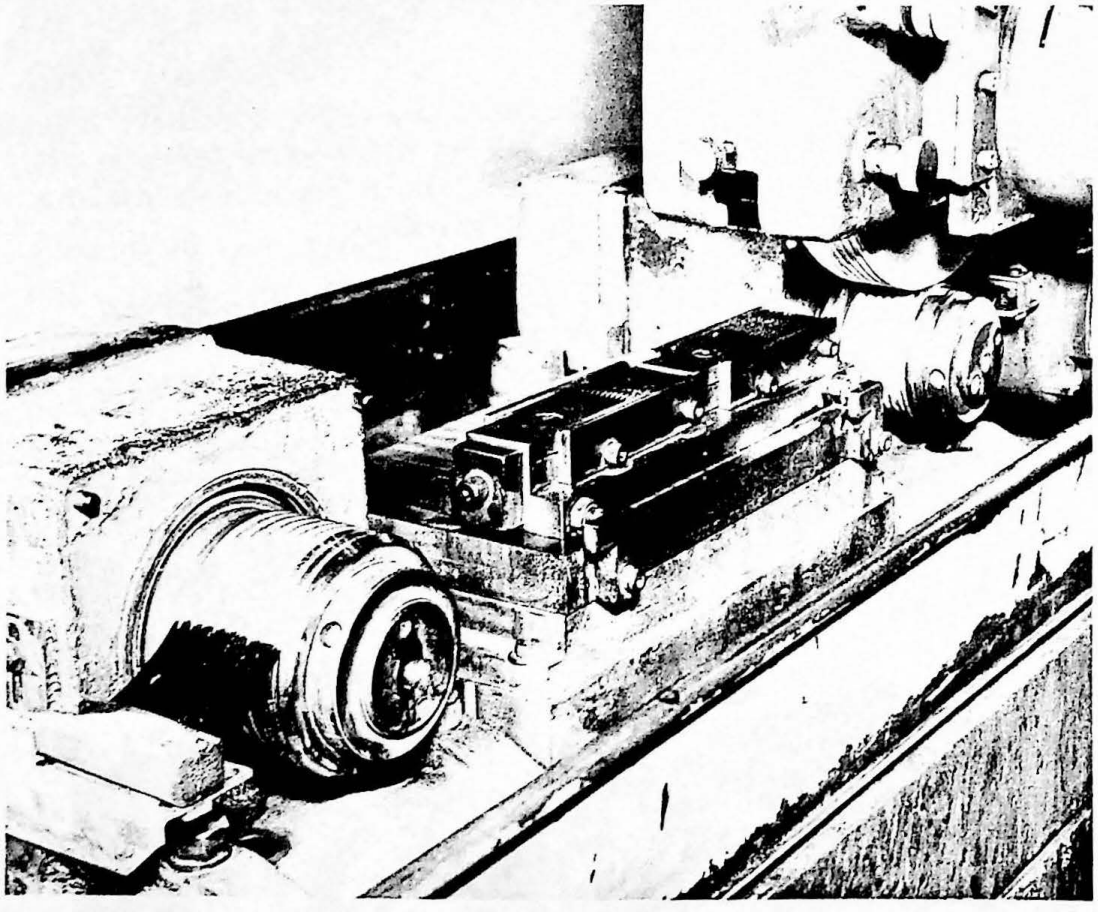


A sine plate is a good example of crush form grinding.

There are two accepted techniques for using a crush-formed grinding wheel. One technique involves feeding down by small increments on each pass of the grinding wheel. A machine with an automatic downfeed may be preset for the required increment so that the wheel lowers automatically after the return from each cut across the work.

The other technique for using a crush-formed grinding wheel involves bringing the wheel down to the level of a full cut and making a single cut across the work. This requires the use of a special slow feed, crush grinding table feed control. This table moves at the required rate of an inch or less a minute as the work feeds into the wheel.

The method used depends to a great extent upon the nature of the wheel and the work. However, in general, work of large surface area is more likely to require automatic downfeed of the wheel in small increments while smaller workpieces are usually ground to finished dimensions in one pass.



Ten serrated knives are crush ground at one time in this special fixture. The "working" crush roll at the right is used to crush-form the grinding wheel for each load. After about 100 wheel dressings, the "master" roll at the left is used to crush form wheel so that worn working roll can be reground.