MAINTENANCE
FOLDER # E2

E2

CARE AND OPERATION

of (Tool Post)

PORTABLE PRECISION LATHE GRINDERS

By

FRED O. ORTHEY
Application Engineer

BOOKLET NUMBER 713

FIFTH EDITION

Price 25 Cents

THE DUMORE COMPANY
Racine, Wisconsin

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CONTENTS

THE HISTORY OF GRINDING

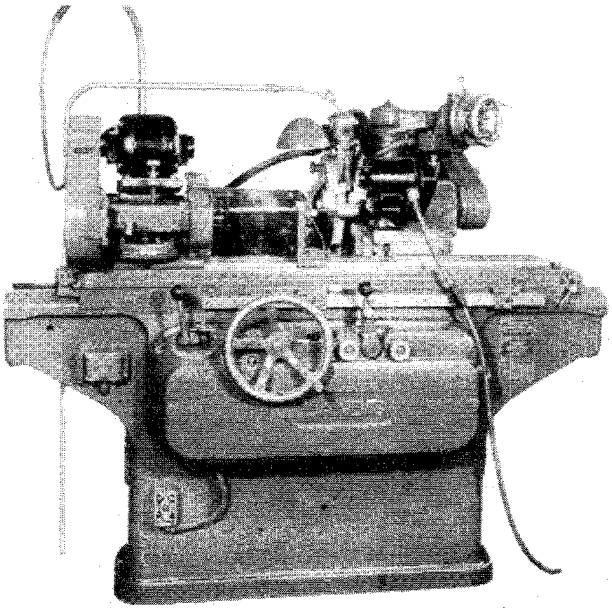
Grinders as machine tools are particularly interesting because they are an exclusive American development. The majority of other machine tools, such as the engine-lathe, planer, and shaper, were first developed in England.

The first grinding machine was a reconstructed lathe set up in the early 60's. As experience accumulated, the universal grinder was built and first exhibited at the Centennial Exposition in 1876.

Necessity was, indeed, the mother of the first grinder. After a piece of metal has been hardened, grinding is the only practical means of truing and finishing it to a desired size. Metal, you know, is distorted in the hardening process and the grinder is used to eliminate this distortion. However, grinding is not confined to hardened metals. Grinding is also done on soft machineable metals; because with a grinder, an operator can hold to close machining tolerances.

Wherever precision of fit or finish is essential and cost is a consideration, the grinder is in use. Grinding has paved the way for mass production, through its aid in the development of the tools and dies which make interchangeability possible. The grinder, therefore, has shown its influence not only in the tool and die industry with which it is associated, but also through the mass production of every conceivable type of capital and perishable goods.

THE FIELD OF USE FOR DUMORE GRINDERS



No. 5 grinder on a Landis Universal grinder, grinding the tapered socket of the Dumore "T" quill. Held to .0001".

Machine tools such as lathes, planers, shapers, boring mills, milling machines, and universal grinders have had their scope and capacity enlarged by the use of Dumore precision grinders.

Portable grinders mounted on these machines have brought precision grinding into every shop, large and small.

Performing the same general function as the cutting tool, industry now has the precision grinder, with its grinding wheel, doing the work. Today the portable precision grinder is being used for various applications such as cylindrical grinding, internal, external, form and surface grinding, and thread grinding. By using a Dumore, many shop owners and superintendents find that they are able to do jobs in their own plant which formerly had to be sent out or not done at all.

THE FIELD OF USE FOR DUMORE GRINDERS (Continued)

Small production runs that would be too costly to set up on a large machine can now be done with a portable precision grinder. The toolrooms have likewise found Dumores indispensable for tool and die grinding.

Dumore precision grinders are a "must" on every list of equipment found in modern and up-to-date toolrooms and shops.

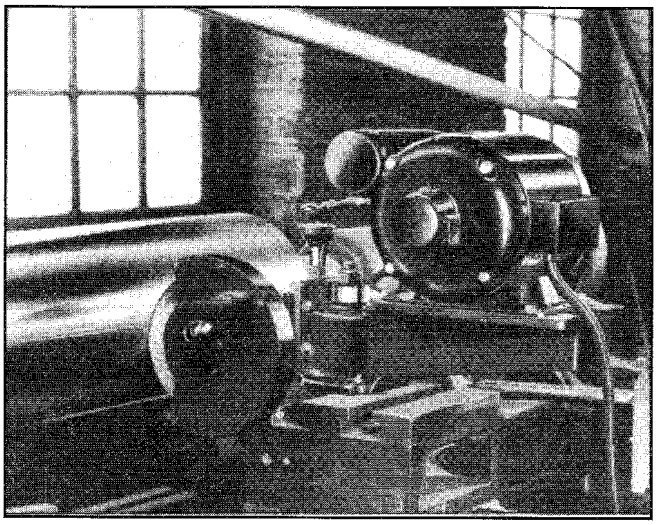
SELECTING THE GRINDER

In order that the best results may be obtained, care should be taken to select the proper grinder. The type of lathe is the first consideration. A large grinder will not work satisfactorily on a small lathe because vibration is apt to be a factor owing to the lack of rigidity in the lathe itself. In every case, the work should, to a large extent, govern the selection of the proper grinder.

The important questions in selecting a tool are: "Will it handle the size and range of work to be ground? Has the grinder sufficient power, or should a larger size be used?"

Each Dumore grinder is built for specific purposes, and for handling a certain range of work. The No. 5 grinder, for example, is extremely versatile and is recommended for toolroom jobs that present a wide range of work. This quality of versatility has been partially obtained in the design of this tool by providing spindle speeds ranging from 4,600 to 42,500 R.P.M.

Sometimes, it is necessary to grind to the full swing capacity of the lathe. A specially designed offset mounting post is available for this purpose; this sets the grinder back and enables it to grind to the lathe's full capacity. This added feature may be helpful in the selection of a grinder which otherwise could not be used.

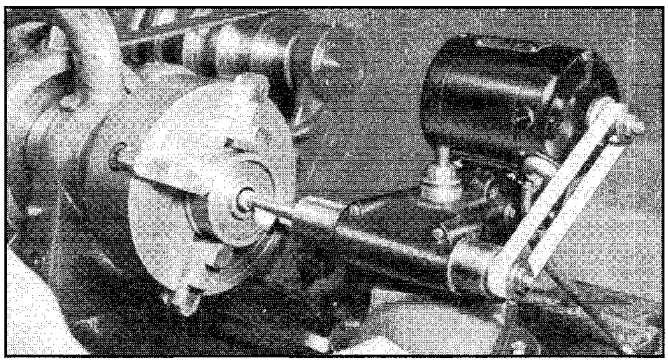


No. 12 grinder reconditioning the piston of a large hydraulic hoist--mounted on a heavy duty lathe.

If versatility is the paramount requisite, grinders such as the No. 5 and No. 7 should be considered. Interchangeable quills are available for these grinders, which make the grinders adaptable not only to external grinding but also to internal grinding.

If the job is large and requires considerable stock removal, then thought should be given to the power requirements. Heavy external work requires the constant speed of an induction motor which has a maximum power output regardless of the changes in the load; for such applications, the No. 77 and No. 12 grinders are ideal.

SELECTING THE GRINDER (Continued)



An appliction of the No. 5E Dumore Grinder with a V5 quill on a small internal grinding job.

Internal work, particularly in the smaller sizes, requires the high speeds obtained with universal motor-driven grinders. These high speeds insure the correct peripheral speed for even the smallest wheels.

Dumore grinders are available with motors ranging in size from 1/14 H.P. to 1 H.P. This range affords the selection of a grinder having the necessary power to do a proper job of precision grinding.

Oftentimes, the operator attempts to grind a job for which his grinder has insufficient power. This usually proves detrimental to the tool, especially if used for any length of time.

As emphasized previously, the job itself determines, to a large extent, the type grinder which is most desirable. Is the job external or internal? If internal, how deep is the hole and will it be necessary to use an extension quill? Questions like these lead to the selection of the proper quill.

SELECTING THE PROPER QUILL

The type and size of the work to be ground determines the proper grinder and quill to be used.

External grinding does not present a problem in the selection of a quill because all external grinding employs only one quill for each grinder. Internal grinding,however, enables a variety of quills to be used,depending upon the diameter and depth of the hole to be ground.

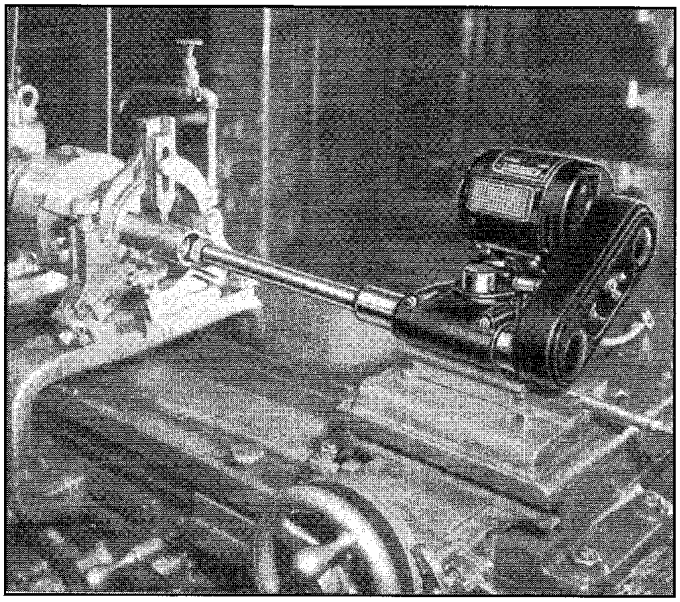
When grinding internally, the diameter of the wheel should be about two-thirds the diameter of the hole. This insures a grinding wheel contact of the greatest efficiency.

There is a certain range of wheel sizes recommended for each quill. To use a wheel larger than that recommended is extremely dangerous, and will have a detrimental effect on motor and quill bearings causing vibration and unsatisfactory grinding results.

Wherever possible, a three-bearing extension quill should be used to supply maximum rigidity and eliminate vibration and chatter marks. If the hole to be ground is large enough in diameter to permit the use of a three-bearing quill,then a quill of this type should be used. The specifications of the various quills available are given in the Dumore catalog to aid in the selection.

When internal quills which are not supported by a third outer bearing are required, much discretion should be used in selecting the proper quills. The shortest possible extension should be chosen to secure the best results. Many select a longer extension, believing that this will increase the scope of the quill. This should not govern the selection because it

SELECTING THE PROPER QUILL (Continued)



A No. 5 Dumore Grinder with a B18 extension quill does a deep internal grinding. This grinder is mounted on a Heald machine.

is only reasonable to expect a longer extension to be more susceptible to vibration. For example, if a hole 3" deep is to be ground, a quill with a 5" extension should not be selected if one with a 3" extension is available.

With the longer extension quills, for internal grinding to a depth of five to six inches (with the exception of three-bearing quills), better results will be obtained by lowering the R.P.M. of the spindle. For example, for any unsupported extension or spindle longer than 3", the recommended speeds on the nameplate of the grinder should be disregarded. With these quills or spindles, wheels ½" diameter or less should not be run over 23,700 R.P.M. Wheels over ½" diameter to 1" diameter should not be run over 14,600 R.P.M.

The standard Dumore grinding quills are designed for horizontal operation only. If the job demands that the quill be used in a vertical position, the quill should be equipped with a special oiling system. This will afford a means of lubricating the upper bearing. The quill then can be used in both the horizontal and vertical positions.

SELECTING THE PROPER WHEEL

Contrary to the commonly accepted opinion, grinding is not an abrasive or rubbing-off process. Photomicrographs show that a grinding wheel cuts in a manner similar to a metal cutting tool.* On examination of the grinding grit, you will find that it is made up of minute particles or chips which have been sheared off the work by the cutting particles of the wheel.

A grinding wheel can therefore be thought of as a disc made up of thousands of minute cutting tools. These cutting particles are held together by the bond of the wheel.

An ideal grinding wheel is one in which the bond wears away as fast as the wheel grains are dulled. The wheel appears soft when the bond is worn away before the grains of the wheel wear and thus you have "loading" of the wheel. Loading is the condition which results when the pores of the wheel surface fill with the grit of the material being ground.

If the grains dull or wear down faster than the bond, the wheel is too hard. This will cause the wheel to glaze. Both loading or glazing can be temporarily relieved by dressing the wheel with a proper diamond dresser. A reasonable variation of the wheel grade can be remedied by adjusting the work and spindle speeds properly.

When the work speed is increased, the wheel will appear softer because the grain of the wheel will be taking a deeper cut. This increased depth of grain cut is caused by the fact that the wheel must remove more material in the same number of cuts per minute.

* See Page 9.

SELECTING THE PROPER WHEEL (Continued)

If the wheel speed is increased, the wheel can remove the same amount of material in fewer cuts and consequently the wheel will appear harder.

The grain size and the grit of a wheel influences the type of finish secured. A coarse wheel is preferable for the rapid removal of stock. The grains are deeply anchored in the bond, allowing greater depth of cut, and the greater porosity of a coarse wheel allows the work to keep cool. An experienced operator, skilled in the use of the diamond, is able to secure a reasonably fine finish from a coarse wheel,but a finer grained wheel is desirable for securing a better finish.

A wheel should always cut freely even with the lightest depth of cut, for if any pressure is used in the finishing cuts,the work is likely to overheat and become distorted.

Good wheels poorly chosen and improperly used will remove metal after a fashion. It usually pays to experiment with several grades of wheels in order to secure utmost efficiency.

When grinding internally, wheels should not be too large in diameter. A large wheel will cause excessive heating because of increased contact. A small wheel, on the other hand, causes excessive wear on the wheel. A wheel approximately two-thirds of the diameter of the hole being ground is most satisfactory.

Probably no other factor is more important to results obtained than the proper selection of a wheel. There are many wheels available, and good judgment, coupled with experience, is necessary for the proper selection.

IMPORTANCE OF BALANCED WHEELS

Most important is the fact that a properly balanced wheel be selected. An unbalanced wheel will create vibration and chatter marks. It will decrease the life of the bearings, and in general all the precision which is built in the grinder cannot overcome its detrimental effects.

Dumore wheels are manufactured to rigid requirements and are carefully balanced to enable smooth operation at high speeds.

The size of the wheel is determined by the job being ground and the quill being used. The maximum wheel diameters recommended for each quill are shown on the Dumore price list under each quill.

After the wheel size is determined, the type of wheel should be considered. Each of the various materials to be ground usually requires a different type wheel. The selection of the proper type wheel requires good judgment and unlimited experience. For that reason The Dumore Company maintains an Experimental Department to select proper wheels for different materials.

Recommendations are given on the Dumore price list and will aid in the selection. If it is desired to grind a material other than those listed,the Dumore Company will gladly submit recommendations for the proper wheel.

NECESSITY FOR SAFETY PRECAUTIONS

It should be noted that wheels are safe for operation at a speed only below the highest recommended. To be run at a speed higher than that recommended (which is approximately 6,500 S.F.P.M. for a vitrified wheel and 9,500 S.F.P.M. for organic bond wheels) will increase the centrifugal force considerably. This may cause the wheel to break. It is always essential to protect the operator by using a wheel guard.

It sometimes happens that wheels, even though properly packed, are cracked in shipping. A good rule is to always "sound" the wheel before mounting. A cracked wheel will have a dull sound whereas a solid wheel will ring when tapped with something solid.

Always check the pulley combinations given on the nameplate of the grinder when putting on a wheel. Be particularly careful to see that the combination recommended is not reversed because this may cause the wheel to run at a speed far in excess to that recommended.

*SETTING UP THE GRINDER ON A LATHE

Before attempting to set up the grinder, the voltage stamped on the nameplate should be checked with the power supply. Incorrect voltage may dangerously affect the operation of the grinder. For example, a 115 volt grinder used on 220 volts will heat up excessively and may damage the windings. On the other hand, a 220 volt grinder used on 115 volts will have only half of its normal power output.

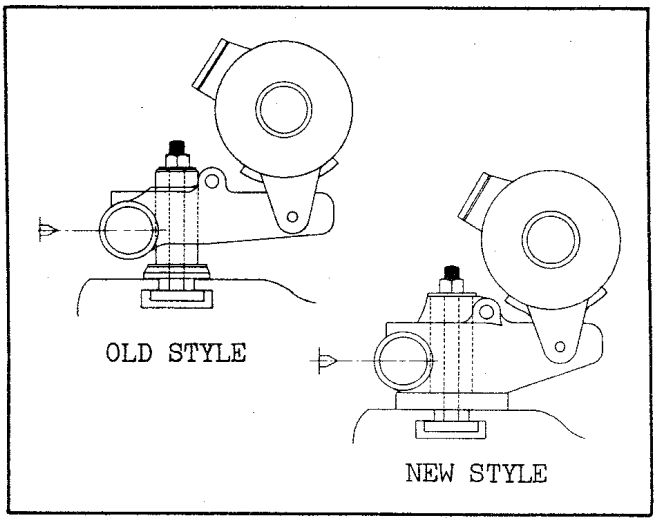
The first step in mounting the grinder on a lathe is to remove the mounting post from the grinder. The T-bolt of the mounting post should then be slipped into the T-slot of the lathe compound. The T-bolt is then tightened down.

Next, the grinder is slipped onto the post and properly positioned to the correct height. The grinder can be locked at the correct height by tightening the lock screw on the side of the grinder.

The quill is then inserted and locked in place by tightening the two lock nuts on the grinder frame. The locating pin on the quill will automatically line it up with the motor pulley.

The chart on the nameplate should be consulted to obtain the correct pulley combination for the grinding wheel which is to be used. This chart should be consulted each time the grinder is set up to eliminate the possibility of using the wrong pulley combination, which may cause a wheel to break because of excessive speed.

The Nos.5, 7, and 77 grinders are now equipped with a new type frame which enables the grinder to be solidly mounted on the compound of the lathe if desired.



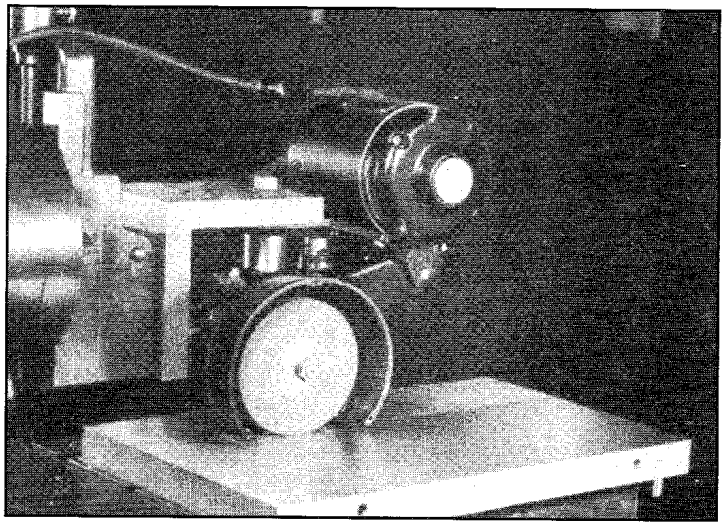
This frame affords a large contact area, increasing the rigidity of the mounting. It is particularly suitable for deep internal grinding when long extension quills are used. With this frame, it is not necessary to use a mounting post, but only a mounting shim and T-bolt. The shim plate will automatically adjust the grinder to the correct height so that the axis of the grinding spindle will be on the center line of the work mounted in the lathe.

Sometimes, it is desirable to mount the grinder on the back side of the lathe. This can be done easily. The grinder, however, must have a direction of rotation opposite from that of standard grinders. This requires an opposite-from-standard direction of threads to prevent the wheel and pulley nuts from backing off. This type of grinder is designated as the "E" type grinder; for example, a No. 5E grinder with a BE quill. Some of the E type grinders and quills are carried in stock as regular stock items.

* See chart Page 20 for close tolerance grinding on a lathe.

MOUNTING THE GRINDER ON A SHAPER

Although Dumore tools are commonly called lathe grinders, this name is a misnomer, since it is possible to mount these grinders on not only a lathe but also on shapers, planers, milling machines, and various other machines.



No. 5 grinder mounted on a shaper with an angle plate grinds a flat surface. Notice the grinding grit is thrown away from the ways.

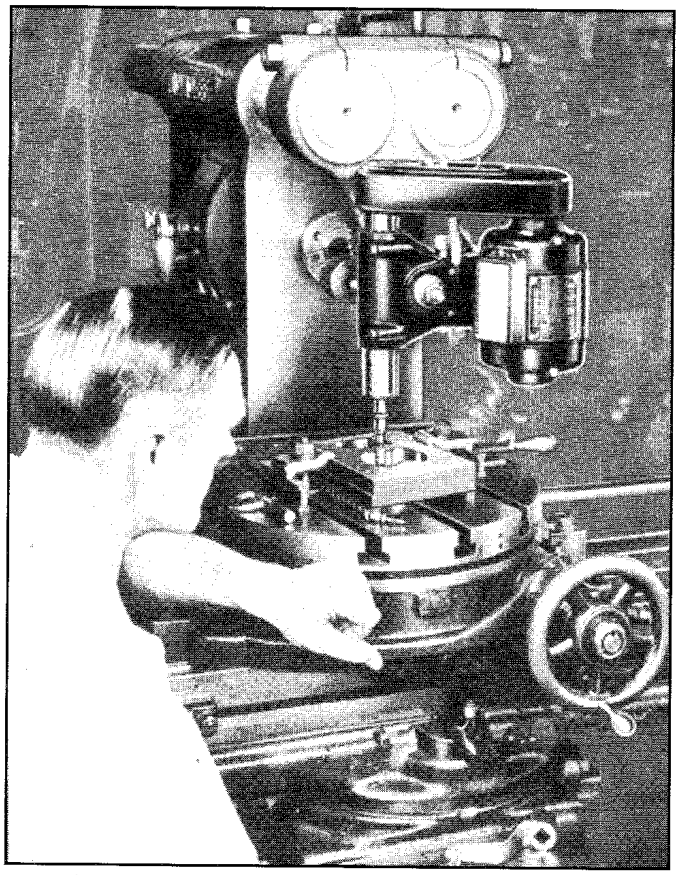
In mounting the grinder on a shaper, it must be positioned so that the grinding grit will be thrown away from the ways of the ram. An angle plate is mounted on the clapper box as indicated in the illustration; the grinder is hung down from this angle plate through the use of the mounting post and the mounting post nut. The travel of the ram and the rotation of the wheel give the desired results.

MOUNTING ON A MILLER

The grinder is mounted on the outer arbor support of the milling machine as shown in the illustration. Since the grinder must be set up in a vertical position, a special quill with a vertical oiling system is required. A special T-bolt and plate is also required.

A rotary table is mounted on the regular table of the milling machine. This provides a method of giving rotary motion to the work being ground.

The required contours are easily ground by manipulating the hand wheels of the rotary and regular tables of the milling machine.



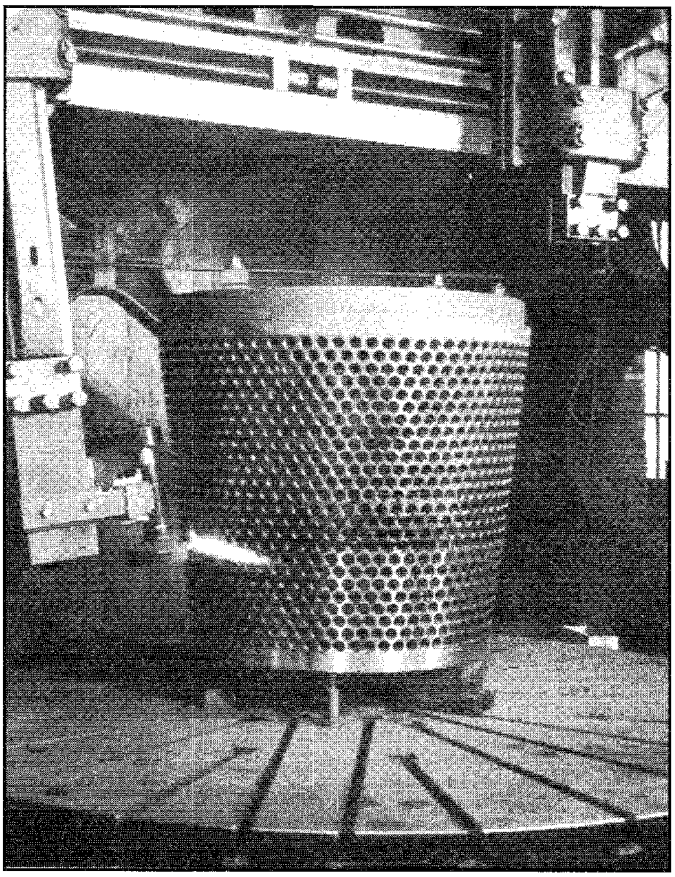
A No. 5 grinder mounted on the head of a miller grinding an irregular motor-lamination die.

MOUNTING ON A BORING MILL

Dumore grinders are frequently used for grinding on both vertical and horizontal boring mills. Because of the work size usually ground on these machines, the No. 77 and the No. 12 grinders are invariably used.

MOUNTING THE GRINDER ON A BORING MILL (Continued)

If the job is external, the grinder may be mounted on the ram of the machine as shown in the illustration.



The No. 12 Dumore grinder mounted vertically grinds a 43" strainer core.

Both the No.77 and No.12 grinders have flat "pancake" frame bases and consequently can be mounted directly on the ram by supplying only a special mounting plate for the ram. Since the grinder is mounted in a vertical position, it must be equipped with a quill having a vertical oiling system to provide oil for the upper bearings.

Oftentimes, shop men desire to grind the internal diameter of large cylinders on a boring mill. This may be done in one of two ways. If the internal diameter of the cylinder is sufficiently large, the entire grinder equipped with an external grinding quill can be passed inside the cylinder and ground in a manner similar to an external grinding application.

If the diameter of the cylinder is too small to permit the entire grinder to enter, a suitable extension quill can be used. The extension of this quill must be of sufficient length to pass through the entire length of the cylinder.

For additional information on this type of work, the factory should be consulted.

THE ASSEMBLY OF DUMORE GRINDERS

Although each individual part of the grinder is carefully constructed, the complete unit must be built properly to produce the best results.

The motor of the grinder is mounted on the frame away from the quill. This decreases the possibility of motor vibration being transmitted to the quill. The motor is mounted pivotally, and a coil spring provides automatic tension for the belt. This eliminates loss of power through belt slippage and insures longer belt life.

A set of interchangeable pulleys provide various spindle speeds for the grinding quill. These pulleys are interchangeable on both the motor and quill. The quill is close to the mounting post to give the shortest possible distance from the center of the grinding spindle to the center

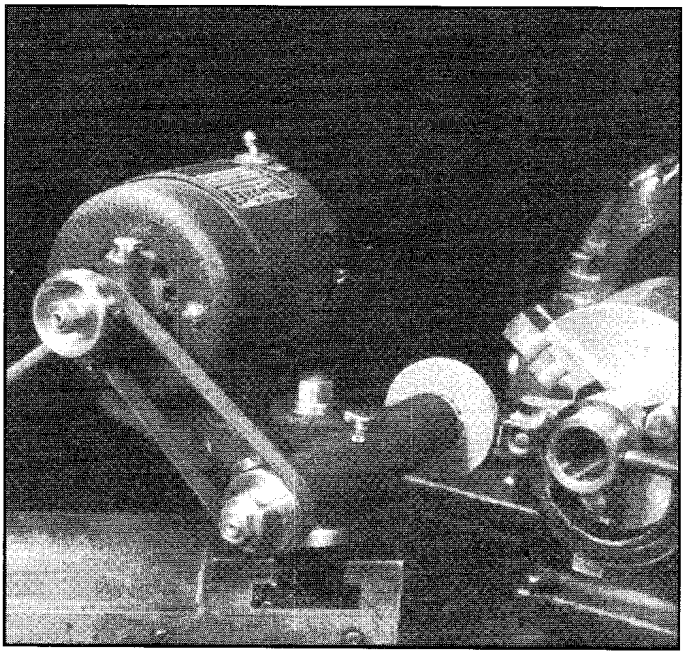
of the post. This increases the rigidity of the grinder. A quill mounted in this manner is close to the work being ground, and this setup enables the full capacity of the lathe to be used.

A removable mounting post permits both radial and vertical adjustment. This increases the ease with which the grinder is set up on a particular job.

DRESSING THE WHEEL FOR PRECISION GRINDING

All new wheels should be diamond dressed before actually doing any grinding. This will make the wheel perfectly concentric and will insure the wheel face being parallel to the work. The wheel should also be dressed each time the grinder is set up for grinding.

After being used for a period of time, the grinding wheel may become either glazed, or it may become loaded. To temporarily relieve this condition, it is necessary to diamond dress the wheel. By dressing the wheel, new cutting particles are exposed.



Correct method of dressing a grinding wheel. Note that wheel is being dressed at the point where it is to contact the work.

A diamond dresser is an essential piece of equipment in precision grinding. Good work cannot be obtained without one. No work can be any better than the wheel producing it, and only a proper diamond will enable one to turn out a quality grinding job, held to close limits.

The "C" clamp diamond holder, which has been designed by Dumore, should be clamped on the work in the lathe. If this is impossible, it should be clamped on a piece of material firmly chucked in the lathe. The grinding wheel should then be passed very slowly across the diamond. It is advisable to take a very light cut, not more than two or three thousandths of an inch at a time.

Care should be taken to see that the height of the horizontal center line of the grinding wheel is at exactly the same height as the horizontal center line of the spindle of the lathe. It is also important to have the diamond set at the horizontal center line of the grinding wheel. This is necessary to insure accurate truing of the face of the wheel.

An angular hole is provided in the "C" clamp so the diamond can be turned to present a sharp corner of the diamond for a clean cut, the object in dressing being to true the wheel and not merely to rough it up to secure fresh cutting particles.

DRESSING THE GRINDING WHEEL(Continued)

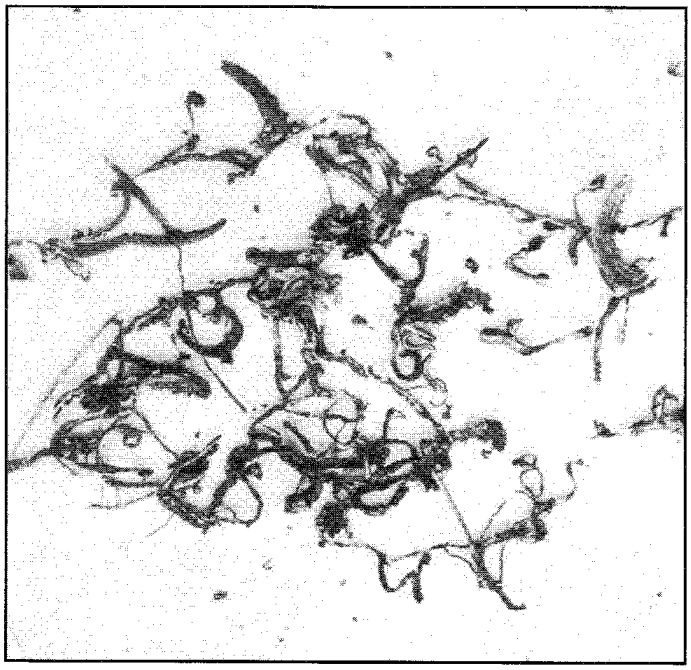
A great deal of care should be taken to dress the face of the wheel on the side where it is to come in contact with the work. A properly dressed wheel will have a wheel face which is absolutely parallel to the work being ground. Unless the wheel is dressed at the point where it contacts the work, the operator is not certain that the wheel face and work are parallel.

The diamond nib should be turned periodically so that a sharp point is always presented. This increases the effectiveness of the diamond and enables wheel dressing to be done more quickly. It also prevents the diamond from wearing on one side and becoming flat, thereby increasing the life of the diamond.

In dressing wheels on a long unsupported extension quill there is a tendency for the diamond to dig in. This does not mean that the quill is not satisfactory but it does prevent the operator from properly dressing the wheel. To overcome this the spindle speed or quill speed can be slowed down to around 16,000 or 23,000 r.p.m. The diamond should also be turned to be certain that a sharp point is presented.

THE FEATURES OF DUMORE GRINDER MOTORS

Because Dumore grinders are built to do precision grinding, they must necessarily be built by precision methods. In order to insure a precision unit leaving the factory, it is necessary to supplement the accurate machining and assembly by careful inspection.



Photomicrograph showing the character of chips removed by a grinding wheel under ideal conditions.
(Courtesy of the Norton Co.)

By these careful manufacturing methods, Dumore produces a grinder motor that is practically free of vibration and gives the smooth performance necessary for precision grinding.

The motor itself is assembled in an aluminum housing. This makes a Dumore grinder a portable tool that is as light as possible. To provide a bearing seat that will stand up in service, the motor housings are cast with steel inserts which serve as bearing seats. This insures a permanent seat for the bearing.

Each moving part of the motor is both statically and dynamically balanced to eliminate vibration and to enable the grinder to grind to accuracies of .0001 inch.

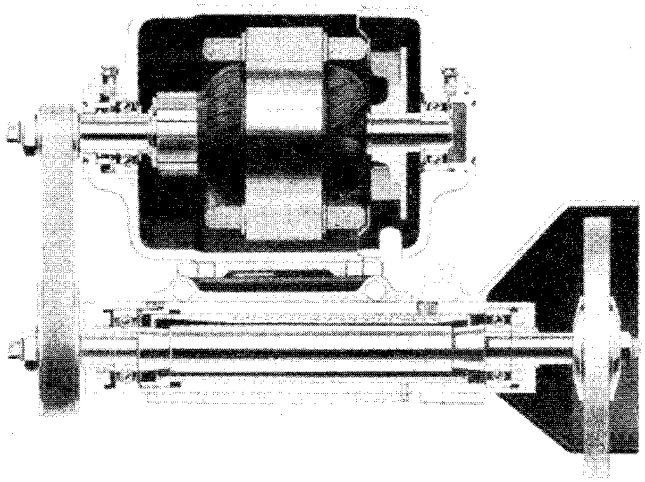
The grinder motor is cooled by forced ventilation. In order to prevent any dust from entering the motor housing, the air is drawn through a filter mounted on the motor. The motor is mounted on a saddle. A coiled spring is arranged between this motor saddle and the grinder frame to provide the proper belt tension. The motor is equipped with specially selected ball bearings, purchased at a premium, for smooth operation even when the motor is turning at 16,000 R.P.M.

THE FEATURES OF DUMORE QUILLS

The most vital part of the grinder is the quill on which the wheel is mounted. This quill must be free from any vibration which would result in chatter marks being transmitted to the work.

So that these quills may be free from vibration, yet run at speeds as high as 42,500 R.P.M., it is necessary to equip them with specially selected precision ball bearings.

It is necessary for the bearings to obtain just the correct amount of oil, because too much oil will create excessive heat, while too little oil will cause the bearings to run dry. This latter condition will result in rubbing of the balls and will cause excessive wear.



Internal construction of a Dumore quill showing lubrication system.

The bearings of the quill are lubricated by the Dumore patented lubricating system. By means of a felt wick which runs the entire length of the quill tube, all the oil is filtered before reaching the bearings. (This felt wick is saturated in oil and rides on a tapered thrower). By means of centrifugal force the oil is drawn along the tapered section of the spindle and vaporized. The "fog" or "mist" of oil is thrown into the bearings. This system insures just the correct amount of oil in the bearings. It results in longer hours of dependable service.

Quills at times, have a tendency to run hot at the bearing ends. This is not harmful —it is merely heat being dissipated from the bearings and should cause no alarm. Heat may rise to fifty-five degrees Centigrade over room temperatures; this is allowable because provisions have been made to take care of the expansion which results from heat.

Because of the heat, allowances must necessarily be made to take care of normal expansion. Dumore quills are equipped with a specially designed internal preload arrangement. This automatic arrangement maintains the correct preload on the bearings, even though the spindle expands or contracts due to heat changes. This allows the bearings to run free, eliminating the possibility of "freezing".

If a new quill is turned with the fingers it may seem to be "stiff" or in other words, it does not turn free. This is due to the quill being cold and a pre-determined amount of preload has been put on the bearings. After the quill is put in operation the heat causes expansion and the automatic preloading arrangement allows the quill to run perfectly free. A quill therefore which is stiff when cold, turns freely under normal operating conditions.

As in the motor, the rotating parts of the grinding quill must also be dynamically balanced. Any unbalanced condition produces vibration, and

every effort must therefore be made to eliminate it. For this reason all wheel collars, grinding wheels, and other parts are statically or dynamically balanced to eliminate vibration factors. The dynamic balancing of each rotating part not only insures smoother operation, but also increases the life of the quill.

REASONS FOR CHATTER AND METHOD OF ELIMINATION

Grinding troubles, which usually result in some undesired mark on the work can be readily traced by an experienced operator.

The most outstanding difficulties encountered in tool post grinding can generally be traced to one of the following:

1. A faulty lathe
2. Improper wheel
3. Improper work speed
4. Improper wheel speed
5. Bumpy belt
6. Improperly dressed wheel
7. Improper care and maintenance of grinder
8. Defective bearings

When encountering trouble, many operators give little attention to any of these difficulties and try to overcome them by using a grinding wheel with special characteristics.

A faulty lathe will offset the smooth operation of the grinding quill by setting up vibration which may be caused by loose spindle bearings,etc. Readjustment of the lathe will overcome this difficulty. Vibration of the floor, transmitted through the machine to the work,must also be guarded against.

Good grinding is the correct combination of wheel, work, wheel speeds, feed, and depth of cut. Any difficulty brought about by one may usually be corrected by readjustment of any of the others, if the variation is reasonable. Because of the many variables present, it is difficult to specify any exact relationship between these factors for the various types of work. For best results, it is wise to determine these by actual trial.

A wheel which is too hard will not cut properly and will cause chatter, glazing, and sometimes burning of the work. If a softer wheel is not immediately available,a remedy may sometimes be affected by either increasing the work speed or decreasing the wheel speed. The proper speeds can usually be obtained after a few trials.

A wheel which is too soft will wear down very fast because of the rapid breakdown of its cutting particles. This rapid wearing away of the wheel may cause the work to be slightly tapered. To remedy this the wheel should be dressed and the work speed decreased or the spindle speed increased. Here again, a few trial grinds will usually give the desired results.

An unbalanced grinding wheel is a great hindrance to precision grinding. Because of the high speeds, an unbalanced condition will not only prove detrimental to the bearings, but will leave a long, regularly spaced chatter mark on the work. For this reason, the Dumore Company recommends the use of Dumore wheels which are carefully balanced. To secure the best results with Dumore grinders, use only Dumore balanced wheels.

CHATTER AND METHOD OF ELIMINATION (Continued)

An improperly dressed wheel does not make a complete parallel contact with the work. This results in vibration, excessive wheel wear, and a less accurate grinding job. Always dress the wheel face on the side where it is to come in contact with the work.

Variations in the thickness of the belt which drives the grinding quill can cause chatter marks; this factor is usually overlooked. A bumpy portion of the belt will set up a regular and even pattern of chatter marks. Never use belts other than those recommended by the manufacturer.

MAINTENANCE OF DUMORE GRINDERS

A grinder, like any other precision tool, should be properly cared for to get the best results.

If the grinder requires servicing of any kind, the operator will find it to his advantage to consult the factory and wherever possible send the grinder in to the factory for a thorough inspection.

Ball bearings used in Dumore products are the finest obtainable; the type most suitable for each application has been carefully chosen. Dirt or grit is responsible for most ball bearing failures; therefore, the importance of preventing the entrance of foreign matter cannot be overstressed. For this reason, Dumore filters the oil by a felt wick before it enters the bearings and strongly recommends that any bearing trouble be referred to the factory.

The care of the bearings and the type of work to which they are subjected, is largely responsible for the life of the bearings. The bearings should be properly lubricated with the correct lubricant and compressed air should never be used in cleaning because this method of cleaning blows dirt into the bearings.

All Dumore quills, with the exception of the No. 12 grinder quills, are built for dry grinding only. If it is desirable to do wet grinding the quills should be equipped with water slingers which can be obtained upon request. The water slingers will prevent the water from entering the quill housing and damaging the bearings. These slingers are effective only when the grinder is in operation and the coolant should never be directed on the quill or wheel unless it is in operation. A good suggestion is to shut off the flow of coolant thirty seconds before stopping the quill, to throw off all coolant, so that it cannot penetrate to the bearings. If coolant reaches the bearings, which are traveling at high speed, they will be damaged beyond repair.

The quills are designed for regular operation in the horizontal position only. Quills are also available for operation in a vertical, or odd-angle position. These quills are equipped with a special oiling system which will provide proper lubrication for the upper bearings.

Because of their design and workmanship, careful attention should be paid to periodic oiling of the quills to insure maximum service. The frequency of oiling will depend upon the speed at which the grinder operates, the type of service to which it is subjected, and the frequency and continuity of service.

MAINTENANCE OF DUMORE GRINDERS (Continued)

All quills are properly oiled when they leave the factory test rooms. However, there may be a considerable lapse of time before the quills are used. During this time the oil tends to seep from the quill. Serious damage can be done to the bearings if the quill is not oiled. Therefore, one tablespoon of oil should be put in the quill before operation. This also applies to quills removed from storage.

After the quills have been in operation they should receive one teaspoon of oil every eight hours. Correspondingly less oil should be used for shorter services.

It is very essential that an oil having proper characteristics be used because of the high speeds and the special Dumore lubricating system. Dumore engineers have, through extensive experiments, selected an oil to meet all requirements. For proper operation Dumore #0 oil is recommended. The Dumore Company will not guarantee the performance of quills which are oiled with other than Dumore #0 oil. As an added precaution, all Dumore oil is filtered at the factory.

Normal brush life of all Dumore grinders will vary from 500 to 2000 hours, depending on the severity and continuity of service. The brushes should be inspected periodically and wiped clean with a dry cloth. When the body of the brush has been worn to a length of 1/4", a new pair of brushes should be installed.

A brush worn beyond this point will seriously score and damage the commutator. When making periodic inspection of brushes, be sure to return brush to holder in its original position so that the brush seat will remain unchanged. Disregard for this precaution will destroy all benefits gained from a diligent inspection. Be sure that the brushes slide freely as you replace them in the brush holders.

The air filter pad should be replaced periodically on grinders equipped with air filters. As dust accumulates on the felt pad, the pad becomes saturated and hampers the free ventilation of the motor by obstructing the air inlet. This may cause the grinder motor to heat. The pad can be replaced by merely removing the snap screen. A good suggestion is to have a few extra air filter pads on hand for immediate use.

Another suggestion is to check the pulleys occasionally. A "nick" on the pulley will tend to wear the belt excessively. Whenever belts get fringy after running only a short time, the pulleys should be examined for nicks which should be eliminated.

THE THREAD GRINDING ATTACHMENT

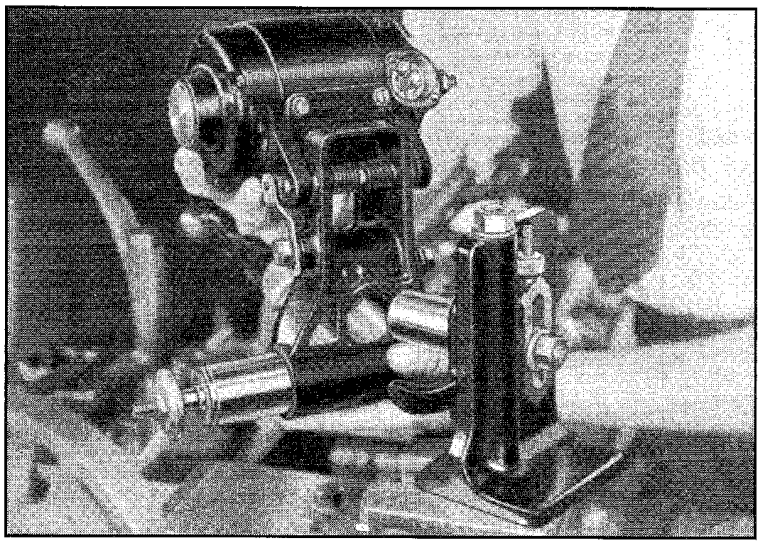
The Thread Grinding Attachment is a portable tool used in connection with the No. 5 Dumore Grinder for easily grinding threads on a lathe. The No. 5 Dumore Grinder is the only grinder with which this attachment can be used.

The attachment is easily set-up to grind threads on any thread cutting lathe. It is ideally suited to small lot thread grinding jobs that do not warrant a costly set-up or the purchase of a large and bulky thread grinding machine.

Setting Up The Thread Grinding Attachment

There are only eight short steps required to set this unit up properly:

1. Set the compound of the lathe at zero or parallel to the ways of the lathe.
2. Mount the horizontal Thread Grinder mounting post in the T-slot of the lathe compound.
3. Remove the standard mounting post from the No. 5 Grinder and slide the grinder over the horizontal mounting post of the Thread Grinding Attachment. With the quill of the grinder on the bottom the entire grinder is moved along the horizontal mounting post until the quill rests against the post lugs. These lugs give the quill and grinder proper alignment. Hold the Thread Grinding Attachment firmly against the lugs and tighten the mounting post stud on the side of the grinder frame.



Slipping the No. 5 Grinder onto the horizontal thread grinder mounting post.

5. Assemble the pulleys and belts on the grinder.
6. The dresser clamp is then fastened on the tail-stock spindle. The dresser rod bearing hole should be down and on the back side of the tail-stock spindle. The wheel dressing attachment is mounted on the dresser rod. This rod is fastened to the dresser clamp, which has been mounted on the lathe tail-stock. (See Illustration page 19.)
7. Consult a screw thread helix angle chart. Determine the helix angle of the thread being ground so that the grinder may be set to the correct helical angle. In setting the grinder to the proper helical angle, the quill is no longer on a horizontal center line with the work. Then it is necessary to raise or lower the grinder on the thread grinding attachment mounting post until the wheel center is on the horizontal center line of the work being ground.

In step (1) the lathe compound is set at zero so that the operator can move the attachment and wheel parallel to the axis of the thread; this allows either side of the thread to be ground. This preliminary adjustment also facilitates relocating the threads after dressing.

If the attachment is to be used for grinding small diameters between centers, it is set at a slight angle to allow the grinder pulley to clear the tail-stock of the lathe.

External and Internal Threads

The standard thread grinding attachment is suitable for grinding only standard U.S. 60 degree threads. Special attachments can be obtained for grinding Acme Threads and special "V" threads up to a 70 degree included angle. For information regarding special attachments, the factory should be consulted.

Both external and internal threads can be ground with the attachment. Any external thread having a pitch within the commercial range can be ground. The grinding of internal threads, however, is limited. The range of internal threads depends upon the depth of the threaded hole, the pitch of the thread and the diameter. The wheel should be mounted on a suitable internal grinding quill such as the "V" extension quill of the No. 5 grinder or the insert spindle type "T" quill with a suitable insert spindle.

When grinding an internal thread, the following facts should be taken into consideration:

1. The depth of the threaded hole.
2. The diameter of the thread.
3. The diameter of wheel available.
4. The length and type of internal grinding quill available.
5. The pitch of the thread.

Suggestions For Operating The Thread Grinding Attachment

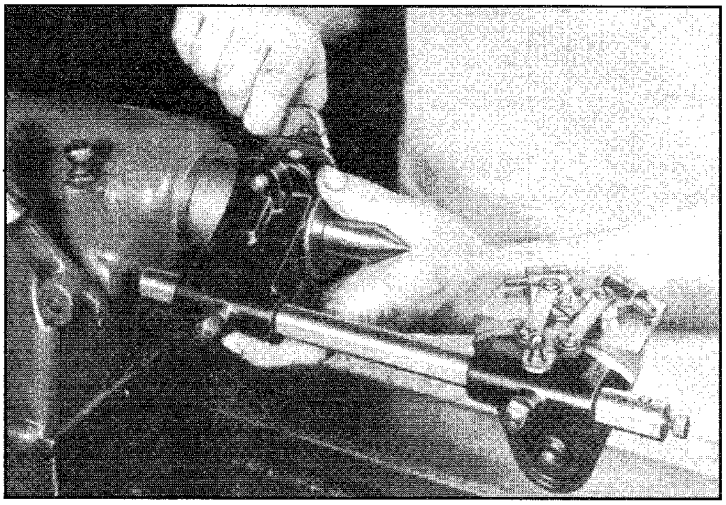
It is very desirable to hold the work speed of the lathe to a minimum. A speed of approximately 2 to 4 S.F.P.M. is most satisfactory. A slow work speed will enable the economical grinding of threads from the solid. A thread which is first chased in the lathe before hardening requires less time to grind than one being ground from the solid.

An accurate lead on the thread being ground depends upon the lead screw of the lathe and consequently, the accuracy of the ground thread will be conditioned by the accuracy of the lead screw of the lathe.

A thread grinding oil is helpful although it is not necessary. If the threads are coated with oil when grinding, the oil serves as a coolant.

Dressing the Grinding Wheel and Relocating the Wheel to its Proper Position in Relation to the Thread

The most efficient method of dressing the grinding wheel is to dress only one side of the wheel at a time. Many believe it is necessary to have the wheel in the exact center of the "V" in the dresser. This is not necessary because if one side of the wheel is dressed and then the lathe carriage on the compound is moved sufficiently to dress the other side, the result will show the wheel to be dressed to a perfect 60 degree included angle. By dressing only one side of the wheel at a time, it is easier to dress to a perfect edge.



Clamping the wheel dresser assembly to the tail stock of the lathe.

It is essential to use sharp diamonds. A dull diamond will make it very difficult to dress a proper point on the wheel because it tears the wheel and results in a jagged edge. The diamonds in the wheel dresser of this attachment are mounted so that they can be turned periodically. When turning the diamond to a new position a sharp edge is presented. Whenever a flat spot is worn on a diamond, it should be turned to get a new cutting edge.

Before a thread is finished, it sometimes becomes necessary to redress the wheel.

This means that after the wheel has been dressed, it must be relocated in the thread. After the wheel has been redressed, it should be moved back to its approximate position. The half-nut of the lathe is then engaged and by using the parallel movement of the compound and feeding to the proper depth, the wheel can easily be adjusted to its proper position. This is much easier than resetting a thread cutting tool since the spark of the grinding wheel when it contacts the work will guide the operator.

To obtain the exact location of the wheel, the operator should spark the wheel on the right side of the thread. The dial micrometer of the compound is then set at zero and by using the parallel movement of the compound, the wheel is moved to the left until it sparks the left side of the thread.

This gives a reading on the dial micrometer and since the dial was set at zero when the wheel sparked the right side of the thread, half of this reading will indicate the center of the thread. For example, if the reading is eighteen, moving back to nine will give the exact center of the thread. The operator should be cautioned to take up the slack in the compound screw when finding center.

HAND GRINDERS

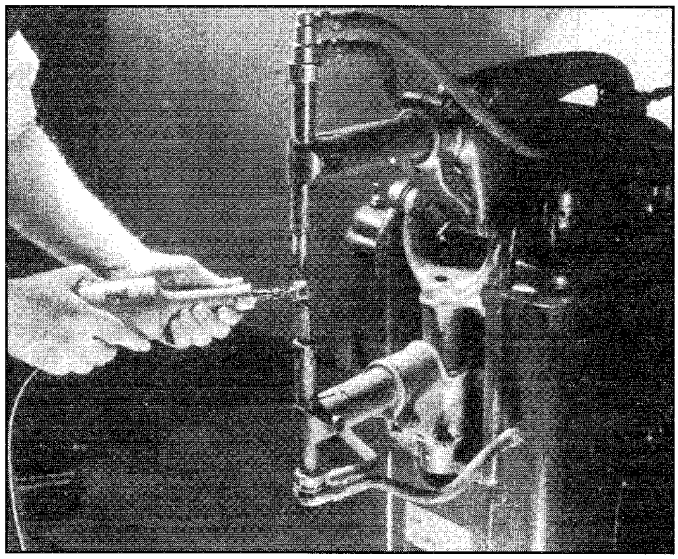
The paramount requisites for hand grinders are light weight and compact construction. As the name implies, this type of tool is small enough to be securely held in either or both hands without tiring the operator. This requires a tool that is light, compact, balanced, and of sufficient power to effectively remove stock. Proper balance is obtained by dynamically balancing the armature; this minimizes the danger of vibration which would make the tool difficult to handle. Moreover, the tool must be designed so that there is a proper distribution of weight to enable ready handling for delicate jobs

Hand grinders can be used in any part of the shop. They are particularly adapted to work in difficult-to-get-at places where larger tools cannot be employed. Their extreme flexibility and adaptability make them popular in tool cribs. As a result, a hand grinder is often subject to abuse because they are used by everyone in the plant. Periodic inspection of hand grinders, therefore, is essential for maximum life and performance.

HAND GRINDERS (CONTINUED)

The inspection should include examination of the brushes to see that they are properly seated. When brushes are worn to a length of about ¼", they should be replaced so that the commutator will not be scored or damaged. Air filters should also be replaced periodically because a clogged and dirty felt may cause the motor to overheat. If the felt filter cap has been removed or lost, dirt will enter the motor housing, causing damage to the winding or a short between the brush and motor case.

Dumore hand grinders are equipped with universal motors which enables them to be used on either A.C. or D.C. This increases the flexibility of the tool since it can be used in any part of the plant without special provision for current. However, the voltage on the line should be the same as the voltage stamped on the grinder.



Here the #10 Dumore Hand Grinder, operating 22,000 R.P.M., is cleaning and straightening up the burned end of the copper tip on a spot welding machine.

It is dangerous to operate a 115 volt grinder on 230 volts since this will cause the grinder to overheat and run at too high a speed, ruining bearings and bending the armature shaft.

The universal motor provides speeds high enough so that small diameter wheels and mounted wheel points can be used. Idling speeds range from 16,000 to 22,000 R.P.M.

The majority of small hand grinders use mounted wheel points only; however, some employ 2" or 2½" straight-faced wheels. The latter, however, must be resenoid bonded. If a vitrified bonded wheel were used, the speed would be excessive.

Whenever hand grinders require repair, it is most economical to send the tool back to the factory. The manufacturers understand its construction and are properly equipped for servicing.

To greatly increase the length of service for hand grinders, too much care cannot be taken to see that the tool is correctly and consistently lubricated. Operating and lubrication instructions should be followed closely and the factory should be consulted on special problems of maintenance and lubrication.

Applications for hand grinders are so numerous that it is futile to attempt listing all of them. Here, however are a few of the more common applications: Correcting inaccuracies in dies; Spark testing steel; Touching up taps; Sharpening dinking, button, and acorn dies; Finishing radii and other irregular shapes; Sharpening cutting tools without removing them from the machinery.

SPECIAL APPLICATIONS

Oftentimes, a special quill or grinder is required for a special application on which a standard grinder cannot be used. In this case, full information and price can be obtained by writing to the factory giving full details of the job. The type of machine on which the grinder is to be mounted, the type of work to be done, continuity of service, power requirements, size of wheel required, and the speed requirements are essential facts for designing a proper quill. Dumore engineers have had twenty-five years of experience in grinding and will gladly work with you on any special grinding application.

CHART IN TENTHS FOR ACCURATE GRINDING ON A LATHE

A tool post grinder, like other machine tools, is capable of doing extremely accurate work. The operator may often feel handicapped in this respect because the graduations on the lathe compound dial are in thousands while his work calls for accuracies to tenths of a thousand. With this in mind the following chart is useful because it shows how an accuracy in tenths can be obtained.

SET COMPOUND OF LATHE TO THE FOLLOWING ANGLE	FEED ON COMPOUND IN INCHES	ACTUAL CUT TAKEN INTO THE WORK	REDUCTION IN DIAMETER OF WORK
30°	.001	.00086	.00172
45°	.001	.00070	.00140
60°	.001	.00050	.00100
70°	.001	.00034	.00068
75°	.001	.000259	.000518
80°	.001	.00017	.00034
84°	.001	.00014	.00028