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HONING ATTACHMENT FOR DRILL PRESS

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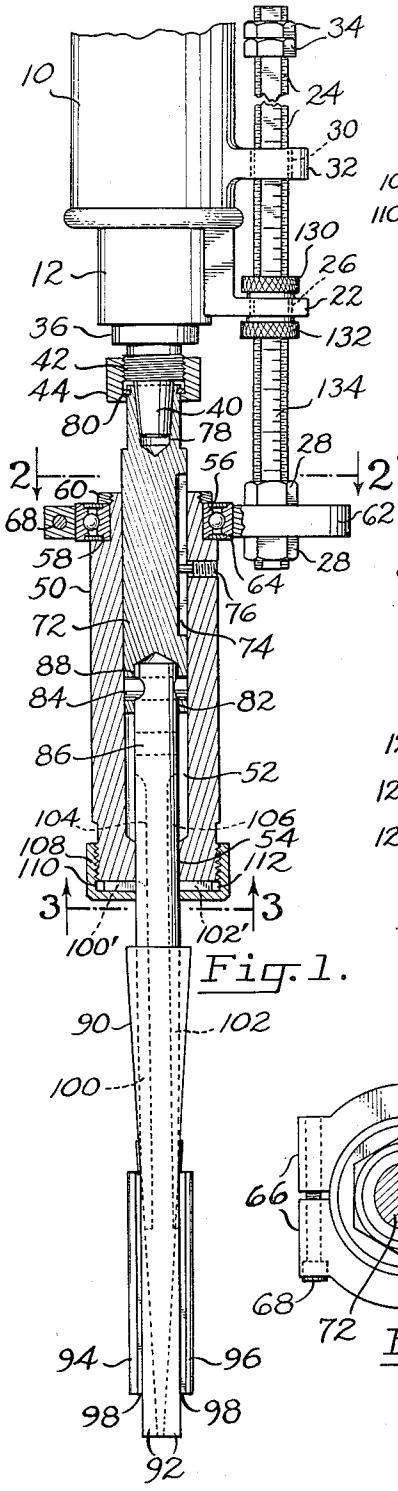


Fig. 1.

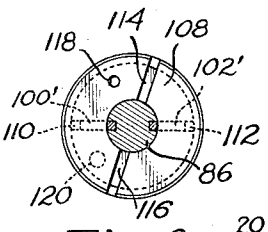


Fig. 3.

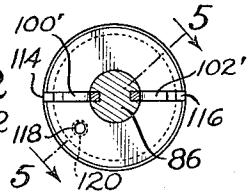


Fig. 4.

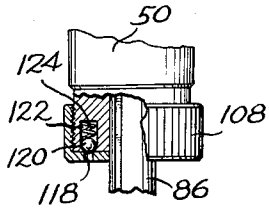


Fig. 5.

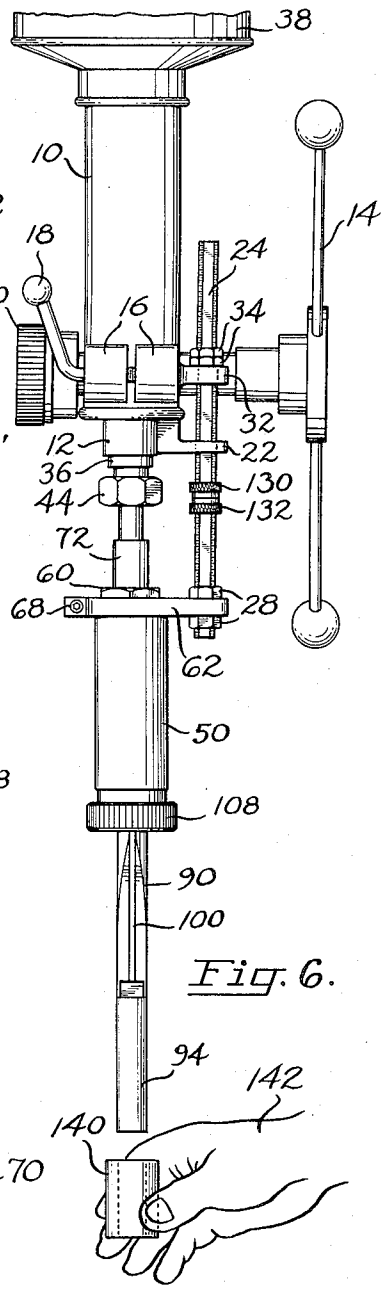


Fig. 6.

Fig. 2.

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HONING ATTACHMENT FOR DRILL PRESS

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6 Claims. (Cl. 51—34)

This invention pertains to apparatus for honing bores to precise dimensions and relates particularly to a novel and versatile honing attachment adapted especially for use with a conventional drill press.

The honing of bores to precise dimensions is a requirement in many fields of industry. It is a requirement in the manufacture of precision equipment, in the finishing of cast parts, in the sizing of bushings, and many others. When the parts to be honed are small in size it is desirable that the same may be held in the hand and passed over a hone. On the other hand, when the bore to be honed is contained within a piece of substantial size and weight, it is desirable that the same be supported upon a firm base and the hone passed through the bore.

There are several rather elaborate and expensive forms of honing apparatus which provide the versatility of operation indicated above. However, there are innumerable small businesses whose operations dictate the desirability of having equipment of such versatility, but whole limited production or budget do not render the purchase of such costly equipment economically feasible. Such is the case, for example, with automotive garages in which the normal course of maintenance and repair of automotive equipment, involves the replacement and re-sizing of bushings. Another example is to be found in the small machine shops in which the honing of bushings, castings and other parts of small and large dimensions is a frequent though not a large scale requirement.

On the other hand, there are presently available certain types of relatively inexpensive honing attachments for drill presses, but all of these possess inherent operational limitations which render them unsuitable for most purposes. Most serious of these limitations is the necessity to shut down the drill press before the operating diameter of the hones can be changed. This limitation imposes not only a tedious burden on the user, but also an economically impractical amount of time to complete a single honing operation.

Accordingly, it is a principal object of the present invention to provide a honing attachment which may be employed with a conventional drill press with all of the versatility available only in elaborate and expensive honing equipment.

Another important object of this invention is the provision of a honing attachment for drill presses, which attachment does not possess the serious limitations of presently available attachments and yet is no more costly.

A further important object of this invention is the provision of a honing attachment especially adaptable for use with drill presses, and which utilizes for its operation the normal functions of the drill press.

Still another important object of this invention is the provision of a honing attachment which is of simplified construction for economical manufacture, which is adaptable for use with any conventional drill press, and which is characterized by a versatility of operation heretofore obtainable only with large and expensive honing apparatus.

The foregoing and other objects and advantages of this invention will appear from the following detailed description, taken in connection with the accompanying drawing, in which:

Fig. 1 is a fragmentary view in front elevation, partly in section, of a honing attachment embodying the features of the present invention, the same being shown in attachment with a conventional drill press;

Fig. 2 is a sectional view taken along the line 2—2 in Fig. 1;

Fig. 3 is a sectional view taken along the line 3—3 in Fig. 1 and showing the hone-supporting means in locked position;

Fig. 4 is a sectional view similar to Fig. 3 and showing the arrangement of parts in position for removal of the hones;

Fig. 5 is a fragmentary sectional view taken along the line 5—5 in Fig. 4; and

Fig. 6 is a fragmentary view in front elevation and illustrating a second mode of operation of the hone attachment and drill press assembly.

As stated hereinabove, the hone attachment of the present invention is particularly adaptable for use with a conventional drill press. Accordingly, there is illustrated in Figs. 1 and 6 of the drawing those elements of a conventional drill press which are pertinent to the mounting and operation of the honing attachment. Thus, the drill press includes a hollow housing 10 which supports a quill 12 for vertical reciprocation, by well known connection with a rotary hand wheel 14. The lower end of the housing is split longitudinally and provided with spaced lugs 16 which are internally threaded to receive a clamping screw 18. This clamp arrangement functions to releasably secure the quill in any desired position of extension within the housing, as is well known.

The connection of the operating handle 14 to the quill 12 also generally includes an adjustable quill return spring mechanism 20 which functions by proper adjustment to counteract the weight of the quill and whatever assembly is connected thereto. Most frequently the spring assembly is adjusted to slightly overbalance the weight of the quill and attached assembly, so that the latter may be returned upwardly by the spring automatically upon release of the handle.

A bracket 22 extends laterally from the lower end of the quill and normally supports the lower end of a vertically extending, externally threaded depth gauge rod 24. Such support normally is effected by extending the rod freely through an opening 26 in the bracket and securing it thereto by tightening a pair of nuts 28 against the opposite surfaces of the bracket. The rod normally projects freely through an opening 30 in a second bracket 32 projecting laterally from the housing 10, and the rod normally is provided with a pair of adjustable stop nuts 34 which function by abutment with the second bracket 32 to limit the downward movement of the quill.

The quill is provided with an internal longitudinal bore in which an elongated spindle 36 is rotatably journaled. The upper end of the spindle is connected in well known manner to a source of power, conventionally an electric motor and pulley system, the latter being shielded by a pulley guard 38, as illustrated in Fig. 6.

The lower end of the spindle projects from the quill and is provided with means by which to attach a drill bit chuck. In the embodiment illustrated, the spindle is provided with a conventional Jacobs male taper 40 and the enlarged threaded section 42 which receives the nut 44. This nut performs several functions, among which are those of assisting the release of a chuck frictionally secured to the taper, and of securing other

forms of attachments, such as taper adapters and routers, which normally are not safely attached merely by frictional engagement with the taper.

It will be understood that other types of drill presses provide spindles with other forms of connectors, such as an internal female taper of the well known Morse type. Adapters are available to effect interchange of these various types of connectors. Accordingly, the specific type of spindle connection is not pertinent to the present invention.

The hone attachment of this invention includes a cylindrical sleeve **50** having a longitudinal bore **52** which is reduced in diameter adjacent its lower end to provide the restricted bore **54**. The upper end of the sleeve is reduced in diameter to receive the annular bearing assembly, the inner race **56** thereof being secured to the sleeve between the shoulder **58** formed by the reduced section and the overlying nut **60** which is releasably engaged with threads formed on said reduced section. A bracket **62** is secured to the outer race **64** of the bearing assembly, as by means of the split clamp **66** and screw **68** illustrated in Fig. 2. The bracket is provided with a laterally extending slot **70** which is dimensioned to receive releasably therein the lower end of the depth gauge rod **24** which normally forms a part of the drill press. Thus, when the honing attachment of this invention is mounted on a drill press, the rod **24** is detached from the quill bracket and replaced upon the sleeve bracket **62** within the slot **70**, with the nuts **28** tightened down upon opposite sides of the bracket, as illustrated in Figs. 1 and 6.

A shaft **72** is mounted within the larger bore **52** of sleeve **50** for longitudinal reciprocation relative thereto. The extent of such relative reciprocation is confined within the limits of a longitudinal groove **74** provided in the surface of the shaft. This groove receives freely therein the projecting end of a set screw **76** secured to the sleeve **50**.

The upper end of the shaft **72** is provided with an internal female taper **78** to accommodate the Jacobs male taper **40** provided on the spindle. The periphery of the upper end of the shaft is reduced in diameter to receive the nut **44** slidably thereover, and a snap ring **80** is received releasably within an annular groove in this reduced section, to limit the upward movement of the nut. In this manner the shaft may be secured positively to the spindle, not only by the interengaging tapers, but also by tightening the nut upon the threaded segment of the spindle.

The lower end of the shaft **72** is provided with an axial socket **82** which is traversed intermediate its ends by a diametrically extending pin **84**. This socket and pin arrangement is adapted to receive and lock therein the shank end **86** of a hone mandrel. This shank end is provided with a bayonet slot **88** for detachable cooperation with the pin **84**. Forwardly of the mandrel shank is a hone supporting section **90**. This section tapers uniformly forward to minimum thickness, and the forward portion of this tapered section is provided with lateral walls **92** which confine therebetween the opposed hones **94, 96**. Each of the hones is mounted on a wedge-shaped base **98** which tapers to minimum dimension toward the shank end **86** of the mandrel. The taper of the hone bases **98** and the hone supporting section **90** of the mandrel are complementary whereby to maintain the working surfaces of the hones parallel at all times as they are expanded and retracted, in manner well known in the art.

The bases **98** of the hones **94, 96** are connected to elongated rods **100** and **102**, respectively, which are received within longitudinal, diametrically opposed grooves **104** and **106** in the mandrel. The upper ends **100'** and **102'** of the hone rods **100** and **102** are offset outwardly for releasable attachment to the sleeve assembly, as will now be described.

The sleeve **50** is threaded externally at the bottom end to receive the internally threaded locking cap **108** thereon. The bottom end face of the sleeve is provided with a pair of diametrically opposed radially extending grooves **110** and **112** and the locking cap is provided with a pair of diametrically opposed radially extending slots **114** and **116**. These pairs of grooves and slots are adapted for registration in one position of adjustment, and this position conveniently is located by the provision of a ball and detent assembly, best illustrated in Fig. 5. The detent **118** is provided by an opening in the locking cap, and the ball **120** is located in a hole **122** in the sleeve, being urged resiliently toward the detent by the backing spring **124**. Thus, as the locking cap **108** and the sleeve **50** are rotated relative to each other in the direction to loosen the cap, a position is reached at which the ball enters the detent, and in this position the pair of grooves **110, 112** and the slots **114, 116** are aligned in cooperative registration (Fig. 4). The outwardly offset ends **100'** and **102'** of the hone rods then may be passed upwardly through the pair of slots in the locking cap into seating engagement in the registering grooves in the sleeve, after which the sleeve and locking cap are rotated in the direction to tighten the cap. In this manner the offset ends of the hone rods are secured firmly within the end grooves of the sleeve (Fig. 3).

The hone attachment described hereinbefore provides, in combination with a conventional drill press, a versatility of operation heretofore obtainable only with rather complex and expensive honing apparatus. As explained hereinbefore, certain honing operations are required to be made upon rather massive objects which require firm support in a fixed position while the hone is passed through the hole to be sized. This type of operation is accommodated by the assembly illustrated in Fig. 1 of the drawing. In this arrangement the quill rod depth gauge **24** is secured at its lower end to the sleeve bracket **62** by means of the clamping nuts **28**, and extends upwardly through the openings **26** and **30** in the quill bracket **22** and housing bracket **32**, respectively. A pair of adjusting nuts **130, 132** are carried on the threaded rod in engagement with the opposite sides of the quill bracket **22**, and the upper pair of abutment nuts **34** are disposed on the rod above the housing bracket.

By moving the pair of adjusting nuts **130, 132** along the rod, the distance between the sleeve bracket **62** and the quill bracket **22** may be varied, thus simultaneously varying the position of the hones **94, 96** along the length of the tapered section **90** on the mandrel. This adjustment determines the operating diameter of the hones, as will be apparent.

Accordingly, the operation of the assembly illustrated in Fig. 1 is as follows:

With the quill **12** retracted into the housing to its maximum extent, by manipulation of the operating handle **14**, or by automatic operation of the return spring assembly **20**, the piece of work to be operated upon is positioned upon the drill press table and the opening to be honed is located directly under the hones **94, 96**. With the operating diameter of the hones reduced to a minimum, by moving them forwardly along the tapered section **90** of the mandrel by adjusting the nuts **130, 132** to increase the spacing between the brackets **22** and **62**, the operating handle then is manipulated to draw the hones forwardly into the opening to be honed. It will be understood that this downward movement of the hones is accompanied also by simultaneous downward movement of the entire assembly of the mandrel, sleeve and quill. The depth to which the hones and mandrel are drawn into the opening may be adjusted and set by proper adjustment of the stop nuts **34** in abutment with the housing bracket **32**. This provision advantageously prevents extension of the hones through the bore as the hones are worked back and forth in the bore during the honing operation.

With the drill press motor energized to rotate the

spindle and the attached assembly of the sleeve, shaft, mandrel and hones, the hones are reciprocated in the bore to hone the latter. The adjusting nuts **130, 132** are rotated in successive increments in the direction to decrease the distance between the brackets **22** and **62**, whereby to draw the hones upwardly toward the shank end **86** of the mandrel and thus increase the operating diameter of the hones. After each increase in hone diameter, the hones are reciprocated in the bore until proper sizing has been achieved. Conveniently, the rod **24** may be provided with a graduated scale **134** by which to determine the point at which the bore has been sized to proper diameter by the hones. Alternatively, the hone assembly may be retracted periodically from the bore being sized, and the diameter of the bore measured to determine when proper sizing has been accomplished.

In the honing of bores in small pieces, such as bushings, it is generally more convenient to be able to hold the piece in the hand and pass it concentrically over the fixed hones. This type of operation is accommodated by the arrangement of the assembly illustrated in Fig. 6 of the drawing. In this arrangement the adjusting nuts **130** and **132** have been removed from the position on opposite sides of the quill bracket **22** in Fig. 1, to a position in which both are below the quill bracket. The assembly of the sleeve and hones thus drops by gravity to the position in which the upper pair of stop nuts **34** are in abutment with the housing bracket **32**. If desired, these nuts may be placed in abutment with opposite sides of the bracket **32** to prevent upward movement of the hone assembly as the piece of work is forced upwardly around the hones.

With the quill bracket elevated to its uppermost position, as by means of the spring assembly **20**, the hones thus are adjusted to minimum diameter. The piece of work **140** held in the hand **142** then is passed upwardly, concentrically over the hones and the operating handle **14** manipulated to extend the quill and mandrel assembly, thereby expanding the hones and enlarging the bore to proper size. This ultimate size may be set on the calibrated rod **24** by proper adjustment of the pair of adjusting nuts **130, 132** to the position at which the quill bracket **22** abuts the upper surface of the nut **130**.

From the foregoing it will be apparent that the honing attachment of the present invention provides, in combination with a conventional drill press, a versatility of operation presently available only in much more elaborate and expensive honing apparatus. For example, the assembly may be arranged for honing massive pieces of work mounted in a fixed position upon a drill press table (Fig. 1), or may be arranged to accommodate hand manipulation of small parts (Fig. 6). In either mode of operation adjustment of the diameter of the hones may be made while the assembly is running, i.e. without shutting down the drill press motor. This is an important practical feature of the invention, since it eliminates the lost time resulting from the necessity of shutting down the assembly for each adjustment of hone diameter, as is required with presently available honing attachments.

All of the foregoing advantages furthermore are provided by the present invention in the form of an attachment of simplified and therefore economical construction, and which is adaptable with speed and facility to any conventional drill press. Accordingly, the present invention affords to those concerns requiring limited or intermittent honing operations, all of the advantages of more elaborate and expensive honing apparatus, at but a fraction of the investment cost, since such concerns generally have one or more drill presses which are used for the more frequent drilling operations. Thus, the attachment of the present invention is ideally suited to such smaller concerns as machine shops, metal casting shops, tool and die shops, jig and fixture shops, automotive garages, and others where limited and intermittent honing operations, together with limited budgets, dictate the practical necessity for inexpensive honing equipment.

It will be apparent to those skilled in the art that various changes in size, shape, arrangement of parts and other details of construction described hereinbefore, may be made without departing from the scope and spirit of this invention. For example, the drill press and honing attachment may be arranged for operation in a horizontal plane, as well as in the vertical arrangement illustrated. Further, the honing attachment may be included as an integral part of a complete honing apparatus, should such permanent assembly be desired. Still further, it will be recognized that the mandrel and hone assembly described and illustrated herein is but one of many commercially available types, and that others may be employed with the driver assembly of this invention merely by modifying the forms of attachments at the forward ends of the shank **72** and sleeve **50**. Accordingly, it is to be understood that the foregoing description is primarily illustrative of the invention and is not to be considered as limiting the scope of the appended claims.

Having now described our invention and the manner in which the same may be used, what we claim as new and desire to secure by Letters Patent is:

1. For use with a hone device having a rotary hone mandrel supporting a hone for relative longitudinal adjustment, hone driving apparatus comprising a housing, a quill movable longitudinally in the housing, a spindle rotatable in the quill, a shaft, spindle attaching means on the shaft, mandrel attaching means on the shaft, a sleeve member on the shaft, the sleeve member and shaft being movable longitudinally relative to each other, means interconnecting the sleeve member and shaft for simultaneous rotation, hone attaching means on the sleeve member, support means engaging the sleeve member for rotation of the latter relative to the support means, and connecting means on the support means for selectively connecting the sleeve member to the housing and quill, whereby when the sleeve member is connected to the housing the hone is retained a fixed distance from the housing and the honing diameter is varied by longitudinal movement of the quill, and when the sleeve member is connected to the quill the honing diameter is maintained fixed and the hone is moved longitudinally with respect to the housing.

2. The apparatus of claim 1 wherein the connecting means is adjustable for varying the spacing between the sleeve member and the selected one of the housing and quill.

3. The apparatus of claim 1 wherein the connecting means comprises a threaded rod extending from the support means freely through apertured projections on the housing and quill, and adjustable nuts on the rod for engaging a selected one of the projections.

4. For use with a hone device having a rotary hone mandrel supporting a hone for relative longitudinal adjustment, hone driving apparatus adapted for use with a drill press or the like having a housing, a quill movable longitudinally in the housing and a spindle rotatable in the quill, the hone driving apparatus comprising a shaft, spindle attaching means on the shaft, mandrel attaching means on the shaft, a sleeve member on the shaft, the sleeve member and shaft being movable longitudinally relative to each other, means interconnecting the sleeve member and shaft for simultaneous rotation, hone attaching means on the sleeve member, support means engaging the sleeve member for rotation of the latter relative to the support means, and connecting means on the support means for selectively connecting the sleeve member to the housing and quill, whereby when the sleeve member is connected to the housing the hone is retained a fixed distance from the housing and the honing diameter is varied by longitudinal movement of the quill, and when the sleeve member is connected to the quill

the honing diameter is maintained fixed and the hone is moved longitudinally with respect to the housing.

5. The apparatus of claim 4 wherein the connecting means is adjustable for varying the spacing between the sleeve member and the selected one of the housing and quill.

6. The apparatus of claim 4 wherein the connecting means comprises a threaded rod extending from the support means freely through apertured projections on the housing and quill, and adjustable nuts on the rod for engaging a selected one of the projections.

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