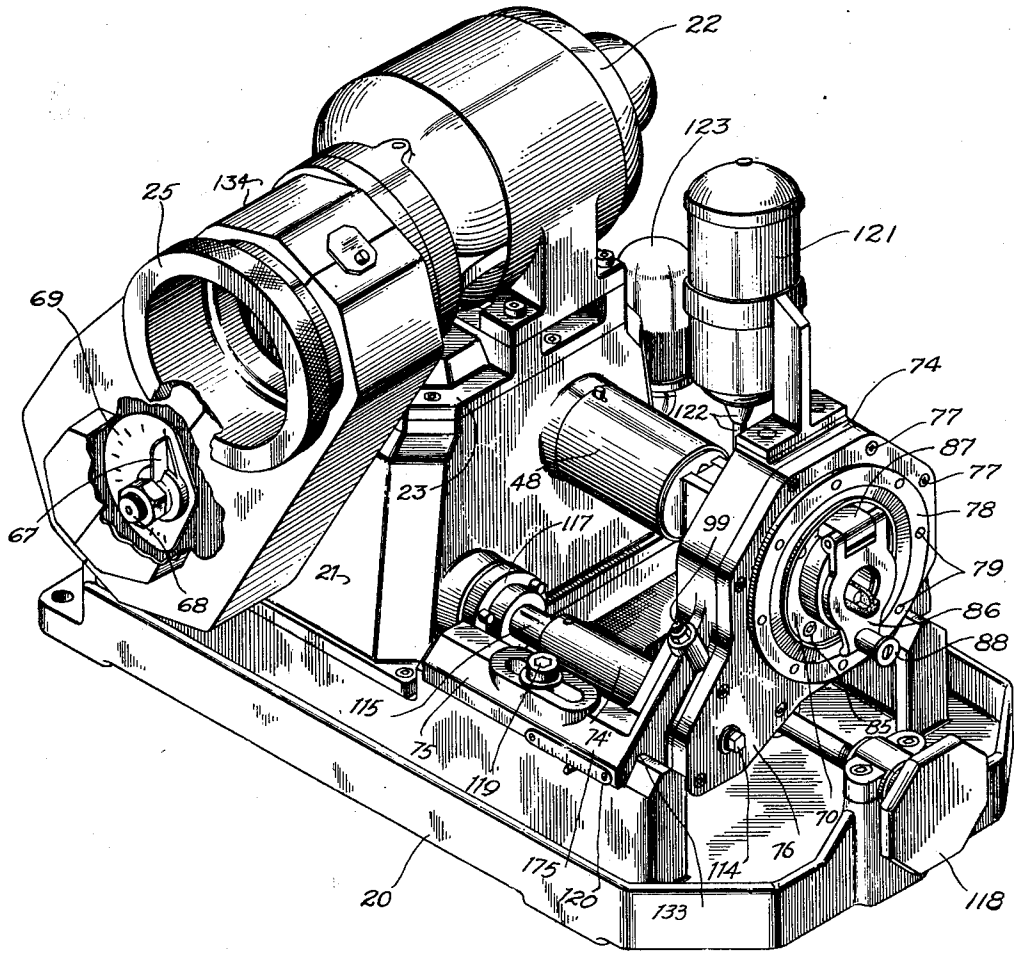
Aug. 22, 1944. W. S. REYNOLDS ET AL 2,356,272

HONING MACHINE

Filed April 28, 1943 3 Sheets-Sheet 1

Fig. 1



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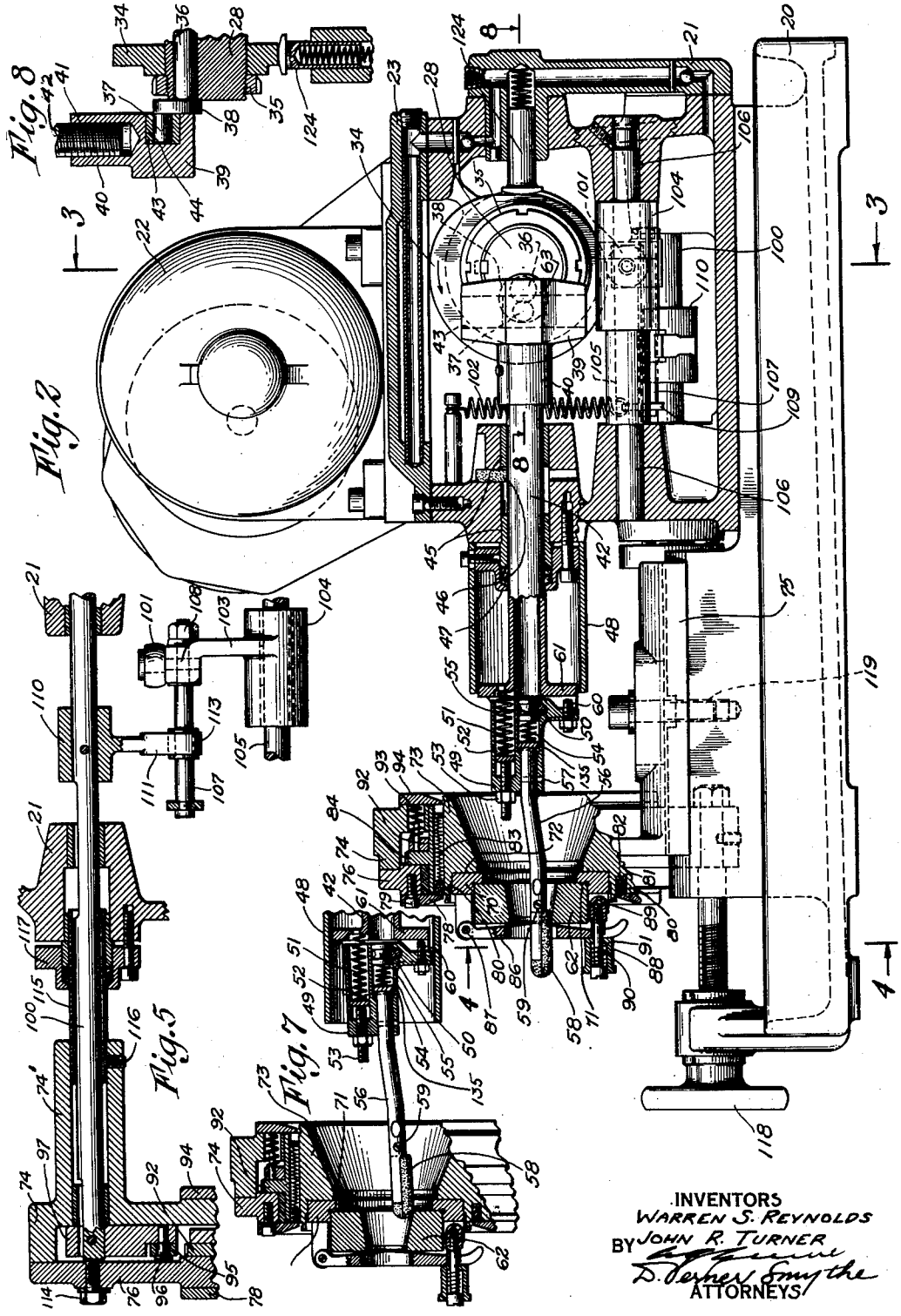


Fig. 8

Fig. 2

Fig. 5

Fig. 7

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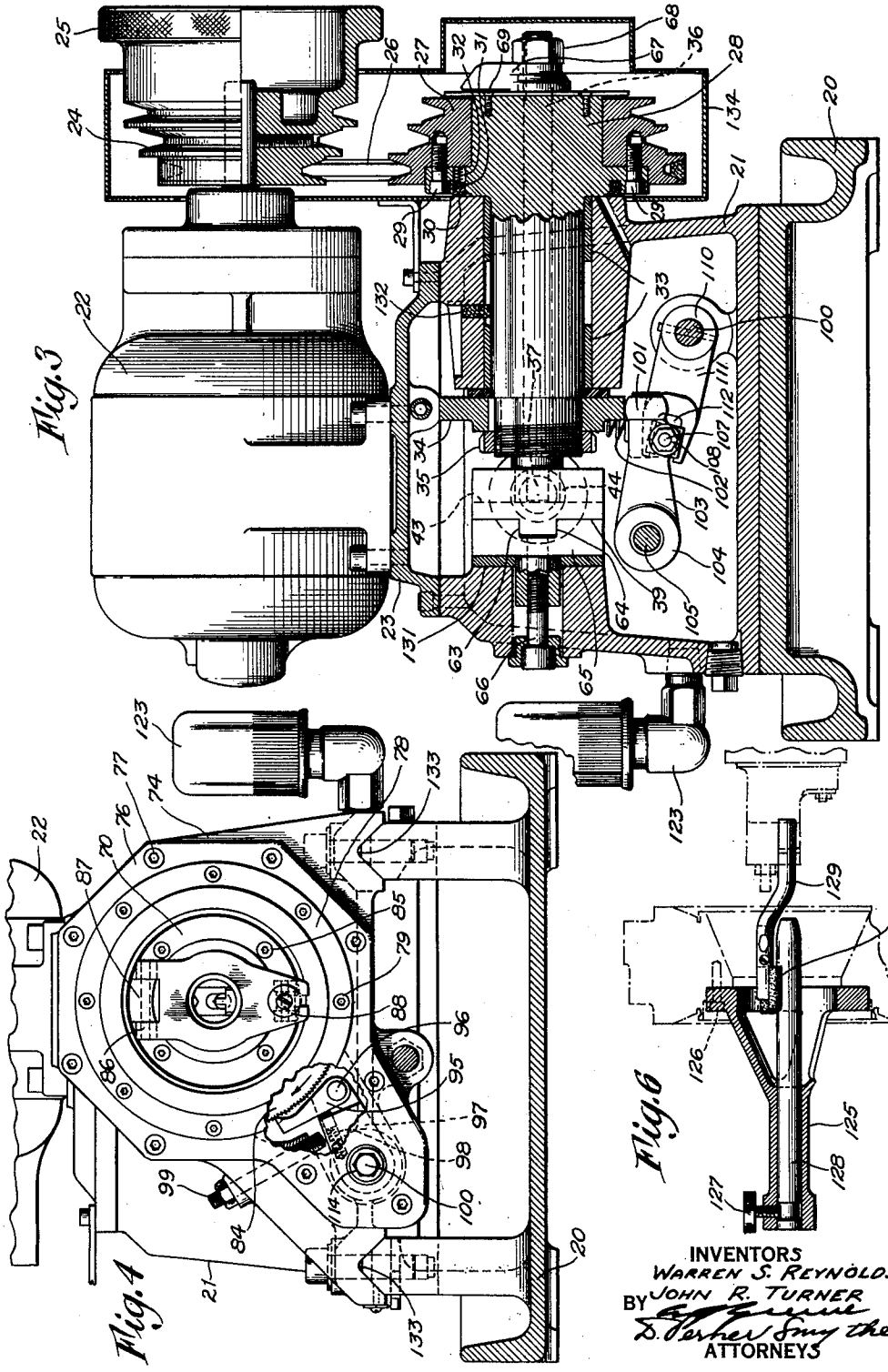


Fig. 3

Fig. 4

Fig. 6

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HONING MACHINE

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8 Claims. (Cl. 51—67)

This invention relates to a machine for honing or lapping surfaces and is particularly adapted for use in finishing draw dies and punches.

In the manufacture of ammunition components by drawing processes, the requirements for the contour and finish of the draw dies and punches is very exacting. Small changes in contour, for example, will often make the difference between failure and success in the correct drawing of tubular articles such as cartridge cases. The finish of the dies and punches is also very important and this has been found particularly to be true when the ammunition components are made of steel. Small scratches on the die drawing surface or punch will frequently leave their imprint or effect on the drawn case. Each of these defects or scratches in the drawn case is a potential point of failure. A cartridge case is subjected to extremely high pressures upon firing and because the metal of the case is close to its mechanical failure limit, it is extremely important that no defects be present. In the manufacture of cartridge cases, a plurality of draw operations are performed with appropriate annealing operations, if necessary, between draws. A defect or scratch in a case produced by one of the first drawing operations will many times be carried through to the end operation and augmented by the successive draws.

It has been found that better results will be obtained if the honing operation on ammunition component draw dies and punches is carried out so that the movement of the hone on the die or punch is parallel to the axis thereof. In this manner, the fine abrasive scratches are in the direction of movement of the cartridge cases relative to the die or punch. It is also desirable to enclose the operative parts of the machine so as to exclude abrasive and other foreign material from the working parts of the device. The other objects of the invention will become apparent from the following description which is merely exemplary and not to be construed as limiting:

In the drawings:

Fig. 1 is a perspective view of the completed machine with the cover broken away to show the selector adjusting means.

Fig. 2 is a side elevation of the device partly in section.

Fig. 3 is an end elevation partly in section, taken along the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary end view of the work holder partly in section taken in the direction 4—4 of Fig. 2.

Fig. 5 is a fragmentary sectional plan view of the work holder indexing operating means.

Fig. 6 is a view of an alternative work holder which may be used for holding a punch.

Fig. 7 is a fragmentary view of the honing actuator when it is near its right hand (Fig. 2) limit of reciprocation.

Fig. 8 is a fragmentary plan view in section of the crank pin driving means and oil pump plunger taken in the direction 8—8 of Fig. 2.

The honing machine of the present invention comprises a frame and means for reciprocating a hone mounted on said frame. The reciprocating means is adjustable so as to vary the length of stroke of the hone and the hone is pivoted in such a manner as to follow the contour of the work, the work being located in a suitable work holder. The work holder is adjustably fastened to the frame of the machine and the mechanism is enclosed and sealed to exclude abrasive material from the working parts. A suitable indexing means is provided to rotate the work holder after each reciprocation of the hone, said work holder having a seat and clamping means for holding a die in position. There also is provided a work support fitting for holding a punch, said work support being adapted to be clamped in the work holder.

The main frame of the machine is shown at 20 and has thereon a housing 21 for containing the main operating parts of the device. The driving motor 22 is mounted on the cover 23 of the housing 21 and said driving motor 22 operates a stepped pulley 24 having a hand wheel 25 integral therewith. Belt 26 serves to drive the pulley 27 which is fastened to main driving shaft 28 by means of screws 29. A sealing ring 30 of some suitable material such as rubber, leather, or other packing material has a metal backing ring 31 with a plurality of springs 32 spaced around the circumference of the shaft serving to urge the ring and seal in tight engagement with the housing 21 of the machine. The main drive shaft 28 is carried by bushings 33 in the main housing of the machine. An oiling wick 132 can be provided to carry oil to said bushings.

A cam 34 is mounted on the main driving shaft and held in place by means of lock nut 35, said cam being used for driving the indexing means and the oil pump as will be described hereafter.

A rotatably adjustable crank pin support shaft 36 is provided, said shaft being eccentric relative to the center of the main driving shaft 28. Shaft 36 carries a crank pin 37 on a circular plate 38,

said crank pin being eccentric to the center of the crank pin adjusting shaft 36. It is apparent that the plate 38 may be other than circular in shape. A reciprocating crosshead 39 is provided with a boss 40 having a screw threaded connection 41 (Fig. 8) with the reciprocating hone actuator 42. Crosshead 39 has a vertical slot 43 in which a square bushing block 44 is slidable, said block having an aperture therein for engaging the crank pin 37. The crosshead 39 has a projecting horizontal rib 63 which engages in a slot 64 located in guide 65. Guide 65 is held in place by means of screw 66 and is accurately positioned by spacer 131, guide 65 serving to assist in directing the crosshead in its rectilinear reciprocating movement.

Rotation of the driving shaft 28 will cause rotation of the crank pin about the center of said driving shaft and the stroke imparted to crosshead 39 will depend upon the distance of the center of the crank pin 37 from the center of the main drive shaft 28. This distance may be adjusted by turning the rotatable crank pin support shaft 36 by means of the selector arm 67 attached thereto, said shaft being locked in place by lock nut 68. Plate 69 is fastened to the main driving shaft so as to give an indication, in cooperation with the selector arm 67, of the relative position of the crank pin to the center of the driving shaft and thus to indicate the stroke of the hone actuator 42. It is seen that in the position shown in Fig. 2 the longest stroke of the crosshead is obtained. As the shaft 36 is rotated 180°, the center of the crank pin will be brought to the center of the driving shaft 28 so that the movement of the crosshead 39 can be adjusted between zero and the full movement possible. Access to the adjusting means is obtained by removing guard 134.

The reciprocating actuator 42 is carried by bushings 45 mounted on the main housing of the machine. A suitable oiling wick 46 is provided for oiling this slidable connection. A stuffing box is provided at 47 and there is a shield 48 for assisting in keeping abrasive and foreign material off of the reciprocating hone actuator, shield 48 also serving as a safety guard. Hone carrier support 49 is pivoted at 50 to the reciprocating hone actuator. A spring 51 is located in the recess 52 in the hone carrier support and the tension thereof may be adjusted by means of screw 53, said spring serving to urge the hone support in a counterclockwise direction (Fig. 2) or the hone against the work. Hone support rod 56 is held in the hone support carrier 49 by means of a bayonet socket joint and pin 57 (complete slot not shown). Spring 54 and its follower 135 are held in place by means of the grooved locking plug 55, said plug being positioned by pivot pin 50. The spring follower 135 bears against the end of the support rod 56. An adjusting screw 60 is provided to limit the counterclockwise rotation of the hone support carrier 49, said screw bearing against the flange 61 of the hone actuator 42. As shown in Fig. 2, the hone is at its left limit of travel and, as the hone moves to the right the hone will rotate about pivot 50 and follow the surface of the die 62 to the position seen in Fig. 7.

The work holder comprises an annular die holding member 70 having a shoulder 71 therein of the correct size to fit the draw die which is to be honed, said annular member 70 being removably held in place in recess 72 of the work holder support 73 by means of screws 85 (Fig. 1). The universal work holder support 73 is rotatable within the work holder casing 74, said casing being integral with the slidable carriage 75, said carrier being slidable on V-grooves 133 (Figs. 1 and 2). A cover 76 is fastened to work holder casing 74 by means of screws 77 (Fig. 1). A ring 78 is fastened to the cover 76 by means of screws 79 (Figs. 1 and 2). Sealing ring 80 is located in recess 81 in the work holder support 73. A metal backing ring 82 is forced against the sealing ring 80 by means of a plurality of springs 83 held in recesses within the work holder support 73 which insures a tight seal between the work holder support and ring 78.

A pivoted clamping means 86 is pivoted at 87 to the annular member 70. Clamp 86 is held in closed position by means of the pivoted latch 88 which is pivoted at 89 to the annular member 70. The latch has a spring member 90 for holding the clamp yieldably in locked position for the purpose of holding the die 62 in place. In order to remove or place another die into the work holder, the handle 91 is pulled to the left against tension of spring 90 and the latch 88 swung downwardly to allow the clamp to be swung outwardly to give access to the die seat of the annular member 70.

The work holder support 73 is held to the left (Fig. 2) by means of ring 92 which is forced to the left by springs 93. In this manner the alignment of the axis of the work holder is assured rather than depending upon horizontal bearings alone. A cover plate 94 is suitably fastened to the casing 74. Ratchet wheel 84, integral with work holder support 73, is operated by pawl 95 which is pivoted at 96 to the pawl carrier 97. A spring 98 serves to press the pawl into engagement with the ratchet wheel 84. An adjustable screw 99 serves to limit the counterclockwise movement (Figs. 1 and 4) of the pawl carrier 97 to thereby adjust the amount of rotation of the work holder upon each oscillation of indexing shaft 100.

Indexing shaft 100 is oscillated by means of cam 34 in the manner set forth hereafter. Cam roller 101 is urged toward contact with cam 34 by spring 102 acting through the connection about to be described. Roller 101 is carried on arm 103 which is integral with hub 104. Hub 104 is attached to shaft 105 and said shaft is carried in bearings 106 of the main frame. A horizontal pin 107 is fastened to arm 103 by means of nut 108 and plate 109 serves as the anchor for spring 102 on pin 107. Shaft 100 has a hub 110 pinned thereto and there is an arm 111 integral with said hub 110. Arm 111 has a bifurcated portion 112 and a square, grooved, slidable means 113, slidable longitudinally on pin 107, and slidable in said bifurcated portion. The indexing shaft 100 is positioned longitudinally of the machine by a pin connection with the pawl carrier 97 and an adjusting screw 114 carried by cover 76 (Figs. 1, 4 and 5). As the carriage 75 is moved longitudinally, shaft 100 will be moved longitudinally therewith and arm 111 will slide on pin 107 together with slidable means 113. Oscillation of arm 103 will thereby be imparted to shaft 100.

A shield and oil passage 115 is fastened to extension 74' of casing 74 by means of set screw 116, the shield being reciprocable in the stuffing box 117 with shaft 100 and oil can pass through this connection from the main housing 21 to the work holder casing 74. Rotation of cam 34 will cause oscillation of arm 103. Oscillation of the arm 103 will produce oscillation of pin 107 which

will be transmitted to arm 111, which in turn will oscillate shaft 100 and shaft 100 will oscillate pawl carrier 97. The positive movement downwardly of arm 103 by cam 34 will produce clockwise rotation of shaft 100 as viewed in Fig. 4, to cause retracting movement of the pawl carrier and pawl. Spring 102 will cause return movement of the pawl carrier, which serves to rotate the work holder, and screw 98 will limit the upward movement of the pawl carrier by the spring and thereby provide an adjustment for the amount of rotation of the work holder. This type of cam and spring arrangement may be termed an open cam wherein the arm is moved positively by the cam and returned by a spring.

Work holder carriage 75 is longitudinally adjustable by means of adjusting screw 118 after lock screws 119 have been loosened. An index 120 (Fig. 1) may be provided to show the position of the carriage.

The honing lubricant or liquid can be supplied by reservoir 121 with a suitable tube 122 to direct the lubricant onto the hone. It is to be noted that the construction of the work holder is such as to prevent entry of abrasive and foreign material into the casing.

An oil sight glass 123 may be provided to show the level of the oil in the main operating casing and an oil pump plunger 124 (Fig. 2) can be used to pump oil from the casing to the various bearings by means of conventional passageways and check valves.

A means for honing a draw punch is provided by the draw punch support fitting shown in Fig. 6. Annular support 70 may be replaced by the punch support 125, screws 126 being used to hold the same in place. Fitting 125 has a locking screw 127 for holding a draw punch 128 in position. The hone arm 129 is suitably shaped to hold the hone 130 on the draw punch.

Summarizing the operation of the machine, a draw die or draw punch is held in place in the work holder support 73. Slidable carriage 75 is then adjusted so as to position the work piece correctly under the hone 58. Selector arm 67 is set to give the proper stroke to the hone by turning the selector arm 67 to position crank pin 37 relative to the center of driving shaft 28. The amount of indexing rotation of the work holder after each reciprocation of the hone is adjusted by means of screw 90. Motor 22 is then started which will cause rotation of driving shaft 28. If desirable, a suitable conventional clock timing switch may be placed in the motor connection to stop the machine after a predetermined time. Rotation of driving shaft 28 will cause reciprocation of hone actuator 42 by moving crank pin 37 and crosshead 39. The hone will follow the contour of the die or punch because of the pivoted carrier support 49 and spring 51, the tension of spring 51 being adjustable by means of adjusting screw 53. The work is indexed by action of cam 34 on cam roller 101, cam 34 being driven by the main drive shaft 28. Cam roller 101 will cause oscillation of arm 111, which in turn will oscillate shaft 100. Shaft 100, through pawl carrier 97 and pawl 95, will indexably rotate ratchet wheel 84, which is attached to the work holder support 73. Seals are provided for the work holder casing and the various operating parts of the machine to prevent the entry of abrasive or foreign material into the working parts of the device.

The present device is a compact universal type machine having various adjustments to provide for different size draw dies and punches to give the desired honing action thereon. A means is provided for easily adjusting the stroke of the hone and for adjusting the position of the work relative to the hone.

What is claimed is:

1. In a honing machine; a reciprocable hone actuator; a hone support pivotally connected to said actuator; a hone mounted on said hone support; a work holder; a rotating drive shaft; a rotatable support eccentrically mounted in said drive shaft; adjusting means for rotating said support to predetermined positions; a crank pin eccentrically mounted on said rotatable support; connecting means between said actuator and crank pin; and means connected to said drive means to indexably rotate said work support.

2. In a honing machine; a reciprocable hone actuator; a hone support pivotally connected to said actuator; a hone mounted on said hone support; a work holder; a rotating drive shaft; a rotatable support eccentrically mounted in said drive shaft; adjusting means for rotating said support to predetermined positions; a crank pin eccentrically mounted on said rotatable support; connecting means for said actuator and crank pin; means operated by said drive means for indexably rotating said work holder; and means to predeterminedly adjust the indexing movement of said work holder.

3. In a honing machine; a reciprocable hone actuator; a hone; a rotating drive means therefor; a crank pin connecting said reciprocable hone and said drive means; rotatable means for adjustably eccentrically supporting said crank pin in said drive means; a work holder; means to indexably rotate said work holder after each reciprocation of said hone; and means to longitudinally adjust said work holder relative to said hone.

4. In a honing machine; a frame; a reciprocable hone actuator; a hone; a rotating drive means; a crank pin connecting said reciprocable hone and said drive means; rotatable means for adjustably eccentrically supporting said crank pin in said drive means; a work holder; cam means on said drive means for operating a work holder indexing shaft; means to slidably mount said work holder on said frame; an indexing mechanism operator for said work holder; and a slidable connection between said indexing shaft and an indexing mechanism operator for said work holder.

5. In a honing machine; a frame; a reciprocable hone actuator; means for reciprocating said hone; an indexable work holder mounted on said frame and having a recess for a ring member for holding a die to be operated upon by said hone; locking means for holding a die in place in said recess, said locking means being readily unlocked and a fitting adaptable to engage said recess and be held therein by said locking means, said fitting having an aperture for receiving and positioning a punch for engagement by said hone.

6. In a honing machine; a hone; a reciprocating actuator for said hone; a work holder; a casing for rotatably supporting said work holder; ratchet teeth on said work holder; a pawl for engaging said teeth; an oscillatable pawl carrier; means to adjustably limit movement of said pawl carrier in a first direction; an open cam for operating said carrier in the opposite direction; and a spring for moving said pawl carrier in said first direction.

7. In a honing machine; a frame; a work

holder; a hone; a reciprocating actuator for said hone; a rotating shaft; an adjustable arm crank pin connection between said drive shaft and said actuator; a work holder indexing cam on said shaft; an indexing shaft operated by said cam; a main housing sealed against foreign material for said drive shaft, crank pin connection and cam; longitudinally adjustable means on said frame for said work holder; a casing for said work holder; an indexing ratchet means in said work holder casing; a ratchet operating shaft slidably connected to said indexing shaft and entering said main housing through a stuffing box; and sealing means between said work holder and casing to prevent foreign and abrasive material from entering said casing.

8. In a work holder for a honing machine; a work holder enclosing means having a bearing face; a work holder support indexably rotatable therein; a ratchet wheel thereon; a ring bearing against one side of said ratchet wheel; a yieldable means acting on said ring to hold the ratchet wheel against said bearing face.

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