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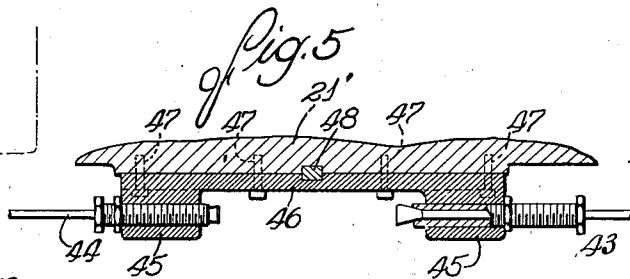
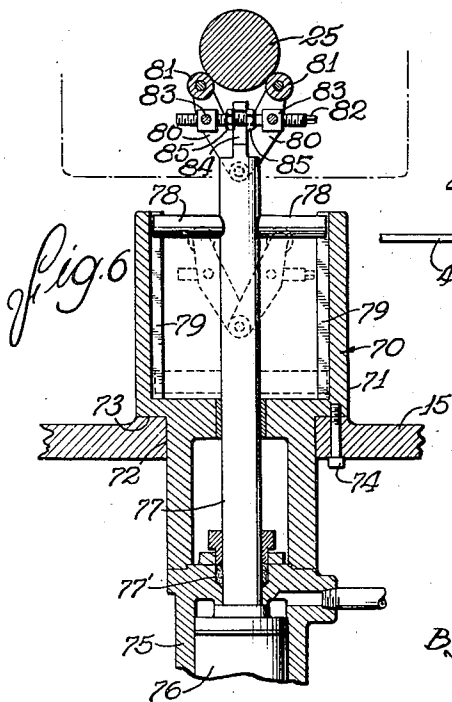
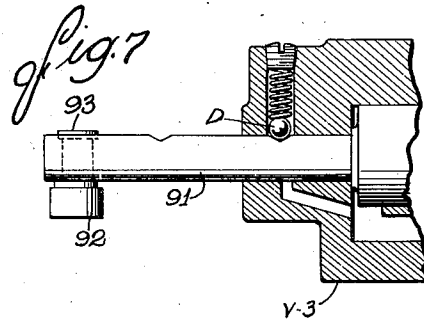
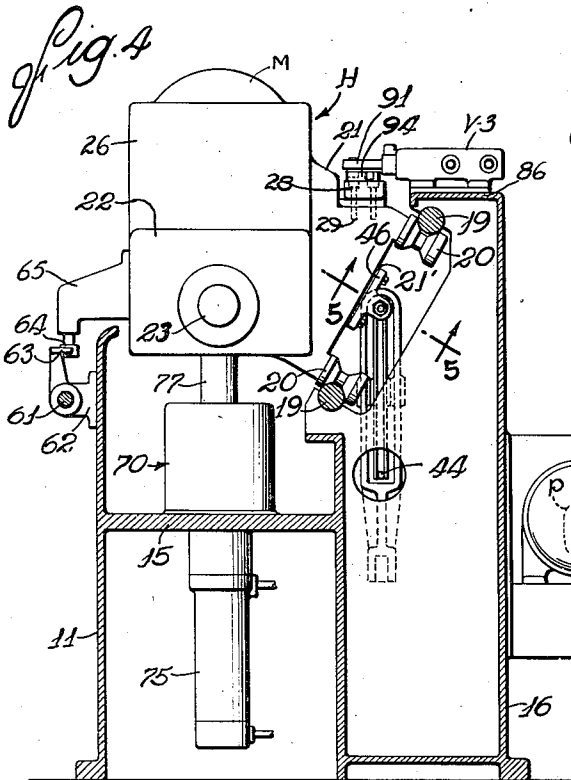
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2,287,085

HONING MACHINE

Filed Sept. 29, 1939

3 Sheets-Sheet 2



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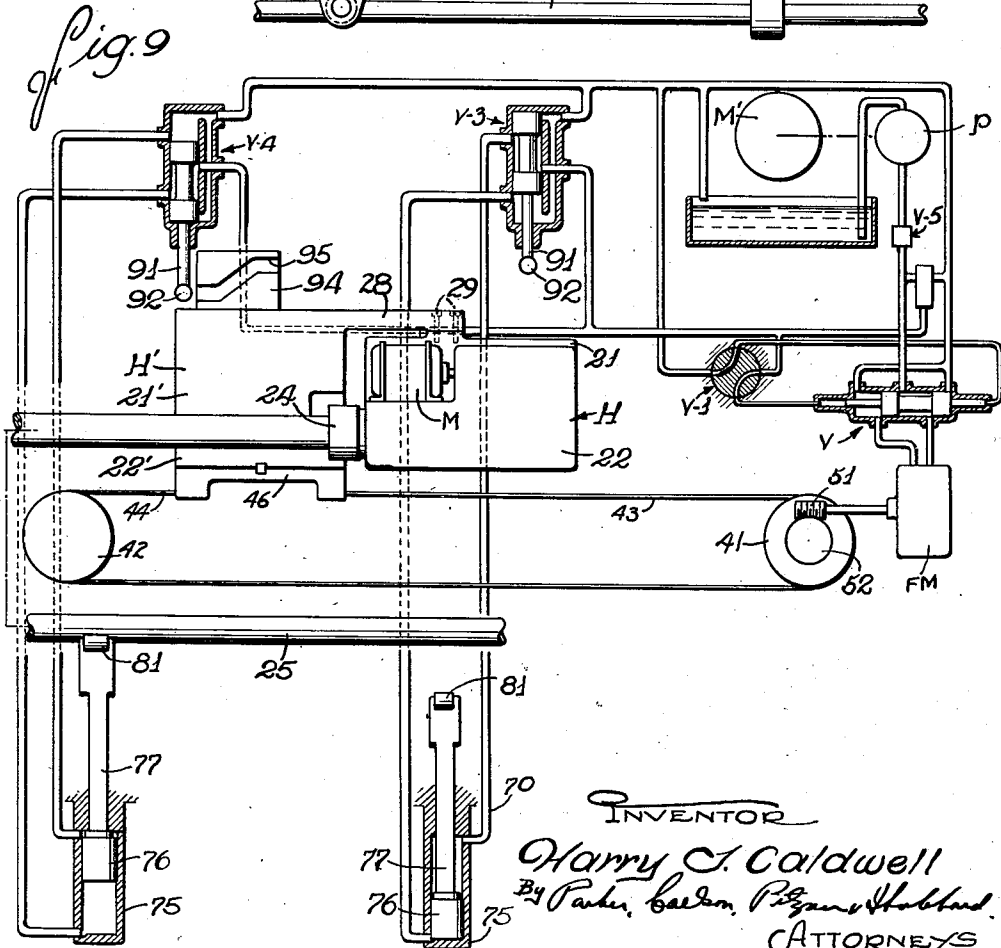
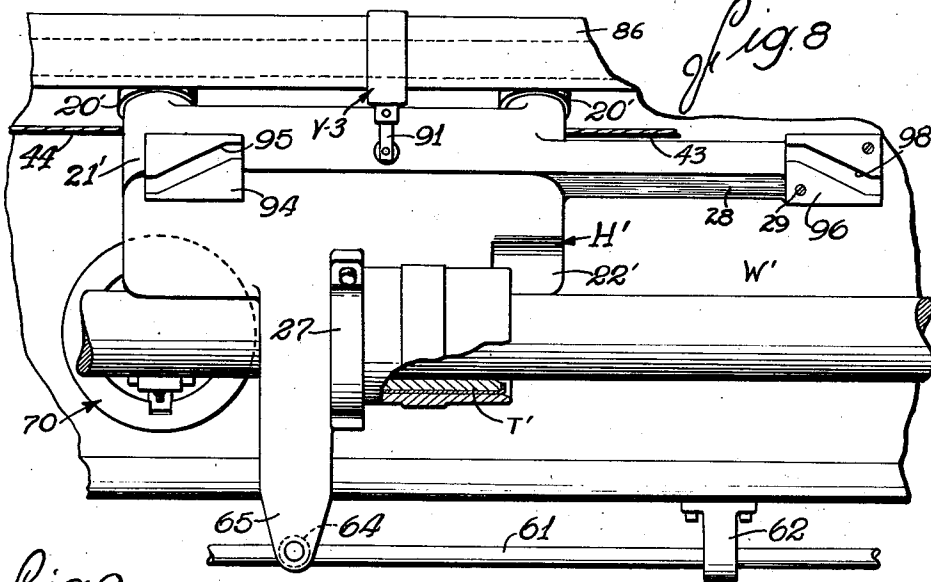
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HONING MACHINE

Filed Sept. 29, 1939

3 Sheets-Sheet 3



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2,287,085

HONING MACHINE

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Application September 29, 1939, Serial No. 297,035

15 Claims. (Cl. 51—3)

The invention relates to machines for dressing cylindrical surfaces and more particularly to machines for dressing such surfaces by a honing or lapping operation.

Honing and lapping operations involve the relative rotation and simultaneous relative reciprocation of a cylindrical abrasive tool or hone and the work piece, the rotational movement being continuous in the honing operation and intermittent in the lapping operation. The term "hon-
10 ing" as employed hereinafter is intended to embrace both operations.

The honing operation is used extensively in dressing both internal and external surfaces where a high degree of accuracy for roundness and straightness and a true smooth surface finish is desired. While the operations are fundamentally the same for both types of work, substantially different operating requirements are involved in holding the tool and work and in effecting the necessary relative movements therebetween. For this reason it has been the practice heretofore to provide separate machines for each type of work.

One object of the present invention is to provide a honing machine of novel and advantageous construction which is universally applicable for honing either internal or external surfaces and which is capable of being quickly and easily adapted for either type of work.

Another object is to provide an improved honing machine in which either the tool or the work may be rotated as required by the particular type of work to be done.

Still another object is to provide in a honing machine a head or carriage of novel and improved construction adapted to serve either as a reciprocatory tool support or as a stationary work support.

A further object is to provide a reciprocatory head or carriage and a guideway therefor particularly suitable for horizontal honing machines and embodying novel features of construction which facilitate the supporting of an elongated element such as a work piece or tool driver at one or more points intermediate its ends.

Other objects and advantages of the invention will become apparent from the following detailed description of the preferred embodiment illustrated in the accompanying drawings in which:

Figure 1 is a side elevational view of a horizontal honing machine embodying the features of the invention, the machine being set up for internal honing.

Fig. 2 is a fragmentary side elevational view of the machine as set up for external honing.

Fig. 3 is a plan view of the main head or carriage of the machine.

Fig. 4 is a transverse vertical sectional view of the machine taken along the line 4—4 of Fig. 1.

Fig. 5 is a detailed view of the mechanism for operatively connecting the flexible traction members with the tool head taken along the line 5—5 of Fig. 4.

Fig. 6 is a vertical sectional view of the retractible work or driver supporting fixture taken along the line 6—6 of Fig. 3.

Fig. 7 is a fragmentary view of a control valve and the operating means therefor.

Fig. 8 is a plan view of the auxiliary head or carriage of the machine.

Fig. 9 is a schematic diagram of the hydraulic circuit showing the arrangement and relationship of the operating and control elements of the machine.

For purposes of illustration, the invention has been shown incorporated in a machine for honing relatively long work pieces which are most conveniently supported in a horizontal position. The machine is equipped with two reciprocable tool heads adapted to be coupled together for reciprocation as a unit for honing certain types of work and separable to allow one head to reciprocate alone for honing other types of work. These comprise a main head H (Figs. 1—4) adapted to carry a conventional internal honing tool T, and an auxiliary head H' (Figs. 1, 2 and 8) adapted to carry an external honing tool T' also of conventional construction. The heads are mounted for reciprocation on a guideway of sufficient length to permit the heads when coupled, to move through a full stroke whereby to traverse the tool from one end of a work piece to the other.

Suitable power driven means, preferably of the hydraulic type, is provided for reciprocating the heads to effect the relative reciprocatory movements of the honing tools and the work pieces on which they are operating. When the machine is used for honing internal surfaces, the work piece is stationarily supported while the tool is rotated and reciprocated. For this purpose, the tool heads are coupled together for reciprocation as a unit, the auxiliary head H' in this case serving merely to drive the main head H which carries the tool.

For honing external surfaces, one end of the work piece is supported in a chuck carried on the rotating spindle of the main head while the

other end of the work is rotatably supported on a center carried by a suitable tailstock removably mounted on the base of the machine. The main head H thus remains stationary at one end of the guideway while the tool is traversed over the work by reciprocation of the auxiliary head or carriage H'. In this instance, the work is rotated by the spindle driving means on the main tool head.

In the preferred form of the machine, the guideway for the reciprocatory heads is offset laterally with respect to the base and the heads are constructed so as to overhang the base and thus align properly with the work. The guideway can thus be made of sufficient length to accommodate both heads without one interfering with the other. It also leaves ample room within the base structure for mounting auxiliary supporting fixtures of the retractible type for supporting an elongated element which may be either the tool driver or the work piece at one or more intermediate points. In other words, the novel arrangement of the guideway materially facilitates the supporting of the element at the intermediate points. Moreover the flexible traction members for reciprocating the heads may be located centrally of the guideway and secured to the heads in a manner such as to eliminate any tendency of the heads to twist upon the guideway.

Referring now to Figs. 1 and 2 of the drawings, the machine selected to illustrate the invention comprises generally a base consisting of a main section 11 and an outboard section 12 bolted or otherwise rigidly secured together in end-to-end relation. The outboard base section serves in this instance as a stationary work support for work to be honed internally by the tool T. For this purpose it is equipped with suitable work holders 13 for holding a work piece such as a hollow tube or cylinder W in a substantially horizontal position with its axis parallel to the guideway on which the head H reciprocates. An adjustable support and guide 14 is also mounted on the outboard section of the base for supporting the honing tool when withdrawn from the work and for guiding the tool into and out of the work.

As will be seen by reference to Fig. 4 the main base section 11 is of generally rectangular cross section and is provided adjacent its upper end with a rigid horizontal bed 15. Arranged in side-by-side relation with the base section 11 is an auxiliary base or frame 16 the upper end of which projects substantially above the top of the main base section. The frame 16 may be of substantially the same length as the base section 11 and its purpose is to support the guideway for the main head H and the auxiliary head H' which carry the internal honing tool T and the external honing tool T', respectively. The guideway, as herein shown, comprises a pair of guide bars 19 mounted on the frame 16 in parallel spaced relation. Preferably these bars are mounted so that the plane of the guideway is inclined upwardly and outwardly from the bed 15 of the machine. Moreover, the inner bar of the pair is located substantially at the edge of the main base section so that the guideway, as a whole is offset laterally with respect to the base. This leaves the base entirely clear for mounting supporting fixtures to be described hereinafter. The heads H and H' are supported on the guide bars by suitable roller members 20 in well known manner.

Referring more particularly to Figs. 3 and 4, the head H in its preferred form comprises a relatively short, rectangular pedestal 21 which may be constructed as a light weight metal casting. The roller members 20 are journaled on studs projecting from the lower end of the pedestal. Rigid with the upper end of the pedestal is a generally rectangular table 22 overhanging the bed 15. Journaled on the table 22 with its axis substantially parallel to the reciprocatory path of the head is a spindle 23 carrying on its outer end a chuck 24 of suitable and well known construction adapted to hold one end of a cylindrical element such as an elongated tubular tool driver 25 such as is employed for carrying the honing tool T or an elongated cylindrical work piece W' to be honed externally.

Mounted on the table 22 of the main head H is a motor M arranged to rotate the spindle 23 through the medium of suitable gearing enclosed in a housing 26 which forms a part of the table. Rotation of the spindle may be utilized to drive either the external honing tool T (through the medium of the driver 25) or the work piece W'.

The auxiliary head H' as shown in Fig. 8 is provided with a pedestal 21' similar in all respects to the pedestal 21 and carrying rollers 20' for supporting the head on the guide bars 19. The upper end of the pedestal 21' terminates in a horizontally extending table portion 22' overhanging the bed 15 and equipped with a suitable fixture 27 for supporting the external honing tool T'.

In the preferred form of the machine, the auxiliary head H' is operatively connected with the head reciprocating mechanism which may be of any suitable character, and when the main head H is to be reciprocated, the two heads are coupled together for movement as a unit. To this end, the pedestal 21' of the auxiliary head is formed with an elongated extension 28 adapted to project over the pedestal 21 of the main head when the heads are brought together as shown in Figs. 1 and 9. Machine bolts 29 threaded into the extension and the pedestal 21 of the main head rigidly connect the heads together.

Thus, it will be noted that the auxiliary head H' is reciprocated for either internal or external honing while the main head H is reciprocated only for internal honing. When the machine is set up for the latter type of honing, the tool T' is removed from the auxiliary head to provide a clear passage for the tool driver 25, the bolts 29 are removed to free the auxiliary head for independent reciprocation and the main head H is moved to the rear end of the guideway to serve as a stationary support for one end of the work piece. As explained above, said one end of the work piece is held in the chuck 24. The other end of the work piece may be supported in any suitable manner as on a conical center 31 mounted on a tailstock 32. The tailstock may be of generally conventional construction preferably embodying the usual adjustable spindle 33 movable axially by means of a crank 34 to engage and disengage the center with the work. As the tailstock is used only when the machine is set up for external honing, it is preferably detachably secured in a suitable guideway 32' extending longitudinally of the bed plate 15 so that it can be easily adjusted for work pieces of different length and can be removed when the machine is to be used for internal honing.

In the exemplary machine, relative reciprocation of the tool and work is effected both for inter-

nal honing and for external honing by reciprocation of the head which carries the tool. While any suitable power driven means may be utilized for reciprocating the head, it is preferred to utilize pressure fluid operated means for this purpose because of its smooth action and ease of control. Moreover, for reasons of economy, it is preferred to employ a single reciprocating mechanism arranged to actuate one or both of the tool heads as required.

The reciprocating mechanism herein shown is of well known construction comprising a power driven actuator in the form of a grooved cable drum 41 (Figs. 1, 2 and 9) rotatably supported at one end of the frame or extension 16. A sheave 42 is rotatably supported at the other end of the frame. Flexible traction members 43 and 44 such as wire cables are operatively associated with the drum 41, each cable being anchored at one end to the drum and extending therefrom below and generally parallel to the guideway. The other ends of the cables are connected together by a member arranged for detachable connection with the auxiliary head H'. As herein shown, each cable is anchored to a bracket 45 (Fig. 5) formed integrally with a flat, plate like member 46 adapted to be secured to the bottom wall of the pedestal 21'. In the present instance the cable 43 is led directly from the members 46 to the cable drum while the cable 44 is carried over the sheave 42. Thus when the drum is rotated in one direction the cable 43 is paid out and the cable 44 is wound up to move the head H' forwardly on the guideway. When the direction of rotation of the cable drum is reversed the cable 44 is paid out and the cable 43 is wound up to move the head H' back toward the rear end of the guideway.

To facilitate assembly of the machine elements, the members 46 is preferably secured to the head H' by bolts 47 threading into the bottom wall of the pedestal 21' thus operatively connecting the reciprocating mechanism with that head. A flat key 48 seated in aligned transverse grooves in the member and the pedestal locks the parts together and protects the bolts from excessive strains.

The cable drum 41 may be rotated by a motor of any suitable type such as a reversible rotary fluid motor FM. As shown in Fig. 9, the fluid motor is drivingly connected with the drum in well known manner through the medium of a worm 51 and worm wheel 52. Pressure fluid is supplied to the fluid motor by a pump P through suitable hydraulic circuits including a reversing valve V of well known construction. An electric motor M' drives the pump. The operation of the valve V is controlled by a pilot valve V' operated by control mechanism which may be generally similar to that disclosed and claimed in my copending application Serial No. 267,572 filed April 13, 1939.

The control mechanism as herein shown, includes a control rod 61 extending generally parallel to the guideway for the heads H and H' and supported in brackets 62 on the side walls of the base section 11 for limited rocking movement. Cam devices 63 adjustably mounted on the control rod are adapted to be engaged by a cam roller 64 carried on a laterally projecting arm 65 of the auxiliary head H'. The cam devices are set so that the engagement by the cam roller takes place as the head approaches the ends of its reciprocatory stroke whereby the control rod is rocked between two limit positions.

The rocking of the control rod serves to operate the pilot valve V' as described in the prior application and thus through the valve V controls the direction of rotation of the motor FM and consequently the direction of movement of the head operatively connected thereto. As the two heads are coupled together for internal honing, the cam roller 64 is operative to control reciprocation in both internal and external honing operations.

To attain a high degree of accuracy in honing relatively long work pieces, it is essential that the rotating element, which may be either the work piece or the tool driver as above explained, be supported so as to avoid any perceptible sagging between the points of support. The machine in its preferred form is therefore equipped with one or more auxiliary supporting units for supporting the rotating element at a point or points intermediate its ends. These units are conveniently mounted on the bed plate 15 of the base section 11 immediately below the element to be supported. The supporting units herein disclosed represent an improvement over supporting units disclosed and claimed in the copending application of A. M. Johnson, Serial No. 279,403, filed June 16, 1939, now Patent No. 2,245,922, granted June 17, 1941.

As clearly shown in Fig. 6, each supporting unit 70 comprises a hollow, general cylindrical frame 71 having a reduced end portion adapted to fit in an aperture 72 in the bed plate 15. The frame thus presents a shoulder 73 adapted to rest on the bed plate and the entire frame structure is rigidly secured thereto as by bolts 74. Where only one support is required, it is ordinarily installed approximately at the center of the bed. If there are a plurality of supports they may be spaced apart appropriately as shown in Figs. 1 and 2.

Carried on the lower end of the frame 71 is a closed cylinder 75 having a working piston 76 with a piston rod 77 projecting through a suitable packing gland 77' at the upper end of the cylinder and into the enlarged upper portion of the frame. Laterally extending pins 78 project from opposite sides of the piston rod and engage in vertical guide slots 79 formed in the sides of the frame to guide the piston rod for vertical reciprocation between the positions shown in full and dotted lines in Fig. 6.

Pivotaly mounted on the upper end of the piston rod 77 are a pair of arms 80 each carrying on its free end a roller 81 adapted to engage the rotating element when the piston rod is operated to its active position. The arms 80 are adapted to be moved toward or from each other to adjust the position of the rollers for elements of different diameter. For this purpose an adjusting screw 82 having right and left hand screw threads at opposite ends for engagement with nuts 83 carried on the respective arms is rotatably anchored to an extension 84 of the piston rod as by opposed lock nuts 85. Accordingly, rotation of the screw in one direction serves to open up the arms while the rotation in the opposite direction closes the arms together. In this way the rollers 81 may be accurately positioned so that when the piston rod 77 is moved to its uppermost position the rollers engage and support the work in the desired straight, sagless condition.

The function of the hydraulic apparatus of the supporting unit is to raise the rollers 81 to active position to support the rotating element and

to retract them within the upper portion of the frame 70 to permit the head H or H' to pass in its reciprocation. For this purpose pressure fluid is supplied to each of the cylinders 75 from the pump P through parallel hydraulic circuits containing individual control valve V—3 and V—4. These valves are of the reversing type, that is, each has a movable plunger operative in one position to direct pressure fluid into the lower end of the associated cylinder 75 and operative in the other position to direct pressure fluid into the upper end of the cylinder.

In order to coordinate the operation of the supporting units with the movements of the heads, means is provided whereby the valves V—3 and V—4 are operated incident to the reciprocation of the heads on the guideway. To facilitate such operation, the valves are preferably mounted on a top plate 86 running longitudinally along the top of the frame 16, each valve being located somewhat to the rear of the unit which it controls so as to allow ample time for retraction of the support. The plunger of each valve is provided at one end with an extension 91 projecting forwardly over the guideway and having at its outer end a vertical stud 93 on which is journaled a roller 92 adapted for engagement by a suitable cam or cams carried by the head H'.

As herein shown, the cams provided for this purpose include a plate 94 having an upwardly opening cam slot 95 adapted to receive the rollers 92. The cam slot is shaped so that in the forward movement of the auxiliary head, the valve plunger is moved inwardly or toward the right as viewed in Fig. 7 so as to direct pressure fluid into the upper end of the cylinder 75 and thus effect withdrawal of the work or driver supporting rollers from the path of the head. On the return movement of the head, the valve is moved back to its original position to direct pressure fluid into the lower end of the cylinder and the supporting rollers are again raised to active position. A spring pressed detent D engaging in suitable notches in the extension 91 acts to hold the valve plunger in either set position.

When the head H' is used alone for honing external surfaces, it is equipped with an additional cam plate 96 which may be conveniently mounted on the extension 28 of the auxiliary head and secured thereto by the screws 29 which serve to couple the heads together for internal honing. The plate 96 has a cam slot 98 disposed reversely to the cam slot 95. Due to the form of this cam slot the valve plungers are shifted into support raising position after the auxiliary head has passed the support. On the return movement of the head the cam slot accordingly sets the valves to lower the supports so that the head can pass while the cam slot 95 again initiates the elevation of the supports to active position. Thus, the work piece is adequately supported on both sides of the tool head so that the tendency to sag is effectually avoided and attendant vibration or "whip" is substantially eliminated.

When the machine is used for internal honing, the supporting units are retracted under control of the cam plate 94 to allow the coupled heads to pass in their movement toward the work. As the tool driver projects forwardly from the head H, there is no necessity of elevating the supports in the rear of the head. Accordingly, the cam plate 96 is removed from the machine for this type of

honing and the supports remain in retracted position until the heads pass through in their return movement.

In setting up the machine for internal honing, the cam plate 96 is removed from the extension 28 of the auxiliary head and that head is rigidly coupled to the main head by means of the bolts 29. The tool driver 25 carrying the internal honing tool T is then secured in the chuck 24 of the main head spindle 23. It will be understood, of course, that the external honing tool T' is removed from its socket in the head H' to provide a passage for the driver. The tailstock 32 is replaced by the tool support and guide 14 and the work piece W is then mounted on the fixtures 13 adjacent the guide.

The honing cycle is now initiated in well known manner by starting the driving motors M and M' and opening the starting valve V5 in the pressure fluid line from the pump P to the fluid motor FM. The latter turns the drum 41 to wind up the cable 44 and move the coupled heads toward the work, the tool entering the same just before the cam roller 64 engages the rear cam 63 of the control rod. Forward movement of the heads continue until the tool is traversed entirely through the work and then the heads reverse due to engagement of the front cam 63 by the roller 64 and the resultant reversal of the fluid motor. During the honing operation, the cam plate 94 coacts with the valves V3 and V4 to effect the retraction of the supports 70 in succession as the heads advance and to initiate the successive elevation of the supports as the heads return. This cycle of operations is repeated at each end of the stroke until the work is finished to the desired dimensions and the machine stopped either manually or by a suitable automatic controller.

To change the machine over for external honing, the bolts 29 are removed to uncouple the heads and the cam plate 96 is secured in place on the extension 28 of the auxiliary head H'. External honing tool T' is secured in its socket and the driver 25 is removed from the chuck 24, the main head being moved to the rear of the guideway as shown in Fig. 2. After the tool support and guide 14 has been replaced by the tailstock 32, the work piece W' may be inserted through the tool T' and secured between the center 31 and the chuck 24.

The honing cycle is started in the manner above explained but in this case, only the auxiliary head H' is reciprocated to traverse the tool T' from one end of the work piece to the other. Motor M drives the main head spindle and thus rotates the work relative to the tool which is non-rotatably supported on the auxiliary head. Reciprocation is controlled by the cam roller 64 coacting with the cams 63 of the control rod as above explained.

In the advance of the head H', the cam plate 94 initiates the retraction of the supports 70, in succession as in the previous case to allow the head to pass. Cam plate 96 reoperates the valves V3 and V4 to raise the supports after the head has passed so that the work is supported against sagging on either side of the head. On the return movement of the head the operation of the cams is reversed, cam 96 initiating the retractions of the supports while cam 94 causes them to be raised after the passage of the head.

It will be apparent from the foregoing that the invention provides an improved honing machine embodying novel features of construction which make it universally adaptable for honing either internal or external cylindrical surfaces. The

machine is equipped with two separate heads one of which may be reciprocated independently or coupled to the other head to act as a driver for the same. Said one head is adapted to carry a non-rotating honing tool such as an external hone and the other head is adapted to carry a rotating tool such as an internal hone. The latter head additionally is capable of serving as a support for the work operated on by the tool carried by the first mentioned head. The heads are mounted on a guideway which, by reason of its novel location with respect to the main base section of the machine leaves that section free for the installations of auxiliary equipment such as a work or driver supporting unit having a member movable in a path substantially perpendicular to the axis of the guideway. This greatly simplifies the problem of supporting elongated elements of this character to prevent sagging intermediate the ends thereof.

I claim as my invention:

1. In a machine for honing internal or external surfaces of elongated work pieces, the combination of a base consisting of a main section and an outboard section, a guideway extending generally parallel to the main base section, a pair of heads mounted for reciprocation on said guideway, power driven reciprocating means operatively connected with one of said heads, means on said one head for carrying an external honing tool, a rotatable spindle on the other head having a chuck adapted to hold either an elongated driver for an internal honing tool or one end of a work piece to be operated on by the external honing tool, means for coupling said heads together for reciprocation as a unit, means on said outboard base section for holding a work piece in position to be operated on by the internal honing tool, both of said heads being reciprocated to traverse the internal honing tool over the work, and a tail stock adapted to be detachably mounted on the main base section for cooperation with the chuck carried by the spindle of said other head for holding and rotating a work piece to be operated on by the external honing, said one head being reciprocated to traverse the tool over the work piece in such operation.

2. In a horizontal honing machine, in combination, an elongated base consisting of a main section and an outboard section arranged in end-to-end relation, means on the outboard base section for supporting an elongated work piece in a generally horizontal position, a frame rigidly secured to one side of the main base section, said frame projecting substantially above the top of the main section, spaced parallel guide bars mounted on the projecting portion of said frame to form a guideway extending generally parallel to the axis of the work piece, and a head mounted for reciprocation on said guideway, said head having a portion overhanging said main base section, and a tool carrying spindle journaled in said overhanging portion of the head in axial alignment with the work piece.

3. In a machine for honing internal or external surfaces of elongated work pieces, the combination of a base consisting of a main section and an outboard section, a guideway extending generally parallel to the main base section, a pair of heads mounted for reciprocation on said guideway, a rotatable spindle on one of said heads, a chuck on said spindle adapted to carry an elongated honing tool driver, means on the other of said heads for carrying an external

honing tool, power driven means for reciprocating said other head, means for coupling said heads together for reciprocation as a unit, means on the outboard base section for holding a work piece to be operated on by the internal honing tool carried by said one head, and means including said one head for holding a work piece to be operated on by the external honing tool carried by said other head.

4. In a machine for honing internal or external cylindrical surfaces, the combination of an elongated frame, a guideway extending longitudinally of said frame, a pair of heads mounted for reciprocation on said guideway, means on one of said heads for holding an external honing tool, means on the other head for holding an internal tool, reciprocating means common to said heads including a cable drum rotatably supported at one end of said frame, power driven means for rotating said drum first in one direction and then in the other direction, a pair of flexible cables anchored to said drum and extending from opposite sides thereof, means connecting said cables with said one head, and means for coupling said heads together for reciprocation as a unit.

5. In a machine for honing internal or external surfaces, the combination of a guideway, an internal honing tool supporting head mounted for reciprocation on said guideway, an external honing tool supporting head mounted on said guideway, said heads being reciprocable on the guideway, pressure fluid operated head reciprocating means, means including a pair of flexible traction members operatively connecting said reciprocating means with one of said heads, and means for coupling said heads together for reciprocation as a unit.

6. In a machine for honing internal or external surfaces, the combination of a guideway, an internal honing tool supporting head mounted for reciprocation on said guideway, an external honing tool supporting head mounted on said guideway, said heads being reciprocable on the guideway, power driven head reciprocating means, means operatively connecting said reciprocating means with one of said heads, and coupling means for securing said one head to the other head to operatively associate the latter head with said reciprocating means.

7. A honing machine having, in combination, a guideway, a head mounted for reciprocation on the guideway, supporting means carried by said head for holding one type of honing tool, a second head mounted for reciprocation on the guideway, supporting means carried by said head for holding a different type of honing tool, power driven means in operative association with one of said heads for independently reciprocating the head on the guideway, and means for coupling said heads together for reciprocation as a unit.

8. A horizontal honing machine having, in combination, a guideway, a head mounted for reciprocation on the guideway, supporting means carried by the head for holding one type of honing tool, a second head mounted for reciprocation on the guideway, means carried by said second head for holding a different type of honing tool, means for reciprocating one of said heads independently of the other including a power driven actuator, a pair of flexible cables operatively associated with said actuator and extending below and generally parallel to the guideway, a member connecting the ends of said ca-

bles and arranged for detachable connection with said one head, and means for coupling said one head with the other head to reciprocate the latter.

9. In a horizontal honing machine, in combination, a base, an elongated element supported at opposite ends in a substantially horizontal position above the base, means for rotating said element, means for supporting said element at an intermediate point comprising a piston supported on the base below said member for movement toward and from the same, a piston rod projecting upwardly from said piston, a pair of arms pivoted on said rod, a roller on each of said arms for engaging and supporting said element, and means for rocking said arms about their pivots to adjust the position of said rollers for accommodating elements of different diameters.

10. A retractable supporting unit comprising, in combination, a hollow cylindrical frame, a cylinder secured to the lower end of said frame, a piston operating in said cylinder, a piston rod projecting upwardly from the piston through said frame, said piston rod having a supporting device upon its upper end, means for guiding the piston rod in its movement comprising a bar extending transversely through the piston rod and projecting on opposite sides thereof, and parallel channels in said frame for receiving the ends of said bar.

11. In a horizontal honing machine, in combination, an elongated base, a frame located at one side of said base, a guideway on said frame, a pair of heads mounted on the guideway, supporting means carried by each head for holding a honing tool over said base, power driven means for reciprocating one or both of said heads, a second guideway on said base, and work supporting means mounted on said second guideway comprising a headstock having a center disposed substantially in axial alinement with the tool holding means carried by said heads.

12. A honing machine having, in combination, a guideway, a head mounted for reciprocation on the guideway, supporting means carried by said head for holding one type of honing tool, a second head mounted for reciprocation on the guideway, supporting means carried by said second head for holding a different type of honing tool substantially in axial alinement with the tool held by said first head, and common power driven means for reciprocating said heads.

13. A honing machine having, in combination, a guideway, a head mounted for reciprocation on the guideway, supporting means carried by said head for holding an external honing tool, a second head mounted for reciprocation on the guideway, a spindle journaled on said second head substantially in axial alinement with the tool carried by said first head and adapted to carry an internal honing tool, and power driven means operable to drive one of said heads individually or both of said heads simultaneously.

14. A horizontal honing machine having, in combination, an elongated base, means on said base for supporting a cylindrical work piece at opposite ends, a head arranged to carry a honing tool of the type adapted to encircle the work piece, a frame located at one side of the base to leave the latter unobstructed, a guideway on the frame supporting said head for reciprocation in a path substantially parallel to the axis of the work piece, power driven means for reciprocating the head on the guideway for traversing the tool longitudinally of the work piece, and auxiliary work supporting means mounted on said base, said supporting means including a work engaging member movable in a path substantially perpendicular to the axis of the work piece to allow the tool to pass when the head is reciprocated.

15. In a machine for dressing elongated cylindrical work pieces, the combination of an elongated base, means on the base for supporting the work piece at opposite ends, a head arranged to carry an abrasive tool of the type adapted to encircle the work piece, a frame located at one side of the base, a guideway on the frame supporting said head for reciprocation in a path substantially parallel to the axis of the work piece, power driven means for reciprocating the head on the guideway for traversing the tool longitudinally of the work piece, auxiliary work supporting means including a member mounted on said base for movement transversely of the work piece, power actuated means operative to hold said member in an advanced position to engage and support the work piece at a point intermediate the ends thereof, and control means for said power actuated means operative to effect periodic withdrawals of said member to allow the tool to pass as the head is reciprocated.

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