Nov. 4, 1952 J. F. SMOLE ET AL 2,616,225

HONE DRIVING MACHINE

Filed April 29, 1947 3 Sheets-Sheet 1

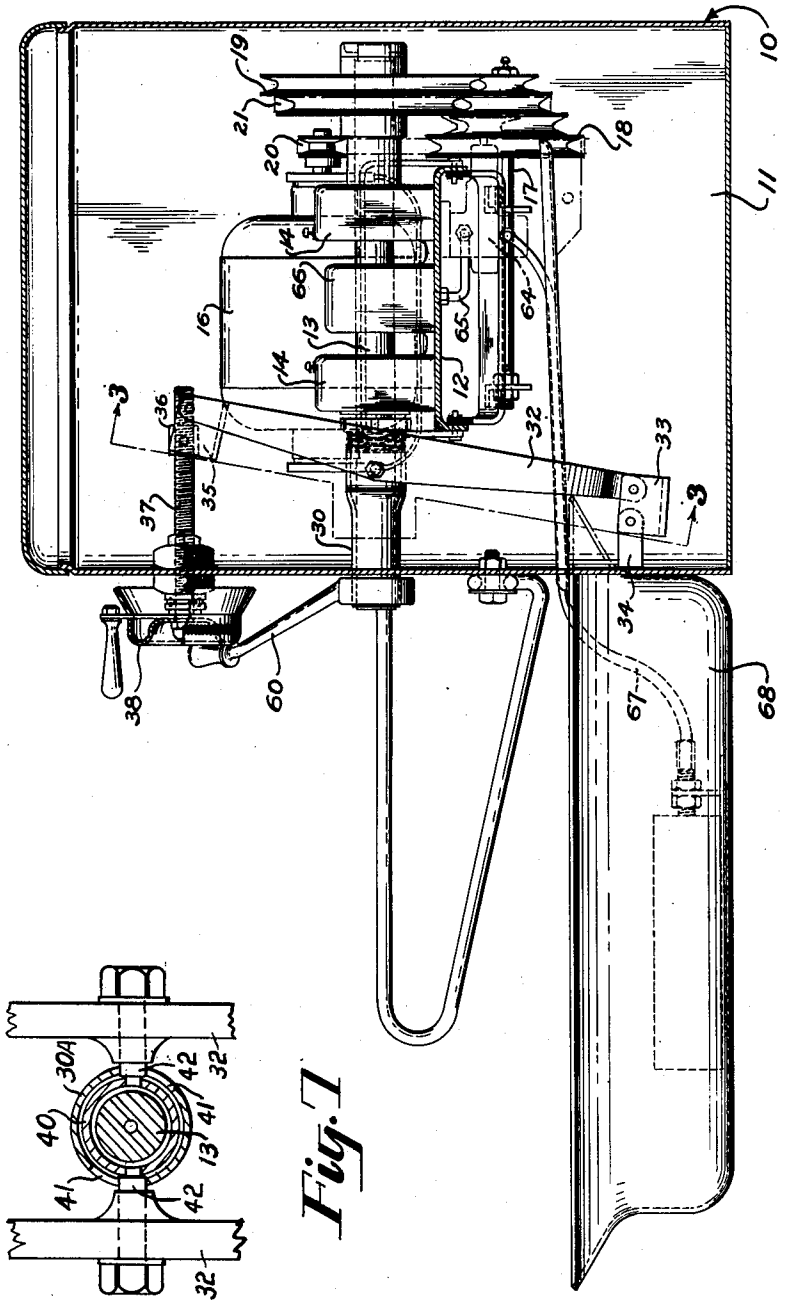


Fig. 1

Fig. 7

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Filed April 29, 1947 3 Sheets-Sheet 2

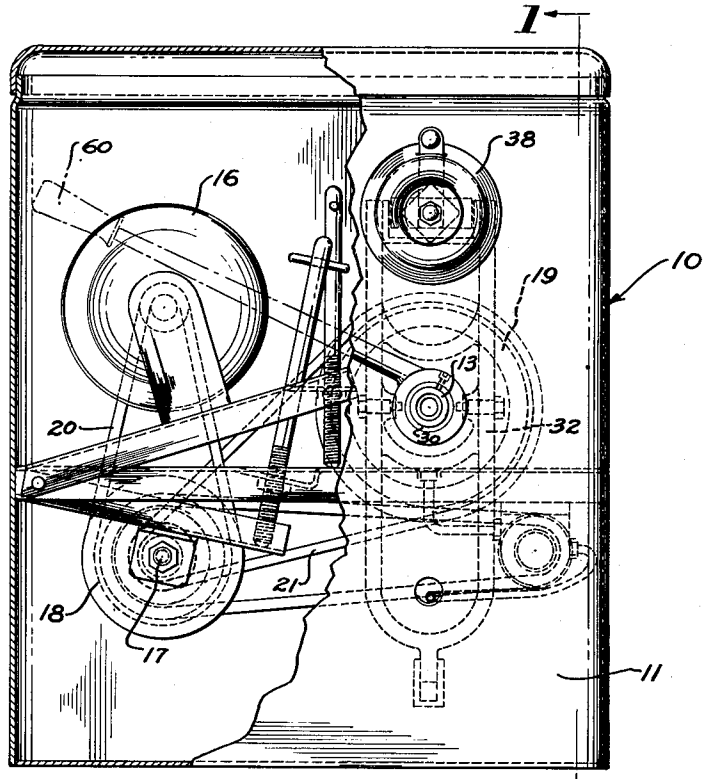


Fig. 2

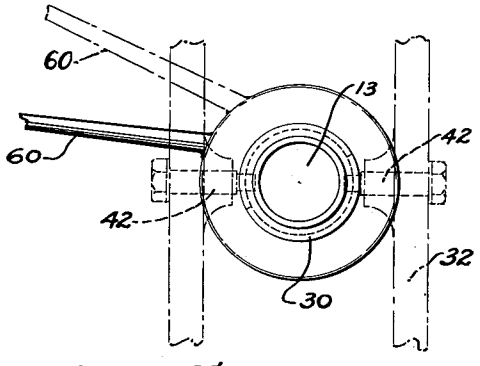


Fig. 5

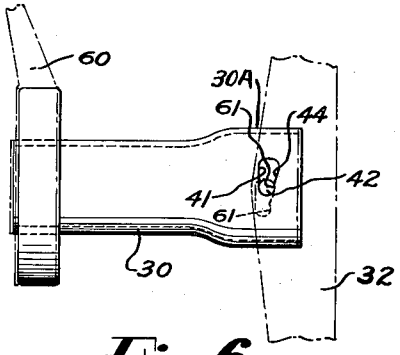


Fig. 6

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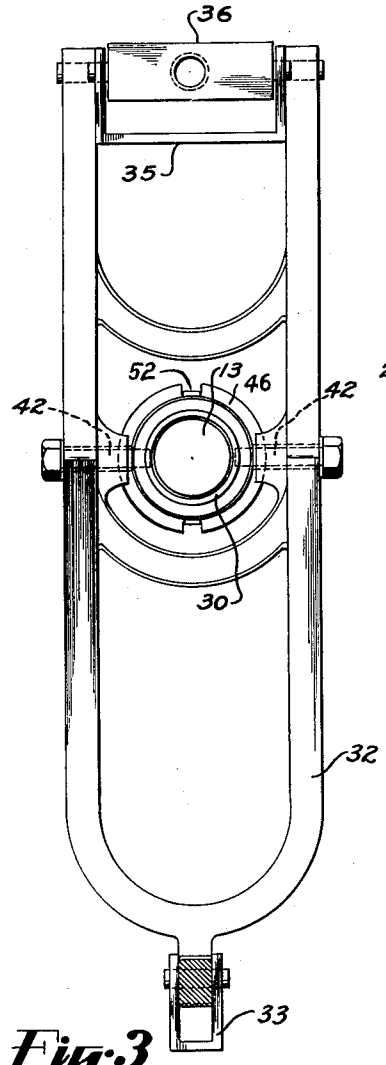


Fig. 3

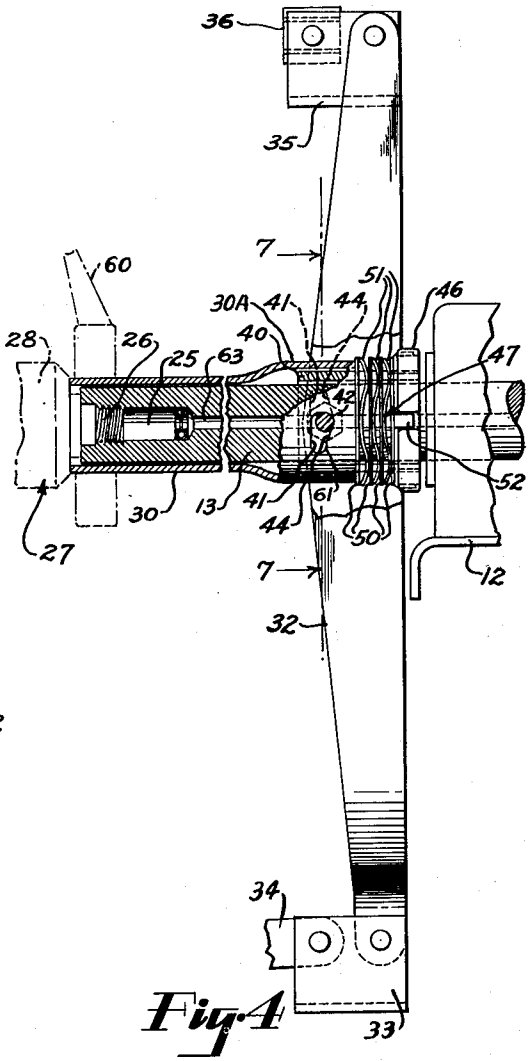


Fig. 4

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2,616,225

UNITED STATES PATENT OFFICE

2,616,225

HONE DRIVING MACHINE

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Application April 29, 1947, Serial No. 744,692

8 Claims. (Cl. 51—72)

1

The present invention relates to hone driving machines.

An object of the invention is to provide a machine for driving an expansible hone, which machine has provision for manually adjusting the effective diameter of the hone while the machine is in operation and which can be manipulated to cause temporary contraction of the honing tool to permit the piece to be honed to be placed over and removed from the hone without working contact with the latter and without disturbing the manual adjustment of the hone diameter.

Other objects and advantages of the invention will be apparent from the following description of a preferred form of the invention, reference being made to the accompanying drawings wherein:

Fig. 1 is a side view partly in section, of a hone driving machine, the section being taken on line 1—1 of Fig. 2;

Fig. 2 is an end view of the hone driving machine, part of the machine being broken away to show other parts;

Fig. 3 is a view taken along line 3—3 of Fig. 1;

Fig. 4 is a side view of the mechanism shown in Fig. 3, certain parts being shown in section;

Fig. 5 is a fragmentary front view of the drive shaft and hone adjusting sleeve of the machine; and

Fig. 6 is a side view of the mechanism shown in Fig. 5; and

Fig. 7 is a partial sectional view of Fig. 5.

Referring to the drawings, we have shown a machine 10 for driving honing tools for honing the inside of cylindrical surfaces. The machine is particularly adapted for driving honing tools that may be adjusted as to their outside diameters while the machine is operating. The machine is also provided with manually operated mechanism for causing contraction of the honing tool diameter to enable the piece being honed to be placed on and removed from the hone without working engagement with it, and without having to disturb the adjusted working diameter of the hone.

The machine 10 consists of a housing 11 having a platform 12 supported therein by the housing walls. A drive shaft 13 is mounted in bearings 14 which are supported on the platform 12. The shaft 13 may be driven by any suitable mechanism, and in the drawings we have shown the shaft driven by an electric motor 16 through a belt drive mechanism that includes a jack shaft 17, having pulleys 18, and

2

pulleys 19 mounted on shaft 13. A belt 20 drives the jack shaft and a belt 21 interconnects the jack shaft with the pulleys 19. The pulley mechanism does not form a part of the present invention and the details are not material here.

The pulleys 19 are on the rearward end of the shaft 13, and the forward end of the shaft projects from the housing 11, through an opening in the housing, and this end of the shaft is provided with a socket 25 (Fig. 4) which is threaded internally as at 26 to receive the threaded spindle of a honing tool 27, as may be seen in Fig. 4. The honing tool 27 may be similar to that of the co-pending application of Jack F. Smole, Serial Number 744,693, filed April 29, 1947, for "Honing Tool," now Patent No. 2,596,961, May 13, 1952, and in general it includes a spindle having honing stones carried thereon and mechanism for causing the stones to move inwardly and outwardly radially relative to the spindle.

The hone tool mechanism comprises a collar 28 which when moved away from the forward end of the shaft 13 causes the honing stones to be moved outwardly radially to expand the diameter of the hone; and comprises a spring (not shown) to retract the honing stones inwardly and move the collar toward the end of the shaft 13 to contract the diameter of the hone. The collar 28 may be moved longitudinally of the tool spindle and away from the end of the shaft as aforesaid by the end of a sleeve 30 which surrounds the drive shaft 13 and which forms a part of the machine 10. The sleeve will move the collar 28 to expand the hone tool as it is moved forwardly or to the left, as viewed in Figs. 1 and 4, and will permit contraction of the hone tool by the hone tool mechanism as it is moved in the opposite direction. The sleeve 30 extends beyond the outer end of shaft 13 for engaging collar 28.

The positions of the sleeve 30 along the shaft 13 to effect desired changes of diameter of the honing tool are determined by an adjusting mechanism comprising a lever 32. The lever 32 is pivoted at its lower end on a link 33 which in turn is pivotally connected to a lug 34 attached to the front wall of the housing 11. The lever 32 is bifurcated and the tines thereof straddle the shaft 13 and sleeve 30, as may be clearly seen in Fig. 3. A bracket 35 is pivotally secured between the tines of the lever at the upper end thereof and this bracket pivotally supports a block 36. The block 36 has a threaded opening therein, into which a threaded rod 37 is received. The rod 37 is rotatively journalled

in an opening through the front wall of the housing and a hand wheel 38 is attached to the outer end of the rod for rotating the latter. It will be seen that as the rod 37 is rotated the lever 32 will be rocked toward or away from the front of the housing, depending upon the direction of rotation of the rod. Preferably, graduations are formed on the edge of the hand wheel, which graduations may cooperate with a suitable indicator on the housing to indicate fine adjustment of the lever position.

The portion of the sleeve 30 intermediate the tines of the lever 32 is enlarged as at 30A and a second sleeve 40 is telescoped within the enlarged portion 30A of sleeve 30. The sleeve portion 30A has openings 41 formed through opposite sides thereof and pins 42 project from the tines of lever 32 through these openings and are secured to the inner sleeve 40 see Fig. 7. The openings 41 in sleeve 30 are elongated circumferentially of the sleeve and the rearward edges 44 thereof are inclined upwardly rearwardly as viewed in Fig. 4 and constitute cams that cooperate with the pins 42 as follows; when the sleeve is rotated counter-clockwise as viewed in Fig. 3, and in a manner to be described, the said edges 44 cam or force the sleeve to the right along shaft 13, as may be seen in Fig. 6. The solid lines of Fig. 6 show one of the openings 41 when the sleeve 30 has been rotated as described and the broken lines indicate the position of the opening 41 prior to rotation of the sleeve 30. The sleeve 30 may thus be moved rearwardly in the hone contracting direction by rotation of the sleeve, as described, by the camming reaction of the edges 44 upon the pins 42.

The rearward end of the second sleeve 40 has a collar 46 threaded thereon and a compression spring 47 surrounds the sleeve 40 and its opposite ends abut the end of the enlarged sleeve portion 30A and the collar 46, respectively. In the present instance the spring 47 is formed of a series of washers 50 and annular waved spring members 51, arranged alternately. The tension of the spring can be regulated by adjusting the collar 46 on the threaded end of sleeve 40. The collar 46 may be locked in position by a key 52. It will be seen that the spring 47 will urge the sleeve 30 forwardly in the hone tool expanding direction. It will be apparent that the tension of spring 47 should be sufficient to overcome the spring actuated tendency of the honing tool to contract and that this tension will determine the outward pressure of the honing stones against the piece being honed.

The sleeve 30 is rotated to cammingly move it against the action of spring 47 by a lever 60 which is attached to the sleeve adjacent its outer end. In order to contract the hone tool, the operator need only push down or depress the lever 60 from the broken line position to the solid line position of Fig. 5, to be referred to, and the sleeve 30 will thereby be rotated and the cam surfaces 44 on the sleeve portion 30A will cooperate with pins 42 to force the sleeve rearwardly and compress the spring 47, thereby permitting the honing tool to contract. In use, when the hone is retracted the work piece can be slipped over the hone. Lever 60 is then restored clockwise rotating the sleeve 30 in the clockwise direction. The sleeve 30 is then urged by the spring 47 to move forwardly to expand the hone tool to engage the work with pressure derived from the spring 47 but the forward movement is yieldingly opposed by the tool. As the hone tool abrades the work piece, it will expand under influence of spring 47, and the sleeve 30 will gradually move forward. In the full counter clockwise rotated position of the sleeve, the position of the openings 41 with respect to the pins 42 is that shown in Fig. 6 for one of them. In the full clockwise rotated position of the sleeve, the pin will be in the upper end of the opening 41, somewhat as shown in Fig. 4; but since at this time, as described above, the sleeve has not yet moved all the way forward, the pin will be forwardly of the cam edge 44. As the sleeve 30 moves forwardly and carries the openings 41 with it, a limit for the sleeve is reached when the cam surfaces 44 engage the pins 42.

The position of the pins 42 thus determines and limits the forward movement of the sleeve 30 and therefore the amount of expansion of the hone tool by the spring 47, and the final diameter of the hole being honed; and this position is adjustably predetermined by setting the position of the lever 32 by the hand wheel 38 as described. Lever 60 may then be depressed again to rotate the sleeve 30 counter-clockwise and move it rearwardly and release the collar 28 to allow the hone tool to contract to permit easy removal of the work from the hone.

The lever 60, see Fig. 5, has two extreme positions at which it is stopped, the broken line and solid line respectively, provided by engagement of the upper and lower ends of the openings 41 with the pins 42, see Fig. 6.

Preferably, as shown in Fig. 6 the opening 41 in the sleeve 30 has a recessed part 61 formed at the lower end of the cam surface 44 so that the edge of the recess will engage the pin 42 when the sleeve is rotated by the lever 60 to the hone contracting position to provide a detent for yieldably holding the sleeve 30 and lever 60 in that position. Recesses 61 may be provided at both openings 41 for both pins 42, one being shown in Fig. 6.

The honing tool may be supplied with cutting oil through a bore 63 in drive shaft 13 and there is an oil pump 64 driven by the motor 16 for supplying oil to the shaft through a pipe 65 and stuffing box 66. Oil is supplied to the pump through pipe 67 which withdraws the oil from a catch basin 68 located beneath the honing tool.

It will be apparent that by our invention the mechanism for effecting quick retraction of the honing tool is formed of few parts that can be easily assembled in a compact space.

Although we have shown but one form of the invention, other forms may be adopted, all falling within the scope of the claims which follow.

We claim:

1. In a hone driving machine, a main frame rotatably supporting a drive shaft, having an end portion provided with means for mounting an expansible honing tool thereon to be rotated thereby coaxially therewith; a sleeve reciprocably movable on the shaft axially thereof, and having an end portion adjacent the said end portion of the shaft for engagement with expanding mechanism of the hone tool to expand the tool by forward sleeve movement; a positionable member supported by the frame and provided with an abutment and variably positionable on the frame to dispose the abutment in different positions in the longitudinal direction of the sleeve; manually operable adjusting means connected to the positionable element to adjustably

move it and the abutment therewith with micrometer movements to dispose the abutment in corresponding positions and to fix it in said positions; a spring reacting upon a portion of the sleeve at all times urging the sleeve to move forwardly toward the end portion of the shaft; the sleeve having a stop portion engageable with the abutment to terminate said forward spring-urged movement; and manually operable retracting mechanism disposed to retract the sleeve against the force of the spring when the mechanism is operated to position the sleeve for spring-urged forward movement.

2. In a hone driving machine, a main frame rotatably supporting a drive shaft, having an end portion provided with means for mounting an expansible honing tool thereon to be rotated thereby coaxially therewith; a sleeve reciprocably movable on the shaft axially thereof, and having an end portion adjacent the said end portion of the shaft for engagement with expanding mechanism of the hone tool to expand the tool by forward sleeve movement; a positionable member supported by the frame and provided with an abutment and variably positionable on the frame to dispose the abutment in different positions in the longitudinal direction of the sleeve; manually operable adjusting means connected to the positionable element to adjustably move it and the abutment therewith with micrometer movements to dispose the abutment in corresponding positions and to fix it in said positions; a spring reacting upon a portion of the positionable element and upon a portion of the sleeve at all times urging the sleeve to move forwardly toward the end portion of the shaft; the sleeve having a stop portion engageable with the abutment to terminate said forward spring-urged movement; and manually operable retracting mechanism disposed to retract the sleeve against the force of the spring when the mechanism is operated to position the sleeve for spring-urged forward movement.

3. In a hone driving machine, a main frame rotatably supporting a drive shaft, having an end portion provided with means for mounting an expansible honing tool thereon to be rotated thereby coaxially therewith; a sleeve reciprocably movable on the shaft axially thereof, and having an end portion adjacent the said end portion of the shaft for engagement with expanding mechanism of the hone tool to expand the tool by forward sleeve movement; a lever, pivotally supported on the frame at one position and having an intermediate portion extending transversely of the sleeve movable longitudinally of the sleeve upon pivotal rocking of the lever; the lever and sleeve provided with abutments, respectively, spaced longitudinally of the sleeve, and a spring between the abutments at all times urging the sleeve to move forwardly toward the end portion of the shaft; a first stop carried by the lever intermediate portion; manually operable adjusting means connected to the lever at another portion and operable to rock the lever on its pivot to different angular positions with micrometer movements to variably position the intermediate portion and the first stop; a second stop carried by the sleeve engageable with the first stop to terminate forward movement of the sleeve; and manually operable retracting mechanism disposed to retract the sleeve against the force of the spring to position it for spring-urged forward movement.

4. In a hone driving machine, a main frame rotatably supporting a drive shaft, having an end portion provided with means for mounting an expansible honing tool thereon to be rotated thereby coaxially therewith; a sleeve reciprocably movable on the shaft axially thereof, and having an end portion adjacent the said end portion of the shaft for engagement with expanding mechanism of the hone tool to expand the tool by forward sleeve movement; a lever, pivotally supported on the frame at one portion and having an intermediate portion extending transversely of the sleeve movable longitudinally of the sleeve upon pivotal rocking of the lever; the lever and sleeve provided with abutments, respectively, spaced longitudinally of the sleeve, and a spring between the abutments at all times urging the sleeve to move forwardly toward the end portion of the shaft; a first stop carried by the lever intermediate portion; manually operable adjusting means connected to the lever at another portion and operable to rock the lever on its pivot to different angular positions with micrometer movements to variably position the intermediate portion and the first stop; a second stop carried by the sleeve engageable with the first stop to terminate forward movement of the sleeve; the sleeve being rotatable on the shaft and a handle connected to the sleeve to rotate it; an inclined cam surface carried by the sleeve and a cam follower surface carried by the lever intermediate portion; the cam surface formed to react on the cam follower surface in one rotary direction of the sleeve to retract the sleeve to a retracted position against opposition by the spring, and to be removed from the cam follower upon rotary movement in the other direction to condition the sleeve for spring-urged forward movement.

5. In a hone driving machine, a main frame rotatably supporting a drive shaft having an end portion provided with means for mounting an expansible honing tool thereon to be rotated thereby coaxially therewith; a sleeve rotable on the shaft in alternate directions, and a handle connected to the sleeve to rotate it; and the sleeve being reciprocably movable on the shaft axially thereof and having an end portion adjacent the said end portion of the shaft for engagement with expanding mechanism of the tool to expand it upon forward sleeve movement; an element supported on the frame having arms straddling the sleeve; a tubular element projecting into the other end of the sleeve; the sleeve having openings in opposite sides thereof; pins extending through said openings and secured at opposite portions to the arms and to the tubular element; the tubular element extending out of the said other end of the sleeve and having a spring abutment thereon spaced from the adjacent end of the sleeve; a compression spring reacting at opposite end portion upon the adjacent sleeve end and upon the abutment, at all times urging the sleeve forwardly; edges at one side of the said openings in the sleeve constituting cam surfaces engaged with the pins by said action of said spring, and formed to react on the pins to effect rearward movement of the sleeve in opposition to said spring upon rotation of the sleeve in one direction, and to be removed from the pins upon rotation of the sleeve in the other direction to condition the sleeve for forward movement.

6. In a hone driving machine, a main frame rotatably supporting a drive shaft having an end portion provided with means for mounting an

expansible honing tool thereon to be rotated thereby coaxially therewith; a sleeve rotable on the shaft in alternate directions, and a handle connected to the sleeve to rotate it; and the sleeve being reciprocably movable on the shaft axially thereof and having an end portion adjacent the said end portion of the shaft for engagement with expanding mechanism of the tool to expand it upon forward sleeve movement; an element supported on the frame having arms straddling the sleeve; a tubular element projecting into the other end of the sleeve; the sleeve having openings in opposite sides thereof; pins extending through said openings and secured at opposite portions to the arms and to the tubular element; the tubular element extending out of the said other end of the sleeve and having a spring abutment thereon spaced from the adjacent end of the sleeve; a compression spring reacting at opposite end portions upon the adjacent sleeve end and upon the abutment, at all times urging the sleeve forwardly; edges at one side of the said openings in the sleeve constituting cam surfaces engaged with the pins by said action of said spring, and formed to react on the pins to effect rearward movement of the sleeve in opposition to said spring upon rotation of the sleeve in one direction, and to be removed from the pins upon rotation of the sleeve in the other direction to condition the sleeve for forward movement, the support on the frame for the said arms being a pivot support positioned for movement of the pins longitudinally of the sleeve upon pivotal movement of the arms; manually operable adjusting means connected to the arms to pivotally move them and fix them in selected positions to selectively position the pins; the pins and said opening edges constituting stops mutually engaged by forward spring-effected movement of the sleeve to selectively predetermine the extent of sleeve movement.

7. A machine for driving an adjustable hone tool of the type comprising honing stones mounted for rotation around an axis, and means to mount the tool coaxial with a drive shaft to rotate it, and axially movable means to adjustably expand the tool diameter and spring means to contract it; the machine comprising: a frame rotatably supporting a drive shaft having a free end provided with means to mount the tool thereon; a hone-tool adjusting machine element extending forwardly and rearwardly longitudinally of the shaft, and having a forward end portion adjacent to the shaft end, and mounted in the machine for forward and rearward reciprocatory movement of the forward end portion in the longitudinal direction of the shaft, to engage the forward end portion with the axially movable means of the tool to expand the tool upon forward movement of the forward end portion and to allow the tool to contract upon rearward movement of the forward end portion; spring means in the machine arranged to react on the machine element at all times to urge the said forward end portion to move forwardly; a stationary support mounted on the frame; a pair of camming elements, one being a cam and the other a cam follower, and one being carried by a rearward portion of the machine element and the other carried by the stationary support; the mounting of the stationary support constructed for movement thereof to different selected positions to dispose the camming element carried thereby in corresponding selected positions; and a first manual means connected to the stationary support operable to move it to selected positions and to fix it in said positions; the said camming elements disposed to be held in mutual engagement by said spring reaction; the machine element mounted in the machine also for reciprocatory movement of the rearward portion in two directions at an angle to the forward and rearward direction; a second manual means connected to the machine element, operable to move the rearward portion in one of said second directions, and the camming elements formed to then effect movement of the machine element against opposition by the spring to move the forward end portion rearwardly; and the manual means operable to restore the rearward portion in the other of said second directions and to thereby cause the spring to move the machine element, to move the forward portion thereof in the forward direction.

8. A machine for driving an adjustable hone tool of the type comprising honing stones mounted for rotation around an axis and means to mount the tool coaxial with a drive shaft to rotate it, and axially movable means to adjustably expand the tool diameter and spring means to contract it; the machine comprising: a frame rotably supporting a drive shaft having a free end provided with means to mount the tool thereon; a hone-tool adjusting machine element extending forwardly and rearwardly longitudinally of the shaft, and having a forward end portion adjacent to the shaft end, and mounted in the machine for forward and rearward reciprocatory movement of the forward end portion in the longitudinal direction of the shaft, to engage the forward end portion with the axially movable means of the tool to expand the tool upon forward movement of the forward end portion and to allow the tool to contract upon rearward movement of the forward end portion; spring means in the machine arranged to react on the machine element at all times to urge the said forward end portion to move forwardly; a stationary support mounted on the frame; a pair of camming elements, one being a cam and the other a cam follower, and one being carried by a rearward portion of the machine element and the other carried by the stationary support; the mounting of the stationary support constructed for movement thereof to different selected positions to dispose the camming element carried thereby in corresponding selected positions; and a first manual means connected to the stationary support operable to move it to selected positions and to fix it in said positions; the said camming elements disposed to be held in mutual engagement by said spring reaction; the machine element mounted in the machine also for reciprocatory movement of the rearward portion in two directions at an angle to the forward and rearward direction; a second manual means connected to the machine element, operable to move the rearward portion in one of said second directions, and the camming elements formed to then effect movement of the machine element against opposition by the spring to move the forward end portion rearwardly; and the manual means operable to restore the rearward portion in the other of said second directions and to thereby cause the spring to move the machine element, to move the forward portion thereof in the forward direction; the spring effected engagement of the camming element carried by the rearward portion with the camming element carried by the stationary support,

constituting a stop limiting forward movement of the forward portion.

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