

March 9, 1937.

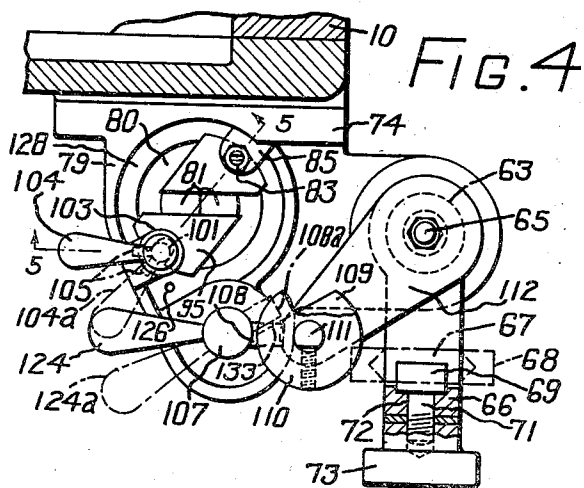
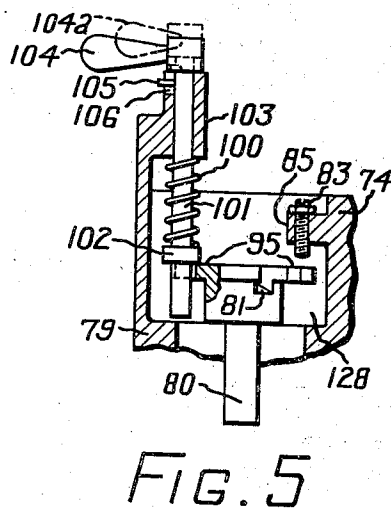
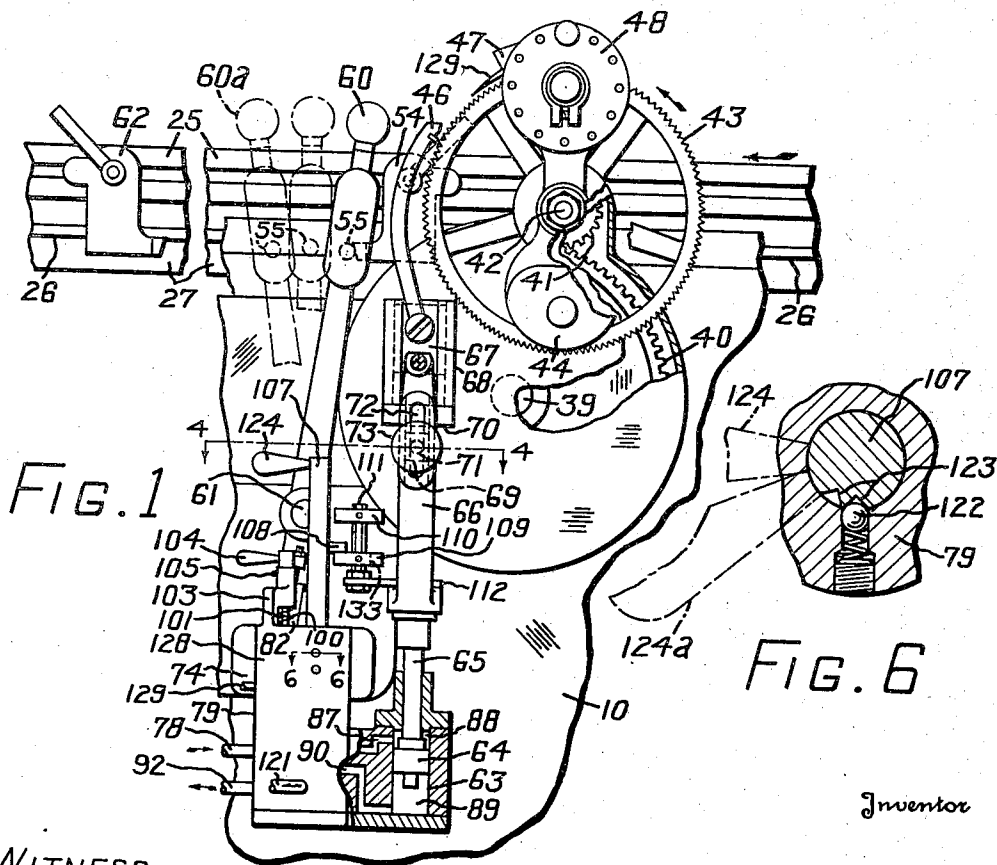
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2,073,574

HYDRAULICALLY OPERATED WHEEL FEEDING MECHANISM

Filed July 16, 1935

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

FIG. 3

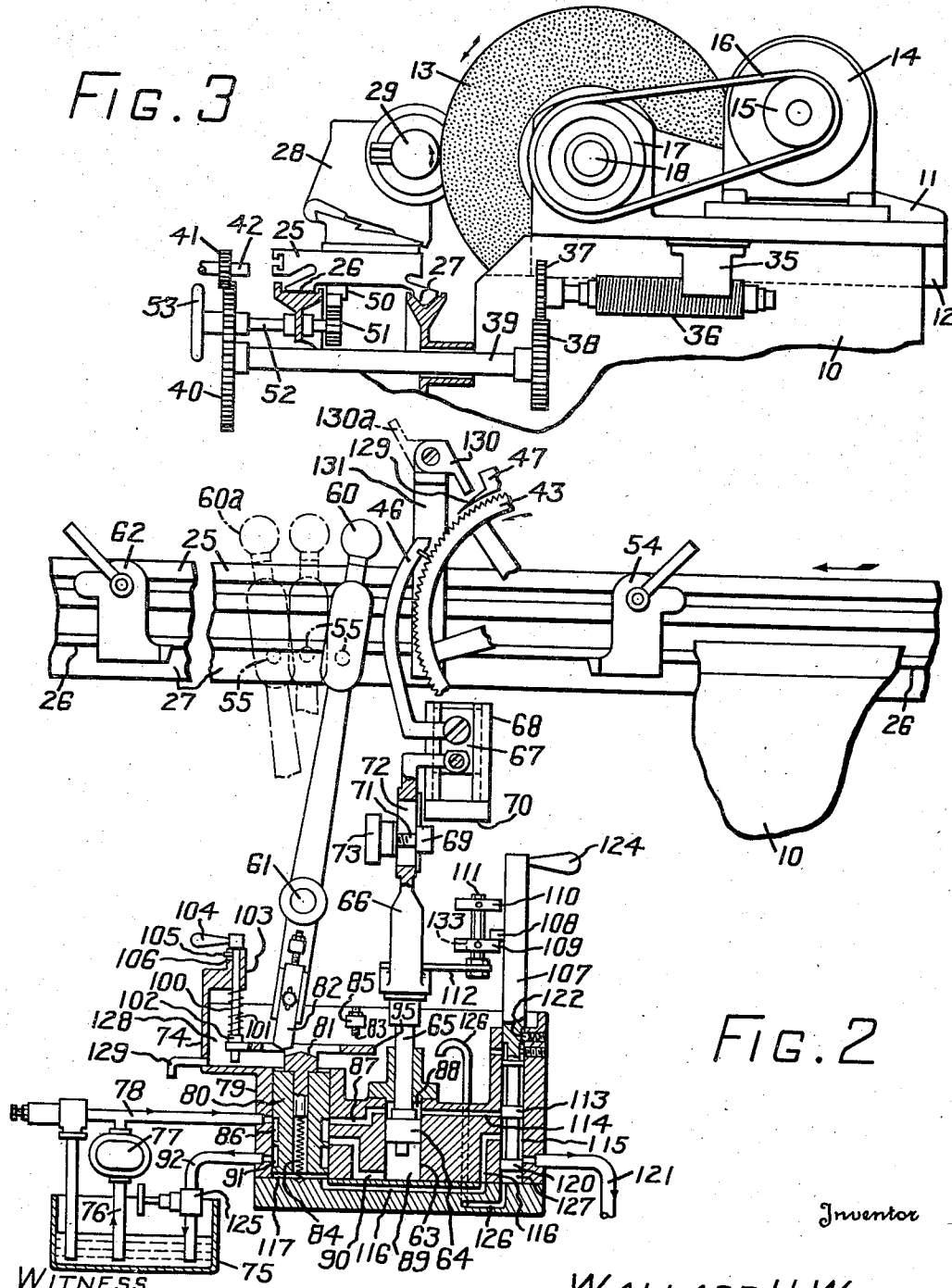


FIG. 2

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UNITED STATES PATENT OFFICE

2,073,574

HYDRAULICALLY OPERATED WHEEL FEED-
ING MECHANISMWallace H. Wood, Worcester, Mass., assignor to
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Application July 16, 1935, Serial No. 31,633

13 Claims. (Cl. 51—165)

This invention relates to grinding machines, and more particularly to a hydraulically operated wheel feeding mechanism.

Heretofore, various feeding mechanisms have been devised operated either mechanically or hydraulically. In most cases, these mechanisms have been arranged for either a plunge-cut feed, that is, where the grinding wheel is of sufficient width to grind the entire length of the work piece while it is fed directly and continuously into the work axis, or have comprised a mechanism which is operated in timed relation with the work table reciprocation to cause an infeeding movement of the grinding wheel when the work table is reversed at the end of its reciprocatory stroke.

In certain types of grinding, it is desirable to provide a hydraulically operated wheel feeding mechanism which is so arranged that the mechanism may be hydraulically actuated intermittently at the end of the reciprocatory stroke of the work table or may be fed directly by the so-called plunge-cut infeeding of the wheel when there is no relative traverse between the wheel and work. This mechanism is preferably so arranged that the feed may be readily changed from a plunge-cut to a traverse grinding feed.

It is one object of this invention to provide a hydraulically operated wheel feeding mechanism which may be operated either for a plunge-cut grinding operation or for an intermittent infeed at the end of the reciprocatory stroke of the table. It is a further object of this invention to provide a hydraulically actuated picker wheel feeding mechanism in which the picker is reciprocated continuously by a fluid pressure motor so that a plunge-cut infeed may be obtained. It is a further object to provide a picker feed mechanism in which the picker may be oscillated by means of a hydraulic motor at the end of the table stroke to cause an intermittent infeed of the wheel in a traverse grinding operation. It is a still further object of this invention to provide a picker actuated wheel feed in which the picker is reciprocated by a fluid pressure motor in which the motor may be operated continuously to obtain a plunge-cut infeed or may be operated intermittently at the ends of the table stroke to obtain an intermittent wheel feed for traverse grinding.

Other objects will be apparent from the foregoing disclosure. One embodiment of this invention has been illustrated in the accompanying drawings, in which like reference numerals indicate like parts.

Fig. 1 is a fragmentary front elevation of the

improved grinding wheel feed mechanism having parts broken away and shown in section to more clearly show the construction;

Fig. 2 is a similar fragmentary front elevation of the feeding mechanism having parts broken away and shown in section, as well as showing diagrammatically the fluid pressure piping system;

Fig. 3 is a fragmentary cross-sectional view, on a reduced scale, showing the arrangement of the wheel slide, work table, table traverse and wheel feeding mechanisms;

Fig. 4 is a fragmentary sectional view, on an enlarged scale, taken approximately on the line 4—4 of Fig. 1;

Fig. 5 is a fragmentary vertical section, on an enlarged scale, taken approximately on the line 5—5 of Fig. 4; and

Fig. 6 is a fragmentary sectional view, on an enlarged scale, taken approximately on the line 6—6 of Fig. 1, showing the spring pressed ball for locating the reversing valve in one of two positions for obtaining either a plunge-cut or an intermittent feed.

The embodiment of this invention illustrated in the drawings comprises a base 10 which supports a transversely movable wheel slide 11 on slideway 12. The wheel slide 11 supports a rotatable grinding wheel 13 which may be driven by any suitable source of power. For the sake of illustration, an electric motor 14 is mounted on the top of the wheel slide 11 and is connected by a motor pulley 15, a belt 16, with a pulley 17 on the end of a wheel spindle 18.

The base 10 also supports a longitudinally movable table 25 which is supported on the usual flat way 26 and V-way 27. The table is provided with a rotatable work supporting means, such as a headstock 28 and footstock (not shown) which are of well-known and standard grinding machine construction to rotatably support a work piece 29 in operative engagement with the grinding wheel 13. The grinding wheel may be fed toward and from the work by means of a half nut 35 depending from the wheel slide 11 which meshes with a rotatable cross feed screw 36 journaled in suitable bearings (not shown) in the base 10. The front end of the feed screw 36 carries a gear 37 which meshes with a gear 38 mounted on the inner end of a rotatable shaft 39. The outer end of the shaft 39 is provided with a gear 40 which meshes with a small gear 41 carried by a shaft 42 which also supports a picker feed wheel 43. The picker wheel is of standard construction and similar to that shown in the prior U. S. pat-

ent to Norton No. 762,838 dated June 14, 1904. The picker wheel 43 may be rotated by a manually operable handle 44 or, if desired, may be rotated intermittently by a picker 46 which serves to engage the notches in the periphery of the picker wheel 43 to rotate it and cause a rotation of the screw 36 and an infeeding movement of the grinding wheel 13. A fixed abutment 47 is carried by the manually operable handle 44 which is arranged in the path of the picker 46 to limit the infeeding movement of the grinding wheel. A micrometer adjusting mechanism 48 is provided to reset the abutment 47 relative to the wheel 43 so that it may be adjusted to vary the extent of infeeding in case of wheel wear or in setting up the mechanism for a given grinding operation.

The table 25 may be reciprocated by any suitable reversing mechanism, either manually or by power. A manually operable table traverse mechanism has been illustrated, including a rack bar 50 depending from the table 25 which meshes with a gear 51 mounted on the inner end of a rotatable shaft 52. The shaft 52 is journaled in suitable bearings (not shown) in the base 10 and is provided at its outer end with a manually operable traverse wheel 53.

The table 25 may also be reciprocated by a mechanical or hydraulic mechanism, the details of which have not been fully illustrated and described in the present case since this mechanism is not considered to be a part of the present invention. For a detailed description of such a mechanism, reference may be had to my copending U. S. patent application Serial No. 741,119 filed August 23, 1934. This mechanism comprises a reversing lever 60 which is pivotally mounted on a stud 61 on the front of the machine base 10. The reversing lever 60 is arranged to be shifted by a pair of adjustable dogs 62 and 54 which engage a pin 55 on the lever 60 and shift the same so as to actuate the reverse lever and thereby change the direction of movement of the table.

To attain the main object of this invention, a suitable hydraulic mechanism is provided which permits either an infeeding movement of the grinding wheel at each reversal of the table or a continuous plunge-cut or straight-in feed of the wheel when no reciprocation of the table is utilized. This mechanism may comprise a fluid pressure cylinder 63 having a piston 64 slidably mounted therein. The piston 64 is connected by a piston rod 65 and a connecting link 66 with a vertically movable slide 67 which is mounted in a slideway 68 on the front of the machine base. The picker 46 is pivotally mounted on a stud on the slide 67. It will be readily apparent that when the piston 64 is reciprocated, the picker 46 will be caused to move up and down relative to the picker wheel and will pick successive teeth on the wheel 43, thereby causing the grinding wheel 13 to be fed into the work 29. This mechanism functions the same regardless of whether a continuous plunge-cut feed or an intermittent feed during table reversal is used. An adjustable stop 69 on the link 66 engages the lower surface 70 of the slideway 68 and serves to limit the upward movement of the picker 46. The stop 69 has a reduced threaded portion 71 which passes through an elongated slot 72 in link 66 and may be clamped in adjusted position thereon by means of a nut 73. By adjusting the position of stop 69, the stroke of the picker 46 may be adjusted so that one or more teeth on the picker wheel 43 will be picked up at each actuation of the picker 46.

The fluid pressure system comprises a reservoir

75 which is preferably located in the base 10 of the machine. Fluid is pumped from the reservoir 75 through a pipe 76 by means of a pump 77 and is forced through a pipe 78 into a control valve 79. The control valve is of a piston type including a valve piston 80, the upper end of which is formed with an arrow point surface 81 arranged in the path of an adjustably positioned arrow point 82 on the reverse lever 60.

The piston 80 is held normally in an upward position against an adjustable stop screw 83 by means of a spring 84. The stop screw 83 is adjustably mounted in a lug 85 projecting from a frame 86. In the upper position of the piston 80, fluid under pressure passing from the pump 77 passes through pipe 78, into a valve chamber 86 in control valve 79 and through a passage 87 into cylinder chamber 88 to cause the piston 64 to move downwardly. The downward movement of the piston serves to cause a downward movement of the picker 46, which turns the picker wheel 43 in a counterclockwise direction to cause an infeeding movement of the grinding wheel. When the piston 80 is in its normally upper position, fluid may exhaust from cylinder chamber 89, through a passage 90 into a valve chamber 91 and exhaust through a pipe 92 into reservoir 75.

Assuming the table to be traveling in the direction of the arrow (Fig. 2), the piston 80 remains in a normally upward position with the plate 95 in engagement with stop screw 83 until the reverse dog 54 engages the reverse lever 60 and swings it into position 60a to reverse the direction of movement of table 25. During the swinging movement of lever 60 from full line position to broken line position 60a, the arrow point 82 rides over the arrow point 81 and causes a downward movement of control valve piston 80 against the tension of the spring 84 so that valve piston 80 instantaneously assumes a position such as that shown in Fig. 2. In this position of piston 80, both the passages 87 and 90 open into valve chamber 86. In this position, fluid under pressure from pipe 78 may pass through both ports 90 and 87 into cylinder chambers 89 and 88 respectively. Due to the differential in the effective areas of the upper and lower surfaces of piston 64, the fluid pressure entering the valve chamber 86 will cause the piston 64 to move upwardly, during which time the fluid within the cylinder chamber 88 will be forced through passage 87 due to the differential of pressures on the upper and lower surfaces of the piston 64 and supplements the fluid under pressure entering chamber 86 through pipe line 78. In this position of the parts, the piston 64 moves upwardly, carrying the picker 46 through an idle upward stroke so that it is ready to engage the additional teeth on the picker wheel 43 to cause a further infeeding of the grinding wheel when the control valve piston 80 is moved upwardly under the influence of spring 84. The speed of upward movement of the piston 64 is governed by the differential in piston areas and also by the extent of the downward movement of valve piston 80 caused by the adjustable arrow point 82. By varying the position of arrow point 82 on the lever 60, the extent of opening of passage 90 into valve chamber 86 may be varied. It will be noted that the piston rod 65 is of a substantial diameter relative to the diameter of the piston 64 so that the effective area of the upper surface of piston 64 is much less than the effective area of the lower surface of piston 64. After arrow point 82 passes

over the high point of arrow surface 81, the released tension of spring 84 causes the valve piston 80 to move upwardly. This movement cuts off the passage 90 from the valve chamber 86. Fluid under pressure then passes through passage 87 into cylinder chamber 88 and causes a downward movement of piston 64 and an infeeding movement of picker 46 and feed wheel 43. During the downward movement of piston 64, fluid exhausts from the cylinder chamber 89, through the passage 90, the valve chamber 91, the pipe 92, into reservoir 75.

It will be readily apparent from the foregoing disclosure that each time the table reverse lever 60 is moved from position 60 into position 60a, or from position 60a into position 60, the valve piston 80 is moved downwardly to cause an upward or idle stroke of the picker 46 relative to the picker feed wheel 43, and when the piston 80 is returned to its normal upward position, the fluid under pressure is passed into cylinder chamber 88 to cause a downward movement of piston 64 and a feeding movement between picker 46 and picker wheel 43.

Plunge-cut feed

In certain types of grinding, where the portion of the work to be ground is equal to or less than the width of the operative face of the grinding wheel, no traversing movement of the table is required. In such an operation, it is desirable to feed the grinding wheel directly and continuously into the work by what is known as a straight-in or plunge-cut feed. To attain one of the objects of this invention, a suitable means is provided which serves to permit either a feed at reversal or a plunge-cut infeeding movement of the grinding wheel. It is desirable to utilize the same piston 64, cylinder 63 and control valve 79 and to supplement these parts with an additional mechanism so that the control valve may be operated either by the reverse lever 60 or by a reversing valve in case a continuous plunge-cut infeed is desired. To accomplish this result, the control valve piston 80, which when operated by the reverse lever is held in a normally upward position, must now be held in a normally downward position. This is preferably accomplished by means of a spring 100 which surrounds a plunger 101 and is interposed between a head 102 on plunger 101 and a projection 103 of the frame 74. The tension of the spring 100 is greater than the tension of the spring 84 so that when the spring 100 is in an operating position with head 102 in engagement with plate 95, the greater tension of spring 100 serves to hold the control valve piston 80 normally in a downward position. When it is desired to operate the mechanism to obtain an infeeding movement of the grinding wheel for a traverse grinding operation, that is, at the end of the work table stroke during the period of reversal, the spring 100 must be held ineffective so that the control valve piston 80, during such operation, is held in a normally upward position, as previously described. To accomplish this result, a handle 104 is provided on the upper end of the plunger 101 and a lock pin 105 is arranged to engage the upper end surface of projection 103 of the casing when plunger 101 is raised vertically and handle 104 rotated so that lock pin 105 slides out of engagement with a vertical elongated slot 106. This movement raises the head 102 out of contact with the plate 95. When it is desired to utilize the feeding mechanism for a plunge-cut feeding operation, the handle 104 is turned so that

pin 105 slides into the elongated slot 106 and releases the tension of spring 100 to force the head 102 downwardly into operating engagement with the plate 95 to move valve piston 80 downwardly and hold it in a normally downward position during the plunge-cut feeding operation. In this position of the parts, fluid under pressure from pipe line 78 passes into valve chamber 86 and due to the fact that both passages 87 and 90 are open into chamber 86, serves to cause the piston 64 to move upwardly into the position illustrated in Fig. 2.

In order that the piston 64 may be reciprocated, a pilot valve 107 is provided which has a pin 108 arranged in the path of a pair of reversing dogs 109 and 110 which are adjustably mounted on a pin 111 supported by an arm 112. The arm 112 is rigidly fixed to the link 66. In the position of the parts illustrated in Fig. 2, the dog 109 has engaged the pin 108 and further upward movement of the piston 64 serves to move the pilot valve 107 upwardly so that pilot valve piston 113 uncovers a passage 114 and allows fluid under pressure from pipe 78 to pass through valve chamber 86, passage 87, cylinder chamber 88, passage 114, into pilot valve chamber 115, and pass through a passage 116 into a control valve chamber 117 to cause the valve piston 80 to move upwardly against the tension of spring 100. When the control valve piston 80 reaches its uppermost position, it closes the passage 90 so as to cut off fluid pressure from the cylinder chamber 86. In this position of the parts, fluid under pressure from pipe 78 passes through the control valve chamber 86, the passage 87, into the cylinder chamber 88 and causes a downward movement of the piston 64 which in turn causes a downward infeeding movement of picker 46 to turn the picker wheel 43 in a counterclockwise direction and cause an infeeding movement of the grinding wheel 13. During the downward movement of the piston 64, the dog 110 engages the pin 108 and moves the pilot valve 107 downwardly a sufficient distance so that the piston 113 closes the passage 114 and cuts off pressure from the passage 116. A pilot valve piston 120 moves downwardly through a sufficient distance to open an exhaust pipe 121 which allows fluid to exhaust from the control valve chamber 117 through the passage 116, into the pilot valve chamber 115 and out through the exhaust pipe 121 and into the reservoir 75. Relieving the pressure from the chamber 117 releases the tension of the spring 100 and allows the control valve piston 80 to move downwardly into the position illustrated in Fig. 2. When the piston 80 assumes the downward position, fluid may again pass through the pipe 78, the valve chamber 86; and the passages 87 and 90 being open serves to cause an upward movement of piston 64 and an idle movement of the picker 46 relative to the picker feed wheel 43. It will be readily apparent from the foregoing disclosure that the pilot valve 107 together with the dogs 109 and 110 serve to cause an intermittent continuous infeeding movement of the grinding wheel when work is to be ground by the plunge-cut method.

When it is desired to stop the continuous infeed, the pilot valve 107 must be retained in a downward position, such as that shown in Fig. 2. This is preferably accomplished by means of a handle 124 mounted on the upper end of the pilot valve 107 which serves to rotate the valve 107 and locate it in one of two positions by means of a spring-pressed ball 122 (Fig. 6) which engages

V-notches 123 in the valve stem 107. When the handle 124 is in the full line position indicated in Fig. 4, the pin 108 is in the position indicated, in the path of both dogs 109 and 110. When it is desired to stop the continuous or plunge-cut feed, the handle 124 is moved into position 124a which serves to shift the pin 108 into position 108a. The lower dog 109 is slabbled off on one side to provide a surface in the line of a chord 133 so that when the dogs are moved downwardly, the dog 110 strikes the pin 108 and moves the pilot valve 107 into its downward position. On the next upstroke of the piston 64, the dogs 109 and 110 are moved upwardly but due to the slabbled-off portion of the dog 109, the dog 109 will pass by and not engage the pin 108. This allows the pilot valve 107 to remain in its lower position. The operator may then turn the handle 104 into position 104a so as to release the tension of the spring 100 and allows the control valve piston 80 to return to its normally upward position under the influence of the spring 84 so that an infeeding movement at reversal may be obtained.

The speed of the upward movement of the picker 46 may be varied to obtain either a fast or a slow return or idle movement of the picker. By adjusting the position of arrow point 82 relative to the lever 60, the extent of the upward movement of control valve piston 80 may be varied. Variation in the extreme downward position of piston 80 serves to vary the opening of passage 90 relative to control valve chamber 86. This opening from the valve chamber 86 into passage 90 varies the amount of fluid under pressure that may be admitted to cylinder chamber 89 and consequently varies the speed of upward movement of the piston 64. The speed of the downward or infeeding movement of the picker 46 may be varied by means of a valve 125 in the exhaust pipe 92 which serves to throttle the exhaust of fluid from the cylinder chamber 89. When the control valve piston 80 is in its uppermost position with the plate 95 in engagement with the screw 83 and the piston 64 moves downwardly, fluid exhausts from the cylinder chamber 89, through the passage 90, the control valve chamber 91, and out through the pipe 92 and the valve 125 into the reservoir 75. It will be readily apparent from the foregoing disclosure that adjustment of the valve 125 serves to control the speed of the downward movement of the picker 46 and thereby varies the speed of the infeeding movement.

An exhaust passage 126 is provided to permit drainage of any fluid in a valve chamber 127 which leaks by the valve piston 120. This fluid from chamber 127 flows into a reservoir 128 formed within the frame 74. Fluid within reservoir 128 overflows through a pipe 129 and returns to reservoir 75.

The operation of this machine is readily apparent from the foregoing disclosure. Assuming the dogs 62 and 54 to be adjusted to the required position and the arrow point 82 and stop screw 83 have been adjusted, and the stop 69 has been adjusted to give the desired movement of the picker, the grinding operation may be started and as the table 25 is reciprocated, the reverse lever 60 is shifted from position 60 to 60a or vice versa, serving through arrow points 82 and 81 to cause a downward movement of the control valve piston 80 to cause an idle upward movement of the picker 46. The return or upward movement of the piston 80 under the influence of spring 84 serves to cause a downward infeeding

movement of picker 46. This infeeding of the grinding wheel will continue at each reversal of the table.

When it is desired to cause a straight-in or plunge-cut feed of the wheel, the operator moves the handle 104 downwardly to lock the spring 100 under operating tension to maintain valve piston 80 in a normally downward position. The handle 124 is then rotated from position 124a into full line position 124 (Fig. 4) which serves to move the pin 108 from position 108a into position 108 to render the pilot valve effective to admit fluid to the control valve so that it functions to continuously reciprocate the piston 64 and cause a continuous reciprocation of the picker 46 and thereby produce a continuous infeeding movement of the grinding wheel.

In the operation of the machine as illustrated in Fig. 2 of the drawings, the infeed by means of the picker continues until the picker rides upon the shield 129. The operator may then manually turn the feed wheel to bring the abutment 47 into contact with the end of picker 46 to positively limit the infeeding movement to size the work.

If it is desired to feed the wheel by means of the picker 46 to size the work, it is necessary to provide a movable stop 130 which is pivotally mounted on a bracket 131 fixed to the base of the machine which when in an operative position is engaged by abutment 47 on the feed wheel to positively limit the infeeding movement of the grinding wheel before the picker 46 rides upon the shield 129. The stop 130 is pivotally connected to the bracket so that it may be readily swung to an inoperative position 130a.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A grinding machine comprising a longitudinally movable work supporting table, a transversely movable grinding wheel slide, means including a reversing lever to reciprocate said table, a feeding mechanism operatively connected to cause a transverse feeding movement of said slide, a fluid pressure piston and cylinder operatively connected to actuate said feeding mechanism, a control valve for controlling the admission of fluid under pressure to said cylinder, and means including a pilot valve actuated in timed relation with said piston to control the admission of fluid to actuate said control valve so as to cause a continuous reciprocation of said piston and to continuously actuate said feed mechanism so as to produce a straight-in or plunge-cut feeding movement of the grinding wheel slide.

2. A grinding machine comprising a longitudinally movable work supporting table, a transversely movable grinding wheel slide, means including a reversing lever to reciprocate said table, a feeding mechanism operatively connected to cause a transverse feeding movement of said slide, a fluid pressure piston and cylinder operatively connected to actuate said feeding mechanism, a control valve for controlling the admission of fluid under pressure to said cylinder, and means including a pilot valve actuated by movement of said piston to control the admission of fluid to actuate said control valve so as to cause a continuous reciprocation of said piston and to continuously actuate said feed mechanism so as to produce a straight-in or plunge-cut feeding movement of the grinding wheel slide.

3. A grinding machine comprising a longitu-

dinally movable work supporting table, a transversely movable grinding wheel slide, means including a reversing lever to reciprocate said table, a feeding mechanism operatively connected to cause a transverse feeding movement of said slide, a fluid pressure piston and cylinder operatively connected to actuate said feeding mechanism, a control valve for controlling the admission of fluid under pressure to said cylinder, and means including a pilot valve actuated in timed relation with the reciprocation of said feeding mechanism piston to control the admission of fluid to actuate said control valve so as to cause a continuous reciprocation of said piston and to continuously actuate said feed mechanism so as to produce a straight-in or plunge-cut feeding movement of the grinding wheel slide.

4. A grinding machine comprising a longitudinally movable work supporting table, a transversely movable grinding wheel slide, means including a reversing lever to reciprocate said table, a feeding mechanism operatively connected to move said slide transversely, a fluid pressure system including a piston and cylinder operatively connected to actuate said feeding mechanism, a control valve operatively connected to control the admission of fluid to said cylinder, means actuated by said reverse lever to actuate said control valve and cause said piston to reciprocate once at each actuation of the reverse lever to cause an infeeding movement of the grinding wheel at the end of the work table stroke, means to render said control valve inoperative with relation to said reverse lever, and a pilot valve to control admission of fluid to said control valve so as to cause a continuous reciprocation of said piston to produce a straight-in or plunge-cut feeding movement of the grinding wheel slide.

5. A grinding machine comprising a longitudinally movable work supporting table, a transversely movable grinding wheel slide, means including a reversing lever to reciprocate said table, a feeding mechanism operatively connected to move said slide transversely, a fluid pressure system including a piston and cylinder operatively connected to actuate said feeding mechanism, a control valve operatively connected to control the admission of fluid to said cylinder, means actuated by said reverse lever to actuate said control valve and cause said piston to reciprocate once at each actuation of the reverse lever to cause an infeeding movement of the grinding wheel at the end of the work table stroke, means to render said control valve inoperative with relation to said reverse lever, and a pilot valve actuated by said piston to control admission of fluid to said control valve so as to cause a continuous reciprocation of said piston to produce a straight-in or plunge-cut feeding movement of the grinding wheel slide.

6. A grinding machine comprising a longitudinally movable work supporting table, a transversely movable grinding wheel slide, means including a reversing lever to reciprocate said table, a feeding mechanism operatively connected to move said slide transversely, a fluid pressure system including a piston and cylinder operatively connected to actuate said feeding mechanism, a control valve operatively connected to control the admission of fluid to said cylinder, means actuated by said reverse lever to actuate said control valve and cause said piston to reciprocate once at each actuation of the reverse lever to cause an infeeding movement of the grinding wheel at the end of

the work table stroke, means to render said control valve inoperative with relation to said reverse lever, adjustable dogs actuated by said piston, and a pilot valve actuated by said dogs to control the admission of fluid to said control valve so as to cause a continuous reciprocation of said piston to produce a straight-in or plunge-cut feeding movement of the grinding wheel slide.

7. A grinding machine comprising a longitudinally movable work supporting table, a transversely movable grinding wheel slide, means including a reversing lever to reciprocate said table, a feeding mechanism operatively connected to move said slide transversely, a fluid pressure system including a piston and cylinder operatively connected to actuate said feed mechanism, a control valve operatively connected to control the admission of fluid to said cylinder, means including a pilot valve to control the admission of fluid to said control valve so as to cause a continuous reciprocation of the piston to produce a straight-in or plunge-cut feeding movement of the grinding wheel, means to render said pilot valve ineffective, and means actuated by said reversing lever to actuate said control valve and cause said piston to reciprocate at each actuation of the reverse lever to cause an infeeding movement of the grinding wheel at the end of the work table stroke.

8. A grinding machine comprising a longitudinally movable work supporting table, a transversely movable grinding wheel slide, means including a reversing lever to reciprocate said table, a feeding mechanism operatively connected to move said slide transversely, a fluid pressure system including a piston and cylinder operatively connected to actuate said feeding mechanism, a control valve operatively connected to control the admission of fluid to said cylinder, adjustable dogs actuated in timed relation with said piston movement, a pilot valve actuated by said dogs to control the admission of fluid to said control valve so as to cause a continuous reciprocation of said piston to produce a straight-in or plunge-cut feeding movement of the grinding wheel slide, means to render said pilot valve inoperative with relation to said dogs, and means actuated by said reversing lever to operate said control valve and cause said piston to produce an infeeding movement of the grinding wheel slide when the reversing lever is shifted at the end of the work table stroke for a traverse grinding feed.

9. A grinding machine comprising a rotatable grinding wheel, a transversely movable wheel slide to support said wheel, a longitudinally movable table, means including a reversing lever to reciprocate said table, means including a movable picker and rotatable feed wheel actuated thereby to cause a transverse feeding movement of the grinding wheel, a fluid pressure mechanism operatively connected to actuate said picker, a control valve for controlling the admission of fluid to said mechanism, means actuated by the reverse lever to actuate said control valve to cause an intermittent feed at each end of the table stroke, means to render said control valve inoperative relative to said reverse lever during a plunge-cut feeding movement, a pilot valve actuated in timed relation with said picker and arranged continuously to actuate said fluid pressure mechanism to produce a plunge-cut feeding movement of the grinding wheel, and means to render said pilot valve inoperative during a traverse grinding operation.

10. A grinding machine comprising a rotatable grinding wheel, a transversely movable wheel slide to support said wheel, a longitudinally movable table, means including a reversing lever to reciprocate said table, means including a movable picker and rotatable feed wheel actuated thereby to cause a transverse feeding movement of the grinding wheel, a fluid pressure mechanism including a piston and cylinder which are operatively connected to actuate said picker, a control valve which is arranged to control the admission of fluid to said cylinder, means actuated by said reverse lever to actuate said control valve to cause an infeeding movement at each end of the table stroke, a second control valve actuated by and in timed relation with the movement of said piston continuously to reciprocate said piston and picker, means to render said control valve inoperative by said reverse lever during the plunge-cut feeding movement, and means to render said second valve inoperative during the intermittent feeding movement.

11. A feeding mechanism for a cylindrical grinding machine comprising a movable picker, a feed wheel actuated thereby, a stop abutment on said wheel, a fixed stop in the path of said abutment to positively limit the infeeding movement, a reciprocable slide arranged to support said picker, fluid pressure means including a piston and cylinder operatively connected to reciprocate said slide, an adjustable stop associated with said piston to limit the movement of said picker in one direction so as to vary the extent of movement of the picker and thereby vary the extent of feeding movement of the grinding wheel, and means including a valve associated with said piston and cylinder which is actuated by dogs

carried by said piston to change the direction of movement of said picker.

12. A feeding mechanism for a cylindrical grinding machine comprising a movable picker, a feed wheel actuated thereby, a reciprocable slide arranged to support said picker, fluid pressure means including a piston and cylinder operatively connected to reciprocate said slide, an adjustable stop associated with said piston to limit the movement of said picker in one direction so as to vary the extent of movement of the picker and thereby vary the extent of feeding movement of the grinding wheel, means including a valve associated with said piston and cylinder, and adjustable dogs carried by said piston to actuate said valve to change the direction of movement of said picker.

13. A wheel feed mechanism for a grinding machine comprising a rotatable grinding wheel, a transversely movable slide to support said wheel, a nut and screw mechanism to cause a feeding movement of said slide, means including a manually operable feed wheel to rotate said screw to cause a forward or rearward feeding movement of the grinding wheel, a movable picker arranged to turn the feed wheel, means including a fluid pressure piston and cylinder which are operatively connected to actuate said picker, a valve arranged to admit fluid under pressure to opposite ends of said cylinder to cause said picker to move in opposite directions, adjustable dogs movable in timed relation with said picker which are arranged to shift the valve to cause a continuous reciprocation of the picker so as to produce a continuous direct infeed of the grinding wheel.

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