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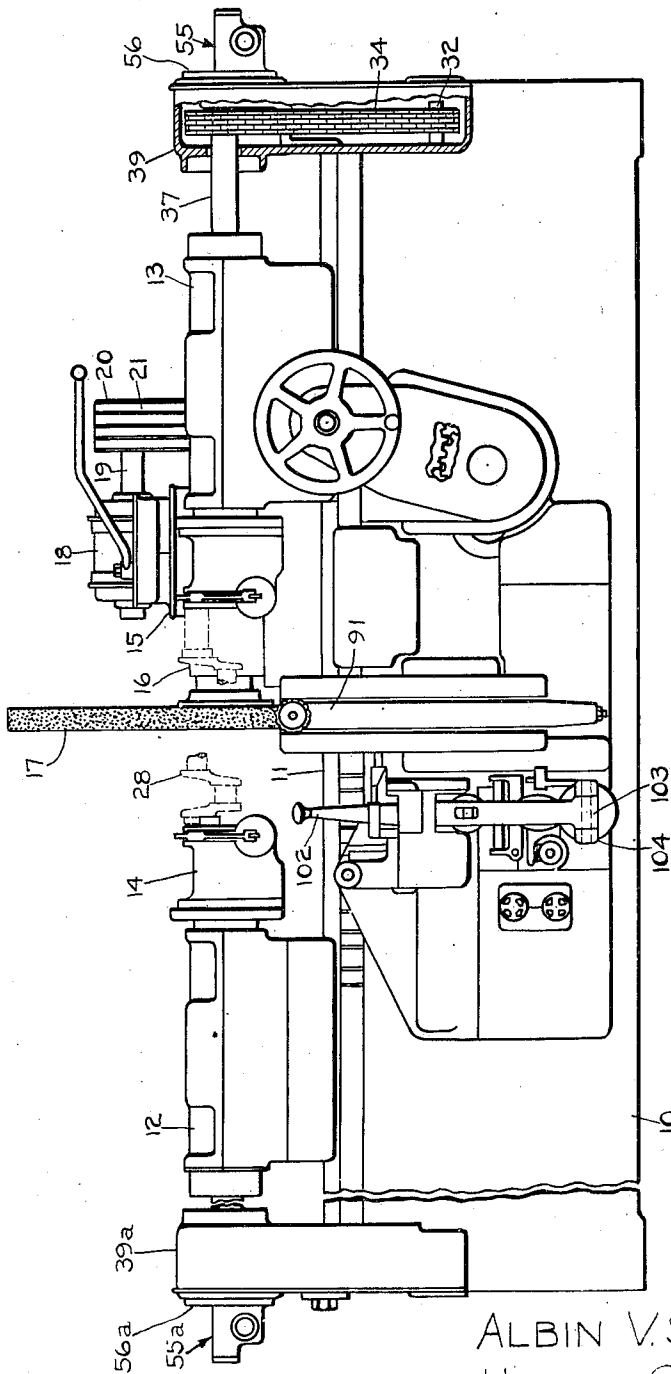
A. V. SPONGBERG ET AL

2,471,706

CRANKPIN GRINDING MACHINE

Filed Feb. 7, 1946

4 Sheets-Sheet 1



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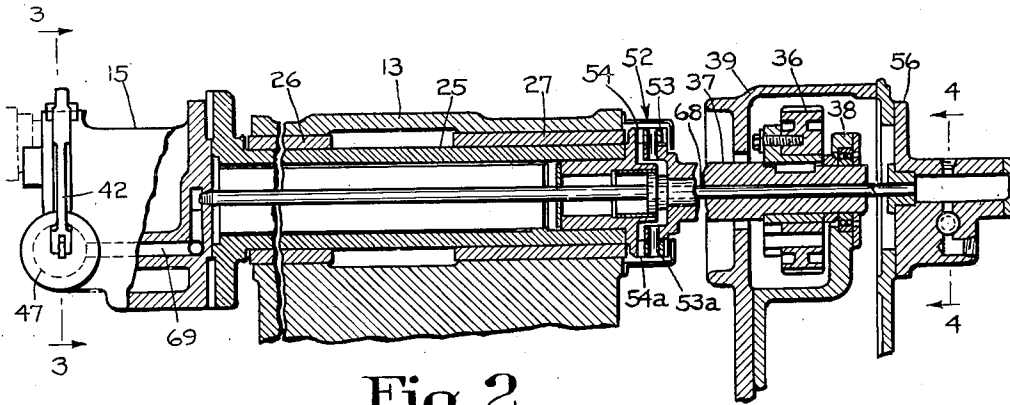


Fig. 2

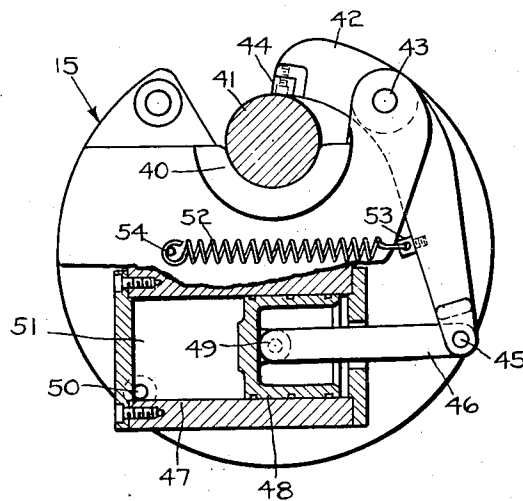


Fig. 3

Inventors

ALBIN V. SPONGBERG

HARRY G. PASHOIAN

By *Harold W. Eaton* Attorney

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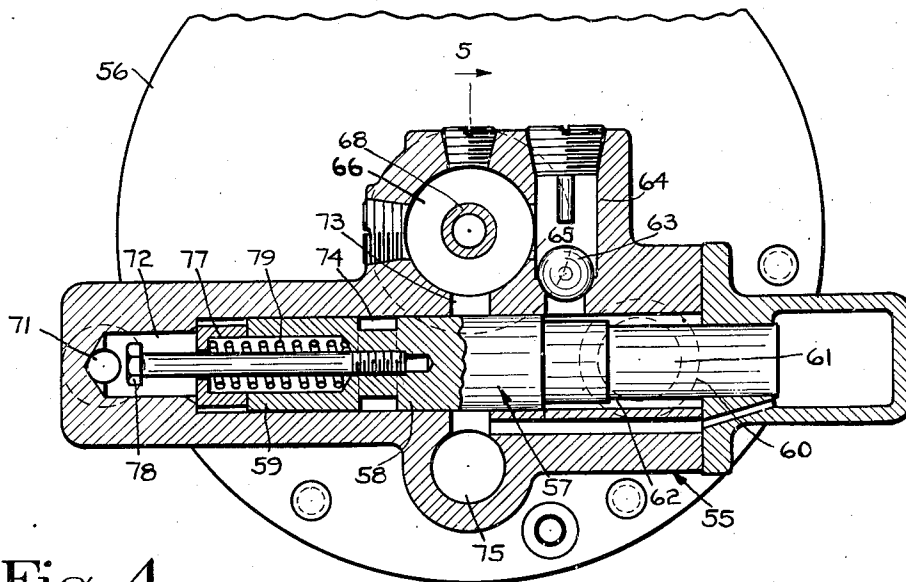


Fig. 4

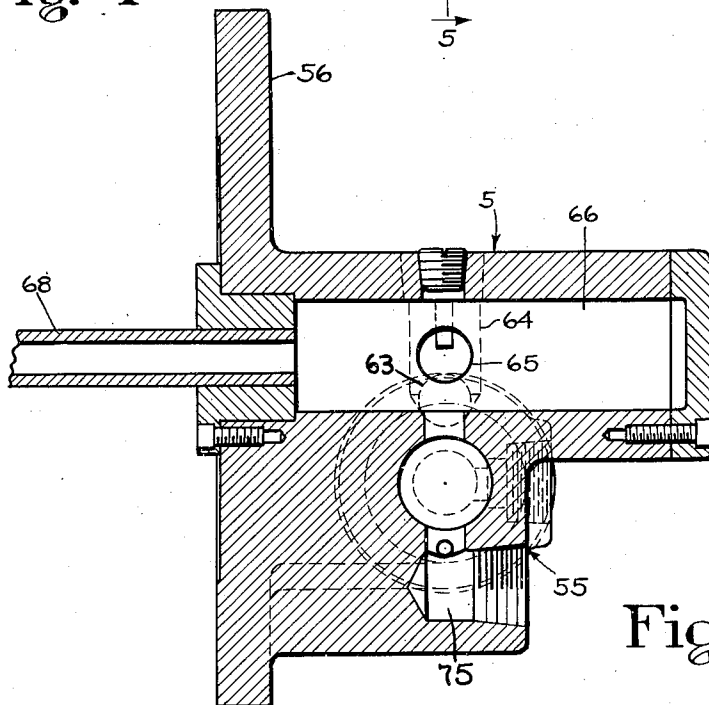


Fig. 5

Inventors

ALBIN V. SPONGBERG
HARRY G. PASHOIAN

By *Harold W. Eaton* Attorney

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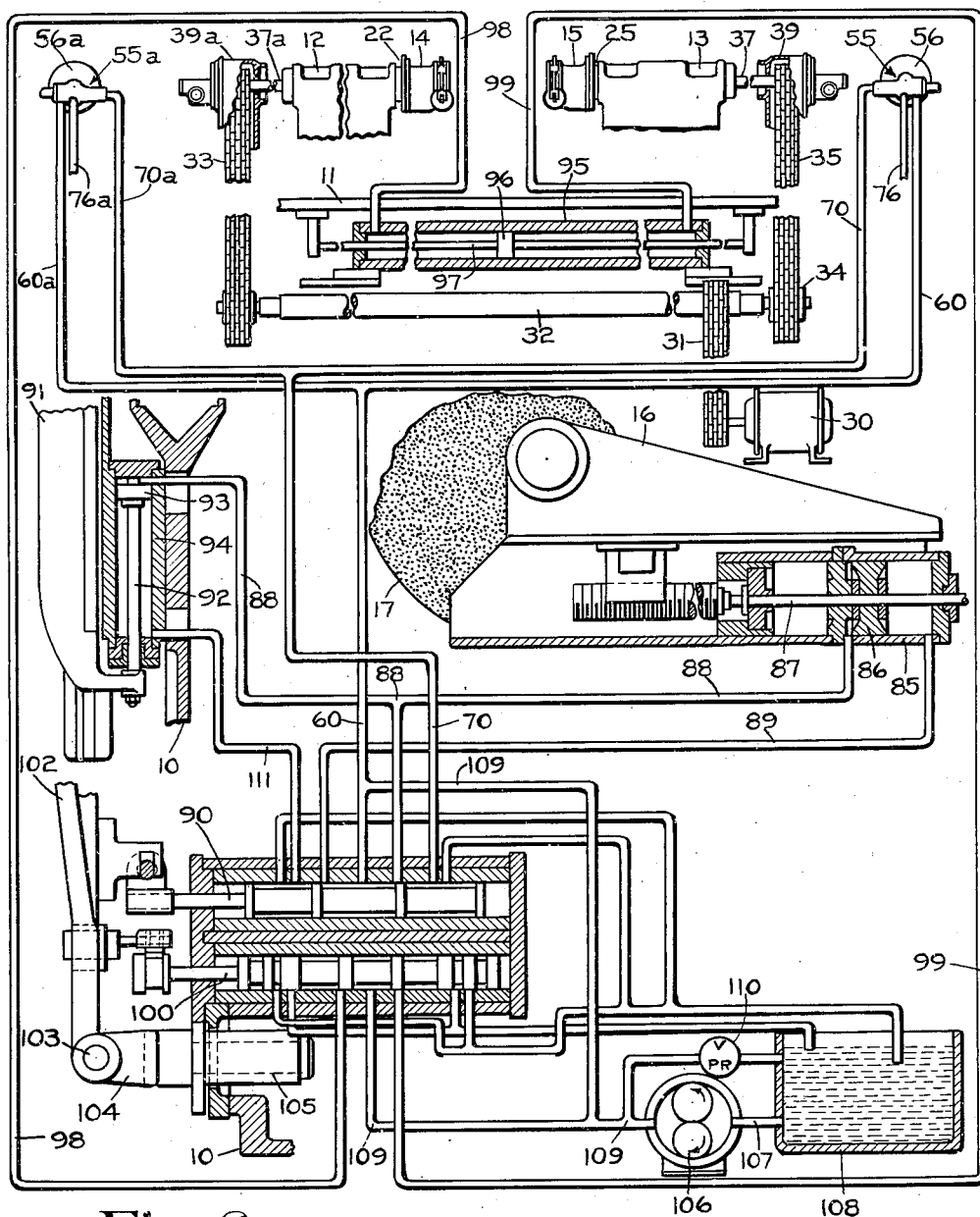


Fig. 6

Inventors

ALBIN V. SPONGBERG

HARRY G. PASHOIAN

384 *Harold W. Eaton* Attorney

UNITED STATES PATENT OFFICE

2,471,706

CRANKPIN GRINDING MACHINE

Albin V. Spongberg and Harry G. Pashoian,
Worcester, Mass., assignors to Norton Company,
Worcester, Mass., a corporation of Massachusetts

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5 Claims. (Cl. 51—237)

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This invention relates to grinding machines, and more particularly to a double head crank pin grinding machine.

One of the objects of this invention is to provide a readily controllable crank pin grinding machine. Another object is to provide a crank pin grinding machine with a pair of opposed aligned pot chucks for supporting and synchronously rotating the opposite ends of a crank shaft. Another object of the invention is to provide a control valve for controlling the admission to and exhaust of fluid from the hydraulically operated pot chucks. Another object of the invention is to provide a control valve which is arranged so that if the fluid pressure fails, the valve will automatically close to lock a column of fluid within the work clamping mechanism so that the clamp will not be released.

A further object of the invention is to provide a pot chuck control valve which is interconnected with the main control valve of the machine so that when a grinding operation has been completed and the main control valve shifted to cause a rearward movement of the wheel slide, the pot chuck control valve will be shifted under the influence of fluid under pressure to allow fluid to exhaust from the clamping cylinders and thereby to release the clamping jaw to facilitate a loading operation. Other objects will be apparent from the foregoing disclosure.

This invention accordingly consists in the features of construction, combinations of elements, and arrangements of parts as will be exemplified in the structure to be hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which is shown one of various possible embodiments of the mechanical features of the invention,

Fig. 1 is a front elevation of a crank pin grinding machine embodying the invention;

Fig. 2 is a vertical sectional view, on an enlarged scale, through the right hand work head showing the hydraulic work clamping mechanism;

Fig. 3 is an end elevation, partly in section, on an enlarged scale, of the right hand pot chuck;

Fig. 4 is a cross sectional view, on an enlarged scale, taken approximately on the line 4—4 of Fig. 2, through the control valve for controlling the hydraulically operated pot chucks;

Fig. 5 is a cross sectional view, taken approximately on the line 5—5 of Fig. 4; and

Fig. 6 is a hydraulic piping diagram of the hydraulic system.

A crank pin grinding machine has been illus-

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trated in the drawings comprising a base 10 which supports a longitudinally movable work supporting table 11. The table 11 serves as a support for a work driving and rotating mechanism comprising a pair of aligned spaced work heads 12 and 13 which are each provided with rotatable spindles for supporting a pair of spaced pot chucks 14 and 15 respectively.

The base 10 also serves as a support for a transversely movable wheel slide 16 which is slidably transversely relative to the base 10 on suitable ways (not shown). The wheel slide 16 serves as a support for a rotatable grinding wheel 17. The grinding wheel 17 may be driven in any suitable manner such as, for example, an electric motor 18 mounted on the upper surface of the wheel slide 16. The motor 18 is provided with an armature shaft 19 which supports a multi V-groove pulley 20. The pulley 20 is drivingly connected by multiple V-belts 21 with a multi V-groove pulley (not shown) which is mounted on the right hand end of the wheel spindle to rotate the grinding wheel 17.

The pot chuck 14 is mounted on the right hand end of a work head spindle 22 which is rotatably journaled in bearings in the work head 12.

A work head spindle 25 is rotatably journaled in bearings 26 and 27 which are in turn supported within the work head 13.

A work driving mechanism is provided for synchronously rotating the work spindle 22 and 25 respectively so as to rotate the opposite ends of a crank shaft 28 to be ground. This driving mechanism may comprise an electric motor 30 which is preferably mounted within the base 10 of the machine. The motor 30 is connected by means of a link chain 31 with a rotatable shaft 32. The shaft 32 is operatively connected by means of a link chain 33 to rotate the spindle 22. The shaft 32 is also provided with a sprocket 34 which is connected by means of a link chain 35 with a sprocket 36 which is keyed to a rotatable shaft 37 journaled within a bearing 38. The bearing 38 is fixedly mounted within the housing 39. The shaft 37 is drivingly connected with work spindle 25 in a manner to be hereinafter described. Both of the work driving mechanisms are identical and it is therefore not believed to be necessary to illustrate both work driving heads and mechanisms in detail.

The pot chucks 14 and 15 are identical in construction except that one chuck is right hand and the other left hand in arrangement. As illustrated in Fig. 3 pot chuck 15 has been shown in end elevation and partly broken away and

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shown in section. This chuck 15 comprises a half bearing member 40 which serves as a support for an end portion 41 of the crank shaft 28. A clamping arm 42 is pivotally supported on a stud 43. The short arm of the clamping arm 42 is provided with a clamping jaw 44. The long arm of the clamping arm 42 is provided with a stud 45 which is connected to one end of a piston rod 46. The pot chuck is provided with a hydraulic cylinder 47 which contains a slidably mounted piston 48. The piston 48 is connected by means of a stud 49 with the piston rod 46. The cylinder 47 is provided with a port 50 which is arranged to admit fluid under pressure to a cylinder chamber 51. It will be readily apparent from the foregoing disclosure that when fluid is admitted to the cylinder chamber 51, the piston 48 will move toward the right into the position illustrated in Fig. 3. This movement rocks the clamping arm 42 in a counter-clockwise direction so that the clamping jaw 44 engages and clamps the portion 41 of the crank shaft 28 into rigid engagement with the half bearing support 40. The pot chuck 14 is identical in construction and consequently has not been illustrated in detail.

A universal driving connection 52 is provided between the shaft 37 (Fig. 2) and the work head spindle 25. This universal connection comprises a pair of diametrically opposed rollers 53 and 53a which are rotatably supported on studs which are fixed relative to the shaft 37. The opposed rollers 53 and 53a slide in elongated slots 54 and 54a which are formed in a flanged member fixed to the spindle 25.

It is desirable to provide a suitable control valve for controlling the admission to and exhaust of fluid from the clamping cylinder 47. A control valve 55 (Figs. 4 and 5) is provided with an integral flanged member 56 which is in turn fixedly mounted on the right hand end of the housing 39. This control valve is preferably a piston type valve having a slidably mounted valve member 57. The slidably mounted valve member 57 comprises integral valve pistons 58 and 59 which are arranged so that the effective area of the piston 59 is considerably greater than the effective area of the piston 58. Fluid under pressure direct from a fluid pump to be hereinafter described passes through a pipe 60 and a port 61 into a valve chamber 62 formed at the right hand end of the valve piston 58. Fluid entering the valve chamber 62 forces the valve member 57 toward the left into the position illustrated in Fig. 4 so that fluid under pressure entering the chamber 62 raises the ball check valve 63 and passes into a chamber 64, through a passage 65 into a chamber 66 and then passes through a pipe 68. The pipe 68 extends through the hollow work head spindle 25 and is connected at its other end to the pot chuck 15. Fluid under pressure passing through the pipe 68 passes through a passage 69 and through the port 50 into the cylinder chamber 51 to swing the clamping arm 42 in a counter-clockwise direction to clamp the work piece within the pot chuck 15.

In order to unclamp the work piece, fluid may be passed through a pipe 70 through a port 71 into a chamber 72 formed at the left hand end of the valve 55, this pressure being the same as that admitted to the chamber 62. Due to the larger effective area of the piston 59 fluid under pressure admitted to the chamber 72 will cause the slidably mounted valve member 57 to move toward the right so that fluid from the cylinder chamber 51

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may exhaust through the port 50, the passage 69, the pipe 68, the chamber 66, and out through a port 73 (Fig. 4) through a valve chamber 74 formed between the valve pistons 58 and 59 and may pass out through an exhaust port 75 and pipe 76 which returns exhausting fluid to the reservoir to be hereinafter described.

A similar control valve 55a is provided for controlling the admission to and exhaust of fluid from the pot chuck 14. The control valve 55a is provided with an integral flanged member 56a which is fixedly mounted on the housing 29a. The details of the valve 55a have not been illustrated since this valve is identical with valve 55 above described. Fluid under pressure from the fluid pressure pump is passed through pipe 68a to actuate the clamping jaw of the pot chuck 14 to clamp the left hand end of the work piece 28 in position within the pot chuck 14. When it is desired to release the clamping jaw, fluid under pressure is passed through a pipe 70a to shift the control valve 55a to shift the valve to an exhaust position so that the clamping jaw of the pot chuck 14 will be unclamped.

In order to attain one of the objects of this invention it is desirable to construct the valve 55a so that in case the fluid pump fails or there is an appreciable drop in the pressure of the fluid within the system, the slidably mounted valve member 57 will be moved toward the right a sufficient distance so that the valve piston 58 closes the port connected to the ball check valve 63 and thus locks a column of fluid within the passages, chambers and the cylinder chamber 51 to hold the clamping jaw 44 in a clamped position thus preventing release of the work piece from the pot chuck 15. This mechanism preferably comprises a slidably mounted sleeve 77 which surrounds a stud 78 which is screw threaded into the slidably mounted valve member 57. A compression spring 79 surrounds the stud 78 and it is contained within apertures formed within the valve piston 59 and the member 77. The compression of the spring 79 is such that in case fluid pressure drops within the valve chamber 62, the compression of the spring 79 will move the slidably mounted valve member 57 toward the right until the head of the stud 78 engages the left hand end of the member 77 in which position the valve piston 58 has closed off the port connecting the valve chamber 62 with the ball check valve 63 thus automatically locking a column of fluid within the clamping cylinder 47 and the connecting passages and chambers.

It is desirable that the passage of fluid through pipes 70 and 70a be automatically controlled so that after a grinding operation has been completed and the wheel slide 16 moved to a rearward or inoperative position, fluid under pressure will be automatically conveyed through the pipes 70 and 70a to unclamp the pot chucks 14 and 15 respectively. In order to obtain this desired result the pipes 70 and 70a are preferably connected with the main control valve of the machine which may be arranged substantially the same as that shown in the prior U. S. Patent to H. A. Silven No. 2,151,666, dated March 21, 1939, to which reference may be had for details of disclosure not contained herein.

The hydraulic control system has been illustrated in Fig. 6 in which a hydraulic cylinder 85 is provided with a piston 86. The piston 86 is connected by a piston rod 87 with the old and

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well known grinding machine feed screw which is connected by the usual half nut with the wheel slide 16. It will be readily apparent from the foregoing disclosure that when fluid is admitted under pressure through a pipe 88 into the left hand end of the cylinder 85 the piston 86 will be moved toward the right to transmit a corresponding movement to the wheel slide 16 and grinding wheel 17. During this movement, fluid within the right hand chamber of the cylinder 85 may exhaust through a pipe 89.

A main control valve 90 is provided for controlling the admission to and exhaust of fluid from the wheel feed mechanism above described, to the work clamp mechanism above described and also to actuate a steadyrest to be hereinafter described.

A vertically movable steadyrest 91 is provided which may be moved vertically to and from an operative position. The details of this steadyrest have not been illustrated since this rest is identical with that shown in the prior patent to Silven above described. The steadyrest 91 is connected to the lower end of a piston rod 92. A piston 93 is fixedly mounted on the upper end of the piston rod 92 and is slidably mounted within a cylinder 94. The steadyrest as illustrated in Fig. 6 is shown in an uppermost or operative position. When it is desired to lower the steadyrest to an inoperative position after a grinding operation, fluid under pressure from the control valve 90 is passed through the pipe 88 into a chamber formed at the upper end of the cylinder 94 to cause a downward movement of the piston 93 and the steadyrest 91.

The table 11 is arranged to be traversed longitudinally by a fluid pressure mechanism comprising a cylinder 95 having a piston 96 slidably mounted therein. The piston 96 is connected to a double end piston rod which extends through the opposite ends of the cylinder 95 and is connected to brackets depending from the underside of the table 11. It will be readily apparent from the foregoing disclosure that when fluid under pressure is passed through a pipe 98 into a chamber formed at the left hand end of the cylinder 95, the piston 96 together with the table 11 will be traversed toward the right. During this movement of the table 11 fluid within a cylinder chamber formed at the right hand end of the cylinder 95 may exhaust through a pipe 99. Similarly if it is desired to traverse the table 11 toward the left, fluid may be admitted through the pipe 99 and exhausted through the pipe 98.

A control valve 100 is provided for controlling admission to and exhaust of fluid from the table cylinder 95.

A main control lever 102 is pivotally mounted on a stud 103 which is in turn mounted on a bracket 104. The bracket 104 is supported by a rock shaft 105. It will be readily apparent from the foregoing disclosure that the control lever 102 may be rocked about the stud 103 so as to control the position of the valve 90 in a manner substantially the same as that shown in the above mentioned Silven patent and may be moved in a plane at right angles thereto about the axis of the stud 105 which movement serves to control the position of the valve 100.

In order to provide a self-contained fluid pressure system for the machine, a reservoir 108 is formed within the base 10 of the machine. A motor driven fluid pressure pump 106 is operatively connected to draw fluid through pipe 107 from the reservoir 108 and to pass fluid under

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pressure through a pipe 109. Fluid under pressure in the pipe 109 passes to the control valve 90, the control valve 100 and simultaneously through the pipes 60 and 60a to the control valves 55 and 55a to actuate the clamping jaws.

After a grinding operation has been completed, the lever 102 is rocked in a clockwise direction about the axis of the stud 103 to move the valve 90 toward the right so as to pass fluid under pressure through the pipe 88 to move the wheel slide 16 and grinding wheel 17 rearward to an inoperative position and at the same time to move the steadyrest 91 downwardly to an inoperative position in a manner above described. When the control valve 90 reaches its extreme right hand end position, fluid under pressure will pass through the pipe 70 and 70a into control valves 50 and 50a respectively to unclamp the clamping jaws and thereby release the ground piece of work from the pot chucks 14 and 15.

The operation of this improved crank pin grinding machine will be readily apparent from the foregoing disclosure. A crank shaft 28 to be ground is placed in position within the pot chucks 14 and 15 respectively after which the control lever 102 is moved in a counter-clockwise direction into the position illustrated in Fig. 6 so that fluid under pressure will be passed through the pipes 60 and 60a to actuate the clamping jaws and thereby clamp the crank shaft within the pot chucks 14 and 15. After the control valve 90 has moved further toward the left, fluid under pressure will be passed through the pipe 89 to cause a forward feeding movement of the grinding wheel and after a still further movement of the valve 90 will be passed through a pipe 111 to raise the steadyrest 91 into an operating position relative to the work. In case there is a drop in fluid pressure within the pipes 60 and 60a, the released compression of the spring 79 will close the port so as to lock a column of fluid within the clamping cylinders and thus lock the clamping jaws in a clamped position. After a grinding operation has been completed the lever 102 may be moved in a clockwise direction to cause the grinding wheel to move to an inoperative position and the steadyrest to be lowered to an inoperative position. With the steadyrest and grinding wheel in inoperative positions, the control lever 102 may be rocked about the axis of the stud 105 to actuate the valve 100 and thereby traverse the table 11 to position the next crank pin in an operative position relative to the grinding wheel 17. After all of the crank pins have been ground, the control lever 102 may be rocked in a clockwise direction to shift the main control valve 90 to its extreme right hand position to unclamp the ground crank pin shaft.

It will thus be seen that there has been provided by this invention apparatus in which the various objects hereinabove set forth together with many thoroughly practical advantages are successfully achieved. As many possible embodiments may be made of the above invention and as many changes might be made in the embodiment above set forth, it is to be understood that all matter hereinbefore set forth, or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

We claim:

1. In a crankpin grinding machine having a transversely movable rotatable grinding wheel, a work support including a pair of opposed aligned work heads, a rotatable spindle in each of said heads, a pot chuck on the adjacent ends of each of said spindles, a pivoted clamping jaw

on each of said chucks, a piston and cylinder on each of said chucks to actuate said clamping jaws, means including a fluid pressure pump to supply fluid under pressure to each of said cylinders, independent control valve on each of said heads between the pump and the chuck cylinders, each of said control valves comprising a slidably mounted valve piston, a port in each of said valves to convey fluid under pressure to the pot chuck cylinders, a compression spring in each of said valves normally to maintain said port closed, direct fluid connections with an end chamber in each of said valves to shift said valve against the compression of said springs to open said port and thereby admit fluid under pressure to actuate the clamping jaws, and fluid connections to convey fluid under pressure simultaneously to an end chamber at the other end of each of said valves to shift said valves so as to unclamp said jaws.

2. In a crankpin grinding machine having a transversely movable rotatable grinding wheel, a pair of opposed aligned crank heads, a rotatable spindle in each of said heads, a pot chuck on the adjacent ends of each of said spindles, a clamping jaw pivotally mounted on each of said chucks, a piston and cylinder on each of said chucks to actuate said clamping jaws, means including a fluid pump for supplying fluid under pressure to said cylinders, a fluid actuated control valve on each of said heads, direct fluid connections between one end of said valve and the fluid pump normally to pass fluid under pressure direct from the pump to said cylinder, a manually operable main control valve for controlling the various mechanisms of the machine, and operative connections between said main control valve and the other end of said fluid actuated valve, said connections being arranged so that when the main control valve is shifted to a work unclamp position, fluid under pressure is passed to shift said fluid pressure actuated control valve to cut off the flow of fluid under pressure to said cylinder and to open an exhaust port to allow fluid to exhaust from said chuck cylinder and thereby to unclamp said jaw.

3. In a crankpin grinding machine having a transversely movable rotatable grinding wheel, a work support comprising a pair of aligned opposed work heads, a rotatable spindle in each of said heads, a pot chuck on each of said spindles including a pivotally mounted clamping jaw and a piston and cylinder to actuate said jaw, a fluid pump, means including a control valve to control the admission to and exhaust of fluid from said chuck cylinder to clamp and release said clamping jaw, a spring normally to maintain said valve in a closed position, direct connections between the fluid pump and said valve to open said valve and clamp said jaw to hold a crankshaft in said chuck, and fluid connections to close said valve after a grinding operation has been completed so as to exhaust fluid from the chuck cylinder and thereby unclamp said jaw to release the finished crankshaft.

4. In a crankpin grinding machine having a transversely movable rotatable grinding wheel, a work support comprising a pair of aligned opposed work heads, a rotatable spindle in each of said heads, a pot chuck on each of said spindles including a pivotally mounted clamping jaw

and a piston and cylinder to actuate said jaw, a piston type control valve including a slidably mounted valve member having a pair of spaced pistons each having differential effective piston areas, a valve chamber in the opposite ends of said valve, a port in the end chamber adjacent to the smaller piston area which is connected to convey fluid under pressure to said chuck cylinder, a compression spring normally to maintain said port closed, direct fluid connections between said pump and said chamber to supply fluid under pressure to open said port against the compression of said spring so as to actuate said clamping jaw, an exhaust port in said valve to exhaust fluid from said chuck cylinder which is closed while pressure is supplied to hold the clamping jaw in a clamped position, and connections between a main control valve and the valve chamber adjacent to the larger piston area to shift said valve piston so as to close said port and open said exhaust port after a grinding operation has been completed to release said clamping jaw.

5. In a crankpin grinding machine having a transversely movable rotatable grinding wheel, a work support comprising a pair of aligned opposed work heads, a rotatable spindle in each of said heads, a pot chuck on each of said spindles including a pivotally mounted jaw and a piston and cylinder to actuate said jaw, a fluid pump, a piston type control valve including a slidably mounted valve member having a pair of spaced pistons each having differential effective piston areas, a valve chamber in opposite ends of said valve, a port in the end chamber adjacent to the smaller piston area which is connected to convey fluid under pressure to said chuck cylinder, a compression spring normally to maintain said port closed, direct fluid connections between said pump and said chamber to supply fluid under pressure to open said port against the compression of said spring so as to actuate said clamping jaw, an exhaust port in said valve to exhaust fluid from said chuck cylinder which is closed when pressure is supplied to hold the clamping jaw in a clamped position, and connections between a main control valve and the valve chamber adjacent to the larger piston area to shift said valve piston so as to close said port and open said exhaust port after a grinding operation has been completed to release said clamping jaw, said spring being arranged to close said pressure port and thereby prevent release of the clamping jaw in case of failure of fluid pressure.

ALBIN V. SPONGBERG.
HARRY G. PASHOIAN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
509,992	Wood	Dec. 5, 1893
993,967	Debauche	May 30, 1911
1,755,937	Steiner	Apr. 22, 1930

FOREIGN PATENTS

Number	Country	Date
687,096	Germany	Jan. 22, 1940