Nov. 30, 1948. F. W. FOUDY 2,455,002

CRANKPIN GRINDING MACHINE

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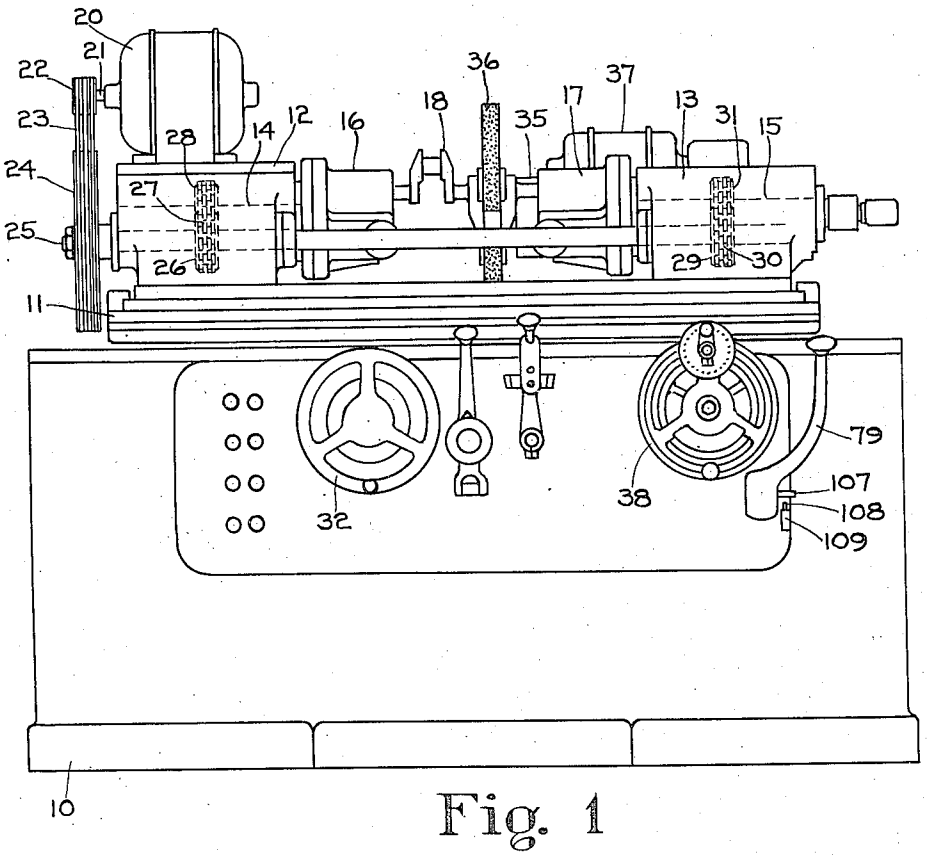


Fig. 1

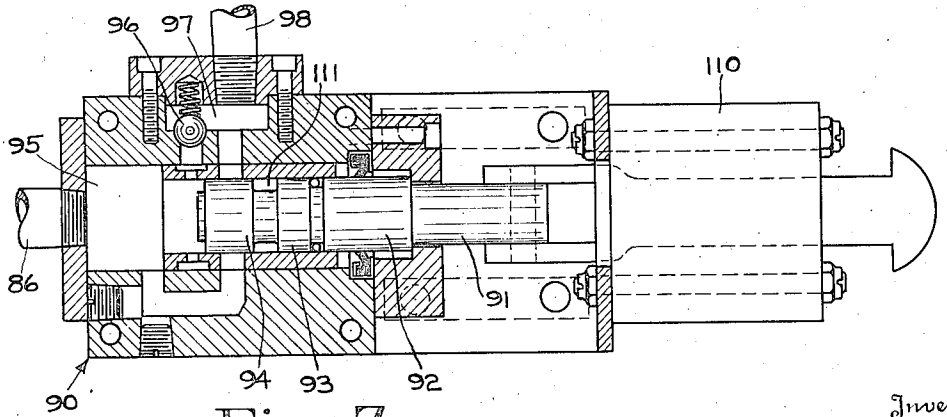


Fig. 7

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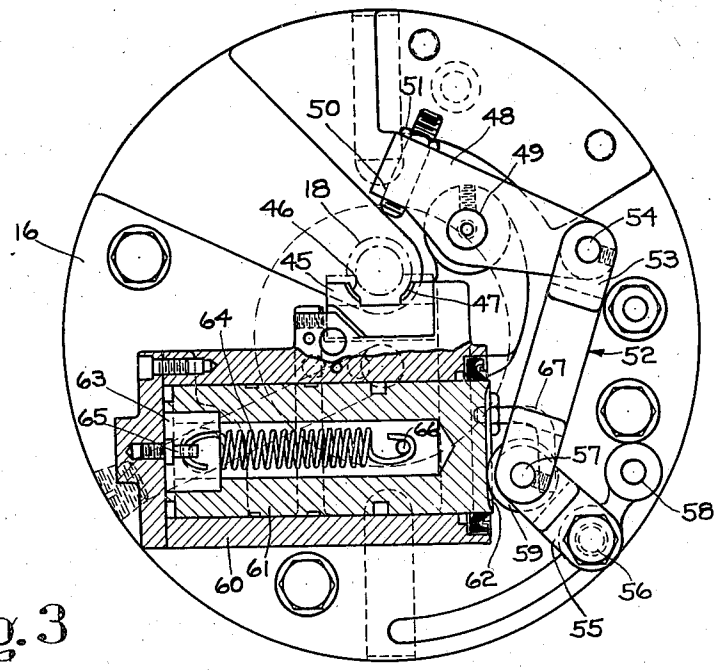


Fig. 3

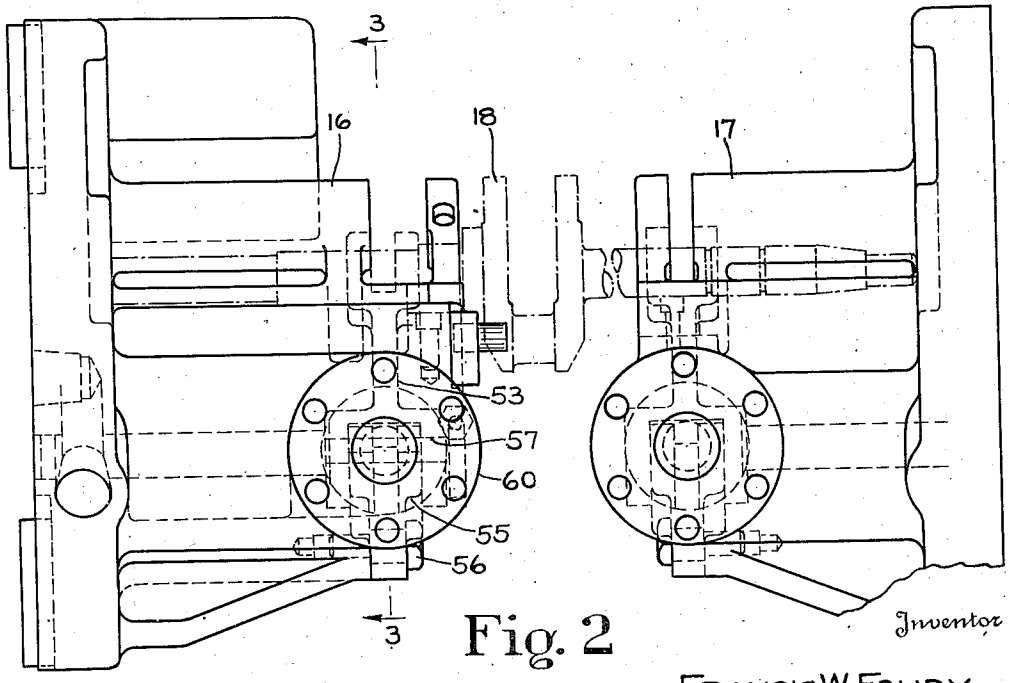


Fig. 2

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CRANKPIN GRINDING MACHINE

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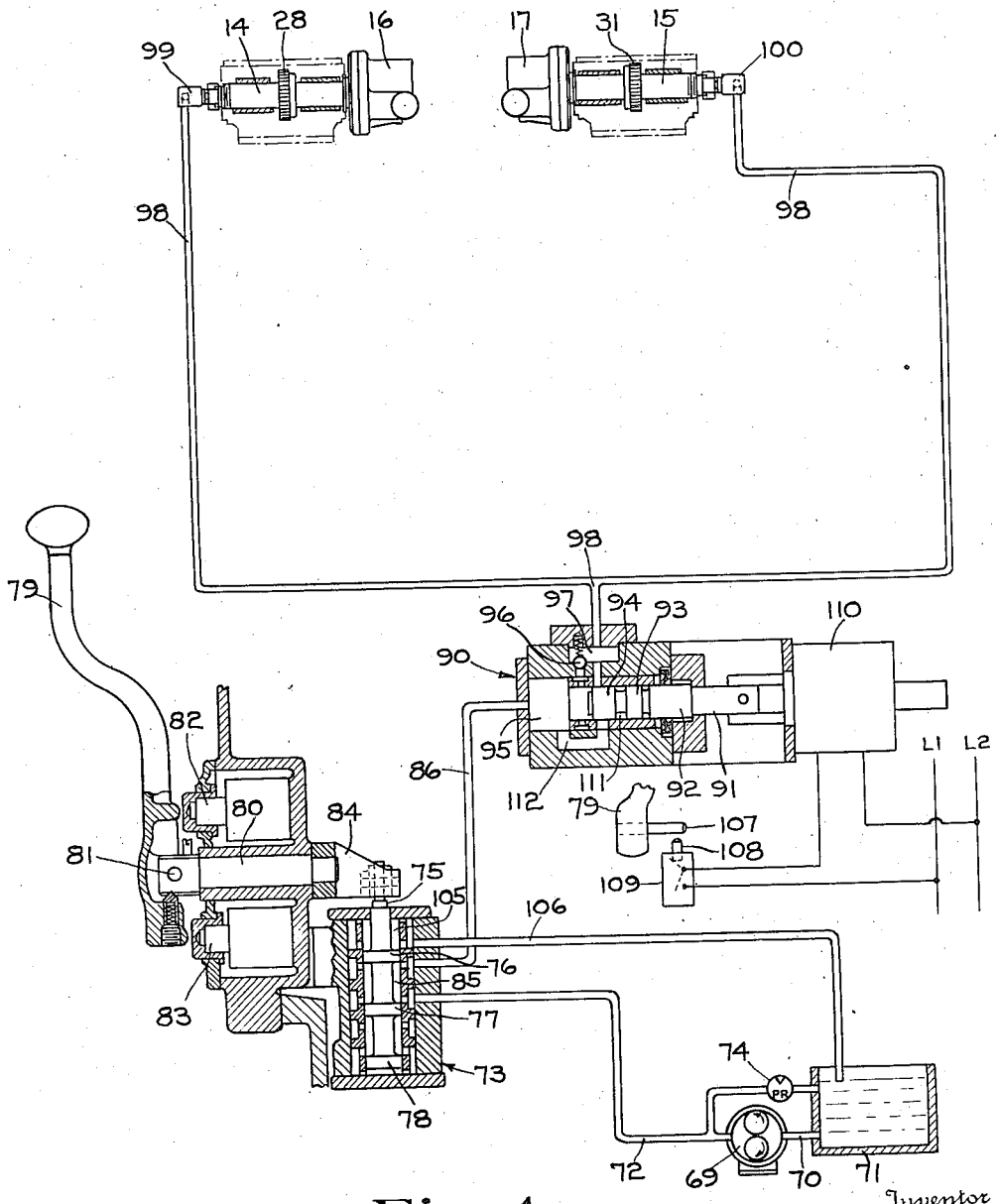


Fig. 4

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CRANKPIN GRINDING MACHINE

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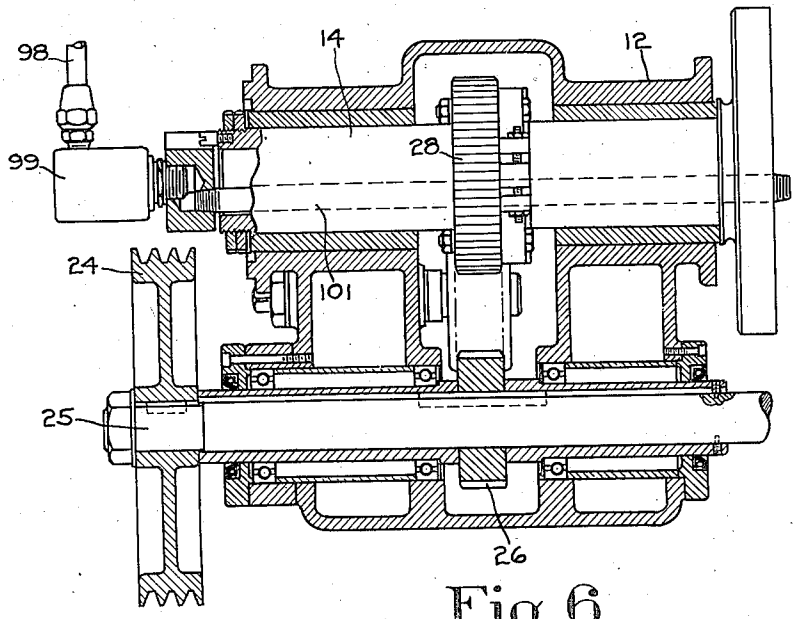


Fig. 6

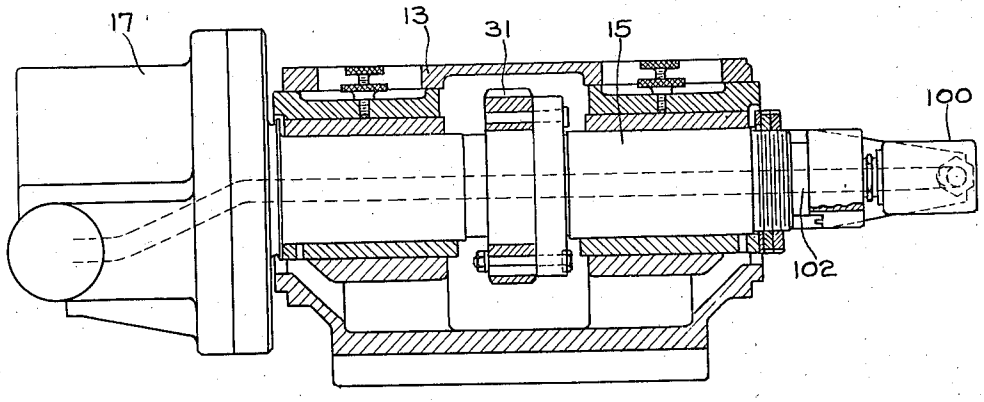


Fig. 5

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UNITED STATES PATENT OFFICE

2,455,002

CRANKPIN GRINDING MACHINE

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Application June 15, 1946, Serial No. 677,000

8 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 of the invention is to provide a crank pin grinding machine with a pair of opposed aligned pot chucks for simultaneously and synchronously supporting and rotating the opposite ends of a crank shaft. Another object of the invention is to provide an improved hydraulically operated pot chuck for supporting a crank shaft. Another object of the invention is to provide a pot chuck having a pivotally mounted clamping arm and a hydraulically actuated toggle lever mechanism to actuate said clamping jaw. A further object of the invention is to provide a safety control valve to admit fluid under pressure simultaneously to the opposed pot chucks which is arranged to trap fluid within the pot chuck cylinders to prevent release of a crank shaft during a grinding 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 the improved crank shaft grinding machine;

Fig. 2 is a fragmentary front elevation, on an enlarged scale, of the pair of opposed pot chucks;

Fig. 3 is a right hand elevation, on an enlarged scale, of the left hand pot chuck, partly in section to more clearly illustrate the hydraulic actuating mechanism therefor;

Fig. 4 is a fragmentary hydraulic piping and electrical wiring diagram showing the pot chuck controlling mechanism;

Fig. 5 is a vertical sectional view, on an enlarged scale, through the right hand work head;

Fig. 6 is a similar longitudinal sectional view, on an enlarged scale, through the left hand work head showing a portion of the spindle driving mechanism; and

Fig. 7 is a sectional view, on an enlarged scale, through the safety control valve for the pot chucks.

An improved crank pin grinding machine has been illustrated in the drawings comprising a base

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10 which serves as a support for a longitudinally reciprocable work table 11. The work table 11 serves as a support for a pair of spaced work heads 12 and 13 which support a pair of rotatable spindles 14 and 15 respectively. A pot chuck 16 is mounted on the inner end of the spindle 14. A similar pot chuck 17 is mounted on the inner end of the work spindle 15 in axial alignment with the pot chuck 16. The pot chucks 16 and 17 are arranged to support and synchronously rotate the opposite ends of a crank shaft 18.

The pot chucks 16 and 17 are preferably motor driven by means of an electric motor 20 which is mounted on the upper surface of the work head 12. The motor 20 is provided with a motor shaft 21 which supports a multiple V-groove pulley 22 which is connected by multiple V belts 23 with a multiple V-groove pulley 24 which is mounted on the left hand end of a rotatable shaft 25. The ends of the shaft 25 are supported in suitable bearings mounted in the work heads 12 and 13 respectively.

In order to synchronously rotate the spindles 14 and 15 and the pot chucks 16 and 17, a sprocket 26 is supported on the shaft 25. The sprocket 26 is connected by a link chain 27 with a sprocket 28 mounted on the spindle 14. Similarly, a sprocket 29 is mounted adjacent to the other end of the shaft 25. The sprocket 29 is connected by a link chain 30 with a sprocket 31 which is mounted on the work spindle 15. It will be readily apparent from the foregoing disclosure that rotation of the motor shaft 21 will be imparted through the V belt drive above described to rotate the drive shaft 25 and thereby synchronously to rotate the work spindles 14 and 15 and the pot chucks 16 and 17.

A suitable traversing mechanism is provided for longitudinally moving and positioning the work table 11. This mechanism may comprise a manually operable traverse wheel 32 which is connected through a gear and rack mechanism (not shown) that the table 11 to traverse the same in either direction so as to position the crank shaft 18 relative to the grinding wheel 36.

The base 10 also serves as a support for a transversely movable wheel slide 35 which supports a grinding wheel 36 on a wheel spindle (not shown). An electric motor 37 is operatively connected to rotate the wheel spindle and the grinding wheel 36. A suitable wheel feeding mechanism may be provided for feeding the grinding wheel toward and from the work to produce the desired grinding action. This mechanism may comprise a manually operable feed wheel 38 which

is arranged to rotate the feed screw (not shown) to impart the desired transverse movement to the wheel slide 35. The nut and screw feed mechanism has not been illustrated in detail since such mechanisms are old and well known in the art. This feed mechanism may be substantially the same as that shown in the expired United States patent to C. H. Norton, No. 762,838 dated June 14, 1904, to which reference may be had for details of disclosure not contained herein.

An improved hydraulically operated pot chuck is provided for supporting, clamping and rotating the opposite ends of a crank shaft 18. The left hand pot chuck 16 may comprise a relatively fixed crank shaft supporting member 45 which is provided with a pair of spaced supporting surfaces 46 and 47 to position and support a crank shaft 18. The supporting member 45 is preferably fixedly mounted relative to the pot chuck 16 so as to locate the crank shaft with its axes of rotation offset relative to the axis of rotation of the spindle 14 by a distance equal to the throw of the crank pins on the crank shaft 18. The pot chuck 16 is provided with a pivotally mounted clamping arm 48 which is pivotally supported on a stud 49. The clamping arm 48 is provided with an adjustably positioned screw 50 which is held in adjusted position by means of a lock nut 51. The screw 50 serves to engage the crank shaft 18 and to lock the shaft 18 in position relative to the pot chuck 16.

In order to positively actuate the clamping arm 48 and to lock the same in a clamped position, a suitable toggle lever mechanism 52 is provided comprising a toggle lever 53 which is pivotally connected at its upper end with the clamping arm 48 by means of a stud 54. A second toggle lever 55 is pivotally supported at its lower end by means of a stud 56 which is fixedly mounted relative to the pot chuck 16. A pivot stud 57 is provided to connect the adjacent ends of the toggle levers 53 and 55. A stop pin 58 is fixedly mounted on the pot chuck 16 and is arranged to limit the swinging movement of the toggle levers 53 and 55 when moved into the work clamped position. It will be readily apparent from the foregoing disclosure that by adjusting the position of the screw 50 relative to the clamping arm 48, the desired clamping pressure may be obtained to lock the crank shaft 18 in the pot chuck 16 when the toggle levers 53 and 55 are moved into engagement with the stop pin 58.

The right hand pot chuck 17 is identical in construction with the pot chuck 16, consequently only the pot chuck 16 has been illustrated and described in detail.

In the preferred construction, a hydraulically operated mechanism is provided for actuating the toggle lever mechanism 52 and the clamping arm 48. This mechanism may comprise a hydraulic cylinder 60 which is fixedly mounted on the pot chuck 16. The cylinder 60 contains a slidably mounted piston 61 having an actuating surface 62 on its right hand end (Fig. 3) which engages a rotatable actuating roller 59 which is rotatably supported on the stud 57.

When fluid under pressure is admitted to a cylinder chamber 63 formed at the left hand end of the cylinder 60, the piston 61 will move toward the right (Fig. 3) to move the actuating roller and the toggle lever mechanism 52 to swing the clamping arm 48 in a counter clockwise direction so that the screw 50 engages and clamps the crank shaft 18 in rigid engagement with the crank shaft supporting member 45.

A yieldable mechanism such as a tension spring 64 is provided for returning the piston 61 into its left hand end position when it is desired to unclamp the crank shaft 18. The left hand end of the spring 64 is connected to a stud 65 carried by the cylinder head on the left hand end of the cylinder 60. The right hand end of the spring 64 is connected to a stud 66 which is fixedly mounted relative to the piston 61. In order to return the toggle levers 53 and 55 into the unclamped position as illustrated in Fig. 3, a hook shaped member 67 is mounted on the right hand end of the piston 61. The hook shaped member 67 is arranged to engage the stud 57 when the piston 61 is moved toward the left so as to swing the toggle levers and thereby to swing the clamping arm 48 in a clockwise direction to release the crank shaft 18.

A fluid pressure system is provided for supplying fluid under pressure to actuate the hydraulic pot chucks and other mechanisms of the machine. This system may comprise a motor driven fluid pressure pump 69 which draws fluid through a pipe 70 from a reservoir 71 which is preferably located within the base 10 of the machine. The pump forces fluid under pressure through a pipe 72 to a control valve 73 to be hereinafter described. A relief valve 74 is connected in the pipe line 72. The relief valve 74 is preferably an adjustable type relief valve so that the operating pressure within the hydraulic system may be varied as desired. Excess fluid under pressure within the system will cause the relief valve 74 to open to return the excess fluid under pressure to the reservoir 71.

The control valve 73 is preferably a piston type control valve comprising a valve stem 75 having valve pistons 76, 77, and 78 formed integrally therewith. A manually operable control lever 79 is pivotally supported on a rock shaft 80 by means of a stud 81 so that the control lever 79 may be moved in two directions, namely toward and from the base about the stud 81 as a pivot and also rocked parallel to the front of the base by a rocking movement of the rock shaft 80. The control lever 79 is arranged to actuate electric push button switches 82 and 83 which are old and well known in machines of this type and which are arranged to control the infeeding movement of the grinding wheel in a manner similar to that disclosed in the prior U. S. patent to B. H. Goehring, No. 2,151,660, dated March 21, 1939, to which reference may be had for details of disclosure not contained herein.

The inner end of the rock shaft 80 carries a rock arm 84 which is operatively connected at its other end to the valve stem 75. As illustrated in Fig. 4 fluid under pressure passing through the pipe 72 enters a valve chamber 85 located between the valve pistons 76 and 77 and passes out through a pipe 86 to a safety valve 90 to be hereinafter described. When the valve 73 is in the position illustrated in Fig. 4 fluid under pressure passes through the pipe 86 to actuate the clamping arms on the pot chucks 16 and 17 to rock the crank shaft 18 in engagement therewith during a grinding operation. After a grinding operation has been completed, the lever 79 may be rocked in a clockwise direction (Fig. 1) which transmits a clockwise movement to the rock arm 84 thereby raising the valve stem 75 so that fluid exhausting through the pipe 86 into the valve chamber 85 may pass outwardly through an exhaust pipe 106 into the reservoir 71.

In order to positively lock the pot chucks in a

work clamped position, it is desirable to provide a suitable safety control valve 90 whereby fluid within the pot chuck cylinders is locked at all times so that in case of a drop in pressure or failure of the fluid pump, the clamping arms can not be released. The safety control valve 90 is preferably a piston type valve comprising a valve stem 91 having valve pistons 92, 93, and 94 formed integrally therewith. Fluid under pressure passing through the pipe 86 enters a valve chamber 95 located at the left hand end of the safety control valve 90 (Figs. 3 and 7). Fluid under pressure entering the valve chamber 95 serves to move the valve piston 94 together with the valve stem 91 toward the right so that fluid under pressure may pass through a ball check valve 96 into a chamber 97 and through a pipe 98 simultaneously to the work heads 12 and 13. The pipe 98 connects with rotatably mounted connectors 99 and 100 respectively which are mounted on the outer ends of the work spindles 14 and 15, simultaneously to convey fluid under pressure through passages 101 and 102 within the spindles 14 and 15 respectively simultaneously to actuate both of the pot chucks 16 and 17 to clamp the opposite ends of the crank shaft 18 therein. It will be readily apparent from the foregoing disclosure that in case of a drop in pressure of the fluid within the pipe 86 caused either by leakage or failure of the pressure pump 69, the ball check valve 96 which automatically closes thus locking and trapping a column of fluid in the pipes 98 and the associated parts to lock the fluid within the clamping cylinders 60 on each of the pot chucks 16 and 17.

When it is desired to unclamp a crank shaft after a grinding operation has been completed, it is desirable to allow fluid to exhaust through the pipe 98 thus requiring only a single pipe connection between the source of fluid under pressure and the hydraulic clamping mechanism. An electric solenoid 110 is operatively connected to the valve stem 91. When the solenoid 110 is actuated, the valve stem 90 is moved toward the left so that the valve piston 94 closes off the passage to the ball check valve 96 and moves the valve pistons 94 and 93 so that fluid may exhaust from the pipe 98 through a valve chamber 111 located between the valve pistons 93 and 94 and to allow fluid to exhaust through the passage 112 into the valve chamber 95 and out through the pipe 86 into the valve chamber 85 and out through the exhaust pipe 106 into the reservoir 71. The tension springs 64 within the pot chuck pistons serve to rapidly move the pistons 61 into an unclamped position thereby forcing fluid from the cylinder chambers 63 through the exhaust passage just previously described rapidly to swing the clamping arms 48 to an unclamped position after a grinding operation has been completed. It will be readily apparent from the foregoing disclosure that a simplified hydraulic safety connection is provided including a single pipe line and a safety control valve to convey fluid to and exhaust fluid from both of the pot chucks 16 and 17 simultaneously. As above described this safety control valve serves to lock fluid within the system thereby preventing an unclamping of a crank shaft during a grinding operation in case of failure of the fluid pressure system.

It is desirable to provide suitable electric connections whereby the solenoid 110 may be automatically energized when the control lever 79 is moved in a clockwise direction (Fig. 1) to shift the cnotrol valve 73 to an exhausting position. This inter-connection comprises a stud 107 mounted on the control lever 79. The stud 107 is arranged to engage the actuating plunger 108 of a normally open limit switch 109, when the control lever 79 is moved in a clockwise direction (Fig. 1) to shift the control valve 73 to an exhausting position, to close an electric circuit thereby energizing the solenoid 110 to shift the valve stem 91 to its extreme left hand position thereby opening an exhaust passage so that when the valve 73 is shifted to an exhausting position fluid may be readily and quickly exhausted from the hydraulic cylinders 60 on both of the pot chucks 16 and 17 respectively.

The operation of this improved crank pin grinding machine will be readily apparent from the foregoing disclosure. Assuming the machine to have been previously adjusted for a given crank shaft, the crank shaft 18 is inserted in position with its opposite ends supported by the crank shaft supporting members 45 of the pot chucks 16 and 17. The control lever 79 is then swung into the position illustrated in Figs. 1 and 4 so that fluid under pressure from the pump passes through the pipe 72 into the control valve 73 in a manner above described and then through the pipe 86 to shift the control valve 90 into the position illustrated in Fig. 4 so that fluid under pressure is passed through the pipes 98 into both of the cylinders 60 on the pot chucks 16 and 17 respectively to swing the clamping arms 48 so as to lock the opposite ends of the crank shaft 18 rigidly in position on the supporting members 45 and maintaining the parts in this position during a grinding operation. After a grinding operation has been completed, the lever 79 is then moved in a clockwise direction so that the valve stem 75 is shifted upwardly to position the valve pistons in a fluid exhaust position. At the same time the pin 107 on the lever 79 actuates the plunger 108 to close the limit switch 109 thus energizing the solenoid 110 to shift the safety control valve stem 91 toward the left into a work unclamped position thus allowing the released tension of the springs 64 rapidly to unclamp the opposite ends of the crank shaft 18 from the pot chucks 16 and 17 after a grinding operation has been completed.

It will thus be seen 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.

I claim:

1. In a crank pin grinding machine having a work head, a rotatable spindle supported thereby, a pot chuck on one end of said spindle including a crank shaft support fixedly mounted on said chuck, a pivotally mounted clamping arm on said chuck to clamp a crank shaft on said support, a fluid pressure piston and cylinder to actuate said clamping arm, a piston type safety valve therefor which is arranged so that fluid under pressure opens said valve, a ball check valve associated with the safety valve to pass fluid under pressure to said chuck cylinder, and a solenoid to close said valve to exhaust fluid from the pot chuck.

2. In a crank pin grinding machine having a work head, a rotatable spindle supported thereby, a pot chuck on one end of said spindle including

a crank shaft support fixedly mounted on said chuck, a pivotally mounted clamping arm on said chuck to clamp a crank shaft on said support, a fluid pressure piston and cylinder to actuate said clamping arm, a piston type safety valve therefor which is arranged so that fluid under pressure opens said valve, a manually operable control valve to admit fluid to or exhaust fluid from said safety valve, a ball check valve associated with the safety valve to pass fluid under pressure to said chuck cylinder, a solenoid to close said valve so as to exhaust fluid from the pot chuck cylinder, and a switch actuated by and in timed relation with the control valve to energize said solenoid.

3. In a crank pin grinding machine having a work head, a rotatable spindle supported thereby, a pot chuck on one end of said spindle including a crank shaft support fixedly mounted on said chuck, a pivotally mounted clamping arm on said chuck to clamp a crank shaft on said support, a fluid pressure piston and cylinder to actuate said clamping arm, a piston type safety valve therefor which is arranged so that fluid under pressure opens said valve, a ball check valve between said safety valve and the pot chuck cylinder to pass fluid under pressure to said chuck cylinder, and a solenoid to close said valve to exhaust fluid from the pot chuck cylinder when it is desired to unclamp the crank shaft, said ball check valve being arranged to pass fluid under pressure to the chuck cylinder so as to trap fluid therein.

4. In a crank pin grinding machine as claimed in claim 1, in combination with the parts and features therein specified of a manually operable control valve, a single pipe to convey fluid under pressure to and exhaust fluid from said safety valve and pot chucks, a manually operable control lever for said control valve, and a limit switch actuated by said lever when the lever is shifted to position said control valve in an exhaust position to energize said solenoid and thereby shift the safety valve to an exhaust position to unclamp a crank shaft.

5. In a crank pin grinding machine having a rotatable work spindle, a pot chuck on said spindle including a relatively fixed crank shaft support on said chuck, a clamping arm pivotally supported on said chuck to clamp a crank shaft in said support, a toggle lever mechanism interposed between the clamping arm and chuck for actuating said clamping arm, a fluid pressure piston and cylinder mechanism for actuating said toggle lever mechanism, a stop to limit the movement of the toggle levers, and an adjustable screw on the clamping arm to facilitate obtaining the desired clamping pressure when the toggle levers are in a stopped position.

6. In a crank pin grinding machine having a rotatable work spindle and a pot chuck thereon including a relatively fixed crank shaft support

on said chuck, a clamping arm pivotally supported on said chuck to clamp a crank shaft in said support, a toggle lever mechanism for actuating said clamping arm in which one of the toggle levers is pivotally connected to the clamping arm, the other of said toggle levers is pivotally connected to said chuck, a pivot stud connecting the adjacent ends of said toggle levers, a roller on said stud, a hydraulic cylinder on said chuck, and a piston therein which engages said roller to actuate said toggle levers and a clamping arm to clamp a crank shaft in said chuck.

7. In a crank pin grinding machine having a rotatable spindle and a pot chuck having a relatively fixed crank shaft support thereon, a clamping arm pivotally supported on said chuck to clamp a crank shaft in said support, a toggle lever mechanism for actuating said clamping arm in which one of the toggle levers is pivotally connected to the clamping arm, the other of said toggle levers is pivotally connected to said frame, a pivot stud connecting the adjacent ends of said toggle levers, a roller on said stud, a hydraulic cylinder on said chuck, a piston therein which engages said roller to actuate said toggle levers and clamping arm to clamp a crank shaft in said chuck, a stop on said chuck to limit the movement of the toggle levers, and an adjusting screw on the clamping arm to facilitate obtaining the desired clamping pressure when the toggle levers are in a stopped position.

8. In a crank pin grinding machine having a work head, a rotatable spindle supported thereby, a pot chuck on one end of said spindle including a crank shaft support fixedly mounted on said chuck, a pivotally mounted clamping arm on said chuck to clamp a crank shaft on said support, a toggle lever mechanism for actuating said clamping arm in which one of the toggle levers is pivotally connected to the clamping arm, the other of said toggle levers is pivotally connected to the chuck, a pivot stud connecting the adjacent ends of said toggle levers, a roller on said stud, a fluid pressure piston and cylinder, said piston being arranged to engage said roller to actuate said toggle levers, means to admit fluid under pressure to said cylinder to clamp a crank shaft in said chuck, and a spring to unclamp said arm and exhaust fluid from said cylinder to unclamp a crank shaft.

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REFERENCES CITED

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

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