Feb. 20, 1934. A. N. RUSSELL ET AL 1,948,189

WOOD GRINDING MACHINE

Filed Feb. 27, 1930 3 Sheets-Sheet 1

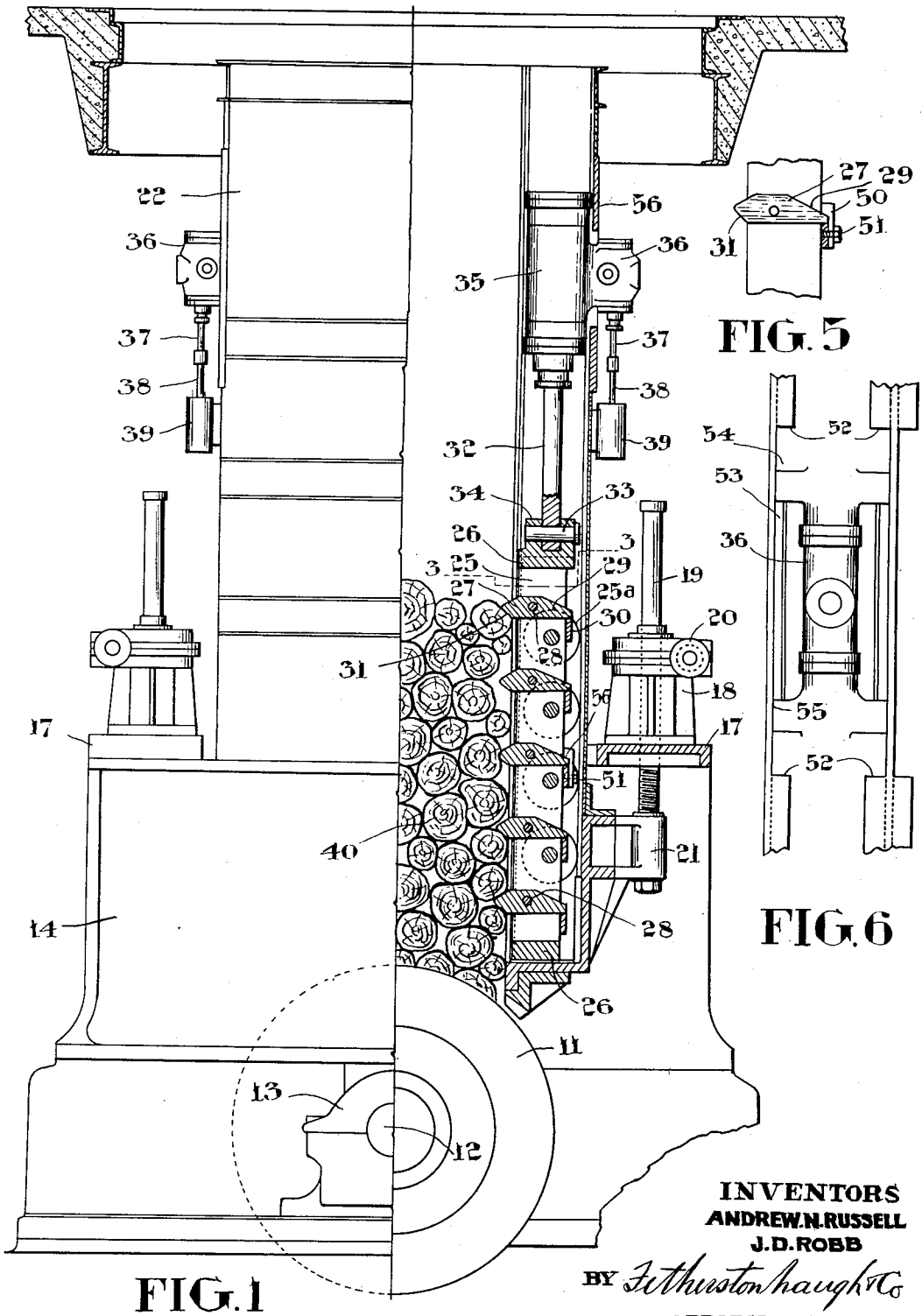


FIG. 1

FIG. 5

FIG. 6

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WOOD GRINDING MACHINE

Filed Feb. 27, 1930 3 Sheets-Sheet 2

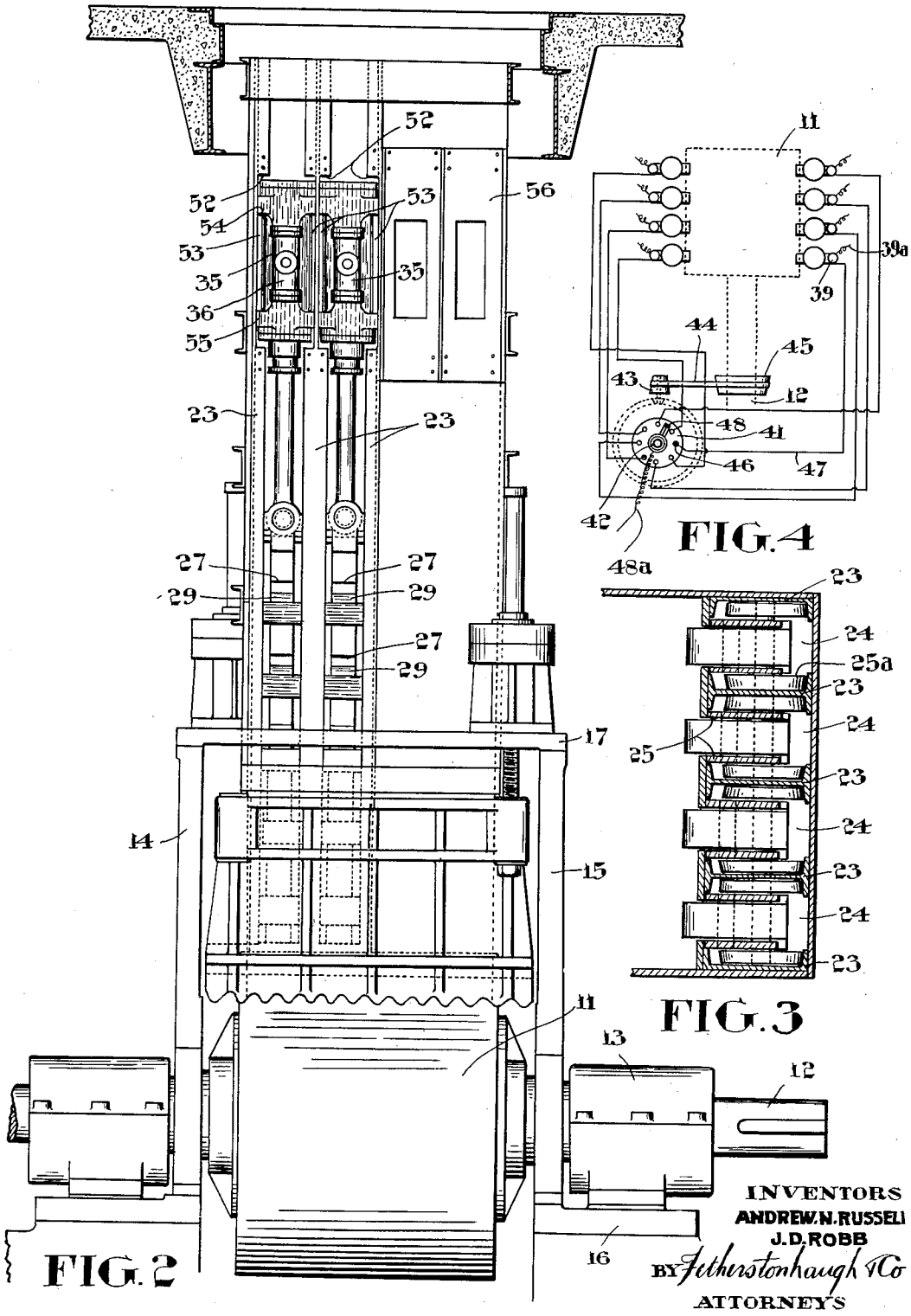


FIG. 2

FIG. 4

FIG. 3

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Filed Feb. 27, 1930 3 Sheets-Sheet 3

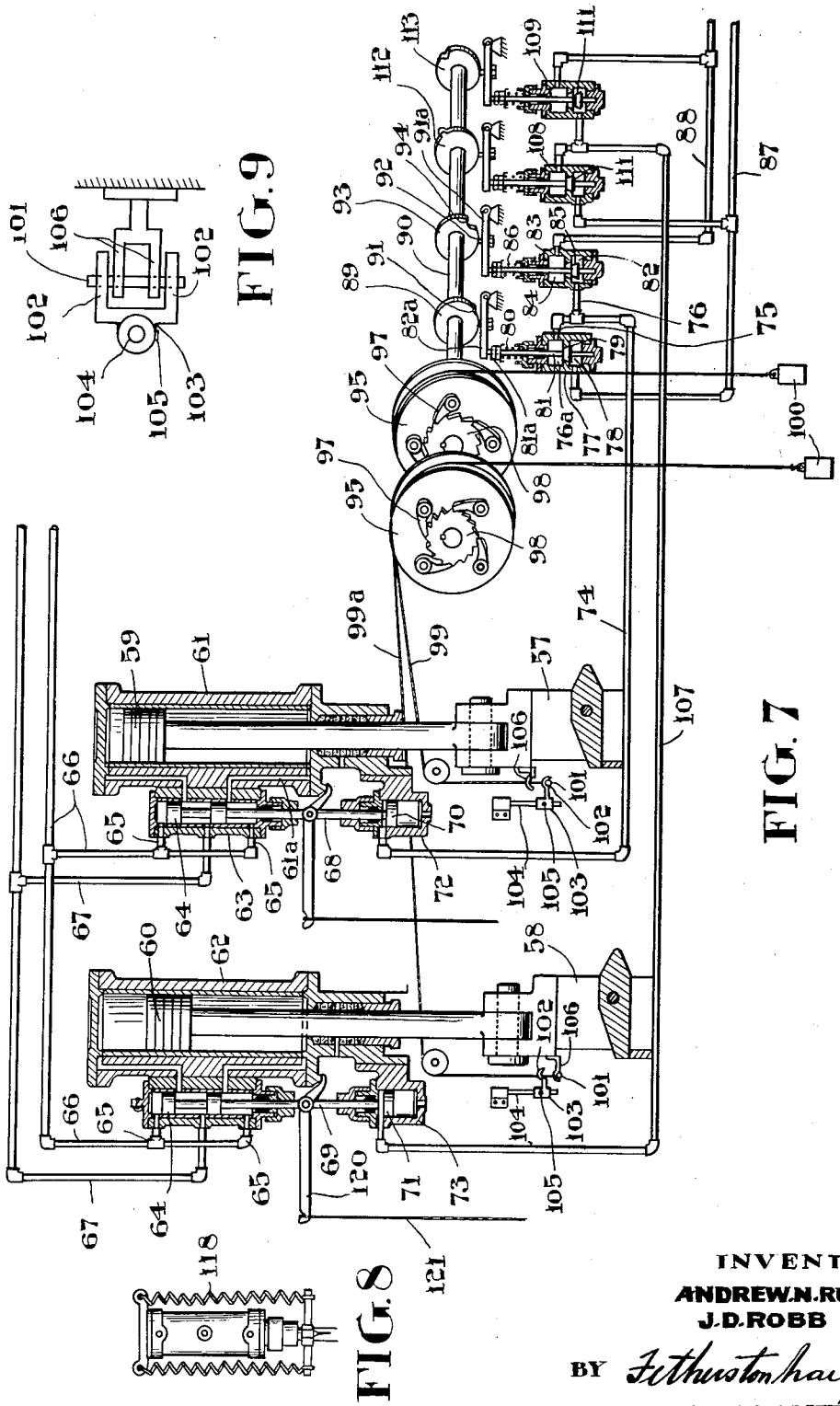


FIG. 7

FIG. 8

FIG. 9

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UNITED STATES PATENT OFFICE

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WOOD GRINDING MACHINE

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Application February 27, 1930. Serial No. 431,908

8 Claims. (Cl. 83—75)

This invention relates to pulp wood grinders of the continuous feed or magazine type.

The pocket type of grinder in general use before the advent of the magazine grinder consisted of a plurality of wood receiving pockets equipped with hydraulic pressure plates or followers functioning to feed the wood to the working surface of the grinding element. This type of grinder has certain advantages incident to the direct application of hydraulic or elastic operating fluid, but the disadvantages, such as high operating cost with comparatively low output, led to the development of the magazine grinder.

Magazine grinders are usually equipped with endless belts having specially formed links or other devices for engaging and feeding the wood to the working surface of the grinding element. These chains are operated at a very slow constant speed from either an oil or an electric motor through the intermediary of a complicated reduction gearing. This arrangement, as compared with the pocket type grinder, provides for continuous feeding of the wood to the grinding element and has certain other advantages, such as low labor costs incident to magazine charging and general operation. The principal disadvantage of the magazine grinder resides in the fact that the chains or other devices employed for feeding the wood to the grinding element are operated by a driving mechanism which lacks the elasticity of the direct hydraulic feed employed in the pocket type grinder and it is well recognized that, from a grinding standpoint, the best results are obtained when the wood is pressed to the grinding surface by the direct application of fluid pressure.

The purpose of the present invention is to provide an improved type of magazine grinder in which the wood is continuously fed to the working surface of the grinding element by the direct application of fluid pressure.

According to this invention, the wood charge placed in the magazine is continuously fed to the working surface of a rotary grindstone by means of two groups of reciprocable feed members arranged at opposite sides of the magazine and actuated by the direct application of fluid pressure. These feed members are each provided with a plurality of pivotally mounted pawls normally arranged to apply feeding pressure to the wood charge only during movement of the members in the direction of the grindstone. During reverse movement of said members, the pressure applying pawls are automatically retracted from engagement with the wood charge so that the feeding members are permitted to slide freely past the wood during such return movement. Each feed member is connected to a piston operating in a cylinder equipped with a valve controlling the flow of operating fluid in such manner that the piston and the feed member connected therewith are alternately moved towards and away from the grindstone. The application of a relatively high pressure to move the feed members on their working strokes and a relatively low pressure to effect return movement of the feed members is described and claimed in applicants' co-pending application Serial Number 612,125, filed May 18, 1932. The valves controlling the various cylinders may be operated either manually or automatically in order to reverse the movement of the pistons and the feed members connected therewith, but it is preferred that these valves be operated in such a manner that when one of the feed members is moving away from the grindstone, the remaining feed members will all be moving in the opposite direction, so that the mass of wood contained in the magazine will be continuously subjected to a substantial and uniform feeding pressure. For example, assuming that four feeding members are provided at each side of the magazine, the flow of fluid to and from the cylinders controlling said feed members will preferably be controlled in such manner that when one of the feed members is moving away from the grindstone the remaining feed members will be moving in the direction of said stone, so that the charge of wood is, at all times, subjected to the pressure of seven of the operating cylinders. As the rate at which the feed members move, during the working strokes, is retarded by the grinding operation and is considerably slower than the rate at which the feed members move during the return strokes, it will be seen that the period of time when only seven of the eight cylinders are applying pressure to the wood will be comparatively short and that, during the greater part of the grinding operation, the wood is subjected to the pressure of all of said cylinders. When it is desired to remove the load from the grindstone, the feeding members may be employed as lifting devices for lifting the wood charge away from the working surface of the stone. In order to accomplish this, suitable means are provided for securing the pawls of certain feed members against pivotal movement so that, during the return stroke of said members the pawls will apply pressure to move the wood charge in a direction away from the working surface of the stone.

Proceeding now to a more detailed description of this invention, reference will be had to the accompanying drawings, in which

Figure 1 is a view partly in side elevation and partly in vertical section of a pulp wood grinder constructed in accordance with this invention.

Figure 2 is a view similar to Figure 1, but taken at right angles thereto.

Figure 3 is a fragmentary transverse sectional view through a part of the magazine taken substantially along the line 3—3 of Figure 1.

Figure 4 is a diagrammatical view of an electric control means for timing the return or non-working strokes of the feed members.

Figure 5 is a detailed view of a locking device employed for tying down the pawls of the feed members when these members are to be employed for lifting purposes.

Figure 6 is an enlarged detailed view showing the manner in which the cylinders controlling the feed members are mounted in the magazine.

Figure 7 is a diagrammatic view of a hydraulic machine controlling the operation of the feed members.

Figures 8 and 9 are views of details embodied in the construction shown in Figure 7.

Referring more particularly to the drawings, 11 designates a rotary grindstone carried by a shaft 12 journalled in suitable bearings 13. These bearings 13, together with spaced side frames 14 and 15, are mounted upon a suitable base plate 16. The upper ends of the side frames 14 and 15 are connected by cross members 17. Mounted on each cross member 17 are a plurality of casings 18 carrying vertically movable screws 19 adapted to be operated by any suitable form of gearing such as the worm gearing generally indicated at 20. The lower ends of the screws 19 are fixed to a supporting frame or casing 21 forming the lower end of a magazine 22. The frame or casing 21 is of well-known construction and is adapted to have its lower face maintained in proper relation to the working surface of the grinding element 11 by suitable adjustment of the screws 19.

The magazine structure includes a series of flanged beams 23 arranged at opposite sides of the magazine and spaced apart, as shown in Figure 3, to provide a plurality of vertical guide ways 24. Mounted in each guide way 24 is a reciprocable feed member comprising a pair of side plates 25 having their upper and lower extremities joined together by suitable cross members 26. Each feed member carries a plurality of vertically spaced pawls 27 mounted between the side plates 25 on suitable pivot pins 28. The pawls 27 are normally balanced on the pivots 28 so that the heel portions 29 rest on cross bars 30 connecting the side plates 25, while the toe portions 31 project beyond the side plates 25 and into the wood receiving space of the magazine. Each feed member is connected to a piston rod 32 by a pin 33 passing through the lower end of said rod and through suitable lugs 34 carried by the upper cross member 26. The upper end of each piston rod 32 is connected to a piston, not shown, operating in a cylinder 35. Each cylinder is equipped with a valve casing 36 containing a reciprocable fluid control valve having a stem 37 connected to the armature 38 of a solenoid 39. The side plates 25 carry rollers 25*a* arranged to travel along the outer flanges of the beams 23.

From the foregoing, it will be understood that the feed members operating in the vertical guide ways 24 are raised and lowered as the operating fluid is alternately admitted to the upper and lower ends of the cylinders 35. During downward movement of the feed members, the pawls 27 assume a position with their projecting toe portions 31 engaging the wood charge 40 and their heel portions 29 resting on the cross bars 30 and pressure is thus applied to force the wood charge towards the working surface of the grindstone. It will be noted that the toe portions of the pawls 27 are provided with upper and lower bevelled edges and the bevelling of the lower edges is such that pressure is applied to the wood charge in a direction at an angle of about 45° with respect to the direction of movement of the feed members, with the result that the applied pressure is distributed throughout the entire mass of the wood charge. During the upward movement of the feed members, the pawls 27 swing about the pivot pins 28 so that the toe portions 31 are retracted from engagement with the wood charge 40, with the result that substantially no resistance is offered to the upward movement of the feed members.

In the present instance, we have shown the feed members arranged in two groups (of four each) located at opposite sides of the magazine and it is desired that the movement of these feed members be controlled, so that, when one feed member is moving upwardly, the remaining feed members will be moving downwardly, whereby the wood charge is at all times subjected to the pressure of at least seven of the cylinders 35. To accomplish this we may, as diagrammatically shown in Figure 4, employ a very simple form of electrical control including a stationary disc 41 arranged to surround a shaft 42 which is equipped with a pulley 43 driven by a belt 44 from a pulley 45 fixed to the shaft 12 of the grindstone 11. The disc 41 carries, in the present instance, eight stationary contact points 46 and each contact point is electrically connected as diagrammatically indicated at 47, to a terminal of one of the solenoids 39, the remaining terminal of each solenoid being connected by a lead 39*a* to a suitable source of current supply, (not shown). The shaft 42 carries a movable contact engageable with each of the stationary contact points 46. The said movable contact 48 may be connected by a wire 48*a* to the aforesaid source of current supply.

The movable contact 48 revolves at a speed proportionate to the number of strokes per minute of the hydraulic pistons and as this contact engages each of the stationary contact points 46, the valve operating solenoid controlled by said stationary contact point is energized to cause fluid to be admitted to the lower end of one of the cylinders 35, whereby the feed member controlled by said cylinder is moved upwardly in a direction away from the grindstone. As the movable contact 48 disengages said stationary contact point 46, the position of the valve associated with said cylinder 35 is reversed by its own weight so that fluid is then admitted to the upper end of the cylinder for moving the feed members downwardly upon the working or pressure applying stroke, in the course of which the pawls 27 engage and apply pressure to the wood charge, as previously explained. With this form of electrical control, it will be seen that the feed members are automatically moved upwardly on the return stroke at predetermined intervals of time, regardless of whether or not the said feed members have completed or only partially completed their pressure applying strokes. The ad-

vantage of this arrangement resides in the fact that when one of the feed members becomes jammed during the working stroke, it will remain inactive only during the interval of time required for the solenoid controlling the same to be energized by engagement of the movable contact 48 with the proper stationary contact 46. As soon as this engagement of contacts occurs, the feed member is quickly raised to the end of its return or non-working stroke and then begins immediately to move downwardly on the working stroke.

It will also be evident that as the feed members move freely past the wood charge during the return or non-working strokes, these members will not become jammed by the arching or bridging of the wood within the magazine. When such arching or bridging of the wood does occur, the pressure applying strokes of the feed members will, of course, be retarded, but, at predetermined intervals, controlled by the movable contact 48 and the stationary contact 46, each feed member will move freely on its return stroke and will then immediately move in a reverse direction to apply pressure to the wood charge at a somewhat different point. In other words, whenever there is arching or bridging of the wood within the magazine, the limited reciprocating movement which the feed members are permitted to have results in the pawls 27 constantly changing their positions to apply pressure to different portions of the wood charge until the arch or bridge is broken down.

While the electrical valve controlling mechanism described in the foregoing operates satisfactorily we prefer, for economical and other reasons, to employ the hydraulic valve controlling mechanism shown in Figures 7 to 9 inclusive. In these figures we have shown feed members 57 and 58 connected, respectively, to pistons 59 and 60 operating in power cylinders 61 and 62. Each power cylinder is equipped with a valve casing 63 housing a slide valve 64. The upper and lower ends of each valve casing are connected by branches 65 to an exhaust 66, while the intermediate portion of said valve casing is connected to a high pressure oil line 67. The valves 64 are connected, respectively, by valve stems 68 and 69 to auxiliary pistons 70 and 71 operating in the auxiliary cylinders 72 and 73. The upper end of cylinder 72 is connected to one end of a pipe 74, the other end of which is provided with branches 75 and 76. The branch 75 communicates with a compartment 76*a* formed in the upper portion of a pilot valve casing 77. This compartment 76*a* is separated from a lower compartment 78 by a valve 79 which is held to its seat by a spring 80 surrounding the valve stem 81 between the upper end of the valve casing 77 and a suitable abutment 81*a*. The branch 76 of pipe 74 communicates with a compartment 82 formed in the lower portion of a second pilot valve casing 83 and is separated from an upper compartment 84 by means of a valve 85, which is held to its seat by a spring 86 arranged substantially as described in connection with spring 80 of the valve 79. The lower compartment 78 of valve casing 77 is connected to a fluid pressure supply line 87, while the upper compartment 84 of the valve casing 83 is connected to an exhaust line 88. The valve 79, which controls communication between the compartments 76*a* and 78 of valve casing 77, is normally held closed by the spring 80 but is adapted to be periodically opened through the instrumentality of a rotary cam 89 mounted on a shaft 90. Cam 89 is provided with a projection 91 functioning, periodically, to depress a lever 82*a* having one end bearing on the upper end of the valve stem 81. The valve 85 is normally held in open position by a pivoted lever 91*a* bearing on the stem of valve 85 and provided with a projection 92 which is pressed downwardly by engagement with a cam 93. This cam 93 is provided with a notch 94 adapted, when positioned directly above the projection 92 to permit the valve 85 to be closed by the pressure of the spring 86. Shaft 90 also carries pulleys 95 and 96 which are revolvably mounted thereon and equipped with a plurality of pawls 97 engaging ratchet wheels 98 fixed to the said shaft. Cables 99 and 99*a* are wound, respectively, around the pulleys 95 and 96 and are each provided at one end with a counter weight 100. The opposite end of each cable is provided with a cross bar 101 adapted at times to be caught beneath the curved prongs 102 of a catch member 103. This catch member is vertically adjustable along the length of a suitable guide 104 and may be secured in adjusted position by any suitable means, such as the set screw indicated at 105. This engagement of the bar 101 beneath the prongs 102 limits the movement of the attached cable in the direction of the pull exerted by the counter weight 100. Each of the feed members 57 and 58 is equipped with a pair of curved prongs 106, adapted, during downward movement of the feed member to pass between the prongs 102 and by engagement with the cross bar 101 exert a downward pull on the cable attached to said cross bar. When these feed members 57 and 58 reach the ends of their upward strokes, the prongs 106 carried thereby are spaced above the prongs 102 of the co-operating catch member 103. By reason of this arrangement, it will be evident that, for reasons to be hereinafter explained, each feed member is permitted to move downwardly a limited distance before exerting a downward pull on the co-operating cable.

The auxiliary cylinder 73 is connected by a pipe 107 to pilot valve casings 108 and 109 corresponding, respectively, to the casings 77 and 83 described in connection with the auxiliary cylinder 72. These casings 108 and 109 are provided with valves 110 and 111 corresponding, respectively, to the valves 79 and 85 and controlled by cams 112 and 113 corresponding, respectively, to the cams 89 and 93. The pilot valve casings 108 and 109 are also respectively connected to the pressure and exhaust lines 87 and 88 in the same manner as described in connection with the pilot valve casing 83.

In the operation of the hydraulc valve control mechanism described in the foregoing, it will be understood that, while only two power pistons 59 and 60 having been actually shown, any number of these pistons may be employed and the same will preferably be arranged as explained in connection with Figures 1 to 6 inclusive. During the downward movement of these power pistons, rotation is imparted to the cam shaft 90 through the medium of the pulley and cable connection provided between each piston and the cam shaft. As the descending speed of the various power pistons will vary according to the resistance offered by the wood charge, it will be understood that the cam shaft 90 will be driven, at a given time, by the power piston which happens, at that particular time, to be moving downwardly at the greatest rate of speed. At such a time, the driving pawls 97 of all the

pulleys on shaft 90 except the pulley which happens to be functioning as the driving pulley, will slip freely on the engaging ratchet wheels 98. At certain intervals, during rotation of cam shaft 90, the pilot valve 79 will be opened by the cam 89 while, at the same time, the co-operating pilot valve 85 will be permitted to close under the action of the spring 86 by the movement of the cam 93 to position the notch 94 in line with the projection 92. The closing of pilot valve 84 disrupts communication between the pipe 74 and the exhaust line 88, while the opening of the pilot valve 79 places said pipe 74 in communication with the pressure line 87. Fluid under pressure is thus permitted to flow into the upper end of the auxiliary cylinder 72 to cause downward movement of the auxiliary piston 70. This downward movement of auxiliary piston 70 causes a corresponding downward movement of the attached slide valve 64, so that the lower end of power cylinder 61 is placed, by means of the port 61*a*, in communication with the high pressure oil line 67, while, at the same time the upper end of power cylinder 61 communicates, via the port 67*a* and the valve casing 63, with the exhaust line 66. By reason of the oil pressure admitted therebeneath, the piston 59 is caused to travel upwardly carrying with it the feed member 57 so that said feed member is positioned for a new downward or power stroke. During continued rotation of the cam shaft 90, the positions of the cams 89 and 93 are shifted so that the valve 79 is permitted to close under the action of the spring 80, while the valve 85 is again moved to open position against the resistance of the spring 86. This closure of valve 79 disrupts communication between the pipe 74 and the pressure line 87, while the opening of valve 85 places said pipe 74 in communication with the exhaust line 88. This permits the auxiliary piston 70 to be moved upwardly or reset by a suitable arrangement of springs 118 associated therewith as shown to advantage in Figure 8.

Each piston operates in the same manner as described in connection with piston 59, but the set of cams controlling the pilot valves co-operating with the slide valve of each power cylinder will have a certain angular displacement about the cam shaft 90 with respect to the sets of cams controlling the operation of the pilot valves co-operating with the remaining power cylinders. In this way, the operation of the slide valve associated with each power cylinder is timed so that the piston operating in said cylinder will begin its upward or non-working stroke at a different time compared with the beginning of the upward stroke of each of the remaining pistons. Hence, it may be said that the cylinders are firing at a fixed time interval and in regular succession.

The power piston connected to each of the feed members may have a tendency to drop rapidly at the beginning of the downward or power stroke, due to the fact that during the first few inches of this stroke, the pawls carried by the feed members may not be brought into pressure applying engagement with the wood charge. It is desirable to prevent the rapid revolution of the cam shaft 90 in response to this quick initial drop of the feed members and power pistons associated therewith and this is accomplished through the instrumentality of the co-operating prongs 102 and 106, previously referred to.

It may also be advisable to provide manual control means for permitting the power pistons to be reversed by hand at any time either individually or in series. To this end, a lever 120 is pivoted to the stem of each main valve 64. The inner end of this lever is fulcrumed against the lower end of the adjacent power cylinder, while the outer end of said lever is attached to an operating cable 121.

In connection with both the electric and hydraulic valve operating mechanisms herein disclosed, it will be noted that the feed members are controlled so that when one feed member is moving on the return or non-working stroke, all the remaining members will be moving in the reverse or pressure applying direction so that the wood charge will be continuously subjected to an adequate and substantially uniform pressure. In this connection, it may be pointed out that the feed members complete the return or non-working stroke in a relatively short period of time, as, during this stroke, the pawls 27 assume positions permitting the feed members to move freely past the wood charge. A much greater time, however, is obviously required for completing the working or pressure applying stroke of each feed member, due to the fact that, during the working stroke, the rate at which the feed members move is dependent upon the rapidity of the grinding action. Hence, as the return stroke of each feed member is completed within a shorter time, than the working stroke, it will be evident that during the greater portion of the grinding operation the wood charge is subjected to the pressure of all of the operating cylinders.

When it is desired to remove all load from the grindstone 11, certain of the feed members may be employed as lifting devices for moving the wood charge away from the working surface of the stone. To this end, the heel portions of the pawls 27 carried by two opposing feed members are secured to the cross bars 30 by means of clamps 50 held in place by suitable screws 51. The pawls are thus tied down to maintain a horizontal position during upward movement of the feed members so that the wood charge is raised with reference to the working surface of the grindstone. The feed members to be employed as lifting devices as herein described, are preferably operated manually by the valve controlling levers indicated at 120 in Figure 7.

In order to facilitate the positioning and removal of the cylinders 35 with reference to the guide ways 24, it will be noted that flange portions of the beams 23 are removed, as indicated at 52, to provide openings large enough to permit the cylinders to be passed laterally therethrough during insertion and removal. Cylinder supporting blocks 53 are fastened to the beams 23 at opposite sides of these openings and the cylinders 35 are formed with upper and lower shoulders 54 and 55 adapted to engage the upper and lower ends of the said blocks, as shown to advantage in Figures 2 and 6.

After the cylinders 35 are mounted on the blocks 53, they may be retained in place by suitable cover plates 56 fastened to the beams 23 in a suitable manner and provided with openings permitting the valve castings 36 to project therethrough.

Having thus described our invention, what we claim is:—

1. A pulp wood grinder equipped with reciprocable feed members having pawls arranged to apply feeding pressure to the wood charge during the working strokes of said members and to slip

freely past the wood charge during the return strokes of said members and locking means adapted to be applied to the pawls of certain of said members so as to retain said pawls in lifting engagement with the wood charge during the return stroke of said members.

2. A magazine pulp wood grinder of the continuous feed type comprising a magazine structure having opposing series of guideways arranged at opposite sides of the magazine, a reciprocable feed member in each guideway comprising a pair of side plates, a plurality of vertically spaced pawls pivotally mounted between the side plates on pivots passing through intermediate portions of the pawls and cross bars connecting the side plates, said pawls being normally balanced on the pivots so that the heel portions rest on the cross bars while the toe portions project beyond the side plates and into the wood receiving space of the magazine.

3. A magazine pulp wood grinder of the continuous feed type comprising a magazine structure having opposed series of vertical guideways arranged at opposite sides of the magazine, a reciprocable feed member in each guideway comprising a pair of side plates, a plurality of vertically spaced pawls pivotally mounted between their ends on pivots extending between and carried by the side plates, and cross bars connecting the side plates, said pawls being normally balanced on the pivots so that the heel portions rest on the cross bars while the toe portions project beyond the side plates into the wood receiving space of the magazine, a piston rod connected to each feed member at the upper ends of the side plates, a piston connected to each piston rod, a cylinder housing each piston, a valve mechanism for controlling the flow of fluid to and from the opposite end of each cylinder, and means for timing the operation of said valve mechanism, said means being connected with and actuated by said feed members.

4. A magazine pulp wood grinder of the continuous feed type comprising reciprocable feed members normally functioning to apply feeding pressure to the wood charge only during the working strokes of said members, a separate pressure responsive operating device for each feed member comprising a cylinder and a piston operating in the cylinder and connected to the feed member, a valve mechanism associated with each cylinder to control the flow of motive fluid to and from opposite ends of the cylinder, a timing shaft, means actuated by said shaft for controlling the functioning of all of the valve mechanisms associated with the different cylinders so that the feed members are operated in a definite sequence and means whereby the timing shaft is operated by the feed members during the working strokes of said members.

5. A magazine pulp wood grinder of the continuous feed type comprising reciprocable feed members normally functioning to apply pressure to the wood charge only during the working strokes of said members, a pressure responsive operating device for each feed member comprising a cylinder and a piston operating in the cylinder and connected to the feed member, a valve mechanism associated with each cylinder and controlling flow of motive fluid to and from opposite ends of the cylinder, an auxiliary pressure responsive device associated with each valve mechanism for operating the same, a timing shaft, means actuated by the timing shaft for operating all of the auxiliary pressure responsive devices in a predetermined sequence and means controlled by the movement of the feed members for operating the timing shaft during the working strokes of said members.

6. A magazine pulp wood grinder of the continuous feed type comprising reciprocable feed members functioning to apply feeding pressure to the wood charge only during the working strokes of said members, a pressure responsive operating device for each feed member comprising a cylinder, and a piston operating in the cylinder and connected to the feed member, a valve mechanism associated with each cylinder and controlling the flow of motive fluid to and from opposite ends of the cylinder, an auxiliary fluid actuated pressure responsive device controlling the operation of each valve mechanism, valves for controlling the flow of fluid to and from said auxiliary fluid pressure responsive devices, a timing shaft and means associated therewith for operating said last mentioned valves in a predetermined sequence and means whereby the timing shaft is actuated by the feed members during the working strokes of said members.

7. A magazine pulp wood grinder of the continuous feed type comprising reciprocable feed members normally functioning to apply feed pressure to the wood charge only during the working strokes of said members, a pressure responsive device associated with each feed member for imparting reciprocating movement thereto and means for operating the pressure responsive devices of the different feed members in a predetermined sequence including a timing shaft, and control valves actuated by the timing shaft for controlling the functioning of all of said pressure responsive devices and driving connections between the feed members and the timing shaft whereby said shaft is actuated by the feed members during the working strokes of said members, the driving connection between each feed member and the timing shaft including pawl and ratchet means permitting said shaft to be driven at any given instant by the feed member which happens to be travelling at the greatest rate of speed at that particular instant.

8. A magazine pulp wood grinder of the continuous feed type comprising opposing series of vertically extending guideways arranged at opposite sides of the magazine, a reciprocable feed member in each guideway comprising a pair of side plates, cross bars connecting said side plates, a plurality of vertically spaced pawls pivotally mounted between the side plates and normally balanced on the pivots so that the heel portions rest on the cross bars while the toe portions project beyond the side plates into the wood receiving space of the magazine, a piston rod connected to each feed member at the upper ends of the side plates, a piston connected to each piston rod, a cylinder housing each piston, a valve mechanism for controlling the flow of fluid to and from the opposite ends of each cylinder, an auxiliary pressure responsive device associated with each of said valve mechanisms for operating the same, a timing shaft, means actuated by the timing shaft for operating all of the auxiliary pressure responsive devices in a predetermined sequence and drive connections between the feed members and the timing shaft functioning to operate said shaft during the working strokes of said members.

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