March 1, 1955 J. D. LYALL 2,703,206

AUTOMATIC FEEDER FOR WOOD GRINDERS

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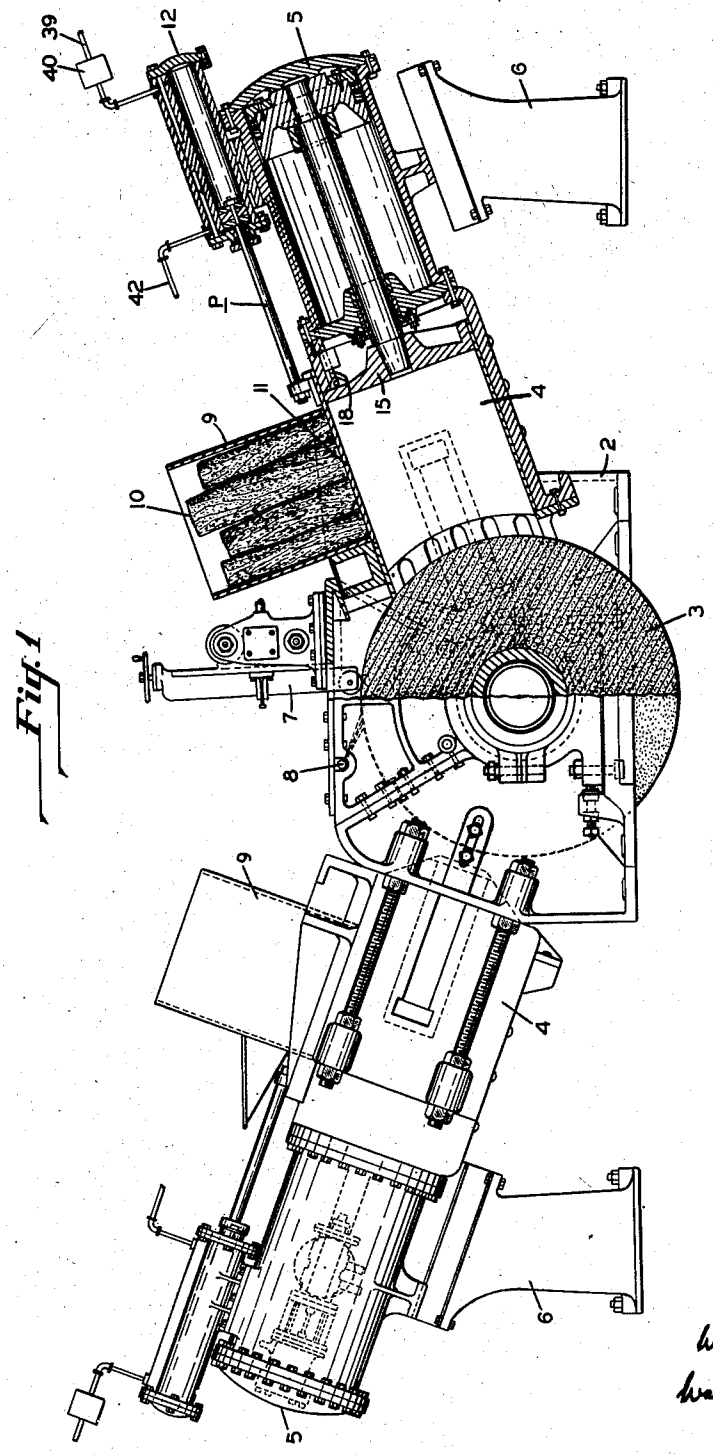


Fig. 1

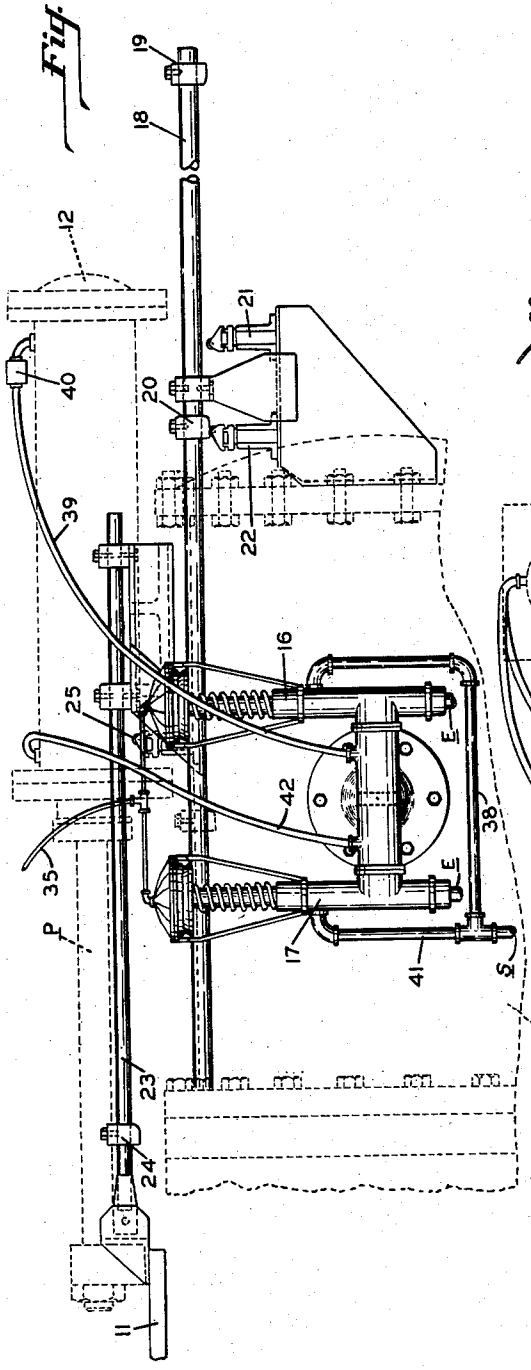
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AUTOMATIC FEEDER FOR WOOD GRINDERS

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Fig. 2



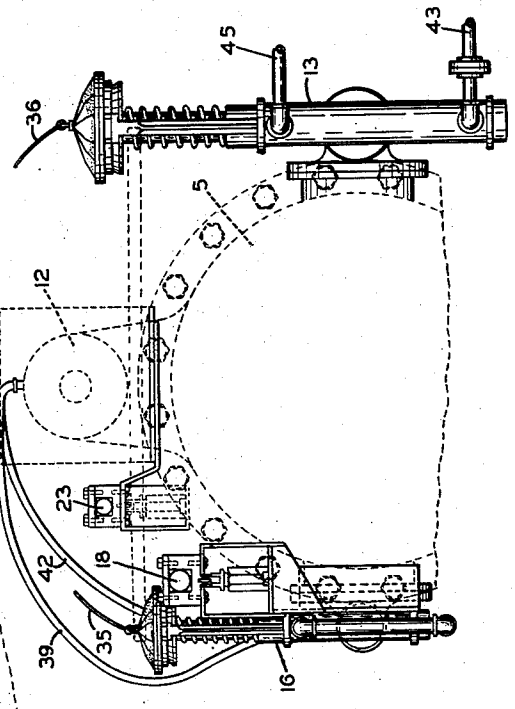


Fig. 3

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AUTOMATIC FEEDER FOR WOOD GRINDERS

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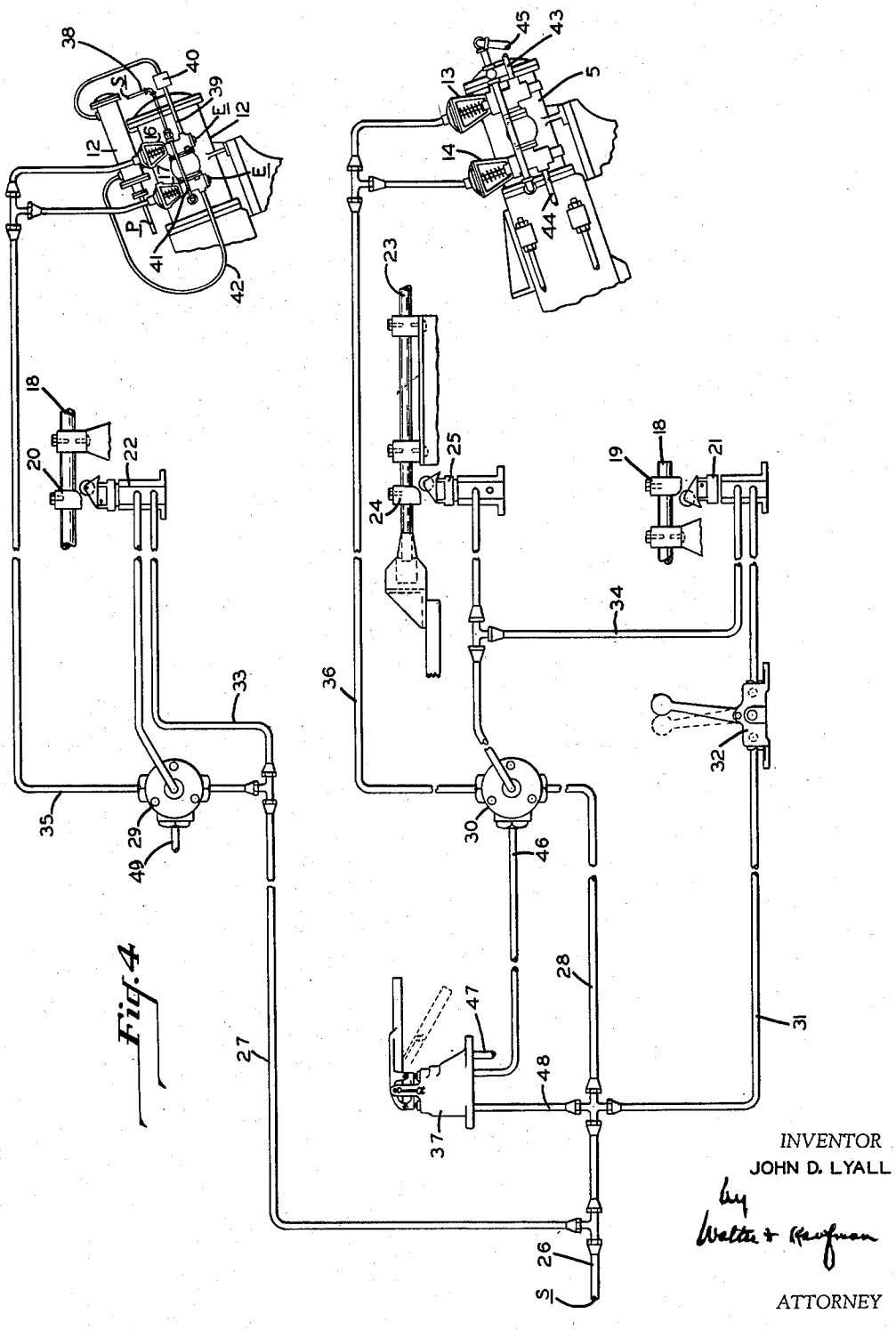


Fig. 4

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AUTOMATIC FEEDER FOR WOOD GRINDERS

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Application March 2, 1951, Serial No. 213,600

5 Claims. (Cl. 241—34)

This invention relates to an automatic feeder for wood grinders generally, but is concerned more particularly with a feeder which will be effective for delivering bolts of wood to a grinder with the bolts disposed in a generally vertical position on end, as contrasted with conventional grinder pocket feeding in which the bolts of wood are normally positioned in a horizontal plane, flatwise in the pocket of the feeder.

In the parallel grinding of wood for the manufacture of fiberboard, as disclosed in the copending application of W. L. Scott, Serial No. 769,295, filed August 18, 1947, now Patent No. 2,642,369, the bolts must be positioned in the pockets of the grinder in vertical position on end. Great difficulty has been experienced in so positioning the bolts for they are of random diameter and tend to assume a horizontal rather than a vertical position. They are quite difficult to stack on end. Considerable time is lost for actual grinding, due to the time required to properly position a charge of bolts of wood in the pocket upon the completion of each grinding cycle.

It is an object of this invention to provide an automatic feeder for wood grinders which will control the action of the grinder ram in both its grinder pressure applying motion and its retracting motion and will also automatically control the charging of the grinder pocket with bolts of wood to be ground.

Another object of the invention is to provide an automatic feeding arrangement by which bolts disposed on end in a hopper, being positioned there manually by a machine feeder or tender, may be discharged as a unit directly into the grinder pocket in proper vertical position.

An additional object of the invention is to provide a feeding device which will be substantially automatic in operation, so that all the operator needs to do is fill the hopper and the machine will automatically discharge the contents of the hopper into the pocket, move the bolts disposed in the pocket from the hopper into grinding relationship, and automatically condition the hopper to receive a new charge of bolts for grinding.

Other objects of the invention will become apparent from a consideration of the following description of a preferred embodiment of the invention.

Generally stated, the apparatus of this invention, is incorporated with the conventional elements of a wood grinder including the grinding stone, the grinder ram, and the grinder pocket. A hopper is provided above the pocket into which bolts of wood to be charged into the pocket are positioned by a workman during the grinding cycle of the machine. A retractable gate is positioned between the hopper and the pocket and may serve the dual function of a bottom for the hopper and a closure for the pocket. This gate may be actuated by an air cylinder—hydraulically, mechanically, or electrically. The grinder ram is preferably hydraulically operated but may be otherwise actuated. Means are provided for automatically retracting the ram upon completion of each grinding cycle; and, preferably, means are provided for automatically retracting the hopper gate upon movement of the ram to its retracted position and to automatically reverse the direction of travel of the grinder ram upon complete retraction of the hopper gate to thereby immediately move the bolts of wood discharged from the hopper into the pocket upon opening of the gate into grinding position and to effect the grinding thereof. Also, it is preferred to control the closing of the gate upon movement of the ram toward the grinding wheel upon initiation of the grinding cycle. The apparatus is particularly useful in the charging and grinding of bolts disposed on end. Where this kind of grinding action is to be effected, the hopper is designed to receive the bolts of wood on end and the gate is arranged for substantially instantaneous retraction to permit the bolts to fall substantially as a unit into the pocket, with the bolts still in a generally verical position and on end.

A preferred embodiment of the invention is illustrated in the attached drawings as applied to a conventional Great Northern Wood Grinder having two pockets arranged for longitudinal grinding. In the drawings:

Figure 1 is a side elevation, partly in section, illustrating a two-pocket Great Northern Grinder with the apparatus of the invention provided thereon;

Figure 2 is a diagrammatic side elevational view illustrating the gate control;

Figure 3 is a rear elevational view similar to Figure 2 showing the gate control and the main cylinder control; and

Figure 4 is a diagrammatic piping layout of the control system with the hydraulic cylinder in the lower portion of the drawing inverted to simplify the illustration.

Referring to Figure 1, the Great Northern Grinder includes a frame **2** in which is mounted a rotatable grinding wheel **3**. Two pockets **4** are provided for the reception of bolts of wood to be ground. Hydraulic cylinders **5** mounted on stands **6** are employed for applying pressure to the bolts of wood received in the pockets **4** to urge the same into grinding contact with the grinding wheel **3**. Wheel dressing mechanism **7** and a water shower arrangement **8**, as well as other conventional equipment of a wood grinder, have been shown in Figure 1. It will be understood, of course, that the invention is applicable to any wood grinder.

The wood delivering and feeding mechanism for each side of a two-pocket grinder is the same, and for that reason only one unit will be described. Mounted on each of the pockets **4** is a hopper **9** into which bolts of wood **10** may be disposed as indicated in the right-hand portion of Figure 1. A gate **11** constitutes the bottom of the hopper **9** and a closure for the pocket **4**. This gate **11** is arranged for sliding movement from an open position to the closed position shown, by means of an air cylinder **12** having its piston rod P attached to the gate **11**. Rapid movement of the gate **11** is essential in the delivery of the bolts of wood **10** to provide for their discharge substantially as a unit into the pocket **4**. If the gate **11** were retracted slowly, the bolts would fall one or a few at a time into the pocket and would not always maintain an upright or substantially vertical position.

The ram and cylinder arrangement **5** for pressing the bolts of wood into engagement with the wheel **3** is of conventional design. Control of the actuation of cylinder **5** is obtained by a pair of reverse-acting air controlled diaphragm valves **13** and **14** (one normally open and one normally closed and reversing upon application of control air under pressure), shown in Figure 4. These valves control the supply of hydraulic fluid to the cylinder **5** to move the ram **15** thereof into engagement with the bolts of wood received in the pocket **4** and to press the same into grinding relationship with the grinding wheel **3** when the valves are in one position; and, when in an opposite position, to retract the ram **15** upon completion of each grinding cycle. The ram **15** is shown in its retracted position in Figure 1.

The air cylinder **12** which actuates the gate **11** is controlled by a pair of similar air controlled diaphragm valves **16** and **17**, also shown in Figure 4.

A control rod **18** (Figure 2) is attached to the ram **15** and moves with it. The control rod **18** carries a pair of actuator cams **19** and **20** which are adjustably secured thereon. These cams are engageable with pilot control valves **21** and **22**, respectively, the operation of which will be more fully hereinafter described. The gate **11** has attached to it a control rod **23** which carries an actuator cam **24** engageable with a pilot control valve **25**.

An air pressure actuated control arrangement for the ram **15** and the gate **11** is shown in Figure 4. Control air

under pressure is supplied from a source S through line **26**. Branch lines **27** and **28** supply air to master control valves **29** and **30**, respectively. Each of these valves **29** and **30** is provided with a diaphragm action and is normally held closed by a spring. The application of control air to the top of the diaphragm overcomes the spring action and opens the valve. When in its normally closed position, the outlet port of valve **30** is in open communication with an exhaust port for venting. Application of air pressure through the outlet port may be utilized to by-pass the diaphragm control in a manner which will be more fully hereinafter described. The diaphragm of valve **29** is provided with a small bleeder opening to exhaust control air from the line extending from pilot control valve **22**.

Line **31** supplies air to pilot valve **21**, and this may be effected through a manual control valve **32** to manually control movement of the ram **15** to hold it in its fully extended position. Line **33** which connects with line **27** supplies air to pilot valve **22**, and line 34 which extends from pilot valve **21** supplies air to master control valve **30** controlled by pilot valve **25**. Pilot valves **21** and **22** are of the type which are normally closed but when engaged by their actuating cams are opened to supply control air to their respective master control valves **30** and **29**. Pilot valve **25** is also normally closed; but when it is actuated by its cam **24**, it exhausts air from line **34** to atmosphere, permitting valve **30** to move to its normally closed position. Line **35** supplies control air from master control valve **29** to diaphragm air valves **16** and **17** for the gate cylinder **12** and line **36** supplies control air from master control valve **30** to the diaphragm air valves **13** and **14** for the hydraulic ram cylinder **5**.

A two-position, hand controlled valve **37** may be provided in the circuit for the diaphragm air control valves **13** and **14** for the hydraulic ram cylinder **5** to permit manual control of retraction of the ram **15** at any time during the operation of the device. The valve **37** is shown in exhaust position in solid lines in Figure 4.

Air for the operation of cylinder **12** to close the gate **11** is supplied from source S through line **38** (top of Figure 4), diaphragm air control valve **16**, line **39**, and a speed control valve **40**. For retracting the gate **11**, air is supplied from source S through line **41**, diaphragm air control valve **17**, and line **42** to the lower end of the cylinder **12**.

As previously mentioned, the valves **16** and **17** are reverse acting or are cross connected for reverse operation upon application of control air under pressure. They are connected in such manner that when control air is supplied to the diaphragms through line **35**, valve **17** will be opened and valve **16** will be closed to the admission of air for actuation of the piston in air cylinder **5** to open the gate **11**; but when the supply of air through control line **33** is interrupted by actuation of pilot control valve **22**. valve **29** will close and air in line **35** will be exhausted, the valves will reverse due to spring pressure and air for actuation of the piston in the air cylinder will be supplied to close the gate. Exhausting ports diagrammatically illustrated at E in Figure 4 are provided for valves **16** and **17** to permit the escape of air from the cylinder as the piston moves therein.

Hydraulic fluid for the actuation of ram 15 of cylinder **5** is supplied from a source **43** to move the ram into engagement with the wood in the pocket to effect grinding. This may be controlled by a governor in accordance with the load on the motor for driving the grinding wheel **3**. This is conventional in two-pocket grinders. The supply of fluid to the cylinder **5** from this source **43** is controlled by diaphragm air control valve **13**. For returning the ram to its inoperative or pocket-loading position, hydraulic fluid will be supplied from a hydraulic pump through inlet **44**, controlled by diaphragm air control valve **14**. Return of exhausted hydraulic fluid may be through a line **45** to a suitable supply tank, not shown.

The diaphragm air control valves **13** and **14** are similar to valves **16** and **17**, previously described, and are connected in such manner that when control air is supplied thereto through line **36**, valve **14** will be opened and valve **13** will be closed. This will result in the ram **15** being retracted to pocket-loading position. When the supply of control air is discontinued, valve **13** will open and valve **14** will close and hydraulic fluid will force ram **15** into grinding position.

Manual control valve **32** which is positioned in line **31** is provided to interrupt the supply of control air to master control valve **30** through pilot control valve **21**. The valve **32** is normally open as shown in solid lines in Figure 4; but, when moved to the dotted line position, the flow of control air from the source S through lines **26** and **31** to pilot control valve **21** will be interrupted. When this occurs, the grinding ram **15** will complete its grinding stroke, but actuation of pilot control valve **21** by cam **19** on rod **18** will not supply control air to valve **30**, the same having been interrupted by manual control valve **32**.

Manual control valve **37** is normally positioned so that air exhausted through line **36** may be discharged to atmosphere through line **46**, valve **37**, and exhaust port **47**. In its second position, indicated in dotted lines in Figure 4, valve **37** connects a branch line **48** connected to line **26** with exhaust line **46**, and when in this position air from source S passes through line **48**, valve **37**, and line **46** into line **36**; for as mentioned previously, valve **30** in its normally closed position connects line **36** to the exhaust line **46**. This provides for venting in normal operation; but when the manual control valve is actuated, it serves to by-pass the diaphragm control of valve **30**, supplying air under pressure to diaphragm valves **13** and **14** and effecting retraction of the ram **15** and opening of the gate **11**. So long as the valve **37** is maintained in the dotted line position the ram **15** will remain fully retracted, for its motion is controlled by valves **13** and **14** which will remain under air pressure, notwithstanding the fact that opening of gate **11** will cause actuator cam **24** to engage pilot control valve **25**, placing line **34** in an exhaust position through pilot control valve **25** as previously described. Should the ram **15** be in the course of its retracting motion at the time the valve **37** is moved to its inoperative position by reason of the application of control air pressure to the diaphragm of control valve **30** through pilot control valve **21**, resulting in the application of air pressure to the diaphragm valves **13** and **14**, the retracting motion will continue; but upon engagement of actuator cam **24** with pilot control valve **25** venting line **34**, valve **30** will move to its normally closed position and air under pressure will flow from source S through lines **26** and **48**, valve **37**, and line **46**, through valve **30** and line **36** to the diaphragm control valves **13** and **14**. The valve **30** is also so arranged that the application of air through line **46** will cause the valve to assume its normally closed position, against the control air pressure applied to its diaphragm.

In the automatic operation of the device, assuming that the ram **15** is in its fully retracted position as shown in Figure 1, the cam **20** attached to control rod **18** shown in Figure 2 which moves with the ram **15** will have engaged the pilot control valve **22** and air will be admitted from the source S through lines **26**, **27**, and **33** and through pilot control valve **22** into the head of master control valve **29**, moving the valve from its normally closed to its open position. Air will then flow from the source S through lines **26** and **27**, through master control valve **29** and line **35** to diaphragm valves **16** and **17**. Upon the application of air pressure to the diaphragm air control valves **16** and **17**, valve **17** will open, valve **16** will close, and air from the source S will flow through the line **41** and valve **17**, through line **42** to the lower end of cylinder **12**, and the piston will be rapidly retracted, snapping the gate **11** to open position.

As air is admitted to cylinder **12**, pressure builds up therein to overcome the friction of the gate **11** against its guides and the wood. This static friction is of considerable magnitude when the hopper is loaded with bolts of wood. As soon as the static friction is overcome, the gate slides in its guides; and since the coefficient of sliding friction is less than that of the static friction, the force required to move the gate falls off rapidly. The air in the cylinder then expands, moving the piston with great speed. As a result, the gate is opened instantaneously; i. e., in less time than can be measured with a conventional hand-operated stop watch, and the bolts of wood fall as a unit into the pocket **4**. A pneumatic cushion is provided in the air cylinder **12** to absorb the shock incurred in stopping the rapid motion of the piston at the end of its stroke.

Since control rod **23** is attached to and moves with the gate **11**, opening of the gate will bring actuator cam **24**

into engagement with pilot control valve 25. When this occurs, air pressure on valve 30 is relieved and it moves to its normally closed position, exhausting air from line 36 from the diaphragm control valves 13 and 14, through line 46, valve 37, and exhaust port 47. Valve 13 will return to its normally open position, valve 14 will close, and hydraulic fluid will flow from the source 43 through valve 13 to cylinder 5, and the ram 15 will move toward the grinding wheel 3, pressing the wood in the pocket against the grinding wheel 3. As the cylinder moves in this direction, the actuator cam 20 will move away from the pilot control valve 22 and the same will close, interrupting the supply of control air to the head of master control valve 29, which will move to closed or exhaust postion. In this position of master control valve 29, air will be exhausted from the diaphragm valves 16 and 17 through line 35, valve 29, and exhaust port 49, and valves 16 and 17 will automatically reverse—valve 16 will open, and valve 17 will close. When this occurs, air from the source S which actuates the piston in cylinder 12 will flow through line 38, valve 16, line 39, and speed control valve 40, and the gate 11 will be closed reasonably slowly. The machine tender then fills the hopper 9 as the wood in the pocket 4 is being ground.

The grinding operation proceeds until the ram 15 reaches the lower end of its stroke; whereupon, the actuator cam 19 engages pilot control valve 21. When this occurs, control air flows from source S through lines 26 and 31, manual control valve 32, pilot control valve 21, and line 34 to the head of master control valve 30, moving the valve from its normally closed or exhaust position to its open position. This then admits air from source S through line 28 to line 36 and from there to diaphragm air control valves 13 and 14 for the hydraulic cylinder 5. Valve 13 will now close and valve 14 will open, admitting hydraulic fluid to the lower end of the cylinder 5 and retracting the ram 15. As the ram retracts, actuator cam 19 leaves pilot valve 21, interrupting the supply of air to master control valve 30; but since this air circuit is closed at pilot valve 25, the positions of diaphragm air control valves 13 and 14 do not reverse until valve 25 is opened upon retraction of gate 11. This does not occur until actuator cam 20 on control rod 18 carried by the ram 15 engages pilot valve 22 which controls the operation of the gate through air cylinder 12 in the manner previously described.

Should it be desired to close down the operation of the machine at the end of a grinding cycle, the operator merely moves manual control valve 32 to its dotted line position and the ram 15 will move to its lowermost or extended position and come to rest there.

If for any reason it be necessary to retract the ram 15 and open the gate 11, regardless of the position of the ram and the operating cycle of the machine, the operator moves the valve 37 to the dotted line position and the ram is immediately retracted and the gate automatically opened, both elements being held in such position so long as the valve 37 is in its dotted line position.

From the preceding description of a preferred embodiment of the invention, it will be clear that the invention is particularly useful in multiple pocket grinders and also in the grinding of wood for the manufacture of insulation board as disclosed in the Scott application identified in the forepart of the specification. Not only is the capacity of the grinder materially increased by providing automatic feeding, but a better and more uniform quality of ground wood fiber is produced. With the present invention, only a minor portion of the operating cycle is required in the retraction of the grinder ram and the charging of the grinder pocket. Thus for the greater part of the operating cycle of the machine the grinding wheel is under a uniform load in both pockets, and the driving motor for the grinding wheel operates at peak efficiency. It is known that with multiple pocket grinders there is a difference in the quality of fiber produced when only one pocket is in operation, for the pressure applied to the grinding rams is varied in accordance with the load on the driving motor; and while governors are provided for increasing the pressure on one pocket when the alternate pocket is being charged, most efficient results and the best fiber is produced when both pockets are in simultaneous operation. With automatic feeding as provided by the present invention, practically the entire grinding cycle is effected with both pockets in operation, for only a very minor portion of the cycle is utilized in retracting the grinding ram and reloading the pocket.

In addition to the foregoing, more efficient use of manpower is obtained, for the machine tender is required only to keep the charging hoppers filled with bolts of wood and need not actuate any controls for retracting the rams or charging the pockets, the same being fully automatic.

I claim:

1. In a feeder for wood grinders having a rotatable grinding stone, a pocket for the reception of bolts of wood to be ground with the bolts disposed on end, and a ram reciprocable through the pocket for pressing the wood to be ground against the stone for longitudinal grinding and for returning to a retracted position for charging of the pocket with bolts of wood to be ground, the combination of a hopper disposed above the pocket, a sliding gate separating the hopper from the pocket and constituting the bottom of the hopper upon which a load of bolts of wood to be ground may be disposed on end, and means for substantially instantaneously retracting said gate to deposit said bolts of wood into said pocket as a unit on end, said means comprising an air cylinder, a piston in said cylinder, a member connecting said piston to said sliding gate, a conduit connecting said cylinder to a source of air under pressure adequate when applied to said piston to overcome the static friction of said gate when loaded with wood to be ground and upon overcoming of said static friction to expand and move said piston with great speed to slide said gate to retracted position, and valve means in said conduit controlled by reciprocation of said ram to said retracted position for controlling the supply of air under pressure to said cylinder to slide said gate to retracted position.

2. In a feeder for wood grinders having a rotatable grinding stone, a pocket for the reception of wood to be ground, and a ram reciprocable through the pocket for pressing the wood to be ground against the stone and for returning to a retracted position for charging of the pocket with wood to be ground, the combination of: a fluid pressure cylinder for reciprocating the ram; a pair of fluid-actuated valves controlling the application of fluid pressure to said cylinder to reciprocate said ram, one of said valves being normally closed and the other being normally open, said valves being reversible upon application of fluid pressure thereto; a master valve controlling the application of fluid pressure to said pair of valves; means for automatically actuating said master valve to control the reciprocation of said ram; and a manually controllable valve for superseding said master valve for controlling the application of fluid pressure to said pair of valves to effect retraction of said ram.

3. In a feeder for wood grinders having a rotatable grinding stone, a pocket for the reception of wood to be ground, and a ram reciprocable through the pocket to a fully extended position for pressing the wood to be ground against the stone and for returning to a fully retracted position for charging of the pocket with wood to be ground, the combination of: a fluid pressure cylinder for reciprocating said ram; a pair of fluid-actuated valves controlling the application of fluid pressure to said cylinder to reciprocate said ram to alternate fully retracted and fully extended positions upon application of fluid pressure to said pair of control valves; and a manually controllable valve for interrupting the supply of fluid pressure to said pair of control valves whereby the ram may be held in its fully extended position.

4. In a feeder for wood grinders having a rotatable grinding stone, a pocket for the reception of wood to be ground, and a ram reciprocable through the pocket for pressing the wood to be ground against the stone and for returning to a retracted position for charging of the pocket with wood to be ground, the combination of: a fluid pressure cylinder for reciprocating the ram; a pair of fluid-actuated valves controlling the application of fluid pressure to said cylinder to reciprocate said ram, one of said valves being normally closed and the other being normally open, said valves being reversible upon application of fluid pressure thereto; a master valve controlling the application of fluid pressure from a source thereof to said pair of valves; means for automatically actuating said master valve to control the reciprocation of said ram through alternate reverse actuation of said pair of valves; and a manually controllable valve connecting said master valve to said fluid pressure source to apply fluid pressure

through said master valve to said pair of valves to effect retraction of said ram.

5. In a feeder for wood grinders having a rotatable grinding stone, a pocket for the reception of wood to be ground, and a ram reciprocable through the pocket to a fully extended position for pressing the wood to be ground against the stone and for returning to a fully retracted position for charging of the pocket with wood to be ground, the combination of: a fluid pressure cylinder for reciprocating said ram; a pair of fluid-actuated valves controlling the application of fluid pressure to said cylinder to reciprocate said ram in alternate directions to a fully retracted position upon application of fluid pressure to said control valves and to fully extended position upon interruption of said application of said fluid pressure; a master valve controlling the application of fluid pressure to said pair of valves; means for automatically actuating said master valve to control the reciprocation of said ram; a normally closed pilot valve controlled

by movement of said ram to said extended position to move said normally closed pilot valve to an open position, said normally closed pilot valve controlling the supply of fluid pressure to said master control valve; and a manually controllable valve for interrupting the supply of fluid pressure through said pilot valve to said master valve, whereby said ram will remain in its fully extended position upon interruption of flow of pressure fluid by said manually controllable valve, notwithstanding opening of said normally closed pilot valve.

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