No. 799,184. PATENTED SEPT. 12, 1905.

J. D. BALDICK.

ROTARY VALVE.

APPLICATION FILED MAR. 31, 1905.

2 SHEETS—SHEET 1.

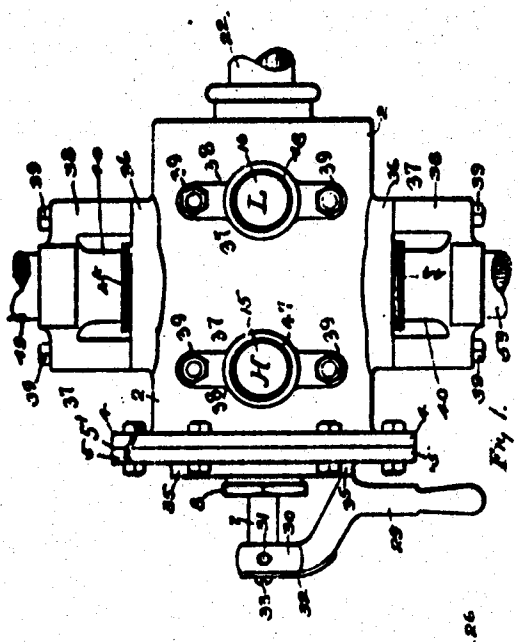

Fig. 1.

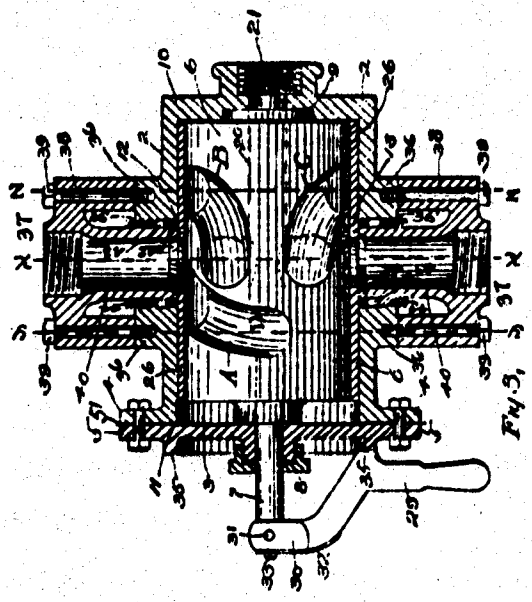

Fig. 3.

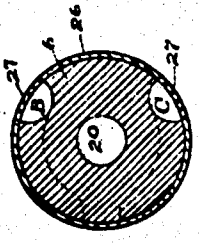

Fig. 6.

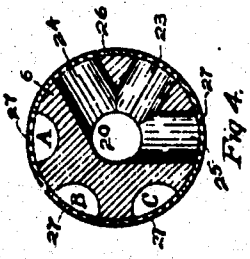

Fig. 4.

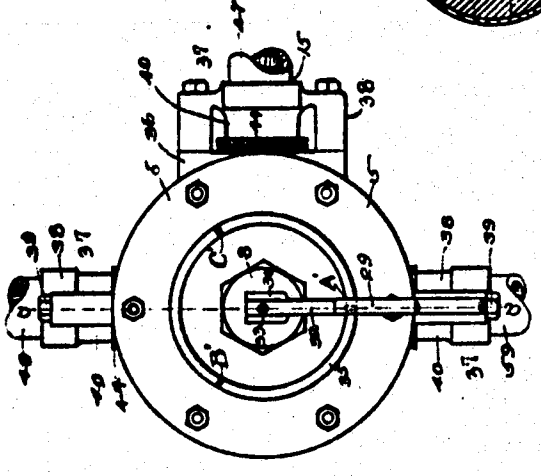

Fig. 2.

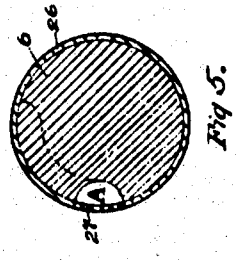

Fig. 5.

Witnesses.
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No. 799,134. PATENTED SEPT. 12, 1905.

J. D. BALDICK.

ROTARY VALVE.

APPLICATION FILED MAR. 31, 1905.

2 SHEETS—SHEET 2.

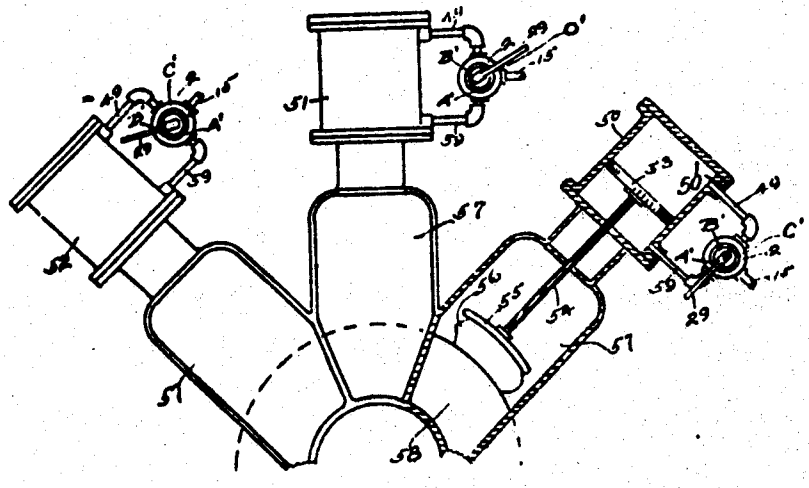

Fig 7.

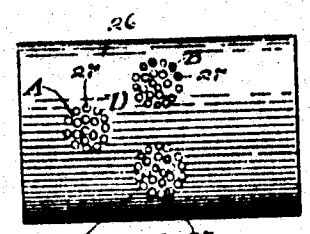

Fig 8.

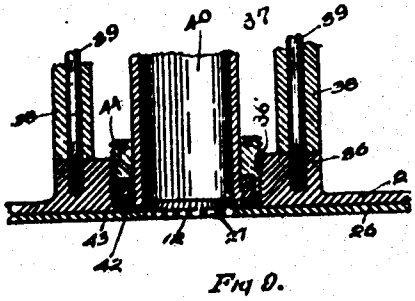

Fig 9.

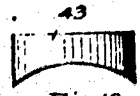

Fig 10.

Witnesses.
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UNITED STATES PATENT OFFICE.

JOHN D. BALDICK, OF BLACK RIVER, NEW YORK.

ROTARY VALVE.

No. 799,134. Specification of Letters Patent. Patented Sept. 12, 1905.

Application filed March 31, 1905. Serial No. 253,072.

To all whom it may concern:

Be it known that I, JOHN D. BALDICK, a citizen of the United States, residing at Black River, in the county of Jefferson and State of New York, have invented certain new and useful Improvements in Rotary Valves, of which the following is a specification.

This invention relates to improvements in rotary valves designed for use in connection with hydraulic grinders employed in the manufacture of wood-pulp; and the invention relates particularly to improvements in valves employed in connection with that class of grinders which are provided with multiple pockets and having operating-cylinders connected therewith, the several pockets being disposed around or above a revolving stone, upon or against which the wood is held by means of hydraulic pressure exerted by the cylinders and in which different degrees of water or other pressure are employed to effect the various workings of the grinding-machines.

The object of this invention is to provide a valve which is capable of supplying either a high or a low pressure to the grinder-cylinders and which may be adjusted in a quick and ready manner by means of an index or gage and a lever to vary the degree of pressure on different parts of the grinding-machine, as well as to cause the discharge of the water or other fluid from the cylinders without any alteration of the machine itself or any appreciable delay in operating the same.

A prominent feature of the invention consists in providing a valve comprising an oblong cylindrical member or plug which is incased in a tight fitting jacket or case provided with perforations and which is capable of being revolved in either direction at will to effect the desired adjustment or purpose.

Other features and parts of the invention will be more readily understood by reference to the drawings forming a part of this specification, and in which —

Figure 1 is a side elevation of my improved rotary valve, showing the two receiving, the two discharge, and the waste-pipe connections and also showing the lever or handle for operating the valve. Fig. 2 is a front end elevation of the said valve, showing the valve-operating lever and also the index or gage used for setting the valve. Fig. 3 is a vertical section of the valve-body on the line *a a* of Fig. 2, showing the valve-plug in elevation and also showing the discharge and waste ports and the manner of constructing and applying the water-tight couplings for the same. Fig. 4 is a sectional view of the valve substantially on the line *x x* of Fig. 3, showing the several ports and ducts for the passage of the water. Fig. 5 is a sectional view of the valve substantially on the line *y y* of Fig. 3, showing the duct A. Fig. 6 is a sectional view of the valve on the line *z z* of Fig. 3, showing the ducts B and C and also discharge duct or passage in the center of the core. Fig. 7 is an elevation of a triple-pocket grinding-machine, showing one cylinder and pocket in section and the manner of connecting the rotary valve to the cylinder. Fig. 8 is an elevation of the tubular jacket which incases the valve-core, showing the general arrangement of the groups of perforations for straining the water. Fig. 9 is an enlarged detail in section of the coupling parts. Fig. 10 is an elevation of the follower used in connection with the water-tight coupling.

Similar reference numerals and characters are given to corresponding parts throughout the several figures of the drawings, and in which the casing 2 is preferably made of cast iron, cylindrical in form, and having one open end 3, which is provided with the flange 4, to which is secured the head 5 by means of suitable bolts, a gasket 5′ being placed between flange 4 and head 5. The case 2 is chambered or bored out to receive a cylindrical valve plug or core 6, which is preferably made of cast iron and substantially solid, as shown in the drawings. The plug or core 6 is provided at one end with a gudgeon or shaft 7, which is preferably a piece of steel, around one end of which the casting is formed, and which serves as a journal for one end of the valve to revolve upon. The shaft 7 has its bearing in the head 5, upon which is the stuffing-box or packing-gland 8. The other end of valve 6 is provided with an enlarged hub-like projection 9, which is used also as a journal and has its bearings in the closed end 10 of the casing 2.

The case or shell 2 is provided with the discharge ports or apertures 12 and 13, located centrally on its upper and lower sides, respectively. These ports are each intended to form a passage for the water-pressure from the valve-chamber 11 to the grinder-cylinder by means of the intervening connections hereinafter set forth. The port 12 is connected with the top of the cylinder and port 13 with the bottom of the cylinder. The case or shell 2 is also provided on one side, Fig. 1, with the

receiving-ports 15 and 16. These ports are connected with the pump system by means of suitable piping, port 15 communicating with the high-pressure and port 16 with the low-pressure pump.

It will be noticed that the rotary valve herein shown and described is intended to be used in connection with both high and low pressure service, the valve being constructed so as to facilitate the employment of either of said pressures, as may be desired.

The plug 6 is provided upon its outer surface with a series of spirally-shaped ducts or recesses A, B, and C, which are preferably formed in the casting in the manner shown in Figs. 3, 4, 5, and 6. These ducts are intended to serve as passages for the water from the receiving-ports to the discharge-ports of the valve on its way to the grinder-cylinders. The center of core or plug 6 is bored out about half its length, as shown by dotted lines in Fig. 3, to form the discharge-passage or exhaust-duct 20, corresponding with the orifice 21, which is formed in the closed end 10 of the casing 2, and to which the waste-pipe 22 is joined by means of ordinary pipe-threads. The plug 6 is also provided with a series of cross ports or ducts 23, 24, and 25, all of which converge toward the center of said plug and connect with the port or passage 20. By the use of these cross-ports the water-pressure may be drawn or discharged from either end of the grinder-cylinder when the valve-plug 6 is set in a position to accomplish the same. The valve-core 6 is further provided with a metallic jacket or casing 26, preferably in the form of a brass or bronze tubing, made to fit the core tightly so as to operate therewith. The said jacket extends the full length of the valve-core and when mounted upon the latter is intended to operatively fit the hollow space or chamber 11 of the valve-casing 2. The said jacket or casing 26 is provided with a series of perforations opposite each of the several ports and at each end of the spirally-shaped ducts, as indicated by the numeral 27. These perforations are provided for the purpose of preventing foreign substances from entering the valve or grinding-cylinder and interfering with the workings of these parts. The valve core and casing can be taken out from time to time by removing the head 5, and the valve and chamber may then be cleansed.

The shaft or gudgeon 7 projects outwardly several inches beyond the head 5, and its outer end is squared to receive the valve-operating lever or handle 29, which is attached to said shaft by means of the yoke 30 and the pin 31. A spring 32 is anchored to the end of shaft 7 and is held in place by the screw 33. This lever or handle is used to operate the valve or plug 6—that is, to rotate the same for the purpose of setting the valve in the several positions necessary to direct the high or low water-pressure to the different parts of the grinding-cylinder. An annular gage or index 35 is cast or formed upon the face side of the head 5 concentrically with shaft 7 and valve 6, as shown in Figs. 1, 2, and 3. This gage or ring is provided with the notches or graduations A', B', and C', which are intended to correspond with the ducts A, B, and C of the valve-plug 6 and are placed at equal distances from each other, as shown in Fig. 2. These notches or gage-marks are employed in connection with the lever 29 in setting the valve in the several positions just described, and the spring 32 is intended to exert its tension so as to hold the lever 29 in the said notches.

In order to illustrate the use of the lever and gage referred to, it may be assumed that the pocket of the grinder is filled with wood ready for grinding and that the lever 29 is set in the notch A'. This will place the valve-plug and jacket so that the perforations over the port or duct A of said plug at the point marked D in Figs. 3 and 8 will be directly opposite the inlet-port 15. Then the high pressure from the pump will enter duct A and pass out through the perforations in the jacket 26 at the other end of said duct, through the port 12, tube 40, and the pipe 49, to the top of the cylinder 50 and exert its force against the piston-head 53, and thereby drive and hold the piston-rod 54 and follower 55 against the piece of the wood 56 which bears upon the grinding-stone 58, as illustrated in Fig. 7 of the drawings. By turning the lever to B', the next point on the indicator, it reverses the pressure, cuts off the high pressure from the top of the cylinder, and places the discharge or cross port 23 in the valve-core opposite to port 12 of the casing 2 to draw water from top of cylinder, and at the same time turns the low pressure into the bottom of cylinder, raises the pressure-foot or follower 55, and thus allows the pocket to be filled again. Then by turning the lever to C', the third point on the indicator, it reverses the low pressure, applies the low pressure to the top of the cylinder, and places discharge-port 24 opposite port 13 at the bottom of the valve-casing 2, forces the pressure-foot or follower 55 down on the wood, and by this means it keeps the high pressure on the other cylinders at a uniform point. When the follower or pressure-foot is again bearing on the wood in pocket and ready to grind, the lever 29 should be turned to the first position A', thus changing the pressure on top of the cylinder from low to high and opening discharge-port 25 and 13 at the bottom of valve-body to complete the draining of water from the lower part of the cylinder without reducing the high pressure.

Where two or more grinders are working from the same pump system, as is generally the case, the operation above described will increase the capacity of the machine for mak-

ing pulp, because it will permit of the full high pressure being kept on the other grinders during the interval in which the empty pocket is being refilled. It is an object of my improved valve to provide for the raising and lowering of the piston and follower at the time of the refilling of a pocket by the employment of the low pressure alone, as described, and under the construction herein shown and described this can be done without loss of time and without reducing or disturbing the high pressure exerted on the other pockets. In case of low water, when the speed of the grinder is slow, one or more cylinders and pockets may be operated on low pressure altogether, thus deriving the full benefit of the power instead of cutting off some of the pockets, as must be done in the case of the old valves now in use. My improved valve may be revolved in either direction freely and produce the same results, and it may be used in connection with a single-pump system by connecting the pump to the low-pressure inlet 16 and then working the lever 29 back and forth on the indicator or gage 35 from one low-pressure notch B' to the other, C'. When lever 29 is at A', the high pressure is on the top of the piston or cylinder 50. When it is desired to draw the water from the top of the piston or cylinder, the operator turns lever 29 to the notch B' of the indicator. Then the water will pass back through the pipe 49 and port 12 into the cross-port 23 of the valve-plug by filtering through the perforations 27 of the jackets 26, thence into discharge-passage 20 and through port 21 into waste-pipe 22, and the lever 29, being at B', opens the passage from the low-pressure pump through the pipe 48 into the receiving-port 16, thence through the duct B and down through port 13 and the pipe 59 into the cylinder beneath the piston. The pressure having been relieved from the top of piston by the opening of discharge-passage 23, as just described, the low pressure will immediately exert itself to raise the piston, and with it the follower, away from the grinder, and the pocket may then be refilled with fresh wood for another grinding. After a pocket has been refilled with wood the operator, in order to economize in the use of the pressure—that is, in order not to disturb the high pressure used on the other grinders—should turn the lever 29 around to notch C', and by so doing the water which has been forced into the lower part of the cylinder to raise the piston and follower will be relieved or discharged by returning through pipe 59 and port 13 into cross-duct 24 of valve 6 and thence through discharge-passage 20 into waste-pipe 22. While the water is being discharged from the lower part of cylinder, as described, the valve still remaining set at C', the low pressure is diverted to the top of the piston for the purpose of driving the piston and follower down on the new wood placed in the pocket. By this means the low pressure is utilized to operate the follower when but slight force or power is required to move the light parts to make ready for grinding, and the high pressure may be kept on the other cylinders, which may be grinding during all this time. To get the low pressure into the top of cylinder, as last described, the water will flow from the pipe 48 through port 16 into the spiral duct C, thence through the jacket 26 into port 12 and pipe 49 into cylinder 50 at 50'. As soon as the follower has been placed on the wood the lever 29 is swung around to A', first position, and that causes the high pressure to again be placed on top of cylinder and the grinding resumed under the high pressure.

The casing 2 is provided with a series of bosses or raised projections 36, which are formed on its outer surface, as shown in Figs. 1, 2, and 3. These bosses are disposed concentrically with the ports 12, 13, 15, and 16 and are intended to provide a solid and level connecting-bed for the water-tight packing-box or coupling 37. The packing-box or coupling 37 is composed of a cap or bridge 38, which fits upon and is secured to the boss 36 by means of the cap-screw 39. The bridge 38, as shown in elevation in Figs. 1 and 2 and in section in Fig. 3, is provided with the central tubular portion 40, which is internally threaded at its outer end to receive a section of pipe, as 47, 48, 49, and 59, and its inner end extends through boss 36 and forms in each instance the ports leading from the pumps to the valve-chamber and from said chamber to the grinding-cylinder. The tube or hollow portion 40 is concaved at its inner end to conform to the circle or curve of the valve-chamber 11 and also the valve 6 and is intended in each instance to bear against the jacket 26 of the valve-plug, so as to make as nearly as possible a close-fitting joint. Boss 36 is bored out at 36' considerably larger than the tubular part 40, so as to provide for the insertion of a suitable gasket or packing material 42 around said part 40, and in order to compress and hold the said packing material in place against the curving surface of the valve-core and the tube 40 I provide a follower 43, preferably in the form shown in Figs. 9 and 10, and I also provide the annular nut or gland 44, which is intended to force and hold the follower down on the packing. The annular nut 44 is externally threaded to engage the threads in the outer end of the aperture 36', formed in the boss 36. The nut or gland 44 is bored out internally, so as to slidably fit the tubular part 40. In assembling these coupling parts the nut 44 and the follower 43 are placed upon the tube 40 and the latter inserted into the port or aperture 36', and then bolts 39 are tightened up, the packing is placed around the tubular part 40, and then the follower 43 is placed on the packing, and the nut 44 is then screwed down by means of a spanner-wrench.

By this means a coupling or joint is formed which will not leak. In a rotary valve of this class it is important that all the couplings are formed so as to be perfectly water-tight, and the purpose of this particular form of coupling and packing is to prevent the water as it passes under pressure from the pumps through the various ports and ducts on its way to the cylinder from leaking out or escaping either into the valve-chamber 11 at the point where the perforated jacket meets the several ports in the casing 2 or to the outside of the valve-body at any of the points where such joints or couplings are made. As a rule the amount of pressure supplied by the pumps is rarely in excess of what is required to carry out the perfect working of the grinding mechanism, and any waste through imperfect coupling or packing, however slight it may be, will interfere with the work with the grinders, and for that reason I have devised the couplings herein shown and described.

Obviously the detail construction of the mechanism as herein shown and described may be altered without departing from the spirit of my invention, and I therefore do not confine the same to the specific form and arrangement of parts herein shown.

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

1. A rotary valve of the class described, comprising a cylindrical casing having one open and one closed end, a plurality of receiving and discharge ports formed therein, a core or plug journaled in said casing, spirally-shaped ducts or recesses formed in the surface of said plug or core, a central discharge passage or duct disposed longitudinally of said plug or core, cross ports or ducts converging to and connecting with said central discharge passage or duct, a tubular jacket or case tightly fitting said plug or core, perforations in said jacket or case adapted to be disposed between the ducts and ports of said plug or core and the ports of said casing, an annular index or gage formed upon the face of said casing, notches or graduations formed in said index or gage, a lever connected with, and adapted to operate said plug or core and to be set in said notches or graduations, and a spring adapted to hold said lever when so set, substantially as described.

2. A rotary valve of the class described, comprising a hollow casing having a detachable head and a plurality of inlet and outlet ports, a cylindrical plug or core journaled in said casing, a series of spirally-shaped recesses or ducts formed in the surface of said core or plug, a central discharge passage or duct extending lengthwise of said plug or core, cross ports or passages converging to and connecting with said central discharge passage or duct, a jacket or casing surrounding said plug or core, a series of perforations in said jacket or casing, adapted to strain a fluid passing from said inlet to said outlet-ports, and provided with means for preventing the leakage or escape of the water or other fluid as it passes through said ports and ducts, an annular gage or index formed upon said detachable head, a series of notches or gage-marks formed in said annular gage or index, and a lever or handle connected with said core or plug and adapted to be operated to rotate and set said plug or core in a number of different positions, substantially as described.

3. A rotary valve of the class described, comprising a cylindrical casing having a detachable head upon one end and a waste-port at the other end, a series of receiving-ports in one side of said casing, a pair of oppositely-disposed discharge-ports formed in said casing, a packing box or coupling secured to said casing and disposed concentrically with each of said receiving and discharge ports, means, comprising a gasket, a follower, and a gland-nut for preventing the escape or leakage of a fluid-pressure around said ports, a valve plug or core journaled in the ends of said casing, spirally-shaped grooves or ducts formed in the surface of said plug or core, adapted to conduct a fluid-pressure from said receiving-ports to said discharge-ports, a series of cross ducts or passages converging toward the center of said plug or core, a central discharge-passage in said plug or core forming a connection between said cross-ports and said waste-port, a perforated tubular jacket or casing tightly fitting said plug or core and adapted to operate therewith, a shaft or gudgeon on one end of said plug or core, an operating-lever connected to said shaft or gudgeon, an annular gage or index formed upon the head of said casing, a series of notches in said gage or index, adapted for indicating the different positions in which said valve plug or core may be set, substantially as described.

4. In a rotary valve of the class described, the combination with a cylindrical casing and a plurality of receiving and discharge ports, of an oblong cylindrical plug or core incased in a tubular jacket and adapted to operatively fit the interior of said casing, spirally-shaped recesses or ducts formed in said plug or core beneath said jacket, discharge passages or ducts extending from the outer surface to the center of said plug or core, a discharge or waste passage extending from one end to the middle of said plug or core, groups of perforations arranged on said jacket through which a fluid-pressure is adapted to flow, packing-boxes to prevent the leakage of water or other fluid around said receiving and discharge ports, an operating-lever connected to said plug or core, and an index or gage to indicate the various positions of said plug or core, substantially as described.

5. A rotary valve of the class described, comprising a cylinder having one flanged end and a

detachable head secured thereto, a cylindrical plug having a perforated jacket rotatably fitting said cylinder, ducts or grooves formed in the surface of said plug, cross-ports radiating from the center of said plug, a central discharge-passage intersecting said cross-ports and extending to the end of said plug, a port in the end of said cylinder connecting with said central discharge-passage, receiving or inlet ports arranged in said cylinder and adapted to connect with said ducts or grooves, discharge or outlet ports in said cylinder adapted to connect with said ducts or grooves and also with said cross-ports, packing boxes or couplings connected with said receiving and discharge ports, an annular gage upon said detachable head, index-notches in said gage, and a lever or crank for operating said plug and adapted to be set in said index-notches, substantially as described.

6. A rotary valve of the class described, comprising a cylinder having one flanged end and a detachable head secured thereto, a cylindrical plug having a perforated jacket rotatably fitting said cylinder, ducts or grooves formed in the surface of said plug, cross-ports radiating from the center of said plug, a discharge-passage intersecting said cross-ports and extending to one end of said plug, a waste-port in the end of said cylinder connected with said discharge-passage, high and low pressure receiving-ports arranged in said cylinder and adapted to connect with the ducts or grooves in said plug, discharge or outlet ports in said cylinder adapted to connect with said ducts or grooves and also with said cross-ports, packing boxes or couplings connected with said receiving and discharge ports, an annular gage upon said detachable head, index-notches in said gage, and a lever or crank for operating said plug and adapted to be set in said index-notches, substantially as described.

7. A valve of the class described, comprising a cylindrical casing, a plurality of receiving and discharge ports formed in said casing, a cylindrical valve-plug journaled in said casing, a tubular jacket mounted upon said valve-plug, groups of perforations in said jacket, a duct formed in the surface of said valve-plug adapted to receive a fluid under high pressure, and a pair of like ducts in the surface of said valve-plug adapted to receive a fluid under low pressure, cross ports or passages in said valve-plug, a central waste or discharge passage intersecting with said cross-ports and connected with a discharge-port in the end of said casing, a series of packing boxes and couplings arranged on said casing and adapted to form the ports for the passage of the fluid to and from said ducts and to said cross-ports, a lever to operate said valve-plug, and a gage or index to indicate the different positions of said valve-plug, substantially as described.

8. In combination with a grinding-cylinder, a valve of the class described, comprising a hollow casing provided with a series of receiving and discharge openings, a valve-core operatively fitting said casing, a tight-fitting jacket incasing said valve-core, spirally-shaped recesses or ducts formed in the surface of said valve-core beneath said jacket, perforations in said jacket forming inlets and outlets for the fluid passing through said receiving and discharge openings and also said recesses or ducts, cross ports or passages converging toward the center of said valve-core, a central discharge-passage intersecting said cross ports or passages, pipes to carry a fluid from the pumps to said valve, pipes to carry a fluid from said valve to the grinding-cylinder, and also to carry said fluid back to said valve, packing boxes or couplings adapted to form pressure-tight connections between said pipes and said valve, a lever connected with said valve-core, a gage or index upon one end of said casing, adapted by means of said lever to indicate a number of different positions in which said valve-core may be set, substantially as described.

9. The combination with a grinding-cylinder and a hollow casing having a detachable head and a high-pressure and a low-pressure receiving-port, of a cylindrical plug journaled in said casing, having a series of spirally-shaped ducts formed in the surface of said plug, one of said ducts adapted to receive a high pressure, and two of said ducts adapted to receive a low pressure, cross-ports converging toward the center of said plug, a central passage formed longitudinally of said plug and intersecting with said cross-ports, a waste-port in the end of said casing in line with said central passage, a jacket incasing said plug and having a group of perforations disposed at the ends of said spirally-shaped ducts and also opposite each of said cross-ports, oppositely-disposed discharge-ports formed in said casing, pipes connecting a pump system with said valve, and pipes connecting said valve with the grinding-cylinder, the latter pipes being adapted to support and hold said valve in position, an indicator upon one end of said casing, and an operating-lever adapted to engage said indicator, substantially as described.

10. The combination with a grinding-cylinder, of a valve of the class described, comprising a suitable casing, a rotatable plug or member operatively fitting said casing, a perforated tubular jacket surrounding said plug or member, a port or passage in said plug or member adapted to direct a fluid under high pressure to the top of the grinding-cylinder, a second port or passage in said plug or member adapted to direct a fluid under low pressure to the top of said cylinder, a third port or passage in said plug or member adapted to direct a fluid under low pressure to the bottom of said cylinder, a series of discharge or relief ports in said plug or member adapted

to drain or carry off the water or other fluid from either end of said grinding-cylinder, a lever operable by hand to change or vary the flow of either of said pressures, or to prevent the passage of the same through said valve, and a graduated gage or ring to indicate the state or position of said valve, substantially as described.

11. A rotary valve of the class described, comprising a cylindrical casing having one open and one closed end, a plurality of receiving and discharge ports formed therein, a core or plug journaled in said casing, spirally-shaped ducts or recesses formed in the surface of said plug or core, a central discharge passage or duct disposed longitudinally of said plug or core, cross ports or ducts converging to and connecting with said central discharge passage or duct, and a tubular jacket or case tightly fitting said plug or core, and having perforations adapted to be disposed between the ducts and ports of said plug or core and the ports of said casing, substantially as described.

12. A rotary valve of the class described, comprising a hollow casing having a plurality of inlet and outlet ports, a cylindrical plug or core journaled in said casing, a series of spirally-shaped recesses or ducts formed in the surface of said core or plug, a central discharge passage or duct extending lengthwise of said plug or core, cross ports or passages converging to and connecting with said central discharge passage or duct, a jacket or casing surrounding said plug or core, and a series of perforations in said jacket or casing, adapted to strain a fluid passing from said inlet to said outlet ports, and provided with means for preventing the leakage or escape of the water or other fluid as it passes through said ports and ducts, substantially as described.

13. A rotary valve of the class described, comprising a cylindrical casing having a waste-port at one end, a series of receiving-ports in one side of said casing, oppositely-disposed discharge-ports formed in said casing, a packing box or coupling secured to said casing and disposed concentrically with each of said receiving and discharge ports, means, comprising a gasket, a follower, and a gland-nut for preventing the escape or leakage of a fluid-pressure around said ports, a valve plug or core journaled in said casing, spirally-shaped grooves or ducts formed in the surface of said plug or core, adapted to conduct a fluid-pressure from said receiving-ports to said discharge-ports, a series of cross ducts or passages converging toward the center of said plug or core, a central discharge-passage in said plug or core forming a connection between said cross-ports and said waste-port, a perforated tubular jacket or casing fitting said plug or core and adapted to operate therewith, a shaft or gudgeon on one end of said plug or core, and an operating-lever connected to said shaft or gudgeon, substantially as described.

14. In a rotary valve of the class described, the combination with a cylindrical casing and a plurality of receiving and discharge ports, of an oblong cylindrical plug or core incased in a tubular jacket and adapted to operatively fit the interior of said casing, spirally-shaped recesses or ducts formed in said plug or core beneath said jacket, discharge passages or ducts extending from the outer surface to the center of said plug or core, a discharge or waste passage extending from one end to the middle of said plug or core, groups of perforations arranged on said jacket through which a fluid-pressure is adapted to flow, packing-boxes to prevent the leakage of water or other fluid around said receiving and discharge ports, and an operating-lever connected to said plug or core, substantially as described.

15. A rotary valve of the class described, comprising a cylinder having a detachable head secured thereto, a cylindrical plug having a perforated jacket rotatably fitting said cylinder, ducts or grooves formed in the surface of said plug, cross-ports radiating from the center of said plug, a central discharge-passage intersecting said cross-ports and extending to the end of said plug, a port in the end of said cylinder connecting with said central discharge-passage, receiving or inlet ports arranged in said cylinder and adapted to connect with said ducts or grooves, discharge or outlet ports in said cylinder adapted to connect with said ducts or grooves, and also with said cross-ports, and packing boxes or couplings connected with said receiving and discharge ports, substantially as described.

16. A rotary valve of the class described, comprising a cylinder, a cylindrical plug having a perforated jacket rotatably fitting said cylinder, ducts or grooves formed in the surface of said plug, cross-ports radiating from the center of said plug, a discharge-passage intersecting said cross-ports and extending to one end of said plug, a waste-port in the end of said cylinder connected with said discharge-passage, high and low pressure receiving-ports arranged in said cylinder and adapted to connect with the ducts or grooves in said plug, and discharge or outlet ports in said cylinder adapted to connect with said ducts or grooves and also with said cross-ports, substantially as described.

17. A valve of the class described, comprising a cylindrical casing, a plurality of receiving and discharging ports formed in said casing, a cylindrical valve-plug journaled in said casing, a tubular jacket mounted upon said valve-plug, groups of perforations in said jacket, a duct formed in the surface of said valve-plug adapted to receive a fluid under high pressure, and a pair of like ducts in the

surface of said valve-plug adapted to receive a fluid under low pressure, cross ports or passages in said valve-plug, and a central waste or discharge passage intersecting with said cross-ports and connected with a discharge-port in the end of said body, substantially as described.

18. In combination with a grinding-cylinder, a valve of the class described, comprising a hollow casing provided with a series of receiving and discharge openings, a valve-core operatively fitting said casing, a tight-fitting jacket incasing said valve-core, spirally-shaped recesses or ducts formed in the surface of said valve-core beneath said jacket, perforations in said jacket forming inlets and outlets for the fluid passing through said receiving and discharge openings and also said recesses or ducts, cross ports or passages converging toward the center of said valve-core, a central discharge-passage intersecting said cross ports or passages, pipes to carry a fluid from the pumps to said valve, and pipes to carry a fluid from said valve to the grinding-cylinder, and also to carry said fluid back to said valve, substantially as described.

19. In combination with a grinding-cylinder a valve of the class described, the combination with a hollow casing having a high-pressure and a low-pressure receiving-port, of a cylindrical plug journaled in said casing, having a series of spirally-shaped ducts formed in the surface of said plug, one of said ducts adapted to receive a high pressure, and two of said ducts adapted to receive a low pressure, cross-ports converging toward the center of said plug, a central passage formed longitudinally of said plug and intersecting with said cross-ports, a waste-port in the end of said casing in line with said central passage, a jacket incasing said plug and having a group of perforations disposed at the ends of said spirally-shaped ducts and also opposite each of said cross-ports, oppositely-disposed discharge-ports formed in said casing, pipes connecting a pump system with said valve, and pipes connecting said valve with the grinding-cylinder, the latter pipe being adapted to support and hold said valve in position, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN D. BALDICK.

Witnesses:

H. C. TEEPELL,

HARRY DE WALLACE.