

Dec. 18, 1951

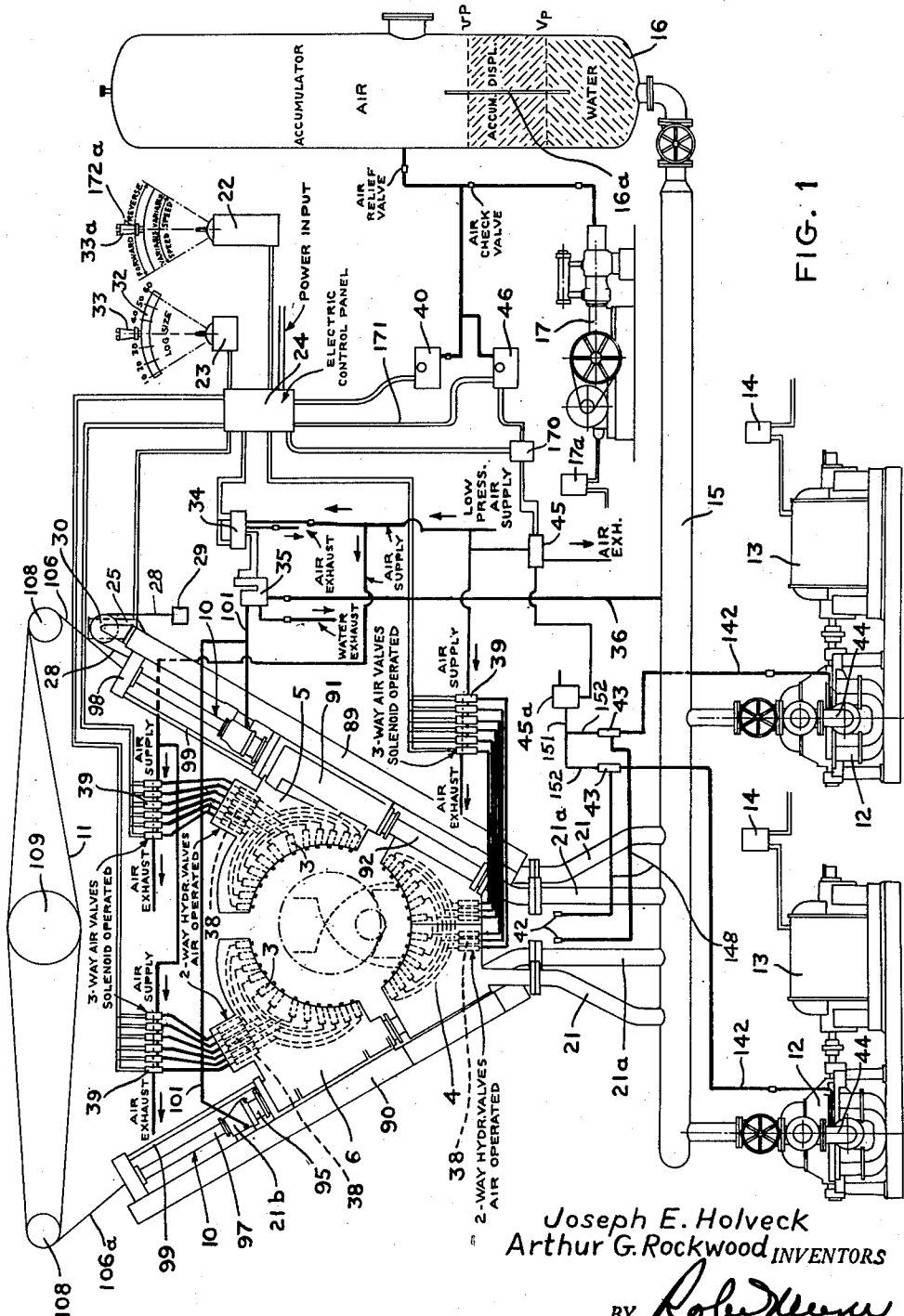
J. E. HOLVECK ET AL

2,578,804

HYDRAULIC-TYPE LOG DEBARKER HAVING CENTRIPETALLY
DIRECTED JETS MOUNTED IN CIRCUMFERENTIAL GROUPS
RADIALLY ADJUSTABLE FOR DIFFERENT SIZE LOGS

Filed April 30, 1946

21 Sheets-Sheet 1



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Dec. 18, 1951

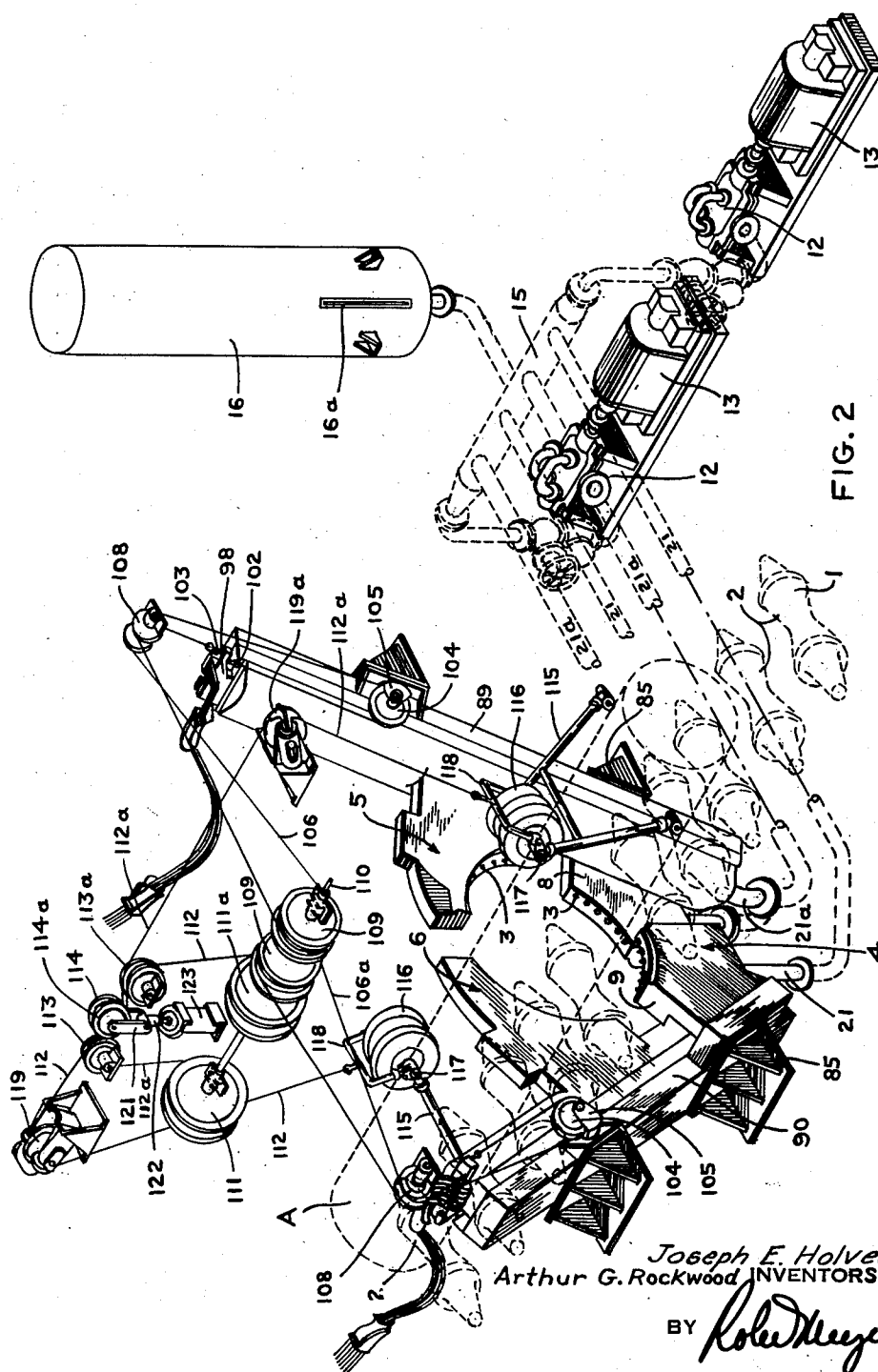
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21 Sheets-Sheet 3

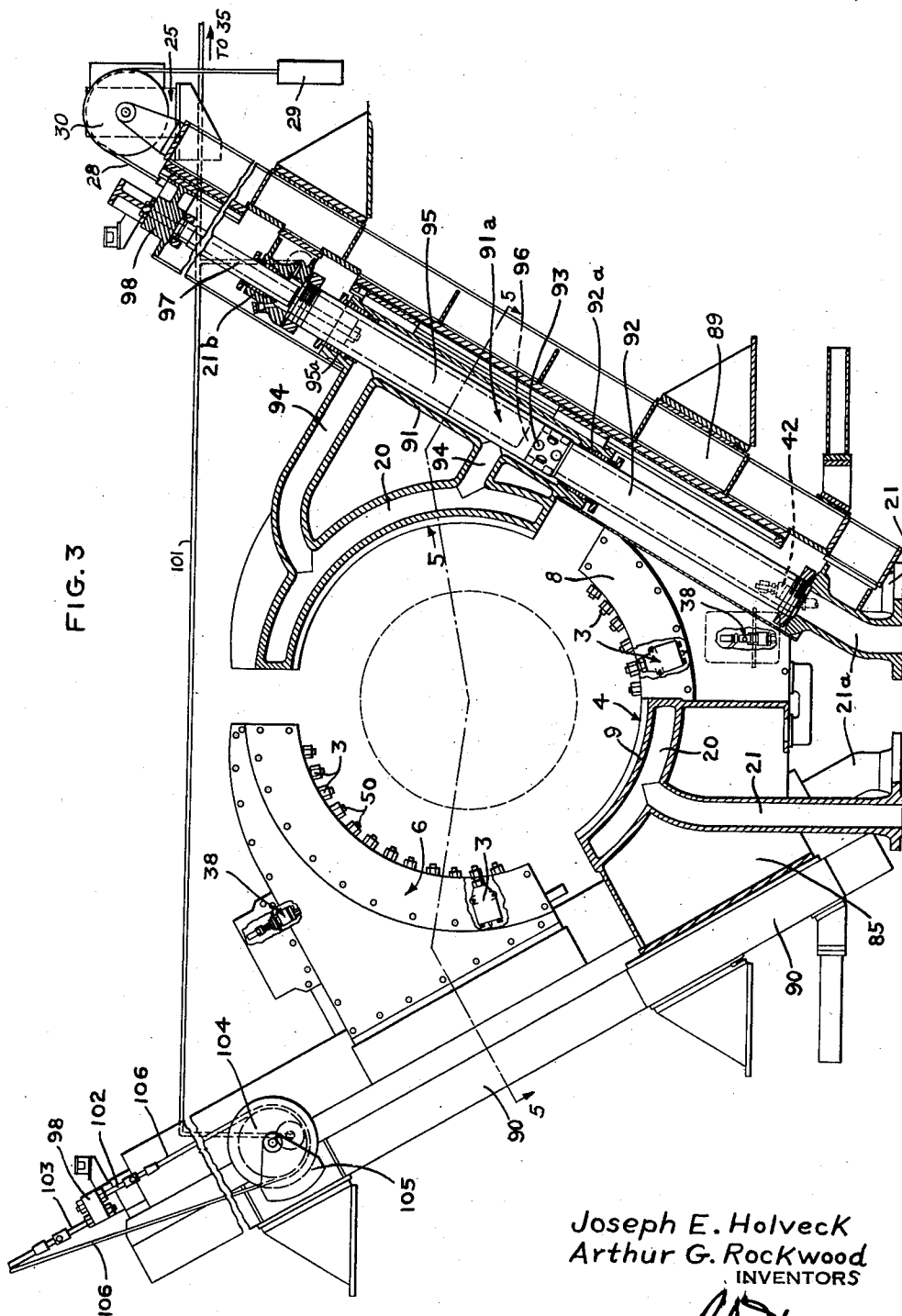


FIG. 3

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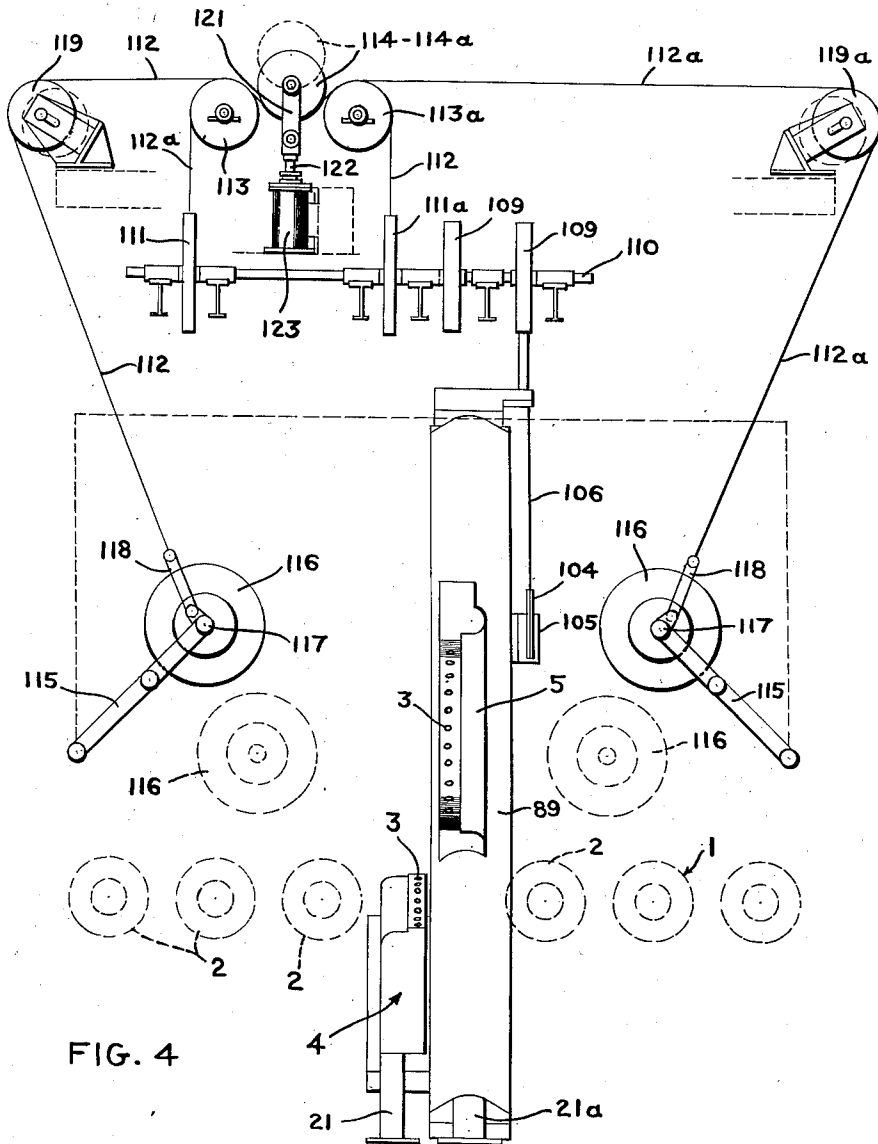
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21 Sheets-Sheet 4



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21 Sheets-Sheet 5

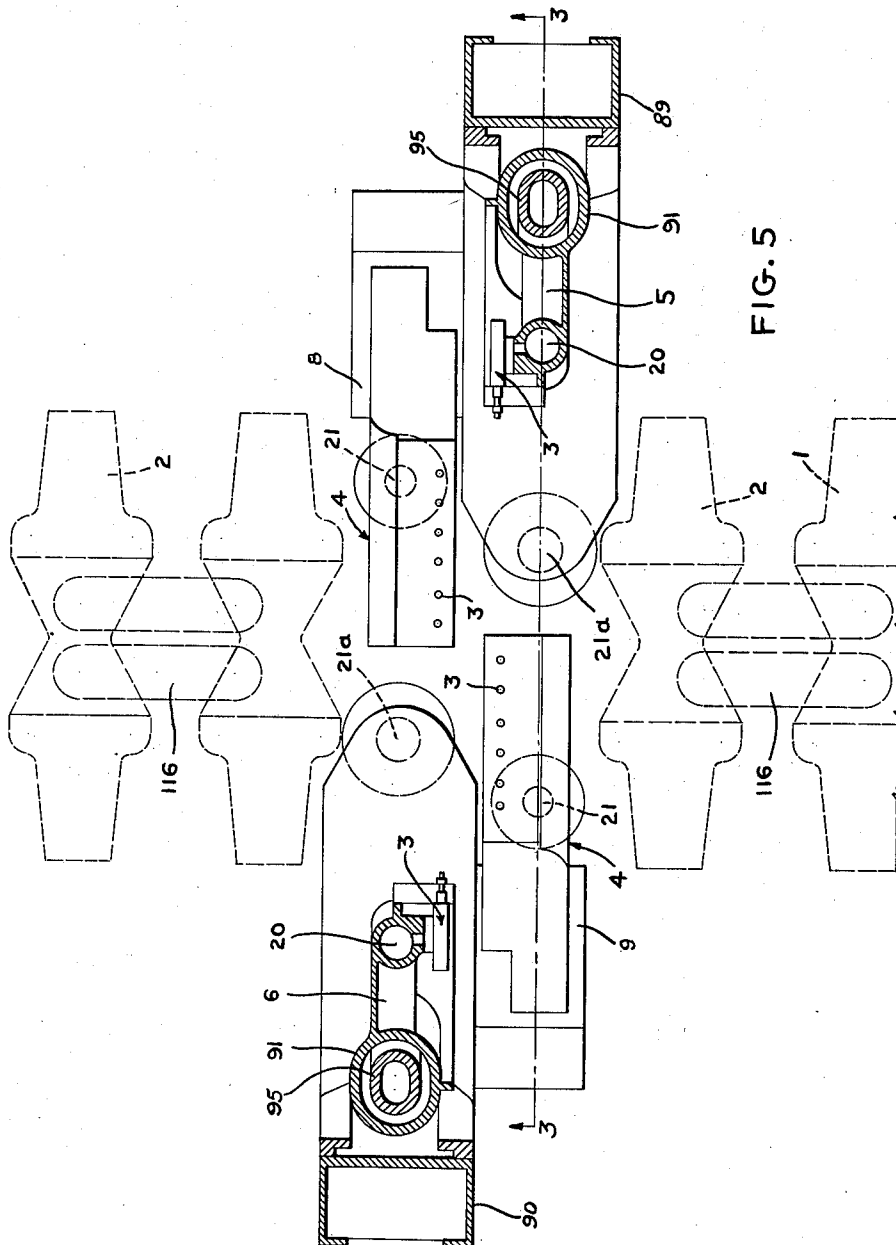


FIG. 5

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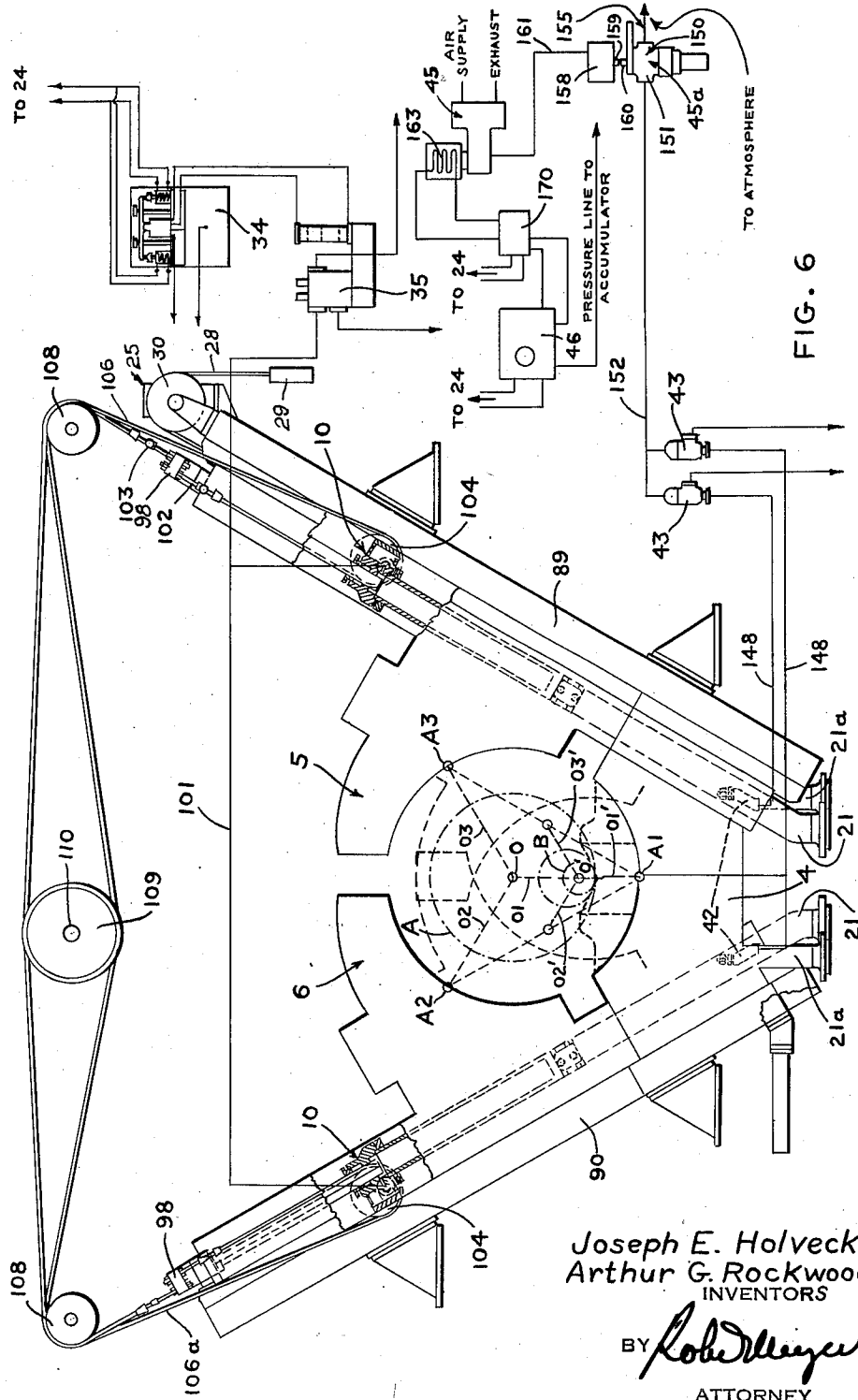
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21 Sheets-Sheet 6



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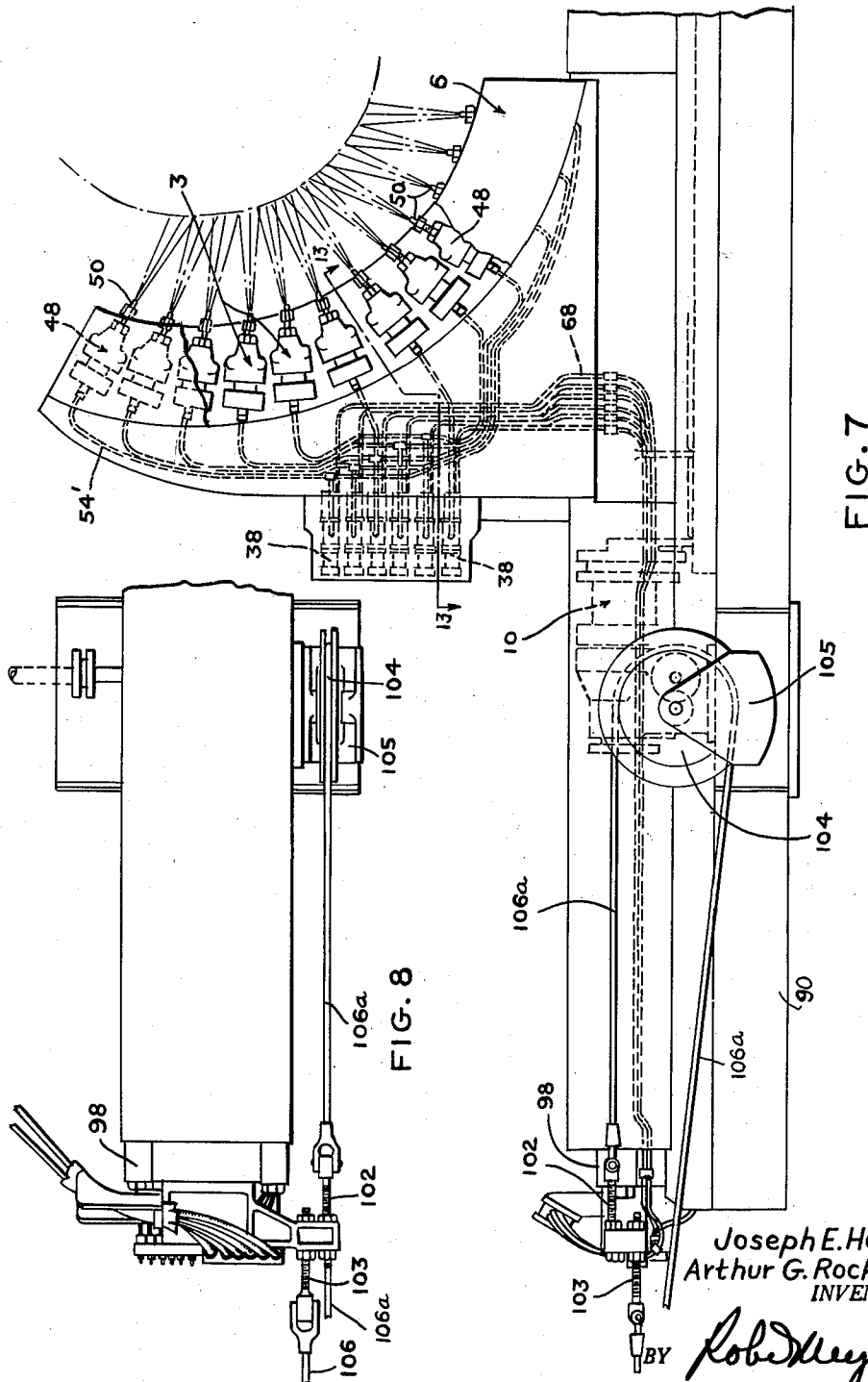
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21 Sheets-Sheet 7



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HYDRAULIC-TYPE LOG DEBARKER HAVING CENTRIPETALLY
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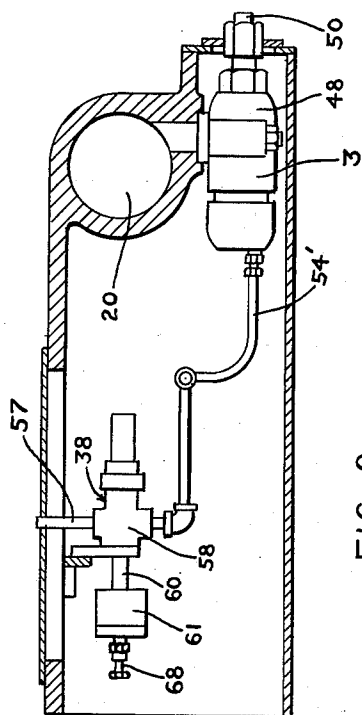


FIG. 9

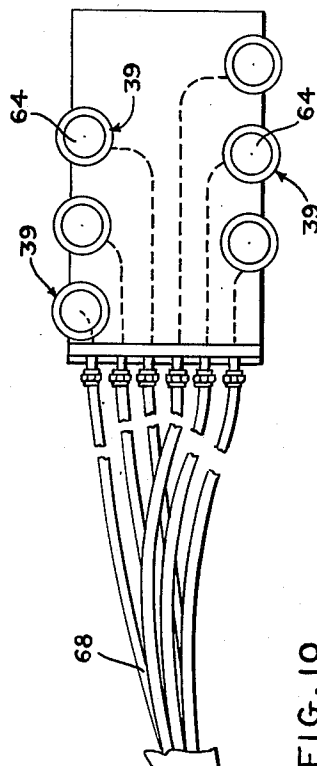
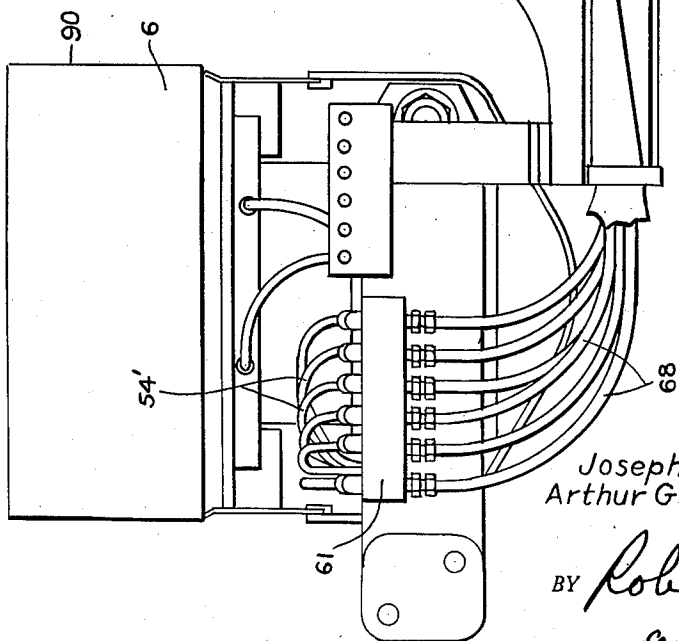


FIG. 10



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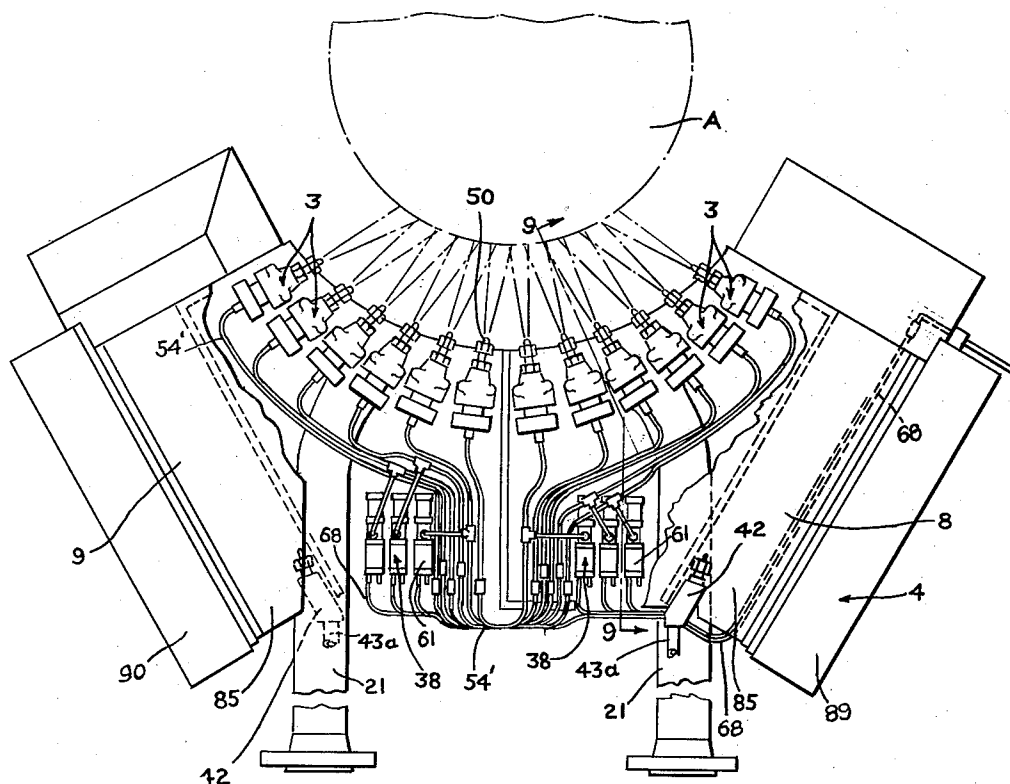


FIG. 11

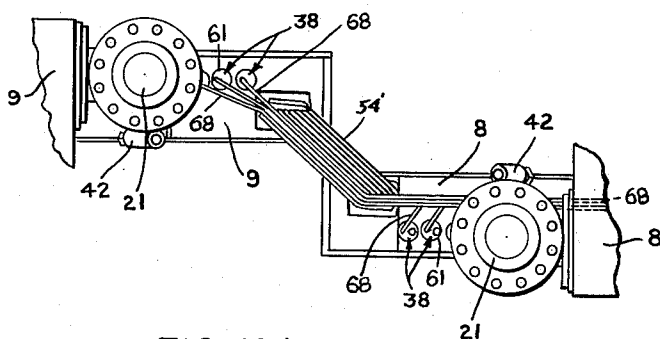


FIG. 12A

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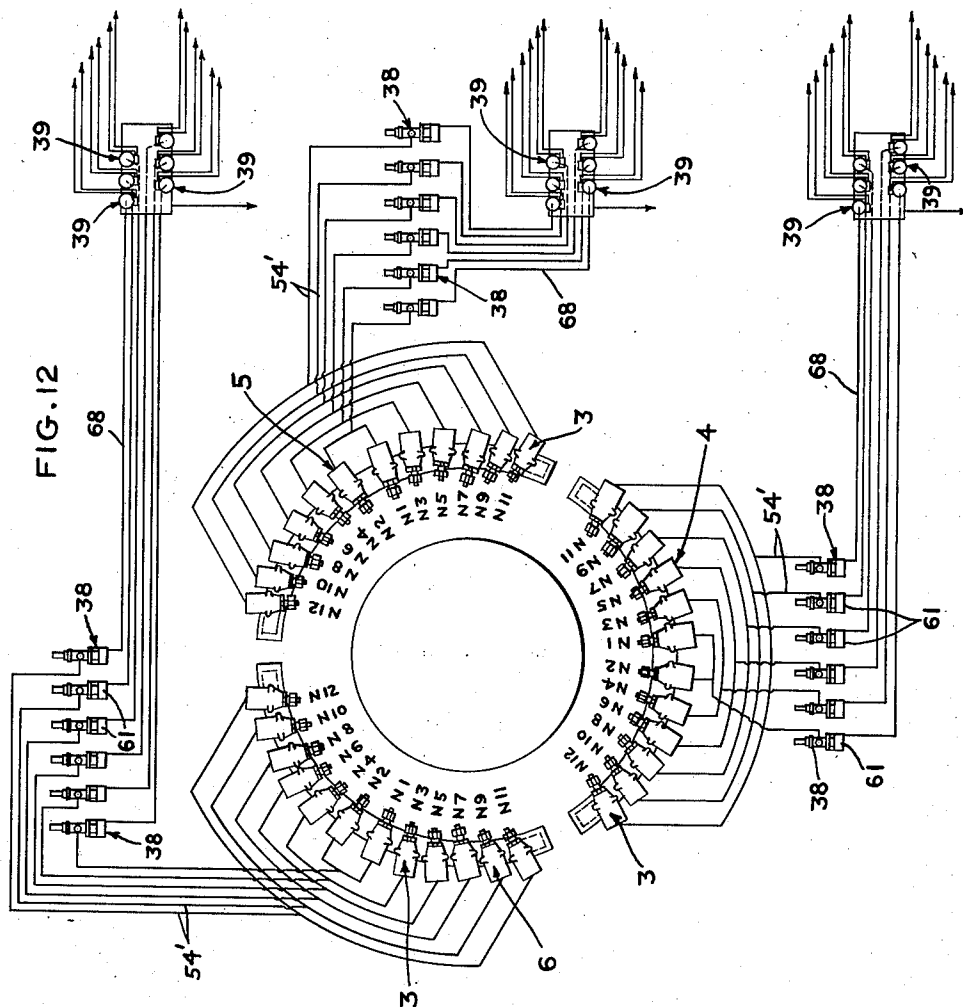
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21 Sheets-Sheet 10



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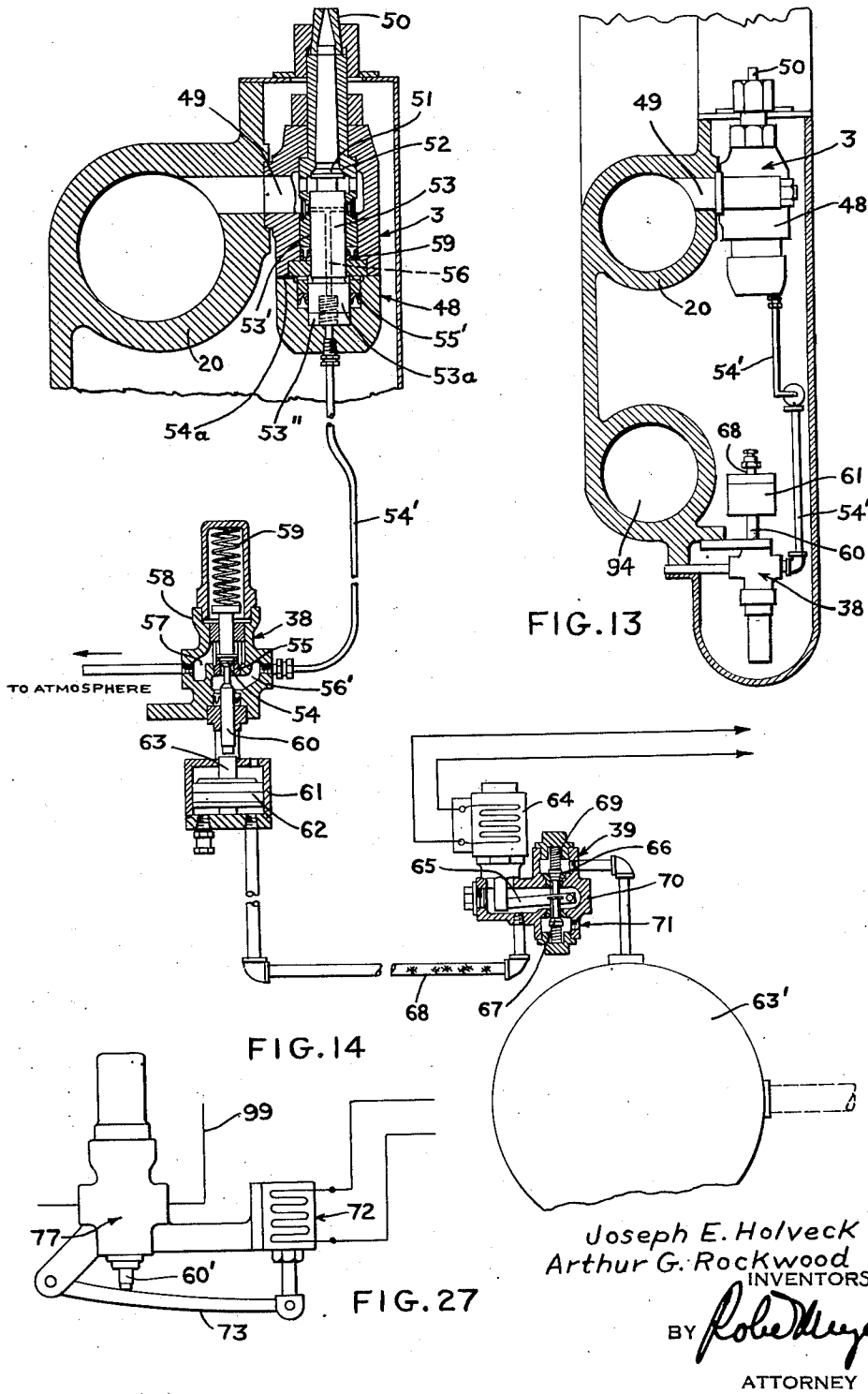
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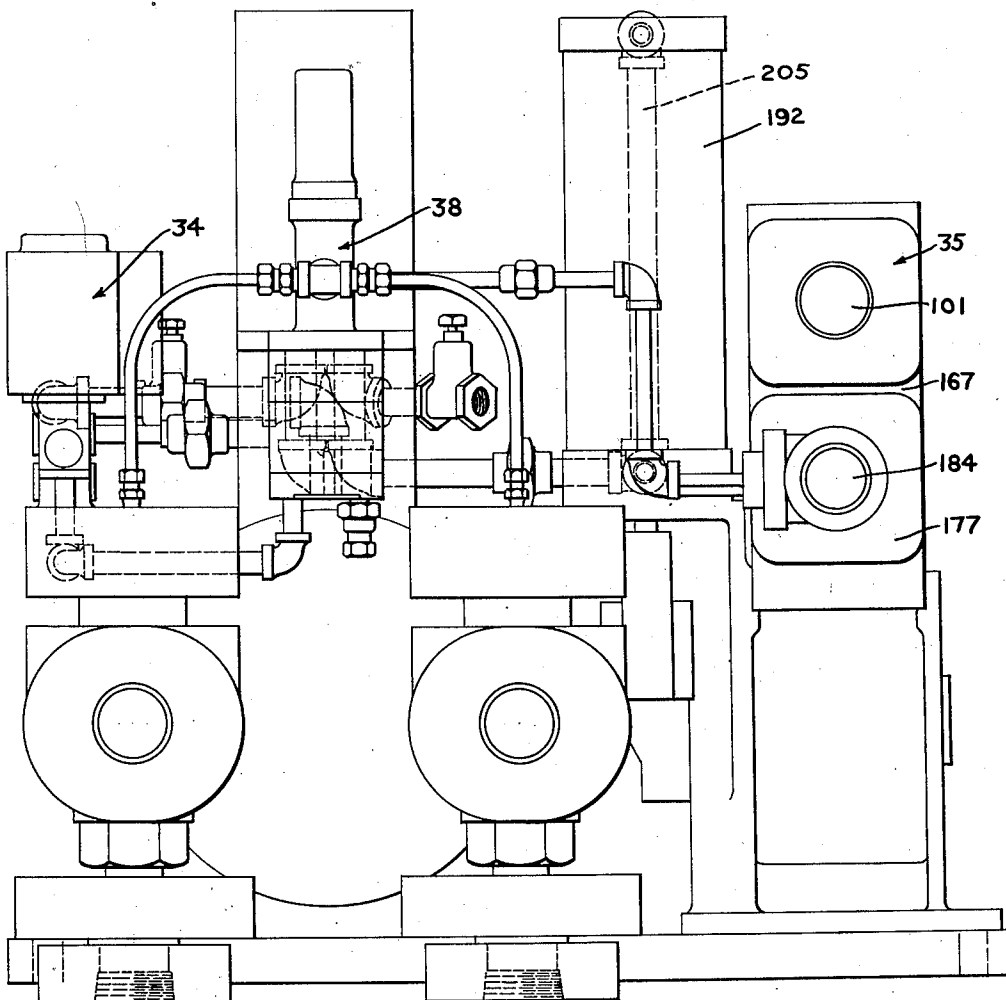


FIG. 15

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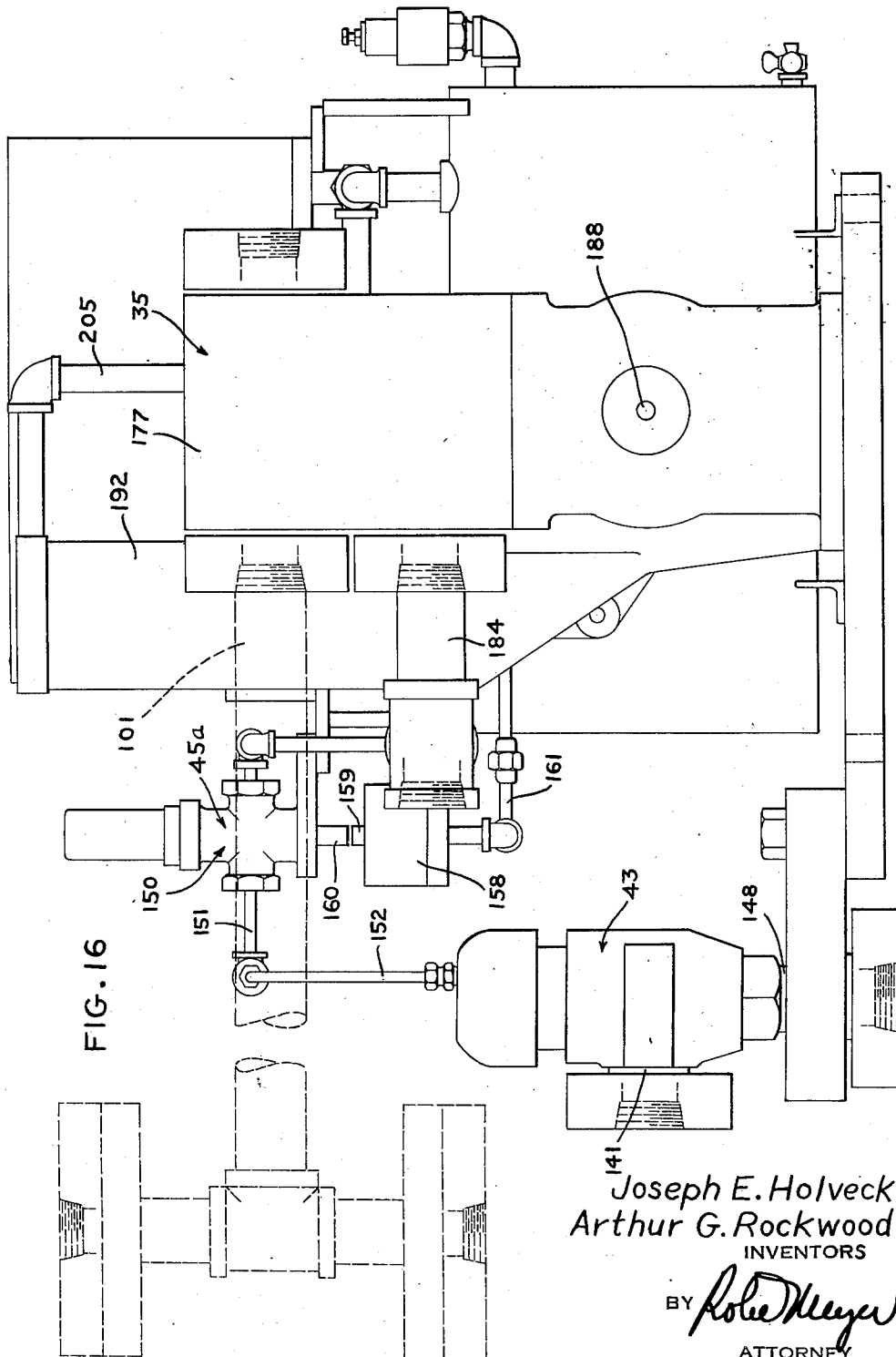
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21 Sheets-Sheet 14

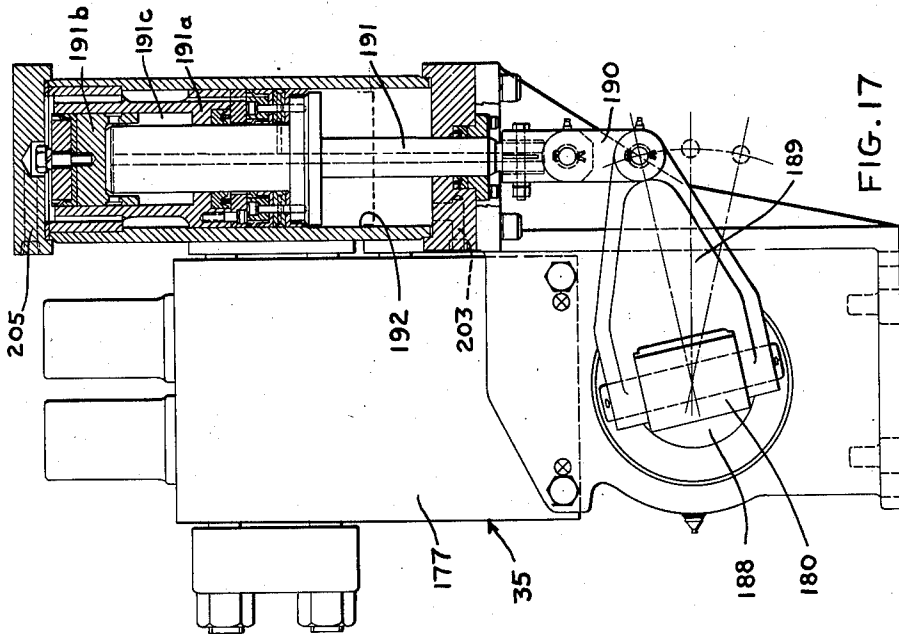


FIG. 17

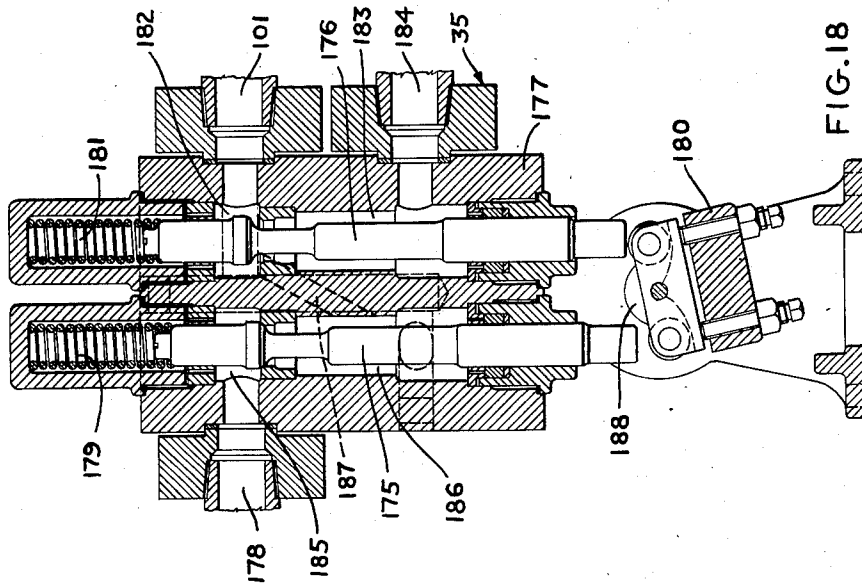


FIG. 18

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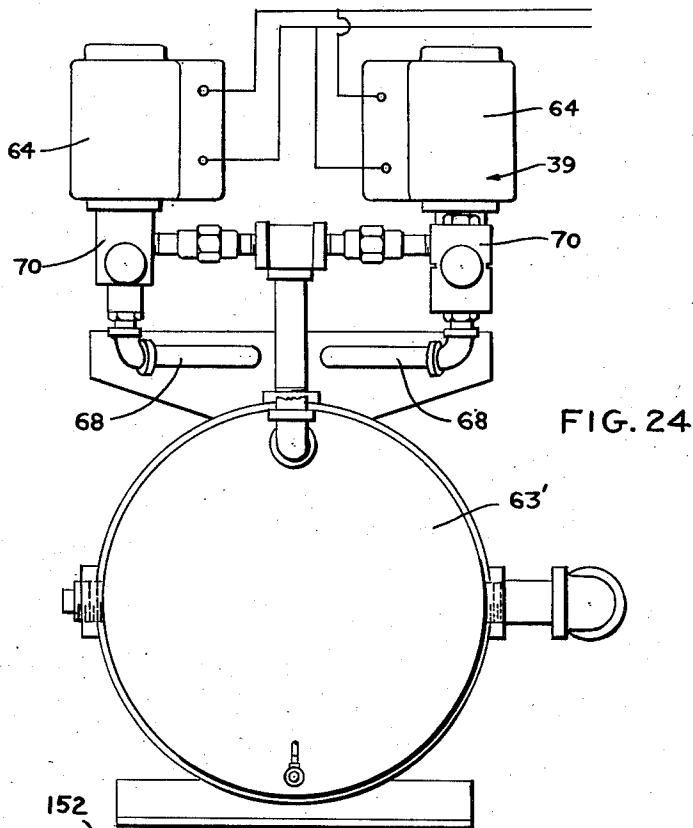
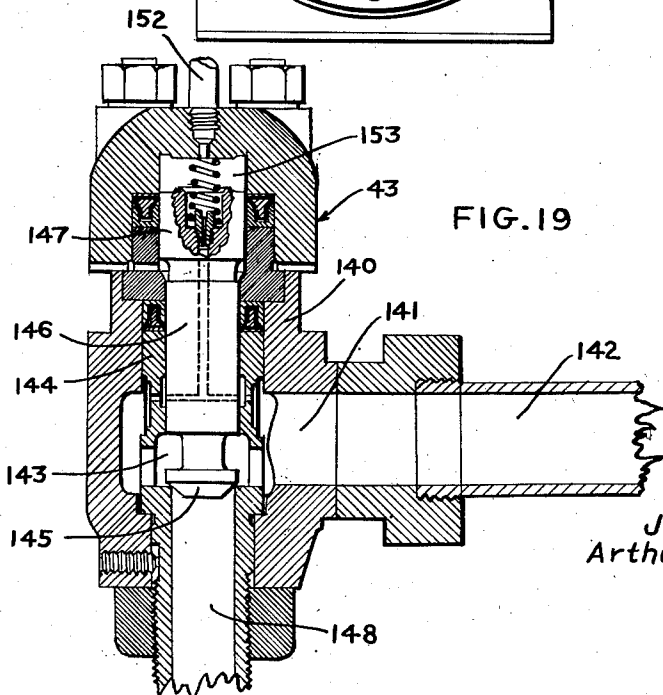
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21 Sheets-Sheet 16

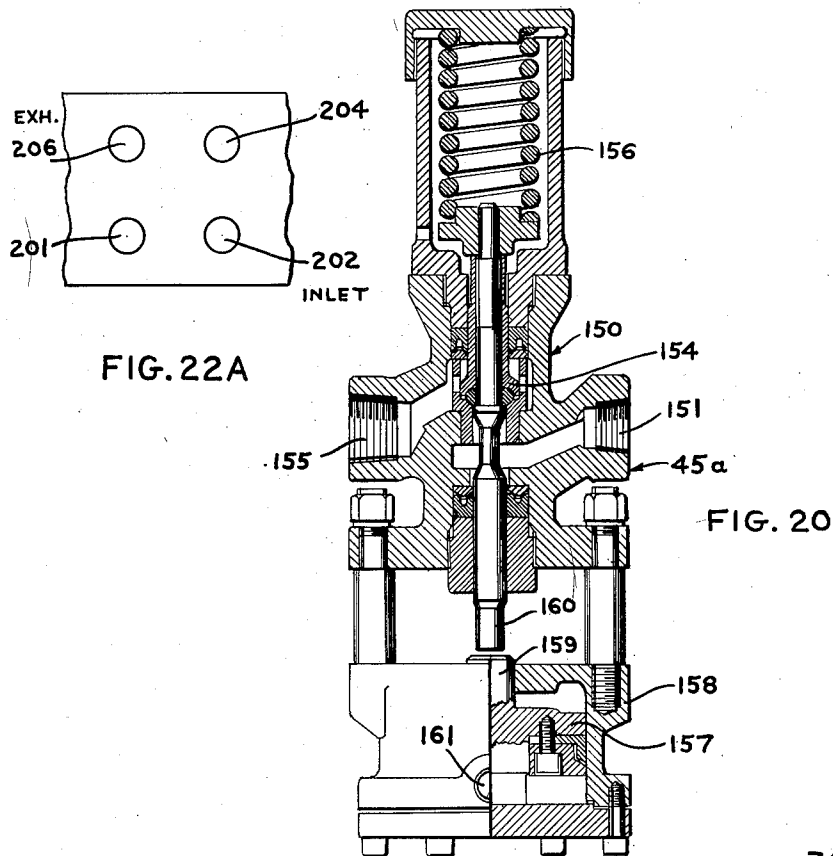
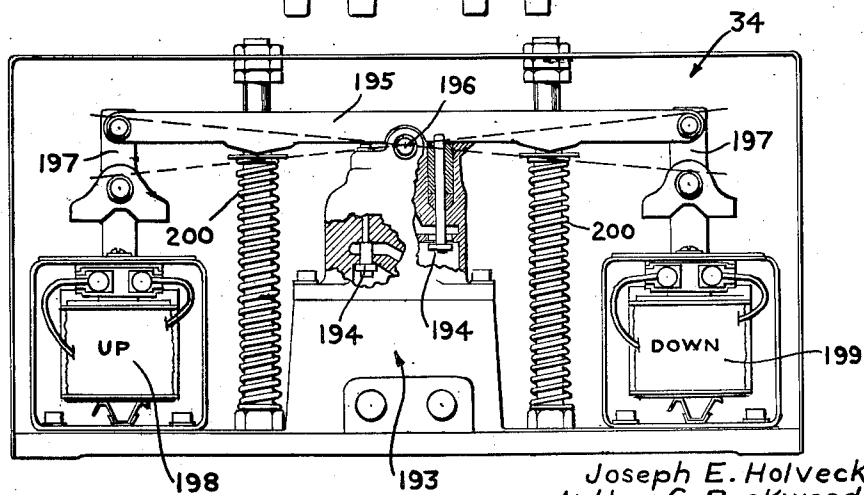


FIG. 21

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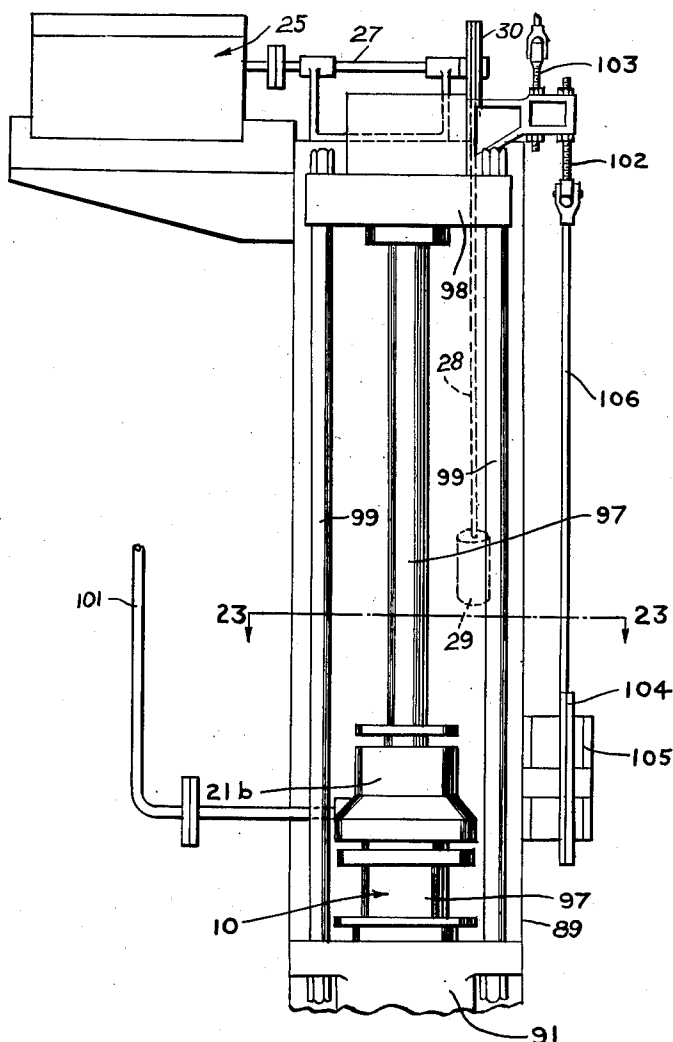


FIG. 22

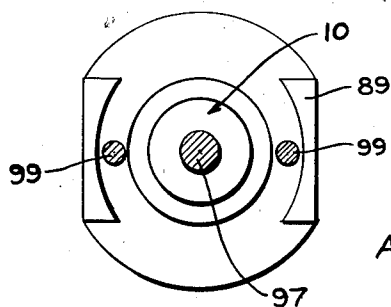


FIG. 23

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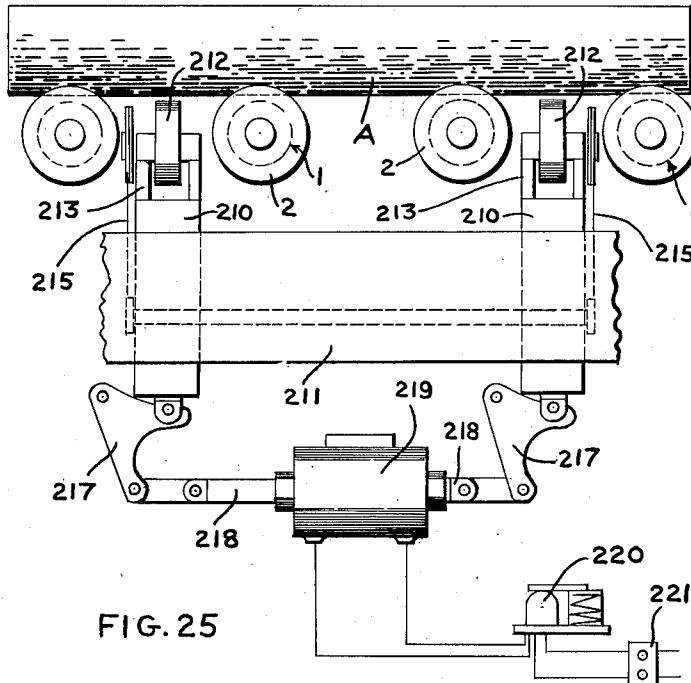


FIG. 25

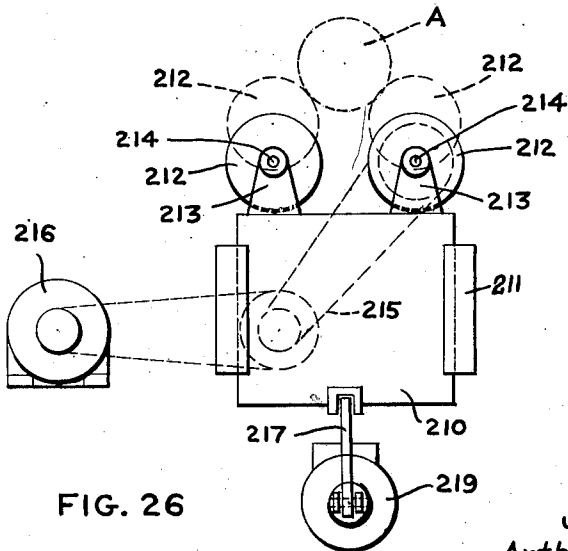


FIG. 26

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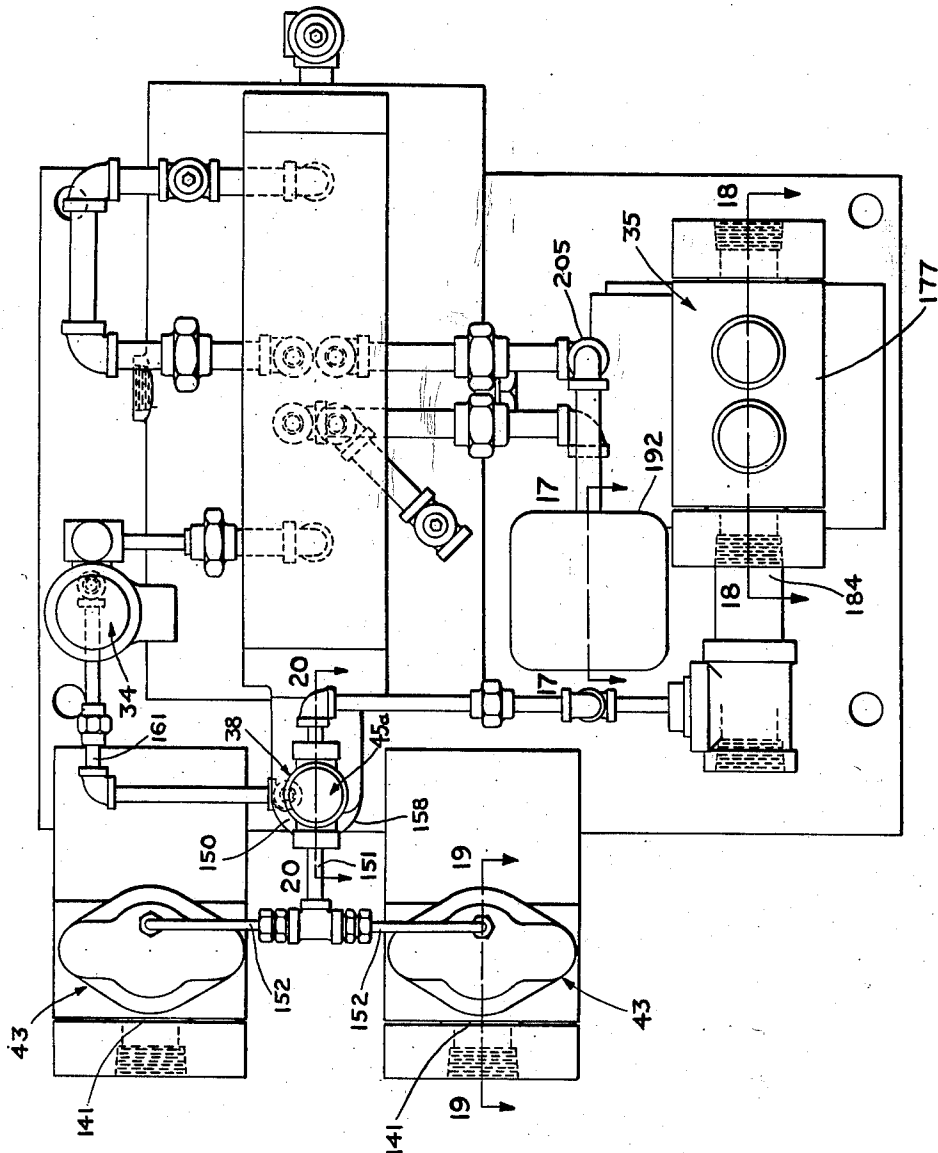


FIG. 28

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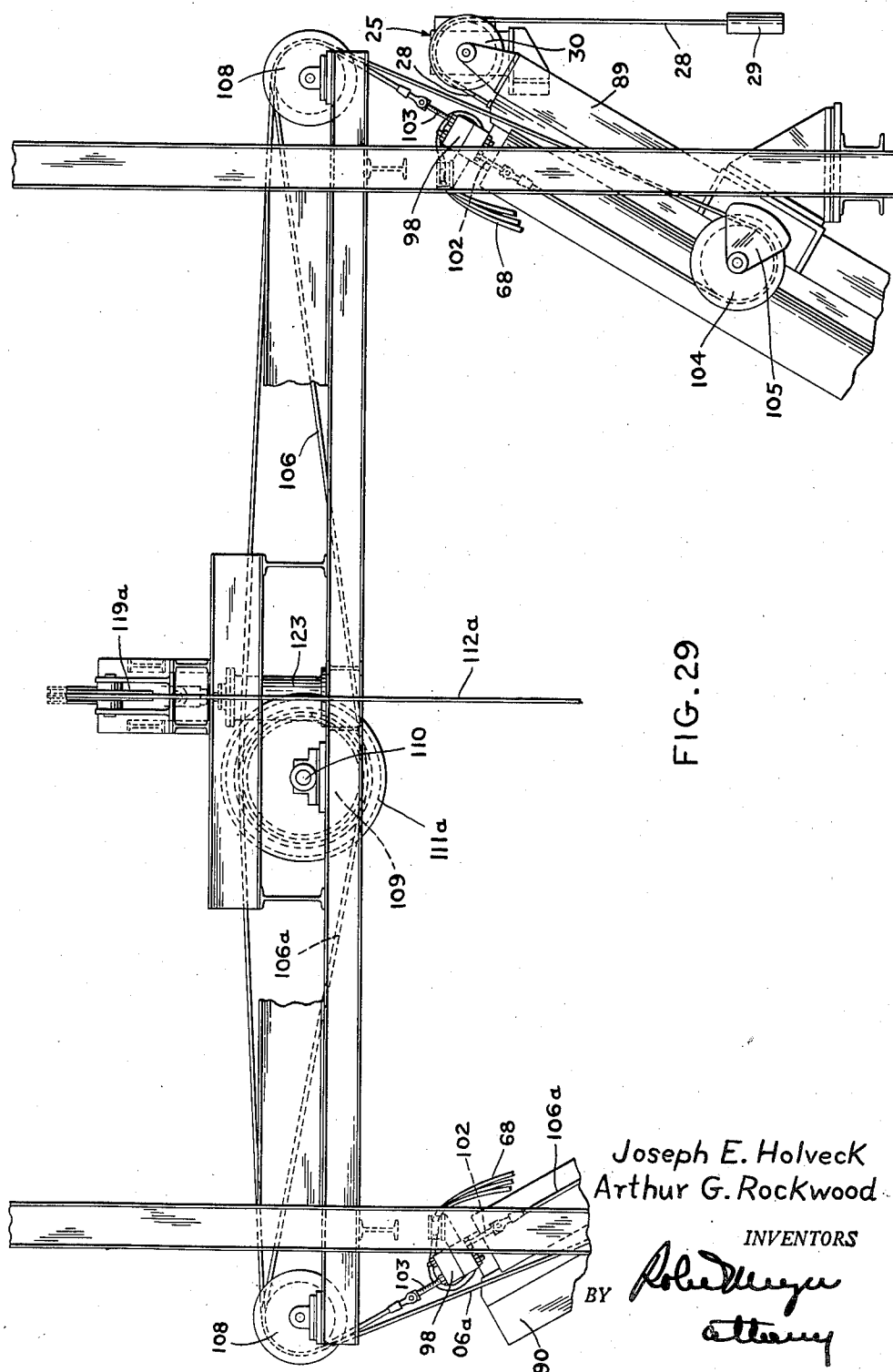


FIG. 29

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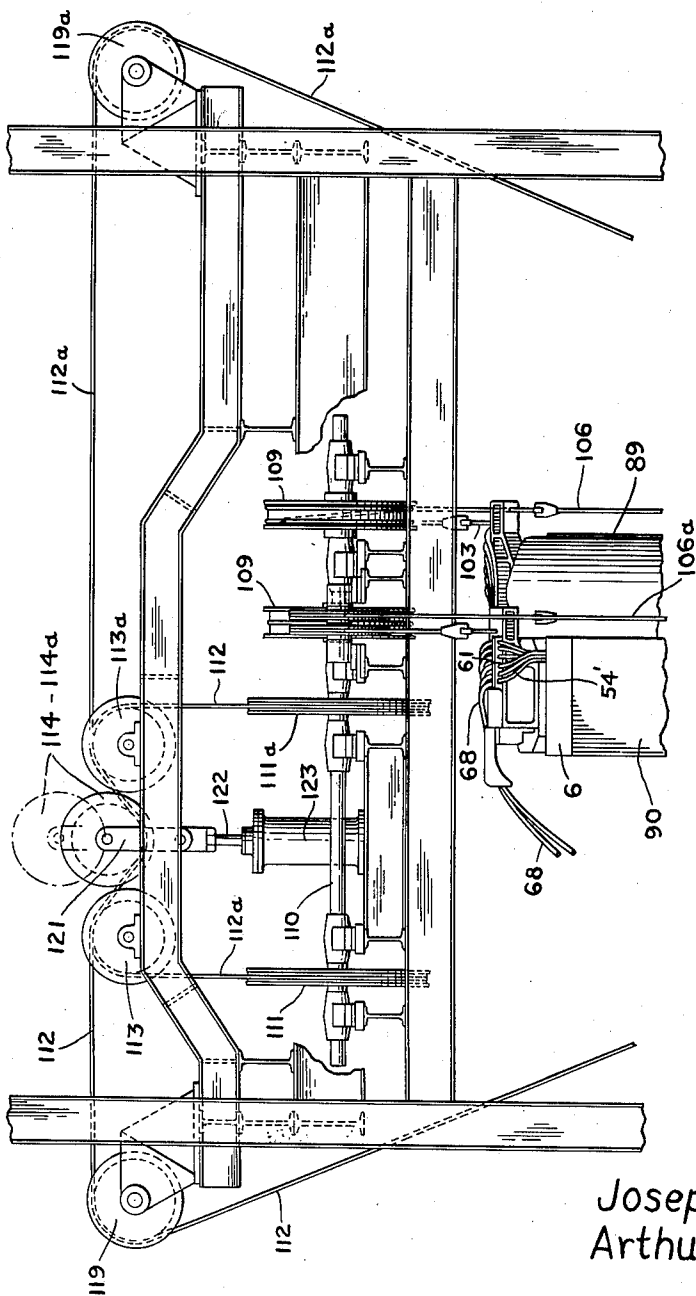


FIG. 30

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UNITED STATES PATENT OFFICE

2,578,804

HYDRAULIC-TYPE LOG DEBARKER HAVING
CENTRIPETALLY DIRECTED JETS MOUNTED
IN CIRCUMFERENTIAL GROUPS RADIAL-
LY ADJUSTABLE FOR DIFFERENT
SIZE LOGSJoseph E. Holveck, Upper Montclair, and Arthur
G. Rockwood, Nutley, N. J., assignors to Worth-
ington Pump and Machinery Corporation, Har-
rison, N. J., a corporation of Delaware

Application April 30, 1946, Serial No. 666,008

36 Claims. (Cl. 144—208)

1

This invention relates to an apparatus for removing bark from tree logs, and more particularly to a bark removal apparatus which will result in an appreciable saving in wood, particularly in the manufacture of wood pulp, in that the bark and cambial layer is removed from the logs, without the wastage of any of the wood, by means of hydraulic erosion through the application of concentrated water jets at high velocity.

The primary object of the present invention is to provide in an apparatus for removing bark from logs, an efficient application of hydraulic jets for the thorough erosion of the bark and cambial layer from the log with an economical centralized hydraulic system for supplying the hydraulic power, together with a simple mechanical method of log conveyance and manipulation at speeds normal in pulp mills and like plants, and, as far as possible, utilizing conventional methods established by the industry in the handling of logs, without embodying complicated mechanical equipment at such places and in such parts where such equipment would be subjected to erosion and corrosion due to high velocity water and particles of loose flying bark.

An object of the invention is the provision of an apparatus for hydraulically removing bark from logs, wherein a plurality of nozzles are arranged in sets, each set constructed and arranged to discharge high pressure-high velocity jets of water against and normal to a portion of the surface of a log as it moves through the apparatus, and to provide control means for the nozzles whereby predetermined groups of nozzles may be held inactive while others discharge the jets of water against a log; that is, to cause the number of active high pressure water jets to be proportionate to the diameter of the log so as to provide complete coverage of the log by the jets without wastage of high pressure-high velocity water and the power required for raising the pressure of the water to the required degree.

Another object of the present invention is to mount the sets of nozzles on segments which carry a manifold for supplying high pressure water to the nozzles carried thereby, and to maintain certain of the segments for movement relative to the axial line of the log enclosing circle formed by the segments so that the position of nozzles may be adjusted in accordance with the diameter of the log being debarked, and to provide hydraulically operated means for moving the segments together with means connecting them for simultaneous movement.

Another object of the invention is to provide

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air-pressure-actuated valves, controlled from a single switch panel structure to control operation of the individual nozzles to cut off or allow discharge of high pressure-high velocity water jets therefrom.

Other objects of the invention are:

To provide air pressure operated means controlled from the switch panel for controlling adjustment of the position of the nozzle-carrying segments;

To provide pressure rollers for engaging a log and holding it on the conveying means, together with means actuated in synchronism with the segment adjusting means for regulating the position of said pressure rollers;

To provide cleaning nozzles for cleaning the apparatus of removed pieces of bark, together with air-pressure-operated hydraulic by-pass valves for controlling the by-passing of some of the high pressure water to said cleaning nozzles;

To provide means operated by movement of the nozzle-carrying segments in accordance with the diameter of the log to be debarked, which means automatically selects the group of operating nozzles required to provide complete jet coverage of the log without wasting of water and without any action on the part of the man operating the apparatus;

To provide means for preventing operation of the nozzles in the event the pressure of the water employed in the jets falls below that pressure required to debark the log;

To provide mechanical means to rotate and position abnormal logs for the most favorable transmission through the apparatus or to rotate or turn a log requiring subsequent passes through the apparatus to provide complete removal of bark and cambial layer;

To provide in general terms, an apparatus which will provide thorough bark and cambial layer removal, economical operation, and practically unlimited production, and will require a minimum amount of manual labor and control.

With these and other objects in view, as may appear from the accompanying specification, the invention consists of various features of construction and combination of parts, which will be first described in connection with the accompanying drawings, showing a hydraulic apparatus for debarking logs in its preferred form; and the features forming the invention will be specifically pointed out in the claims.

Figure 1 is a diagrammatic layout of the hydraulic bark-removing apparatus.

Figure 2 is a perspective view, showing gener-

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ally without specific detail the hydraulic bark-removing apparatus.

Figure 3 is a view partly in section and partly in elevation taken on the line 3—3 of Figure 5, showing the nozzle-carrying segments and their moving mechanism.

Figure 4 is a view in side elevation of two of the nozzle-carrying segments and shows in diagram the log guiding rollers and their operating mechanism.

Figure 5 is a horizontal section through the nozzle-carrying segments, and shows the log conveyor in dotted lines, and is taken on the line 5—5 of Figure 3.

Figure 6 is a diagrammatic view of the nozzle-carrying segments together with their carrying and moving mechanism, and shows the cleaning nozzles together with their control mechanism.

Figure 7 is a fragmentary view, showing one of the nozzle-carrying movable segments and having parts broken away to show the nozzles, and showing part of the segment-moving mechanism in side elevation.

Figure 8 is a fragmentary plan of that part of the segment-moving mechanism shown in Figure 7.

Figure 9 is a cross-section through one of the nozzle-carrying stationary segments, taken on the line 9—9 of Figure 11.

Figure 10 is a detail view, showing in plan part of the nozzle control and selective mechanism.

Figure 11 is an elevation view, partly broken away, showing the stationary bottom nozzle-carrying segment, the nozzles carried thereby, and their pressure operated control valves.

Figure 12A is a bottom plan view of the structure shown in Figure 11.

Figure 12 is a diagrammatic view, showing the arrangement and grouping of the nozzles and their control mechanism.

Figure 13 is a cross-section through one of the nozzle-carrying movable segments, showing the manner of mounting the nozzles and their control valves and taken approximately on lines 13—13 of Figure 7.

Figure 14 is a longitudinal section through one of the nozzles, its pressure actuated control valve, and the electrically operated valve which controls operation of the pressure-actuated control valve.

Figure 15 is an end elevation of the mechanism which controls operation of the nozzle-carrying segments and the bypass of pressure fluid to the cleaning nozzles.

Figure 16 is a side elevation of the movable segments and bypass pressure fluid control unit as seen from the right of Figure 15.

Figure 17 is a vertical section taken on the line 17—17 of Figure 28.

Figure 18 is a section taken on the line 18—18 of Figure 28.

Figure 19 is a section taken on the line 19—19 of Figure 28.

Figure 20 is a vertical section through a three way air valve structure employed in the debarker and taken on line 20—20 of Figure 28.

Figure 21 is a detail view partly in section and partly in elevation of a solenoid operated pressure fluid control valve employed in the debarker.

Figure 22A is a detail view, showing the port arrangement of the solenoid operated valve shown in Figure 21.

Figure 22 is a fragmentary side elevation of one of the segment guides.

Figure 23 is a cross section on line 23—23 of Figure 22.

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Figure 24 (see Sheet 15) is a view in elevation, showing the manner of mounting the nozzle controlling solenoid operated valves together with a pressure fluid storage tank which is associated with each assembly.

Figure 25 is a semi-diagrammatic elevation of the mechanism for turning logs.

Figure 26 is a semi-diagrammatic view in end elevation of the log turning mechanism.

Figure 27 (see Sheet 11) is a view in side elevation showing a modified form of mechanism for operating the nozzle control valve.

Figure 28 is a top plan view of the mechanism which controls operation of the nozzle-carrying segments and the by-pass of pressure fluid to the cleaning nozzles, and which is shown in elevation in Figure 15 of the drawings.

Figure 29 is a front elevation of part of the supporting super structure of the hydraulic debarker.

Figure 30 is a side elevation of the structure shown in Figure 29.

In describing the hydraulic bark removing apparatus, a general description of the entire apparatus and its method of operation will be first set out, and the specific description of the various parts making up the apparatus and the control mechanisms therefor will appear in the specification subsequent to the general description and operation.

The logs to be debarked are taken from any suitable source, such as the log pond at the mill, and are delivered in any suitable manner by any suitable means (not shown) to a conveyor structure 1 of the debarking apparatus. The conveyor structure 1 which is shown in dotted lines in Figures 2 and 5 of the drawings, may be of any approved type of log conveyor such as now employed in pulp mills, and it is shown diagrammatically in Figures 2 and 5 of the drawings as consisting of a plurality of parallel rolls 2 having log engaging conical surfaces over which the log travels. The rolls 2 of the conveyor 1 may be driven in any suitable manner by any suitable type of driving means (not shown).

The log from which the bark is to be removed moves along longitudinally over the conveyor 1 and passes longitudinally through the circle or ring assembly which is formed by a plurality of nozzles and valves 3 from which high-pressure high-velocity jets of water are directed against the log in continuing increments throughout the length of the log.

The nozzles and valves 3 are arranged in sets as clearly shown in Figures 1, 2, 3 and 12. The combined nozzles and valve structures 3 are carried by segments 4, 5 and 6. The segment 4 is stationarily supported while the segments 5 and 6 are movable in the manner hereinafter more fully described. This ring assembly as shown constitutes a total of thirty-six nozzles, (the assembly may constitute a greater or lesser number of nozzles) which by adjustment of the segments 5 and 6 can be formed into a solid unbroken ring so that the high velocity jets discharging through the nozzles will contact the entire circumference of the log, resulting in complete removal of the bark in one pass as the full length of the log moves longitudinally through the ring of nozzles. For a ring assembly with thirty-six nozzles the maximum diameter log which may be barked in one pass is limited to an unbroken ring of jets formed by the three segments of thirty-six nozzles.

The assembly of the ring of the three seg-

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ments is shown for a larger diameter of log than the maximum for thirty-six nozzles and consequently a log of this greater diameter will require more than one pass. In all multiple pass barking the log is rotated between passes by the rotating device shown in Figures 25 and 26 of the drawings (described in detail later) in order to bring the unbarked portion of the log surfaces within ranges of the nozzles.

The design of the nozzle and determined location of the movable segments 5 and 6 with respect to the distance of the nozzle from the surface of the log is such that coverage of each jet on the log surface is approximately equivalent to the ratio of one jet or nozzle per inch of log diameter. The grouping of the nozzles for descriptive purposes can more clearly be illustrated by the following tabulation showing the number of nozzles and passes used for various sizes of logs.

Size log in dia. inches	Number of Passes through ring	Number of nozzles per pass	Total number of nozzles for full log coverage
Up to 12"	One	12	12
12 to 18"	One	18	18
18 to 24"	One	24	24
24 to 30"	One	30	30
30 to 36"	One	36	36
36 to 48"	Two	24	48
48 to 60"	Two	30	60
60 to 72"	Two	36	72

Since the number of segments is three and the coverage of each segment is one third of the log circumference, then for larger logs than the maximum for thirty-six nozzles the rotation required between passes is one sixth of the circumference or 60 degrees.

Any other ratio of jet coverage per inch of log diameter may be employed as well as any other grouping or number of total nozzles.

In the above set up it is assumed that the grouping of jets in each of the three segments are used at the same time. The arrangement is flexible and a group of nozzles in any one or two segments may be used at one time, the number of passes and partial rotations of the log to give full coverage being dependent upon the predetermined arrangement.

Referring to Figure 12 of the drawings, the grouping of active nozzles may include for all segments, any number of nozzles selected from the center portion of each segment, such as N1, N2, N3, N4 segment 4—N1, N2, N3, N4 in segment 5, and N1, N2, N3, N4 segment 6. The active nozzles for successive passes may also be selected to rotate with respect to a segment such as:

Segment 4—nozzles N12, N10, N8, N6, N4, N2—1st pass

Segment 4—nozzles N1, N3, N5, N7, N9, N11—2nd pass

Segment 5—nozzles N12, N10, N8, N6, N4, N2—3rd pass

Segment 5—nozzles N1, N3, N5, N7, N9, N11—4th pass

Segment 6—nozzles N12, N10, N8, N6, N4, N2—5th pass

Segment 6—nozzles N1, N3, N5, N7, N9, N11—6th pass

This grouping and consecutive action of nozzles will give full coverage of a log normally requiring thirty-six nozzles for one pass but taking six passes to completely bark this same size log. For low production with ample time available between

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consecutive logs the water and power demand can be reduced by this method of operation. A further reduction in power demand can be accomplished by reducing the nozzle groups from six to four or three with a corresponding increase in passes for six to nine or twelve.

The nozzle and valve structures 3, as previously stated, are arranged in a plurality of sets, three of such sets being shown in Figure 12 of the drawings, although it is to be understood that more or less sets of nozzles and jets may be provided, depending upon the diameters of the logs to be debarked by the particular apparatus.

Each of the segments 5 and 6 and both sections 8 and 9 of the stationary segment 4 have manifolds 20 therein (see Figures 2, 3 and 5 of the drawings) which are connected by suitable pipes 21 and 21A to a manifold 15 so that the high pressure water will be delivered to the respective manifolds 20 from an accumulator 16 and from pumps 12.

The nozzle and valve structures 3 are carried by nozzle-carrying segments 4, 5, and 6 which are in turn carried by suitable supporting structures, as shown at 89 and 90. The segment 4, which carries the set of nozzle and valve structures 3 which are below and about the lower portion of the log, is stationary, is carried by the supporting structures 89 and 90, and is preferably formed in two sections 8 and 9 which, as shown in Figures 2 and 5 of the drawings, are offset in the direction of travel of the log for purposes of structural advantage.

The segments 5 and 6 are slidably carried by the supporting structures 89 and 90 and are moved lengthwise along the supporting structures 89 and 90 by hydraulically operated mechanism generally indicated at 10 and which, like other specific structures of the apparatus, will be hereinafter described in detail. As clearly shown in the drawings, the supporting structures 89 and 90 incline outwardly at approximately an angle of 30° from a vertical plane bisecting a circle formed by the sets of nozzles as they extend upwardly from the lower stationary segment 4, and thus the diameter of the effective log-receiving circle is either increased or decreased as the segments 5 and 6 are moved upwardly or downwardly on the inclined supporting structures 89 and 90.

The segments 5 and 6 are connected for synchronous movement by suitable connecting means, generally indicated at 11, so that both of these segments will move in unison to maintain the proper relationship of the various sets of nozzle and valve structures 3 in all positions of adjustment of the segments.

Water is taken from any suitable source of supply (not shown) and is pumped by high pressure pump 12, either centrifugal or reciprocating, as desired. In the drawings, the high pressure pumps 12 are shown as centrifugal pumps driven by electric motors 13, the stopping and starting of which motors, and consequently of the pumps, is controlled by approved types of motor starting boxes shown at 14. The pumps 12 deliver the high pressure water into the manifold 15, and from the manifold 15 into the hydro-pneumatic accumulator 16 where a reserve supply of the high pressure water is maintained at all times to take care of operation of the maximum number of nozzle and valve structures 3 and so as to permit the use of smaller, less expensive pumps in the apparatus as well as reducing the power consumption cost required for operating the pumps.

The hydro-pneumatic accumulator 16 contains a certain ratio of compressed air and water volumes under variable pressures maintained by the pumps. The useful water displacement between levels v_P and V_P is based on the established expansion of the compressed air between the maximum pressure P and minimum pressure p thereby delivering into the system a volume of water equivalent to the difference in levels v_P and V_P .

The high pressure level v_P in the accumulator is determined by the zero flow characteristics of the centrifugal pumps and the low pressure level V_P is determined by a pressure governor 49 adjusted and set to shut off flow through the nozzle and valve structures 3.

An air compressor 17 of any approved construction having any approved type of control indicated at 17a is utilized to charge the accumulator initially with the required volume of air. This compressor is also used to replenish any air lost through leakage and absorption.

A gage glass 16A is mounted on the accumulator to indicate the level of water and volume of compressed air for the purpose of maintaining the required volume of air in the accumulator. As the level of the water rises above the normal level v_P the compressor is manually started and by increasing the air volume, the water level is lowered and when it again reaches the normal level v_P the compressor is shut down.

Normally either one of the two pumps, depending upon the demand, operate continuously. In conjunction with the accumulator 16, when the water demand through all the nozzles and valves 3 is greater than the pump delivery the accumulator 16 automatically supplies the difference between pump delivery and demand. Also when the water demand is less than the pump delivery then the excess between pump delivery and demand is supplied to the accumulator 16 thereby maintaining a required storage of useful water volume in the accumulator as indicated between the levels v_P and V_P , in Figure 1.

The nozzle and valve structures 3, which will be hereinafter referred to as nozzles, are carried by the various segments and are constructed and designed to discharge high pressure water in high velocity chisel-like jets which will impinge against the bark on the log and erode or break the bark from the log in sections or pieces of various sizes, thus effectively removing the bark and the cambial layer from logs as the logs pass through the apparatus.

The nozzles 3 in each of the sets of nozzles are divided into groups, and all of the nozzles in each corresponding group of each set are connected for simultaneous operation; that is, for example, four nozzles in each of the sets may be connected in a group, and these groups carry the four nozzles of each set and are so controlled that they will operate simultaneously, thus permitting control of the number of jets of water discharging against a log. It is understood, of course, that logs of various diameters will be passed through the debarking apparatus and that a log of small diameter will require a fewer number of jets to remove the bark and cambial layer therefrom than will be required by a log of larger diameter, and thus the control of the nozzles in groups in each set will permit control of the total number of jets discharging against the log so that only the number of jets required to properly remove the bark and cambial layer from the log will be discharging thereagainst. This will result in a

material savings in water and power consumed when debarking smaller logs. As hereinabove referred to, and hereinafter described, the groups of nozzles may be controlled in practically any arrangement or sequence, so that the nozzles in only one group of each set may be operative at one time, or so that the nozzles of all groups of all sets may be operative, but the groups are usually so connected that at least one group in each set will always be in simultaneous operation during one debarking pass of the log so as to provide complete circumferential coverage of a log by the jets projected from the nozzles.

The operation of the entire apparatus is controlled from two master switches 22 and 23 through an electric control panel 24, and the number of groups of nozzles in operation at any one time is controlled by an electric selective switch 25 through the electric control panel 24. The selective switch 25, is operated upon the movement of one of the segments 5 or 6 so that the number of nozzles in operation to project high velocity jets of water against a log are controlled directly by the adjustment of the segments 5 and 6 and indirectly by the diameter of the log passing through the apparatus. This operation of the selective switch 25, which is of a type of selective switch that may be purchased upon the open market and is of standard manufacture of various electrical companies, such as the Westinghouse Electric and Manufacturing Company, is provided by means of a pulley 30 mounted upon the operating shaft 27 (see Figure 22) of the switch 25. A rope or cable 28 is passed about the pulley 30 and has a weight 29 on one end thereof, while the other end of the rope 28 after passing about the pulley 30 is connected to the crosshead 98 of the hydraulically operated mechanism 10 so that the selective switch will be operated in accordance with the distance of movement of the segment 5.

The movement of the segments 5 and 6 by the hydraulically operated mechanisms 10 is controlled from the master switch 23 through the electric control panel 24. The master switch 23 has a graduated dial 32 associated with an operating handle 33 of the switch. The dial 32 is graduated to show various different diameters of logs from the minimum size to the maximum size which the apparatus is designed to handle, and by adjusting the handle 33 to the indication on the dial 32 corresponding approximately to the diameter of the log moving into the apparatus, the flow of pressure fluid to the hydraulically operated mechanisms 10 is controlled through the provision of a four-way solenoid operated valve structure 34 which in turn controls the operation of a three-way hydraulic valve structure 35. The latter valve structure is connected through suitable piping indicated at 36 to the manifold 15 and through suitable pipings 161 to the hydraulic mechanism 10. The control through the four-way solenoid operated pressure fluid control valve 34 and the three-way actuated hydraulic valve 35 controls the degree of movement of the segments 5 and 6 in accordance with the setting of the handle 33 of the master switch 23, and, consequently, in accordance with the diameter of the log passing through the apparatus.

The flow of the high pressure water through the nozzles is controlled, in the preferred form of the invention shown in Figures 1 through 23, and 28 through 30 of the drawings, by pressure actuated two-way valve structures 38, operated by air taken from any suitable source such as

an air reservoir 63' shown in Figures 14 and 24 of the drawings, and the delivery of air under low pressure to the pressure actuated two-way valves 38 is in turn controlled by solenoid operated valves 39. The operation of the solenoid actuated valves 39 is controlled through the electrical control panel 24 from the selective switch 25, and trigger switch 172a.

A governor 40 for high pressure air is provided and as shown diagrammatically in Figure 1, is connected to the accumulator 16 and to the electrical control panel 24 so that when the pressure of the water in the accumulator 16 which, of course, is the pressure of the water in the manifold 15, falls below the degree of pressure required for effectively removing the bark from a log, the various nozzle controlling mechanisms will be automatically cut off through the electrical control panel 24 until such time as the pumps 12 again build up sufficient pressure of water in the accumulator 16 to effectively remove the bark, at which time the nozzle control mechanisms will be thrown back into operation through the electrical control panel. In actual operation only a very few seconds are required to build up the pressure of the water to the proper degree so that in the operation of the device no material length of time will be lost in this shutdown period for the building up of the pressure.

A plurality of cleaning spray nozzles 42 are provided for removing the pieces of bark from the conveyor and other parts of the mechanism. These small pieces of bark fly in all directions during the operation of the device and may, at times, cling to parts of the structure of the apparatus. The cleaning spray nozzles 42 are connected through hydraulic by-pass valves 43 which are in turn controlled by three-way solenoid-operated air valves 45, and two-way hydraulic valves 45A. The operation of the air valves 45 is controlled by a high pressure governor 46 of any approved construction which may be purchased upon the open market. The high pressure governor 46 is connected in hydraulic circuit with the accumulator 16 and in electrical circuit with a relay 170 and the solenoid of solenoid actuated air valve 45 to actuate opening and closing by-pass valves 43 through two way hydraulic valves 45A thereby permitting by-passing of water from pumps for keeping pumps cool during shut off period of nozzles 3 and at the same time utilizing this normally wasted water to flush away accumulated bark between segments.

In Figures 25 and 26 of the drawings, a mechanism (hereinafter more fully described) is shown for rotating logs, and this mechanism is positioned in the apparatus at any suitable along the conveyor structure 1 so that a log on the conveyor may be rotated for the purpose of positioning it in the best position for conveyance through the barker. Such positioning of logs is desirable at times because of the fact that many logs fed to the apparatus will have stubs of limbs thereon, knots, or deep crevices therein, and the operator by watching operation of the apparatus will soon learn the most effective position of such irregularities of log surface to insure the proper removal of bark from the logs. Then also, when full production activity of the debarking apparatus is not required and it is desired to operate at lower power consumption cost, the operator may prefer to use only a few of the nozzles in each set and thus to remove only part of the bark from the log on the passage of the log through the apparatus. Then, by reversing the direction of

operation of the conveyor 1 through conventional reversing mechanism (not shown), the log may be returned to the entrance of the apparatus, partially rotated by the rotating mechanism, shown in Figures 25 and 26, and then rerun through the apparatus for removing bark which was not removed by the first passage. This operation will permit the use of fewer nozzles and consequently reduce the amount of water required on each passage of a log through the apparatus, thereby reducing the load on the pumps 12.

Nozzle construction and control mechanism

A section through one of the nozzle structures 3 together with its control mechanism is shown in Figure 14 of the drawings, and in side elevation in their connected relations with the various segments in Figure 13. The nozzle structure forms the basis of a companion co-pending application, Serial No. 660,048, filed April 6, 1946, now Patent No. 2,542,526 dated February 20, 1951, and, consequently, it will not be claimed in the present application, and its construction will be only generally described and shown.

All of the nozzle structures 3 are identical in construction as are also the cleaning nozzles 42, and each of them comprises a carrying body 48 which is attached in any suitable manner to the manifold 20 of the segment on which the respective nozzles are mounted. The body 48 and the adjacent wall of the manifold 20 have a common passage 49 therein which communicates with the interior of the manifold 20 and through which the high pressure water flows into the body 48. Passage of the high pressure water through the body 48 and out of the nozzle tip 50 is controlled by a valve 51, integral with piston 53 and enlarged piston head 53a located within the body 48, and co-operating with a valve seat 52. The nozzle tip 50 is removably connected to the body 48 so that it may be replaced when worn, and it is constructed and designed to discharge the high pressure water, which flows through the body 48, at high velocity in a chisel-like jet so as to provide maximum erosion action of the water jets against the bark and cambial layer of the log.

The valve 51 is operated by hydraulic pressure acting upon the differential of the piston 53 and piston head 53a. Piston 53 operating in cylinder 53' has a smaller area than piston 53a operating in cylinder 53'' and a greater area than valve 51.

Constant pressure is maintained in cylinder 53' by keeping it constantly open to pressure in manifold 20 and by sealing it off from atmospheric leakage bleed off passage 54a by packing 59.

Intermittent pressure is maintained in cylinder 53'' by opening and closing the valve 54 of the valve structure 38. When valve 54 is closed pressure from manifold 20 is transmitted through passage 56 in the piston 53 and piston head 53a and maintained in cylinder 53''. This pressure acting upon the larger area of piston head 53a over-balances the pressure on the smaller area of piston 53 thereby keeping valve 51 closed.

When the valve 54 of the valve structure 38 is opened to atmosphere the pressure in the cylinder 53'' becomes considerably less than the pressure in cylinder 53' due to the restricted flow through a restricting orifice 54a and the unrestricted flow from cylinder 53'' through piping 54', valve structure 38, and valve 54, to atmosphere. This differential in pressure causes the unbalanced force on piston 53 to open valve 51 allowing pressure water to flow through seat 52 and nozzle 50. The piston head 53a is sealed off from atmos-

spheric leakage bleed off passage 54a by packing 55'.

The valve structure 38 embodies a valve 54 which co-operates with a suitable valve seat to control the passage of water from the inlet side 56' to the atmospheric outlet side 57 of the housing 58 of the valve structure 38, and, consequently, to control the flow of operating pressure fluid to the housing 48 for operating the piston 53. The valve 54 is urged to its closed position by a spring 59, and it has an operating stem 60 for forcing the valve off its seat 55 against the tension of the spring 59. A cylinder 61 is provided in which is mounted a reciprocating piston 62. The stem 63 carried by the piston 62 is positioned in alignment with the stem 60 so that when the piston 62 is forced upwardly it will move the valve 54 off its seat 55. Control of delivery of pressure fluid, that is, low pressure air from a storage reservoir 63' or direct from a low pressure supply system, into the cylinder 61 for moving the piston 62 is provided by the three-way solenoid actuated valve structure 39. When the solenoid 64 of the valve structure 39 is energized, it will rock the lever 65 and move the upper valve 66 off its seat and, at the same time, move the lower or outlet control valve 67 onto its seat, thus allowing low pressure air to flow from the reservoir 63' through the valve structure 39 and the pipe 68 into the cylinder 61 and move the piston 62 in the cylinder 61 against the tension of the spring 59, thereby raising valve 54 and allowing the trapped water or pressure fluid to flow from cylinder 53'' through pipe 54' and valve 38 to atmosphere. This action opens valve 51. Upon de-energizing of the solenoid 64, the lever 65 will drop under action of the tensioning spring 69 and seat the valve 66 while opening the valve 67, and thus the low pressure air will be allowed to bleed from the cylinder 61 and back through the pipe 68, past the exhaust or outlet valve 67, and from the housing 70 of the valve structure 39 to atmosphere through the outlet or exhaust port 71. This action causes valve 54 to seat on valve seat 55, thereby sealing off flow from cylinder 53'', and thus causing valve 51 to close.

A modified form of mechanism for operating the piston 53 of valve 48 of the nozzle structure is shown in Figure 27 of the drawings.

In Figure 27 of the drawings, a solenoid 72 is connected through a lever 73 to the valve stem 60'. The valve stem 60' is in turn connected to a valve which is positioned in the housing 77 of the two-way hydraulic valve structure. The valve structure 77 is similar in construction and operation with the valve structure 38 shown in Figure 14 of the drawings and embodies a valve similar to the valve 54 which is urged on its seat by a spring corresponding to the spring 59 and is forced off its seat by movement of the stem 60' under operation of the lever 73 by the solenoid 72 to permit the bleeding of pressure fluid from the nozzle structure 3.

The energizing and de-energizing of the solenoid 72 in this modified construction is controlled through the electric control panel 24 of the apparatus by the selective switch structure 25 and trigger switch 172a in exactly the same manner as in which the energizing and de-energizing of the solenoids 64 is provided, and the energizing and de-energizing of the solenoid 72 controls operation of the valve 77 in the same manner in which operation of the valve 38 is controlled. The valve likewise controls the de-

livery of high pressure fluid into the nozzle structure 3 for operating the piston 53 and valve 52 therein in the same manner as described in connection with the construction shown in Figure 14 of the drawings.

As clearly shown in Figures 1, 3, 7, 10, 11 and 12 of the drawings, the various pressure fluid control valves 38 and the solenoid actuated valves 39 are arranged in groups for each set of nozzles, and each of the control valves 38 controls the delivery of operating pressure fluid to two nozzles in each set, and thus the nozzles in each of the sets carried by each of the segments 4, 5 and 6 are connected for simultaneous operation in groups of two. It is to be understood that this connection of the nozzles in groups of two is only one selected grouping of the nozzles, and without departure from the scope of the present invention, the nozzles may be connected singly or in groups of two, four, six or any desired number of nozzles in each group as may be advisable for the particular work to be performed by the apparatus. The structure shown in Figure 9 of the drawings shows the supporting structure and the arrangement of one of the nozzles 3 and its control valve structure 38 which is carried by the stationary lower segment, while the structure shown in Figure 13 shows a section through one of the movable segments and the nozzle and its control valve carried thereby.

The stationary nozzle carrying segment 4 as shown in Figures 1, 2, 3, 11 and 12 comprises one third of the total ring assembly and is made up of two sections 8 and 9. Each section 8 and 9 is supported by brackets 85 which in turn are mounted on fixed bases 89 and 90. Each section 8 and 9 has mounted thereon an assembly of nozzle and valve structures 3 and air operated hydraulic two way valves 38. Schematic connections between nozzle 3 and valves 38 with solenoid operated three way air valves 39 all in section are shown in Figure 14.

Each section 8 and 9 has a manifold 20 and connecting pipe 21 (see Figure 3) through which high pressure water from pumps 12 and accumulator 16 is supplied.

Movable segments

The two movable nozzle carrying segments 5 and 6, shown in Figures 1, 2, 3, 7 and 12 as comprising two thirds of the total ring, are duplicates in construction and movement, except one is left hand and the other is right hand. Each segment 5 and 6 (see Figure 3) comprises a substantially cylindrical portion 91 slidably supported upon fixed hollow rams 91a and fixed base supports 89 and 90.

The fixed base supports 89 and 90 with hollow rams 91a incline outwards from a vertical plane bisecting the circle of nozzles so that as the segments 5 and 6 are moved upwardly they will also move outwardly in a radial manner from the axis of an approximate circle formed by the ring of nozzles, thereby increasing the ring diameter; the reverse being true when they are moved downwardly, thereby decreasing the ring diameter of jets from the nozzles by the adjustment of segments 5 and 6.

The positioning of the nozzle ring or segments is further illustrated by the dotted line graph in Figure 6. The dotted circle A represents the diameter of the largest size log, and B represents the diameter of the smallest size log. For the largest log A, the nozzle segments take the position indicated by points A1, A2, and A3 which are the central points of segments 4, 6 and 5.

The relation between all segments 4, 5, and 6 with assembly of nozzles 3 and log A is such that all lines O1, O2, and O3 are normal to tangents through respective central segment points A1, A2 and A3 and pass through the center O of the log.

This same relation holds true for the smallest diameter log B wherein all lines O1', O2', and O3' are also normal to tangents through the same respective central segment points and also pass through the center O' of the log.

This same relation between all segments and nozzle assemblies and logs holds true for any size log between maximum and minimum sizes of logs A and B.

Each movable segment has mounted thereon an assembly of nozzles 3 and air operated hydraulic two way valves 39 as shown in Figures 1 and 12. Solenoid operated valves 39 are mounted in a fixed stationary position as shown in Figures 10 and 24. Connections between valves 39 and 38 are through flexible hose conduits and piping 68. Schematic connections between nozzles 3 and valves 38 with solenoid operated 3-way valves 39, all in section, are the same as shown in Figure 14.

The fixed hollow rams 91a, see Figure 3, which slidably support the movable segments 5 and 6 are supported by manifolds 21a at the bottom and by stuffing box headers 21b at the top. Structures 21a and 21b are in turn attached to and anchored to the base structures 89 and 90. The hollow ram 91a has a hollow section 92 which provides for water passage from pumps 12, accumulator 16 and manifolds 21a through ports 93 to cylinder 91 and continuing through ports 94 to manifold 20. From manifold 20 the water flows through nozzle structure 3 for removing bark from the log.

The upper portion of the hollow ram 91a has a hollow cylindrical portion 95. This cylinder is separated from the hollow section 92 by a partition 96. The hollow portion 95 acts as a hydraulic cylinder for the solid ram or plungers 97. The plungers 97 in each segment 5 and 6 have a reciprocatory movement in the cylinders and are attached to crossheads 98 which are connected by tie rods 99 to cylindrical portion 91 of each segment. See also Figures 22 and 23.

The lower portion 92 of each fixed hollow ram 91a which passes through stuffing boxes 92a is smaller in diameter than the upper portion 95 passing through stuffing box 95a. This difference in diameters and resultant differential area, by means of the constant hydraulic pressure in cylinder 91 produces a downward thrust on segments 5 and 6. The ram or plunger 97, reciprocated in cylinder 95, has an area greater than the differential area of ram 91a. Pressure and flow to cylinder 95 and ram or plunger 97 is connected to the pumps 12 and accumulator 16 through connecting piping 101 and valve 35, see Figure 1. When high pressure water is delivered to cylinder 95 in each segment 5 and 6 from the same source as that delivered to cylinder 91 and at the same pressure through three way valve 35, segments 5 and 6 will move in an upward direction. This movement is due to the greater area of rams 97 over the differential area of rams 91a acting upon cylinder 91.

When pressure water from cylinders 95 is allowed to flow to atmosphere through piping 101 and valve 35 then the total downward pressure on cylinders 91 is greater than the resistance to

flow from cylinders 95 and segments 5 and 6 will move in a downward direction.

When pressure water is locked in cylinder 95 by shutting off flow to atmosphere and from the pressure system then segments 5 and 6 remain stationary.

The positioning of segments 5 and 6 by movement to either an outward and upward position or inward and downward position and then locked in a stationary position at any location within the limits of movement is controlled by three-way hydraulic valve 35 (see Figures 6, 15 and 18) under action of the four-way solenoid air operated valve 34 (see Figures 1, 21 and 22a). The valve structure 34 is in turn controlled from the master switch 23 through the electric panel 24.

The movable structures, see Figures 2 and 6 of the drawings, comprising mainly segments 5 and 6, rams 97, crossheads 98, are connected for simultaneous movement by sheaves 104, 108, 109 and endless cables 106 and 106a. Idler sheaves 104 are attached by brackets 105 to the fixed bases 89 and 90. Idler sheaves 108 are attached in pairs and are supported in fixed position on a superstructure above each side of the barker assembly. A pair of sheaves 104 and 108 are free to rotate with the movement of cables 106 and 106a. A pair of sheaves 109 are keyed to shaft 110 in spaced relation. Cables 106 and 106a are clamped to the sheaves 109 within the rotary travel of the sheaves. Both cables 106 and 106a are endless around the sheaves but have one end fastened to the upper portion of crossheads 98 and the other end to the under portion of crossheads 98 by suitable fasteners 103 and 102. Any movement of either segment 5 and 6 is transmitted to the other segment through cables 106 and 106a through the sheaves 109 keyed to the shaft 110. Therefore both segments 5 and 6 are connected for simultaneous movement; that is the movement of both segments under action of their respective plungers 97 connected to the common hydraulic pressure system will be synchronized causing the two segments to move and stop in unison and in parallel positions.

Lug-centering guide rollers

Sheaves 111 and 111a are keyed on shaft 110. A cable 112a is anchored to sheave 111 and passes upwardly over idler sheave 113, under idler sheave 114, over idler sheave 113a, over idler sheave 119a to yoke 118 which is connected to shaft 117 supporting the press rollers 116. The shaft 117 is carried by a yoke or bracket 115.

Cable 112 anchored to keyed sheave 111a passes upwardly over idler sheave 113a, under idler sheave 114a, over idler sheave 113, over idler sheave 119 to yoke 118 connected to shaft 117 supporting press rollers 116.

The press rollers 116 are rotatably supported on the shafts 117 and, when resting on a log, are free to be rotated by longitudinal movement of the log. The shafts 117 are carried by supporting brackets or yokes 115 pivotally free to rock.

The length of cables 112 and 112a is such that press rollers 116 are suspended over the conveyor rolls 1 over the path of the log in such a manner that the press rollers are slightly below the upper surface of a given size log as determined by the position of segments 5 and 6. When the log moves under and contacts the rollers, the rollers lift up and roll over the top

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surface of the log. The weight of both brackets 115 with assembly of press rollers 116 tend to keep the log centralized on rollers 1 so as to pass through the center of the nozzle assembly of segments 4, 5 and 6.

The press rollers, by being connected to shaft 110 through cables 112 and 112a and sheaves 111 and 111a which are keyed to shaft 110, will rise and fall in synchronism with the corresponding movement of segments 5 and 6, because the latter are connected to shaft 110 through cables 106 and 106a and sheaves 109, 109.

The press rollers can be lifted free from the log at any time by downward movement of sheaves 114 and 114a, which movement shortens the cables 112 and 112a between sheaves 111 and 111a and yoke 115.

The idler sheaves 114 and 114a are carried by a bracket 121 which is connected to the piston rod 122 which is in turn connected to a reciprocating piston (not shown) mounted in the cylinder 123. The structure including the piston rod 122 and idlers 114 and 114a may be operated in any suitable manner preferably by low pressure air taken from the same source which supplies air to the valve operating structure 33.

Means to supply cleaning nozzles with high pressure fluid that by-passes debarking nozzles

For by-passing part of the flow of water from both pumps 12 to avoid overheating when all of the nozzles 3 are shut off and also for controlling flow of pressure water through the cleaning nozzles 42, a two way automatically controlled hydraulic valve 43 is used for each of the pumps 12. The hydraulic valves 43 are substantial duplicates of the valve controlling and operating structure of the nozzle and valve structures 3, differing therefrom slightly as will be noted by comparison of Figures 14 and 19 of the drawings.

The pressure actuated hydraulic valve 43 (see Figure 19) comprises a housing 140 which has an inlet 141 connected to a pipe 142 which is in turn connected to the discharge pipe 44 of one of the pumps 12, to receive high pressure water from the pumps.

The inlet 141 opens into a chamber 143 in a valve cage 144, which is located in the housing 140. A valve 145 which controls the flow of the high pressure water through the valve structure 43 is operated in the same manner as the valve 51 of the nozzle structure shown in Figure 14 by means of action of the pressure fluid on the differential areas of a piston 146 and a piston head 147, under control of the three way solenoid operated air valve 45, and two-way hydraulic air operated valve 45a. This latter valve 45a is similar to the valve structure 38, and a longitudinal section thereof is shown in Figure 20 of the drawings.

When the valves 145 are open or unseated, the high pressure water from the pumps 12 will flow past the valves and out through outlet pipes 148 to the cleaning nozzles 42. If the valves 145 are closed, the water will cease to flow.

The valve structure 45a, as shown in Figure 20 of the drawings, comprises a housing 150 which has an inlet 151 which is connected to a pipe 152 (see Figure 6) leading from a cylinder 153 in the by-pass valve structure 43, so that when a valve 154 is off its seat, the pressure fluid from the cylinder 153 may flow through the valve structure 45a and out through an outlet 155 to atmosphere or waste. The valve 154

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is urged on its seat by a spring 156 and is moved off its seat by a pressure operated piston 157. The piston 157 reciprocates in a cylinder 158, and moves the valve 154 through movement of a stem 159 on the piston 157 and a stem 160 on the valve 154. Operating air from any suitable source, such as the air reservoir shown in Figures 14 and 24, enters the cylinder 158 through a port 161 under control of a solenoid actuated valve structure 45 (see Figure 6). This solenoid actuated valve structure 45 is of approved type which can be purchased upon the open market, and is the same in construction as the solenoid operated valve structure 39 shown in Figure 14 of the drawings and controls the operation of the piston 157 in the same manner that the valve 39 controls operation of the piston 62.

Energizing and de-energizing of a solenoid 163 of the valve structure 45 is controlled by operation of the pressure governor 46, through the electrical control panel 24.

When the pressure in the accumulator 16 and the hydraulic system of the apparatus reaches close to the high pressure, zero flow characteristic, of the pumps 12, the pressure governor 46 will be operated to close an electric circuit and energize the solenoid 163 to open the bypass valves 43 in the manner heretofore described.

An electrical relay 170, of any approved form such as can be purchased upon the open market, is normally closed and is positioned in the electrical circuit to the solenoid 163, and is in parallel with a circuit indicated at 171 (see Figure 1) which is controlled by a trigger switch 172a. The trigger switch is mounted on the operating handle 33a of the master switch 22.

With the trigger switch 172a normally open and all of the nozzles 3 closed, the relay 170 remains closed and the solenoid 163 becomes operative when the pressure in the system approaches the shut off limit of the pumps, as provided through the pressure governor 46, to operate the by-pass valves 43.

When the trigger switch 172a is closed the circuit to the solenoid 163 through the control panel 24 and relay 170 is broken and the by-pass valves close, cutting off the wastage flow from the pumps and causing the full discharge of the pumps to enter the bark-removing water system of the apparatus. This control is such that the by-pass valves 43 are opened automatically by means of the pressure governor 46 and closed manually by operating the trigger switch 172a.

Means controlling supply of high pressure fluid to hydraulic mechanism that positions nozzle segments

Two longitudinal or vertical sections through the three-way hydraulic valve structure 35 is shown in Figures 17 and 18 of the drawings.

The delivery of pressure fluid to the hydraulic mechanisms 10 moving the segments 5 and 6 and the exhaust of pressure fluid from the hydraulic mechanisms 10 is controlled by a pair of reciprocating valve structures 175 and 176 which are mounted for reciprocating movement in a suitable housing 177. The cylinder housing 177 has connection with the source of supply of high pressure fluid through an inlet 178, and the passage of this high pressure fluid is controlled by the piston valve 175. The piston valve 175 is held seated by a tensioning spring 179 and is unseated by operation of a rocker member 180 in a manner hereinafter more specifically described. The valve

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176 which is under the seating pressure of spring 181 is also forced off its seat by action of the rocker arm 180. In Figure 18 of the drawings the valve 176 is shown off of its seat so that the pipe connection 101 from the hydraulic mechanism 10 (see Figure 1) through chambers 182 and 183 is open to exhaust or atmosphere through the exhaust outlet 184, and thus when the valves 175 and 176 are in the position shown in Figure 18 of the drawings, the pressure fluid will be bled from the cylinders 95 (see Figure 3) to atmosphere, and so allowing the segments 5 and 6 to move downward.

When the position of the valves 175 and 176 is reversed from that shown in Figure 18, by means of the rocker arm 180, the pressure fluid will flow from the pressure inlet 178 through chambers 185 and 186 and through port 187 (see dotted lines in Figure 18), thence through pipe 101 to the hydraulic mechanism 10, thus causing the segments 5 and 6 to move upwardly.

When the rocker arm 180 is in a horizontal position both piston valves 175 and 176 are closed and there is no pressure fluid flow either to or from the hydraulic mechanism 10 and consequently the movable segments 5 and 6 remain stationary.

The rocker 180 is mounted for rocking movement upon a suitable shaft 188 which is in turn connected to crank member 189 and a pivoted linkage 190 to a piston rod 191. The piston rod 191 is connected to a piston 191a, as clearly shown in Figure 17 of the drawings. The piston 191a is mounted for reciprocatory movement in a cylinder 192, and it is reciprocated by air pressure delivered to it under control of the four-way solenoid operated air valve structure 34, shown in some detail in Figure 21 of the drawings.

It is to be understood that the three-way hydraulic valve structure 35 disclosed in Figures 17 and 18 does not form any part of the present invention, and, consequently, it has only been described sufficiently to permit an understanding of its general manner of operation, and no detailed description of its structure has been given, since any other approved structure which will perform the same function and may be purchased upon the open market may be substituted for the structure shown and herein described.

The four-way solenoid operated air valve structure 34 is shown in Figure 21 of the drawings, and this structure is also a standard type of structure which may be purchased upon the open market. Therefore, its construction will be only generally referred to and not specifically described, and it is to be understood that any suitable type of analogous structure may be substituted for that shown and herein described without departing from the scope of the present invention. This four-way solenoid operated valve structure comprises a valve housing 193 in which is reciprocally mounted a plurality of valves 194. The valves 194 are operated by an operating arm 195 which is pivoted to the housing 193 as shown at 196. The ends of the operating bar 195 are connected in any suitable manner, as shown at 197, to a pair of solenoids 198 and 199 of approved construction, energizing of which is controlled through the electrical control panel 24. Springs 200 also engage the bar 195 upon opposite sides of the pivot 196. By energizing and de-energizing of the solenoids 198 and 199 under control through the electrical control panel 24, the four-way control valve is actuated to control the flow of pressure fluid to the valve structure 35 for permitting

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control of the movement of the segments 5 and 6.

When the solenoid 199 is energized, the solenoid 198 will be de-energized, and the control will be to move the segments 5 and 6 downwardly, while when the reverse is true, that is, when the solenoid 198 is energized and the solenoid 199 is de-energized, then the control will be to move the segments 5 and 6 upwardly. When both solenoids are de-energized, the segments 5 and 6 will be held stationary.

Thus when solenoid 199 is energized and 198 is de-energized, valves 194 will be manipulated so that pressure air will flow through port 201 (see Figure 22a) to lower portion of cylinder 192 through port 203 while upper portion of cylinder 192 is open to exhaust port 206 through connections 205 and 204. This causes piston 191a to move into top position as shown, causing cylinder 95 to exhaust and segments to move downwardly.

When solenoid 198 is energized and 199 de-energized, valves 194 will be manipulated so that pressure air will flow through port 204 to upper portion of cylinder 192 through port 205 while lower portion of cylinder 192 is open to exhaust port 206 through connections 203 and 201. This causes piston 191a to move to the extreme bottom position causing high pressure fluid to flow into cylinder 95 causing segments to move upwardly.

When both solenoids 198 and 199 are de-energized, valves 194 are manipulated so that pressure air will flow through both ports 201 and 204 to upper and lower portions of cylinder 192 thereby causing piston 191a to assume a neutral position, shown by the dotted line in Figure 17 through operation of piston 191b in cylinder 191c. This causes rocker arm 195 to assume said horizontal position, thereby closing both valves 175 and 176, which in turn closes both pressure and exhaust ports in housing 177 so that segments 5 and 6 remain stationary.

Means for positioning and feeding logs

The mechanism for turning or rotating the logs on the conveyor 1 is shown in Figures 25 and 26 of the drawings. The specific construction of this mechanism is not a part of the present invention, and it is shown in the drawings and described herein merely as one type of mechanism which may be employed for rotating or turning the logs, and it is to be understood that any other suitable mechanism may be employed for this purpose without departing from the scope of the present invention.

The log rotating or turning structure shown in Figures 25 and 26 of the drawings comprises a pair of vertically movable roller-carrying members 210 which are slidably mounted in a suitable guide and supporting structure 211. The roller supporting members 210 each carry a plurality of log engaging rollers 212 which are rotatably supported on suitable brackets 213. The shafts 214 which carry the log turning rollers 212 are connected by suitable power transmitting mechanism, indicated at 215, to a motor or other prime mover 216 so that when the prime mover 216 is operating, the log engaging rollers 212 will be rotated.

The movable roller-carrying members 210 are connected by suitable linkage 217 to a pair of piston rods 218 which are in turn connected to the opposite ends of a piston (not shown) which reciprocates in a cylinder 219 so that when the piston rods 218 are moved in one direction, the members 210 will be moved upwardly to move the

rollers 212 into position for engagement with a log shown at A on the conveyer structure 1 at which time the rotation of the rollers 212 by the motor 216 will rotate the log contacted by the rollers. Upon the movement of the piston rods 218 in the opposite direction, the sliding members 210 will be moved downwardly into their normal position and out of contact or engagement with a log on the conveyer 1. Control and operation of the piston rods 218 may be made by suitable type of control mechanism such as the solenoid-actuated valve structure 220 shown in Figure 25. This solenoid-actuated valve structure may be of any suitable type that may be purchased upon the open market, and it is shown in Figure 25 as under control of a push button switch 221.

Briefly summing up the operation of the improved hydraulic debarking apparatus; logs to be debarked are delivered by any suitable type of conveying means to the conveying rollers 1 and are fed longitudinally through the debarking means. As the log approaches the hydraulic debarking means the operator manually operates a suitable switch which, through the electrically controlled panel 24, sets the segment adjusting mechanism in operation to move the nozzle carrying segments 5 and 6 simultaneously or in synchronism on their supports, to adjust them to proper position depending upon the diameter of the log to be debarked, such movement of the segments at the same time setting into operation other mechanism, through the electrically controlled panel 24, for controlling the number of jets of high pressure water to be discharged against the log during its travel through the debarking apparatus. As the log moves through the apparatus it is held against wobbling by the pressure rollers 116. The high pressure jets of water are directed towards the axis of the log and effectively remove the bark as the log passes through the substantially circular arrangement of nozzles formed by the fixed and movable segments 4, 5 and 6.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown, but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. In an apparatus for hydraulically removing bark from logs, a plurality of centripetally directed nozzles annularly arranged in spaced relation so that high-velocity jets of water issuing simultaneously from the nozzles will converge towards the periphery of a log to form in effect a continuous ring of bark-removing water, said spaced nozzles being mounted in sets, certain of said sets of nozzles being mounted for relative movement to different positions in order to accommodate logs of different diameters, means for supplying water under high pressure to said nozzles to produce high velocity jets of water from the nozzles, and manually controlled pressure operated means for moving said movable sets of nozzles to positions to properly direct the high pressure water jets against a log to be debarked.

2. An apparatus for hydraulically removing bark from logs as claimed in claim 1 including means for controlling the delivery of high pressure water to said nozzles, a pressure actuated governor acted upon by pressure of water supplied to said nozzles and connected to said high pressure water delivery control means to cut off supply of water to the nozzles when the pressure

of water falls below a predetermined pressure degree.

3. Apparatus for removing bark from logs as claimed in claim 1 including means for automatically cutting off the delivery of water from certain of the nozzles of each set upon certain predetermined positions of adjustment of the sets of nozzles, means for controlling the delivery of high pressure water to said nozzles, a pressure actuated governor acted upon by pressure of water supplied to said nozzles and connected to said high pressure water delivery control means to cut off supply of water to the nozzles when the pressure of water falls below a predetermined pressure angle.

4. An apparatus for hydraulically removing bark from logs as claimed in claim 1 including means for feeding logs through the apparatus, a cleansing nozzle for projecting high velocity cleansing streams of water against said log conveying means, a pressure water by-pass connecting said cleansing nozzles to said means for supplying water under high pressure to said centripetally directed nozzles, a by-pass valve in said by-pass, and means for controlling operation of said by-pass valve.

5. An apparatus for hydraulically removing bark from logs as claimed in claim 1 including means for controlling the delivery of high pressure water to said nozzles, a pressure actuated governor acted upon by pressure of water supplied to said nozzles and connected to said high pressure water delivery control means to cut off supply of water to the nozzles when the pressure of water falls below a predetermined pressure degree, means for conveying logs through said apparatus, a cleansing nozzle for projecting a high velocity cleansing stream of water against said log conveying means, a pressure water by-pass connecting said cleansing nozzle to said means for supplying water under high pressure to said centripetally directed nozzles, a by-pass valve in said by-pass, and means for controlling operation of said by-pass valve.

6. An apparatus for hydraulically removing bark from logs as claimed in claim 1 including means for controlling the delivery of high pressure water to said nozzles, a pressure actuated governor acted upon by pressure of water supplied to said nozzles and connected to said high pressure water delivery control means to cut off supply of water to the nozzles when the pressure of water falls below a predetermined pressure degree, means for conveying logs through said apparatus, a cleansing nozzle for projecting high velocity cleansing streams of water against said log conveying means, a pressure water by-pass connecting said cleansing nozzle to said means for supplying water under high pressure to said centripetally directed nozzles, a by-pass valve in said by-pass, a solenoid for operating said by-pass valve, a second pressure actuated governor acted upon by pressure of water supplied to said centripetally directed nozzles for controlling energizing of said by-pass valve operating solenoid, and means interconnecting said first and second pressure actuated governors and said solenoids to energize the solenoids to open the by-pass valve to supply high pressure water to the cleansing nozzle upon the cutting off of the supply of high pressure water to said centripetally directed nozzles.

7. An apparatus for hydraulically removing the bark from logs as claimed in claim 1 wherein each of said centripetally directed nozzles em-

bodies a pressure actuated valve, pressure actuated control valves for controlling the application of seating pressure to said pressure actuated valves, and means for controlling delivery of pressure fluid from a source outside of the pressure water supply means of the apparatus for operating said pressure actuated control valves.

8. An apparatus for hydraulically removing bark from logs as claimed in claim 1 including a governor acted upon by pressure of water supply to said nozzles, and means actuated by said governor for preventing flow of water through any of said nozzles when the pressure of the water flowing to the nozzles falls below a predetermined pressure.

9. An apparatus for hydraulically removing the bark from logs as claimed in claim 1 including, cleansing nozzles for projecting cleansing streams of water against said log, conveying means, by-pass valves for controlling flow of high pressure water to said cleansing nozzles, pressure actuated means for controlling flow of water through said by-pass valves, and means for delivering actuating pressure fluid to said pressure actuated means.

10. An apparatus for hydraulically removing bark from logs as claimed in claim 1 including by-pass valves for by-passing high pressure water from its flow to said centripetally arranged nozzles when the pressure in the apparatus reaches a predetermined degree, and means for controlling operation of said by-pass valves.

11. Apparatus for removing bark from logs as claimed in claim 1 including means for automatically cutting off the delivery of water from certain of the nozzles of each set upon certain predetermined positions of adjustment of the sets of nozzles, by-pass valves for by-passing high pressure water from its flow to said centripetally directed nozzles when the water pressure in the apparatus reaches a predetermined degree, and means for controlling operation of said by-pass valves.

12. Apparatus for hydraulically removing the bark from logs as claimed in claim 1 including valves for controlling the flow of water through said nozzles, electrical means for controlling opening and closing of said valves, a selective switch for controlling operation of said electric valve control means, and means operable upon movement of said movable nozzles and connected to said selective switch for operating the selective switch upon movement of the nozzles.

13. An apparatus for hydraulically removing bark from logs as claimed in claim 1 including electrically controlled pressure operated valves for automatically cutting off delivery of water from certain of said nozzles.

14. An apparatus for hydraulically removing bark from logs as claimed in claim 1 including means actuated by movement of the movable sets of nozzles for automatically cutting off the flow of water through certain of the nozzles upon movement of the movable sets into predetermined positions.

15. In an apparatus for hydraulically removing bark from logs, a plurality of nozzle-carrying segments, a set of centripetally directed nozzles carried by each of said segments, the nozzles of all of the sets arranged in spaced relation so that high velocity jets of water issuing simultaneously from the nozzles will converge towards the periphery of a log to form in effect a continuous ring of bark-removing water, means movably supporting certain of said segments, means

for moving said movable segments to position the nozzles carried thereby in different proper relative positions in order to properly direct the high velocity jets of water against logs of different diameters to be debarked, and means for supplying water under high pressure to said nozzles to produce high velocity jets.

16. An apparatus for hydraulically removing bark from logs as claimed in claim 15 including pressure actuated valves individual to certain nozzles in each set whereby by operation of the valves flow of water may be cut off through part of the nozzles of each set, means for controlling operation of said valves, said valve operating means connected to and synchronized with said segment-moving means to operate upon nozzle position changing movement of the segments to automatically operate said valves to control the number of jets of water projected by said nozzles in accordance with the positions of the movable segments.

17. An apparatus for hydraulically removing bark from logs as claimed in claim 15 including pressure actuated valves, solenoid actuated valves controlling delivery of actuating pressure fluid to said pressure actuated valves, and manually operated means set in accordance with the diameter of a log to be debarked for controlling energizing of said solenoid actuated valves.

18. An apparatus for hydraulically removing bark from logs as claimed in claim 15 including means for controlling the delivery of high pressure water to said nozzles, a pressure actuated governor acted upon by pressure of water supplied to said nozzles and connected to said high pressure water delivery control means to cut off supply of water to the nozzles when the pressure of the water falls below a predetermined pressure degree.

19. An apparatus for hydraulically removing bark from logs as claimed in claim 15 including pressure actuated valves, solenoid actuated valves controlling delivery of actuating pressure fluid to said pressure actuated valves, and manually operated means set in accordance with the diameter of a log to be debarked for controlling energizing of said solenoid actuated valves, an electrical control panel for controlling energizing of the solenoids of said solenoid actuated valves, means for controlling the delivery of high pressure water to said nozzles, a pressure actuated governor acted upon by pressure of water supplied to said nozzles and connected to said high pressure water delivery control means to operate said control panel to cut off the supply of water to the nozzles when the pressure of the water falls below a predetermined pressure degree.

20. An apparatus for hydraulically removing bark from logs as claimed in claim 15 including means for moving logs through the apparatus, a cleansing nozzle for projecting high velocity cleansing streams of water against said log moving means, a pressure water by-pass connecting said cleansing nozzles to said means for supplying water under high pressure to said centripetally directed nozzles, a by-pass valve in said by-pass, and means for controlling operation of said by-pass valve.

21. An apparatus for hydraulically removing bark from logs as claimed in claim 15 including pressure actuated valves, solenoid actuated valves controlling delivery of actuating pressure fluid to said pressure actuated valves, manually operated means set in accordance with the diameter of a log to be debarked for controlling energizing of said solenoid actuated valves, a

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cleansing nozzle for projecting a high velocity cleansing stream of water against said log conveying means, a pressure water by-pass connecting said cleansing nozzle to said means for supplying water under high pressure to said centripetally directed nozzles, a by-pass valve in said by-pass, and means for controlling operation of said by-pass valve.

22. An apparatus for hydraulically removing the bark from logs as claimed in claim 15 including by-pass valves for by-passing high pressure water from its flow to said centripetally directed nozzles when the water pressure in the apparatus reaches a predetermined degree, and a pressure actuated governor acted upon by pressure of the water pressure for controlling operation of said by-pass valves.

23. An apparatus for hydraulically removing the bark from logs as claimed in claim 15 including valves for controlling the flow of water through said nozzles, electrical means for controlling opening and closing of said valves, an electric selective switch, means connecting said selective switch to said movable nozzle carrying segments to operate the selective switch upon movement of the movable segments to selectively operate said valves.

24. In an apparatus for hydraulically removing bark from logs, a plurality of nozzle carrying segments, means for rigidly supporting one of said segments, means movably supporting the others of said segments, a plurality of centripetally directed nozzles carried by each of said segments with all of the nozzles carried by all of the segments arranged so that high velocity jets of water issuing simultaneously from all or part of the nozzles will converge towards the periphery of a log to form in effect a continuous ring of bark-removing water, water manifolds formed in said segments and having water supply connections to said nozzles, means for supplying high pressure water to said manifolds, valves for controlling the flow of water from said manifolds through said nozzles, and means for operating said valves.

25. An apparatus for hydraulically removing bark from logs as claimed in claim 24 wherein said segment moving means constitutes hydraulically operated means and manually operated setting means set in accordance with the diameter of a log to be debarked for controlling operation of said hydraulic means.

26. An apparatus for hydraulically removing bark from logs as claimed in claim 24 including pressure rollers, means mounting said pressure rollers for movement toward or away from the periphery of a log being debarked so that the rollers engage the log, and means connecting said movable segments and said rollers so that movement of the segments to regulate their positions in accordance with the diameter of a log to be debarked causes simultaneous movement of said rollers.

27. An apparatus for hydraulically removing bark from logs as claimed in claim 24 including pressure roller supporting brackets pivotally carried by said apparatus and located to pivot on axes transversely of the axis of the log being debarked, and pressure rollers carried by said brackets for engagement with the periphery of a log to be debarked.

28. An apparatus for hydraulically removing bark from logs as claimed in claim 24 wherein said pressure water flow control valves are pressure actuated, valves for controlling delivery of pressure actuating fluid to said pressure water

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flow control valves, and electrically operated means controlling operation of said actuating fluid flow control valves.

29. An apparatus for hydraulically removing bark from logs as claimed in claim 24 wherein said pressure water flow control valves are pressure actuated, valves for controlling delivery of pressure actuating fluid to said pressure water flow control valves, and electrically operated means controlling operation of said actuating fluid flow control valves, the nozzles carried by each of said segments being arranged in sets, said electrical means arranged so that the pressure water flow control valves of the corresponding sets of nozzles carried by the different segments will be operated simultaneously.

30. An apparatus for hydraulically removing bark from logs as claimed in claim 29 including a selective switch for selectively controlling operation of said valve operating means, means connected to said selective switch and to one of said movable segments for operating said selective switch upon movement of the segment.

31. An apparatus for hydraulically removing bark from logs as claimed in claim 24 wherein said high pressure water supply means includes a main pressure water manifold connected to said segment manifolds, a pressure actuated governor connected to and operated by pressure of water in said main manifold, and means connected to and operated by said governor for cutting off flow of water through said nozzles when the pressure of the water in said manifold falls below a predetermined degree.

32. Apparatus for hydraulically removing the bark from logs as claimed in claim 24 wherein said high pressure water supply means includes a main pressure water manifold and which includes hydraulically operated means for moving said movable segments, a hydraulic valve for controlling flow of pressure water from said last named manifold to said hydraulically operated means, and manually operated means for controlling operation of said hydraulic valve.

33. Apparatus for hydraulically removing the bark from logs as claimed in claim 24 wherein said high pressure water supply means includes a main pressure water manifold and which includes hydraulically operated means for moving said movable segments, a hydraulic valve for controlling flow of pressure water from said last named manifold to said hydraulically operated means, manually operated means for controlling operation of said hydraulic valve, and cables interconnecting said movable segments to cause synchronous movement of the segments.

34. Apparatus for hydraulically removing the bark from logs as claimed in claim 24 wherein said high pressure water supply means includes a main pressure water manifold and which includes hydraulically operated means for moving said movable segments, a hydraulic valve for controlling flow of pressure water from said last named manifold to said hydraulically operated means, manually operated means for controlling operation of said hydraulic valve, a selective switch for selectively controlling operation of said valves, and means connected to said selective switch and to one of said movable manifolds for operating the selective switch upon movement of the manifold.

35. In an apparatus for hydraulically removing bark from logs, a plurality of centripetally directed nozzles annularly arranged in spaced relation so that high velocity jets of water issuing simultaneously from the nozzles will converge

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towards the periphery of a log to form in effect a continuous ring of bark-removing water, said spaced nozzles being mounted in sets, certain of said sets of nozzles being mounted for relative movement to different positions in order to accommodate logs of different diameters, means for supplying water under high pressure to said nozzles to produce high velocity jets of water from the nozzles, manually controlled pressure operated means for moving said movable sets of nozzles to positions to properly direct the high pressure water jets against a log to be debarked, and means for automatically cutting off the delivery of water from certain of the nozzles of each set upon certain predetermined positions of adjustment of the sets of nozzles.

36. In an apparatus for hydraulically removing bark from logs, a plurality of centripetally directed nozzles annularly arranged in spaced relation so that high velocity jets of water issuing simultaneously from the nozzles will converge towards the periphery of a log to form in effect a continuous ring of bark-removing water, said spaced nozzles being mounted in sets, certain of said sets of nozzles being mounted for relative movement to different positions in order to accommodate logs of different diameters, means for supplying water under high pressure to said nozzles to produce high velocity jets of water from the nozzles, manually controlled pressure operated means for moving said movable sets of nozzles to positions to properly direct the high pressure water jets against a log to be debarked, pressure rollers, means mounting said pressure rollers for movement toward or away from the periphery of a log being debarked so that the rollers engage the log, and means connecting said movable sets of nozzles and said rollers for synchronous movement so that movement of said

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movable sets of nozzles to regulate their positions in accordance with the diameter of a log to be debarked causes simultaneous movement of said rollers.

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