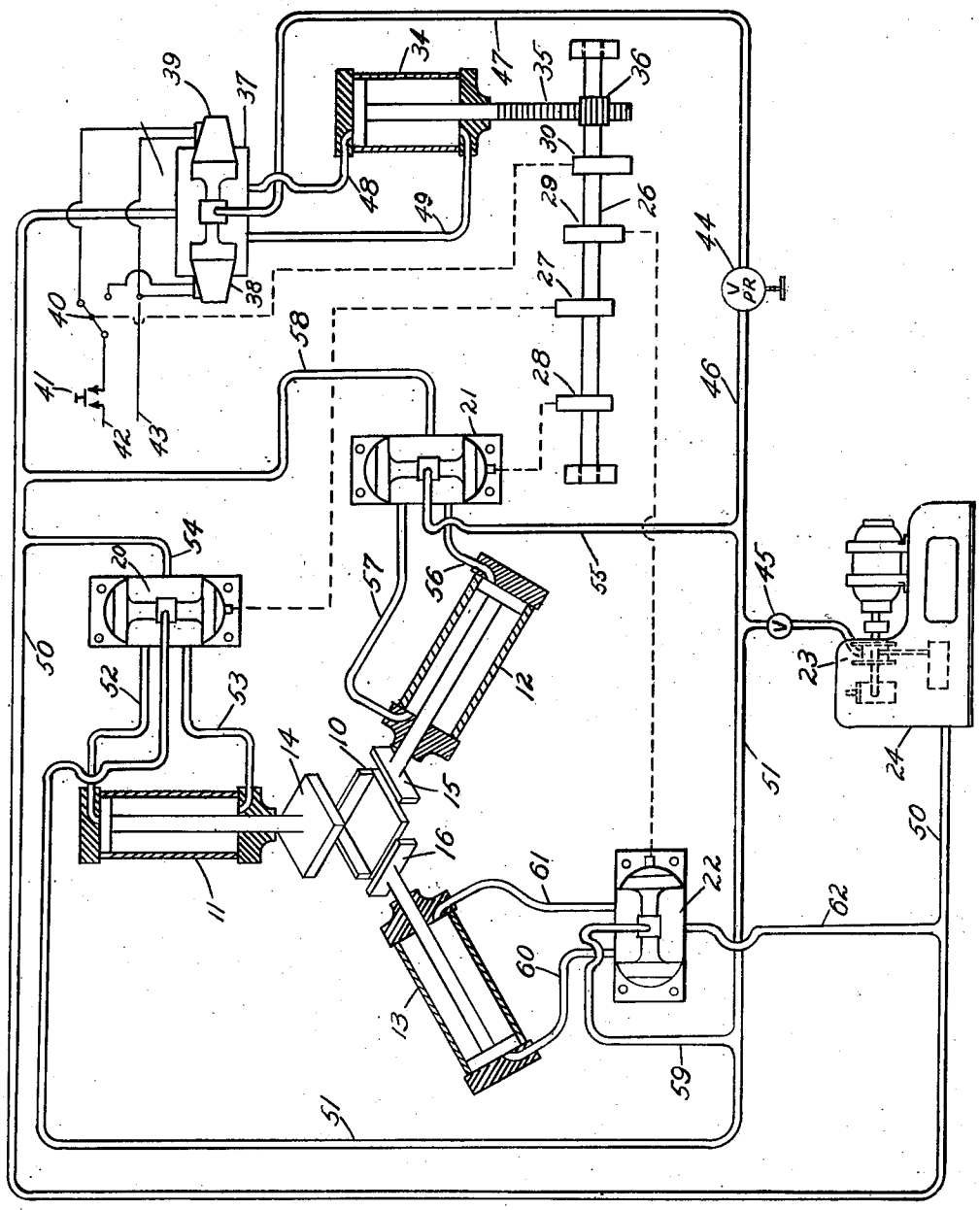
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HYDRAULIC PRESS SYSTEM

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HYDRAULIC PRESS SYSTEM

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My invention relates to a hydraulic press system and more particularly to hydraulic press systems for forming and shaping objects such as, for example, bacon, meat, or other material.

In the operation of hydraulic press devices for shaping and forming bacon, meat, or other material a plurality of the press rams or pressure devices are operated in sequence to compress the bacon, meat or other material into block or angularly-shaped forms.

Therefore an object of my invention is the provision of a hydraulic press system which automatically causes the plurality of the press devices to be operated in sequence, in which the timing sequence is determined by the pressure encountered by the press devices.

Another object of my invention is the provision of successively operating a plurality of fluid press devices in sequence and in controlling the sequence operation automatically by means of a fluid pilot device which is adapted to govern the flow of fluid to and from the fluid press devices.

Another object of my invention is the provision of a hydraulic press system having a plurality of press devices arranged to be successively operated in sequence, in which the timing of the sequence is determined by the pressure within the system, together with the provision of operating the press devices in a forward sequence or in a reverse sequence.

Another object of my invention is the provision of operating a plurality of press devices in a forward sequence or in a reverse sequence depending upon the establishment of certain fluid circuits.

Other objects and a fuller understanding of my invention may be had by referring to the following description and claims taken in conjunction with the accompanying drawing which shows a diagrammatic arrangement of a hydraulic press system embodying the features of my invention.

With reference to the drawing, I have illustrated my invention as being applied to a bacon or meat press which is illustrated generally by the reference character **10**. The press is shown diagrammatically and comprises principally a suitably supported base having two sides. Cooperatively associated with the press **10** are three press work devices **11**, **12** and **13** which actuate respectively press plates **14**, **15** and **16**. Each of the press work devices may be similarly constructed and comprises a cylinder and a piston arranged to be reciprocally actuated by a suitable fluid. In forming or shaping a piece of bacon or other material, it is placed upon the base of the press, after which the press plates **14**, **15** and **16** are operated in sequence to compress the piece upon all sides. As illustrated, the press plate **14**, when actuated downwardly, presses the bacon or other material from above against the base of the press. When the press plate **15** is actuated laterally and sidewards, it presses upon the side of the bacon or other material and squeezes same against the opposite side of the press. A similar squeezing operation is performed by the press plate **16** when it moves laterally and sidewards against the piece of material being formed. While I am describing my fluid system as being particularly applicable to bacon or meat presses, it is understood that my system may be adapted to operate other types of presses requiring a sequential movement of a plurality of press devices.

The press work devices **11**, **12** and **13** are arranged to be respectively controlled by control valves **20**, **21** and **22**. Each control valve is of similar construction and comprises a fluid housing having a spring biased reciprocal valve mounted therein arranged to control the flow of fluid to and from opposite sides of the piston within the cylinder of the press work devices. The control valves are connected in fluid circuit relation with a motor driven pump **23** which, when driven, pumps fluid from a fluid container **24** to the control valves **20**, **21** and **22**, whereupon the fluid is distributed to the work press devices **11**, **12** and **13**. The entire fluid circuit arrangement between the pump and the control valves and the press work devices may be characterized as a work fluid system.

As diagrammatically illustrated, the reciprocal valves within the housings of the control valves **20**, **21** and **22** are arranged to be actuated against the biasing action of springs mounted within the housings by a cam or sequence means illustrated generally by the reference character **26**. The cam or sequence means **26** comprises a suitably mounted shaft upon which are mounted a plurality of individual cams **27**, **28**, **29** and **30**. Upon the rotation of the shaft of the sequence means **26**, the cam **27**, as indicated by the dash-line, reciprocally actuates the valve within the housing of the control valve **20**, the cam **28**, as indicated by the dash-line, reciprocally operates the valve within the housing of the control valve **21**, and the cam **29**, as indicated by the dash-line, reciprocally operates the valve within the housing of the control valve **22**. The shaft is

rotated by means of a fluid pilot device 34 comprising a cylinder and a piston which actuates a rack 35 to rotate a pinion 36 mounted upon the shaft. The reciprocal movement of the piston within the pilot device 34 is controlled or governed by an electrically operated fluid control valve 37. An electro-magnet 38 is mounted upon one end of the control valve 37 to actuate the valve in one direction and an electro-magnet 39 is mounted upon the other end of the control valve 37 to actuate the control valve in the opposite direction. The electro-magnets are arranged to be electrically energized from supply conductors 42 and 43 through a push button 41 and a pole changer 40, the latter of which is operated, as indicated by the dash-line, by means of the cam 30 mounted upon the shaft of sequence means 26. The control valve 37 is connected in fluid circuit relation with the work fluid system through an adjustable pressure relief valve 44.

In explaining the operation of my system, let it be assumed that the respective parts occupy the positions shown in the drawing and that the valve 45 in the fluid pipe leading from the pump 23 is open. In the positions as shown, it is further assumed that the control valves are in position to cause the fluid pressure to constrain the pistons in the press work devices 11, 12 and 13 and the piston in the pilot device 34 to the rear. In this position, the fluid pressure within the system is at a high value because the rearward movements of the several pistons are constrained against further movement of travel. The setting of the adjustable pressure relief valve 44 is such that under a condition of high fluid pressure within the work fluid system, the fluid is permitted to flow through the pipe 46, the pressure relief valve 44 and the pipe 47 to the central feed port of the control valve 37, after which the fluid flows out of the control valve 37 through the pipe 48 to the upper side of the piston within the pilot device 34. The fluid forces the piston in the pilot device 34 forwardly and causes the rack 35 to turn the pinion 36 and rotate the cams of the sequence means 26. As the piston within the pilot device 34 moves forwardly the fluid on the forward side of the piston is exhausted out through the pipe 49 into the control valve 37, after which the exhaust fluid flows through the common exhaust pipe 50 to the fluid container 24 of the pump assembly. The rotation of the shaft of the sequence means 26 causes the cam 27 to actuate the control valve 20 to its opposite position which permits fluid under pressure to flow from the pump 23 through the pipe 51 to the central feed port of the control valve 20, after which fluid flows through the pipe 52 to the rearward side of the piston in the press work device 11. The fluid upon the rearward side of the piston in the press work device 11 urges the press plate 14 downwardly for pressing the bacon or other material against the base plate of the press 10. The downward movement of the piston in the press work device 11 exhausts the fluid on the forward side of the cylinder through the pipe 53 into the control valve 20, after which the exhaust fluid flows through the pipe 54 into the common exhaust pipe 50 to the container 24 of the pump assembly. Just as soon as the control valve 20 is actuated to connect the rearward portion of the cylinder of the work device 11 in circuit relation with the fluid pump 23, the pressure within the work fluid system immediately drops to a low value. Under the condition of this low fluid pressure the adjustable pressure relief valve 44 functions to arrest the flow of the fluid through the pipes 46 and 47, in which event the movement of the piston within the pilot device 34 immediately stops and the sequence means 26 remains in the position it occupied upon the actuation of the control valve 20. The piston within the work press device 11 continues to move downwardly until the press plate 14 encounters the bacon or other material to be pressed. Pressure is continued to be exerted upon the bacon or other material until the pressure within the work fluid system attains a high value sufficient to operate the adjustable pressure relief valve 44 which permits fluid to flow through the pipes 46 and 47 and the control valve 37 into the rearward side of the piston in the pilot device 34. The piston within the pilot device 34 is then again urged forwardly and the rack 35 turns the shaft of the sequence means 26 until the cam 28 actuates the control valve 21 to its opposite position which connects the rearward end of the press work device 12 in circuit relation with the work fluid system. The fluid now flows through the pipe 55 into the central feed port of the control valve 21, after which the fluid flows through the pipe 56 into the rearward side of the piston in the work press device 12. The fluid entering the rearward side of the piston in the work device 12 forces the piston and the press plate 15 laterally against the side of the bacon or other material in the bacon press. As the piston in the press work device 12 moves forwardly, the fluid on the forward side of the piston is exhausted through the pipe 57 in the control valve 21, after which the fluid flows through the pipe 58 into the common exhaust pipe 50 to the fluid container 24 of the pumping unit. Just as soon as the control valve 21 is actuated by the cam 28 to permit fluid to flow into the rearward side of the piston of the press work device 12, the fluid pressure within the fluid work system drops to a low value which permits the pressure relief valve 44 to function and arrest the flow of the fluid through the pipes 46 and 47 and the control valve 37 to the rearward side of the pilot device 34. The arresting of the flow of the fluid through the pilot device 34 by the pressure relief valve 44 stops the rotation of the shaft of the sequence means 26 so that the shaft remains in the position it occupied when the cam 28 actuated the control valve 21 to its opposition position. The fluid continues to flow into the rearward side of the piston in the press work device 12 and constrains the press plate 15 laterally against the side of the bacon or other material in the press 10. As the press plate 15 encounters resistance, the pressure of the fluid in the work fluid system again builds up to the high value sufficient to operate the pressure relief valve 44 and again to permit the fluid to flow through pipes 46 and 47, the control valve 37 and the pipe 48 to the rearward side of the piston in the pilot device 34. The fluid in the pilot device 34 again actuates the rack 35 to rotate the pinion 36 and the shaft of the sequence means 26 until the cam 29 actuates the control valve 22 to its opposite position which permits fluid to flow through the pipe 59 into the central feed port of the control valve 22, after which fluid flows through the pipe 60 into the rearward side of the piston in the press work device 13. The fluid delivered to the rearward side of the piston in the press work device 13

forces the piston and the press plate 16 laterally against the side of the bacon or other material in the press 10. As the piston within the press work device 13 moves forwardly, the fluid on the forward side of the piston is exhausted through the pipe 61 in the control valve 22, after which it flows through exhaust pipe 62 into the common exhaust pipe 50 to the fluid container 24. Just as soon as the control valve 22 is connected to the rearward side of the piston in the press work device 13 the pressure in the work fluid system immediately drops to a low value and the pressure relief valve 44 again operates to arrest the flow of fluid to the pilot device 34 which means that the shaft of the sequence device 26 remains in the same position that it occupied when the cam 29 actuated the control valve 22 to its opposite position. The fluid continues to flow to the rearward side of the piston in the press work device 13 and constrains the press plate 16 against the side of the bacon or other material for completing the pressing operation, in which position the bacon or other material is confined on all sides between the base and the two sides of the press and the press plates 14, 15 and 16. Upon the press plate 16 encountering work resistance, the pressure within the work fluid system again builds up to a high value to operate the pressure relief valve 44 and permits fluid to flow through the pipes 46 and 47, the control valve 37 and the pipe 48 to the rearward side of the pilot device 34. The rack 35 again rotates the pinion 36 causing the cam 30 to actuate the pole changer 40 to its opposite contact position. The forward movement of the piston within the pilot device 34 is terminated when the piston engages the forward head of the cylinder. The piston is now in position to be actuated into reverse sequence and this is initiated by depressing the push button 41 which energizes the electro-magnet 38 for actuating the control valve 37 to its opposite position causing fluid to flow from the control valve 37 through the pipe 49 to the forward side of the piston within the pilot device 34. This operates the sequence means 26 in the opposite direction and the sequential operation of the control valves 20, 21 and 22 are biased by the springs in the housings to their opposite positions for returning the pistons within the work press devices 13, 12 and 11, in the order named, to their rearward positions. Thus the pistons are arranged to form a complete forward and rearward work cycle which comprises, one, constraining the pistons within the press work devices 11, 12 and 13 forwardly against the bacon or material to be pressed and then, two, returning the pistons within the press work devices 13, 12 and 11 to their rearward positions. In the performance of the complete work cycle, the pressure relief valve 44 admits the flow of fluid to the pilot device 34 upon the existence of a high pressure fluid condition in the fluid work system until the next press work device is connected in the work fluid system whereupon the pressure relief valve, because of the re-establishment of the existence of a low pressure fluid condition, arrests the flow of fluid to the pilot device 34 until the next sequence movement is resumed upon the piston of the connected work device encountering work resistance and producing a high fluid pressure condition in the fluid work system.

Although I have described my invention with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

I claim:

1. A fluid system comprising, in combination, a fluid pump, a work fluid system having a plurality of fluid work devices arranged to be successively connected to the pump and operated in sequence, work hydraulic circuits connecting the work devices to the pump, a control valve in the respective work hydraulic circuits, sequence means for successively operating the control valves to govern the sequential operation of the work devices, said work devices each comprising a cylinder and a piston and effecting as each is successively connected to the pump a low pressure fluid condition in the work fluid system until the piston encounters work resistance which produces a high pressure fluid condition in the work fluid system, a fluid pilot device for successively actuating the sequence means, a pilot hydraulic circuit connecting the fluid pilot to the work fluid system, a pressure relief valve in the pilot hydraulic circuit to govern the flow of fluid to the pilot device for actuating the sequence means and the control valves, said pressure relief valve admitting the flow of fluid to the pilot device under a high pressure fluid condition in the work fluid system and arresting the flow of fluid to the pilot device under a low pressure fluid condition in the work fluid system.

2. A fluid system comprising in combination, a fluid pump, a work fluid system having a plurality of fluid work devices arranged to be successively connected to the pump and operated in sequence, work hydraulic circuits connecting the work devices to the pump, a control valve in the respective work hydraulic circuits, sequence cam means for successively operating the control valves to govern the sequential operation of the work devices, said work devices each comprising a cylinder and a piston and effecting as each is successively connected to the pump a low pressure fluid condition in the work fluid system until the piston encounters work resistance which produces a high pressure fluid condition in the work fluid system, a fluid pilot device comprising a cylinder and a piston for successively actuating the sequence means, a pilot hydraulic circuit connecting the fluid pilot to the work fluid system, a pressure relief valve in the pilot hydraulic circuit to govern the flow of fluid to the pilot device for actuating the sequence means and the control valves, said pressure relief valve admitting the flow of fluid to the pilot device under a high pressure fluid condition in the work fluid system and arresting the flow of fluid to the pilot device under a low pressure fluid condition in the work fluid system.

3. A fluid system comprising in combination, a fluid pump, a work fluid system having a plurality of fluid work devices arranged to be successively connected to the pump and operated in sequence, work hydraulic circuits connecting the work devices to the pump, a work control valve in the respective work hydraulic circuits, sequence cam means for successively operating the work control valves to govern the sequential operation of the work devices, said work devices each comprising a cylinder and a piston and effecting as each is successively connected to the pump a low pressure fluid condition in the work

fluid system until the piston encounters work resistance which produces a high pressure fluid condition in the work fluid system, a fluid pilot device comprising a cylinder and a piston for successively actuating the sequence means, a pilot hydraulic circuit connecting the fluid pilot to the work fluid system, a directional control valve in the pilot hydraulic circuit for controlling the direction of the reciprocal movements of the piston in the pilot device, means for actuating the directional control valve, a pressure relief valve in the pilot hydraulic circuit to govern the flow of fluid to the directional control valve and the pilot device for actuating the sequence means and the work control valves, said pressure relief valve admitting the flow of fluid to the pilot device under a high pressure fluid condition in the work fluid system and arresting the flow of fluid to the pilot device under a low pressure fluid condition in the work fluid system.

4. A fluid system comprising, in combination, a fluid pump, a work fluid system having a plurality of fluid work devices arranged to be successively connected to the pump and operated in sequence, work hydraulic circuits connecting the work devices to the pump, a control valve in the respective work hydraulic circuits, sequence means for successively operating the control valves to govern the sequential operation of the work devices, said work devices each comprising a cylinder and a piston and effecting as each is successively connected to the pump a low pressure fluid condition in the work fluid system until the piston encounters work resistance which produces a high pressure fluid condition in the work fluid system, a fluid pilot device for successively actuating the sequence means, a pilot hydraulic circuit connecting the fluid pilot to the work fluid system, a pressure relief valve in the pilot hydraulic circuit to govern the flow of fluid to the pilot device for actuating the sequence means and the control valves, said pressure relief valve admitting the flow of fluid to the pilot device upon the existence of a high pressure fluid condition in the fluid work system until the next work device is connected in the work fluid system whereupon the pressure relief valve because of the re-establishment of the existence of a low pressure fluid condition arrests the flow of fluid to the pilot device until the cycle is resumed upon the piston of the connected work devices encountering work resistance and producing a high fluid pressure condition in the fluid work system.

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