Nov. 29, 1927. 1,651,203

T. A. HIBBINS

HYDRAULIC SEWER PIPE PRESS

Filed July 24, 1926 6 Sheets-Sheet 1

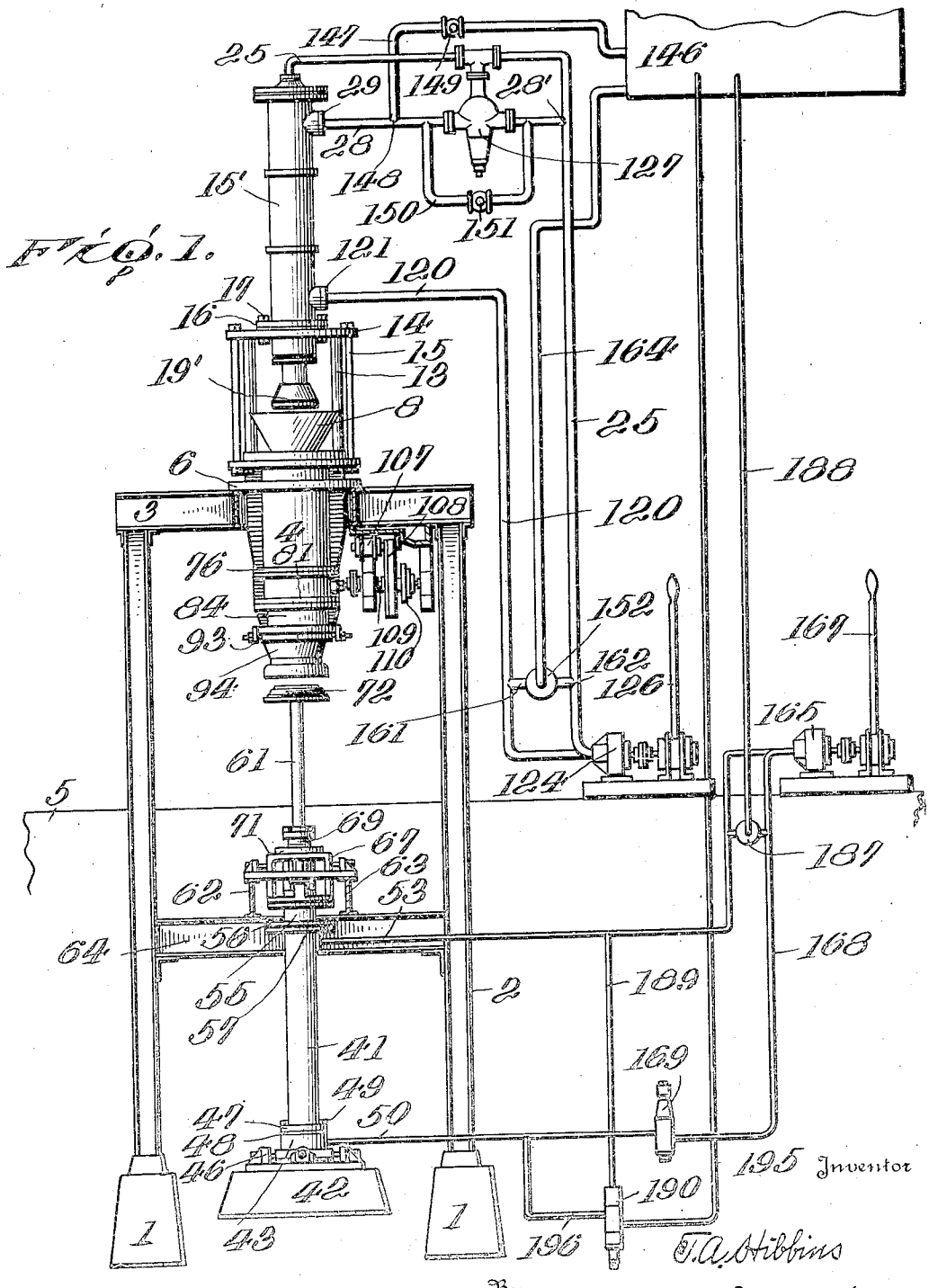


Fig. 1.

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HYDRAULIC SEWER PIPE PRESS

Filed July 24, 1926 6 Sheets-Sheet 2

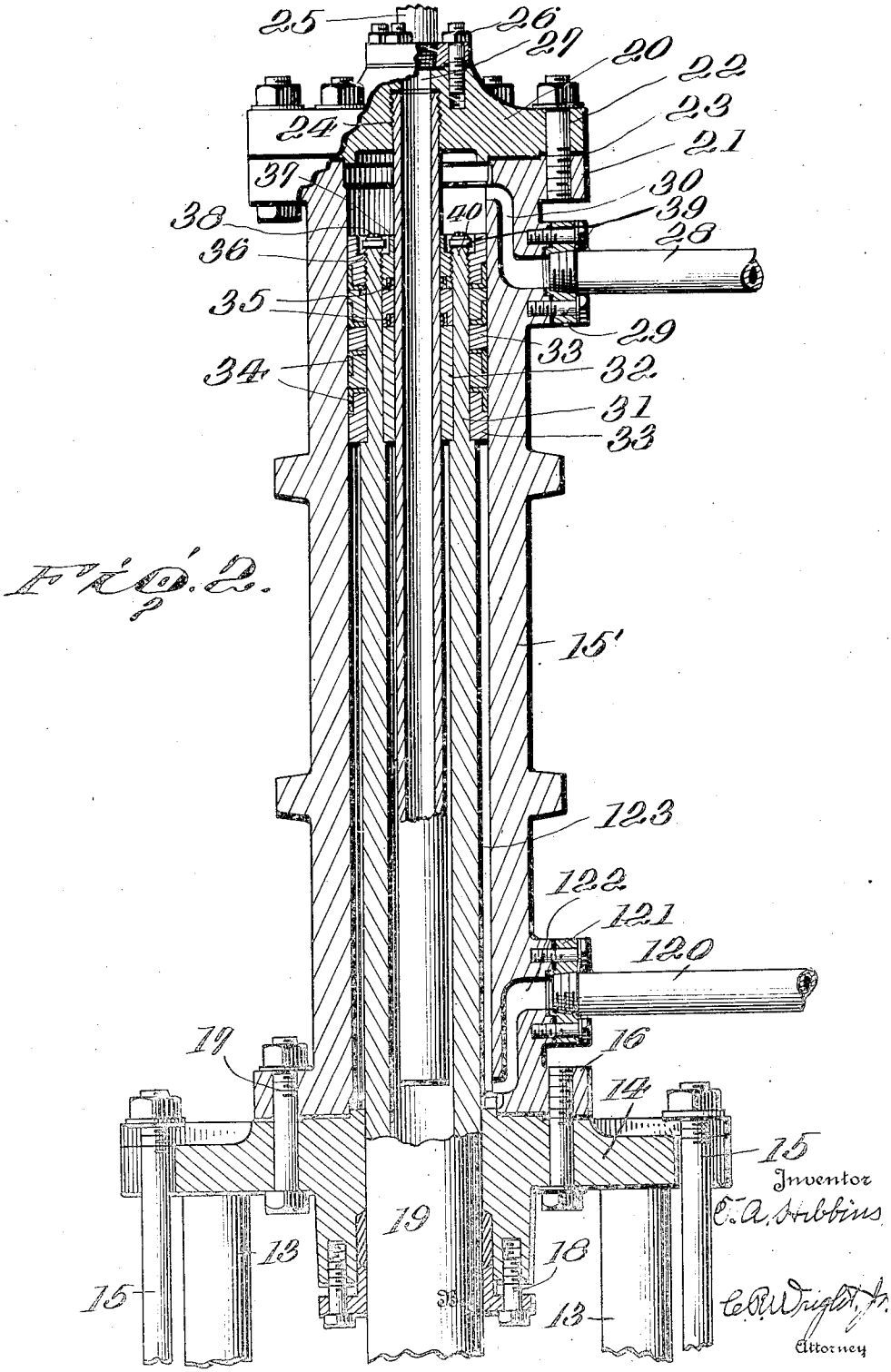


Fig. 2.

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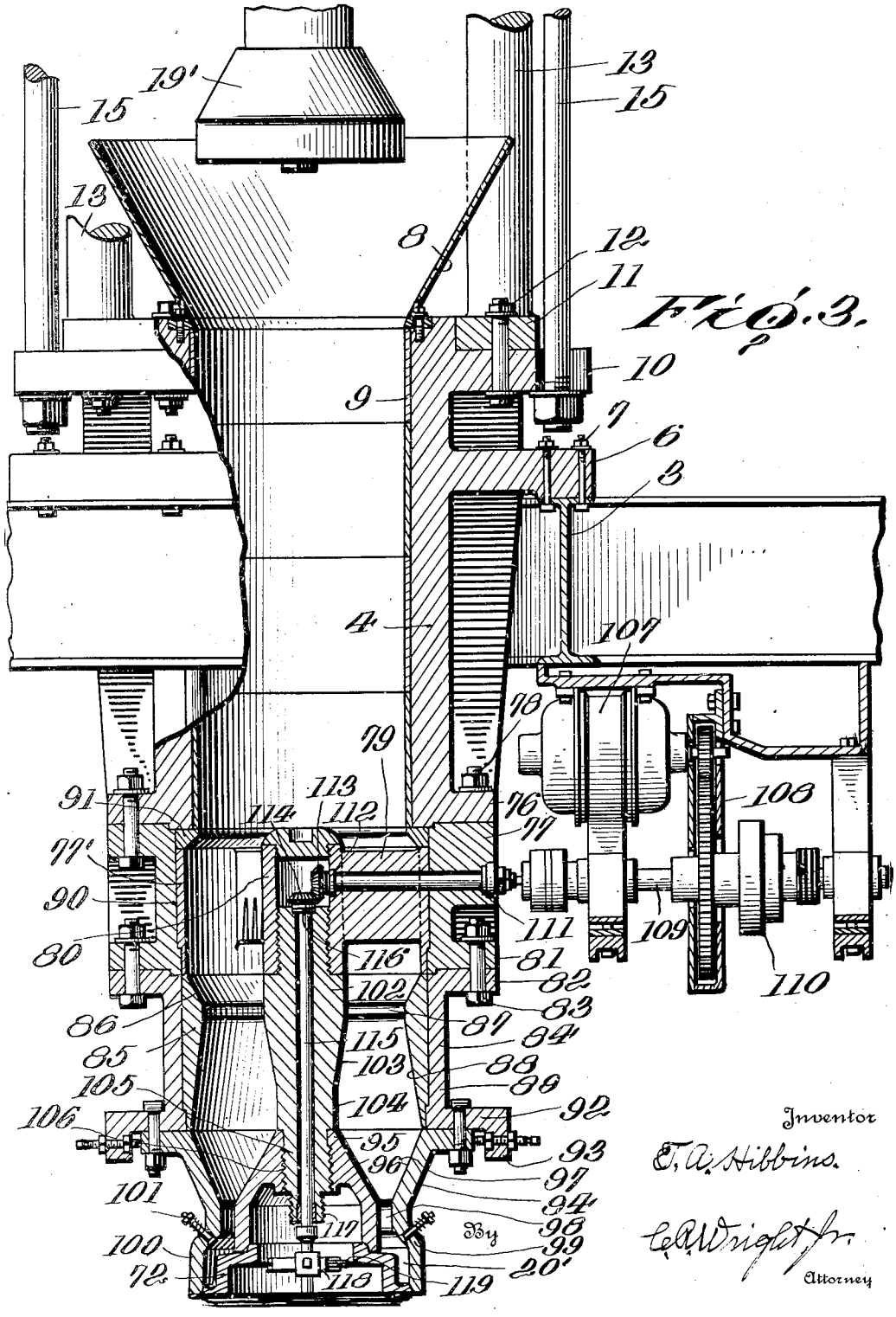


FIG. 3.

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HYDRAULIC SEWER PIPE PRESS

Filed July 24, 1926 6 Sheets-Sheet 4

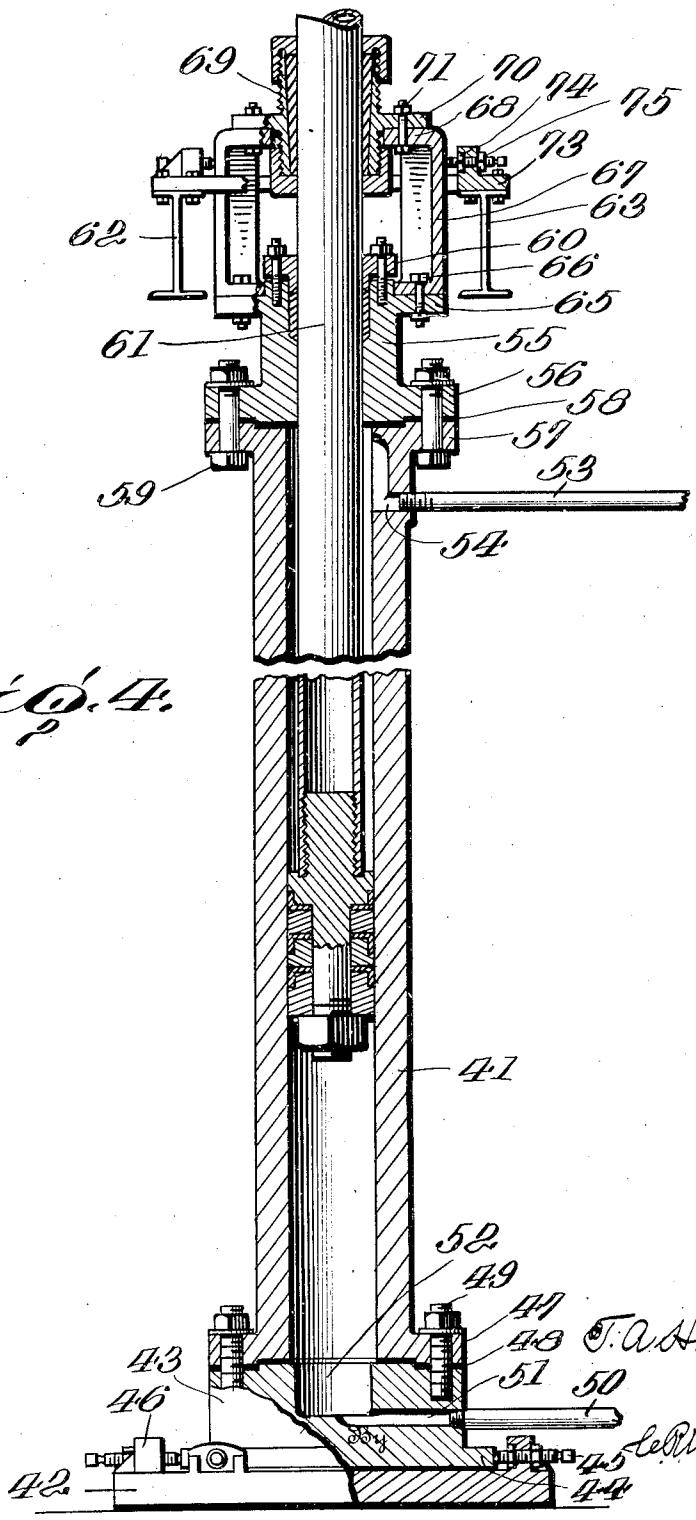


FIG. 4.

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HYDRAULIC SEWER PIPE PRESS

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FIG. 5.

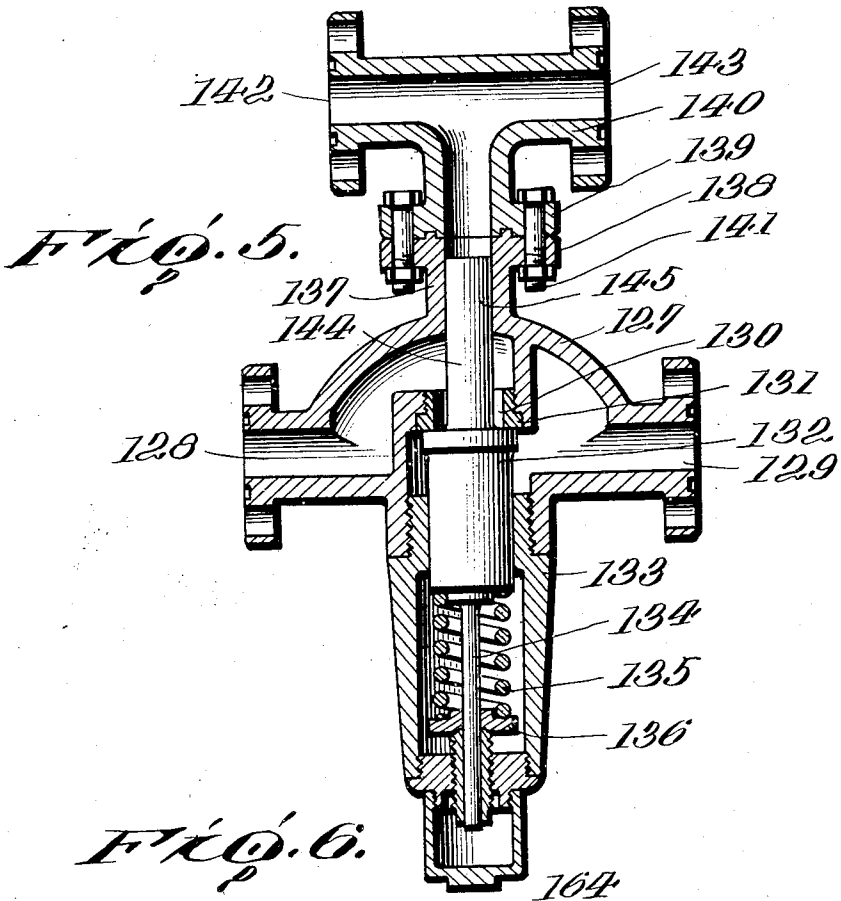
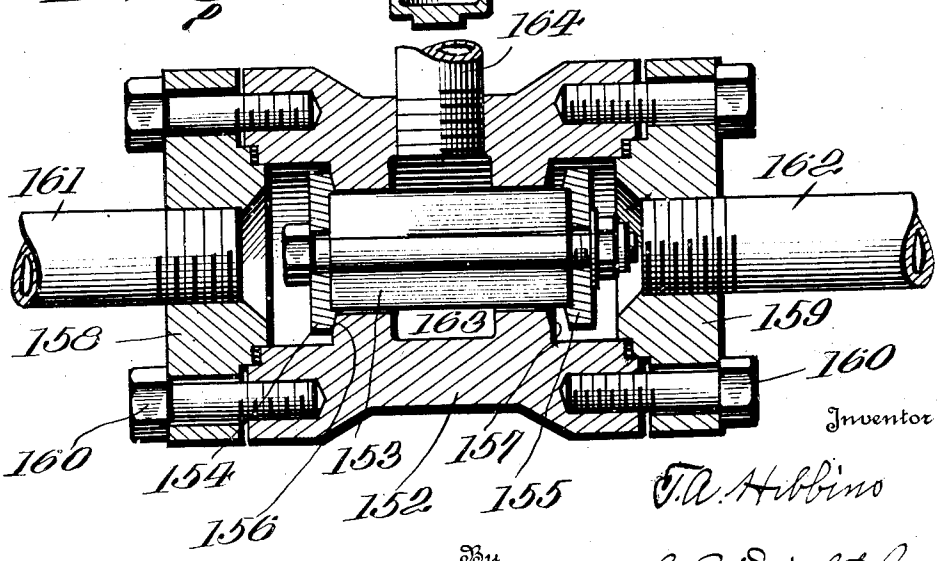


FIG. 6.



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Filed July 24, 1926 6 Sheets-Sheet 6

Fig. 7.

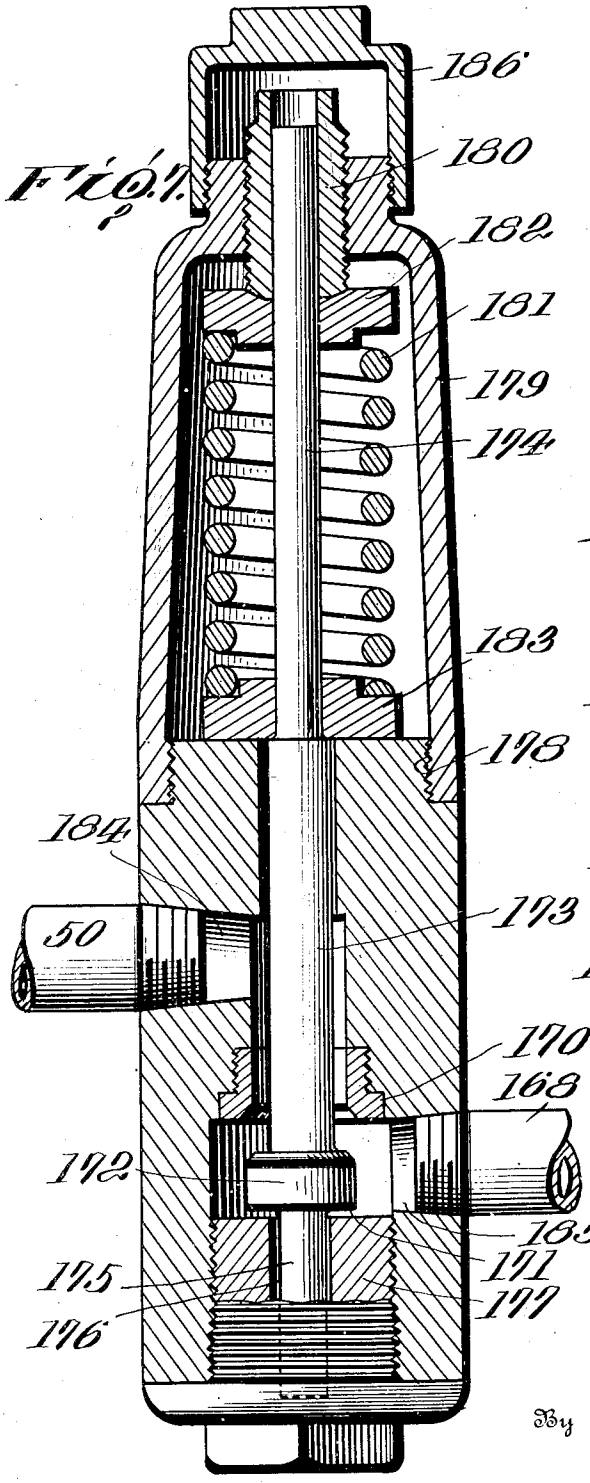
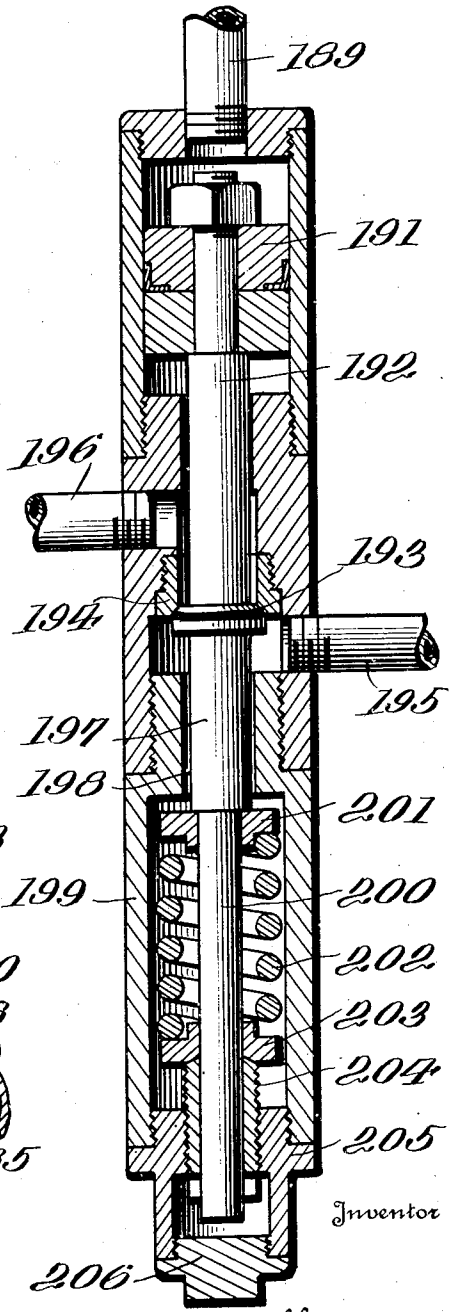


Fig. 8.



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Patented Nov. 29, 1927. 1,651,203

UNITED STATES PATENT OFFICE.

THOMAS A. HIBBINS, OF WELLSVILLE, OHIO, ASSIGNOR TO THE STEVENSON COMPANY, OF WELLSVILLE, OHIO.

HYDRAULIC SEWER-PIPE PRESS.

Application filed July 24, 1926. Serial No. 124,740.

My invention relates to improvements in hydraulic sewer pipe presses.

The object of my invention is to provide a sewer pipe press operated entirely by fluid pressure and providing means whereby the clay plunger on the first part of its stroke has a very rapid downward movement until it engages the clay in the clay cylinder, and after thus engaging the clay the plunger slows down while the clay is forced into the die in which the pipe is formed.

Another object of my invention is to provide a press of this character in which the clay plunger is raised by the same fluid pressure that forces it downwardly, and providing means whereby the entire fluid system is filled with fluid and automatically maintained filled with fluid under all conditions.

Another object of my invention is to provide a hydraulic means for raising the die hoist for raising the die head for forming the socket at the upper end of the pipe, and providing means whereby a predetermined pressure is maintained on the die hoist so that the die head will maintain the desired pressure on the pipe during its downward movement so that excessive pressure can not be placed upon the die head to cause a buckling of the pipe, but at the same time maintaining a sufficient pressure on the die to prevent any longitudinal pulling action on the pipe by its own weight.

A further object of my invention is to provide a hydraulic press of this character in which the operation of the clay plunger is automatic in that the pressure or resistance of the clay against the same will automatically slow the same down, so that the clay will have time to slowly pass through the die to form a perfect pipe, and the means for holding the die head against the lower end of the pipe being automatic so that the upward pressure thereof against the lower end of the pipe can not exceed a certain point.

A further object of my invention is to provide a piping system whereby the fluid for operating the plunger in both directions in a continuous system having means interposed therein so that the fluid can be caused to circulate in either direction to force the clay plunger downwardly, and to raise the same. The die hoist operating mechanism is also a continuous system of piping having interposed therein means for changing the circulation of the fluid in the system for raising and lowering the die hoist.

A further object of my invention is to provide a press of this character in which the die and clay feeding mechanism is so formed that the clay is broken up by the three way steel arch and again compressed in a solid mass within the ring above the die so that a perfect pipe is formed, and having means for severing the pipe from the body of clay when the pipe of desired length has been formed.

A still further object of my invention is to provide a press of this character in which the operating mechanism is so positioned that the press can be operated by a single person, and absolute control maintained over the forming of the pipe, and at the same time providing a very effective press having many details of structure and combination of parts hereinafter more fully set forth.

In the accompanying drawings:—

Figure 1 is a diagrammatical view of my improved press.

Figure 2 is an enlarged vertical sectional view of the clay plunger cylinder showing it in a raised position.

Figure 3 is a vertical sectional view taken through the mud hopper and die and showing my improved means for severing the pipe from the body of clay and also showing means for compressing the clay and the die for forming the pipe and socket thereon.

Figure 4 is an enlarged vertical sectional view of the die head cylinder.

Figure 5 is an enlarged vertical sectional view of the main cylinder control valve.

Figure 6 is an enlarged sectional view of the form of differential valve arranged in both the clay plunger cylinder and in the die head hoist cylinder fluid system, for supplying fluid thereto and maintaining the systems full of fluid.

Figure 7 is an enlarged vertical sectional view of the die head hoist control valve.

Figure 8 is an enlarged vertical sectional view of the die head hoist relief valve.

Referring now to the drawings, 1 represents the base, and 2 the metal frame, preferably made of angle iron and of any de-

sired structure, and having at its upper end the transverse supporting frame 3 adapted to support the compressing chamber 4. As shown, this frame extends above the floor level 5 the proper distance so that when a pipe is completed in the press it is a slight distance above the floor level, for the convenience of removing the pipe from the die head. While I have shown and described this arrangement of support it will be understood that this is only a conventional form and the same could be varied in many ways to meet conditions without departing from my invention.

The compressing chamber 4 is preferably supported by the frame 3, by the flange 6 as shown in Figures 1 and 3 of the drawings. This flange, as fully shown in Figure 3, is bolted to the frame 3 by means of bolts 7. The upper end of the chamber 4 is provided with a hopper 8 in which the clay is fed and the hopper is charged in any desired manner. The chamber 4 has a hard cast iron lining 9 to prevent wear on the inner face of the chamber, and said chamber 4, adjacent its upper end, is provided with an annular flange 10, upon which rests the annular plate 11, bolted thereon by the bolts 12. The plate 11 is provided with a series of upwardly extending integral standards 13, which have rigidly carried by their upper ends the annular ring 14, and the same is clamped downwardly on the flange 10 by means of the bolts 15. The member 14 is provided with an opening through which the clay plunger passes, and the clay cylinder is provided with an annular flange 16, resting upon the upper end face of the member 14 and bolted thereto by means of bolts 17. The clay plunger cylinder 15′, as shown, is of an elongated form and its lower end forms a tight joint with the member 14, a stuffing box 18 is supported by the member 14 to form a tight joint with the hollow clay plunger piston rod 19, as shown in Figures 1 and 2 of the drawings. The upper end of the clay plunger cylinder 15′ is closed by the cylinder head 20, clamped thereon or to a flange 21 by means of the bolts 22, having a packing 23 arranged to form a tight joint between the cylinder and the head. Screwed within the cylinder head 20 is a tube or pipe 24 which extends down into the hollow clay plunger piston rod 19, as clearly shown in Figure 2 of the drawings. Connected to the upper end of the cylinder head is a fluid supply pipe 25 preferably connected by means of bolts 26, and the inner end of said pipe communicates with an opening 27 in the cylinder, and said opening communicating with the upper end of the hollow tube or pipe 24. Connected to one side wall of the clay plunger cylinder 15′ is a pipe 28 connected thereby by the screws 29, and said pipe having its inner end in communication with a passage 30, arranged within the side wall of the cylinder 15′. This passage extends upwardly as shown in Figure 2 of the drawings and has its upper end communicating with the bore of the cylinder close to its upper end.

The clay plunger piston rod 19 is reduced on its inner and outer faces as indicated at 31, and arranged on the inner reduced portion thereof is a packing ring 32 which engages the outer face of the tube 24. Arranged on the outer reduced portion of the clay plunger piston rod 19 are a series of rings 33, which have suitable packings 34 arranged therebetween, and which engage the inner wall of the clay plunger cylinder 15′. Arranged between the rings 33 are packings 35, which engage the tube 24 and form a tight joint therewith. The upper end of the reduced portion 31 of the piston rod 19 is externally and internally threaded. Screwed on the external threads is a ring 36, which is screwed downwardly and tightly clamping the rings 33 and the packings 34 in the position shown in Figure 2 of the drawings. Screwed on the internal threads of the reduced portion of the piston is a ring 37 which clamps the packings 35 tightly against the tube 24. The extreme upper end of the reduced portion 31 of the piston is provided with a series of threaded projections 38, over which washers 39 are placed, and said washers clamped thereon by means of nuts 40, which prevent the turning of either of the inner ring 37 or the outer ring 36.

The die hoist cylinder 41 is laterally adjustably supported upon a base 42. This is accomplished by having the head 43 flanged at 44, engaged by means of set screws 45, carried by the flange 46, formed integral with the base 42. The die hoist cylinder 41 is provided at its lower end with a flange 47, and arranged between the flange and the head 43 is a packing 48, and the cylinder tightly clamped on the head by means of bolts 49, as clearly shown in Figure 4 of the drawings, whereby a tight joint is formed between the head and the cylinder. The cylinder head 43 has connected thereto a pipe 50 which has its inner end communicating with a passage 51, arranged in the cylinder head, and said passage 51 communicating with a depression 52 arranged in the cylinder head directly below the bore of the die hoist cylinder and in communication therewith.

The upper end of the die hoist cylinder 41 has connected thereto a pipe 53 which has its inner end communicating with a passage 54, communicating with the bore of the cylinder. The upper end of the die hoist cylinder is closed by the head 55, which as shown in Figure 4 of the drawings, is of an elongated form and provided at its lower end

with a flange 56 resting upon the flange 57, carried by the upper end of the die hoist cylinder. Between the flanges 56 and 57 is a packing 58, and the cylinder head is clamped to the cylinder by means of the bolts 59. The upper end of the cylinder head 55 is provided with a stuffing box 60, by means of which a tight joint is formed with the die hoist piston rod 61.

The frame 2, below its upper end, is provided with transverse beams 62 and 63 supported by the transverse beams 64, arranged at right angles thereto. The upper end of the cylinder head 55 is provided with an annular flange 65 upon which is clamped, by the bolts 66, the flange 67 which extends upwardly and has its upper end turned inwardly as indicated at 68, and adapted to support the bearing 69. The bearing 69 is provided with a lateral flange 70 bolted at 68 by means of the bolts 71. This bearing braces the die hoist piston rod 61, and in order to properly center the piston rod so that the die head or former 72 carried at its upper end may be held so as to properly cooperate with the lower end of the die, I provide lateral adjusting means for the bearing. In order to accomplish the adjustment, the beams 62 and 63 support the annular ring 73 having the upwardly turned flange 74 provided with set screws 75, which engage the outer face of the member 67, whereby the bearing can be shifted for a purpose heretofore set forth.

The receptacle 4, at its lower end, is provided with an annular flange 76, and below the flange is an arch ring 77 bolted to the flange by means of the bolts 78. The arch ring 77 carries a removable arch 77′ which is provided with three or more arms 79, which extend inwardly and have formed therewith the cylinder portion 80, arranged in the center of the arch. These arms not only serve as a support for the member 80 but also divide the clay and cause a certain compression thereof to cause it to more readily mix so that when it enters the die proper there will be no air holes in the clay. The arch ring 77 at its lower end is provided with an annular flange 81 to which is bolted the annular flange 82, by means of bolts 83. The flange 82 is carried by the compressor ring 84, which has an annular lining 85 therein and this lining is provided with the inwardly beveled wall 86 terminating at its lower end with the vertical wall 87, and said vertical wall terminating in an outwardly flared wall 88. This liner 85 is supported by means of the flange 89 formed on the inner face of the ring 84. The arch 77′ is supported by the upper end of the compressor ring 85 and the arch 77′ supports the ring 91, which in turn supports the liner 9 of the receptacle 4.

The lower end of the compressor ring 84 is provided with an annular flange 92 having its outer end turned downwardly as indicated at 93. Resting against the lower face of the annular flange 92 is one section 94, of the die which with the other section forms the annular passage 95 having converging walls 96 and 97 terminating in the annular vertical passage 98 which forms the pipe. The lower end of the die section 94 is flared outwardly as indicated at 99, to form a socket on the end of the pipe. The wall 100 of said flared portion is provided with a series of relief valves 101 which break the vacuum when the die head hoist is lowered with socket in place.

The tubular member 80 formed integral with the arms 79 is internally threaded and into which is screwed the member 102 which extends downwardly and has an inwardly tapering wall 103 terminating in the vertical wall 104. The lower end of the member 102 is reduced as indicated at 105 and externally threaded, and upon which is screwed the ring like die member 106, which carries or forms the wall 96, forming the passage 95.

Carried by the frame 3 is an electric motor 107 driving a train gear 108, and which in turn drives a shaft 109 through the magnetic clutch mechanism 110. The shaft 109 extends outwardly and passes through an opening in the arch ring 77 and through the arch and one of the arms into the tubular member 80 carried by the arm 79. The roller bearings 111 and 112 are provided for the shaft, as shown in Figure 3 of the drawings, and the inner end of the shaft 109 carries a beveled gear 113 meshing with the beveled gear 114 carried by the upper end of the vertical shaft 115, mounted in the member 102. A bearing 116 is provided for the upper end of the shaft 115, and a bearing 117 is provided for the lower end of the shaft 115, both carried by the member 102. The shaft 115 extends below the member 102 and carries a head 118 which carries the knife 119, which is pivoted so that it is thrown outwardly by centrifugal force to sever the pipe when it has been formed of the desired length. The specific construction of this knife will not be fully described as it is covered by an application Serial Number 124,742 executed on even date herewith.

The clay plunger cylinder 15′ adjacent its lower end has connected thereto a pipe 120 by means of the coupling 121 and the inner end of said pipe communicates with a passage 122 arranged in the wall of the cylinder, and communicates at its lower end with the space 123 between the clay plunger piston rod 19 below the piston packing carried by the upper end thereof. Arranged at any convenient point close to the machine is a rotary fluid pump 124 driven preferably by the electric motor and controlled through the lever 126. The pipe 120 leading from

the lower end of the clay plunger cylinder is connected to the pump 124 and the pipe 25 leading from the tube 24 is connected to the other side of the pump, whereby the fluid in the pipes 120 and 25 is caused to circulate in either direction by the pump control lever. The pipe 25 intermediate the cylinder and the pump has the outer end of the pipe 28 connected thereto at 28'. Interposed in said pipe 28 is a main cylinder control valve 127 which is provided with the two ports 128 and 129, which communicate with each other within the valve by means of the port 130, having the seat 131 arranged therein, and closed by the valve 132. The valve 127 is provided with an extension 133 into which the valve 132 extends, and said valve is provided with a small rod 134 around which is arranged a coil spring 135, which normally holds the valve 132 on its seat as clearly shown in Figure 5 of the drawings. An adjusting nut 136 is provided for varying the tension of the spring 135 so that the valve can be adjusted so that it will open under different pressure. The main cylinder control valve casing 127 is provided with an extension 137, provided with a flange 138 to which is connected the flange 139 of the T coupling 140 and the connection between the flanges 138 and 139 is preferably made by the bolts 141. The pipe 25 is connected to the opening 142 of the coupling 140, and the other end of the pipe leading from the pump is connected to the opening 143. The valve 132 is provided with an extension 144 which is of a diameter considerably less than that of the valve and passes upwardly through the passage 130 and enters the cylindrical opening 145 in the extension, and closely fits the wall thereof. As heretofore stated, the fluid passes from the pump 124 through the pipe 25 and through the coupling 140 to the tube 24 within the clay plunger cylinder, and passes downwardly therein and forces the clay plunger downwardly. When the pressure in this pipe 25 has reached a predetermined point sufficient to overcome the pressure of the spring 135 the valve 132 is unseated. The difference in area of the extension 145 and that of the valve is such that the pressure on the valve entering from the pipe 25 through the pipe 28 will not be counterbalanced, therefore, the valve will open. By opening the valve 132 and driving the pump at the same rate of speed it will be seen that the same amount of oil is passing from the pump through the pipe 25, but the pressure is reduced because a portion of it passes into the tube in the clay plunger cylinder and a portion of it is diverted and passes through the main cylinder control valve and through the pipe 28 and through the passage 30 into the clay plunger cylinder. The greater volume of liquid required reduces the speed of the clay head piston rod 19 when compressing the clay. Arranged close by and above the clay plunger cylinder is a fluid reservoir 146, which is provided with a pipe 147 connected at 148 to the pipe 28, between the clay plunger cylinder and the main cylinder control valve. This pipe 147 is provided with a check valve 149 which allows oil to flow into the system at 148, when there is no pressure in the pipe 28, but the check valve prevents the oil from passing back to the tank when pressure is in the pipe 28. In order to allow the oil to pass from the clay plunger cylinder through the pipe 28 to the pump 124 when the direction of rotation thereof is reversed, I have provided a by-pass pipe 150 which extends around the main cylinder control valve 127, and is provided with a check valve 151, thus, it will be seen that when the main control valve is closed by the spring 135 and the pump is rotated in a direction to force the fluid through the pipe 120 to the lower end of the clay head cylinder to raise the clay head, the checking valve 151 will be open and the oil will pass from the pipe 28 around the control through the by-pass 150 and back through the pipe 25 to the pump 124. In order to provide for maintaining the system full of fluid when the pump is operating and the check 149 is closed, I have provided a differential valve 152 which comprises an elongated casing having a passage therethrough, and having arranged in said passage a member 153, and said member having at its ends the two valves 154 and 155 adapted to engage the seats 156 and 157, as will be later described. The differential valve casing 152 is closed by the two heads 158 and 159 held thereon by the bolts 160. The head 158 has connected thereto a pipe 161 which is connected to the pipe 120 leading from the pump to the lower end of the clay plunger cylinder 15'. Connected to the head 159 is a pipe 162, which leads outwardly and is connected to the pipe 25, which leads to the upper end of the clay plunger cylinder 15'. The member 153 as shown is corrugated to allow the fluid to pass towards each end of the casing, and arranged centrally in the casing 152 is an annular recess 163 which communicates with an opening in the casing in which is screwed the pipe 164, which leads upwardly and connects with the fluid supply tank 146. By the construction of this differential valve it will be seen that when the pump is operated to draw the fluid through the pipe 120 from the lower end of the clay plunger cylinder 15' the pressure in the pipe 162 works against the valve 155 and closes it as the pump is creating a pressure in the pipe 25. This unseats the valve 154 so that if there is not sufficient fluid in the pipe 120 to supply the pump to its capacity, the fluid flows by gravity and suction through the pipe 164, through the casing of the dif-

ferential valve out through the pipe 161, to the pipe 120, thus there is always a full supply of fluid to the pump.

When the pump is operating in the opposite direction and drawing the fluid through the pipe 25 from the upper end of the clay head cylinder and forcing it out through the pipe 120 to the lower end of the clay head cylinder, the valve 154 is seated as shown in Figure 6 of the drawings, and fluid flows by gravity or suction through the pipe 164, and out through the pipe 162 to the pipe 25, whereby the system is supplied with the desired amount of fluid to allow the pump to work at full capacity.

Arranged at a convenient point close to the pump 124 is a second pump 165 operated by a motor and controlled by the lever 167. The pipe 53 leading from the upper end of the die head hoist cylinder 41 is connected to one side of the pump and the pipe 168 is connected to the opposite side of the pump and extends downwardly, and is connected to the die head hoist control valve 169. The die head hoist control valve consists of a casing having a valve seat 170 arranged therein and a passage 171 communicating with a central bore and also with the pipe 50. Arranged within the die hoist control valve casing is the valve 172 adapted to cooperate with the valve seat 170 and on one side of the valve is a stem 173 which extends upwardly, and has a reduced upper end 174. The valve 172 at its lower face is provided with a guide or extension 175 which is of a diameter less than the extension 173, this extension 175 extends into the opening 176 arranged in a removable plug 177 threaded into the lower end of the die hoist control valve casing. The die hoist control valve casing is externally threaded as indicated at 178 upon which is screwed a housing 179, carrying at its upper end a removable guide 180 through which the reduced extension 174 of the valve loosely slides. Surrounding the extension 174 of the valve 172 is a coil spring 181 which abuts against the member 182, which is held by the guide 180. The lower end of the spring 181 engages the washer 183 rigidly fastened to the extension 174 of the control valve, and said spring normally holding the control valve open, as clearly shown in Figure 7 of the drawings. When this valve is in the position shown in Figure 7, the fluid is passing from the pump through the pipe 168, around the valve out through the opening 184, and into the pipe 50 to the lower end of the die hoist cylinder and forcing the die hoist upwardly. When the pressure in the pipe line 168 and 50 reaches 250 lbs. per square inch or more the pressure of the fluid passing into the casing through the pipe 168 engages the lower face 171 of the valve 172, and thus closes it and cuts off the pressure to the lower end of the die hoist cylinder. This is due to the fact that the extension 175 of the valve 172 is of a less diameter than the extension 173, thus when the pressure is equal on each side of the valve it will close and shut off the pressure to the die hoist cylinder. The upper end of the die hoist valve casing is provided with a removable cap 186 which fully protects the guide and prevents dirt from entering the same. Arranged between the pipe 53, leading from one side of the pump 165 to the upper end of the die hoist cylinder and the pipe 168 leading from the other side of the pump to the lower end of the die hoist cylinder through the die hoist control valve, is a differential valve 187, which has connected thereto a pipe 188 leading upwardly, and connected to the oil supply tank 146. This differential valve 187 works precisely like the differential valve 152, and Figure 5 of the drawings may be referred to for the operation thereof. Connected to the pipe 53, leading from the pump 165 to the upper end of the die hoist cylinder 41, is a pipe 189 which leads downwardly and is connected to the upper end of the die hoist release valve casing 190. This casing, as shown, is provided with a piston 191 arranged in one end adjacent the pipe 189. The piston rod 192, carrying the piston extends downwardly and is provided with a valve 193 adapted to cooperate with the valve seat 194. Communicating with one side of the die hoist release valve casing, is a pipe 195, which leads upwardly and is connected to the fluid supply tank 146. Connected to the opposite side of the casing above the valve 193 is a pipe 196 which is connected to the pipe 50 communicating with the lower end of the die hoist cylinder. The pipe 50, as shown in Figure 1 of the drawings, also communicates with the die hoist control valve. The valve 193 of the die hoist release valve is provided with a downward extension 197 which extends through the guide opening 198, and within the housing 199. This extension 198 is provided with a reduced portion 200 which has connected thereto a washer 201 against which the spring 202 bears. The opposite end of the spring bears against a washer 203 rigidly carried by the guide 204 which in turn is carried by the die hoist release valve casing through the medium of the removable cap 205, as clearly shown. The cap 205 is closed by the threaded plug 206. It will be seen by reference to Figures 1 and 8 of the drawings that the die hoist release valve is normally held closed by the spring 202. When the pressure on the pump is reversed, pressure through the pipe 189 exerts the pressure on the piston and opens this valve against the tension of the spring. This releases the high pressure on the lower end of the die hoist cylinder, and allows it to pass outwardly through the pipes 50, 196, the valve 190 and

pipe 195, and at the same time, when this takes place, a die hoist control valve is automatically opened up due to the decrease in pressure in the pipe lines 168 and 50. The operation of the apparatus is as follows:—

The clay head 19′ having been previously raised to its limit of upward movement, clay is fed into the hopper 8 in any desired manner until it is approximately filled. The lever 126 is moved to start the pump 124 in operation so that oil is drawn from the lower end of the clay plunger cylinder 15′, through the pipe 120 and discharged from the pump through the pipe 25 into the upper end of the tube 24. The fluid passes downwardly through the tube into the mud head piston rod 19, and the rod having the packing 35 to prevent the fluid from passing from the hollow piston rod it will be seen that the piston rod is moved downwardly fairly rapidly and engages the clay in the hopper 8. The engagement of the clay head 19′ with the clay in the hopper causes a back pressure in the tube 24 and back into the pipe 25. This back pressure into pipe 25 causes the fluid to engage the end of the extension 145 carried by the valve 132, and unseat the valve against the tension of the spring 135. This unseating of the valve allows the fluid to pass from the pipe 28 through the opening in the main control valve, past the valve 132 and out through the opening 128 into the pipe 28, and enter the clay head cylinder 15′ through the passage 30. This by-passing of a portion of the fluid through the pipe 28 to the clay plunger cylinder above the piston carried by the clay plunger piston rod 19, requires a greater volume of the fluid when the pump is rotated at a given speed, as the area of the spaces into which the oil is flowing is greatly increased and thus the movement of the clay head piston rod 19 is slowed down as it forces the clay downwardly into the hopper and through the chamber 4. The clay head 19′ continues downwardly in the chamber 4, forcing the clay into the arch 77′, where the clay is divided by the arms 79, and more thoroughly compressed to squeeze out any air in the clay and pass from the arch through the compressor chamber 84, and is again compressed by the inwardly diverging wall 86. The clay then passes into the die 94 and is compressed by the walls 96 and 97.

It will be understood that previous to this operation the die head 72 has been forced upwardly in the position shown in Figure 3. This is accomplished by operating the lever 167 of the pump 165 to cause the pump 165 to rotate in a direction to cause the fluid to be drawn from the upper end of the die hoist cylinder 41, through the pipe 53, and discharged outwardly through the pipe 168, and through the pipe 50 to the lower end of the die hoist cylinder, as will be hereinafter more fully set forth. The mud head 19′ is continued to be forced downwardly until the space 20′ is filled with clay to form the socket at the end of the pipe. The operator by experience knows when the socket has been formed and he then reverses the direction of movement of the lever 167 so that the pump 165 is drawing the fluid from the lower end of the die hoist cylinder 41 through the pipe 50, through the die hoist control valve 169, and through the pipe 168 to the pump. The fluid then passes from the pump out through the pipe 53, to the upper end of the die hoist cylinder 41, and gradually forces the former head downwardly so that the former or die head is gradually lowered as the clay is forced from the die forming the pipe. The die hoist control valve 169 maintains a pressure of 250 lbs. per square inch in the pipe 50 so that all times the die head is exerting the pressure on the lower end of the pipe so as not to cause a drawing action of the pipe, and allowing the pipe, supported by the die head, to travel faster than the clay that is being forced from the die. After the die head has been lowered to form a pipe of the desired length the levers 126 and 127 are both moved in a position to stop the pumps 124 and 165. The pressure in the pipes 50 and 53 is maintained so that the pipe is supported by the die head under the normal pressure. The electric motor 107 is then started, which, through the gear 108 drives the shaft 109, which in turn drives the beveled gear 113, which meshes with the gear 114, and the shaft 115 is very rapidly rotated. The knife 119 is normally held in a retracted position in beyond the inner vertical passage 98. The rapid rotation of the shaft 115 causes the knife 119 to be thrown outwardly by centrifugal force and sever the pipe from the body of clay passing through the passage 98. By this time the die head has reached a position just above the floor level 5, and the pipe is removed therefrom. The die head is then forced upwardly as heretofore described.

The lever 126 is then moved so that the pump 124 is drawing the fluid through the pipes 25 and 28 from the upper end of the mud head cylinder 15′, and also from the tube 24, and forcing it out from the pump through the pipe 120 to the lower end of the mud head cylinder 15′, in the space 123 below the packing rings, which forces the mud head upwardly to bring it a considerable distance above the hopper 8, so that another charge of clay can be placed in the hopper 8, and the operation repeated.

In the general description of the operation I have not described the differential valves and by-passes for releasing the pressure in the die hoist cylinder 41, and clay plunger cylinder 15′, as this was described in the

specific description of the clay plunger cylinder control valve, die hoist control valve, differential valve, and die hoist release valve.

Having thus fully described my invention what I claim is:—

1. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, hydraulic means for causing the downward movement of the piston, and automatic means for causing a slowing down of the movement of the piston.

2. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, hydraulic means for causing the downward movement of the piston, and automatic means controlled by the pressure on the clay plunger for slowing down the movement of the piston.

3. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, hydraulic means for moving the piston down, and means operated by the resistance of the clay against the clay plunger for slowing down the movement of the piston.

4. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a die for forming the pipe arranged below the clay plunger, hydraulic means for moving the piston downwardly in engagement with the clay in the die, and means caused by the resistance of the clay against the plunger for increasing the hydraulic pressure and slowing down the movement of the piston.

5. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a die below the plunger, hydraulic means for moving the piston downwardly and causing the clay plunger to force the clay through the die, and means caused by the pressure of the clay on the plunger for increasing the pressure and for diverting a portion of the hydraulic means to cause a slowing down movement of the piston.

6. A hydraulic pipe press comprising a cylinder, a piston therein, a piston rod extending outwardly from the piston, a clay plunger carried by the piston rod, a die below the plunger, hydraulic means for moving the piston downwardly, means caused by the pressure of the mud on the plunger for increasing the pressure in the cylinder and slowing down the movement of the piston, and hydraulic means for raising the piston in the cylinder.

7. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, hydraulic means for raising and lowering the piston, and automatic means for slowing down the downward movement of the piston.

8. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, means for circulating fluid from the upper to the lower end of the cylinder for raising and lowering the piston, and means caused by the greater volume of fluid required in the cylinder on the last part of the downward movement of the piston for slowing down the movement thereof.

9. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid circulating system communicating with the upper and lower ends of the cylinder, a pump in said system whereby the piston is caused to move up and down in the cylinder by fluid pressure, means caused by the greater volume of fluid required in the cylinder during a portion of the downward movement of the piston for slowing down the movement thereof.

10. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure circulating system extending from the lower end of the cylinder to the upper end, a pump in said system, automatic means caused by the greater volume of fluid required in the cylinder during a portion of the downward movement of the piston for slowing down the movement thereof.

11. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid circulating system connecting the upper and lower ends of the cylinder, a pump in said system means caused by the greater volume of fluid required in the cylinder for slowing down the downward movement of the piston and increasing the pressure.

12. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said system, automatic means for maintaining the system full of fluid, and automatic means caused by the greater volume of fluid required in the cylinder on a portion of the downward movement of the piston for slowing down the movement thereof and increasing the pressure.

13. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said system, automatic means for maintaining the system full of fluid, and automatic means operated by pressure on the plunger, for causing a greater volume of fluid to be required in the cylinder on the downward movement of the piston for slowing down the movement of the plunger and increasing the pressure.

14. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system

connecting the upper and lower ends of the cylinder for raising and lowering the piston, and automatic means operated by pressure on the plunger for relieving the pressure in the system on the downward movement of the piston, and slowing down the movement of the plunger and increasing the pressure.

15. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said system, an automatic means for keeping the system filled with fluid when the fluid is moving in either direction, and automatic means for relieving the pressure on a portion of the downward movement of the cylinder caused by a greater volume of fluid required in the cylinder for slowing down the movement of the plunger and increasing the pressure.

16. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, hydraulic means for raising and lowering the piston, automatic means for slowing down the movement of the piston, a die hoist cylinder below the first mentioned cylinder, a piston therein, a die head carried by the piston, hydraulic means for raising and lowering the die head, and means for maintaining the predetermined pressure on the die head in its downward movement.

17. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a hydraulic circulating system for raising and lowering the piston, automatic means for slowing down the downward movement of the piston, a die hoist cylinder below the first mentioned cylinder, a piston therein, a die head carried by the piston, a hydraulic circulating means connecting the upper and lower ends of the die hoist cylinder, and means for maintaining a predetermined pressure on the die head during the downward movement thereof.

18. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a hydraulic circulating system connecting the upper and lower ends of the cylinder for raising and lowering the mud head, automatic means for slowing down the downward movement of the clay plunger, a die head cylinder below the first mentioned cylinder, a piston therein, a die head carried by the piston, a hydraulic circulating system connecting the upper and lower ends of the die head cylinder for moving the die head up and down, and automatic means for maintaining a predetermined pressure on the die head in its downward movement.

19. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a die below the plunger, hydraulic means for raising and lowering the die head, automatic means for slowing down the movement of the mud head, a die head cylinder below the die, a piston therein, a die head carried by the piston and cooperating with the die, and hydraulic means connected with the die head cylinder for raising and lowering the die head.

20. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, hydraulic means for raising and lowering the mud head, automatic means operated by the pressure of the clay on the plunger for slowing down the movement of the plunger, a die hoist cylinder, a piston therein, a die head carried by the piston, and hydraulic means for raising and lowering the die head.

21. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, hydraulic means for raising and lowering the plunger, means operated by the pressure on the plunger for increasing the hydraulic pressure caused by the greater volume of fluid required in the cylinder, for slowing down the movement of the plunger, and a die head operating in conjunction with the plunger, and hydraulic means for raising and lowering the die head.

22. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, hydraulic means for raising and lowering the plunger, automatic means controlled by the pressure on the plunger for causing a greater volume of fluid to be required in the cylinder for slowing down the movement thereof, a die below the plunger, into which the clay is forced by the plunger, a die head cylinder below the die, a piston therein, a die head carried by the piston, and cooperating with the die, hydraulic means for raising and lowering the die head, and means for maintaining a predetermined pressure on the die head.

23. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, hydraulic means for raising and lowering the plunger, an automatic means for slowing down the movement of the plunger, a die below the plunger, a die hoist cylinder below the die, a piston therein, a die head carried by the piston, hydraulic means for raising and lowering the die head, and a rotary knife within the die and thrown outwardly by centrifugal force for severing the pipe from the body of clay, when the die head has reached its downward position.

24. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, hydraulic means for raising and lowering the mud head, means operated by pressure on the plunger for increasing the hydraulic pressure in the cylinder for causing a greater volume of fluid to be required in the cylinder on the down-

ward movement of the piston for slowing down the movement thereof, a die below the plunger, a die hoist cylinder below the die, a piston therein, a die head carried by the piston, and cooperating with the die, to form a socket on the lower end of the pipe and to support the pipe, and hydraulic means for raising and lowering the die head.

25. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a die below the plunger, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said fluid pressure system, for drawing the fluid from either end of the cylinder and forcing it to the other end, for raising and lowering the plunger, and automatic means for increasing the pressure in said fluid system for causing a greater volume of fluid to be required in the cylinder on the downward movement of the piston for slowing down the movement of the plunger.

26. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a hydraulic system connecting the upper and lower ends of the cylinder, a pump in said system for drawing the fluid from either end of the cylinder and forcing it to the other end, and the control valve between the pump and the upper end of the cylinder for relieving the pressure for causing a greater volume of fluid to be required in the cylinder for slowing down the downward movement of the plunger.

27. A hydraulic pipe press comprising a cylinder, a piston therein, a cylinder plunger carried by the piston, a fluid pressure system connecting the ends of the cylinder, a pump in said fluid pressure system for drawing the fluid from either end of the cylinder and forcing it to the other end, automatic means keeping the fluid system filled with fluid, and a control valve between the pump and the upper end of the cylinder for relieving the pressure for causing a greater volume of fluid to be required in the cylinder and slowing down the downward movement of the plunger.

28. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the ends of the cylinder, a pump in said fluid pressure system, a control valve in the system between the pump and the upper end of the cylinder for relieving the pressure for causing a greater volume of fluid to be required in the cylinder and slowing down the downward movement of the plunger, and a by-pass around said valve for allowing the fluid to pass to the pump on its reverse movement.

29. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump interposed in said system, a control valve in said system between the pump and the upper end of the cylinder and operated by pressure for relieving the pressure between the pump and the upper end of the cylinder for causing a greater volume of fluid to be required in the cylinder for slowing down the downward movement of the plunger.

30. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump interposed in said system for drawing the fluid from either end of the cylinder and forcing it to the other end, a control valve interposed in the system between the pump and the upper end of the cylinder and operated by pressure for relieving the pressure for causing a greater volume of fluid to be required in the cylinder, and slowing down the downward movement of the plunger, automatic means connected with a fluid supply tank for keeping the fluid system filled with fluid.

31. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a continuous fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said fluid pressure system, and automatic means controlled by the fluid pressure for slowing down the downward movement of the piston.

32. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a continuous fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said fluid pressure system, automatic means in said system between the pump and the upper end of the cylinder for slowing down the downward movement of the piston.

33. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a continuous fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said fluid pressure system, automatic pressure controlled means between the pump and the upper end of the cylinder for causing a greater volume of fluid to be required in the cylinder for slowing down the downward movement of the piston.

34. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the ends of the cylinder, a pump in said fluid pressure system, automatic pressure controlled means in said system between the pump and the upper end of the cylinder, and a differential valve connecting the system between the pump and the cylinder, and communicating with the fluid supply

tank for maintaining the system filled with fluid.

35. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a continuous fluid pressure system connecting the ends of the cylinder, a pump in said fluid pressure system, automatic means in the system between the pump and the upper end of the cylinder, and operated by pressure caused by the resistance on the clay plunger for slowing down the downward movement of the piston.

36. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said system, a valve in said system between the pump and the upper end of the cylinder and adapted to release the pressure in the cylinder after it has increased for causing a greater volume of fluid to be required in the cylinder, for slowing down the downward movement of the piston.

37. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the ends of the cylinder, a pump in said fluid pressure system, a pressure controlled valve in the system between the pump and the upper end of the cylinder for reducing the pressure for causing a greater volume of fluid to be required in the cylinder and slowing down the downward movement of the piston, and a by-pass around said valve for allowing the fluid to pass back to the system from the cylinder on the upward movement of the piston, and a check valve in said by-pass.

38. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said system, a differential valve connecting the system between the pump and the cylinder, and having a fluid supply pipe connected to a supply tank, automatic means in the system between the pump and the upper end of the cylinder for causing a greater volume of fluid to be required in the cylinder, for slowing down the downward movement of the piston, and a by-pass around said automatic means for allowing the fluid to flow back through the system on the upward movement of the piston.

39. A hydraulic pipe press comprising a cylinder, a piston therein, a fluid pressure system connected to the lower end of the cylinder, and having two pipes connected to the upper end of the cylinder for supplying fluid to the cylinder internally and externally of the piston, a pump in said system intermediate the connections with the upper and lower ends of the cylinder, a normally closed valve in the pipe for supplying external pressure to the piston and operated by the pressure in the pipe supplying pressure internally to the piston, whereby fluid is supplied simultaneously through both pipes when pressure reaches a certain point for slowing down the downward movement of the piston.

40. A hydraulic pipe press comprising a cylinder, a piston therein, a hollow piston rod carried by the piston, a tube carried by the cylinder and passing through the piston, and working in the hollow piston rod, a fluid pressure system connecting the lower end of the cylinder, and the tube carried by the upper end of the cylinder, a pump in said fluid pressure system, a pipe leading from the system between the pump and the tube and connected to the cylinder on the outside of the tube, a valve normally in said pipe normally held closed, means operated by the pressure in the pipe leading to the tube for opening the valve and simultaneously supplying fluid to the tube and the cylinder for slowing down the downward movement of the piston, and a by-pass around the valve for allowing the fluid to pass back to the system on the upward movement of the piston.

41. A hydraulic pipe press comprising a cylinder, a piston therein, a piston rod carried by the piston, a clay plunger carried by the piston rod, a die below the clay plunger, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said system, a die hoist cylinder below the die, a piston therein, a fluid pressure system connecting the upper and lower ends of the die hoist cylinder, a pump in said fluid pressure system, and a die head carried by the piston and cooperating with the die.

42. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the ends of the cylinder, automatic means in said system for slowing down the downward movement of the piston, a die below the clay plunger, a die hoist cylinder below the die, a piston therein, a fluid pressure system connecting the upper and lower ends of the die hoist cylinder, automatic means in said fluid pressure system for maintaining a predetermined pressure on the piston in its downward movement, and a die head carried by the piston and cooperating with the die.

43. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the ends of the cylinder, automatic means in said system for slowing down the downward movement of the piston, a die below the clay plunger, a die hoist cylinder below the die, a piston therein, a fluid pressure system connecting the upper and lower ends of the die hoist cylinder, automatic means in said system for maintaining a pre-

determined pressure on the piston in its downward movement, and a die head carried by the piston and cooperating with the die.

44. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said system for drawing the fluid from either end of the cylinder and forcing it to the opposite end, automatic means for maintaining the system filled with fluid, automatic means in the system between the pump and the upper end of the cylinder for reducing the pressure for slowing down the downward movement of the piston, a die below the plunger, a die hoist cylinder below the die, a piston therein, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said system, automatic means for maintaining the system filled with fluid, automatic means in said system for maintaining a predetermined pressure on the piston in its downward movement, and a die head carried by the piston and cooperating with the die.

45. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said system, automatic means for keeping the system filled with fluid, a by-pass connected to the system between the pump and the upper end of the cylinder for causing a greater volume of fluid to be required in the cylinder and slowing down the downward movement of the piston, a die below the clay plunger, a die hoist cylinder below the die, a piston therein, a fluid pressure system connecting the upper and lower ends of the system, a pump in said system, automatic means for keeping the system filled with fluid, control and release valves in said system for maintaining the predetermined pressure on the downward movement of the piston, and a die head carried by the piston and cooperating with the die.

46. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said system, a differential valve communicating with the system on each side of the pump for supplying fluid to the system when the pump is working in either direction, and automatic means in the system between the pump and the upper end of the cylinder for causing a greater volume of fluid to be required in the cylinder and slowing down the downward movement of the piston.

47. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the ends of the cylinder, a pump in said fluid pressure system for drawing the fluid from one end of the cylinder and forcing it to the other, a differential valve connecting the system between the pump and the cylinder, a fluid supply pipe connected to the differential valve for supplying fluid to the system on either side of the pump, a by-pass connected to the system between the pump and the upper end of the cylinder, a normally closed valve in said by-pass pressure means operating said valve when the pressure in the cylinder has been increased, for relieving the pressure in the system between the pump and the upper end of the cylinder for causing a greater volume of fluid to be required in the cylinder, for slowing down the downward movement of the piston.

48. A hydraulic pipe press comprising a die, a die hoist cylinder below the die, a piston therein, a fluid pressure system connecting the upper and lower ends of the die hoist cylinder, a die head carried by the piston and cooperating with the die, and automatic means in said fluid pressure system for maintaining a predetermined pressure on the piston in its downward movement.

49. A hydraulic pipe press comprising a die, a die hoist cylinder below the die, a piston therein, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said system for drawing the fluid from one end of the cylinder to the other, automatic means in said system for maintaining the predetermined pressure on the piston in its downward movement, a die head carried by the piston and cooperating with the die.

50. A hydraulic pipe press comprising a die, a die hoist cylinder below the die, a piston therein, a fluid pressure system connecting the ends of the cylinder, a pump in said system, a differential valve connecting the system between the pump and the cylinder for maintaining the system filled with fluid when the pump is working in either direction, and automatic means in said system for maintaining a predetermined pressure on the piston in its downward movement, and a die head carried by the piston and cooperating with the die.

51. A hydraulic pipe press comprising a die, a die hoist cylinder below the die, a piston therein, a fluid pressure system connecting the upper and lower ends of the cylinder, a differential valve connecting the system and adapted to maintain the system filled with fluid when the pump is working in either direction, and release and control valves in said system for maintaining a predetermined pressure on the piston.

52. A hydraulic pipe press comprising a die, a die hoist cylinder below the die, a

piston in the cylinder, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said system, a differential valve connecting the system and supplied with fluid from a tank, and maintaining the system filled with fluid when the pump is working in either direction, a control valve in said system, a by-pass leading from the system to the fluid supply tank, and a release valve in said by-pass to allow the fluid to pass back into the tank, and a die head carried by the piston and cooperating with the die.

53. A hydraulic pipe press comprising a die, a cylinder below the die, a piston therein, a fluid pressure system connecting the upper and lower ends of the cylinder, and a pump in said system, a differential valve connecting the system and having a supply pipe connected to a supply tank for maintaining the system filled with fluid when the pump is working in either direction, a pressure control valve in said system, a by-pass leading from the system to the fluid supply tank, a release valve in said by-pass and operated by the pressure in the system, and a die carried by the piston and cooperating with the die.

54. A hydraulic pipe press comprising a die, a die hoist cyinder below the die, a piston therein, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said system, a differential valve connecting the system, a pipe leading from a tank, to the differential valve for supplying fluid thereto, and maintaining the system filled with fluid when the pump is working in either direction, a control valve in said system and normally held open and closed by pressure, a by-pass leading from the system to the fluid supply tank, a release valve normally held closed in said by-pass, and means operated by the pressure in the system for opening the release valve, whereby a predetermined pressure is maintained on the piston in its downward movement, and a die head carried by the piston and cooperating with the die.

55. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connected to the upper and lower ends of the cylinder, and a differential valve connecting the system, a pipe leading from the differential valve to the fluid supply tank, whereby the system is maintained filled with fluid when the fluid is circulating in either direction.

56. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said system, a differential valve communicating with the system between the pump and the ends of the cylinder, a supply pipe communicating with the differential valve and a fluid supply tank, for maintaining the system filled with fluid when the pump is working in either direction, an automatic means in the system between the pump and the upper end of the cylinder for reducing the pressure and slowing down the downward movement of the piston.

57. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said system, automatic means for keeping the system filled with fluid on the rotation of the pump, in either direction, and an automatic valve in the system between the pump and the upper end of the cylinder for causing a greater volume of fluid to be required in the cylinder and slowing down the downward movement of the piston.

58. A hydraulic pipe press comprising a cylinder, a piston therein, a fluid pressure system connecting the ends of the cylinder, a pump in said system, automatic means for supplying fluid to the system for maintaining the same filled with fluid when the pump is working in either direction, a by-pass connected to the system between the pump and the upper end of the cylinder, a valve in said by-pass normally held closed, and operated by pressure in the system for allowing the fluid to pass through the by-pass and slow down the downward movement of the piston.

59. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said system, a differential valve connecting the system, a fluid supply pipe connected to the differential valve, and a fluid supply tank for maintaining the system filled with fluid when the pump is working in either direction, a by-pass connected to the system between the pump and the upper end of the cylinder, a valve in said by-pass automatically held closed, means operated by the pressure in the cylinder for opening said valve in the by-pass and slowing down the movement of the piston, a pipe connected to the by-pass and with the fluid supply tank, and a check valve in said pipe.

60. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the upper and lower ends of the cylinder, automatic means in the system for slowing down the downward movement of the piston, a die below the clay plunger, a die hoist cylinder below the die, a piston within said cylinder, a die head carried by the piston and cooperating with the die, a

fluid pressure system connecting the upper and lower ends of the die hoist cylinder, and automatic means in the die hoist cylinder, a fluid pressure system for maintaining a predetermined pressure on the piston in its downward movement.

61. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the piston, a fluid pressure system connecting the ends of the cylinder, a pump in said fluid pressure system, an automatic valve in the system between the pump and the upper end of the cylinder for relieving the pressure for retarding the downward movement of the piston, a die below the clay plunger, a die hoist cylinder below the die, a piston therein, a die head carried by the piston and cooperating with the die, a fluid pressure system connecting the upper and lower ends of the cylinder, a pump in said system, a control valve in the system between the pump and the lower end of the die hoist cylinder, a by-pass leading from the system adjacent the control valve and leading to a fluid supply tank, a release valve in said by-pass, and means operated by the fluid in the system between the pump and the upper end of the die hoist cylinder for opening the release valve, whereby a predetermined pressure is maintained on the die hoist piston during its downward movement.

62. A hydraulic pipe press comprising a cylinder a piston therein, a clay plunger carried by the piston, a fluid pressure system connected to the upper and lower ends of the cylinder, a pump in said system, a differential valve casing communicating with the fluid pressure system on each side of the pump, and comprising a casing having a sliding member provided with two valve faces adapted to be seated by pressure from the system from each side of the pump, and having a supply pipe connected to a fluid reservoir, whereby the system may be supplied with fluid when the pump is working in either direction.

63. A fluid pressure system for operating a hydraulic pipe press comprising a pump adapted to be rotated in either direction, pipes connected to either side of the pump for operating the press in its up and down direction, a differential valve between the two pipes and comprising a casing having its opposite ends in communication with the pipes, a reciprocating member therein, two valve faces carried by the reciprocating member, one capable of being open and the other closed, or both partially open, and a fluid pipe connected to the center of the casing and communicating with a fluid supply tank, whereby one valve face is seated to prevent the passage of the fluid by the reciprocating means, and to allow fluid to pass from the supply pipe around the other valve face to the fluid pressure system.

64. A hydraulic pipe press comprising a cylinder, a piston therein, a hollow piston rod within the cylinder, a clay plunger carried by the hollow piston rod, a tube connected to the upper end of the cylinder and extending through the piston into the hollow piston rod, a packing between the piston and the tube, a fluid pressure system connected to the lower end of the cylinder and to the upper end of the tube, a pump in said system, a pipe communicating with the system and the upper end of the cylinder, a control valve in said pipe, and normally held closed by spring means, a piston connected within the control valve and in communication with the system supply fluid to the tube, whereby when the pressure in the tube has reached a predetermined point it opens the control valve and allows the fluid to flow to the upper end of the cylinder, and act upon the piston and slowing down the downward movement thereof.

65. A hydraulic pipe press comprising a cylinder, a piston therein, a hollow piston rod carried by the piston, a clay plunger carried by the lower end of the hollow piston rod, a tube carried by the cylinder head and extending into the hollow piston rod, said piston having a packing with the tube and the wall of the cylinder, means for supplying fluid to the tube for forcing the piston rod downwardly, and means for supplying fluid to the cylinder above the piston, and means for supplying fluid to the lower end of the cylinder.

66. A hydraulic pipe press comprising a cylinder, a piston therein, a clay plunger carried by the lower end of the hollow piston rod, a tube carried by the head of the cylinder, and extending into the hollow piston rod, said piston formed by having the rod reduced to its inner and outer faces and internally and externally screw threaded and adapted to receive packing rings on its inner and outer faces to form a tight joint within the tube and the wall of the cylinder.

In testimony whereof, I have signed this specification.

THOMAS A. HIBBINS.