

Sept. 27, 1932.

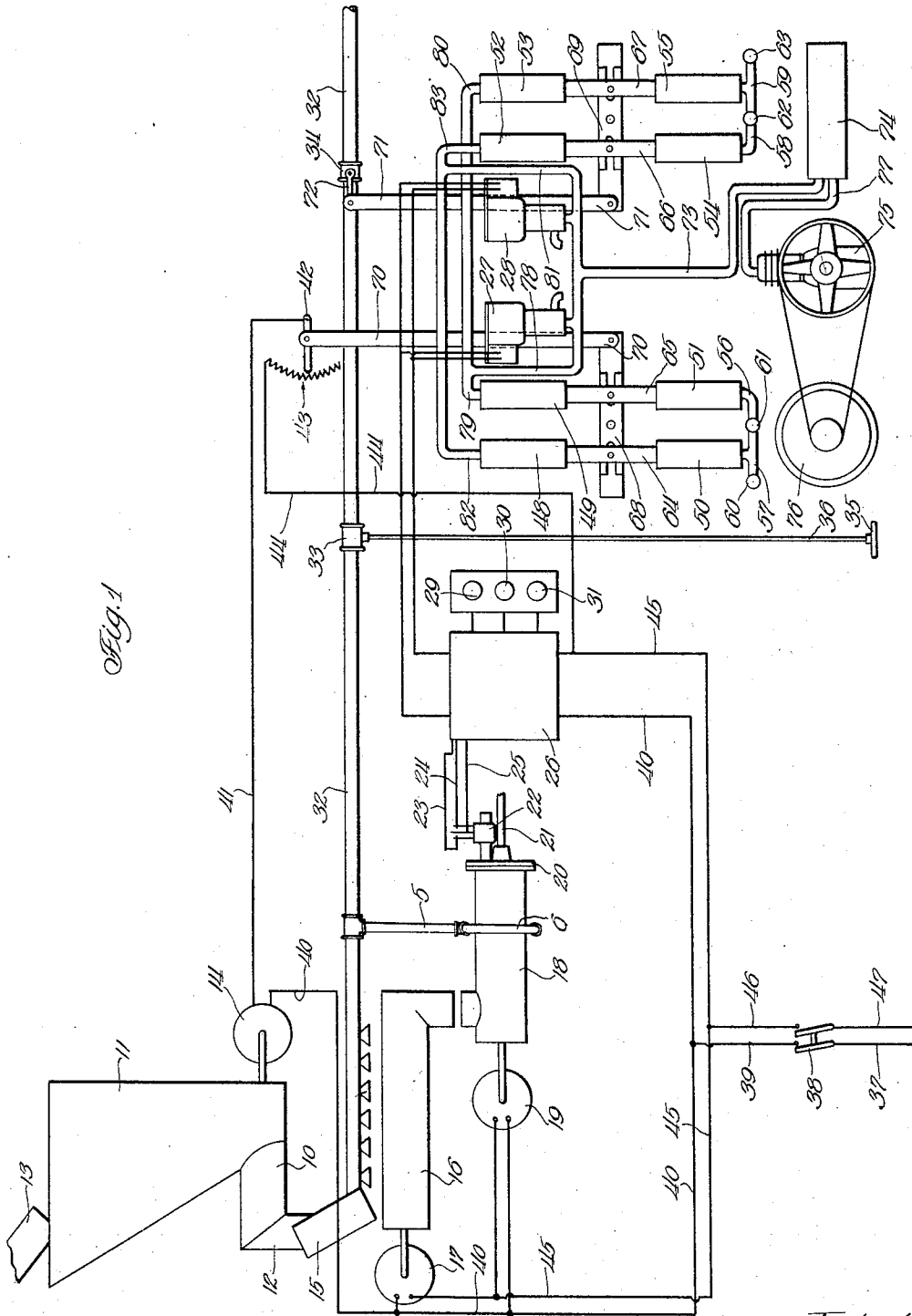
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1,879,367

CLAY TEMPERING: MEANS AND METHOD

Filed June 15, 1931

5 Sheets-Sheet 1



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CLAY TEMPERING MEANS AND METHOD

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Fig. 2

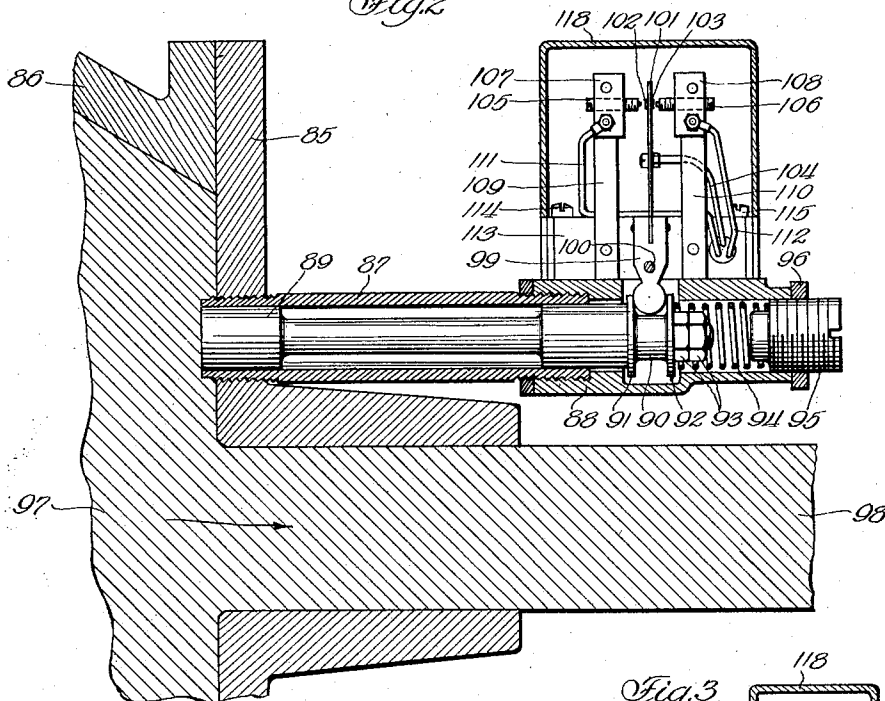


Fig. 3

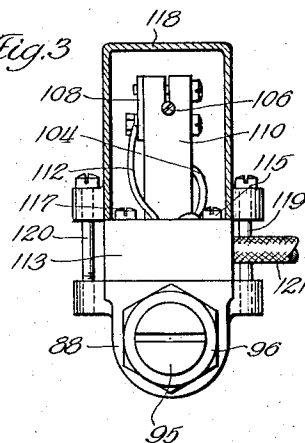
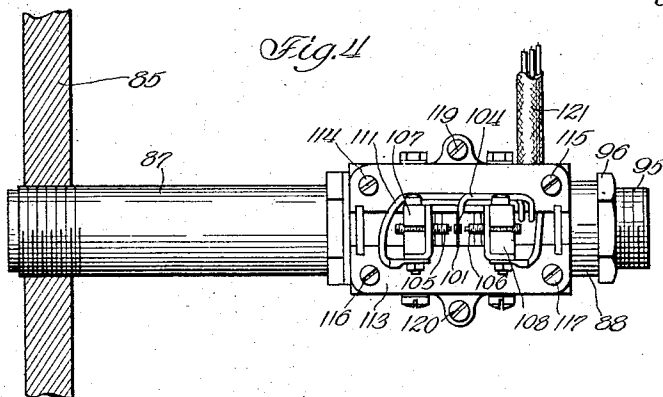


Fig. 4



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Fig. 6

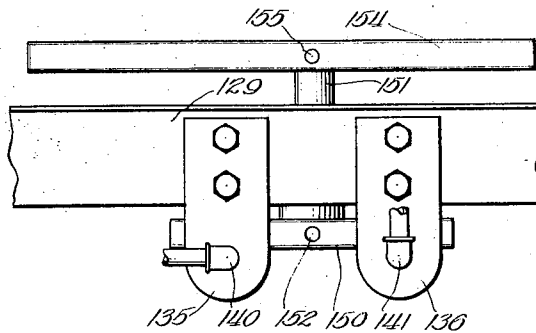
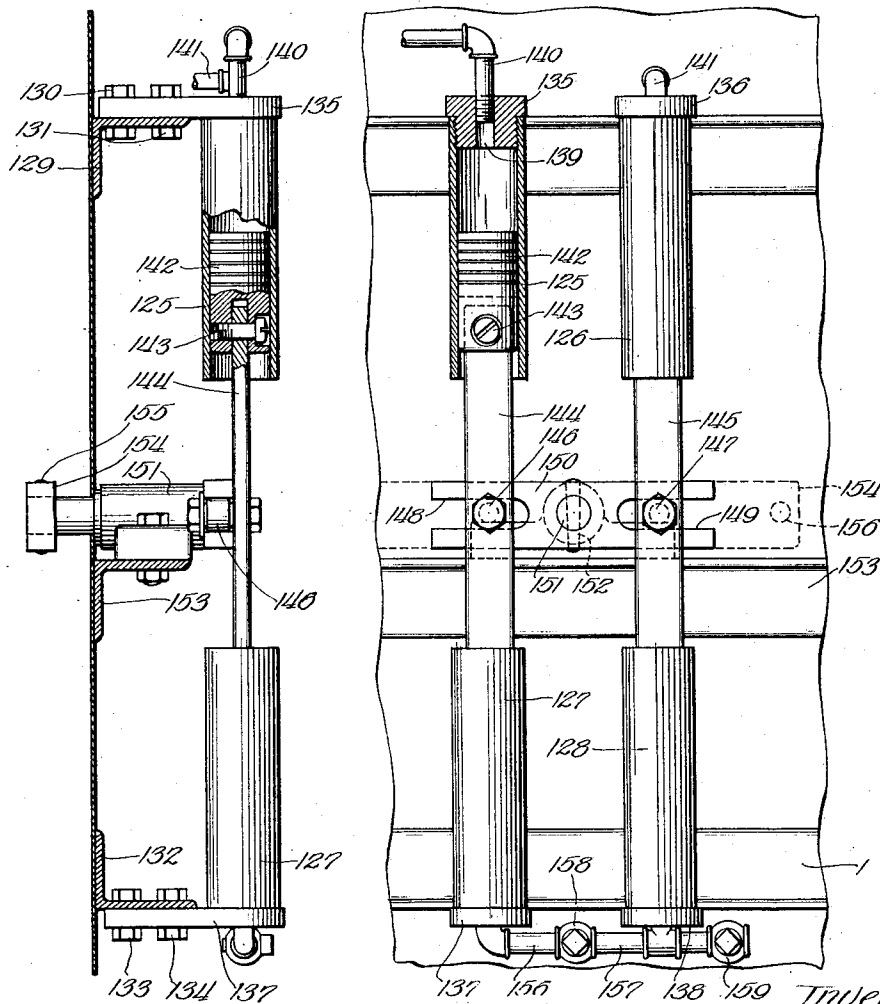


Fig. 5



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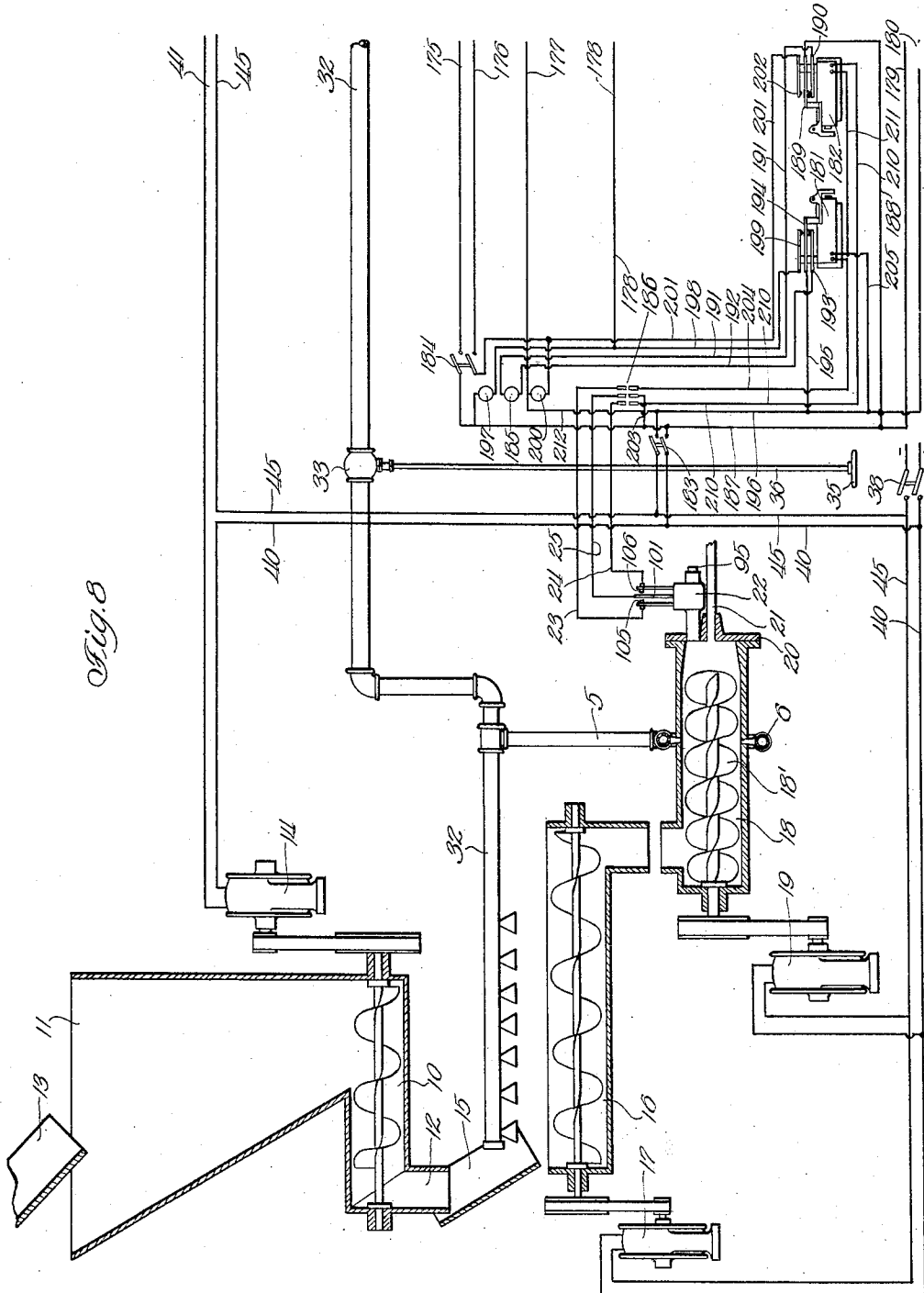
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CLAY TEMPERING MEANS AND METHOD

Filed June 15, 1931

5 Sheets-Sheet 4



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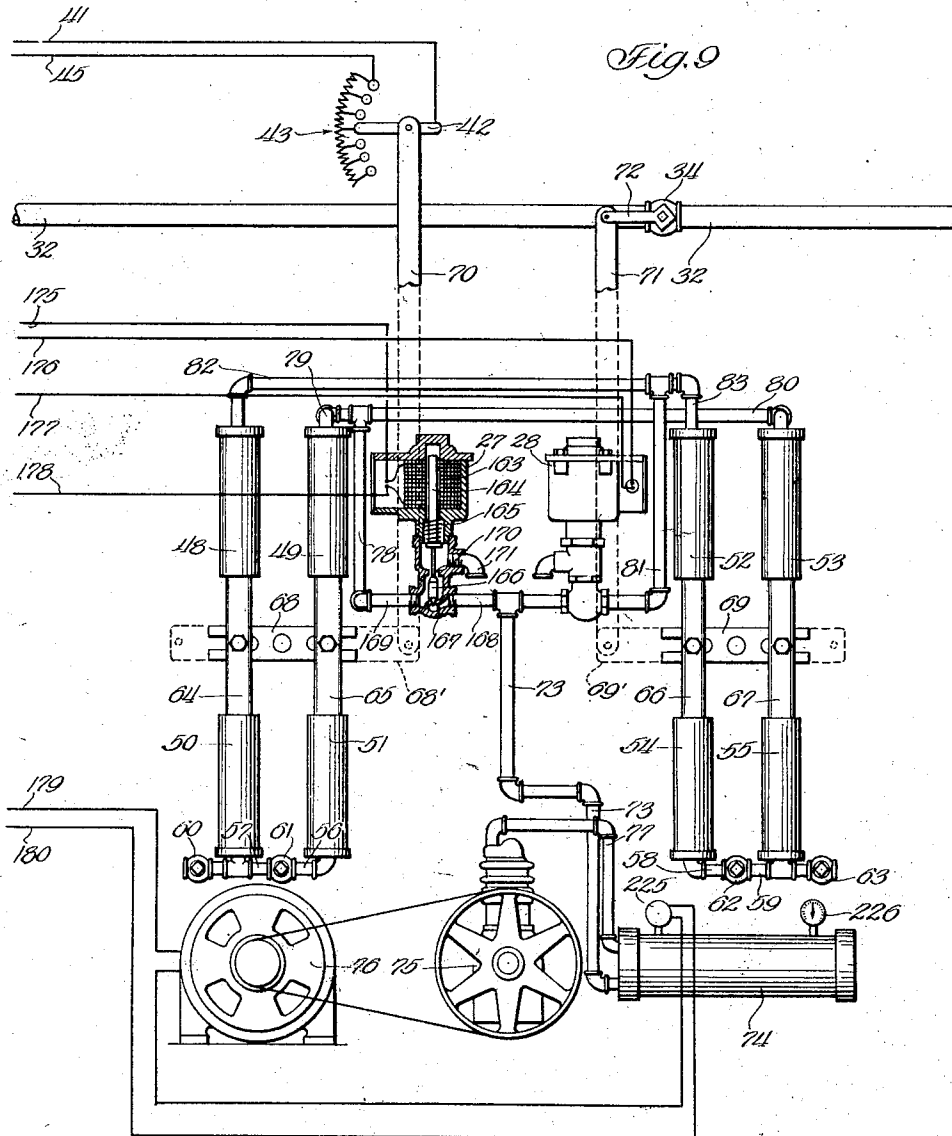
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CLAY TEMPERING MEANS AND METHOD

Filed June 15, 1931

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CLAY TEMPERING MEANS AND METHOD

Application filed June 15, 1931. Serial No. 544,357.

This invention relates to a method and to apparatus for mixing and for tempering clay, and is particularly concerned with a novel method and with means for determining and for automatically maintaining the moisture content in clay and the like.

It will be advisable to recall briefly the background from which the invention has emerged before presenting a description thereof.

Known clay mixing methods and apparatus comprise, generally, a crusher or grinder, and means for mixing the clay, such as a pug mill or the like, where the clay is tempered with water in order to obtain the proper plasticity. This pug mill feeds the clay to an auger machine where the clay is further treated and finally extruded through a suitable die. Water is added in case the clay from the crusher is too dry, and dry clay is added in case the clay is too wet. This tempering with water or with dry clay, respectively, is necessary because the raw clay is rarely of a character that it can be used without tempering. It must also be considered that the clay coming from the crusher is not uniformly dry or uniformly wet over a period of time, but that dry and wet clay in varying degrees of moisture alternate. Rarely, if ever, can the clay from the crusher be used without tempering in one way or another, in varying degrees, to obtain the proper consistency and plasticity for the desired working condition.

The tempering, i. e., the adding of varying amounts of water and dry clay, respectively, at the pug mill, is usually left to the experience of an attendant. It will be apparent that this method is somewhat crude, and requires a skilled attendant. However, even with a highly skilled expert at the pug mill, it may happen that the consistency of the clay extruded by the auger machine, varies below and above the desired condition. It is very difficult, if not impossible, to obtain a uniform product by this method.

Attempts have therefore been made in the past to devise means whereby the proper result might be obtained automatically in-

stead of depending on the operator's judgment and skill.

In my copending application, Serial No. 505,769, filed December 31, 1930, I have shown a method and apparatus for automatically determining and for automatically maintaining the proper plasticity and consistency of clay in a substantially continuous process of manufacture. The tempering, i. e., the adding of water and of dry clay at the pug mill is controlled automatically, and expert attention is eliminated.

The principle of the operation which I employ in the method disclosed in the above mentioned application is based on the fact that the electric resistance of the clay varies with the moisture contained in the clay. I have provided means for measuring the resistance of the clay extruded by the auger machine, and control means governed thereby for controlling the operation of rheostats or the like, which are connected in the circuits of motors. These motors are provided for actuating the clay feeding apparatus and a water pump, respectively. When the moisture in the clay rises, the water supply is automatically throttle and the dry clay supply is accelerated. When the moisture content is too low, the apparatus operates to cut down the dry clay supply and increases the water supply. A balance is thus obtained which insures a uniform product.

The present invention also presents an automatic system for regulating the consistency and plasticity, that is, for tempering the clay. The operating principle of the method disclosed in the present case is based on the fact that the pressure in the auger machine varies with the plasticity of the clay. This will be better understood from the following discussion.

In the so-called stiff mud process of making brick and tile, the clay is in a plastic state, and is extruded through a die by means of the auger machine. The clay is more or less mobile, and the pressure of the screw in the auger machine forcing the clay through the die, against the resistance created by the die, will cause the clay between the end of the screw and the die to be under pressure.

Since the clay is mobile, the pressure will be transmitted in all directions in the space between the screw and the die. Although the pressure may not be the same in a direction
 5 at right angles to the flow of the clay, there will be a lateral pressure which will bear a definite relation to the pressure in the direction of the flow of the clay, and this pressure will be uniform under conditions of constant plasticity, speed of the screw in the
 10 auger machine, and the power applied, provided the screw is fed uniformly and a definite amount is extruded per unit of time.

The degree of plasticity of a given clay is
 15 effected by the amount of water added to a unit of clay. If a definite plasticity of clay is decided on as being standard for certain wares, then if more water is added per unit of clay, it will become softer and more plastic,
 20 and, in a substantially continuous operating process, it will be extruded easier. The pressure between the auger screw and the die will be less. On the other hand, if the water is reduced per unit of clay, the plasticity will
 25 become less, the clay will become harder and stiffer, and will cause a greater pressure between the auger screw and the die. It may be mentioned as an illustration of this fact that dies are frequently broken due to a condition
 30 of decreased plasticity of the clay.

It will be seen, therefore, that the pressure in the auger machine, between the screw and the die, varies with the plasticity of the clay, and I utilize these variations in pressure
 35 for the purpose of automatically governing and controlling the operation of the tempering apparatus.

The control mechanism comprises a pressure relay attached to the auger machine.
 40 This pressure relay responds to variations in pressure of the clay within the auger machine and actuates thereby an armature for the closing and opening, respectively, of certain contacts placed in the circuit of certain control relays. One or the other relay will
 45 be energized in this way, in response to the actuation of the pressure relay.

So long as the plasticity and consistency of the clay conform to a predetermined condition, the pressure relay will be neutral, and none of the relays will be energized. A white
 50 light will indicate to the attendant that the clay extruded by the auger machine is as desired.

I provide a feeder, and a motor therefor, for feeding dry clay to the pug mill, and a water line with a valve for regulating the water supply to the pug mill, with a branch
 55 pipe line to the auger machine for also feeding moisture to the latter. A rheostat is provided for regulating the speed of the motor for the dry clay feeder.

The water supply to the auger machine is intended to provide an immediate softening of the clay in this machine. It will pref-

erably take the form of a separate high-pressure water connection, but I have shown the branch 5 connected to the line 32 for the sake of convenience. Control of the flow through
 70 the branch 5 may be obtained simultaneously with the actuation of valve 33. The provision of a water supply directly to the auger will eliminate the lag that would otherwise occur until the new mixture would arrive from the pug mill 16.

The rheostat for the control of the feeder motor and the valve for the water line are each under the control of pressure operated mechanisms, whereby the setting of the rheostat and of the valve can be accomplished as
 75 desired. These pressure operated mechanisms, in turn, are under the control of solenoid operated valves adapted to permit the entry of compressed air or the like into the pressure mechanisms, to operate the same in
 80 the proper directions, so that the setting of the rheostat and of the valve can be accomplished in order to change or modify the water supply and the dry clay supply to the pug mill whenever required. The solenoid
 85 operated valves which admit compressed air or the like into the pressure mechanisms, are controlled by the previously mentioned relays which respond to the pressure relay co-operating with the auger machine. A green
 90 light will indicate the operation of the system if the clay is too dry, i. e., whenever the water supply is accelerated and dry clay supply cut down; and a red light will indicate the operation
 95 of the system if the clay is too wet, i. e., whenever the system operates to decrease the water supply and to increase the dry clay supply.

By the cooperation of the apparatus briefly sketched above, I accomplish a perfect automatic tempering in a novel and efficient manner.

I shall now describe the invention with reference to the accompanying drawings. In
 100 these drawings:

Figure 1 is a somewhat diagrammatic layout of the entire system;

Figure 2 represents a side view of the pressure relay, partially in cross section, as attached to the die of the auger machine;

Figure 3 illustrates an end view partially in cross section, of the pressure relay;

Figure 4 shows a top view of the pressure relay, with certain parts removed in order to illustrate the details;

Figure 5 is a front view of one unit of pressure cylinders with one cylinder in cross section;

Figure 6 illustrates a top view of the pressure cylinders;

Figure 7 shows a side view of the mounted pressure cylinders with one cylinder in partial cross section; and

Figures 8 and 9, when placed with the Figure 9 to the right of the Figure 8, with the

corresponding lines in alignment, represent the entire system in detail.

Referring now particularly to the Figure 1, the system comprises various parts and apparatus in cooperative assembly as is explained below:

A feeder 10 having a bin 11 and a discharge portion 12 is fed with dry clay from a grinder by means of a chute 13. The feeder is operated by means of a motor 14. A chute 15 connects the feeder 10 with the pug mill 16 controlled by a motor 17. This pug mill feeds the clay to an auger machine 18 controlled by motor 19. The clay column 21 is extruded by the auger machine through the die 20.

A pressure relay 22 is mounted on the die 20 of the auger machine. This pressure relay is responsive to the variable pressure of the clay in the auger machine and is adapted to close various circuits over the wires 23, 24 and 25. These wires terminate in a control mechanism indicated generally by the reference numeral 26. The control mechanism comprises two relays for the control of the solenoid operated valves 27 and 28. There are also three signalling lights provided as is indicated by the numerals 29, 30 and 31. These lights are of white, green and red colors, respectively, and will be lighted in order to indicate the operation of the system. The white light 30 will be connected to current when the system operates normally, that is to say, when the clay column 21 extruded by the auger machine is of the desired consistency and plasticity. The green light 29 will indicate that the clay is too dry, that is to say, this light will be connected to current when the system operates to reduce the dry clay supply from the feeder 10 and to accelerate the water supply to the pug mill 16 and to the auger machine 18. The red light 31 will indicate a condition when the clay is too wet, i. e., an operation of the system causing a decrease in the water supply and an increase in the dry clay supply.

The water supply to the pug mill 16 is by way of the water line 32, with a branch pipe 5 connecting with a water inlet 6 disposed around the auger 18.

It should be recalled, however, that the branch 5 may be a separate pipe line, as previously mentioned, and the remarks made relative to the purpose and function of the water feed to the auger machine should be remembered whenever reference is made to the branch pipe 5.

The water line 32 is provided with a manually operable valve 33 and with a valve 34. The valve 33 may be actuated by the hand wheel 35 attached to the rod 36. The operation of the valve 34 is dependent on the actuation of certain pressure controlled mechanisms including pressure cylinders as will be described later on. It will be understood

that the water supplied over the pipe line 32 can be regulated by means of the valve 34 in accordance with the demand of the system.

It may be remarked at this point that a valve may also be provided in the branch pipe leading to the auger machine 18, if desired. The branch pipe 5 is intended to accelerate the tempering process and its application may take different forms, so long as the broad idea of conducting moisture to the auger is realized. A softening of the clay will be achieved in the auger machine without waiting for the tempering effect of the water supplied to the pug mill.

The motor 14 controls the speed of the feeder 10 which supplies dry clay to the pug mill 16. An acceleration of this motor will therefore cause more clay to be fed to the pug mill while a decrease in the speed of the motor 14 will cause a corresponding decrease in the amount of clay fed to the pug mill 16. It will be seen that the motor is connected to current over a circuit which includes the following branches:

Supply wire 37, switch 38, branch 39, feed wire 40, to the motor 14, and from there over the feed wire 41, movable contact arm 42 of the rheostat 43, wire 44, branch wires 45, 46, to the switch 38 and back to the current source over the supply wire 47. The feed wires 40 and 45 also connect to the control mechanism 26, and also to the motors 17 and 19 of the pug mill 16 and of the auger machine 18, respectively. The speed of the motor 14 can be controlled by the rheostat 43. This control is accomplished by a unit of pressure cylinders under the control of the solenoid operated valves 27 and 28, and these valves in turn are controlled from the electric apparatus diagrammatically indicated at 26 depending upon the operation of the pressure relay 22 attached to the die 20 of the auger machine 18.

Each unit of pressure cylinders comprises two pressure cylinders proper and two dash pots. The unit of pressure cylinders which is shown on the left of the solenoid operated valve 27 is provided for the actuation of the movable rheostat contact arm 42. The unit of pressure cylinders indicated at the right of the solenoid operated valve 28 is provided for the actuation of the movable control lever 72 of the valve 34. The first mentioned unit of pressure apparatus comprises the pressure cylinders 48-49 and the dash pots 50-51. The second mentioned unit of pressure apparatus comprises the pressure cylinders 52-53 and the dash pots 54-55. It will be seen that each pair of dash pots is provided with regulating by-pass connections as indicated by the numerals 56-57 and 58-59, and also with regulating valves 61 and 62, respectively. The purpose of these by-pass lines and the valves is to regulate the speed of the pressure apparatus. The setting of

the valves 61 and 62 will determine the ease with which the dash pot fluid can pass from one dash pot to the other, thereby determining the speed of the pistons within the cylinders 48 and 49 since these pistons displace the fluid in the dash pots when they move downwardly within the corresponding cylinder. In other words, each piston is connected to a corresponding rod 64-65 and 66-67 respectively, and operates vertically down against the pressure in the corresponding dash pot 50-51 and 54-55. Depending on the pressure obtaining in each of the dash pots during the operation of the pistons in the pressure cylinders, the speed of the rods 64-65 and 66-67, and therefore the speed of the pistons, will be more or less. The valves 60 and 63 are filling valves.

Each pair of rods 64-65 and 66-67, respectively, is adapted to move a connecting link such as indicated by the numeral 68 and 69, respectively. Each of these links is pivotally mounted as shown, and is adapted to operate another connecting link as indicated by the numerals 70 and 71. These latter links connect with the movable contact arm 42 of the rheostat and with the control lever 72 of the valve 34, respectively.

It will be apparent from the apparatus as far as the same has been described above, that the entry of a suitable pressure medium into the cylinder 49, for example, will cause the piston in this cylinder to move the rod 65 downwardly, thereby rocking the link 68 and pulling the link 70 also downwardly. Accordingly, the arm 42 of the rheostat 43 will be operated to increase the resistance in the circuit of the motor 14. On the other hand, if a suitable pressure medium is allowed to enter the pressure cylinder 48 to move the piston therein against the pressure in the dash pot 50, the link 68 will be rocked to push the connecting link 70 upwardly, whereby the movable contact arm 42 of the rheostat 43 will be moved to decrease the resistance in the circuit of the motor 14. In the first case, the speed of the motor 14 will be decreased and, accordingly, the supply of dry clay from the feeder 10 to the pug mill 16 will be decreased. In the second case, responsive to an operation of the piston in the cylinder 48, the link 70 will move upwardly, the resistance in the circuit of the motor 14 will be decreased and the motor 14 therefore will be accelerated. More dry clay will be supplied to the pug mill 16.

The operation of the second unit of pressure apparatus comprising the cylinders 52-53 and the dash pots 54-55, respectively, is identical to the operation above described with reference to the first unit. This second unit is adapted to move the connecting link 71 up or down, as the case may be, to decrease or to increase the water supply over the water

line 32 by corresponding operation of the control lever 72 of the valve 34.

The solenoid operated valves 27 and 28 represent the apparatus adapted to admit a suitable pressure medium into the cylinders 48-49 and 52-53, respectively, whenever a decrease or increase, as the case may be, of dry clay and water, respectively, is required in accordance with a predetermined consistency and plasticity of the clay column extruded at the auger machine. Each of these solenoid operated valves 27 and 28 is a three-way valve. The pressure medium in the case which I have shown in Figure 1 may be compressed air fed to the three-way valves 27 and 28 over the pipe line 73 from the tank 74. This tank is kept at constant pressure by means of an air compressor 75 which is operable by motor 76. The air compressor 75 feeds compressed air to the tank 74 by way of the pipe line 77. This is a diagrammatic representation of the system and I have therefore omitted various details such as the current supply to the motor 76, and the motor control.

It will be seen that the pipe line 73 supplies compressed air to the solenoid operated valves 27 and 28 and that connections branch off from these valves to the pressure cylinders. The branch connection 78 supplies compressed air to the cylinder 49 and also to the cylinder 53 by way of the lines 79 and 80, respectively; the branch 81 from the solenoid operated valve 28 supplies compressed air to the pressure cylinders 48 and 52 over the branches 82 and 83, respectively. Therefore, whenever the valve 27 is operated to admit compressed air into the pressure cylinders the pistons in the cylinders 49 and 53 will be actuated. The rod 70 will therefore move downwardly to increase the resistance in the circuit of the motor 14 of the dry clay feeder 10, and the rod 71 will move upwardly in a direction to open the valve 34 whereby the water supply will be increased. In other words, whenever the valve 27 operates, the water supply will be increased and the dry clay supply will be decreased. Whenever the valve 28 is actuated to admit compressed air into the pressure cylinders, the pistons in the cylinders 48 and 52 will move downwardly. Accordingly, the rod 70 will move upwardly to decrease the resistance in the circuit of the motor 14 and to accelerate thereby the dry clay supply, while the rod 71 will move downwardly to decrease the supply of water by operating the control lever 72 in a direction to close the valve 34 in the water line 32.

The operation of the system will be better understood from a detailed description of the various control apparatus involved. I shall first describe in detail the structure of the pressure relay 22 with reference to the drawings shown in Figures 2, 3 and 4.

Referring now to the Figures 2, 3 and 4,

numeral 85 is the die attached to the auger machine, a part of which is shown at 86. A cylinder 87 is fitted into the die 85 and also into the housing 88 of the pressure relay. A piston 89 is enclosed within the cylinder 87 and is provided with a working head 90 having flanges 91, 92 which prevent the piston 89 from moving more than a predetermined distance in either direction. The flanges 91 and 92 of the piston are for this purpose disposed in a recessed portion of the housing 88 as shown particularly in Figure 2. The piston is assembled by dropping the head 90 into the housing 88 and by then bolting the head 90 tight to the piston 89 by means of the nuts 93. A spring 94, regulated by the screw plug 95, is provided so that the pressure of the spring 94 on the working head 90 and the piston 89 may be balanced against the pressure on the piston within the auger machine due to the pressure of the clay. The nut 96 permits adjustment of the screw plug 95 as desired.

If the pressure of the clay within the auger machine increases, that is, if the plasticity and consistency of the clay (which is indicated by the numeral 97) causes a greater pressure upon the die 85, as the clay column 98 is extruded in the direction of the arrow, this pressure will be transmitted to the piston 89 and this piston will therefore be moved to the right (in Figure 2) against the pressure of the spring 94. This operation will occur if the clay is too dry. If on the other hand the plasticity and consistency of the clay is changed due to increase in water in the clay, the pressure within the auger machine will be decreased and the piston 89 will therefore be allowed to move toward the left (in Figure 2) due to the pressure exerted by the spring 94. This variable action of the piston 89 in response to the changed plasticity and consistency of the clay is utilized for operating certain contact mechanisms as will be described next.

A contact lever 99 made from insulating material, is pivoted on the pin 100. This lever 99 fits snugly in the slot defined by the flanges 91 and 92 of the working head 90. The lever 99 will therefore be rocked around the pin 100 whenever the piston 89 moves responsive to the changed pressure within the auger machine. Fastened to this lever 99 is a contact spring 101 having contacts 102 and 103, and provided with a lead wire 104 extending to certain electric equipment which will be described presently. The contacts 102-103 will establish connection with the stationary adjustable contacts 105 and 106, respectively, whenever the piston 89 moves in the corresponding direction and rocks the insulating lever 99 which carries the contact spring 101.

The contacts 105 and 106 are adjustable within the carriers 107 and 108, respectively,

mounted on the insulating pillars or posts 109 and 110. Lead wires 111 and 112 are connected to the contact heads or plates 107 and 108, respectively.

The insulating posts 109 and 110 are mounted on an insulating base 113. The base 113 is made of parts bolted together, and holds the above described assembly of contacts and other parts. These parts are assembled as a unit and are bolted to the housing 88 by means of screws 114, 115, 116 and 117. A cover 118 is held on the insulating base by means of screws 119 and 120.

The lead wires 104, 111 and 112 leave the housing in the form of a cable as indicated by the numeral 121 in the Figures 3 and 4. A standard three wire plug may be attached to the other end of the cable for conveniently completing the electrical connection to the other control equipment.

The assembled pressure relay is attached to the die head 85 or may be laterally attached to the frame 86 of the auger machine. The sensitivity of the operation of the pressure relay is regulated by the distances between the screw contacts 105 and 106 from the contacts 102 and 103 on the contact spring 101. It will be seen that when the piston 89 is balanced by the force of the spring 94 against a certain pressure of the clay, the contact spring 101 will be in a central position and no contact will be made with either of the adjustable screw contacts 105 or 106. This condition will be maintained for clay of predetermined plasticity and consistency, and as long as this plasticity is maintained the contact spring 101 will remain in the central position.

Should the pressure of the clay increase due to lesser plasticity, the piston 89 will be forced in the direction of the flow of the clay and the contact 102 of the contact spring 101 will establish connection with the stationary contact 105. Should the plasticity of the clay be increased, the spring 94 will force the piston 89 farther into the clay in accordance with the decrease of pressure of the clay, and the contact 103 on the contact spring 101 will establish connection with the contact 106.

The operation of the pressure relay relative to other apparatus in the system will be described presently with reference to other figures. I will next describe the pressure apparatus shown in the Figures 5, 6 and 7.

Referring now to the Figures 5, 6 and 7, these figures represent one unit of pressure cylinders. The units are made right and left for the sake of symmetry. These figures represent a unit which may be for example, the right hand unit shown in connection with the diagrammatic layout Figure 1, or the right hand unit shown in Figure 9. The units of cylinders and dash pots are identical and a detailed description of the construction of

one cylinder and unit will therefore suffice for conveying a clear understanding.

The cylinders are of the open end type for ease of manufacture and for the purpose of avoiding the use of stuffing boxes. The unit comprises the cylinders 125-126 and the dash pots 127-128. The cylinder heads are mounted on the bracket 129 which may be attached to the wall or to a structural framework of a cabinet wherein the equipment is located. The attachment may be made by means of bolts and nuts such as indicated by the reference numerals 130-131. The dash pots are attached in a similar manner to a bracket such as 132 which may be fastened similarly. The attachment is again made by means of bolts and nuts such as shown at 133 and 134. The cylinder heads 135-136 and also the dash pot heads 137-138 may for the purpose of mounting be formed with extensions such as shown in the drawings. The cylinder heads are screwed into the corresponding cylinders. Each cylinder head has an opening, such as indicated at 139 in connection with the cylinder head 135, for attaching the pipe connection such as 140 and 141. The piston in each of the cylinders, such as the piston 142 in the cylinder 125, is provided with a connecting pin 143 for attachment to the rod such as 144. This rod 144 connects with the corresponding dash pot such as 127. A similar rod 145 connects the piston within the cylinder 126 and the dash pot 128.

Each of the rods 144-145 is provided with an operating pin such as 146-147, respectively. These operating pins operate in slots 148 and 149, respectively, of the rocking lever such as 150, which is fulcrumed on a shaft such as 151, the connection being made by means of a key pin such as 152. This rocking shaft 151 may be suitably supported by a bracket 153 as particularly indicated in the Figure 7. The rocking shaft 151 extends transversely through the assembly as shown and at the end of this rocking shaft is fastened another rocking lever as is indicated by the numeral 154. This latter rocking lever is keyed to the shaft 151 by means of a key pin such as 155.

It will be seen, particularly from Figure 5, that I have provided a hole 156 at the right end of the rocking lever 154. This hole serves for the attachment of a counterweight in order to balance the weight of a certain operating rod which extends from the rocking lever 154 to the valve in the water line. This will be described later on.

The dash pots are interconnected by piping furnished with a regulating valve 158 and a filling valve 159. By opening the valve 158 more or less, the speed of the pistons within the cylinders 125 and 126 can be regulated by controlling the rapidity of the flow of fluid contained in the dash pots, from one

to the other. Filling fluid may be inserted by means of the valve 159.

It will be seen from the above description of the pressure cylinder unit shown in Figures 5, 6 and 7, that the lever 154 connected to the rocking shaft 151 will be rocked when either of the pistons in the cylinders 125 and 126 operates, thereby moving the corresponding one of the rods 144-145 which actuates the rocking lever 150. A connecting link is attached to the rocking lever 154, connecting this lever with a certain regulating apparatus such as the rheostat or the control lever of the valve in the water line. Therefore, in response to the operation of one of the pistons in the cylinders 125 and 126 the lever 154 will be rocked, will move the connecting link in a manner to be described later on, and will thereby operate either the rheostat or the valve in the water line depending on the connection of the pressure cylinder unit in the system. Compressed air for the operation of the pistons within the cylinders 125 and 126 is admitted through the piping 140 and 141, respectively, under the control of certain solenoid operated valve means mentioned previously.

The structure of such a solenoid operated valve may be best explained with reference to the Figure 9.

Referring now to Figure 9, the solenoid operating valves are indicated by the reference numerals 27 and 28. They correspond to the valves indicated by like reference numerals in Figure 1. The valve 27 is shown in cross section in order to explain its operation. The valve comprises a suitable housing and disposed within this housing is the solenoid coil 163. A plunger 164 is held in normal position by the spring 165 depressing the valve plug 166 and closing thereby the port 167 through which may be admitted compressed air from the piping 168. The pipes 169 and 78 connect the valve with the pressure cylinders 49 and 53. It will be seen that the exhaust port 170 is now open, permitting air from the cylinders to be exhausted through the port 170 to the exhaust opening 171. When the solenoid energizes, the plunger 164 will be raised, and the valve plug 166 will close the exhaust port 170 and will open the inlet port 167. Compressed air will then be admitted from the piping 168 through the inlet port 167, and by way of the pipes 169 and 78 to the corresponding cylinders 49 and 53 for operating the piston therein, and for actuating the mechanism in a manner briefly described previously. The three-way solenoid operated valve 28 is of the same construction.

Having described the essential parts of the apparatus in detail, the operation of the system as a whole will be described next with reference to the Figures 8 and 9. These figures should be placed side by side, with Fig-

ure 8 to the left of Figure 9, with the corresponding lines registering.

The electric apparatus may be designed to operate on direct current or on alternating current as desired. For convenience of description's sake I have indicated in Figure 8 the main supply wires by positive and negative signs in order to facilitate the tracing of the circuits. Since the representation of the system as shown in Figures 8 and 9 is merely a detailed and more elaborate replica of the diagrammatic layout shown in Figure 1, I will apply in these Figures 8 and 9 the same reference numerals indicating identical parts as I have shown in Figure 1. Additional and other reference numerals will be used only where it is necessary or convenient for facilitating the description. It is believed that an understanding will be best conveyed by explaining the operation of the system.

Referring now to Figures 8 and 9, the operation is as follows:

The feeder bin 11 is kept full of ground clay in a dry condition, or in the condition as it comes from the grinders. The motor 14 operating the feeder 10 is run at approximately half speed, and this speed will deliver enough clay at constant speed and feed to keep the pug mill 16 and auger machine 18 filled to capacity for normal production. The water valve 34 is set half open, at which setting it will supply enough water to the pug mill 16 by way of the water-line 32 to temper the clay.

Water will also be supplied to the auger machine over the branch pipe 5 or its equivalent. This branch pipe 5 connects with a tube 6 having nozzles or openings extending into the auger. The amount of water admitted into the auger machine can be regulated by suitably proportioning the outlet orifices which lead from the tube 6 into the auger. A valve in the branch 5 may be employed to shut off the supply of water to the auger if desired.

When the mill is shut down, the main switch 38 is opened, and the water valve 33 is closed. The switch 184, which may be disposed on a suitable instrument panel together with other apparatus, is also opened, breaking the circuit to the solenoid operated valves 27 and 28 extending over the wires 175-176.

When it is desired to start the mill, the switch 38 will be closed and the valve 33 will be opened entirely. The switch 184 in the circuit to the solenoid-operated valves is kept open. Water is now supplied to the system. The dry clay feeder can operate when the circuit for its motor 14 is closed over the wire 45, rheostat resistance 43, movable arm 42 of the rheostat, wire 41, motor 14, wire 40 back to the other pole of the current source. The rocking levers 68' and 69' are then operated manually for regulating the speed of

the dry clay feeder and the water supply until the column 21 of the clay extruded by the auger machine 18 has attained the desired plasticity. By moving these rocking levers 68' and 69', manually, the setting for the valve 34 and the setting for the rheostat in the circuit of the motor 14 will be determined. This manual setting of the rocking levers 68' and 69' therefore represents a preliminary operation when the mill is started.

When the clay column 21 from the auger machine has attained the proper plasticity, the screw plug 95 on the pressure relay 22 will be adjusted to balance the pressure between the die 20 and the auger 18' in the auger machine. The balance is obtained when the contact spring in the pressure relay 22 is in a neutral position between the stationary contacts 105 and 106 (Figures 2, 3 and 4). I have shown the contact spring 101 and the contacts 105 and 106 of the pressure relay 22 outside the housing for the sake of description. The parts are under cover as shown in the Figures 2, 3 and 4.

The above described operations will represent the normal operating condition of the system. Switch 183 will now be closed for connecting the signalling lamps 185, 197 and 200 to the circuit.

The white lamp 185 will show this normal operating condition since its circuit will now be closed from the positive supply wire, switch 38, branch connections 40, switch 188, branch wire 187, branch 188, contact spring 189 of the relay 182, in resting position, contact spring 190, branch 191, signal lamp 185, branch 192, contact spring 193 of the relay 181, contact spring 194, in resting position, branch 195, branch 196, switch 183, branch wire 45, switch 38 and back over the negative supply wire to the current source.

The green signalling lamp 197 will not be supplied with current since the circuit extending over the wire 198 is open at the contact 199 of the relay 181. The circuit of the red signalling lamp 200 extending over the wire 201 is likewise open at the contact 202 of the relay 182. The switch 184 is now closed. The whole system is in condition to operate automatically.

As long as the white signalling light 185 shows, it is an indication that the plasticity of the material is normal.

In case the material in the feeder bin 11 becomes too dry, then the normal water supply over the pipe 32 to the pug mill will not be sufficient to give the normal plasticity. The pressure at the point of extrusion in the auger machine will increase due to the stiffer condition of the clay. The pressure on the piston in the pressure relay 22 will therefore increase and will overbalance the pressure of the spring (see Figures 2, 3 and 4) thus forcing the piston in a direction corresponding to the direction of the flow of the clay column

21. A circuit will be closed between the stationary contact 105 and the contact spring 101 for the energization of the relay 181. This circuit may be traced from the positive current supply wire, switch 38, branch 40, switch 183, branch 203, contact in the three-wire plug 186, branch 25, contact spring 101 in the pressure relay 22, contact 105 in the pressure relay, branch 23, contact in the three-wire plug 185, branch 204, winding of the relay 181, branch 205, branch 196, switch 183, branch 45, switch 38, and then back to the current source over the negative supply wire.

18 The relay 181 will be energized in the above circuit and will open the contact between the contact springs 194 and 193, but closing the contact between the springs 194 and 199. Due to the opening of the contact 193-194 of the relay 181 in response to its energization, the circuit for the white signal lamp will be opened, and the circuit for the green signal lamp 197 will be closed. This circuit extends from the positive supply wire, switch 38, branch 40, switch 183, signal lamp 197, branch 198, contact 199, contact 194, branch 195, branch 196, switch 183, branch 45, switch 38, and then back to the current source over the negative supply wire.

20 The condition which is assumed to exist is that the clay is too dry. Therefore, the dry clay supply must be decreased and the water supply must be accelerated. In other words, more resistance must be inserted in the circuit of the motor 14 for the dry clay feeder and the valve 34 must be opened in order to secure an accelerated water supply over the pipe line 32. This can only be accomplished by operating the connecting link 70 (Figure 9) downwardly in order to insert more resistance into the circuit of the motor 14 (Figure 8) and by operating the connecting link 71 upwardly, thereby moving the lever 72 of the valve 34 upwardly and opening the valve. 45 With more resistance in the circuit of the motor 14, the motor 14 will run slower and less dry clay will be supplied to the pug mill 16. With the valve 34 opened, more water will be transmitted through the pipe line 32. As soon as the proper consistency is attained again, the setting of the rheostat 43 and of the valve 34 must be restored, that is to say, as soon as the predetermined original condition is obtained, the apparatus must return to the previously discussed normal condition.

The required operation intimated in the foregoing paragraph is accomplished as follows:

50 When the relay 181 is energized, the contacts 194-199 are closed, thereby closing the circuit for the green signal lamp which denotes to the attendant that the condition of the clay is too dry, or, rather to say, that the system operates in order to correct this con-

dition of the clay. The closure of the contacts 194-199 also closes the circuit for the solenoid operated three-way valve 27. This circuit extends from the positive supply wire, switch 38, branch 40, switch 183, switch 184, branch 175, solenoid winding 163, branch 178, branch 198, contacts 199-194 of the relay 181, branch 195, branch 196, switch 183, branch 45, switch 38, and then back to the current source over the negative supply wire.

The solenoid three-way valve 27 (Figure 9) operates, that is to say, the plunger 164 is drawn upwardly. The exhaust port 170 is thereby closed and the inlet port 167 is opened. Compressed air from the tank 74 will pass through the pipe 73, pipe 168, inlet port 167, pipes 169 and 78, into the cylinder 49 and by way of the pipe branch 80 into the cylinder 53. The pistons within these cylinders will therefore move downwardly and will operate the levers 68' and 69'. The lever 68' will pull the connecting link 70 downwardly while the lever 69' will push the connecting link 71 upwardly. Therefore, the connecting link 70 will move the rheostat arm 42 to insert more resistance into the circuit of the motor 14 extending over the branch wires 41 and 45, while the connecting link 71 (actuated by the operation of the piston within the cylinder 53) will actuate the lever 72 of the valve 34 upwardly in the direction to open the valve for the purpose of accelerating the water supply.

Less clay and more water will be fed to the pug mill 16. The result will be that the lesser feeding of clay and the accelerated supply of water will tend to bring the plasticity back to normal, and the pressure within the auger machine against the piston of the pressure relay 22 relative to the spring within the pressure relay will be restored. When the balance is restored, that is to say, when the proper plasticity of the clay within the auger machine is obtained, the contact spring within the pressure relay will break the contact in the circuit for the relay 181 and this relay 181 will drop back. When this relay deenergizes, it will open the contacts 194-199 thereby interrupting the circuit for the green lamp 197 and for the solenoid operated three-way valve 27, and closing the contacts 194-193, restoring the circuit for the white signal lamp. The green signal lamp is disconnected and the solenoid 163 of the valve 27 is disconnected from current. Accordingly, the plunger 164 will drop back into the position in which it is shown in the drawing (Figure 9) thereby closing the inlet port 167 and opening the exhaust port 170. The pressure within the cylinders 49 and 53 will therefore exhaust through the exhaust port 170 and through the exhaust connection 171.

The condition is again restored to normal. It will be observed that in normal position

all the cylinders 48-49 and 52-53 are open to exhaust ports in the solenoid valves 27 and 28.

Now let us assume that the amount of moisture in the clay fed to the pug mill 16 is too great. The plasticity of the clay within the auger machine will be increased, and the pressure of the clay on the die will be decreased. The spring within the pressure relay will overbalance the pressure on the piston and the piston will move farther into the clay in a direction opposite to the direction of the flow of the clay column 21. Accordingly, the spring 101 in the pressure relay 22 will make contact with the stationary contact 106 and a circuit will be closed for the energization of the relay 182. This circuit extends from the positive supply wire, switch 38, branch 40, switch 183, branch 203, middlemost contact on the three-wire plug 186, branch wire 25, contact spring 101, contact 106, branch wire 24, left hand contact in plug 186, branch 210, winding of the relay 182, branch 211, branch 205, wire 196, switch 183, branch 45, switch 38, and then back to the current source by way of the negative supply wire.

Relay 182 energizes in the above circuit, and opens the contacts 190-189, while closing the contacts 189-202. The circuit for the white signal lamp 186 which extends over the contacts 189-190 is therefore opened, and the circuit for the red signal lamp 200 is closed. This latter circuit for the red signalling lamp 200 will extend from the positive supply wire, switch 38, branch 40, switch 183, branches 187 and 188, contacts 189 and 202 on the relay 182, branch 201, red signal lamp 200, branch 212, switch 183, branch 45, switch 38, and then back to the current source over the negative supply wire. The lighting of the red signal lamp 200 will indicate the particular operating condition of the system to the attendant.

The actuation of the relay 182 and the consequent closure of the contacts 189-202 also closes a circuit for the operation of the solenoid three-way valve 28, shown in Figure 9. This latter circuit extends over the following path: From the positive supply wire, switch 38, branch 40, switch 183, branches 187 and 188, contacts 189-202, branch 201, switch 184, branch 176, winding of the solenoid three-way valve 28, branch 177, branch 212, switch 183, branch 45, switch 38 and then back to the current source over the negative supply wire.

The three-way valve 28 is structurally exactly the same as the valve 27 described in detail previously. When the solenoid in this valve energizes, the plunger, such as the plunger 164 in the valve 27, will be attracted and the inlet port will be opened while the exhaust port of the valve 28 will be closed. Accordingly, compressed air will enter the

cylinders 48 and 52 by way of the pipe 73, inlet port of the valve 28, pipe 81, pipes 83 and 82, respectively. The pistons in the cylinders 48 and 52 will be moved downwardly. The levers 68' and 69' will be rocked in the reverse direction from the direction in which they were moved in the first place. In other words, the connecting link 70 will be moved by the lever 68' in an upward direction for moving the rheostat arm 42 to remove resistance from the circuit of the motor 14 of the feeder 10. The connecting link 71, on the other hand, will be moved downwardly due to the operation of the piston within the cylinder 52 thereby actuating the lever 72 of the valve 34 in the direction to close the valve 34 and to decrease thereby the water supply. With less resistance in the circuit of the motor 14, the motor will be accelerated, thereby accelerating the supply of dry clay to the pug mill 16. With the valve in a position which throttles the supply of water through the pipe line 32, less water will be supplied to the system. The dry clay supply will therefore be accelerated and the water supply will be decreased. This operation obviously is the proper remedy for the condition which has been assumed, namely, that the clay was too wet.

The system operating in the above described manner will tend to balance the relative between the clay and the water, thus tending to bring the plasticity back to normal, and when this is accomplished, the pressure against the piston in the pressure relay 22 will be balanced with the pressure of the spring in the pressure relay. The contact spring 101 will again move to the central position, breaking contact with the stationary contact 106. When the contact spring in the pressure relay moves back to normal and breaks the connection with the contact 106, the circuit for the relay 182 will be interrupted and this relay will be deenergized.

Upon deenergizing, this relay will open the circuit across its contacts 189-202 and will restore the circuit across the contacts 189-190. Accordingly, the red signal lamp 200 will be extinguished and the white signal lamp 186 will again be connected in the circuit across the contacts 189-190. Due to the opening of the contacts 189-202, the three-way solenoid operating valve 28 (Figure 9) will be deenergized and the plunger in this valve will drop back, moving the valve plug to close the inlet port and to open the exhaust port. Accordingly, the compressed air supply from the pipe 73 will be cut off and the cylinders 48 and 52 will exhaust through the exhaust opening on the valve 28 in the same manner as was described in connection with the operation of the valve 27.

The condition is normal again and the

white signal lamp 186 indicates the normal operation of the system.

These operations will take place whenever the plasticity and consistency of the clay changes. The whole system will automatically tend to keep the pressure on the piston within the pressure relay 22 balanced with the pressure of the spring within this pressure relay, thereby maintaining the plasticity constant to the point decided upon for normal operation of the system.

It will be noted that the motor 76 of the air compressor 75 is connected to current by way of the branch connections 179 and 180. A pressure control motor switch 225 is provided in the circuit of the motor 76 for actuating the motor whenever the pressure in the tank 74 falls below a predetermined point. This arrangement of the pressure operated motor switch 225 in the circuit of the motor 76 will tend to keep the pressure within the tank 74 constant. A gauge 226 may be provided on the pressure tank 74 to indicate to the attendant the pressure within the tank.

It will be seen from the foregoing explanations that my invention represents an advance in this particular art which renders many advantages in addition to labor saving, increased efficiency as well as accuracy of operation. It is, of course, evident that numerous modifications may be devised regarding the details of construction of the various parts as well as the embodiment of the invention as a whole. The invention may be used in connection with the manufacture and preparation of widely different materials apart from its use as described in connection with the preparation of clay. I have shown pressure control cylinders to which is fed compressed air. It will of course be understood that hydraulic operating mechanisms may be substituted and may be regulated under the control of a pilot valve or the like in substitution of the electrical control. Many other changes may be devised either in the details of the parts or in the operation of the entire system.

I therefore desire it to be understood that what I have described and shown is intended to represent an embodiment for the purpose of teaching others how the invention may be applied to practical use, but not for the purpose of indicating the limitations of the invention either in its details or in its entirety. I have defined in the following claims what I believe is new in the art, and I intend to use and to apply the invention within the scope and meaning of these claims.

I claim as my invention:

1. In a system for preparing clay, having a feeder, a mixing machine, and an extrusion machine disposed in serial relation, water supply means cooperating with said mixing machine for tempering the clay fed to said machine through said feeder, and pressure

responsive means cooperating with said extrusion machine for automatically proportioning the relation of the clay from said feeder and said water supply to maintain the plasticity of the clay constant at the point of extrusion of said extrusion machine.

2. In a system for preparing clay, having a feeder, a mixing machine, and an extrusion machine disposed in serial relation, water supply means cooperating with said mixing machine for tempering the clay fed to said machine through said feeder, pressure responsive means cooperating with said extrusion machine, and means controlled by said pressure responsive means for automatically proportioning the relation of the clay from said feeder and said water supply to maintain the plasticity of the clay constant at the point of extrusion of said extrusion machine.

3. In a system for preparing clay, having a feeder, a mixing machine, and an extrusion machine disposed in serial relation, water supply means cooperating with said mixing machine for tempering the clay fed to said machine through said feeder, pressure responsive means cooperating with said extrusion machine, electro-responsive means controlled by said pressure responsive means, and pressure operating means controlled by said electro-responsive means for automatically proportioning the relation of the clay from said feeder and said water supply to maintain the plasticity of the clay constant at the point of extrusion of said extrusion machine.

4. In a system for preparing clay, having a feeder, a mixing machine, and an extrusion machine disposed in serial relation, water supply means cooperating with said mixing machine for tempering the clay fed to said machine through said feeder, pressure responsive means cooperating with said extrusion machine and responsive to the pressure of the clay extruded thereby, said pressure responsive means being adjustable to maintain a predetermined neutral position in response to a predetermined pressure within the extrusion machine, electro-responsive means operable by said pressure responsive means upon a change of pressure within said extrusion machine, valve means actuated by said electro-responsive means upon operation thereof, and pressure operated means controlled by said valve means for automatically proportioning the relation of the clay from said feeder and said water supply to restore said predetermined pressure within said extrusion machine.

5. In a system for preparing clay, including an extrusion machine for treating and for extruding a tempered clay mixture, an auger in said machine, a die on said machine, said auger forcing said clay through said die, pressure relay means on said machine,

stationary contact means in said relay, movable contact means adapted to establish connection with said stationary contact means, and means responsive to variations in pressure between said auger and die above and below a predetermined pressure for actuating said movable contact means to establish connection with certain of said stationary contact means.

6. In a system for preparing clay, including an extrusion machine for treating and for extruding a tempered clay mixture, an auger in said machine, a die on said machine, said auger forcing said clay through said die, pressure relay means on said machine, stationary contact means in said relay, movable contact means adapted to establish selective connection with said stationary contact means, operating means responsive to the pressure of said clay between said auger and said die for actuating said movable contact means to establish connection with certain of said stationary contact means, and means for balancing said operating means against any predetermined pressure for preventing the response of said operating means while said pressure is maintained.

7. In a system for preparing clay, including an extrusion machine for treating and for extruding a tempered clay mixture, an auger in said machine, a die on said machine, said auger forcing said clay through said die, pressure relay means on said machine, stationary contact means in said relay, movable contact means adapted to establish connection with said stationary contact means, operating means responsive to the pressure of said clay between said auger and said die for actuating said movable contact means to establish selective engagement with said stationary contact means, and adjustable means cooperating with said operating means for balancing said operating means against a predetermined pressure.

8. In a system for preparing clay, including an extrusion machine for treating and for extruding a tempered clay mixture, an auger in said machine, a die on said machine, said auger forcing said clay through said die, pressure relay means on said machine, stationary contact means in said relay, movable contact means adapted to establish connection with said stationary contact means, operating means responsive to the pressure of said clay between said auger and said die for actuating said movable contact means to establish selective engagement with certain of said stationary contact means, adjustable means for balancing said operating means against a predetermined pressure for inhibiting the operation thereof while said pressure is maintained, and means controlled by said relay means when actuated for readjusting the tempering of said clay to alter the plas-

ticity thereof for restoring the predetermined pressure between said auger and said die.

9. In a system for preparing clay, including an extrusion machine for treating and for extruding a tempered clay mixture, an auger in said machine, a die on said machine, said auger forcing said clay through said die, relay means on said machine, stationary contact means in said relay, movable contact means adapted to establish connection with said stationary contact means, operating means responsive to the pressure of said clay between said auger and said die for actuating said movable contact means to establish selective engagement with said stationary contact means, adjustable means for balancing said operating means against a predetermined pressure to inhibit the operation thereof while said pressure is maintained constant, and electro-responsive signaling means for indicating the normal operation of said system while said pressure is maintained constant.

10. In a system for preparing clay, including an extrusion machine for treating and for extruding a tempered clay mixture, an auger in said machine, a die on said machine, said auger forcing said clay through said die, relay means on said machine, stationary contact means in said relay, movable contact means adapted to establish connection with said stationary contact means, operating means responsive to the pressure of said clay between said auger and said die for actuating said movable contact means to establish selective engagement with said stationary contact means, adjustable means for balancing said operating means against a predetermined pressure to inhibit the operation thereof while said pressure is maintained constant, electro-responsive signaling means for indicating the normal operation of said system while said pressure is maintained constant, and relay means operably responsive to the actuation of said relay means on said extrusion machine upon variation in pressure therein for inhibiting the operation of said first signaling means and for actuating other signaling means.

11. In a system for preparing clay, a feeder for feeding clay, water supply means for tempering said clay, a pug mill for mixing said tempered clay, an auger machine having a die for extruding said clay, means for regulating the operation of said feeder, means for regulating the operation of said water supply, and pressure controlled means for automatically actuating said regulating means to maintain the passage of a substantially constant predetermined volume of clay through said pug mill and through said auger machine and to proportion the relation of the amount of clay from said feeder and the water supply to maintain the plasticity

of the clay substantially constant at the point of extrusion of said auger machine.

12. In a system of the class described, comprising a pug mill, a feeder for feeding material to said pug mill, water supply means for supplying water to said pug mill, variable control means for said feeder and for said water supply means, and pressure controlled means for actuating said variable control means.

13. In a system of the class described, comprising a pug mill, a feeder for feeding material to said pug mill, water supply means for supplying water to said pug mill, variable control means for said feeder and for said water supply means, pressure operated means for actuating said variable control means, and solenoid operated valve means for governing said pressure operated means.

14. In a system of the class described, comprising a pug mill, a feeder for feeding material to said pug mill, water supply means for supplying water to said pug mill, variable control means for said feeder and for said water supply means, pressure means for actuating said variable control means to maintain the passage of a substantially constant predetermined volume of material through said pug mill and to proportion the amount of material and the amount of water to maintain a substantially constant predetermined plasticity of said material.

15. In a system of the class described, comprising a pug mill, a feeder for feeding material to said pug mill, water supply means for supplying water to said pug mill, variable control means for said feeder and for said water supply means, pressure operating means for automatically controlling the operation of said variable control means, and pressure means for securing the actuation of said pressure operating means.

16. In a system of the class described, a feeder, a motor therefor, a rheostat for said motor for regulating the speed thereof, a water supply means, a valve for regulating the passage of water through said supply means, a pair of pressure cylinders for said rheostat and for said valve, a piston in each of said cylinders, a dash pot for each piston, a rocking lever cooperating with each pair of pistons, a link for operatively connecting each rocking lever with said rheostat and said valve, valve means for supplying operating fluid to said cylinders, an inlet port and an exhaust port in said valve means, a plug cooperating with said ports, and means for actuating said plug to open said inlet port and to close said exhaust port to admit fluid to said cylinders and to open said exhaust port while closing said inlet port to inhibit the flow of fluid to said cylinders and to connect said cylinders to atmosphere through said exhaust port.

17. In a system for preparing clay, a pug

mill, a feeder therefor, a motor for said feeder, control means for regulating the speed of said motor, a pair of pressure cylinders, pistons therein, and means operated by said pistons for actuating said control means to regulate the speed of said motor.

18. In a system of the class described, a pug mill, a feeder for feeding material to said pug mill, supply means for supplying water to said pug mill, control means for regulating the operation of said feeder, control means for regulating the operation of said supply means, pressure cylinders, pistons therein, and means operated by said pistons for governing the operation of said control means to regulate and to proportion the amount of material and the water supply to said pug mill.

19. In a system of the class described, a pug mill, a feeder for feeding material to said pug mill, supply means for supplying water to said pug mill, control means for regulating the operation of said feeder, control means for regulating the operation of said supply means, pressure cylinders, pistons therein, means operable by said pistons for controlling the operation of said control means to regulate and to proportion the amount of material and the water supply to said pug mill, and pressure responsive means for governing the operation of said pistons.

20. In a clay preparing system, a pug mill, means for feeding clay thereto, means for supplying water thereto, a pair of pressure cylinders, pistons therein, and means governed by the actuation of said pistons for regulating said water supply to said pug mill.

21. In a clay preparing system, an auger machine, a pug mill for feeding clay to said auger machine, means for feeding clay to said pug mill, means for supplying water to said pug mill, pressure cylinders, pistons therein, control means operable by said pistons for regulating and for proportioning said clay supply and said water supply to said pug mill, and pressure responsive governing means cooperating with said auger machine for automatically governing the actuation of said pistons.

22. In a system of the class described, comprising an auger machine, a pug mill for feeding tempered material to said auger machine, feeder means for feeding said material to said pug mill, supply means for supplying water to said pug mill, said auger machine having an auger and a die for extruding said prepared material by the operation of said auger, a pressure being created between said auger and said die, said pressure being in proportion to the plasticity of said material and said plasticity depending upon the contents of water in said material, master relay means cooperating with said auger, said master relay means being responsive to said pressure between said auger and

5 said die, means for adjusting the operation
of said master relay to balance the same
against a predetermined pressure, means gov-
erned by said master relay to augment the
supply of water and to decrease the supply
of clay in response to increased pressure upon
decreased plasticity of said clay, and means
for augmenting the supply of water and for
decreasing the supply of clay in response to
10 decreased pressure upon increased plasticity
of said clay.

23. In a system for preparing clay, a pug
mill, means for feeding clay to said pug mill,
water supply means for said pug mill, an
15 auger machine for receiving this clay mix-
ture from said pug mill and for extruding
the same, and water supply means connected
to said auger machine.

24. In a clay preparing system, a machine
20 for mixing and for preparing clay, means
for measuring the pressure of said clay with-
in said machine, and means for supplying
water to said machine.

In witness whereof, I hereunto subscribe
25 my name this 10th day of June, 1931.

ALFRED F. C. LOTZ.