June 16, 1931. G. S. HOUSMAN 1,810,078

APPARATUS FOR AND METHOD OF MAKING BRICKS

Filed Jan. 21, 1928 4 Sheets-Sheet 1

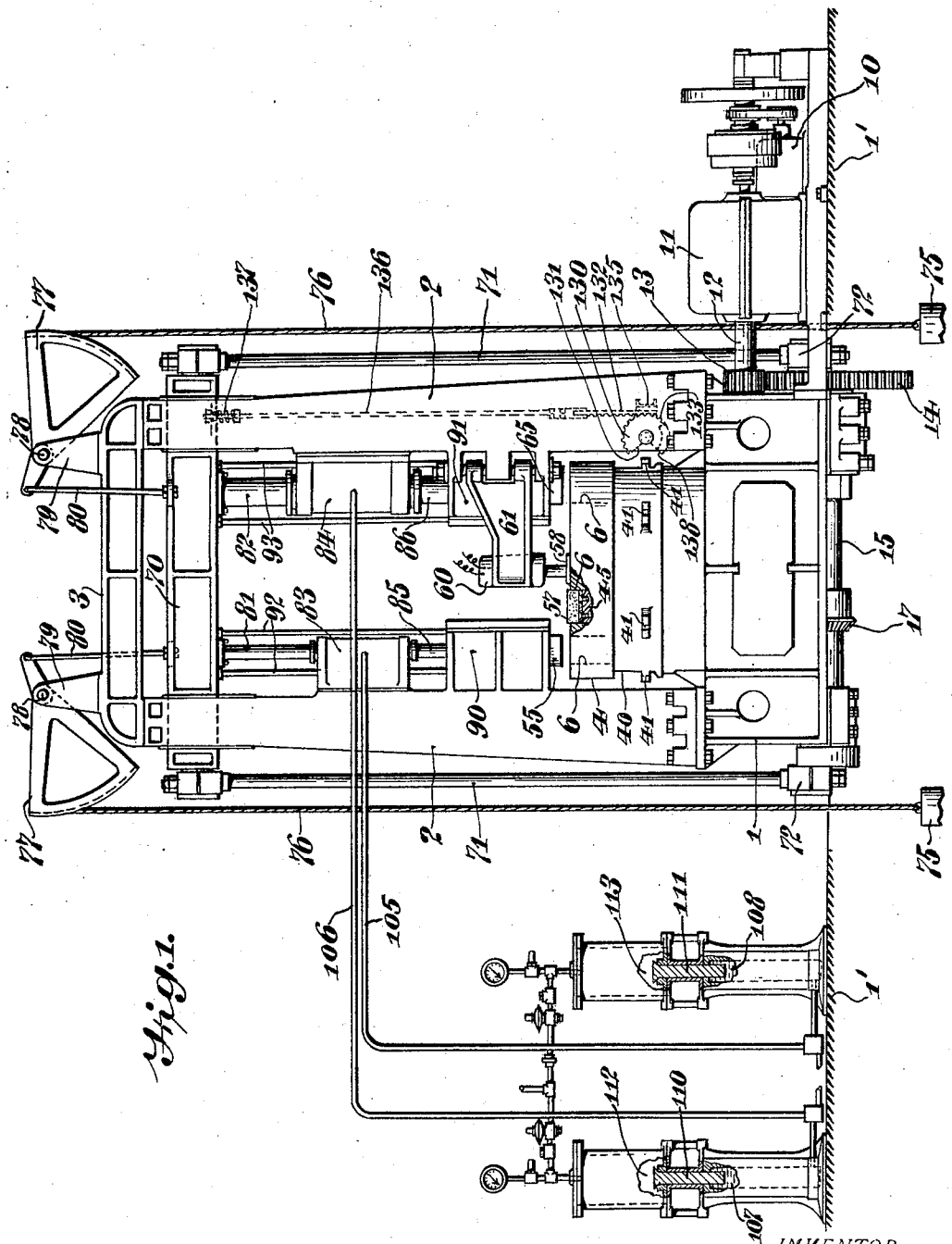


Fig. 1.

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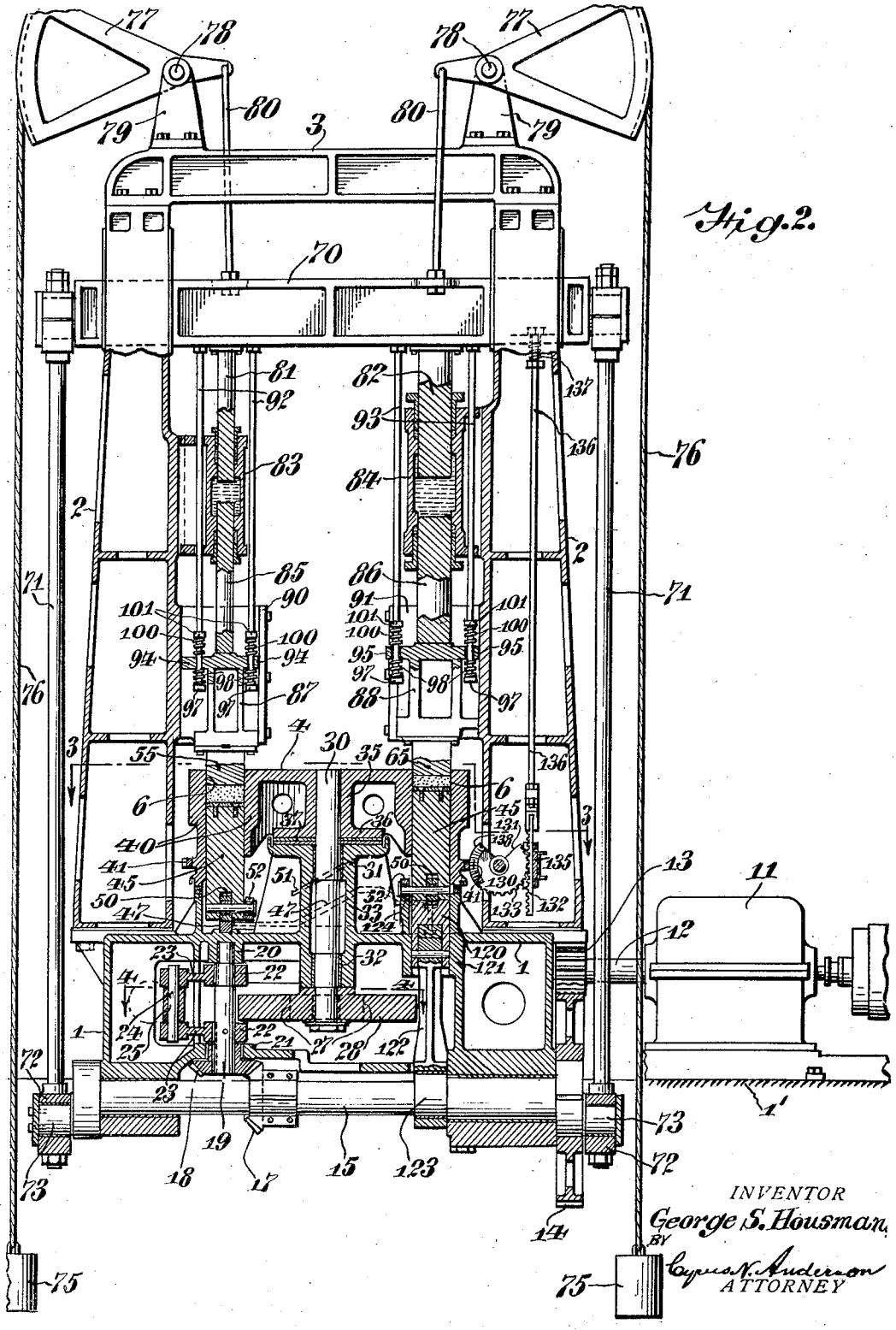


Fig. 2.

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APPARATUS FOR AND METHOD OF MAKING BRICKS

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Fig. 3.

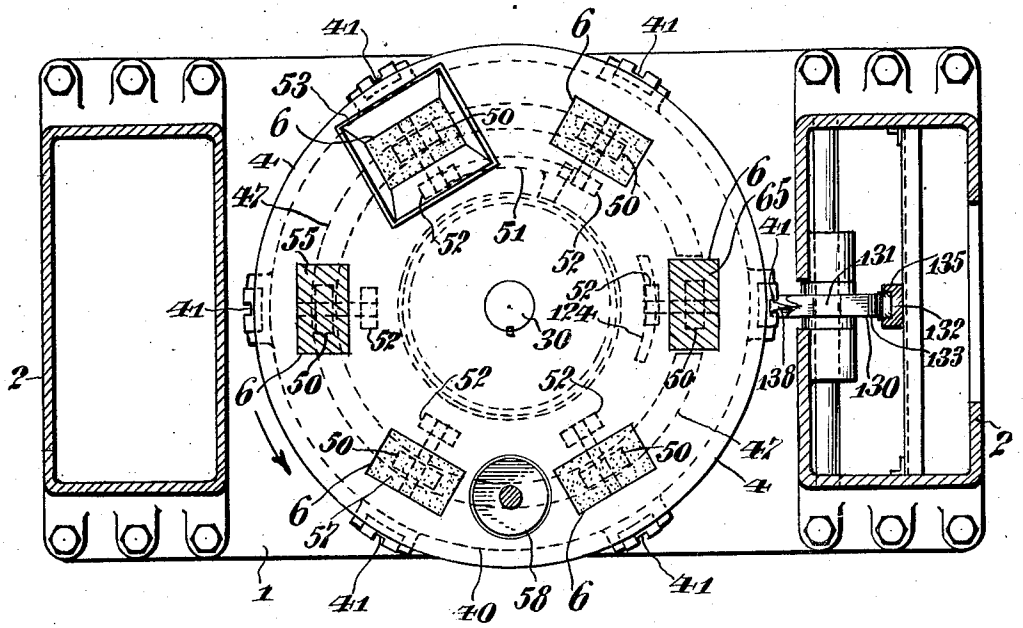
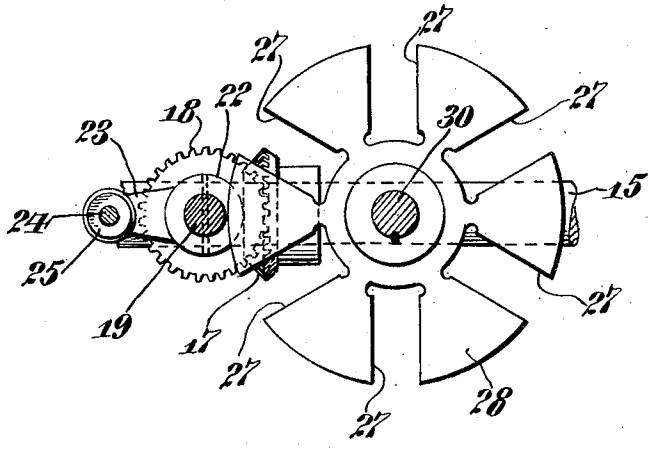


Fig. 4.



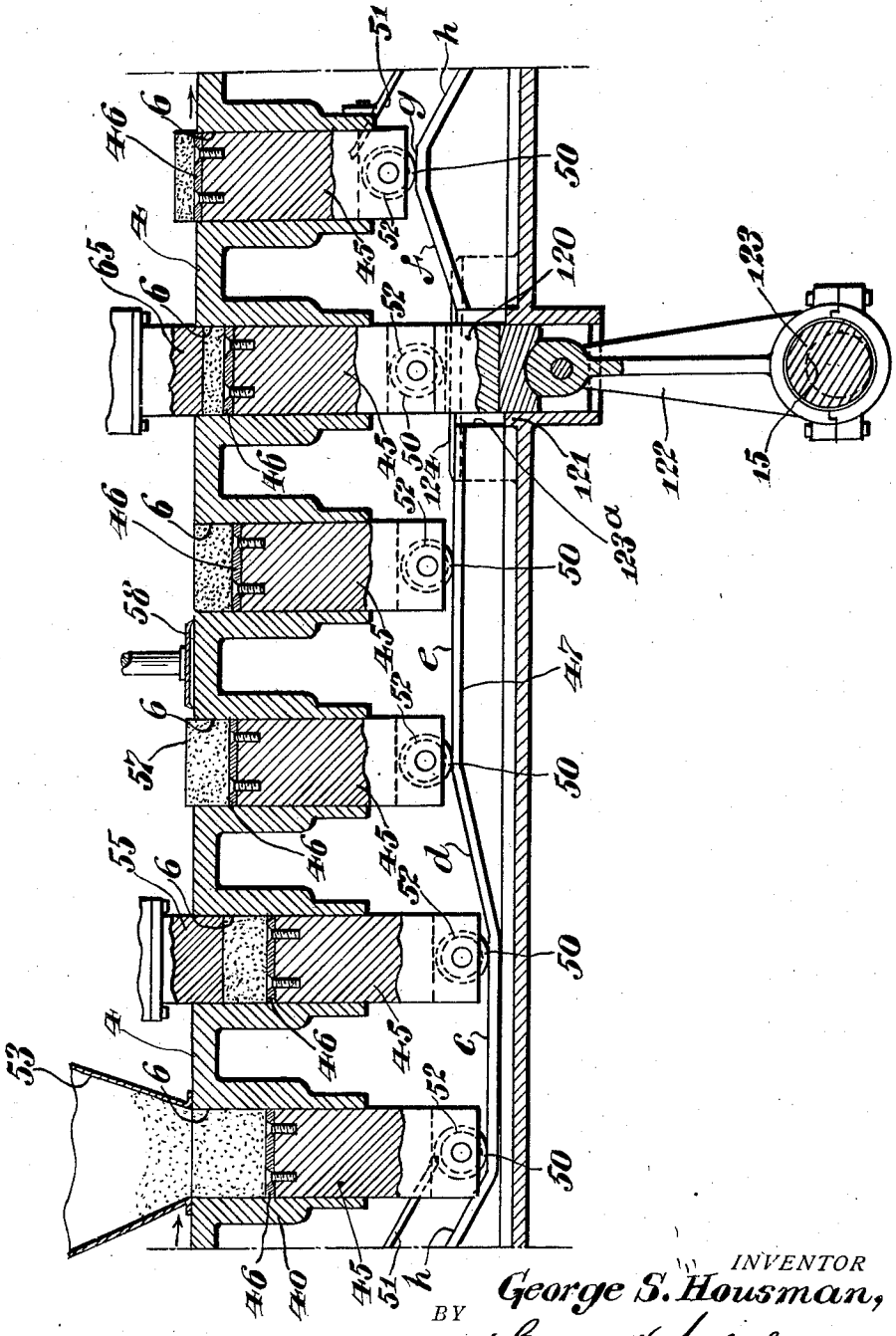
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Filed Jan. 21, 1928 4 Sheets-Sheet 4

Fig. 5.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR AND METHOD OF MAKING BRICKS

Application filed January 21, 1928. Serial No. 248,296.

My invention relates to apparatus for and methods of manufacturing bricks, but more particularly to an apparatus and method by the employment of which bricks of desired dimensions may be made, the apparatus and the method being of such character that all bricks having the same dimensions may be made to contain or embody the same or practically the same mass. The material employed in the manufacture of bricks in accordance with the method embodying my invention is that usually employed in the manufacture of refractory bricks, but material suitable for the manufacture of bricks of other character may be employed.

The general object of the invention is to provide a novel apparatus and method by the employment of which bricks of refractory or other suitable material may be manufactured wherein all bricks of the same dimensions shall respectively include or embody equal or practically equal masses of material, and wherein each brick shall be of the same or practically the same dimensions and density. It will be understood that the amount of material, the dimensions, and the density may be selected to suit the desires and requirements of the manufacturer or the user of the bricks.

It also is an object of the invention to provide a method of novel procedure wherein masses of material are subjected to a preliminary predetermined pressure whereby each mass, even though the amount of material therein may vary in amount from other masses, is rendered of the same or practically the same density as every other mass or batch of material which may be acted upon, and wherein after such preliminary predetermined pressure the top portions of the several brick masses are cut off or severed in one way or another so that each brick shall have practically, if not identically, the same dimensions, after which the said brick masses are subjected to a final pressure by which the brick forming operation is completed.

Another object of the invention is to provide an apparatus wherein the method may be practiced and carried out cyclicly and continuously without removal of the moldable brick masses until after the completion of the operations thereon.

A further object of the invention is to provide an apparatus and a method wherein and whereby, as a preliminary predetermined pressure is applied to a moldable mass in one mold cavity, a second and final predetermined pressure is applied simultaneously to another mass contained in the same mold cavity in which it previously was subjected to preliminary predetermined pressure, the table or other body containing the said mold cavities having in the meantime been caused to travel from one predetermined position to another predetermined position. Moldable material during these pressure operations is being delivered into another mold cavity so that it will be ready to be subjected to the preliminary predetermined pressure referred to after the completion of the last named preliminary and final pressure operations.

Another object of the invention is to provide an apparatus and a method wherein the preliminary and final predetermined forces of compression are maintained during or for appreciable intervals of time to allow and to cause the fine particles of the moldable masses under compression to adjust themselves with respect to each other whereby the texture of the bricks may be rendered more uniform and even than otherwise would be the case.

I shall not attempt here to point out all of the various objects and advantages incident to my invention, but additional and further objects and advantages thereof will be referred to and pointed out in the detailed description thereof which follows or will become apparent from such description.

In order that the invention may be readily understood and its advantages from a practical standpoint fully appreciated, reference may be had to the accompanying drawings in which is illustrated an apparatus which is novel in itself and which may be employed in the carrying out of my new and novel method.

In the drawings:

Fig. 1 is a view partly in side and partly in vertical sectional elevation of an apparatus embodying novel features of construction invented by me and by which the novel method invented by me may be practised;

Fig. 2 is a view partly in vertical section and partly in elevation of a portion of the apparatus shown in Fig. 1, the said view being taken in a plane parallel to that of Fig. 1;

Fig. 3 is a horizontal sectional view taken in the plane of the line 3—3 of Fig. 2;

Fig. 4 is a transverse sectional view taken in the plane of the line 4—4 of Fig. 2; and

Fig. 5 is a developed view in sectional elevation showing the relation of certain parts of the mechanism of the apparatus to each other, and also illustrating the steps which take place in the carrying out of the method.

In the drawings I have shown a base portion, indicated at 1, of a frame structure. The said frame structure including the said base portion is mounted and supported upon any suitable support or foundation as indicated at 1'. Extending upwardly from the base portion are a couple of upright posts or standards 2 located in oppositely disposed spaced relation to each other. The upper ends of the posts or standards 2 are connected by a cross beam 3, as shown. The various operating parts of the mechanism are mounted and supported upon the frame structure comprising the parts 1, 2 and 3 previously referred to.

The apparatus comprises a table 4 within which is provided a series of openings 6 constituting molds within which material is adapted to be compressed in the formation of bricks.

The table 4 is rotatable. Any suitable power means may be employed for rotating the said table, but in practice I employ a motor, indicated at 10, the shaft of which is connected to a reducing mechanism inclosed within the casing 11. From the said reducing mechanism a shaft 12 projects, the inner end of which is provided with a small spur gear 13 which meshes with a relatively large spur gear 14 mounted upon the adjoining end of a shaft 15. The said shaft 15 is provided intermediate its ends with a bevel gear 17 which meshes with a bevel gear 18 mounted upon the lower end of a vertical shaft 19 supported in bearings 20 and 21 at the upper and lower sides of the hollow base portion 1 of the frame structure. The shaft 19 is provided with sleeves 22 from each of which projects an arm 23 which arms are in parallel relation to each other. The outer ends of these arms are provided with openings which are in alinement with each other, within which openings a pin or bolt 24 is mounted upon which pin or bolt is in turn mounted a wearing sleeve 25.

Rotation of the shaft 15 causes rotation of the vertical shaft 19 which in turn causes revolution of the pin or bolt 24 around the axis of the shaft 19. The wearing sleeve 25 upon the pin or bolt 24 engages notches 27 provided in a disk 28 and extending radially from the axis thereof. The engagement of the pin 24 and wearing sleeve 25 thereon in the notches 27 causes rotative movement at intervals of the disk 28. The mechanism or means just described by which the disk 28 is rotated at intervals or step by step is that commonly referred to as a "Geneva" mechanism.

The disk 28 is mounted upon the lower end of a shaft 30 mounted or supported in bearings 31 and 32 formed at the upper and lower ends of a hollow vertical centrally located supporting member 33 constituting a part of the base portion 1 of the frame structure. The upper end portion of the shaft 30 projects above the upper end of the supporting member 33, as shown. The table 4 is secured to the projecting upper end portion of the said shaft to rotate therewith. The said table is provided at its center with a depending portion 35 which terminates at its lower end in a widened portion 36 which rests upon bearing disks 37 upon the upper widened end of the support 33. It may be noted that the "Geneva" machanism for effecting rotation of the disk 28 causes an initial slow movement thereof followed by a relatively fast movement and finally a slow terminating movement.

The relation of the notches 27 in the disk 28 and the operating means for engaging the said notches to cause rotation of the said disk to the openings 6 in the table 4 is such that, when the table is stationary during the period after the wearing sleeve 25 has passed from a notch and prior to its entrance into the next succeeding notch, the said openings are located in proper relation to certain mechanism which cooperates therewith as hereinafter will be set forth.

The table is provided at its outer edge with a depending portion indicated at 40 which in effect constitutes a rim therefor. The openings 6 are provided at intervals, as shown in Fig. 3, in the said rim portion. Upon the outer side of the rim portion adjoining its lower edge notched projections 41 are provided at intervals. There are six of these notched projections and each projection is associated with an opening 6 in the table 4. The said openings and the notches in the said projections preferably are so located that a radial line from the axis of the table bisects an opening 6 and the notch in the projection associated therewith. Such relationship is not essential to the invention but is preferred.

Plungers 45 are provided which project upwardly into the lower ends of the openings

6. The upper ends of these plungers are provided with renewable wear plates 46. The plungers are adapted to be moved up and down or reciprocated within the openings 6, as is clearly indicated or shown in Fig. 5 of the drawings. For that purpose a track 47 is provided upon the base portion 1 of the frame structure, which track is of circular shape and is provided with portions of different height, as is best shown in Fig. 5 of the drawings. Each of the plungers 45 is provided with a bearing roller 50 which is adapted to rest and ride upon the upper side of the track 47. It will be noted that the said track is provided with a relatively low portion at *c* of a length sufficient to accommodate simultaneously or at the same time the rollers 50 of any two adjoining plungers 45. The relatively low portion *c* of the track is connected by an inclined portion *d* to an intermediate portion *e* and the later is connected by an inclined portion *f* to a flat portion *g* which is the highest point or portion of the track. The high portion *g* is connected by an inclined portion *h* to what may be described as the rear end of the relatively low portion *c*. For the purpose of causing the plunger 45 to descend from the high position to which it is elevated by the portion at *g* of the track a cam 51 is provided for engaging the upper side of a roller 52 carried upon the inner end of the pin of each plunger upon which the roller 50 thereof is mounted. During the period that the pin 24 and wearing sleeve 25 thereon are disengaged from the notches 27 in the disk 28 the table 4 remains stationary. When in such stationary position material is discharged from a hopper 53 into the appropriate mold opening 6. The material may be delivered successively to the mold openings from a hopper or may be otherwise placed therein. It may be noted that the material introduced into these mold openings is of refractory character which has been treated previously in known manner to form the same into a moldable mass. It is to be understood that material of other character suitable for making bricks may be used.

During the period that the material is being delivered from a hopper or otherwise into a mold opening the material previously delivered into the immediately adjoining mold opening in advance of that being filled is subjected to a predetermined pressure by a plunger 55. As stated, the pressure exerted by a plunger 55 upon the material in the mold openings in the table 4 is the same even though the amount of material which may have been delivered at different times into the said openings may vary. The result of applying the same pressure at each preliminary pressure operation is that the respective masses after such pressure are of the same or practically the same density. In other words, any two bodies or masses so treated which are of identically the same dimensions would embody or contain the same or practically the same amount of material. The two masses under these conditions would be equal or practically so in every respect and that is the condition sought to be effected by the preliminary pressure treatment effected in the first pressure operation following the delivery of the material into a mold opening 6.

After delivery of material into a mold opening and after the preliminary pressure has been effected the table is given a single step movement, which movement does not begin, of course, until after the plunger 55 has been withdrawn from the upper end of the mold opening 6. Such forward movement causes the plunger 45, which has been in cooperation with the plunger 55, to travel upwardly upon the inclined portion *d* of the track 47 onto the intermediate portion *e* thereof. Such upward movement of the plunger 45 causes the bricks which have been formed previously to project above the plane of the upper side of the table, as indicated at 57. The projecting upper end portions of the bricks thus formed are sheared off by the rotating shearer or cutter 58 the lower cutting edge of which is located or held constantly in the same horizontal plane. It will be understood that when bricks of a predetermined size are being manufactured the portion *e* of the track 47 will occupy a certain fixed position with relation to the plane of the cutting edge of the cutter 58; but if desired means may be provided for adjusting the portion *e* of the track toward or from the said cutter so that bricks of different sizes or dimensions may be made. It follows, therefore, that bricks after they have passed beyond the cutter or shearing device 58 are of practically if not identically the same size and in view of the fact that each has been subjected to the same pressure it follows that all of them embody or contain practically if not identically the same mass or amount of material.

Any suitable means may be provided for effecting rotation of the cutter 58, but in the construction as illustrated I have provided an electric motor 60 for that purpose which is supported upon an arm 61 which is adapted to be moved or adjusted into position to properly adjust the cutter with relation to the table 4 and with relation to the bricks the tops of which are to be sheared off thereby.

It will be noted that in the preliminary pressure operation shown near the left hand end of Fig. 5 of the drawings the bottom plunger 45 remains stationary during the said operation, the entire pressure being effected by a downward movement of the upper or top plunger 55.

The final pressure by which the bricks are

completed is effected between one of the bottom plungers 45 and a top plunger 65, reciprocations of the latter being effected in the same manner as are the reciprocations of the plunger 55. In the final pressure operation the bottom plunger 45 is also moved upwardly at the same time that the top plunger 65 is moved downwardly so that pressure is effected by movement of the plungers simultaneously in opposite directions.

After completion of the pressure resulting from the cooperation of the plunger 65 with a plunger 45 and after upward movement of the plunger 65 to effect disengagement thereof from an opening 6 the table 4 is rotated so as to convey or carry the said plunger 45 from its position in alinement with the plunger 65 forwardly so that the roller 50 at the lower end thereof travels up the inclined portions *f* onto the flat horizontal portion *g* by which the said plunger 45 is elevated so as to project the upper end thereof into a plane coincident with or slightly above the plane of the top side of the table 4. By this means the completed bricks are elevated so that they may be discharged from the table either manually or by the use of any suitable known mechanically operated means.

During the period that the final pressure is being effected between the plunger 65 and a cooperating plunger 45 one of the mold openings is being filled with moldable brick making material and the material in another of said openings adjoining that which is being filled is being subjected to the preliminary pressure operation previously referred to and described. At the same time the final pressure between a plunger 45 and the plunger 65 to complete the formation of the bricks is being effected. It may be noted at this point that the final pressure employed in the completion of the formation of the bricks in practice is much greater than that employed in the preliminary pressure operation. The excess of pressure in the final pressure operation over that in the preliminary pressure operation may be selected at the will of the operator or manufacturer to meet requirements.

I shall now describe the means for effecting operation of the plungers 55 and 65.

A cross head 70 is mounted at the upper end portions of the upright posts or standards 2 and in its vertical reciprocatory movements is guided at its opposite ends by the portions of the said posts or standards with which it is in engagement. For the purpose of effecting vertical reciprocatory movements of the cross head 70 it is pivotally connected at its outer ends to and is supported upon the upper ends of the connecting rods 71. The opposite lower ends of the said connecting rods terminate in straps or sleeves 72 which are engaged by cranks 73 upon the opposite ends of the shaft 15. By reason of such connection the rotation of the shaft 15 causes reciprocatory movements of the connecting rods 71 to thereby effect corresponding movements of the cross head 70 connected to and supported upon the upper ends thereof. The weight of the cross head 70 and parts carried thereby is counter-balanced by weights 75 connected to the lower ends of flexible cords or the like 76 the upper ends of which are connected to the upper ends of the quadrant shaped portions 77 of levers pivoted intermediate their ends at 78 upon brackets 79 which project upwardly from the cross bar 3. The inner ends of the said levers, which are much shorter than the outer quadrant end portions thereof, are connected to the upper ends of rods 80 the lower ends of which are connected to the cross head 70. It will be seen, therefore, that the combined weight of the two weights 75 tends to effect upward vertical movement of the cross head 70 and parts connected with and supported thereby.

The cross head is provided with rods or bars 81 and 82, preferably cylindrical in cross section, spaced from each other and constituting parts of the means for actuating the plungers 55 and 65 respectively. The diameter of the rod or bar 81 is substantially less than the diameter of the rod or bar 82. The increase in diameter of the rod or bar 82 is for the purpose of effecting the relatively great pressure which is applied by the plunger 65 in the second and final pressure operation in the process. The said rods or bars 81 and 82 constitute parts of plunger actuating means.

The lower ends of the rods or bars 81 and 82 respectively project into stationary cylinders 83 and 84. These cylinders are supported in opposed relation to each other upon the inner sides of the opposing posts or standards 2. The two cylinders are of different sizes corresponding to the different sizes of the rods or bars 81 and 82. These cylinders are filled with a suitable fluid, such as water. Piston-like members 85 and 86 in alinement with the rods or bars 81 and 82 (and contituting parts of the plunger actuating means) project into the respective cylinders 83 and 84 from the lower ends thereof. The lower ends of the respective members 85 and 86 contact with the upper sides of what may be described as frame structures 87 and 88 which are of identical construction except as to size. These frame structures are slidably mounted in what may be described as housings 90 and 91 provided upon the inner sides of the posts or standards 2. To the lower ends of these frame structures 87 and 88 the plungers 55 and 65 respectively are connected. Extending downwardly from the cross head 70 are two pairs of rods 92 and 93 the lower ends of which

project through holes provided in flange-like portions 94 and 95 upon the upper ends of the frame structures 87 and 88. The lower ends of these rods terminate in heads 97 as shown. Between the said heads and the lower sides of the flange-like portions 94 and 95 coiled springs 98 are provided. Similar coiled springs 100 are located between the upper sides of the said flange-like portions and sleeves 101. The presence of these spring 98 and 100 provides yielding connection between the lower end portions of the rods 92 and 93 and the flange portions 94 and 95 of the frame structures 87 and 88. The interiors of the cylinders 83 and 84 are in communication through pipes 105 and 106 with the lower ends of cylinders 107 and 108 which are filled with a fluid. Plungers 110 and 111 project into the upper ends of the cylinders 107 and 108. The upper ends of these plungers project respectively into the lower ends of cylinders 112 and 113 to which a suitable fluid, which may be a gaseous fluid, is supplied under the requisite pressure by compressing means, not illustrated. The mechanism including the cylinders 107, 108, 112 and 113 constitutes means for releasing the fluid from the cylinders 83 and 84 when the pressures therein have reached certain predetermined limits. The pressure releasing means will not be described further because its construction is similar to and operates upon the principle disclosed and described in United States Patents No. 1,473,388 and No. 1,473,389, granted on November 6, 1923, to Frank H. Smith and Alois K. Nowak.

When the cross head 70 is moved downwardly the rods or bars 81 and 82 are moved in a like direction so that the lower ends thereof move downwardly in the cylinders 83 and 84 respectively. Downward pressure exerted by the said rods or bars is transmitted through the fluid in the cylinders to the piston-like members 85 and 86 and thereby is transmitted to the plungers 55 and 65 to effect the preliminary and final pressures employed in the method as has been described. When the resistance offered by the material which is being compressed reaches a certain predetermined point or amount the pressure release means functions so that further downward movement of the plungers 81 and 82 or either of them does not effect any further or additional pressure upon the plungers 55 and 65 or either, as the case may be.

Preferably the mechanism is so adjusted that the predetermined pressure is reached just before the rods or bars 81 and 82 reach their lowermost positions so that for a short period (a few seconds) during each pressure operation the compressed moldable mass is held under such predetermined pressure to permit the particles thereof to adjust themselves to each other. By this means bricks of finer and more uniform and even texture may be produced.

Upon upward movement of the cross head 70 the rods or bars 81 and 82 are carried upwardly and the rods 92 and 93 operate to lift the frame structures 87 and 88 and to thereby cause upward movement of the members 85 and 86. It will be understood that the function of the rods 92 and 93 is to lift the frame structures 87 and 88 with the plungers 55 and 65 carried thereby upon the upward movement of the cross head 70; and that there may be a certain amount of lost motion between the rods 92 and 93 and the flange-like portions 94 and 95 of the frames 87 and 88 at the initial point of upward movement of the cross head 70.

In order to effect upward movement of any one of the plungers 45 which may be in position to cooperate with a plunger 65 simultaneously with the downward movement of the latter I employ a lifting block 120 mounted in a bearing or housing 121 provided in the upper side of the base portion 1 of the frame structure. The said lifting block is in alinement with the plunger 65 and also with any plunger 45 which may be brought into alinement with the said plunger 65. When the plungers 45 and 65 are in such relation to each other the upper side of the lifting block 120 is adapted to contact with the lower end of said plunger 45, as is shown in Figs. 2 and 5. The lifting block 120 is pivotally connected to the upper end of a connecting arm 122 the lower end of which is provided with a strap which is mounted upon an eccentric 123 upon the shaft 15. The high point of the eccentric 123 is located in diametrically opposed relation to the cranks 73, previously referred to, so that as the cranks 73 operate to cause downward movement of the cross head 70 the eccentric 123, operating through the connecting bar 122, causes upward movement of the lifting block 120 to effect a corresponding upward movement of the plunger 45 which may be located in alinement therewith and in alinement with the plunger 65. It therefore will be seen that the final pressure operation by which the bricks are completed is effected by oppositely moving pressure plungers so that both sides of the bricks, during the final operation, are subjected to compression. Compression pressures applied in opposite directions have been found to provide bricks of more uniform density throughout the mass thereof. The block 120 in its upward and downward movements operates in or through an opening in the track formed by removing or omitting a portion thereof, as indicated at 123^a. When the lower end of a plunger 45 is located over an opening 123^a and prior to the engagement or contact of the block 120 therewith the said plunger is held or supported against possible downward

movement by means of a short track section 124 which engages the under side of the roller 52 carried thereby.

As has been pointed out already, the table 4, during the filling and pressure operations, is stationary. Means should be provided for insuring that the table during that period shall be held positively against movement in either direction about its axis. The means employed by me for that purpose comprises a disk 130 having a notch 131 formed by the removal of a segmental portion thereof. The said disk is rotatably mounted in adjoining relation to the circumference of the lower portion of the flange-like portion provided at the outer edge of the table to which reference has been made previously. The disk is so located that a portion of the edge thereof is adapted to engage the notches in the notched projections 41 previously referred to. Oscillation or partial rotation of the disk alternately in opposite directions is effected by means of a rack 132 the teeth of which engage teeth 133 upon a portion of the edge of the disk 130. The rack bar 132 is held in cooperative relation to the teeth 133 upon the disk by means of a holding and guiding device 135. The rack bar is connected at its upper ends to the lower end of a rod 136 the upper end of which is connected, preferably yieldingly, to the cross head 70, as indicated at 137. Vertical reciprocatory movements of the cross head 70 effected in the manner as hereinbefore described causes like reciprocatory movements of the rod 136 and the rack bar 132 connected to the lower end thereof. Such reciprocatory movement causes oscillatory movements of the disk 130 about its axis. When the cross head 70 moves upwardly the disk 130 is rotated or oscillated in an anti-clockwise direction so that the edge thereof which is in adjoining relation to the lower portion of the flange at the outer edge of the table 4 is disengaged from the notch in a notched projection 41 and the notch 131 in the disk is moved into position opposite the said notched projection to permit rotation of the table 4. In order to facilitate the entry of an edge portion of the disk into the notches in the notched projections 41 the said portion is tapered so that it is of wedge shape as shown at 138. One edge of the notch 131 constitutes the end or edge of the tapered wedge shaped portion, as shown. The thickness of the disk 130 is greater than the width of the notches in the projections 41 from which it will be apparent that the entry of the tapered portion 138 into the said notches will operate to position the table and hold it in position. The disk 130 is rotated in clockwise direction upon the downward movement of the cross head 70 to effect engagement of the edge thereof with a notch in one of the notched projections 41.

Although the amount of the preliminary and final pressures which may be employed may vary, it may be assumed merely for the purpose of illustration that in the present operation the pressure release mechanism is so set as to effect a pressure of one thousand pounds per square inch in the preliminary pressure operation, and two thousand pounds per square inch in the final pressure operation.

Although I have shown the mold openings in the table 4 and the plungers 45, 55 and 65 so constructed as to effect the formation of a single brick at each operation it will be understood that the construction may be such as to effect the formation of a plurality of bricks at each operation.

In conclusion the operation of the apparatus and the method will be described briefly with reference to Fig. 5 of the drawings, the assumption being made that the moldable material has just been delivered from the hopper 53 into a cavity and that all of the other cavities are empty.

In the beginning of an operation a cavity is filled with the moldable material. The table or other body containing the mold cavities is then rotated through one step so as to bring the cavity previously filled with the moldable material therein underneath the plunger 55. The said plunger is then operated to effect a preliminary predetermined pressure upon the material previously delivered into the said mold cavity from the hopper 53. Such rotation or movement of the table has operated to move the next adjoining mold cavity into position underneath the hopper 53 and during the time or interval that the plunger 55 is being operated to compress the material in the mold cavity in alinement therewith moldable material is being delivered to the next adjoining mold cavity in the rear. The next movement of the table causes the bottom plunger 45, which has cooperated with the plunger 55, to travel up onto the portion *e* of the track 47 and as the step by step rotation of the table is continued the cutter 58 operates to shear off the upper side of the brick after it has been preliminarily compressed. Finally, after having its upper end portion cut off as indicated in Fig. 5 the sized brick mass is carried into position underneath the plunger 65 so that upon downward movement thereof and simultaneous upward movement of the alined plunger 45 the brick mass is subjected to final compression. As such final pressure operation is being effected a preliminary pressure operation is being effected by the plunger 55 and during that period moldable material is being delivered unto an adjoining mold cavity, all of which is clearly shown diagrammatically in the said Fig. 5.

It will be seen that by my invention, as hereinbefore described, I am enabled to pro-

duce bricks which are practically of the same size and each of which contains or embodies practically the same amount of material as is contained in every other brick. It follows that the density of the respective bricks is the same or practically the same.

It will be apparent from the foregoing that by my invention I am enabled to manufacture bricks the characteristics of which as to size, density, etc., are practically the same, which is a factor of practical importance if the bricks are made of refractory material and if they are for use in operations where high temperatures are involved.

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

1. In an apparatus of the character described, the combination of a movable member having mold cavities located at intervals therein in which bricks are adapted to be molded, means for effecting movement of said member at intervals, a plunger for subjecting the material in a mold cavity to a preliminary pressure of predetermined amount, and means for thereafter applying final pressure of predetermined amount to the material in said mold cavity, the said final pressure being greater than the preliminary pressure.

2. In apparatus for manufacturing bricks, the combination of a movable member having mold cavities therein in which the moldable material is placed, means for effecting step by step movement of said member, a plunger for applying preliminary pressure to the material after it has been placed in a mold cavity, means for releasing said pressure, means for subjecting the material in said mold cavity to a final pressure greater than the preliminary pressure, and means for releasing the said last mentioned means to control the amount of pressure exerted thereby.

3. In apparatus for manufacturing bricks, the combination of a rotatable member having mold cavities located at intervals therein in which the moldable material is adapted to be placed, means for effecting step by step rotation of said member, means for applying pressure to the moldable material which may be placed in a mold cavity, means for releasing the said pressure applying means when the pressure thereof has reached a predetermined amount, means operating as the said member is rotated to move the said compressed material in the said mold cavity toward the top of the said member so that the end thereof may project above the said table, means for severing the projecting end portion of said material in a predetermined fixed plane, means for subjecting the said material to a second pressure greater than the first mentioned pressure, and means for releasing the said last mentioned means when the pressure exerted thereby has reached a certain amount.

4. In apparatus for the manufacture of bricks, the combination of a table having mold cavities located therein for the reception of moldable material, means for effecting rotation of said table, plungers projecting into the said mold cavities from the bottoms thereof, a reciprocatory plunger adapted to be projected into the said cavity from the top thereof to effect a preliminary pressure of the moldable material therein, means for releasing said pressure when it has reached a certain predetermined amount, means for removing said last mentioned plunger from the said mold to permit rotation of the said table, means for sizing the brick produced by the said pressure operation, means for thereafter subjecting the said brick to final compression at a greater pressure than said preliminary pressure, and means for releasing the said compression means after the pressure exerted thereby has reached a predetermined amount.

5. In apparatus for manufacturing bricks, the combination of a table, said table having mold cavities located at intervals therein, which cavities are adapted to receive successively moldable material, plungers projecting into the said mold cavities from their lower ends, a cross head, means for effecting reciprocatory movements of the said head, a plunger having operative connection with the said cross head and adapted to project into the said mold cavities as they are moved successively into alinement therewith, automatically operable means for releasing said plunger when the pressure exerted thereby has reached a predetermined amount, means whereby upward movement of the said cross head causes upward movement of the said plunger to remove the same from the cavity into which it may have been projected, means becoming operative upon movement of the said table from the position which it occupied during the said pressure operation to cause upward movement of the lower plunger to effect upward movement of the brick in the said cavity toward the upper side of the said table, means for shearing off a portion of the projecting upper end of the said brick, a second plunger adapted to enter the said mold cavity from the top side thereof, means for effecting simultaneous upward movement of the plunger entering the said mold cavity from its lower end in a direction opposite that of the movement of the upper plunger, and means acting automatically to release the said second plunger whereby the pressure exerted by the said cooperating plungers is limited to a predetermined amount.

6. In apparatus for manufacturing bricks, the combination of a table, said table having mold cavities located at intervals therein,

which cavities are adapted to receive successively moldable material, plungers projecting into the said mold cavities from their lower ends, a cross head, means for effecting reciprocatory movements of the said head, a plunger having operative connection with the said cross head and adapted to project into the said mold cavities as they are moved successively into alinement therewith, automatically operable means for releasing said plunger when the pressure exerted thereby has reached a predetermined amount, means whereby upward movement of the said cross head causes upward movement of the said plunger to remove the same from the cavity into which it may have been projected, means becoming operative upon movement of the said table from the position which it occupied during the said pressure operation to cause upward movement of the lower plunger to effect upward movement of the brick in the said cavity toward the upper side of the said table, means for shearing off a portion of the projecting upper end of the said brick, a second plunger adapted to enter the said mold cavity from the top side thereof, means for effecting simultaneous upward movement of the plunger entering the said mold cavity from its lower end in a direction opposite that of the movement of said second plunger, means acting automatically to release said second plunger whereby the pressure exerted by the said cooperating plungers is limited to a predetermined amount, and means for causing further upward movement of the lower plunger upon further rotative movement of the said table to discharge the finished brick from the said mold cavity.

7. In apparatus for manufacturing bricks, the combination of a rotatable table having mold cavities located at intervals therein, which cavities are adapted to receive successively charges of moldable material, plungers projecting upwardly into said cavities, means for causing longitudinal movements of said plungers in succession as rotation of the said table is effected, separate means for effecting simultaneous compression of charges in different cavities, one of said pressures being greater than the other, and means for releasing automatically the said separate means when the respective pressures exerted thereby have reached predetermined limits.

8. In apparatus for manufacturing bricks, the combination of a table having mold cavities located at intervals therein, which cavities are adapted to be charged successively with moldable material, means for effecting step by step rotation of said table, plungers projecting upwardly into the said mold cavities, a cam track upon which the said plungers are supported, the said track effecting movements of the said plungers in the said cavities as the said table is rotated, separate means operating simultaneously to subject the material in a couple of cavities to compression, the pressure exerted by one of said means being less than that exerted by the other, the said other compressing means compressing a charge which already has been compressed by the means exerting the less pressure, and fluid control means operating automatically to release the said compressing means when the pressures exerted thereby have reached predetermined limits.

9. In apparatus for manufacturing bricks, the combination of a rotatable table having mold cavities located at intervals therein into which moldable material is adapted to be charged, means for effecting step by step rotation of said table, plungers adapted to enter the said cavities for compressing moldable material therein, the said compression being effected during stationary intervals of the said table, means for effecting reciprocatory movements of the said plungers, and means operated by the last mentioned means for engaging the said table to hold the same against movement during a compression operation.

10. In apparatus for manufacturing bricks, the combination of a table having mold cavities located at intervals therein, which cavities are adapted to be charged with moldable material, means for causing step by step rotation of said table, plungers for compressing the material in said cavities, a reciprocating cross head, connections between said plungers and said cross head whereby reciprocatory movements of said plungers are effected, a rotatable member located in adjoining relation to the outer edge of said table, and means connected with the said cross head for effecting oscillatory movements of said means to engage and disengage the said table to hold the same against movement during a compressing operation and to permit rotation thereof during the intervals between compressing operations.

11. In apparatus for manufacturing bricks, the combination of a table having mold cavities therein, which cavities are adapted to be charged with moldable material, said table having notched projections located at intervals upon its periphery, means for causing step by step rotation of said table, plungers adapted to enter the said cavities to effect compression of the moldable material therein, a reciprocating cross head, connections between said cross head and said plungers whereby reciprocatory movemovements are imparted to the latter to effect compression of the material in said cavities, an oscillatable disk supported in a plane extending substantially at right angles to a plane tangent to the adjoining periphery of the said table, the edge of which disk is adapted to engage the notches in said notched projections, said disk having a segmental portion thereof removed to form a notch,

and connections between the said cross head and the said disk whereby reciprocations of the cross head cause oscillatory movements of the said disk to cause it to engage the notches in said projections and to cause the notch in the said disk to be moved into alinement with the said projections to permit rotation of the said table.

12. In apparatus for manufacturing bricks, the combination of a table having mold cavities located at intervals therein, which cavities are adapted to be charged with brick making material, means for causing step by step rotation of said table, plungers for compressing the material in said cavities, a reciprocating cross head, connections between said plungers and said cross head whereby reciprocatory movements of said plungers are effected, and means having communications with said connections and acting automatically to control the pressure exerted by the said cross head acting through the said connections.

13. The method of manufacturing bricks, which comprises the charging of a mass of moldable material into a mold cavity, subjecting the same to a controlled predetermined preliminary pressure, and thereafter subjecting it to a final controlled predetermined completing pressure.

14. The method of manufacturing bricks, which comprises charging a mass of moldable material into a mold cavity, applying preliminary pressure thereto, automatically releasing the said pressure when it has reached a predetermined amount, thereafter forming the mass thus produced to a predetermined definite size, thereafter applying final pressure to the sized mass, and automatically releasing said final pressure when it has reached a predetermined amount.

15. The method of manufacturing bricks, which comprises the charging of masses of moldable material successively into mold cavities, applying controlled predetermined equal preliminary pressures successively to the said masses, thereafter forming each mass to practically the same size, and thereafter subjecting each sized mass to controlled predetermined equal pressure to complete the formation of the said bricks.

16. The method of manufacturing bricks, which comprises the charging of masses of moldable refractory material successively into mold cavities, applying automatically controlled predetermined equal preliminary pressures sucessively to the said masses, thereafter forming each mass to practically the same size, and thereafter subjecting each sized mass to automatically controlled predetermined equal pressure greater than the preliminary pressure.

17. The method of manufacturing bricks, which consists of charging a series of mold cavities successively with masses of moldable refractory material as the said cavities travel past a selected point, acting upon the masses after they have been charged into the said cavities to render all of them of practically the same density, thereafter successively moving the said masses upwardly in their cavities so that the bottom of each will occupy the same horizontal plane, removing top portions of the said masses to render each mass of practically the same size as every other mass, and thereafter subjecting the said masses automatically to controlled predetermined pressure to reduce their size and increase their density, the size and density of each mass after the last mentioned action thereon being practically the same as every other mass.

18. The method of manufacturing bricks, which consists in charging moldable masses of brick making material into mold cavities successively as said cavities are located at a selected point, thereafter subjecting each of said masses automatically to a controlled predetermined pressure while they are located at a selected point, forming the said masses to practically the same size after the subjection thereof to such pressure, and finally subjecting each of said masses to a controlled predetermined pressure greater than the pressure previously exerted thereupon.

19. The method of manufacturing bricks, which consists in charging moldable masses of refractory material into mold cavities successively as said cavities are carried by a selected point, thereafter subjecting each of said masses to a controlled predetermined pressure as they are carried by a selected point, forming the said masses to practically the same size after the subjection thereof to such pressure, and thereafter applying positive pressures simultaneously in opposite directions to the said masses to complete the formation of the said bricks, one of said pressures being released when it reaches a predetermined amount whereby the final pressure to which the said bricks are severally subjected is the same.

20. The method of manufacturing bricks, which comprises the placing of moldable material in a cavity and subjecting the same to a predetermined pressure and maintaining the same at such predetermined pressure for an appreciable period of time.

21. The method of manufacturing bricks, which consists in the placing of the moldable brick material in a mold cavity, subjecting the same to a preliminary predetermined pressure, thereafter again subjecting the same to a predetermined pressure to complete the molding operation, and maintaining the said predetermined pressures during appreciable periods of time.

22. The method of manufacturing bricks, which consists in delivering moldable brick making material successively into a series of

mold cavities, subjecting the said moldable material successively to controlled predetermined preliminary pressures, thereafter successively cutting away portions of the preliminarily pressed brick masses to render them all of practically the same size, subjecting the said sized brick masses successively to final automatically controlled predetermined pressures, the final pressure operation upon a brick mass being effected simultaneously with the preliminary pressure operation upon another mass.

23. The method of manufacturing bricks, comprising the placing of moldable material in a mold cavity, subjecting the same to automatically controlled predetermined compressive pressure, moving the compressed mass through a predetermined distance in said cavity, cutting the same while in said cavity to a predetermined size, retaining the mass in said cavity and subjecting it to a second automatically controlled predetermined greater pressure and thereafter removing the completed brick from said cavity.

24. The method of manufacturing objects of predetermined density and size from moldable material which comprises subjecting successive portions of the said material respectively to the same cycle of operations, each of which cycles comprises the subjecting of the portion being molded to a controlled predetermined compressive pressure in a mold cavity, moving the object in the said mold cavity to a predetermined position and causing a portion thereof to project from said mold cavity, removing the portion which projects from the said mold cavity to regulate the quantity of the material necessary to be embodied in the object, subjecting the residual portion to a second controlled predetermined compressive pressure, and thereafter removing the same from the said mold cavity.

25. The method of manufacturing objects of predetermined density and size from moldable material which comprises the subjecting of successive portions of the said material respectively to the same cycle of operations, each of which cycles comprises the subjecting of the portion being molded to a controlled predetermined preliminary compressive pressure in a mold cavity, moving the object in the said mold cavity to a predetermined position wherein a portion thereof projects from the said mold cavity, removing the portion which projects from the mold cavity to regulate the quantity of the material necessary to be retained for the object, subjecting the residual portion to a final controlled predetermined compressive pressure greater than the preliminary pressure and sufficient to produce a predetermined size, and thereafter removing the same from the said cavity.

26. In apparatus for manufacturing bricks, the combination of a member having a mold cavity therein in which the moldable material is placed, a plunger for applying preliminary pressure to the material after it has been placed in a mold cavity, means for applying pressure to said plunger, means for releasing said last named means when the pressure thereof has reached a predetermined amount, means for subjecting the material in said mold cavity to a final pressure, and means for releasing the said last named means when the pressure thereof has reached a predetermined amount.

27. In apparatus for manufacturing bricks, the combination of a movable member having a mold cavity therein in which the moldable material is placed, means for effecting step-by-step movement of said member, a plunger for applying preliminary pressure to the material which has been placed in a mold cavity, means for applying pressure to said plunger, means for releasing said last named means when the pressure thereof has reached a predetermined amount, a plunger for subjecting the material in said mold cavity to a final pressure, means for applying pressure to said plunger, and means for releasing said last named pressure-applying means when the pressure thereof has reached a predetermined amount.

28. In apparatus for manufacturing bricks, the combination of a movable member having a mold cavity therein in which the moldable material is placed, means for effecting step-by-step movement of said member, a plunger for applying preliminary pressure to the material which has been placed in a mold cavity, a fluid medium for applying pressure to said plunger, fluid controlled means for releasing the pressure on said fluid medium when the pressure thereof has reached a predetermined amount, a plunger for subjecting the material in said mold cavity to a final pressure, a fluid medium for applying pressure to said last-named plunger, and fluid controlled means for releasing the pressure on said last-mentioned fluid medium when the pressure thereof has reached a predetermined amount.

In testimony that I claim the foregoing as my invention I have hereunto signed my name this 19th day of January, 1928.

GEORGE SCOTT HOUSMAN.