(No Model.) 5 Sheets—Sheet 1.

B. C. WHITE & J. A. BOYD.

BRICK MACHINE.

No. 418,099. Patented Dec. 24, 1889.

Fig. 1.

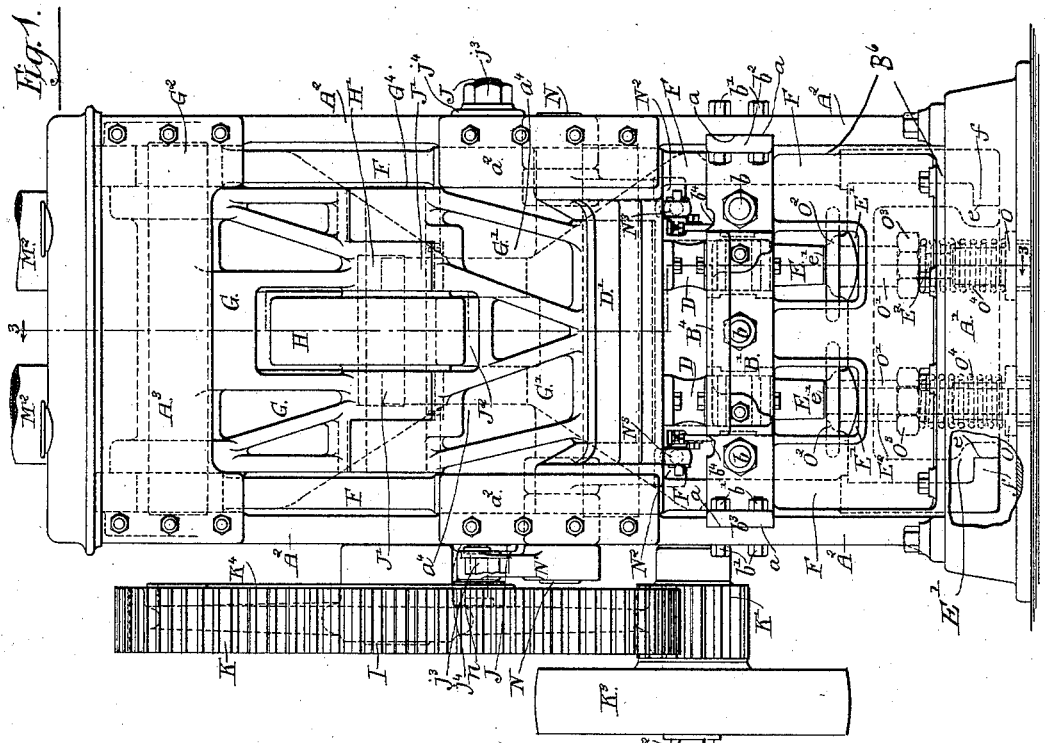

Fig. 2.

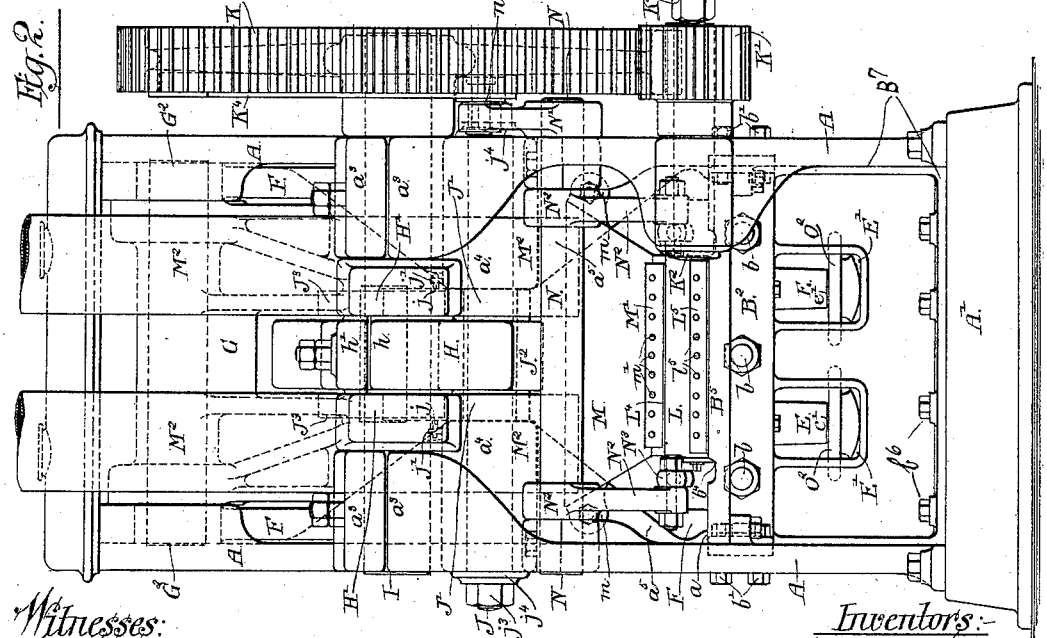

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Fig. 4.

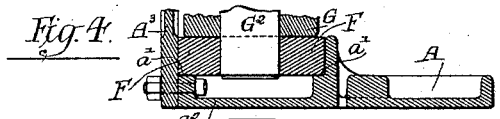


Fig. 3.

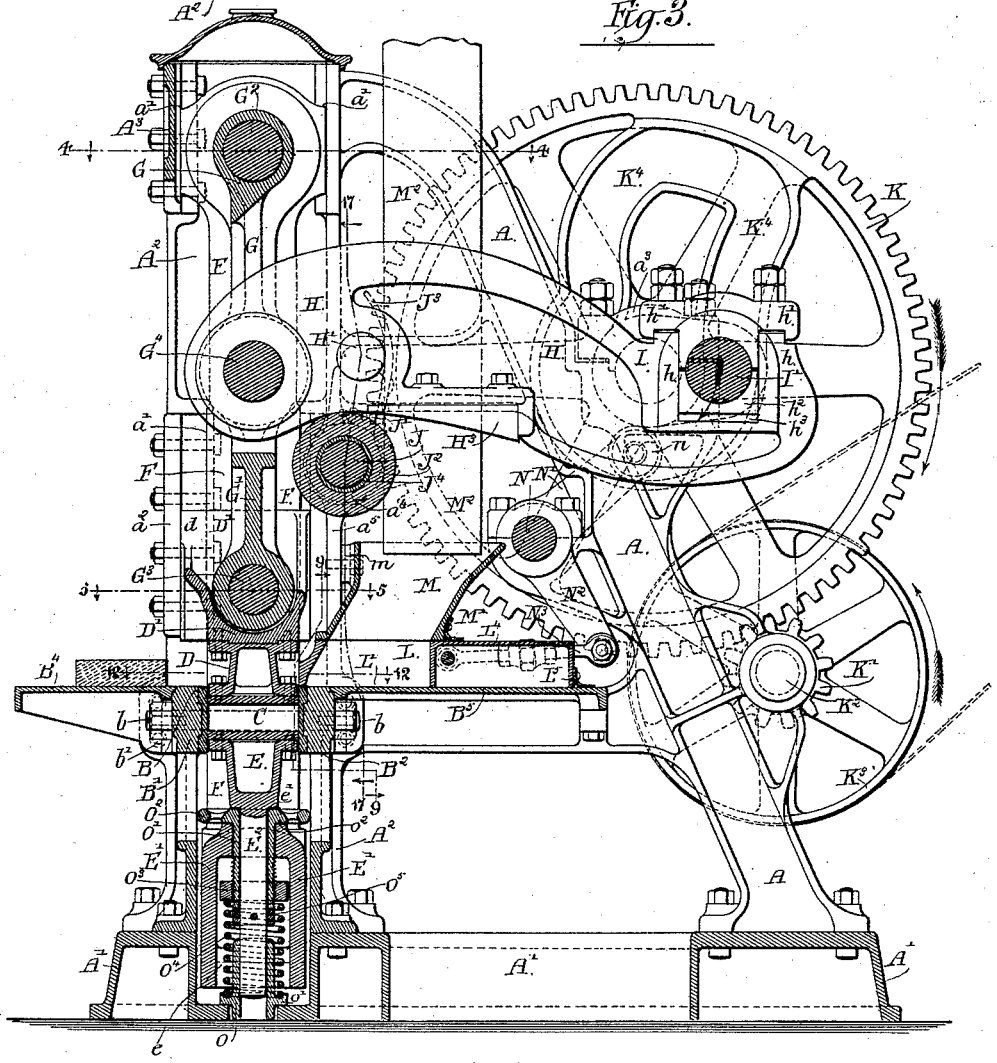
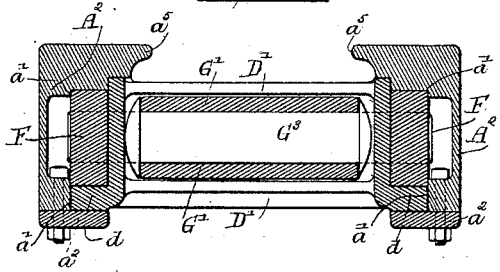


Fig. 5.



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No. 418,099. Patented Dec. 24, 1889.

Fig. 6.

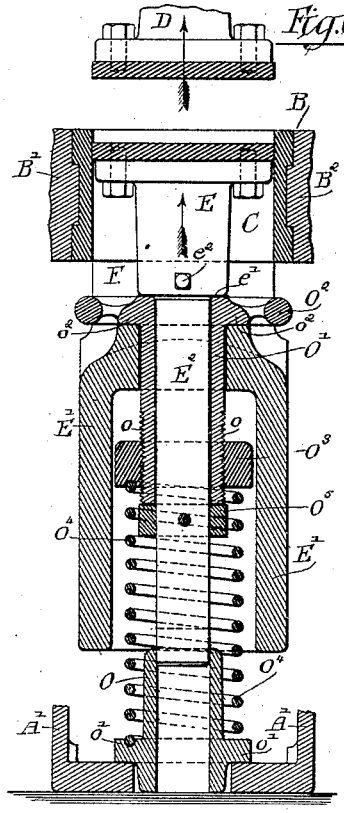


Fig. 7.

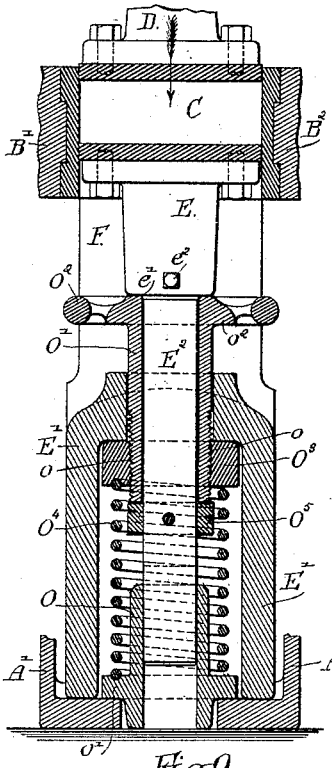


Fig. 8.

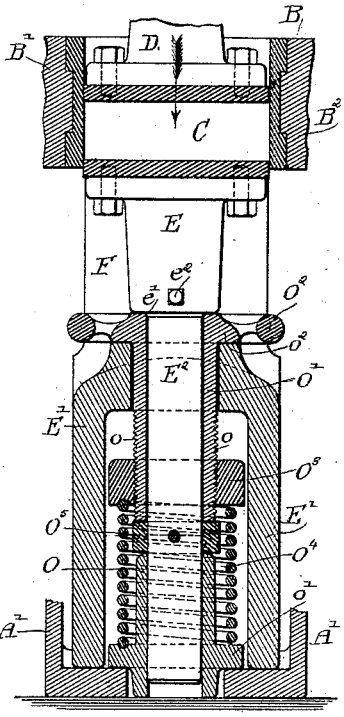


Fig. 9.

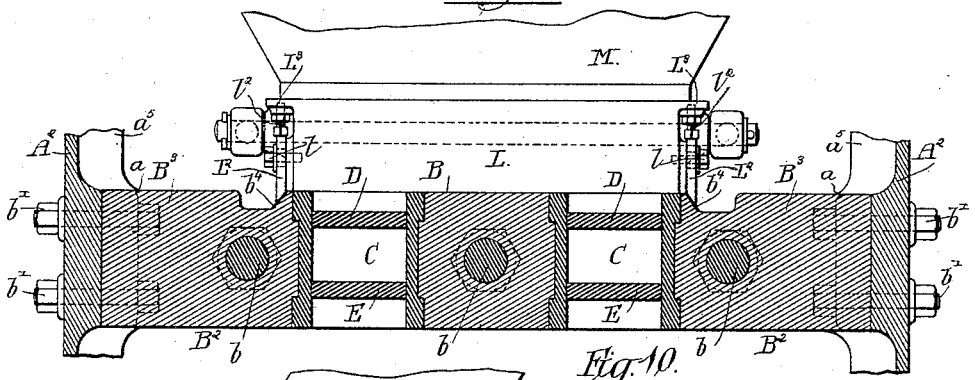
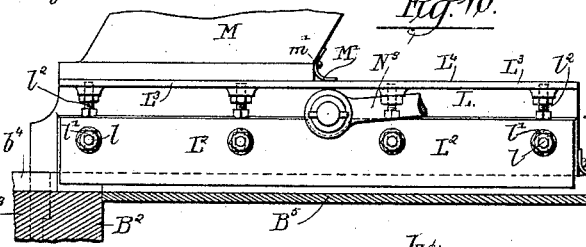


Fig. 10.



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BRICK MACHINE.

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Fig. 11.

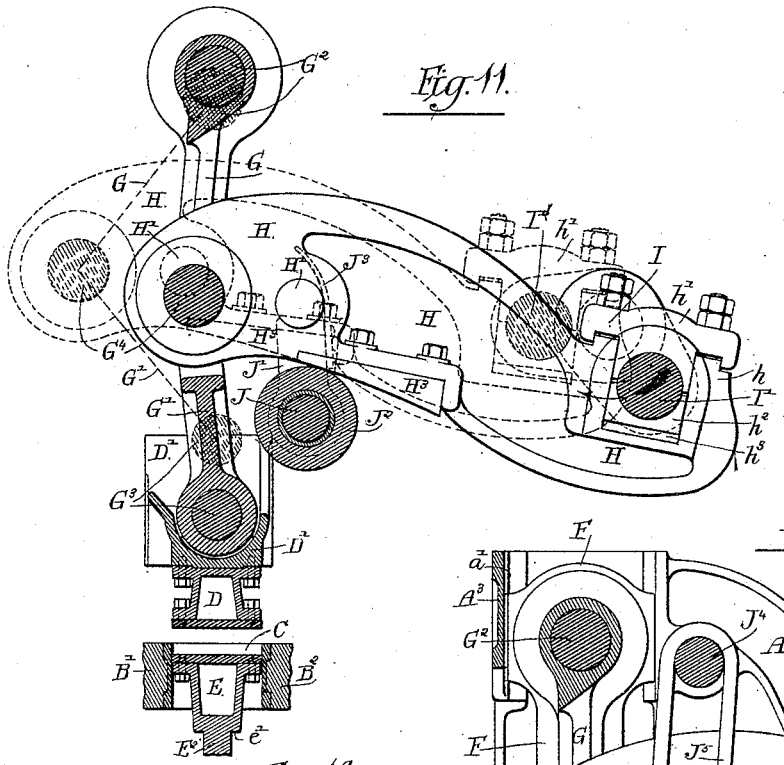


Fig. 13.

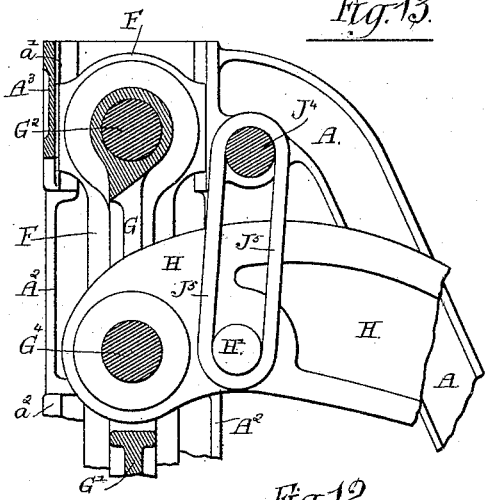


Fig. 14.

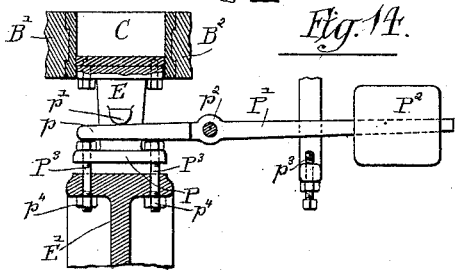
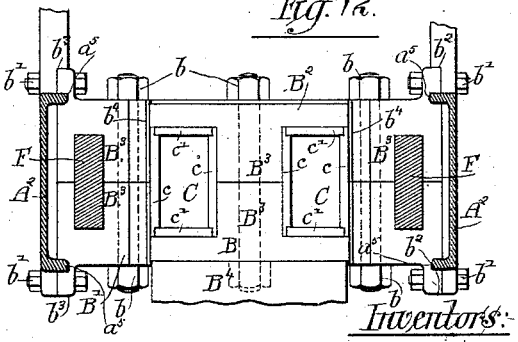


Fig. 12.



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(No Model.) 5 Sheets—Sheet 5.

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BRICK MACHINE.

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Fig. 15.

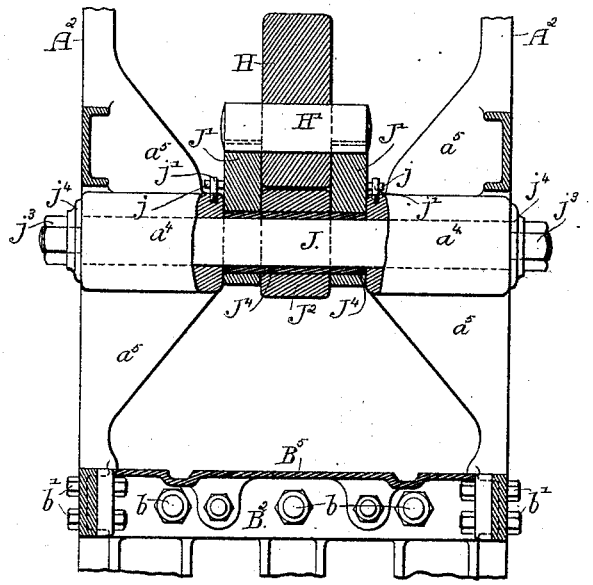
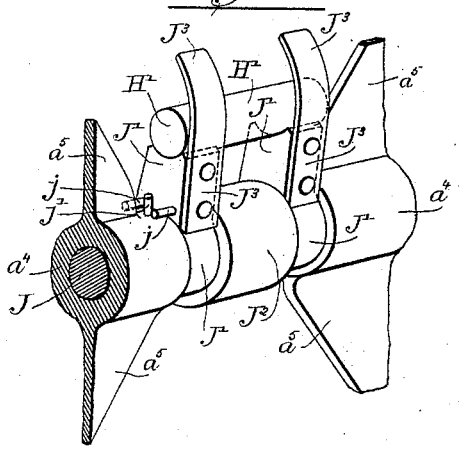


Fig. 16.



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UNITED STATES PATENT OFFICE.

BRUCE CLARK WHITE AND JAMES A. BOYD, OF CHICAGO, ILLINOIS, ASSIGNORS TO CHISHOLM, BOYD & WHITE, OF SAME PLACE.

BRICK-MACHINE.

SPECIFICATION forming part of Letters Patent No. 418,099, dated December 24, 1889.

Application filed April 10, 1888. Serial No. 270,210. (No model.)

To all whom it may concern:

Be it known that we, BRUCE CLARK WHITE and JAMES A. BOYD, both, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Brick-Machines; and we do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to that class of machines for making brick in which the clay to form the bricks is fed automatically to a mold or molds, and is compressed therein by means of two opposing plungers, which are moved toward and from each other for compressing the brick, and which are also moved within the mold in such manner as to accomplish the discharge of the finished brick therefrom.

The invention embraces improvements in machines of the character described in several particulars, as will be hereinafter fully described, and pointed out in the appended claims.

In the accompanying drawings, illustrating our invention, Figure 1 is a front elevation of a machine embodying the invention. Fig 2 is a rear elevation of the same. Fig. 3 is a vertical section taken upon line 3 3 of Fig. 1. Fig. 4 is a detail section taken upon line 4 4 of Fig. 3. Fig. 5 is a detail section taken upon line 5 5 of Fig. 3. Figs. 6, 7, and 8 are detail sections illustrating the means for supporting and actuating the lower plunger, showing different positions of the latter. Fig. 9 is a vertical section taken upon line 9 9 of Fig. 3, showing the feed-box in elevation. Fig. 10 is a detail side view of the feed-box and its guides. Fig. 11 is a diagram illustrating different changed positions of the devices by which the plungers are actuated. Fig. 12 is a detail plan section of the mold-table, taken upon line 12 12 of Fig. 3. Fig. 13 illustrates a modified construction in the fulcrum for the beam H. Fig. 14 illustrates a weight employed in place of a spring to lift the lower plunger. Fig. 15 is a detail section taken upon line 17 17 of Fig. 3. Fig. 16 is a perspective view of certain of the parts shown in Fig. 15.

The main frame of the machine herein illustrated as embodying our invention consists of two heavy vertical frame-plates A A, arranged parallel with each other at opposite sides of the machine and attached to a massive base A′, which connects the said frame-plates at the bottom of the machine. The said frame-plates A A embrace two vertical standards A^2 A^2, affording bearings for the vertically-movable parts of the machine, and said frame-plates are connected with each other at the top of the frame by a horizontal cross-girt A^3.

B is a mold-table, which is located at a convenient distance above the base A′, and is arranged horizontally between and bolted at its ends to the vertical standards A^2 A^2 of the frame. Within the said mold-table are located the molds C C, of which the machine shown is provided with two. Said mold-table is herein shown as comprising two separate castings B′ B^2, Figs. 3 and 12, located in front and rear of the molds, which latter are formed by means of inwardly-projecting parts B^3 B^3, cast upon the front and rear portions B′ B^2 of the table, meeting at the center line of the table. The castings B′ B^2 are held together by means of horizontal bolts *b b*, passing through said castings between the molds and at the ends of the castings in the manner shown. The castings B′ B^2 are secured to the frame-standards A^2 A^2 by means of horizontal bolts *b′ b′*, inserted through wings b^2 b^3 at the ends of the castings B′ B^2 and through the said standards. Said parts B′ B^2 of the mold-table, for the purpose of giving a rigid and unyielding support to the said table, and to prevent the same from springing or yielding in its center under the heavy strain incident to pressing the brick, are provided with vertical webs B^6 B^7, which extend downwardly to and rest or bear throughout their full length upon the frame-base A′. The said webs are desirably extended to and fitted at their side edges against the frame-standards A^2 A^2 and provided with horizontal flanges at their lower edges, through which flanges and the base are inserted bolts b^6, affording

a rigid connection between the parts. The webs B^6 B^7, bolted to the frame-base in the manner shown, serve to transmit to said base a part of the strain coming upon the table, and at the same time hold the adjacent parts rigidly and strongly from either lateral or vertical displacement when the machine is in action. Said webs B^6 B^7 are provided with openings at points beneath the molds, in the manner shown, to afford access to the lower plungers for supplying steam thereto and for reaching the adjusting devices connected therewith, which are hereinafter described.

To afford a strong connection between the mold-table and the frame-standards A^2, the latter are provided with notches or mortises a a at their inner faces, within which notches or mortises the ends of the castings B' B^2 are inserted, and within which they are held by means of the bolts b' b'. The castings B' B^2, in the particular construction shown, form the parts of the mold-table immediately adjacent to the molds. Horizontal extensions of said table at the front and rear of the molds, for the purpose of supporting the feeding devices for the clay and the finished bricks, are formed by a horizontal plate B^4 at the front of the molds, which plate is bolted to the casting B' in the manner shown, and by a second horizontal plate B^5, which is located at the rear of the casting B^2 and is sustained at its front edge by resting upon the said casting B^2, which latter is provided with a recess or rabbet to receive it, and at its rear end by attachment at its side edges to the horizontal girts A^3 A^3, Fig. 3, forming parts of the frame-plates, the particular attaching device shown consisting of inwardly-projecting lugs upon the girts, to which the said plate B^5 is bolted at its rear corners, in the manner illustrated.

D D are a series of plungers constructed to enter and slide in the upper parts of the molds C C, said plungers being attached to a horizontal cross-head D', located above the mold-table B.

E E are lower plungers constructed to slide in the molds C C, and supported by a single rigid cross-head E', located beneath said mold-table.

F F are two heavy vertical bars, which are mounted in guide-surfaces a' a', formed in the inner faces of the frame-standards A^2 A^2, engaging corresponding guide-surfaces upon the bars. Said bars extend from a point near the bottom of the machine, through the ends of the mold-table B, to points near the upper ends of the frame-standards A^2 A^2. The bars are held or guided at two points only, one at the top of the frame-standards and the other just above the mold-table, the guide-surfaces a' a' being relatively short and located at these places only. At their parts below the mold-table the slide-bars are free from the standards and are without guides, any bearing-surfaces at these points being undesirable from the fact that the clay and dirt which falls from the mold-table is liable to cover or enter between the surfaces in contact in case any guides are present. At their lower ends the said bars F F are provided with inwardly-extending projections f f, entering notches or rabbets e e in the ends of the cross-head E', the bars being attached to the cross-head by means of bolts passing through the said bars and engaging the cross-head. The slide-bars are held in place at the middle guides by means of detachable parts a^2 a^2, which are bolted to the front edges of the frame-standards and form the front walls of the guideways. At the top of the frame the slide-bars are held in place by the cross-girt A^3, which is secured at its ends to the frame-standards in such manner that its inner face forms the bearings for the edges of the slide-bars. The upper cross-head D' has bearings at its ends against and is vertically-guided both by the slide-bars and by the surfaces a' a'. As more clearly shown in Fig. 5, the end surfaces of the said cross-head are fitted to slide against the inner faces of the slide-bars, while said cross-head is provided near its front face with two vertical flanges d d, which extend past or overlap and bear against the front edges of the said slide-bars.

G G' are toggle-arms, which are pivoted, respectively, to the upper ends of the slide-bars F F and to the upper cross-head D'. The upper end of the upper toggle-arm G is desirably made the full width of the space between the slide-bars F F, as clearly shown in Figs. 1 and 2, and said toggle-arm is pivotally connected with the said slide-bars by means of a heavy pivot-pin G^2, fixed at its ends in the slide-bars and extending through a long bearing-aperture in the toggle-arm. The lower toggle-arm G' is constructed to enter a recess in the upper surface of the cross-head D', and is pivotally connected with the latter by means of a pivot-pin G^3, inserted through bearing-apertures in opposite ends of said cross-head and in the lower end of said toggle-arm.

The toggle-arms G G' are pivotally connected with each other by means of a heavy pin G^4, inserted through the overlapping forked ends of said toggle-arms, said pin being also adapted to engage a heavy beam H, by which power is applied to the toggle-arms. Said beam engages the center of the pin G^4, and the toggle-arms are centrally recessed to afford space for the entrance of the end of said beam between their parts in bearing with the pin, in the manner illustrated in the drawings.

I is a heavy crank-shaft mounted in bearings a^3 a^3 in the frame-plates A A, said crank-shaft being located approximately in the same horizontal plane with the pivot-pin G^4 and some distance to the rear of the toggle-arms. Said crank-shaft is provided with a heavy crank-pin I', with which the beam H is engaged. The said crank-shaft I is so disposed with relation to the toggle-arms G G'

that in the rotation of said shaft said toggle-arms will be alternately straightened out and flexed by the action of the crank and beam. Said parts are so disposed, furthermore, that the toggle-arms will be straightened out or brought into alignment with each other at the time the crank-pin is at the extreme limit of its throw away from the toggle-arms.

The beam H is herein shown as provided with a bearing h, engaged with the crank-pin I', which bearing is provided with an adjustable cap h', located at the top of the beam, the end of the beam being extended beneath the crank-pin and made heavy and strong at this point in the manner illustrated. Beneath the crank-pin is desirably placed an adjustable bearing-block h^2, beneath which may be placed a thicker or thinner plate or shim h^3 or other adjusting device by which the block may be adjusted vertically toward or from the beam. The adjustment of the block h^2 obviously changes the vertical position of the end of the beam engaged with the crank-pin, and also with that engaged with the toggle-arms, so that a means is thus provided for adjusting the vertical positions of the plungers, the vertical movement of which latter is controlled by said beam in a manner hereinafter more particularly pointed out. The action of the toggle in forcing the plungers toward each other obviously tends to thrust both the upper ends of the slide-bars and the upper cross-head horizontally toward the rear. By reason of the presence of the flanges d d of the said cross-head in bearing against the front edges of the slide-bars, however, such horizontal component of the oblique pressure of the toggle-arms is taken by the upper and middle parts of the slide-bars, instead of coming partially on the bars and partially on the frame-standards through the cross-head.

J is a pin or shaft mounted horizontally in the frame-plates A A beneath the beam H, and having its ends secured in two hubs a^4 a^4 upon the frame-plates. Upon said shaft are mounted two vertically-arranged oscillating arms J' J', which are made concave upon their upper ends, and are adapted to engage the ends of a heavy pin H', which is secured in the beam H between its ends, and preferably nearer that end of the beam engaged with the toggles G G'.

J^2 is a roller mounted upon the shaft J between the arms J' J', and adapted to engage the lower surface or edge of the said beam H. we have shown in the accompanying drawings the said beam H as provided in its lower surface with a separate cam-block H^3, bolted to that part of the beam which comes in contact with the roller J^2, the purpose of said block being to take the wear from the edge of the beam. Said cam-block will commonly be made of harder metal than the beam, and it may be removed and replaced by a new one when worn to such an extent as to interfere with the accurate movements of the parts.

J^3 J^3 are arms or prongs attached to the said arms J' J' and extending upwardly at the rear of the pin H', and j j, Figs. 15 and 16, are two stops upon the arms J', adapted to engage a pin or lug j' upon the hub a^4 of the frame. The stops j j limit the forward and backward oscillating movement of the arms J' J', while the prongs J^3 J^3 serve by engagement with the pin H' to insure the throwing of said arms backwardly or to the rearward limit of their movement and in position for engagement with the said pin H' after the latter has been moved so as to become disengaged from the arms, in the manner hereinafter set forth. The rocking arms J' J' and the roller J^2 engage the beam H as the latter is moved in the turning of the crank-shaft, and serve as fulcrums or points of support for the beam, so that the latter operates as it is moved by the crank-shaft to raise and lower the toggle-arms, the slide-bars, the upper and lower cross-heads, and plungers. A vertical movement is thus given to the upper and lower plungers for discharging the brick from the mold and for moving the brick within the mold to smooth and polish the edges of the brick during the compression of the same, and to enable the clay to be fed to the molds, as will hereinafter more fully appear. The parts thus arranged to form a fulcrum for the beam H are liable to be subjected to a very heavy strain in lifting the plungers within the molds at the time the compression of the brick is taking place, and in order to give suitable strength and rigidity to the frame and to transmit a part of the strain directly to the mold-table vertical inwardly-extending flanges a^5 a^5 are cast upon the frame-standards in position to extend from the hubs a^4 a^4 downwardly to points above the table. The said hubs are desirably extended inwardly from the frame-plates, and the flanges a^5 a^5 are arranged to sustain the inner ends of said hubs, as well as to give rigidity to the frame, Figs. 15 and 16.

As an additional and further means of giving rigidity to the frame to withstand the downward strain brought upon the pin J in lifting the plungers in the mold, we place a sleeve J^4 about the pin J, between the hubs a^4 a^4 of the frame, the ends of said sleeve being placed in contact with the inner ends of the hub, and we extend the ends of said pin outside of the frame-plates and place upon the ends thereof nuts j^3 j^3 in bearing against washers j^4 j^4, which overlap the adjacent outer surfaces of the frame-plates. It is entirely obvious that when a heavy downward strain is brought upon the middle of the pin J the effect will be to depress the middle part of the pin, thereby drawing together the hubs. The presence of the sleeve J^4 between the hubs will obviously prevent any springing of the side plates under a strain of the character described. Said sleeve furthermore gives additional stiffness to the pin between the

hubs, and also affords a bearing-surface to the arms J^3 and roller J^2, so that the wear of the same will not come directly upon the pin, but comes upon the said sleeve, which latter may be easily and cheaply renewed in case its surface becomes too much worn for further use.

K is a heavy drive-wheel affixed to the shaft I outside of the frame-plate A. Said drive-wheel is provided with peripheral cogs, which engage a pinion K′, mounted upon a stud K^2, located at the rear part of the frame, said stud having upon it a belt-pulley K^3, over which may be placed a driving-belt for transmitting power to the machine.

L is a sliding feed-box, which rests and slides upon the top of the mold-table B^5 at the rear side of the molds. Said feed-box consists of a horizontal plate or casting provided at its end adjacent to the molds with rectangular openings L′ L′, corresponding in horizontal dimensions and in number with the molds C C. The openings L′ L′ are closed at their bottoms by the mold-table, upon which the feed-box rests, except when the feed-box is moved forward to bring said openings over the molds. Upon the surface of the mold-table, at either side of the feed-box, are formed two outwardly and downwardly inclined or beveled surfaces b^4 b^4, the upper edges of which are in vertical alignment with the outer surfaces of the side walls of the feed-box. The mold-table is herein shown as provided with grooves or depressions exterior to said beveled surfaces b^4 b^4; but said table may be otherwise constructed to afford said beveled surfaces, as may be found convenient or desirable. The space between said beveled surfaces, however, forms in effect a flat surface elevated above the adjacent parts of the mold-table. The said beveled surfaces b^4 b^4 are extended from the rear end of the mold-table to a point somewhat forward of the front edges of the molds.

At each side of the feed-box is located a vertical plate L^2, the lower edge of which is beveled and fits against the beveled surface b^4 of the table. Said plates L^2 are made vertically adjustable upon the feed-box, and for this purpose are herein shown as attached to the sides of the box by means of bolts l, passing through vertical slots l' in the plates.

As a means of more positively holding the plates L^2 from vertical movement, and for more accurately adjusting the same, vertically-arranged set-screws l^2, having squared heads, are inserted in overhanging flanges L^3 at the upper edges of the feed-box, in such position as to bear at their lower ends against the upper edges of the plates L^2 L^2. By adjusting said set-screws l^2 l^2 up and down the plates L^2 may be made to bear with greater or less pressure upon the oblique bearing-surfaces b^4 b^4, as may be found convenient or desirable. In practice the said plates L^2 L^2 will be forced downwardly to such an extent as to lift the feed-box very slightly above its seat, so that the weight of the box will come upon the said plates and the oblique bearing-surfaces.

In the use of a feed-box resting upon the horizontal top surface of the feed-table it is found almost impossible to retain the feed-box in bearing contact with the table, owing to the accumulation of clay between the bearing-surfaces, which clay firmly adheres thereto, and as it accumulates gradually raises the feed-box from its natural position.

In the use of beveled surfaces such as are here illustrated any clay getting between the oblique bearing-surfaces and the edges of the plates L^2 L^2 will be scraped or rubbed from the bearing-surfaces by the latter, and will fall or slide downwardly away from the upper part of said oblique bearing-surfaces, so that the latter will always remain clear and in condition to allow the smooth and accurate action of the feed-box.

M is a stationary feed-hopper located over the sliding feed-box L at a point adjacent to the upper plungers D. Said hopper is herein shown as sustained by means of lugs m m upon the sides of the hopper, which are bolted to the vertical flanges a^5 a^5 of the frame-standards A^2 A^2. Said hopper is fitted closely at its lower edges to the horizontal top surface of the feed-box in a manner heretofore common. Said feed-box L has a horizontal reciprocatory motion through a distance sufficient to carry the openings L′ L′ over the molds C C and under the feed-hopper. When beneath the hopper, the feed-box receives material from the same, and such material is discharged into the molds when the feed-box is moved forward.

At the rear of the receptacle L′ L′ the feed-box is provided with a smooth horizontal top surface L^4, Figs. 3 and 10, which extends the full width of the feed-box and is somewhat longer than the distance through which the latter travels in operation. Said surface L^4 is for the purpose of supporting material within the hopper during the time the feed-box is being moved forwardly to carry the clay to the molds.

For the purpose of keeping clean the top surface L^4 of said feed-box we attach to the rear margin of the hopper M a scraper M′, consisting of a strip of thin flexible sheet metal secured to the vertical face of the hopper by screws m' m', or otherwise, and bearing at an angle at its free edge against the top surface of the feed-box. A scraper thus arranged acts with a constant pressure, and will tend to remain sharp by reason of the wearing away of its edge in contact with the surface of the feed-box. We have shown a similar scraper L^5 as applied to the rear edge of the feed-box, and as bearing upon the top surface of the mold-table for the purpose of keeping the latter clean. Said scraper L^5 is shown as attached to the feed-box by means of screws l^5 l^5 in the same manner as before described in connection with the scraper M′.

Means are provided for giving reciproca-

tory motion to the feed-box in the machine, illustrated as follows: N is a rock-shaft mounted at its ends in the frame-plates A A and provided with an upwardly-extending arm N′, which engages a cam K^4 upon the drive-wheel K, and with two depending arms N^2 N^2, which are connected by pitmen N^3 N^3 with the opposite sides of the feed-box, in the manner clearly shown in the drawings, Figs. 2 and 3. The cam K^4 is a grooved cam adapted to engage a roller *n* upon the arm N′, and is so shaped as to advance the feed-box over the molds at the time the upper plunger is lifted above the same, as will hereinafter more fully appear.

The operation of the main parts of the machine, constructed as above described is as follows: The clay is fed to the hopper M through tubes M^2, preferably in a slightly moist and pulverulent condition. The clay from within the said hopper fills the recesses of the feed-box when the latter is at the rearward limit of its movement, and is carried forward by said feed-box and deposited in the molds. At the time the feed-box moves forward to fill the molds the upper plungers are lifted to a point above the top surface of the feed-box, so as to allow the latter to pass beneath said plungers. After the clay has been deposited in the molds the feed-box is retracted by the action of the cam K^4, and the plungers D and E are then brought toward each other within the molds for compressing the brick. The compression of the brick is produced solely by the action of the toggle-arms operating through the medium of the slide-bars F F and the upper and lower cross-heads D′ and E′. The vertical position of the plungers within the molds at the time of compressing the brick is, however, determined by the action of the beam H, rocking arms J′ J′, and roller J^2, the weight of the cross-heads, toggle-arms, and connected parts being sustained by the said beam, rocking arms, and roller during this operation. We have so constructed the said parts in the particular machine shown that the greatest compression of the brick takes place at or near the middle of the molds and during the time both sets of plungers are moving upwardly therein. After the brick has been compressed the plungers D and E are separated by the reverse movement of the toggle-arms, while the lower plunger is lifted by the action of the beam, the crank, and rocking-arms, so as to force the finished brick upwardly out of the molds. The compressed brick are thrust from their position upon the tops of the lower plungers by the action of the forward edge or end surface of the feed-box as it advances to fill the molds, such advance movement of the feed-box for this purpose being timed to take place before the lower plungers descend. A brick having a much more uniformly smooth surface at its side edges and ends is produced when the clay is moved bodily within the mold during the time that compression is taking place, it being a well-known fact that if the clay remains stationary and the plungers advance at equal speed toward each other the brick will have a rough or granulated appearance at a line along the middle of the edge and end of the brick. We have so constructed the parts of the machine shown, therefore, that the plungers are moved within the mold during the process of compression, so that the clay at the edges of the brick is carried along the side walls of the mold, which act thereon with a smoothing or slicking action. To produce a movement of the plungers in the manner stated, we so arrange the actuating devices that the upper plunger first moves downwardly from its position when the mold is filled with clay until it enters the mold, so that the clay is brought under considerable pressure before the beginning of the upward movement of both plungers and subjected to the greatest pressure while both plungers are moving upwardly through the molds. It follows from this mode of operation of the parts that the clay which is to form the side edges and ends of the brick is moved bodily upward along the side walls of the mold during the entire time that compression is taking place, with the result of smoothing the surface of the brick, in the manner above stated. It has been proposed heretofore to give vertical movement to the plungers of a brick-machine by means of connecting rods or beams connecting the toggles with a crank-shaft, which connecting rods or beams are arranged to bear upon rollers forming fulcrums by which the lifting is accomplished. We have found, however, that the power required to move the plungers within the mold at the time the brick is under compression is very great, and in the use of roller-fulcrums such as are above described the strain upon the beam and rollers is so great as to produce much friction and cause rapid wearing away of the rollers and of the surface of the beam in bearing therewith. The rocking arms J′ are intended to take from the roller J^2 the pressure of the beam at the time when the brick is being subjected to pressure, the said arms J′ being made of such length as to sustain the beam clear of the roller J^2 during the time mentioned. After the plungers have separated to release the pressure upon the brick, however, the upward bodily movement of the plungers and connected parts for the full discharge of the brick may be accomplished by engagement of the roller J^2 with the beam. The arms J′, or equivalent depending arms or links, hereinafter described, may be so arranged as to engage and sustain the beam H through a greater or less portion of its horizontal movement, as desired, and in some instances it may be found convenient to dispense with the roller J^2 and produce the required vertical movement of the plungers and connected parts solely by the action of the rocking arm or link. A construction of this lat-

ter kind is illustrated in connection with a suspended link in Fig. 13 of the drawings.

The operation of the beam, rocking arms, and roller in lifting the plungers may be more readily understood by reference to Figs. 3 and 11. In Fig. 3 the parts are shown with the plungers at the point of greatest compression and moving upwardly, the beam H being at the farthest limit of its throw away from the toggles and the toggle-arms in alignment with each other. The downward movement of the crank-pin I′, as indicated by the arrow in Fig. 3, is obviously acting to lift the toggles, plungers, and connected parts, the beam at this time being supported by the engagement of the pin H′ with the rocking arms J′. By reason of the pressure upon the brick the plungers can be moved upwardly at this time only by the exertion of a considerable degree of force; but a sufficient amount of power is clearly provided for by the leverage exerted by the beam H as the latter is turned about the pivot H′, while the heavy downward pressure of the beam is transmitted to the frame through the medium of the rocking arms J′ and shaft J. The required rigidity in the frame to sustain the strain upon the parts at this time is further provided for by means of the vertical ribs a^5 a^5, which extend from the hubs a^4 a^4, supporting the rock-shaft J, downwardly to the mold-table B, in the manner hereinbefore stated. As the movements of the parts are continued past the position shown in Fig. 3, the upper and lower plungers will be lifted by the upward movement of the end of the beam engaging the toggles, while at the same time said plungers will be separated under the horizontal movement of the beam in a direction to flex said toggles, the position of the parts when the crank-arm has moved through about sixty degrees from its horizontal position being shown in full lines in Fig. 11. At this time the plungers will have been considerably elevated and the lower plunger will be near the top of the mold, while the roller J^2 has come in contact with the lower surface of the beam and the pin H′ is about to leave or become disengaged from the rocking arms J′. After the parts have passed the position shown in full lines in Fig. 11 there will be comparatively little resistance to the upward movement of the plungers, excepting that due to the weight of the parts. The position of the said parts when the beam H is at the extreme limit of its throw toward the toggles is shown in dotted lines in Fig. 11, the toggles in this position of the parts being flexed to the greatest extent and the upper plunger lifted sufficiently above the mold-table to allow the passage beneath it of the feed-box. The lower plungers must necessarily remain for some time at the level of the top of the mold-table in order to allow the finished brick to be thrust therefrom, and inasmuch as the position of said lower plungers during this time will be determined by the action of the roller J^2 upon the lower surface of the beam H said lower surface of the beam is accurately shaped to give such motion to the outer end of the beam as will sustain the lower plunger immovable with its top surface flush with the top of the mold-table for a required time. In case the lower plungers are supported by springs or yielding supports, in the manner hereinafter described, however, such accurate formation of the lower edge of the beam will not be necessary. As will readily be seen from the dotted lines in Fig. 11, the pin H′ of the beam leaves the rocking arms J′ J′ and moves away from the same when the beam is sustained upon the roller J^2, so that the prong J^3, applied to the arm J′ in the manner before described, will at this time act to throw said arms J′ backwardly to the position illustrated in Fig. 3. During the rearward or return stroke of the beam H, by which the compression of the brick is effected, the end of said beam which is engaged with the crank-pin I′ will be elevated above the crank-shaft, while the weight of the upper and lower cross-heads and plungers, together with the slide-bars and toggles, will be sustained by engagement of the lower cross-head E with the frame or a stop thereon. In such backward movement of the beam, therefore, the latter will be sustained by the lower cross-head, slide-bars, and toggles at one end, and by the crank-pin at its opposite end, in such position that the beam will remain disengaged from the roller J^2 and rocking arms J′. As the crank-pin descends into the position shown in Fig. 3, at the backward limit of the throw of the beam, however, the pin H′ will engage the rocking arms J′ J′ before the beam reaches its horizontal position, so that the beam will begin to act to raise the lower plunger shortly before the point of greatest compression is reached. The brick thus undergoes compression while it is moving upwardly in the mold, as hereinbefore stated. It is to be understood, however, that the point of compression may be reached before the lower plunger begins to move upwardly from the bottom of the mold, or after it has moved upwardly some distance therein, the point at which the greatest compression is reached obviously depending upon the length of the beam H and the relative location of the several pivotal connections between the parts.

In Fig. 13 we have illustrated a construction hereinbefore referred to, in which depending pivoted arms or links are used in place of the rocking arms J′ J′. In this instance J^4 is a heavy shaft or pin supported in the frame-plates A at opposite sides of the machine and extending over the beam H. J^5 J^5 are heavy depending pivoted arms or links engaged with the said shaft or pin J^4 and with the pin H′ of the beam H. Said links J^5 J^5 obviously afford a moving or swinging fulcrum for the beam H as the latter is moved longitudinally for actuating the toggles. The said links are

shown as arranged to sustain the beam throughout the entire length of its throw. When this construction is used, however, it will commonly be necessary to provide a movable connection between the lower plungers and the parts by which they are directly actuated—such, for instance, as that hereinafter described—so that said lower plungers may remain flush with the mold-table during the time that the bricks are being moved therefrom. In some instances, however, the pivotal connections of the links may be so disposed as to give such motion to the parts that the lower plungers will be sustained therefrom at the level of the mold-table a sufficient length of time to allow the bricks to be removed.

The machine shown in the drawings embraces, as a separate and further improvement, certain novel features of construction in the means connecting the lower plungers with the parts by which the same are actuated, as follows: The said lower plungers E, instead of being positively or rigidly attached to the lower cross-head E′, are vertically movable with relation to said lower cross-head, and said plungers are sustained from the ground or from the frame of the machine independently of the cross-head by means of a spring or springs or counterbalance weight or weights, so that said lower plungers may in certain positions of the lower cross-head be adjusted vertically within the mold independently of the cross-head, the said plungers, however, being provided with surfaces or shoulders adapted to engage the cross-head at certain points of its movement, so that the plungers will be forcibly and positively lifted in the compression of the brick. In the specific form of these parts shown in Figs. 1, 3, 6, 7, and 8 the plungers E are provided with vertical depending stems E^2, which pass through centrally-arranged apertures in the upper part of the cross-head E′, which, in this instance, is made hollow or of inverted-U shape in cross-section. At its lower end the stem E^2 is held and guided in a vertical tubular guide O, attached to and supported upon the frame-base A′. At a short distance below the plunger proper the stem E^2 is provided with a shoulder e'. Around the upper part of the said stem E^2 and below the shoulder e' is placed a sleeve O′, provided at its top with a hand-wheel O^2 and at its lower part with screw-threads o. Upon the screw-threaded lower end of the sleeve is placed a ring or collar O^3, which is held from turning with the sleeve by flat faces upon the collar engaging the side walls of the cross-head.

O^4 is a spiral spring placed around the stem E^2, bearing at its upper end against the under surface of the collar O^3 and at its lower end against a stationary surface or shoulder, herein shown as formed upon a flange o' of the tubular guide O. At its upper end the sleeve O′ is provided with an outwardly-extending flange or collar o^2, constructed to engage the top surface of the cross-head E′.

O^5 is a ring or collar rigidly attached to the stem E^2, in contact with the lower end of the sleeve O′. These parts are so arranged that the lower plunger may either be sustained by engagement of the shoulder e' with the top of the sleeve at the time when the flange o^2 rests upon the top of the cross-head, as illustrated in Figs. 3 and 6, or by means of the spring O^4 at the time when the cross-head is free from the said flange o^2, as illustrated in Fig. 7. The said spring O^4 is of such strength that it will sustain the plunger and the sleeve at times when there is no pressure upon the plunger, and the parts are so disposed that when the cross-head is at the lower limit of its movement said cross-head will be free from the flange o^2, and the lower plunger will be held up by the spring, so as to bring the collar O^3 in contact with the under surface of the cross-head, whereby the position of the plunger within the mold at the time of filling the same is positively determined. It follows that when the lower cross-head is at the lowermost limit of its movement the lower plunger will stand above the bottom of the mold, and will be supported in such position by the spring, and the purpose of the screw-connection between the sleeve O′ and the collar O^3, which immediately engages the spring, is to enable the said sleeve to be vertically adjusted in the collar for the purpose of adjusting the vertical position of the plunger within the mold at the time of filling the same. Such position of the plunger obviously determines the amount of clay which is fed to the mold by the feed-box. It follows that by turning the said sleeve at a time when the lower cross-head is depressed the lower plunger may be adjusted in the mold to give any quantity of clay, as found desirable or necessary, for making bricks of suitable size, according to the quantity and condition of the clay and other circumstances. The accurate adjustment of the lower plunger will obviously be independent of the tension of the spring, inasmuch as the spring will be compressed to a considerable extent at the time the lower cross-head is at the lower limit of its movement and in bearing against the collar O^3, as clearly shown in Fig. 7. When the upper plunger descends into the mold after the latter has been filled with clay, the approach of the upper plunger toward the lower plunger will cause the said lower plunger to recede, the same being sustained at this time solely by the spring O^4. The position of the parts after the upper plunger has entered the mold is clearly shown in Fig. 7. In the downward movement of the upper plunger the clay will of course be compacted to a greater or less extent, owing to the tension of the spring. The downward movement of the lower plunger as the upper plunger descends will continue until the shoulder e'

strikes the sleeve O′, when said plunger will come to a firm and unyielding bearing on the lower cross-head, and its further downward movement will be arrested. The plunger is desirably arranged to stop at a point near the bottom of the mold, as clearly shown in Fig. 8. The collar O^5 serves to prevent the descent of the sleeve O′ without the plunger and stem in case the plunger sticks in the upper part of the mold. The upward movement of the lower cross-head for the purpose of compressing the brick will preferably begin at about the time the said lower plunger has come to bearing upon the lower cross-head, the time at which the plungers begin their upward movement obviously depending, in the machine illustrated, upon the location of the rocking arms J′ and the pin H′ of the beam H, as hereinbefore described. The lower plunger will obviously be lifted so as to bring its upper surface flush with the top of the mold-table by the action of the lower cross-head, and the spring O^4 may be of such length that the collar O^3 will be lifted free from the spring at this time. In case this construction is used, or in case the spring, while of sufficient length to remain in engagement with the collar O^3, is too weak to sustain the weight of the upper plunger when the latter is at the upward limit of its movement, the movement of the lower cross-head must be so controlled by the shape of the lower edge of the beam H, or otherwise, that the said lower plunger will be held immovable in the upper part of the mold while the brick is being removed therefrom. Desirably, however, the spring O^4 is made of sufficient strength to sustain the lower plunger when the latter is at the upward limit of its movement, and in such case a stop e^2 is placed on the stem E^2 below the mold-table and above the shoulder e' in such position as to engage the lower surface of the table or other stationary stop or projection upon the frame when the lower plunger is flush with the top surface of the table. Such stop is obviously necessary in order to prevent the spring from throwing the lower plunger above the surface of the table, the collar O^3 at the time the lower cross-head is elevated obviously being free from the same, so as to present no obstacle to the further upward movement of the lower plunger, as will be clearly seen from an inspection of Fig. 6. When the spring is arranged to support the lower plunger level with the top of the table and a stop is employed to hold the plunger in this position, it is obviously not essential that the lower cross-head should remain immovable at the upward limit of its movement for any considerable length of time, or even that the said cross-head should lift the lower plunger the full length of its throw, inasmuch as the spring and stop will sustain the lower plunger at the upward limit of its movement while the brick is being removed from the plunger, even though the lower cross-head begins immediately to descend, and the spring may be of sufficient strength to lift the lower plunger and the brick after the brick has been pushed nearly out of the mold. It follows that by the use of the spring and stop constructed to sustain the lower plunger at the top of the molds any special construction in the actuating devices of the machine for holding the lower plungers immovable—such, for instance, as the cam-surface upon the lower edge of the beam H, hereinbefore referred to—may be omitted. In the use of a spring and stop thus arranged, therefore, depending pivoted arms or links J^4 J^4 may be employed as the sole means of sustaining the toggle-actuating beam H, and the roller J^2 may be dispensed with, as hereinbefore described in connection with Fig. 13 of the drawings. The employment of a spring or its equivalent and a stop arranged to support the lower plunger or plungers in the manner above stated is therefore of great importance in a machine of the character herein shown, for the reason that it renders unnecessary a careful construction and adjustment of the parts to give the exact movement and dwell required for the lower plungers, while at the same time the life of the machine is increased, inasmuch as the wearing of the parts or bearing-surfaces by which motion given to the lower plungers will not prevent the successful operation of the machine, as will obviously occur in cases where the position of the lower plungers with relation to the table depends solely upon the accuracy of the adjustment and form of the working parts—such, for instance, as the cam-surface of the beam H and the roller J^2.

One important advantage gained by the employment of a spring or yielding support for the lower plungers arises, however, from the fact that the said plungers are thereby rendered adjustable for the purpose of giving a large or small capacity to the molds without in any way interfering with or requiring any adjustment of the cross-heads by which said plungers are immediately actuated. In some machines as heretofore made the descent of the lower plungers has been limited by adjustable stops placed upon the frame in position to engage the lower cross-head. In such prior constructions it has been found difficult to accurately adjust the stops, as the stops become rapidly worn by the constant and forcible contact of the lower cross-head therewith, so that they can seldom be retained in adjustment for any considerable length of time. In a machine constructed as herein proposed, on the contrary, the vertical position of the lower cross-head when at the lowermost limit of its movement may be varied considerably without interfering with the proper operation of the parts, so that no accurately-adjusted stops are required to limit the downward motion of the lower cross-head, and elastic stops or cushions may be arranged to receive the impact of the said lower cross-head, if desired. In such prior

construction, furthermore, it is obviously impossible to provide for a vertical movement of both plungers first downwardly and then upwardly within the molds, as occurs in the operation of the machine described, it being entirely obvious that the upward movement of both plungers during the time compression is taking place, which movement begins when the lower plunger is at the bottom of the mold, is highly advantageous for smoothing the edges and ends of the brick, in the manner hereinbefore stated.

In carrying out that part of our invention which relates to the construction and actuation of the lower plungers, said plungers may obviously be supported by a yielding or adjustable support with the use of devices differing materially from the particular ones above described—as, for instance, it will be readily seen that a counterbalance-weight may be applied in place of the springs for lifting the lower plungers. A construction of this kind is shown in Fig. 14. In this instance the lower plunger E is immediately sustained by a standard P, the lower surface of which is adapted to rest upon the top of the cross-head E′. P′ is a horizontally-arranged lever having a forked end p, adapted for engagement with lugs or projections p' at opposite sides of the standard P. The said lever P′ is pivoted at p^2 to a suitable stationary support, and upon its end remote from the plunger is placed a weight P^2, of such size as to counterbalance the weight of the lower plunger and the parts immediately connected therewith. An adjustable stop p^3 may be employed to limit the downward movement of the lever, so as to arrest the lower plunger when it reaches the top of the mold. Vertically-arranged bolts P^3 P^3, inserted through the lower part of the standard P and through the cross-head E′, said bolts being provided at their ends with heads p^4, may be employed as a connection between the lower cross-head and plunger for the purpose of drawing the latter downwardly against the action of the weighted lever and for retaining the said plunger in position for the insertion of clay within the mold, as hereinbefore described. The springs or weights employed to lift the lower plungers obviously counterbalance to some extent the weight of the cross-heads and connecting parts, and at the same time aid in forcing the brick from the mold, thereby lessening the power required to be exerted by the actuating devices when the plungers are being lifted.

Referring to the construction shown in Figs. 3, 6, 7, and 8, the sleeve O′ is desirably fitted loosely about the stem E^2, so that said stem is not held from lateral movement by engagement with said sleeve, but is sustained and guided solely by engagement with the interior of the mold and with the tubular guide O. The sleeve O′ may also be desirably fitted somewhat loosely in the cross-head E′. By so constructing these parts that they do not bear laterally upon or against the stem E^2, we gain the advantage of making the movement of the lower plungers entirely independent of lateral movement or shifting of the cross-head. In other words, the lower plunger will remain perfectly true, and will move vertically within the mold and retain its horizontal position while in action, notwithstanding any lateral shifting or movement of the cross-head, which may take place by reason of the heavy strain thereon, or by reason of the slight wearing of the slide-bar guides or other parts, it being of course understood that the direct upward or downward pressure coming upon the horizontal engaging surfaces of the said stem of the sleeve O′ and the cross-head will have no tendency to move the plunger or stem laterally. By reason of the advantage gained by the particular construction set forth the features whereby the lower plunger is held in position independently of the lower cross-head, as above set forth, are herein claimed as part of our invention.

The machine herein illustrated is what is known as a "two-mold" machine; but the frame is made of such width as to allow the use of three or four molds and plungers in place of those illustrated.

Certain of the features of construction in the mold-table herein illustrated are shown and claimed in a separate application, Serial No. 295,159, filed in the Patent Office on the 2d day of January, 1889.

We claim as our invention—

1. The combination, with a mold and plungers working therein, of means for actuating the plungers, embracing toggle-arms connected with the opposite plungers, a crank-shaft, a beam connected with the said crank-shaft and with the middle joint of the toggle-arms, and a fulcrum for the beam movable with the latter in a direction endwise of the beam, substantially as described.

2. The combination, with a mold and plungers working therein, of means for actuating the plungers, embracing toggle-arms connected with the opposite plungers, a crank-shaft, a beam connected with the said crank-shaft and with the middle joint of the toggle-arms, and a fulcrum for supporting the beam pivoted at one end upon the frame and engaged at its free end with the said beam, substantially as described.

3. The combination, with a mold and upper and lower plungers working therein, of upper and lower cross-heads connected with the said plungers, vertical slide-bars attached to the lower cross-head, toggle-arms connected with the said slide-bars and the upper plunger, a crank-shaft, a beam connecting the middle joint of the toggle-arms with said crank-shaft, and an arm pivoted at one end to the frame and engaged at its opposite end with the said beam, substantially as described.

4. The combination, with a mold and plungers working therein, of means for actuating

the plungers, embracing toggle-arms connected with said plungers, a crank-shaft, a beam connected with the shaft and with the middle joint of the toggle-arms, a pivotally-supported fulcrum for supporting the beam engaging said beam, and a stationary roller located in position to act upon the lower edge of the beam, substantially as described.

5. The combination, with a mold and plungers sliding therein, of toggle-arms connected with said plungers, a crank-shaft, a beam connecting said crank-shaft with the middle joint of the toggle-arms, a pivotally-supported fulcrum engaging said beam, and a roller engaging the beam, said beam being provided with a separate cam-block attached to its lower edge in position for contact with the roller, substantially as described.

6. The combination, with the machine-frame, a mold, and plungers sliding therein, of toggle-arms connected with the said plungers, a crank-shaft, a beam connecting said crank-shaft with the middle joint of said toggle-arms, said beam being provided with a horizontal pin, a fulcrum pivotally supported below the beam and constructed for engagement with the pin at its upper end, and a prong extending above said fulcrum in position to be encountered by the said pin upon the beam, substantially as described.

7. The combination, with the mold-table, plungers, cross-heads, toggle-arms, crank-shaft, and beam, of side frame-plates provided with integral inwardly-projecting hubs a^4 a^4 and with notches a a, receiving the ends of the mold-table, a pin J, inserted in said hubs, and a fulcrum for the support of the beam mounted upon said pin, the said side plates being provided with integral webs a^5, extending from the said hubs a^4 downwardly to the said notches a a and abutting against the mold-table, substantially as described.

8. The combination, with the mold-table, plungers, cross-heads, toggles, crank-shaft, and beam, of side frame-plates provided with inwardly-extending hubs a^4 a^4, a pin J, inserted through the hubs and provided with heads or nuts on its outer end, a sleeve surrounding said pin between the hubs, and a fulcrum or support for the beam supported upon said pin and sleeve, substantially as described.

9. The combination, with the vertical side frame-plates, horizontal frame-base, and molds of a brick-machine, plungers sliding therein, and actuating devices for the plungers located above the molds, of a mold-table consisting of two parts or castings, having the molds formed between their upper parts and provided with vertical webs extending downwardly to the frame-base, said parts being bolted to each other and to the frame-plates by horizontal bolts, and the webs being bolted at their lower edges to the frame-base, substantially as described.

10. The combination, with the machine-frame, a mold, and upper and lower plungers, of upper and lower cross-heads for actuating the plungers, the lower plungers being movable relatively to the cross-head, and a yielding support sustaining the lower plunger, whereby the same may be moved independently of the lower cross-head, substantially as described.

11. The combination, with a mold, of upper and lower plungers sliding therein, cross-heads sustaining the plungers, said lower plunger being vertically movable with relation to the lower cross-head, a yielding support sustaining the said lower plunger independently of the lower cross-head in certain positions of the latter, and shoulders or surfaces upon said lower plunger and cross-head adapted to limit the relative movement of said parts, substantially as described.

12. The combination, with the mold and lower cross-head, of a lower plunger movable vertically with relation to the cross-head, a yielding support sustaining said plunger independently of the cross-head, and horizontal surfaces or shoulders upon or connected with said plunger and acting against the cross-head to limit the movement of the plunger with relation to the cross-head in both directions, whereby the said plunger is moved positively by the cross-head during a part of both the upward and downward movement of the latter, substantially as described.

13. The combination, with a mold and a lower cross-head, of a lower plunger which is movable vertically with relation to the cross-head, and a yielding support sustaining said plunger independently of the cross-head, said plunger being provided with a vertically-adjustable stop limiting the upward movement of the plunger with relation to the cross-head, whereby the position of the plunger within the mold at the time the latter is filled may be regulated as desired, substantially as described.

14. The combination, with the mold and lower cross-head of a brick-machine, of a lower plunger provided with a vertical stem passing through the cross-head, and with a horizontal surface or shoulder engaging the top surface of said cross-head, and a yielding support sustaining said plunger independently of the cross-head, substantially as described.

15. The combination, with the mold and lower cross-head, of a lower plunger provided with a vertical stem passing freely through said lower cross-head, and with a horizontal surface or shoulder engaging the top surface of the cross-head, a yielding support for said plunger, and a stationary guide upon the frame engaging the said stem, whereby the plunger is guided by the mold and said stationary guide independently of the cross-head, substantially as described.

16. The combination, with the mold and lower cross-head, of a lower plunger provided with a depending vertical stem passing through the cross-head, a sleeve surrounding said stem and provided with surfaces or shoul-

ders adapted to engage both the plunger-stem and cross-head, a vertically-adjustable collar upon said sleeve, and a spring acting with an upward pressure upon said collar, said collar being adapted for engagement with the lower surface of the cross-head, substantially as described.

17. The combination, with a mold-table provided with beveled surfaces, of a feed-box, vertically-arranged plates movably connected with the sides of the feed-box and engaging said beveled surfaces at their lower edges, and vertical set-screws inserted in the feed-box and bearing downwardly against said plates, substantially as described.

In testimony that we claim the foregoing as our invention we affix our signatures in presence of two witnesses.

B. CLARK WHITE.
JAMES A. BOYD.

Witnesses to the signature of B. C. White:
M. E. DAYTON,
O. N. WILLIS.

Witnesses to the signature of Jas. A. Boyd:
C. S. WHITNEY,
I. W. MATTHEWS.