No. 661,238. Patented Nov. 6, 1900.

T. A. EDISON.

MACHINE FOR FORMING PULVERIZED MATERIAL INTO BRIQUETS.

(Application filed May 23, 1898.)

(No Model.) 5 Sheets—Sheet 1.

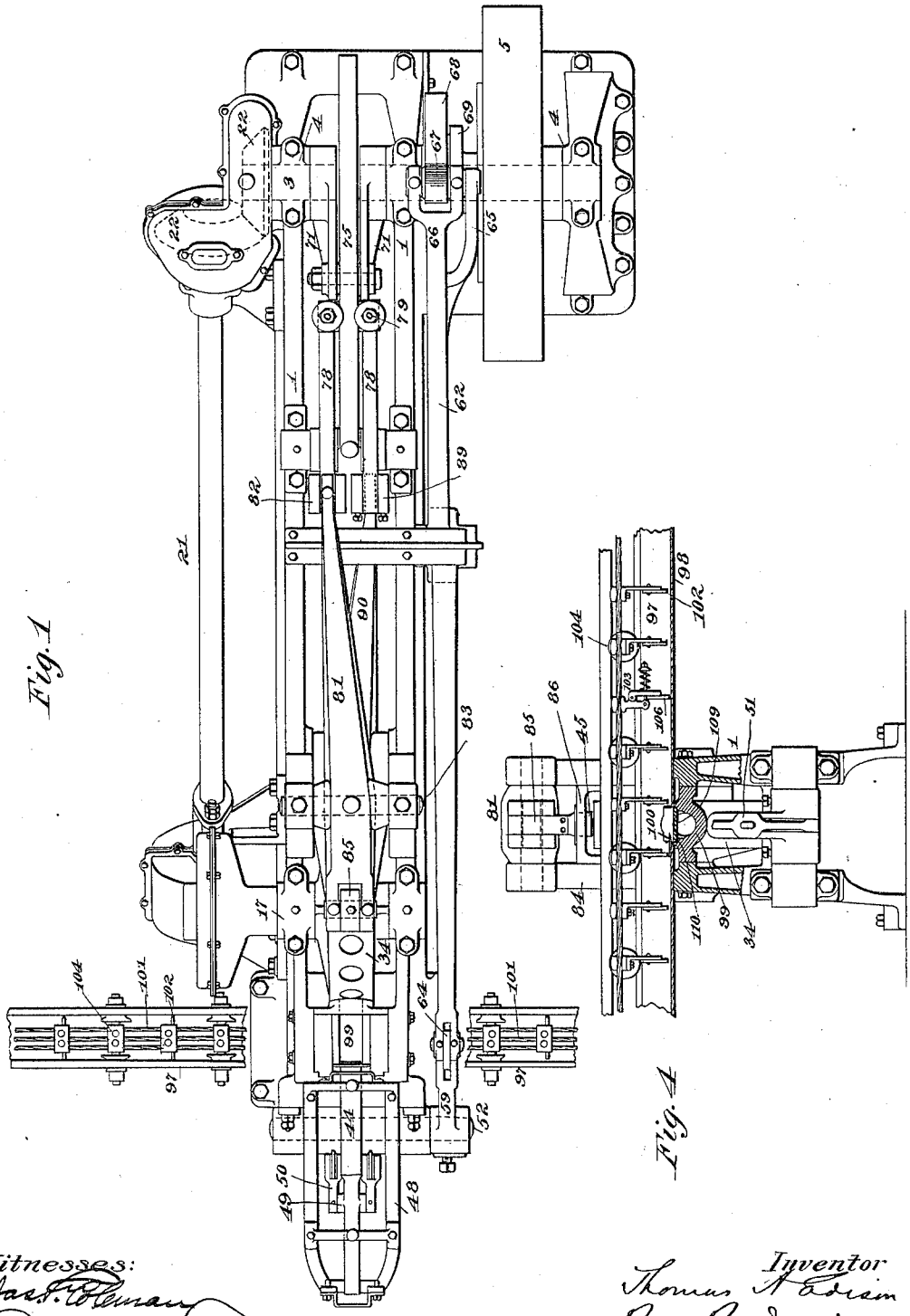

Fig. 1

Fig. 4

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(No Model.) 5 Sheets—Sheet 2.

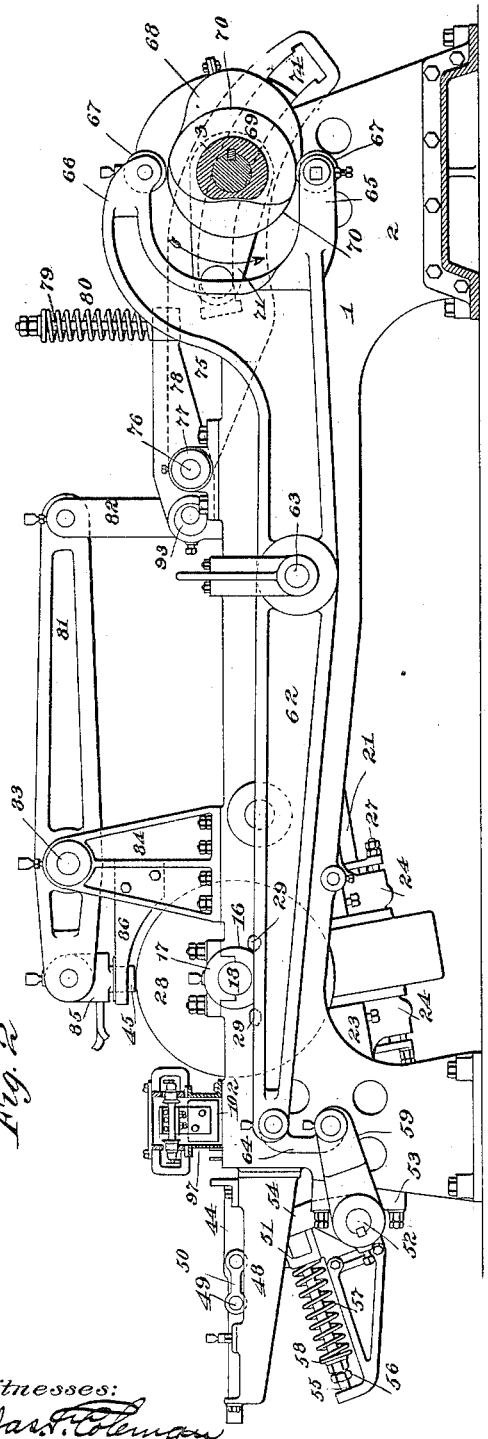

Fig. 2

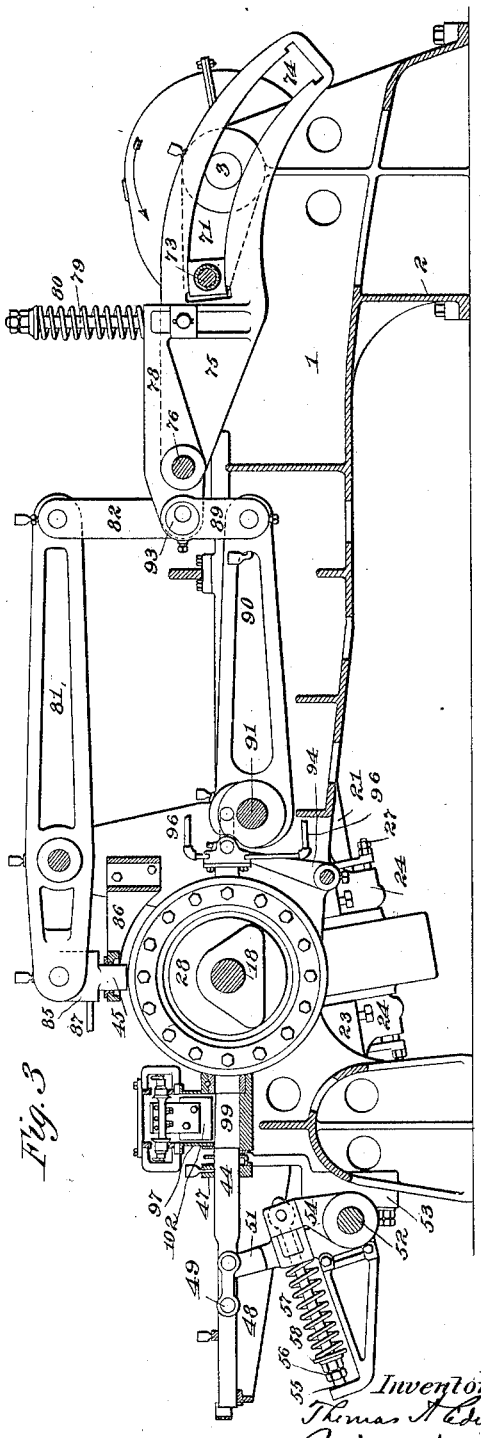

Fig. 3

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(No Model.) 5 Sheets—Sheet 3.

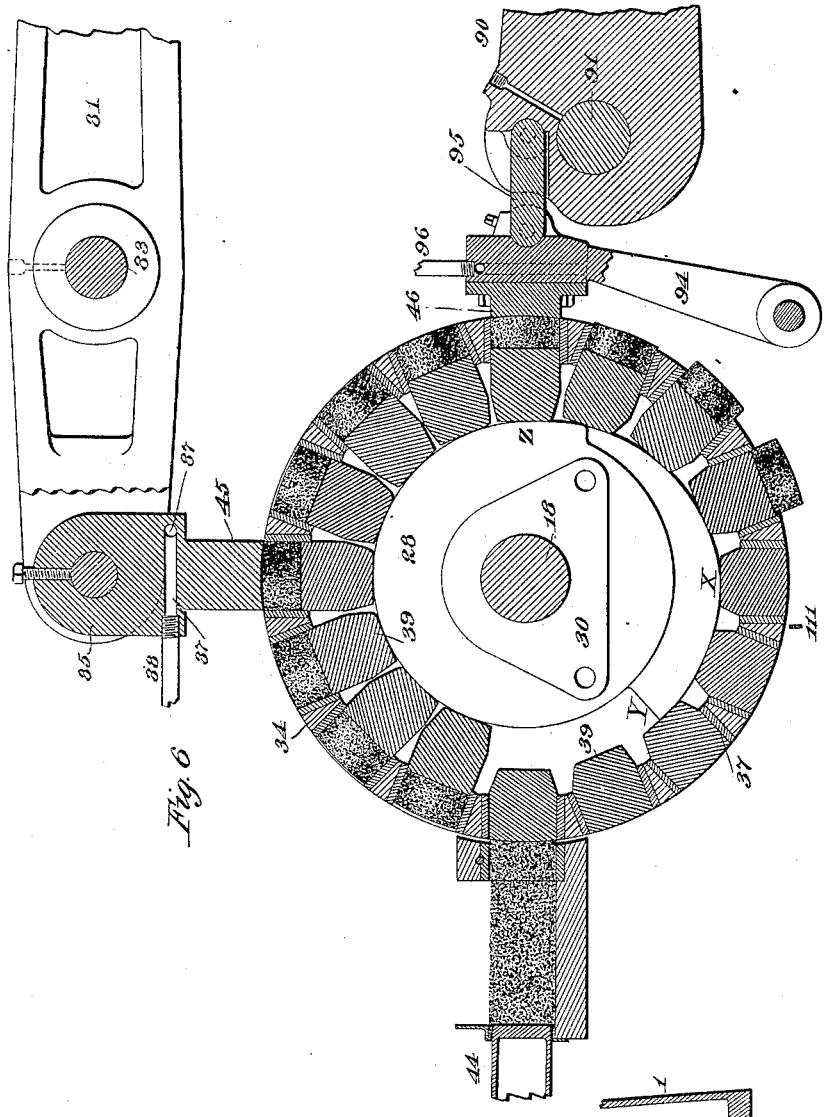

Fig. 6

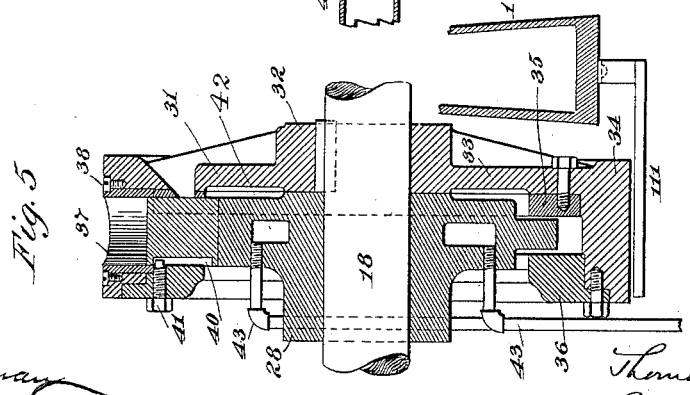

Fig. 5

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(No Model.) 5 Sheets—Sheet 4.

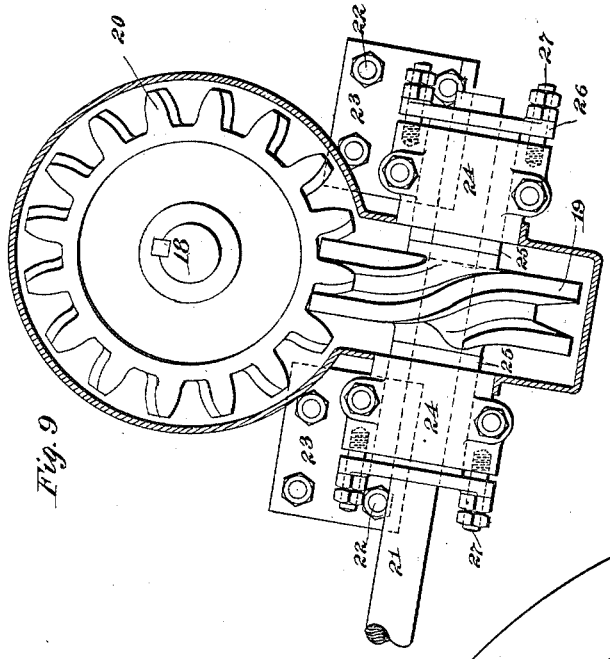

Fig. 9

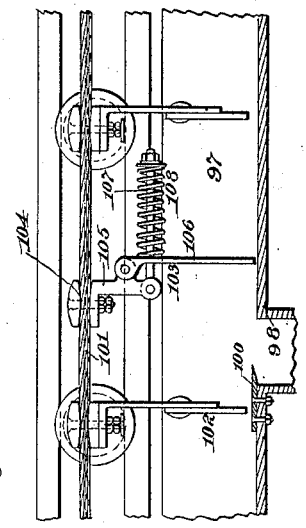

Fig. 10

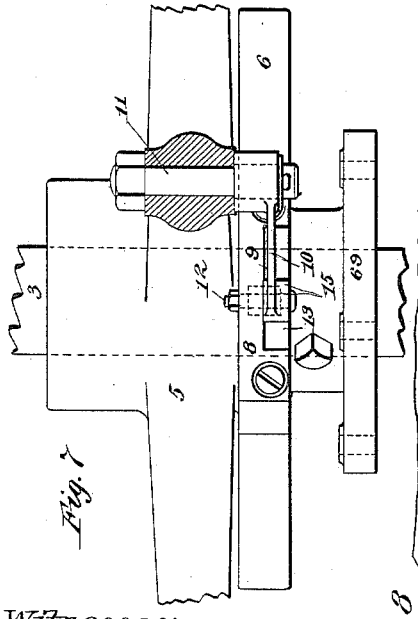

Fig. 7

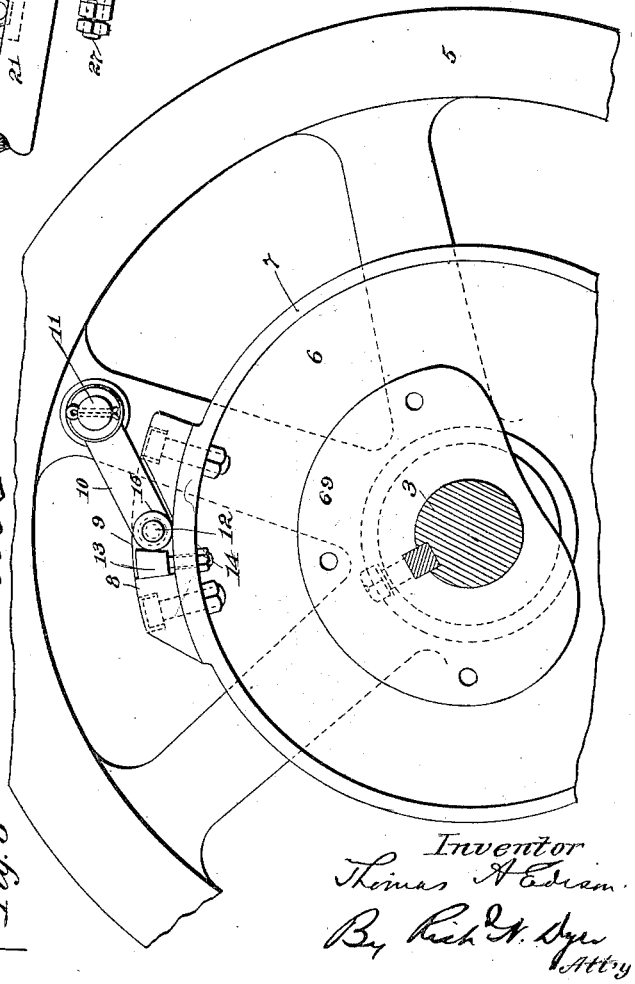

Fig. 8

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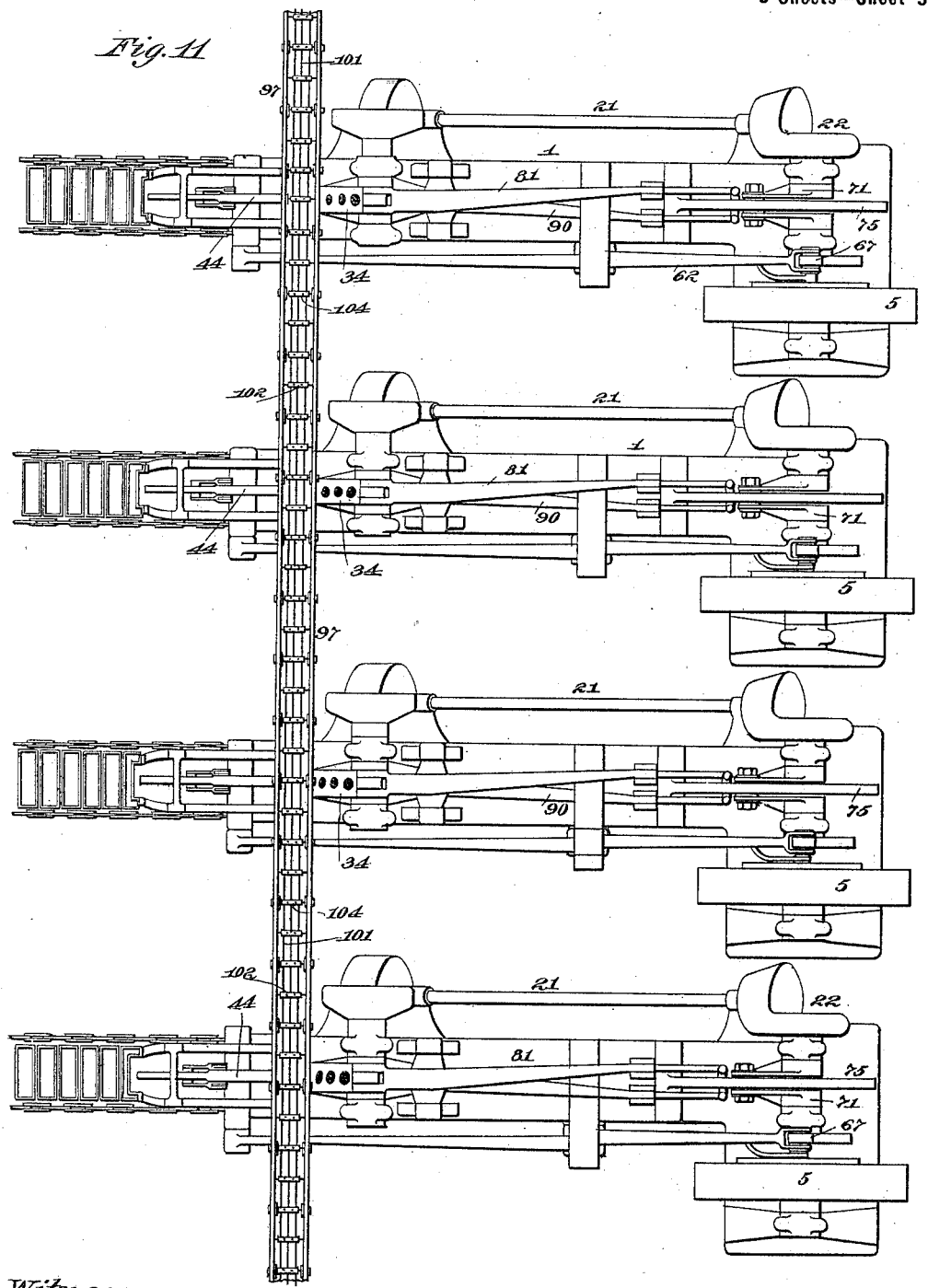
MACHINE FOR FORMING PULVERIZED MATERIAL INTO BRIQUETS.

(Application filed May 23, 1898.)

(No Model.) 5 Sheets—Sheet 5.

Fig. 11



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UNITED STATES PATENT OFFICE.

THOMAS A. EDISON, OF LLEWELLYN PARK, NEW JERSEY.

MACHINE FOR FORMING PULVERIZED MATERIAL INTO BRIQUETS.

SPECIFICATION forming part of Letters Patent No. 661,238, dated November 6, 1900.

Application filed May 23, 1898. Serial No. 681,475. (No model.)

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, residing at Llewellyn Park, in the county of Essex and State of New Jersey, have invented a certain new and useful Improvement in Machines for Forming Pulverized Material into Briquets, (Case No. 990,) of which the following is a specification.

My invention relates to a machine for forming finely-pulverized material into compact solid bricks or briquets; and the device is designed for particular use in the bricking of finely-pulverized concentrated iron ore and finely-pulverized coal. The invention is, however, capable of use in the formation of ordinary building-bricks and, with the necessary modifications to fit it to the particular use, may also be employed in the formation of lozenges and similar articles.

In the construction of a machine suitable for the bricking of pulverized concentrated iron ore and pulverized coal it is desirable that the material should be first subjected to a moderately heavy pressure, so as to place the briquets in the desired approximate form, and that subsequently the requisite pressure to secure the desired density should be applied to the briquets, this subsequent pressure being obtained either by a single operation or by a plurality of operations. In the present application I shall describe as the preferred embodiment of my invention a machine adapted to subject the material to three successive compressive effects. In order that the briquets may be subjected to a plurality of compressive operations, it is desirable that the operative parts should be so arranged that the briquets during their formation should be simultaneously subjected to different compressive effects and that the same briquet should be successively subjected to the different compressive effects. This result may be accomplished by providing a rotatable mold-carrier, with which coöperate the desired number of radially-arranged plungers, three of said plungers being preferably used. The first plunger will force the material into one of the molds and subject it to the preliminary compression. The second plunger will act upon the primarily-formed briquet and subject it to a heavy pressure, so as to further compress it, and the third plunger will subject the briquet to an enormous final compression in order that the desired density and firmness thereof may be obtained. A single briquet thus considered will, it will be noted, be subjected successively to the different compressing operations. When, however, the first briquet is being subjected to the effect of the second plunger, the first plunger is subjecting a successive briquet to its preliminary or primary compression, and when the last-mentioned briquet is subjected to the effect of the second plunger the first plunger will subject a successive briquet to a preliminary compression and the third plunger will subject the first briquet to its final compression. It will therefore be seen that different briquets are subjected simultaneously to different compressive operations. In this way the bricking-machine embodying my present improvements will enable successive compressive operations to be applied in the process of formation of briquets, yet the completed briquets will be ejected from the device after each compressive operation, provided, of course, the compressive operations take place simultaneously, as is preferable.

In the bricking of concentrated iron ore and of finely-pulverized coal with which a suitable binding agent has been admixed it is preferable to keep those parts of the apparatus with which the material may come into contact in a sufficiently-heated state as to prevent sticking, and my present invention contemplates means by which this may be done. When, however, the device is employed for the bricking of materials not requiring a binding agent, the special means for heating the molds and plungers will not be necessary.

In the bricking of concentrated iron ore on a commercial scale I have found that a desirable arrangement is to employ a series of bricking-machines to which the material will be fed automatically, so as to obviate the expense of hand-feeding, and devices by which this end may be accomplished are also included in my present invention.

One object of my invention is to provide a machine for the purpose which will be simple in construction and wherein during the process of formation different briquets will

be simultaneously subjected to different compressive effects and the same briquet will be successively subjected to different compressive effects, whereby a completed briquet will be ejected from the machine at each compressive operation.

A further object is to provide suitable safety devices which will allow for the requisite pressure to be applied to the briquets, but which will prevent the breakage of any of the parts in case of unusual hardness of material or in the event of an unusually large amount of material being introduced within the first mold.

A further object of the invention is to provide means by which the several molds may be kept in a sufficiently-heated state as to prevent the sticking of the material within the molds in the bricking of pulverized material in which a binding agent is used, as concentrated iron ore and coal.

A further object of the invention is to provide an improved form of automatic feeding apparatus by which the material will be automatically fed to the machine where it may be operated upon by the primary plunger, such automatic feeding apparatus being especially intended for use in connection with a series of bricking-machines arranged side by side and by which very large amounts of material can be economically disposed of.

Broadly stated, my invention in its preferred form comprises a rotatable mold-carrier in which are placed a series of molds, each mold being provided with a movable bottom. Coöperating with this mold-carrier is a plurality of plungers, which are radially disposed with reference to the carrier, and three of which are preferably used. These plungers will be all preferably operated simultaneously from a main driven shaft by suitably-arranged levers, by means of which the different compressive effects will be obtained. Since, in order to obtain a greater compressive effect on the final plunger than on the primary or intermediate plungers, it is desirable that the extent of movement of said plungers should be substantially inversely proportional to the compressive effect thereof, the mold-bottoms are arranged to travel outward, whereby after the briquet has been subjected to the primary compression it will by reason of the mold-bottom be moved outward, so that its surface will be flush with the periphery of the mold-carrier and it be immediately operated upon by the intermediate plunger. As the briquet after this intermediate compression advances toward the final plunger it will be further advanced within the mold until its surface is again flush with the periphery of the mold-carrier and it will then be operated upon by said final plunger. In this way I reduce lost motion in the device, the briquets being operated upon by the intermediate and final plungers almost from the very commencement of movement of said plungers. The several levers by which the plungers are operated will be each provided with sections movable with respect to the others, which sections will be normally maintained in engagement by spring-pressure, but will allow for separation in operation, thereby acting as an effective safety device to prevent breakage in the event of exceptionally hard material being encountered or in case an unusually large amount of material has been forced by the primary plunger into one of the molds. The mold-carrier will be heated by steam or hot water and the intermediate and final plungers will also be preferably heated in the same way when the apparatus is used in the bricking of concentrated iron ore or coal to which has been added a suitable binding material in order to prevent sticking of the briquets in the mold. For the bricking of iron ore or coal on a large scale a plurality of my improved bricking-machines will be mounted side by side and a single automatic feed will be provided for keeping all said machines supplied with the proper amount of material.

In order that my invention may be better understood, attention is directed to the accompanying drawings, forming a part of this specification, and in which—

Figure 1 is a plan view of the bricking-machine, illustrating the preferred embodiment of my present invention; Fig. 2, a side elevation thereof with the driving-wheel removed; Fig. 3, a longitudinal section, partly in elevation; Fig. 4, a section through the feed-trough, illustrating the preferred form of automatic feeding mechanism; Fig. 5, a cross-section through the mold-carrier; Fig. 6, a longitudinal section through the mold-carrier and plungers; Fig. 7, a plan view illustrating the preferable form of safety-catch between the main driving-wheel and the main shaft; Fig. 8, a side view of Fig. 7; Fig. 9, an enlarged detail view illustrating the adjusting device for the drunken-worm shaft; Fig. 10, an enlarged section through the feed-trough, and Fig. 11 a plan view illustrating a series of bricking-machines with a single automatic feed therefor.

In all of the above views corresponding parts are represented by the same characters of reference.

The main frame of the improved bricking-machine comprises, essentially, two side frames 1 1, cast to suitable base or foundation portions 2. The side frames 1 1 extend essentially parallel to each other. 3 is the main driven shaft, mounted in suitable bearing-boxes 4 in the framework of the machine and carrying a suitable pulley-wheel 5, by which said shaft may be driven. The pulley 5 is connected to the shaft 3 through a safety-catch. (Illustrated more particularly in Figs. 7 and 8.) Keyed to the main driving-shaft adjacent to the driving-pulley 5 is a disk 6, carrying a rim 7. Bolted to the rim 7 is a block 8, having a cut-away portion 9 therein.

Working within this cut-away portion 9 is the lower end of a link 10, which is connected to a heavy bolt 11, extending through one of the spokes of the driving-wheel 5. The lower end of said link engages a shear-bolt 12, made preferably of brass and of such a diameter that in the event of dangerously-heavy strains being imposed upon it the said bolt will be sheared off, so as to allow the pulley 5 to turn loosely on the shaft 3 and bringing the machine to rest. In order to prevent backlashing of the machine from forcing the disk 6 suddenly ahead against the inertia of the fly-wheel, and thereby shearing the bolt 12, I provide a wedge-block 13, carried on the bolt 14 and adjustable thereby, and which engages a collar 15 on the link 10.

The frames 1 1 are formed near their rear ends with bearing-boxes 16, having caps 17 for the mold-carrier shaft 18. The said shaft in the operation of bricking pulverized iron concentrates is subjected to an enormous pressure, and it should therefore be made relatively heavy. The mold-carrier shaft 18 is driven with an intermittent step-by-step movement from the main shaft 3, preferably by a drunken worm 19 engaging a worm-gear 20, keyed to the shaft 18. (See Fig. 9.) The drunken worm 19 is keyed to a shaft 21, which is driven from the shaft 3 through the bevel-gears 22. The bevel-gears 22 and also the worm-gear 20 and the drunken worm 19 are all incased and run in oil, so as to be kept properly lubricated and also to exclude dust, which is very prevalent especially in mills in which the bricking of iron ore is carried on. The shaft 21 extends at an angle to the horizontal, and by reason of this fact I am enabled to secure a very delicate adjustment of the drunken worm 19 relatively to the worm-gear 20, this adjustment being more clearly illustrated in Fig. 9.

23 23 are plates secured to the side frame and carrying bearing-boxes 24 at their lower ends, in which bearing-boxes the shaft 21 works.

25 25 are bushings surrounding the shaft 21 within the bearing-boxes 24 and engaging on both sides of the worm 19. The bushings 25 are each provided with lugs 26, through which pass adjusting-screws 27, permanently screwed into the bearing-boxes and having adjusting-nuts thereon. It will be observed that by operating the adjusting-nuts the bushings may be moved laterally, and a very delicate vertical adjustment of the worm will thus be secured. The drunken worm 19 is so arranged that during one-third of each rotation the worm-gear 20 will be advanced one tooth, while during the remaining two-thirds of each rotation the said worm-gear will be maintained stationary. Carried upon the shaft 18 is a cam 28, which is firmly bolted to one of the side frames by bolts 29, so that said cam will be held against rotation. The bolts 29 are tapped into heavy ears 30, (see Fig. 6,) cast to the cam. The cam 28 for a small part of its circumference is concentric, this concentricity in Fig. 6 extending approximately from the point X to the point Y. From the point Y to the point Z the cam is slightly eccentric, its diameter in practice increasing only about one-fourth of an inch. From the point Z the diameter of the cam rapidly increases until when almost in a diagonal line with the point X its diameter is sufficient to have forced the mold-bottoms to their maximum extent, as will be explained.

Mounted upon the shaft 18 at the side of the cam 28 and rigidly keyed to said shaft is a mold-carrier 31, comprising, essentially, a sleeve 32, a disk 33, and a concentric head 34. This mold-carrier may be cast in one piece. Carried on the inside of the mold-carrier 31 is an annular steel ring 35, bolted in place, and on the outside of said mold-carrier is bolted a retaining-ring 36, both of said rings being preferably made of steel. Carried in the face of the mold-carrier 31 are a series of molds 37, which are held in place by screws 38. Each of said molds is provided with a movable bottom 39, the inner surface of which slides upon the stationary cam 28. Each bottom 39 is provided with a longitudinal slot 40 therein, with which engages the end of a bolt 41, passing through the ring 36 and by which the mold-bottoms will be prevented from falling out.

When the apparatus is used for the bricking of pulverized-iron concentrates or pulverized coal with which a binding material has been mixed, it is desirable that the molds should be kept sufficiently warm to prevent the briquets from sticking therein, and this result may be accomplished in part by making the cam 28 hollow at 42, steam being supplied thereto through the pipes 43 43. Coöperating with the mold-carrier in this the preferred embodiment of my invention are three plungers 44, 45, and 46, respectively, the first of these plungers being used for the purpose of forcing a supply of material into one of the molds and giving thereto a primary compression, the second plunger being employed for the purpose of giving to the material thus formed a heavy intermediate pressure, and the third plunger being used for applying an enormous pressure to the briquet, whereby it will be given the desired solidity and firmness. The plunger 44 works in suitable bearings 47, carried by bridge-pieces 48, extending across the frames 1 1 at the rear portions thereof. Rigidly secured to the plunger 44 are trunnions 49, connected by links 50 at each side to the upper ends of a lever 51, said lever being mounted on a shaft 52, carried in brackets 53 cast with the side frames. Rigidly secured to the shaft 52 is a heavy arm 54, the upper end of which is in engagement with the lever 51 at about its center. Extending from the said upper end of the arm 54 is a rod 55, which passes through the lever 51, being provided on its outer end with adjusting-nuts 56, and the lower end of said rod being

supported by a triangular-shaped bracket connected to the lever 51, as shown in Figs. 2 and 3.

57 is a heavy spiral spring mounted between the lever 51 and a heavy washer 58, as shown more particularly in Fig. 3. By means of the nuts 56 the tension of the spring 57 may be adjusted, as will be understood. Keyed to the shaft 52 on the outside of one of the brackets 53 is a crank 59.

62 is a long lever mounted on a heavy shaft 63 at one side of the machine and extending almost the entire length of the side frames. This lever is made as light as possible and is connected at its rear bifurcated end with the free end of the crank 59 by a link 64. The forward end of the lever 62 is provided with two integral arms 65 and 66, which carry friction-rollers 67. The friction-roller on the arm 66 engages a cam 68, and the friction-roller on the arm 65 engages a cam 69, both of said cams being keyed to the main driven shaft 3, and, in fact, the said cams may be made integral, if desired. Both of the cams 68 and 69 are provided with concentric portions 70, on which for substantially one-half of the revolution of the shaft 3 the rollers 67 will bear, so that during such half of rotation the arm 62 will be kept in a stationary position. It will be observed that the cam 69 bears an inverse relation to the cam 68, so as to allow the forward end of the lever 62 to be elevated by the cam 68 engaging the roller on the arm 66, the engagement between the roller on the arm 65 with the cam 69 providing for a positive movement of the lever 62.

The driven shaft 3 is divided between the side frames 1 1 and carries the two crank-arms 71, which are connected together by a pin working in a block 73. The said block 73 is mounted within a slot 74, formed in the curved forward end of the lever 75, which lever is mounted on the shaft 76, supported in suitable bearings 77 in the side frames.

Mounted on the shaft 76 on each side of the lever 75 is a lever 78, the forward ends of which are normally in engagement with projections on the sides of the lever 75. Extending up from these projections on the lever 75 are two rods 79, which pass through the levers 78 and which carry heavy spiral springs 80. One of the levers 78 is connected at its rear end beyond the shaft 76 to a lever 81 by means of links 82. The lever 81 is carried on a shaft 83, mounted in brackets 84, bolted to the side frames. The inner end of the lever 81 is bifurcated, as shown, and between said bifurcated portions is connected the upper portion 85 of the plunger 45, said plunger being guided by a suitable guide 86, extending rearwardly from the brackets 84. The specific construction of this plunger is illustrated more particularly in Fig. 6, the essential feature of novelty being the provision immediately above the plunger portion of two connecting steam-passages 87, bored therein, which passages are connected by steam-pipes 88, made of sufficiently-flexible metal as to allow for the movement of the plunger. In this way the intermediate plunger will be kept heated, and the briquet when the latter has a binding material mixed therewith will be prevented from sticking to the plunger. The rear end of the other lever 78 is connected by links 89 to the end of a knuckle-lever 90, pivoted on a heavy shaft 91, extending between the side frames. The connecting-pin 92, which connects the links 89 with the said lever 78, is preferably mounted in eccentrics 93, carried by said links. By turning these eccentrics 93 in any suitable way a very delicate adjustment between the levers 90 and 78 may be obtained. A similar adjustment may be applied between the links 82 and the other levers 78, as will be understood.

The third plunger 46, which gives to the briquet its final compression, is carried on the upper end of an arm 94, mounted on a shaft extending across the side frames of the machine. Connecting the upper end of said arm 94 with the knuckle of the knuckle-lever 90 is a steel connecting-block 95, having semicircular ends bearing against concentric shoulders formed in the knuckle-lever and in the upper end of the arm 94. This connecting-block 95 is pinned between ears formed on said lever and arm, so that the said connecting-block will serve to retract the third plunger after the same has operated. In the compressing operation, however, none of the strain is taken on these pins and all the strain will be taken on the shoulders referred to, as shown clearly in Fig. 6. The third plunger 46 is also provided with steam-pipes 96, by which it will be kept heated when the machine is used in the bricking of concentrated iron ore or coal, to which material has been added a binder, as explained.

The material is fed to the machine in any suitable way, that illustrated being, however, considered preferable. Extending back of the machine and at right angles thereto, immediately above the line of the plunger 44, is a rectangular trough 97, made, preferably, of two channel-irons with a single bottom plate, as shown. This trough is provided with openings 98 therein, (see Fig. 10,) directly above the said plunger 44, and beneath said opening is a U-shaped pocket or receptacle 99, carried by the main frame of the machine and with its forward end extending adjacent to the periphery of the mold-carrier. One side of the pocket 99 is preferably provided with a more or less sharpened edge 100, against which the material is adapted to be directed and by which a portion of the material will be cut off and caused to be deposited in the receptacle 99. The material is moved along the trough 97 by any suitable conveying device, a flight conveyer being illustrated and consisting of three endless wire ropes 101, carrying the flights or scrapers 102, clamped to said ropes. The flights 102 in

their movement through the trough 97 clear the cutting-tool 100; but in order to prevent the accumulation of material below the line of travel of said flights I employ a number of spring-pressed flights 103, also carried by the endless ropes 101. In constructing these spring-pressed flights I secure to the clamp 104, which is carried by the endless ropes 101, a downwardly-extending arm or bracket 105, to which the flight proper, 106, is pivoted, said flight working against the bottom of the trough 97 and moving all the material therein. Extending out from the lower end of the bracket 105 is a rod 107, which passes through the flight 106 and which carries a coiled spring 108 thereon. This spring connection between the flights 106 and the bracket 105 allows these flights to move backward when they strike the cutting-tool 100. If for any reason it is desired to temporarily suspend the operation of any machine—such, for example, as by difficulties being encountered in the oven for that particular machine—a slide 109, working in grooves 110, may be used to cut off the pocket 99 from the supply of the material, so that although the machine will continue to operate it will not receive any material.

In the bricking of iron concentrates on a large scale and in order that the operations may be carried on as economically as possible I prefer to make use of a series of my improved bricking machines arranged side by side in front of a battery of ovens, in which the briquets are subsequently baked, and to extend the trough 97 back of all said machines, so that they will all be supplied by the operation of the flights or scrapers 102 and 106.

Assuming the bricking-machine to be used in the formation of briquets of concentrated iron ore which is in finely-pulverized form and to which a suitable binding material has been added, the operation of a single machine will be as follows: The cam 28, intermediate plunger 45, and final plunger 46 will be kept hot by the steam connections explained. Power is applied to the pulley 5, which rotates the driven shaft 3. Material is fed to the trough 97 and is carried along said trough by the flights or scrapers 102 and 106, a part of said material being cut off from the main mass by the action of the cutting-tool 100 and being deposited in the pocket or recess 99 of each machine. It may be observed that when the adhesion between the particles of the material is slight the cutting edge 100 may be omitted, and the pockets or recesses 99 will be filled by the material dropping therein.

Let us suppose that the drunken worm 19 has just completed its feed movement of the mold-carrier and that one of the molds 37 is in line with the plunger 44, another mold is in line with the intermediate plunger 45, and a third mold is in line with the final plunger 46. In the position of the parts we have assumed the cam 68 will be just commencing to elevate the lever 62. This elevation of the lever 62 will take place in approximately one-fourth of a revolution of the shaft 3. The rear end of said lever will be depressed and through the crank 59 will rock the shaft 52, swinging the arm 54 toward the machine and through the spring connection moving also the arm 51 so as to force the plunger 44 toward the mold-carrier. The plunger in passing through the receptacle or chamber 99 will force the material out of said chamber into the proper mold and will also give to the material the necessary primary compression. In the machine now under consideration and in the formation of briquets of concentrated iron ore this primary compression is about twelve hundred pounds and the movement of said plunger is approximately seven inches. The preliminary compression will force the material into the mold so as to entirely fill the same. The shaft 3 continuing to rotate moves the lever 62 in the opposite direction to withdraw the plunger, this operation taking place in approximately one-fourth of the rotation, and during the remaining half of such rotation the recess or receptacle 99 is again filled with material. These operations are repeated until the material in the first mold we have considered has been brought in line with the second plunger 45. That plunger is operated through the crank-arms 71. In the position shown in Fig. 3 the crank-arms are just commencing to operate said plunger. The said crank-arms in moving downward in the direction of the arrow by the rotation of the main driven shaft 3 swing the lever 75 on the shaft 76, and through the spring connections 80 oscillate both levers 78. Through the links 82 the forward end of the lever 81 will be elevated, depressing the rear end thereof and forcing the plunger 45 with great pressure against the material in the mold. In the machine under consideration the pressure of the plunger 45 is approximately twelve thousand pounds and its movement is one inch. As the machine continues to operate the first mold will be moved toward the third plunger 46, in which movement the mold-bottom will ride up on the cam 28 toward the point Z until the outer surface of the partially-finished briquet has been brought in line with the periphery of the mold-carrier, so that when the first mold is in line with the third plunger the partially-finished briquet will be almost in contact with the said plunger. When, therefore, in the operation of the driven shaft 3 the lever 75 is moved, the links 89, through the other lever 78, will elevate the forward end of the knuckle-lever 90 and an enormous pressure will be exerted against the third plunger to give to the briquet its necessary solidity and firmness. In the machine under consideration the pressure applied to the briquet by the plunger 46 is sixty thousand pounds and the movement of said plunger is one-eighth of an inch. As the mold-carrier advances the bottoms of the molds containing

the finished briquets will ride up on the eccentric portion of the cam 28 until the said mold has reached its lowermost position, at which point its bottom will have entirely ejected the finished briquet, which will be caught on a suitable traveling apron or chute and be carried to the drying or baking ovens, if necessary. If desired, a spring-finger 111 may be used to eject the finished briquet. (See Figs. 5 and 6.)

The particular advantage of my improved bricking-machine, aside from those advantages which arise from the compactness and efficiency of its mechanical constructions, is the fact that by its use the material will be subjected to successive and gradually-increasing pressures, while at the same time the finished briquet will be ejected from the machine at each compressive action. This advantage, it will be noted, is due to the fact that the same briquet is successively subjected to the action of different compressive effects and that different briquets are simultaneously subjected to the action of different compressive effects. I consider it of importance that the material in the process of formation should be subjected to successive and increasing compressing operations rather than to a single compressing operation, because in that way I am enabled to get a very even quality of output, briquets produced by these machines differing but slightly in their weight. This I attribute largely to the fact that the compressive effect of each of the several plungers remains substantially unchanged, as also does the movement of each of said plungers. Therefore by providing means by which always approximately the same quantity of material will be forced by the primary plunger into its mold and be subjected to the preliminary compression and by keeping the material in the molds always approximately flush with the surface of the mold-carrier the effect of the intermediate and final plungers will be substantially always the same on different briquets.

The operation of my improved bricking-machine and its principles being understood in the production of briquets of iron ore, coal, and similar substances, the ways in which it will be modified for other uses will be apparent to those skilled in the art.

Having now described my invention, what I claim as new, and desire to secure by Letters Patent, is as follows:

1. In a machine for forming briquets of pulverized material, the combination of a mold, a plunger coöperating therewith, a divided lever for moving said plunger, and a safety-spring uniting the sections of said lever, substantially as set forth.

2. In a machine for forming briquets of pulverized material, the combination of a mold, a plunger coöperating therewith, a rock-shaft, an arm carried by said rock-shaft and connected with said plunger, a main driving-shaft, a lever, a cam on the main shaft for operating said lever, a second arm carried by the rock-shaft, and connections between said arm and said lever, substantially as set forth.

3. In a machine for forming briquets of pulverized material, the combination of a mold, a pivoted arm adjacent to said mold, a "final" plunger carried by said arm, and a knuckle-lever for operating said plunger, substantially as set forth.

4. In a bricking-machine, the combination with the mold-carrier and its coöperating plungers, of a driven shaft, connections between said shaft and said plungers for oscillating the latter, connections between said shaft and the mold-carrier for rotating said carrier with a step-by-step movement, a driving-pulley loosely mounted on said shaft, and a safety connection between said pulley and shaft, substantially as set forth.

5. In a bricking-machine, the combination with the mold-carrier and its coöperating plungers, of a driven shaft, connections between said shaft and said plungers for oscillating the latter, connections between said shaft and the mold-carrier for rotating said carrier with a step-by-step movement, a driving-pulley loosely mounted on said shaft, a link connected to said pulley, and a shear-bolt for securing said link to said shaft, substantially as set forth.

6. In a bricking-machine, the combination with the mold-carrier and its coöperating plungers, of a driven shaft, connections between said shaft and said plungers for oscillating the latter, connections between said shaft and the mold-carrier for rotating said carrier with a step-by-step movement, a driving-pulley loosely mounted on said shaft, a link connected to said pulley, a shear-bolt for securing said link to said shaft, and an adjustable wedge-block behind said shear-bolt, substantially as set forth.

7. In a bricking-machine, the combination of a rotatable mold-carrier, plungers coöperating therewith, a main driving-shaft, a worm-gear carried by the shaft of the mold-carrier, a drunken worm for driving said gear, an inclined shaft carrying said worm, and an adjustable bearing-plate carrying said shaft and adjustable laterally, substantially as set forth.

8. In a bricking-machine, the combination of a rotatable mold-carrier, plungers coöperating therewith, a main driving-shaft, a worm-gear carried by the shaft of the mold-carrier, a drunken worm for driving said gear, an inclined shaft carrying said worm, a bearing-plate carrying said shaft and adjustable laterally, adjusting-screws for said plate, and clamping-screws therefor, substantially as set forth.

9. In a bricking-machine, the combination of a mold, a plunger coöperating with said mold, means for reciprocating said plunger, a receptacle in line between said plunger and mold for receiving material which is forced by said plunger into said mold, and a trough above said recess along which the material is

carried and deposited in said recess, substantially as set forth.

10. In a bricking-machine, the combination of a mold, a plunger coöperating with said mold, means for reciprocating said plunger, a receptacle in line between said plunger and mold for receiving material which is forced by said plunger into said mold, a trough above said recess along which the material is carried and deposited in said recess, and a conveyer for moving the material in said trough, substantially as set forth.

11. In a bricking-machine, the combination of a mold, a plunger coöperating with said mold, means for reciprocating said plunger, a receptacle in line between said plunger and mold for receiving material which is forced by said plunger into said mold, and a cutting-tool at the edge of said recess, substantially as set forth.

12. In a bricking-machine, the combination of a mold, a plunger coöperating with said mold, means for reciprocating said plunger, a receptacle in line between said plunger and mold for receiving material which is forced by said plunger into said mold, a cutting-tool at the edge of said recess, a trough above said recess along which material is carried, a conveyer for moving the material along said trough, and spring-pressed flights or scrapers carried by said conveyer and yielding when engaging with said cutting-tool, substantially as set forth.

13. In a bricking-machine, the combination of a rotatable mold-carrier, a plurality of plungers coöperating with said carrier, means for rotating said carrier with an intermittent movement, means for reciprocating said plungers, a pocket between one of said plungers and the mold-carrier, and a trough above said pocket or recess along which the material is moved and from which it drops into said recess, substantially as set forth.

14. In a bricking-machine, the combination of a rotatable mold-carrier, a plurality of plungers coöperating with said carrier, means for rotating said carrier with an intermittent movement, means for reciprocating said plungers, a pocket between one of said plungers and the mold-carrier, a trough above said pocket or recess along which the material is moved and from which it drops into said recess, and a conveyer in said trough for moving the material therein, substantially as set forth.

15. In a bricking plant, the combination of a series of bricking-machines, each having a mold and a plunger coöperating with said mold, a pocket between each of said plungers and its coöperating mold, and a trough extending past the pockets or recesses of all the bricking-machines and along which the material is moved, substantially as set forth.

16. In a bricking plant, the combination of a series of bricking-machines, each having a mold and a plunger coöperating with said mold, a pocket between each of said plungers and its coöperating mold, a trough extending past the pockets or recesses of all the bricking-machines and along which the material is moved, and a conveyer working in said trough for moving the material therein, substantially as set forth.

17. In a bricking plant, the combination of a series of bricking-machines arranged side by side, each comprising a rotatable mold-carrier, a series of plungers coöperating therewith, means for reciprocating said plungers, and means for giving to the mold-carrier a step-by-step rotary movement, a pocket arranged between one of said plungers and the mold-carrier of each machine, and a trough extending above the pockets or recesses of all the machines, along which the material is moved and from which the material drops into said pockets or recesses, substantially as set forth.

18. In a bricking plant, the combination of a series of bricking-machines arranged side by side, each comprising a rotatable mold-carrier, a series of plungers coöperating therewith, means for reciprocating said plungers, and means for giving to the mold-carrier a step-by-step rotary movement, a pocket arranged between one of said plungers and the mold-carrier of each machine, a trough extending above the pockets of all the machines, along which the material is moved and from which the material drops into said pockets or recesses, and a conveyer in said trough for moving the material therein, substantially as set forth.

19. In a bricking-machine, the combination of a mold, a plunger coöperating therewith, a receptacle between said plunger and the mold, and a movable cover for said receptacle, substantially as set forth.

20. In a bricking-machine, the combination of a mold, a plunger coöperating therewith, a receptacle between said plunger and the mold, a movable cover for said receptacle, and a trough mounted above said receptacle and along which the material is moved, substantially as set forth.

This specification signed and witnessed this 11th day of April, 1898.

THOMAS A. EDISON.

Witnesses:

J. F. RANDOLPH,

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