(No Model.) 2 Sheets—Sheet 1.

W. S. URQUHART & H. P. MALLORY.

MACHINE FOR CRUSHING CLAY.

No. 511,566. Patented Dec. 26, 1893.

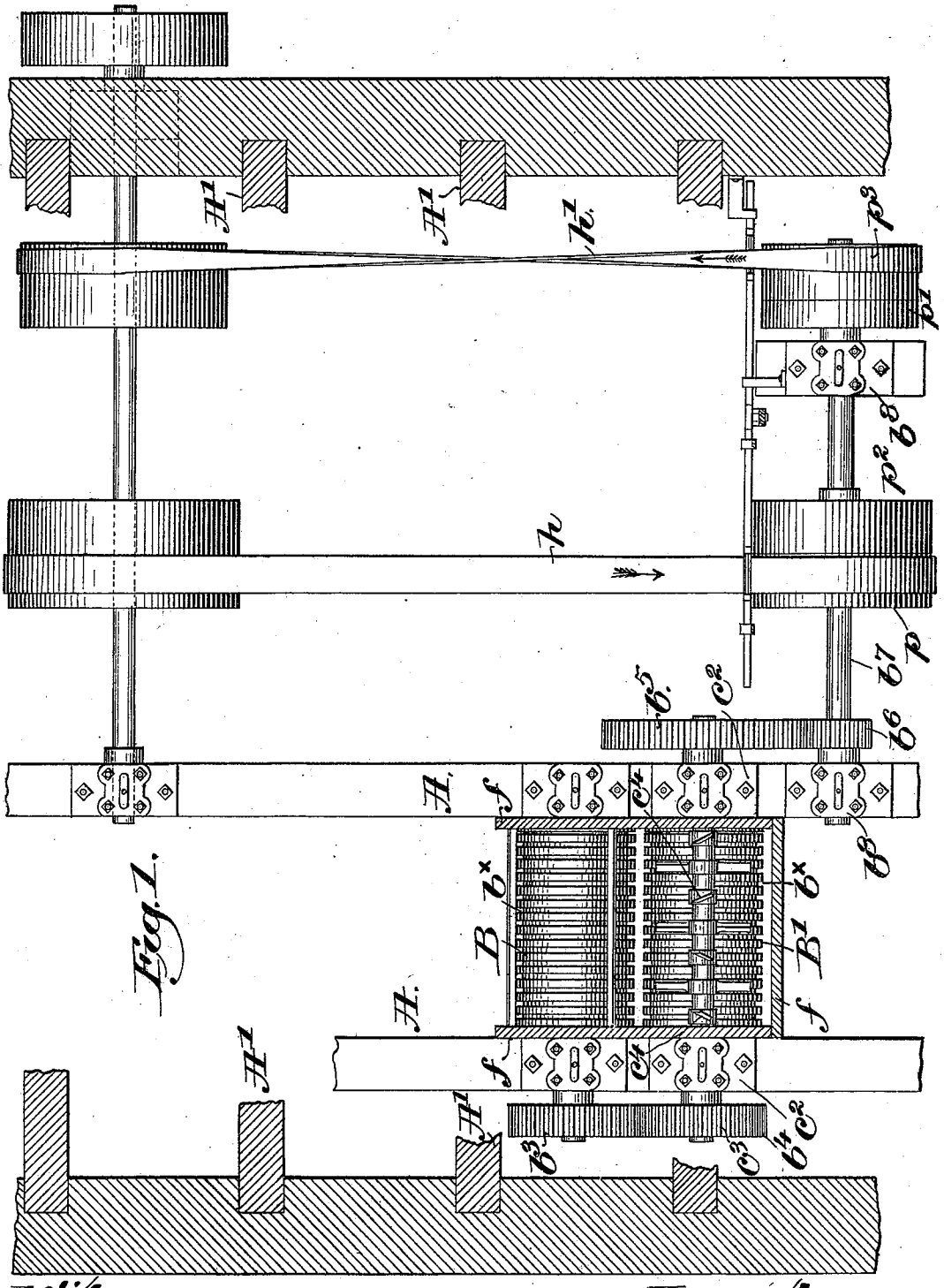


Fig. 1.

Witnesses.
Louis N. Carvell.
Edward F. Allen.

Inventors:
William S. Urquhart,
Henry P. Mallory,
by Crosby & Gregory Attys.

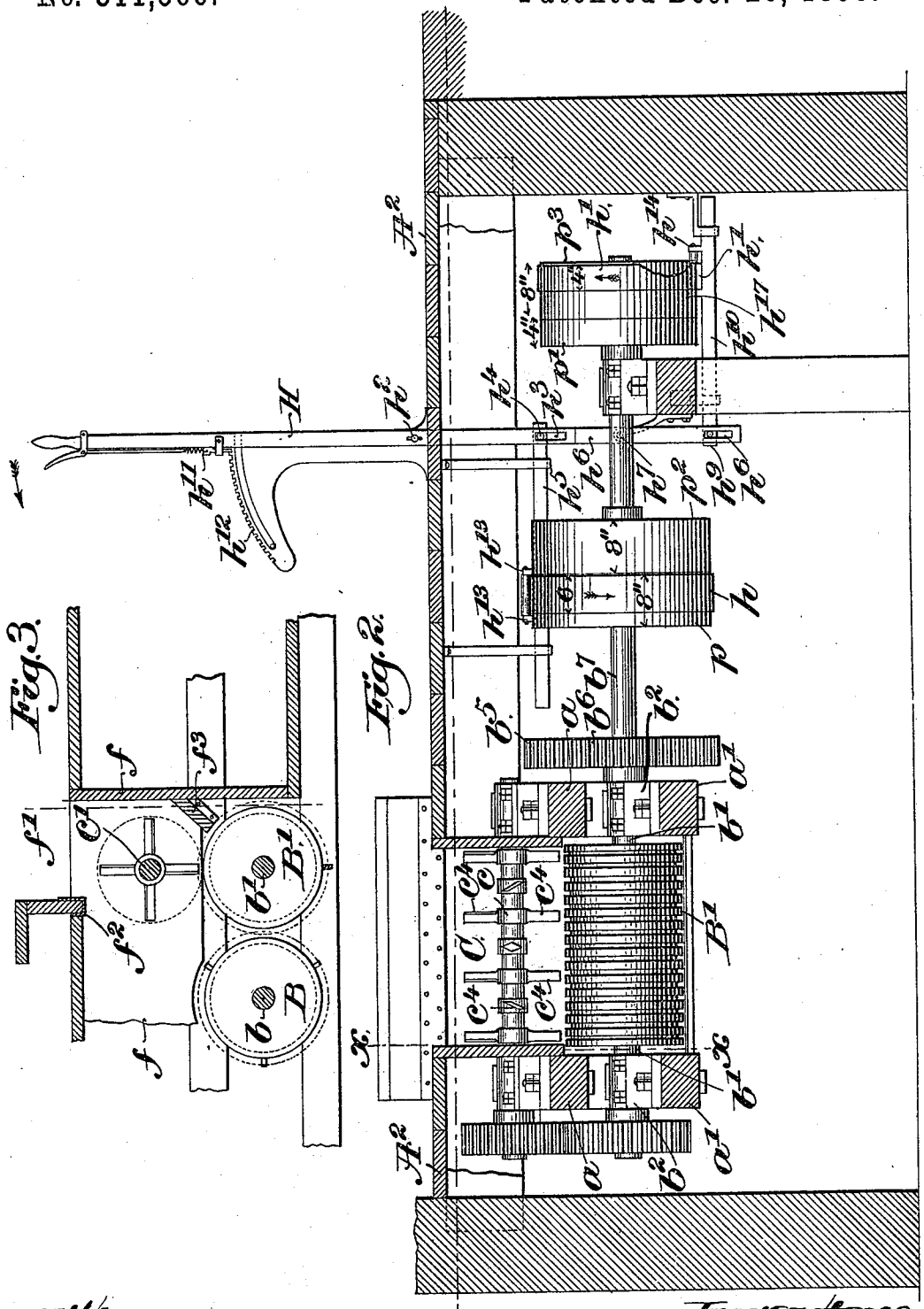
THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

W. S. URQUHART & H. P. MALLORY.

MACHINE FOR CRUSHING CLAY.

No. 511,566. Patented Dec. 26, 1893.



Witnesses.
Louis N. Sowell,
Edward F. Allen.

Inventors:
William S. Urquhart,
Henry P. Mallory,
by Crosby & Gregory
Attys.

THE NATIONAL LITHOGRAPHING COMPANY,
WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM S. URQUHART, OF CAMBRIDGE, AND HENRY P. MALLORY, OF NEWTON, MASSACHUSETTS.

MACHINE FOR CRUSHING CLAY.

SPECIFICATION forming part of Letters Patent No. 511,566, dated December 26, 1893.

Application filed July 17, 1893. Serial No. 480,689. (No model.)

To all whom it may concern:

Be it known that we, WILLIAM S. URQUHART, a subject of the Queen of Great Britain, residing at Cambridge, and HENRY P. MALLORY, of Newton, county of Middlesex, State of Massachusetts, have invented an Improvement in Machines for Crushing Clay and the Like, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to crushing machines, and particularly to machines used for crushing large lumps of clay to reduce and prepare the latter for formation into bricks.

In most brick-yards it is necessary in order to secure the clay in sufficient quantity, to excavate the same by means of steam shovels, blasting or otherwise, leaving the clay in large lumps or pieces which it is impossible to crush and properly prepare for the brick-making machine with the machinery now in use except the crushing rolls of such machinery be run at a high speed. As clay is more or less filled with stones of various sizes, much difficulty is experienced in running the rolls at high speed because of the stones getting between and stopping the rolls and frequently breaking the rolls or some other part or parts of the machine. This liability of breakage necessitates constant attention and frequent stopping and starting of the machine, greatly reducing the capacity of the machine in a day's work.

In our efforts to develop a machine which would break up large lumps of clay, yet be run at a slow speed, or such speed as would prevent breakage of any of the parts by a constant stoppage due to a stone or stones working between the rolls, we have devised a machine embodying the invention forming the subject matter of this present application.

A machine embodying our invention comprehends a plurality of crushing rolls which are preferably grooved annularly to better bite or draw in the clay so that they may be run at a comparatively slow speed, one or more of the rolls also being preferably provided with a longitudinal strip or strips to assist in forcing the clay down into the grooves at the bite between the rolls.

To break up the large lumps of clay and leave the same in such condition that they will be caught by and drawn in between the slowly moving rolls, which otherwise would not draw it in, we provide a preparatory breaker, which first acts upon the large lumps and breaks the same into small pieces or lumps of such size as are readily caught by or drawn between the crushing rolls, the clay issuing from the latter in such a pulverized condition as fits it for formation into bricks by suitable machines. The breaker blades are set at an angle, the angular pitch of some of the blades being opposite to that of the remaining blades, whereby the material passed through the breaker is thrown back and forth by the oppositely pitched blades and thoroughly pulverized.

In the drawings, Figure 1 represents in top or plan view one form of machine embodying this invention and which we have selected to illustrate the invention; Fig. 2, a side elevation looking from the bottom of Fig. 1, and Fig. 3, a vertical section taken on the dotted line x—x, Fig. 2.

Referring to the drawings, A, A, represent a suitable frame which may be of any necessary or desired construction adapted to the location of the machine, the same being in the present instance shown as secured to the under sides of the floor timbers A′ upon which is laid the usual floor A^2. The frame, as herein shown, comprehends two pairs of stringers a, a', the stringers of each pair being arranged one above the other and connected in suitable manner.

The crushing rolls B, B′, have their journals b, b', journaled in suitable bearings b^2, carried by and secured to the lower stringers a' of the frame. The journals at one of the ends of the rolls B, B′, are fitted outside their respective bearings with the gear wheels b^3, b^4, in mesh with each other, so as to cause like but opposite rotation of the two rolls. The roll B′ at its end opposite the gear wheel b^4 is in the present construction provided with a large gear wheel b^5 in mesh with a pinion b^6 fast on a driving shaft b^7 journaled

in suitable bearings b^8 and provided with the fast pulleys p, p', and loose pulleys p^2, p^3.

In the present construction we have provided a single breaker C, the same in the construction shown consisting of a long hub c provided at its opposite ends with journals c' mounted in suitable bearings c^2, carried by and secured to the upper sides of the stringers a of the frame, the journal at one end of the said hub being provided outside its bearing with a gear wheel c^3, see Figs. 1 and 2, which is in mesh with and driven by the gear wheel b^4 upon the roll B'. The hub c of the breaker is provided with a series of radiating angular breaker blades c^4, which in their rotation just clear the periphery of the roll B', some of the blades being pitched in one direction and some in an opposite direction. In the construction shown the blades at opposite sides of the middle of the length of the hub are pitched in opposite directions, *i. e.*, they diverge from the middle of the hub in the direction of rotation of the latter, so that as the breaker rotates, these blades will not only act to break up lumps of clay, as will be described, but will act like a propeller to move the broken pieces toward the center of the breaker and of the crushing rolls, to keep the clay from accumulating and clogging at the sides of the machine. The opposite angular pitch of the breaker blades causes the material passed through the breaker to be moved or thrown back and forth according to the location of the oppositely pitched blades which may be varied in different machines and for different classes of work, the material thus thrown back and forth being thereby thoroughly broken and intermixed and placed in better condition to enter between the crushing rolls.

In practice the rolls and breaker will preferably be inclosed within a suitable casing f, which is provided preferably above the breaker with an inlet or feed opening f' guarded at one side by a vertically adjustable wall board f^2, see Fig. 3, which board is adjustable toward and from the breaker to regulate the feed. We also preferably provide an inclined table f^3, see Fig. 3, to divert the broken lumps of clay inwardly toward the top of the crushing roll B' to be better acted upon by the latter and carried over into the bite between the two rolls.

In order to increase the drawing and crushing power of the rolls B, B', we have provided their peripheral surfaces with a series of annular grooves $b^\times$, the grooves in the two rolls being preferably arranged opposite each other, the said grooves thus providing upon each roll alternate high and low surfaces, the edges of which it has been found in practice better act upon and draw in the lumps of clay than do smooth rolls of the same size and running at the same or higher speed. While we have herein shown these grooves as annular or circumferential grooves extending around the rolls, each groove lying in a plane standing at right angles to the axis of its roll, yet it is evident that they need not necessarily lie in planes at right angles to the axes of the rolls, for they may lie in other planes or extend in other directions so long as they run around the rolls.

By providing the rolls with square grooves, as shown, it will be seen that a large aggregate space is left between the rolls through which the material to be crushed may pass in large quantities, larger than would be the case were the rolls perfect cylinders and separated by the same distance; but it will also be noticed that the maximum distance between the grooved rolls is so small that large lumps of clay, and stones can not enter between the same. Therefore the injuring of the machine by the introduction of large stones into the crushed clay is obviated.

If the rolls were true cylinders separated sufficiently to give the same area of opening between as is represented between the grooved rolls placed near together, the opening between the cylinder rolls would be sufficient to permit stones of large size to pass through, which, of course, should be avoided.

Referring now particularly to Figs. 1 and 2, h and h' represent cross driving belts driven in suitable manner in the direction represented by the arrows, said belts being driven by any suitable counter-shaft, not necessarily constituting a part of this invention.

In order to properly describe the operation of the stopping, starting and reversing mechanism, we will assume that the fast and loose pulleys p and p^2, have each an eight-inch face, and that the belt h is six inches in width, and that the fast pulley p' is a four-inch pulley, the loose pulley p^3 an eight-inch pulley, and the belt h' a four-inch belt.

H represents a suitable controlling device shown as a lever pivoted at h^2, and slotted at its lower end at h^3, to receive the pin h^4, passed through one end of the horizontal shipper rod h^5, and through the upper end of the auxiliary lever h^6, fulcrumed at h^7, said auxiliary lever at its lower end being in turn slotted at h^8 to receive a pin h^9 on the horizonal shipper rod h^{10}. The shipper rod h^5 is provided with two lugs h^{13} standing at opposite sides of and close to the belt h to move the latter when the shipper rod is reciprocated, and the shipper rod h^{10} is provided with two lugs h^{14} at opposite sides of the belt h' to move the latter when the said shipper rod h^{10} is reciprocated, the lugs h^{14}, however, being separated at a greater distance than the width of the belt h', as shown, so that there is a lost motion shown as about two inches between the shipper rod h^{10} and its belt h' for a purpose to be hereinafter described.

The controlling device H is provided with a suitable hand-operated latch mechanism h^{11}

which co-operates with a toothed sector h^{12} to retain the said device and the belts in desired working positions.

As shown in Figs. 1 and 2, the belt h is shown as upon and driving the fast pulley p, and the driving shaft b^7, together with the rolls and the breaker in the directions indicated by the arrows thereon, the cross belt h' running in an opposite direction upon the loose pulley p^3.

Assuming the machine to be in motion as described, the clay as it comes rough from the clay pit when excavated, is fed to the machine through the opening f', Fig. 3, the large lumps of clay being immediately struck by the rotating blades of the breaker and pulverized or broken into smaller lumps or pieces which, partly by the rotative action of the breaker and partly by reason of the inclined table f^3, are diverted upon and over the top of the roll B′ and down into the bite between it and its companion roll B, the two rolls together acting to draw the lumps down between them and to crush the clay to such an extent that it may immediately be carried on or directed to a brick making machine or machines to be formed into bricks.

In practice the crushing rolls need be revolved at a speed not exceeding fifty revolutions more or less per minute, while the breaker revolves preferably at a speed of or about sixty-seven revolutions per minute. So it will be seen that the rotative speed of any of the parts is so slow that if a stone or stones carried to the machine in the clay become lodged between the crushing rolls, the machine will stop, permitting the belts to slip, before any part or parts break. The operator, however, has the machine at all times immediately under his control, for by grasping the lever or controlling device H and drawing the same to the left in the direction of the arrow Fig. 2, the belt h is moved to the right from the fast upon the loose pulley p^2, while the belt h' is moved to the left from the loose pulley p^3 upon the fast pulley p' to thereby change the direction of rotation of the shaft b^7 and the rolls. The relative width of the pulleys and belts is now apparent, for the belt h being six inches in width may be moved two inches to the right off the fast pulley before the lost motion between the shipper h^{10} and the belt h' is taken up, further movement of four inches of the belt h carrying the latter entirely upon the loose pulley, while a corresponding movement of the shipper h^{10} carries the four-inch belt h' to the left to but not upon the fast pulley p', so that in an intermediate position of the controlling device H, both belts run upon loose pulleys, and the machine will be at rest. Further movement of the controlling device H in the same direction as before from its intermediate position referred to to its lowermost position, moves the belt h across and with its edge slightly over the edge of the loose pulley p^2 still running upon the latter, however, the same movement carrying the belt h' from the loose pulley p^3 upon the fast pulley p' to reverse the direction of rotation of the driving shaft p^7 and the rolls. It will thus be seen that a partial movement of the controlling device stops the machine and a whole movement in the same direction reverses the machine, and that the controlling device may be retained in such intermediate positions as are necessary to maintain the belts in proper operative positions upon their respective pulleys.

In practice the driving belt h is kept only so far upon the fast pulley p as will provide sufficient power to run the rolls at the requisite speed, and as there is no extra margin of power with the belt in this position, the minute a stone gets between the rolls the belt will simply slip upon its pulley, while the latter and its rolls will stop rotation.

By adjusting the positions of the belts upon the pulleys any required power may be acquired.

To facilitate the passage of the clay through or between the rolls, we provide either or both the same,—in the present instance only one roll B′—with one or more longitudinal strips e secured to the periphery of the roll and extending as shown throughout the entire length thereof, the said strip projecting beyond the periphery of the roll a distance substantially equal to the separation of the rolls so that it will pass freely between the two during the rotation of the same. The strip or strips thus provided act upon any lump or lumps of clay which may rest between the rolls without passing through, and push the said lump or lumps down into the bite of the rolls and into the bottoms of the grooves in the same to be broken and pulverized thereby. Beneath one or both of the rolls,—in the present instance the roll B′—, we prefer to mount a stationary strip or clearer e' which scrapes or removes from the roll any pieces or lumps of clay which may adhere thereto, and tend to follow around with the roll.

While we prefer to embody our invention in a construction substantially like that herein shown to illustrate the same, yet it is evident that the invention may be embodied in various machines differing more or less in construction and design from that herein shown by us, without departing from the spirit and scope of the invention.

Having described one form of our invention, and without restricting ourselves as to details of construction, what we claim, and desire to secure by Letters Patent, is—

In a crushing machine, two horizontally arranged crushing rolls, means to rotate the same, and a feed opening to conduct the material to be crushed to the rolls, combined with a rotating breaker arranged between the said feed opening and rolls, and provided

with angular breaker blades pitched in opposite directions to thereby break up and intermix the material issuing from said feed opening and distribute the same uniformly along and between said rolls, substantially as described, to operate, substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

WILLIAM S. URQUHART.
HENRY P. MALLORY.

Witnesses:
FREDERICK L. EMERY,
LAURA MANIX.