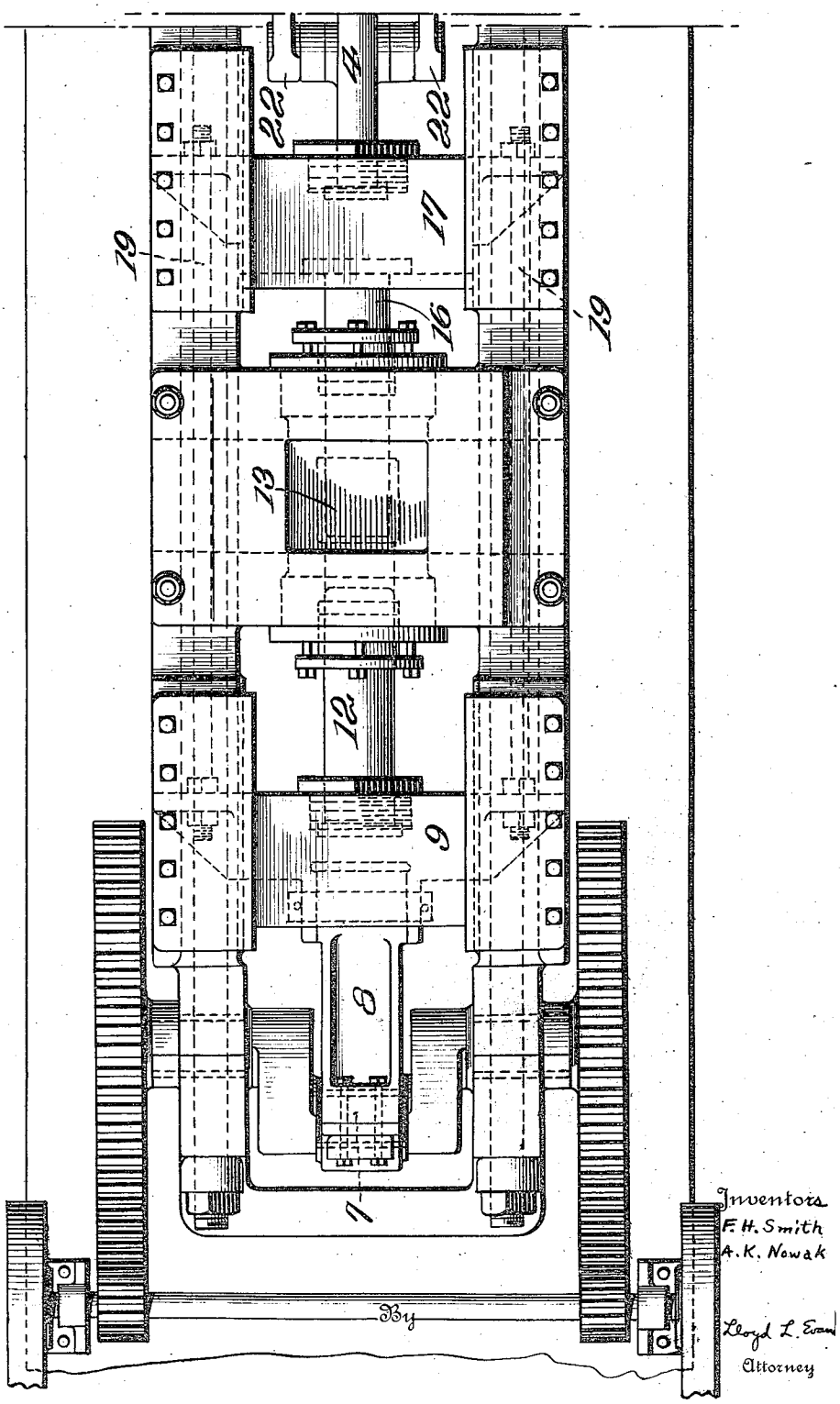
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F. H. SMITH ET AL

BRIQUETTING PRESS

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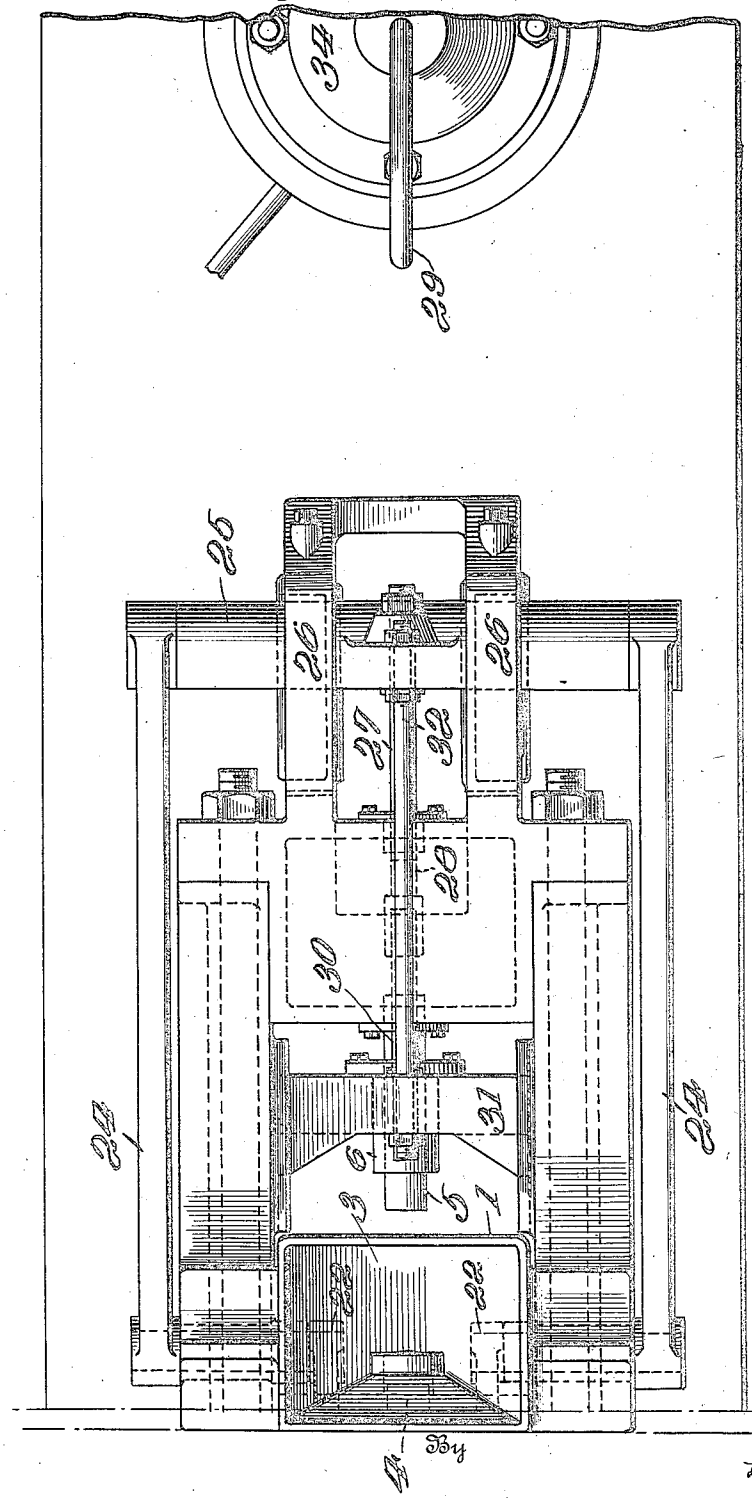


Fig. 2.

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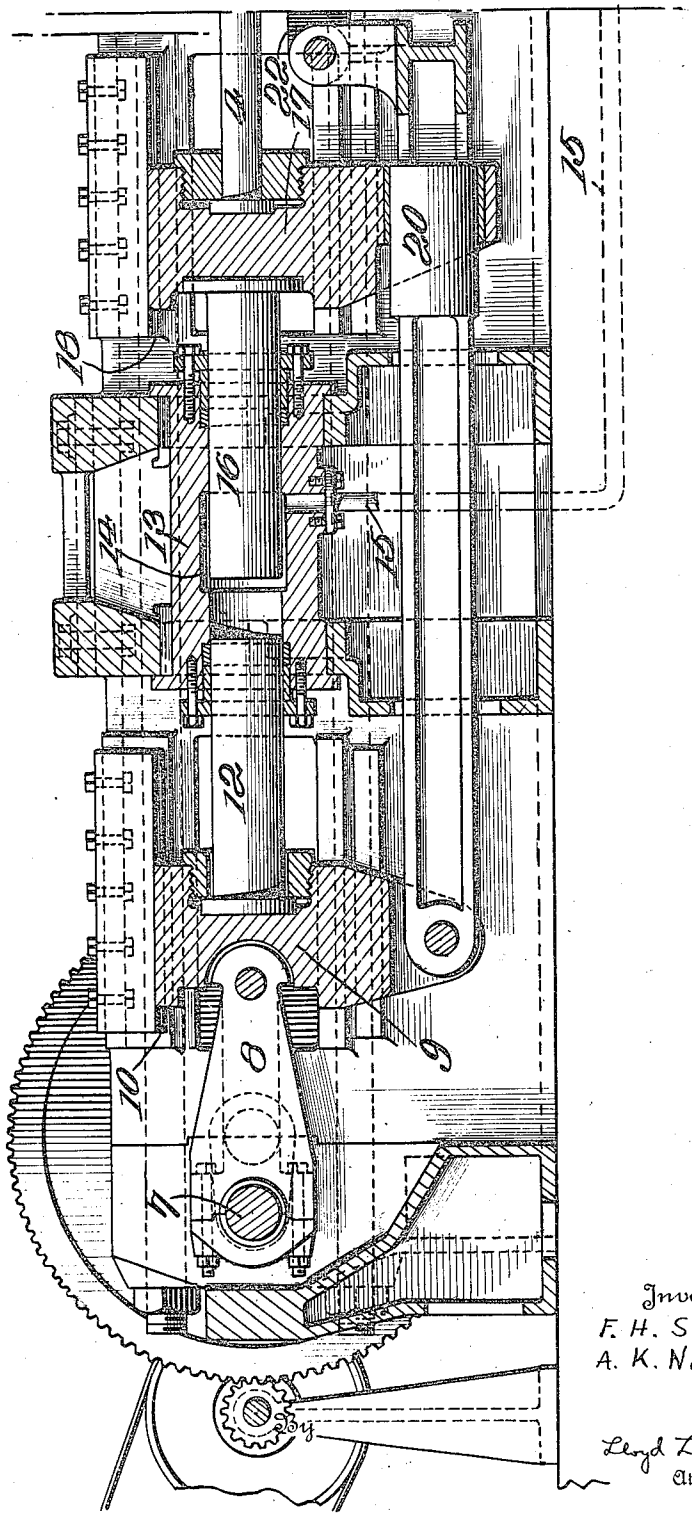
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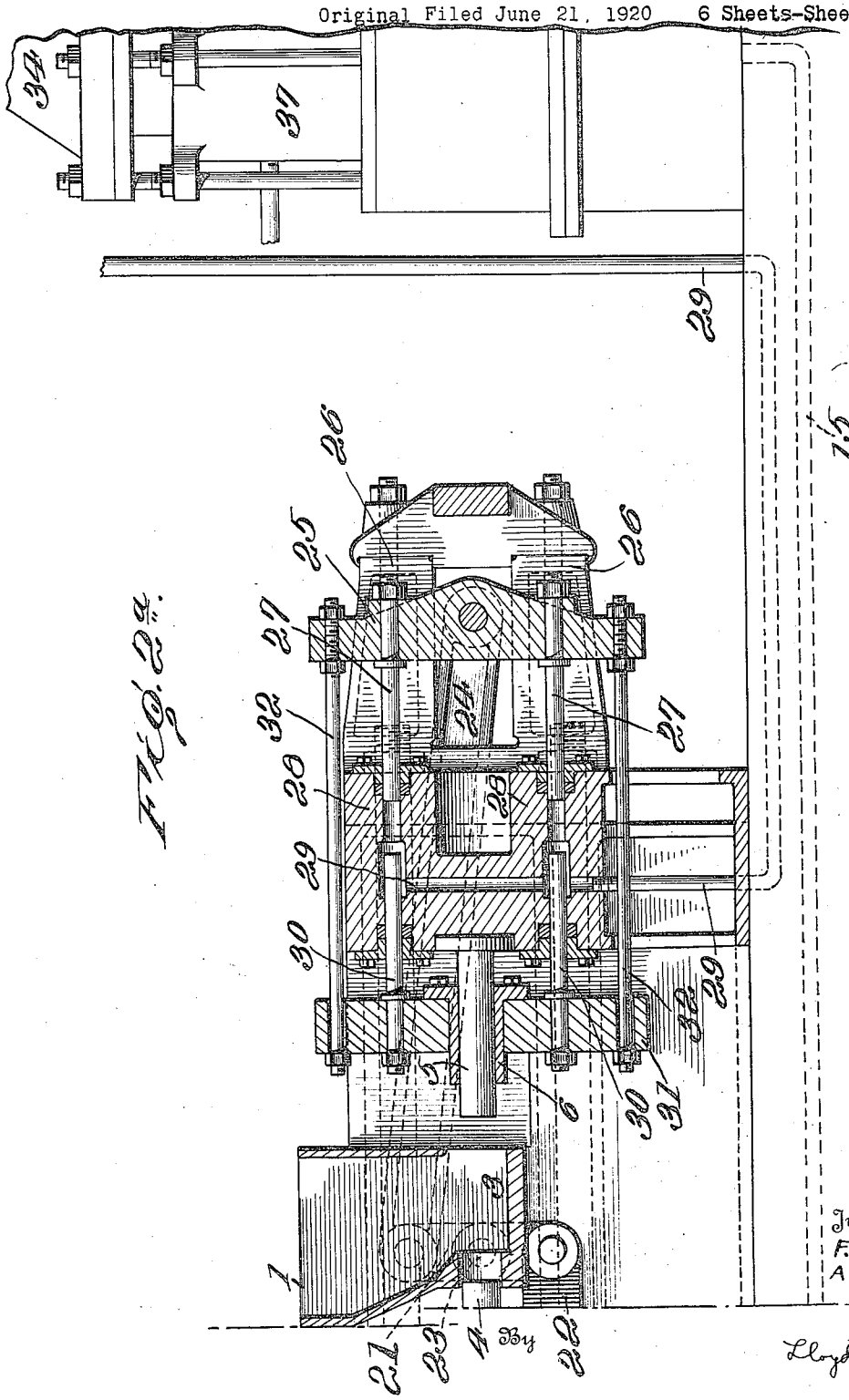


FIG. 22.

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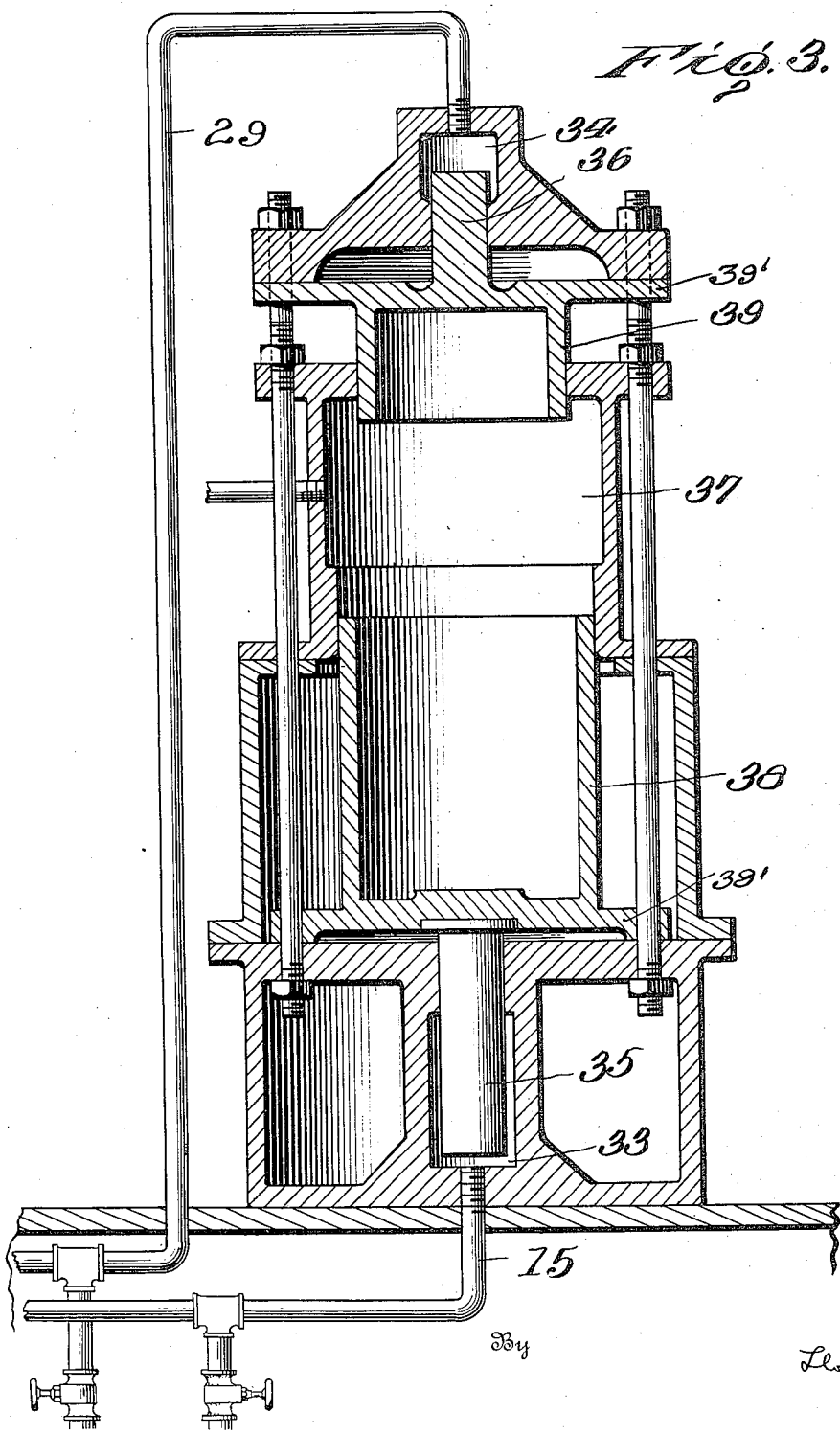
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Fig. 3.



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Original Filed June 21, 1920 6 Sheets-Sheet 6

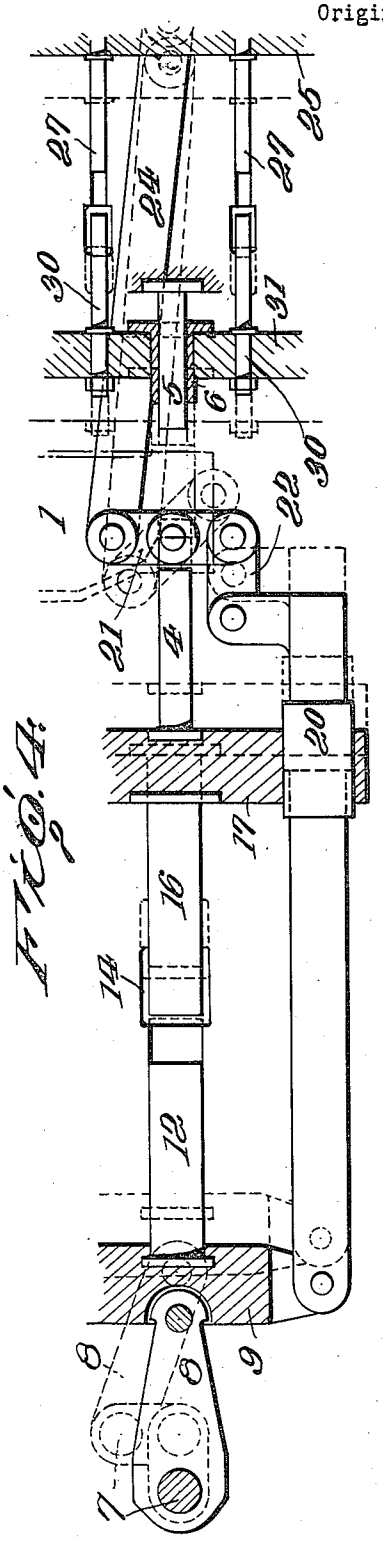


Fig. 4.

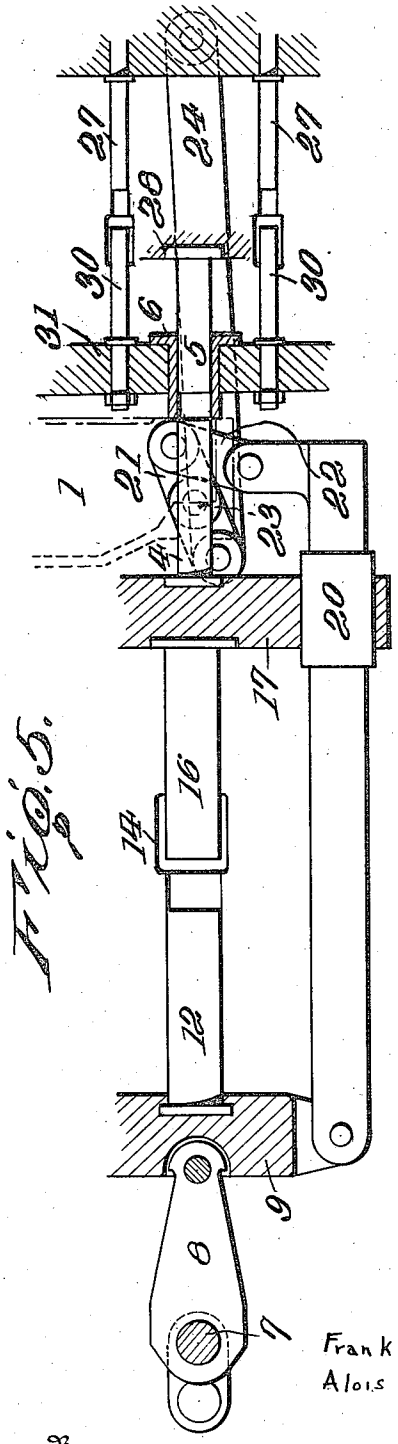


Fig. 5.

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UNITED STATES PATENT OFFICE.

FRANK H. SMITH AND ALOIS K. NOWAK, OF CANTON, OHIO.

BRIQUETTING PRESS.

Application filed June 21, 1920, Serial No. 391,840. Renewed May 24, 1923.

To all whom it may concern:

Be it known that we, FRANK H. SMITH, a subject of the King of Great Britain, and ALOIS K. NOWAK, a citizen of the United States, residing at Canton, in the county of Stark and State of Ohio, have invented a certain new and useful Improvement in a Briquetting Press, of which the following is a full, clear and exact description, reference being had to the accompanying drawings.

This invention relates to a mechanically driven briquetting press of the type in which both the mould casing and the plunger reciprocate and are each actuated through a medium by positively driven pistons.

It is the object of this invention to provide such a machine capable of operating upon a great variety of materials, particularly materials of non-uniform composition, such for example as iron and steel turnings, to produce briquettes of substantially uniform density. Among the improvements contemplated in this invention are simplifying the supporting guides and actuating connections for the mould and plunger; cushioning the mould casing to prevent injury thereto should hard masses of large size be fed thereto; providing means for positively ejecting the pressed blocks from the mould casing; and providing a hydraulic cushion between the plunger and its actuating means and between the mould casing and its operating means whereby either will yield upon reaching a certain predetermined pressure and the press will act as a hydraulic press after a certain pressure on the material is established, maintaining this pressure on each block during an appreciable portion of each stroke.

This application is an adaptation particularly for briquetting of the mechanically actuated hydraulic press disclosed in our prior application, Serial Number 360614, Feb. 24, 1920.

In the accompanying drawings, Fig. 1 is a top plan view of one end of the machine showing the driving connections to the plunger cross head. Fig. 1ª is a top plan view of the remainder of the machine. Fig. 2 is a longitudinal section of the portion of the machine shown in Fig. 1. Fig. 2ª is a longitudinal section of the portion of the machine shown in Fig. 1ª. Fig. 3 is a longitudinal section taken centrally through the compressed air pressure regulating chamber. Figure 4 is a diagrammatic view showing the plunger and mould casing with their operating connections. In this view the plunger and mould casing and their operating connections are shown in full lines in the positions which they occupy at the beginning of the stroke: i. e., when the plunger and mould casing are fully retracted: and showing in dotted lines the position which these parts occupy when the operating eccentric has moved through 90 degrees. Figure 5 gives a diagrammatic view similar to Figure 4, showing the parts in the position which they occupy when the operating eccentric has moved through 180 degrees: i. e., at the completion of the forward stroke of the plunger.

Material to be formed into briquettes is supplied to the hopper 1 communicating with the plunger chamber 3 therebeneath. Reciprocating in the plunger chamber is a plunger 4 and in alinement therewith is a stationary backing block 5 which has a reciprocating mould casing 6 slidable thereon. The mould casing 6 is movable from a position in which the stationary backing block 5 projects beyond the forward end thereof to a position in which it bridges the space between the backing block and the hopper. In the latter position the mould casing and backing member form a mould into which the material is pressed by the plunger 4 on the forward stroke thereof and from which the briquette is ejected by the block 5 on the return movement of the mould casing.

The plunger 4 and the mould casing 6 are both actuated by the crank shaft 7 driven from any suitable source of power. A pitman 8 connects the crank shaft 7 with a crosshead 9 sliding in grooves 10 in the main frame of the machine. A piston 12 is fixed at one end to the crosshead 9 and works in one end of a stationary cylinder 13. The cylinder 13 has a slightly enlarged central portion 14 which is supplied with liquid from an inlet pipe 15. In the end of the cylinder opposite the piston 12 is a second piston 16 which is attached to a second crosshead 17 sliding in grooves 18 in the main frame. The crosshead 17 is connected to the crosshead 9 by pull-back bolts 19 which are connected to permit the crossheads to approach each other on the forward stroke and serve to draw the cross-

head 17 back on the return stroke. The crosshead 17 carries the press plunger 4.

Motion is transmitted from the shaft 7 through the pitman 8 to crosshead 9 and piston 12 carried thereby through the body of liquid in the cylinder 13 to the piston 16 and crosshead 17 which carries the plunger 4.

Motion is transmitted to the reciprocating mould casing 6 by means of slides 20 on opposite sides of the machine connected to the crosshead 9 at one end and to the lower ends of crank arms 21 through short links 22 at their opposite ends. The crank arms 21 are pivoted at their central portions on fixed stub shafts 23 on opposite sides of the hopper and are pivotally connected at their upper ends to connecting rods 24 which are pivoted to a crosshead 25 sliding on guides 26 fixed to the frame of the machine. Attached to the crosshead 25 are pistons 27 working in cylinders 28 similar to cylinder 13 and having liquid supply passages 29. Pistons 30 work in opposite ends of cylinders 28 and are rigidly connected to a crosshead 31 slidably mounted on backing block 5. Pull-back bolts 32 connect cross heads 25 and 31 and permit relative movement therebetween in one direction so that the forward movement of the crosshead 31 is imparted through the liquid in cylinders 28 and the bolts serve only to draw the cross head 31 back on the return stroke.

Due to the arrangement of crank shaft 7 and pitman 8, as well as the slight play in the hydraulic cylinder, the first half of the stroke of the plunger 4 is slower than the last half. Due to the arrangement and proportional lengths of the links 22 and crank arms 21 the first half of the stroke of the mould casing is much faster than the last half. This enables the mould casing to move up to the hopper and bridge the space between the hopper and backing block before the plunger has moved any considerable distance in the casing, and prevents spilling of loose material.

The links 22 are slightly longer than the distance from their point of connection to the arms 21 to the shafts 23 so that the arms 21 are moved past dead center with respect to the connecting rods 24 on the forward stroke of the operating slides 20. By reason of this arrangement, the mould casing during the last portion of the stroke of the plunger moves in the same direction as the plunger and on the beginning of the return stroke the mould casing follows the plunger back for a slight distance, so that the block formed in the mould casing is moved away from the backing block 5 and on the return stroke the briquette strikes the backing block a hammer-like blow whereby it is more easily dislodged from the mould casing.

The liquid passages 15 and 29 communicate respectively with cylinders 33 and 34 having pistons 35 and 36. The cylinders 33 and 34 are arranged adjacent the bottom and top of the air pressure chamber 37. The pistons 35 and 36 reciprocate in the cylinders 33 and 34, respectively, and have relatively larger piston portions 38 and 39 slidably fitting into the air chamber. Intermediate the pistons 35, 38 and the pistons 36, 39 are enlarged portions or heads 38′ and 39′ which are normally held seated against the casing by the air pressure in the chamber.

Air is maintained at a predetermined pressure in the air chamber 37, which can be varied by any suitable means.

The quantity of liquid in the piston cylinders is such that when the pistons 12 and 16 and 27 and 30 are in normal position there is no pressure on the liquid, the pressure in the air chamber reacting against the pistons seating them against the casing so that no pressure is exerted in the cylinders 13 and 28.

On the forward stroke of the pistons 12 and 27 motion is imparted to the plunger and mould casing respectively by pressure transmitted through the liquid in the cylinders 13 and 28. As the resistance met with by the plunger and the mould casing increased, pressure in the cylinders 13, 28, 33 and 34 increases until a pressure is reached sufficient to move the pistons 35 and 36 against the predetermined air pressure acting upon the pistons 38 and 39 thereof. From this time on until the end of the stroke the pressure exerted by the plunger is substantially uniform and is continued during a portion of the return stroke of the plunger and the mould casing by the pressure in the air chamber acting against the pistons 38 and 39 until the heads 38′, 39′ are again seated against the ends of the casing.

Operation.

In the ordinary operation of this machine a predetermined pressure is supplied to the air pressure chamber 37 in order to seat heads 38′ and 39′ against the casing. Liquid is then admitted to lines 15 and 29 and the cylinders supplied thereby. When the driving mechanism is thrown in, the plunger 4 and mould casing 6 move forward under the pressure of interposed bodies of liquid, as hereinbefore described. By reason of the fact that the pitman 8 is relatively short the piston 12, and consequently the plunger 4, is moved very slowly during the first half of the stroke. By reason of the link connection through sliding rod 20, links 21, 22 and 24 the mould casing 6 is moved rapidly toward the hopper during the first half of the stroke so that it quickly bridges the space between the hopper and backing block 5. On continued movement of the plunger 4 and mould casing 6 material is forced by the plunger into the mould casing and

against the backing block. After the pressure on the material has increased sufficiently to react through the interposed bodies of liquid and unseat the heads 38′ and 39′, a constant pressure will be maintained on the material during the remainder of the forward stroke and a portion of the return stroke as hereinbefore described.

As hereinbefore stated, crank arms 21 and links 22 are so proportioned that the arms 21 move past dead center with reference to the links 24, so that as the plunger nears the end of the forward stroke, the movement of the mould casing 6 is reversed, so that the plunger 4 and mould casing 6 move in the same direction. This has the effect of loosening the briquette from the mould casing. The movement of the mould casing toward the backing block also has the effect of pressing briquette at both ends, which tends to make the briquette of uniform density throughout. When the movement of the plunger 4 is reversed and it starts back on the return stroke the direction of movement of the sliding rod 20 is also reversed, again reversing the direction of movement of the mould casing so that the mould casing follows the plunger 4 for a short distance until the crank arms 21 have been moved past dead center with reference to the links 24, the mould casing 6 then returning to its rear-most position. The effect of this movement is to move the briquette bodily away from the backing block 5 and then dislodge the briquette from the mould casing 6 by impact against the backing block 5.

The piston 39 is smaller than the piston 38 so that less pressure on the liquid is required to force the piston 39 in against the air pressure. The reason for this is that should a large hard object be caught between the plunger and mould casing, the mould casing will yield and move back clear of the plunger casing, permitting the obstruction to drop out.

Having thus described one embodiment of our invention, we wish it understood that our invention is not limited to the constructions and combinations herein shown and described, but what we desire to claim is set forth in the following claims.

Claims.

1. In a briquetting press, a reciprocating plunger, a mould reciprocating in alignment therewith, actuating means for said plunger and mould, and an hydraulic cushion interposed between the actuating means and the mould.

2. In a briquetting press, a reciprocating plunger, a reciprocating mould, actuating means for the plunger and mould, and a pneumatically cushioned hydraulic cylinder interposed between the mould and the actuating means.

3. In a briquetting press, a reciprocating plunger, a reciprocating mould, actuating means for reciprocating the plunger and mould, an hydraulic cushion interposed between the plunger and the actuating means, and an hydraulic cushion interposed between the mould and the actuating means.

4. In a briquetting press a reciprocating plunger, an opposed reciprocating mould, actuating means for the plunger and mould, hydraulic cylinders interposed between the actuating means and the plunger and between the actuating means and the mould, and pressure controlling means for the hydraulic cylinders.

5. In a briquetting press a reciprocating plunger, an opposed reciprocating mould, actuating means for the plunger and mould, hydraulic cylinders interposed between the plunger and actuating means and between the mould and actuating means, and a pneumatic pressure control for the hydraulic cylinders.

6. A briquetting press comprising a reciprocating plunger and a reciprocating mould, pistons fixed to the plunger and mould, cylinders in which said pistons are mounted, pistons working in the opposite ends of said cylinders, and mechanical actuating means for said last mentioned pistons.

7. The briquetting press as specified in claim 6 in combination with passages leading from said cylinders, cylinders connected with said passages, and counterbalancing pistons in said cylinders.

8. The briquetting press as specified in claim 7 in combination with enlarged heads upon said counterbalance pistons and a pneumatic cylinder enclosing said enlarged heads.

9. The briquetting press as specified in claim 8, said enlarged head connected to the counterbalance piston for the mould cylinder being smaller than the other enlarged head.

10. In a briquetting press a mechanically actuated reciprocating plunger, an opposed mechanically actuated reciprocating mould, a yielding connection between the mould and its actuating means.

11. In a briquetting press a reciprocating plunger, an opposed reciprocating mould, a yielding actuating means for the plunger, yielding actuating means for the mould, the actuating means for the mould being yieldable at a lesser pressure than the actuating means for the plunger.

12. In a briquetting press a reciprocating plunger, an opposed mould reciprocating in alignment therewith actuating means for the plunger and mould, means for unyieldingly moving said plunger and said mould with the actuating means until a predetermined pressure is exerted thereon and then permitting said plunger or said mould to

yield with respect to the driving means while maintaining said predetermined pressure thereon.

13. In a briquetting press a reciprocating plunger, an opposed mould reciprocating in alignment therewith, means for actuating the plunger and mould, hydraulic cushioning means between the actuating means and the plunger and mould, and means to permit yielding of the hydraulic cushioning means upon the exertion of a predetermined pressure while maintaining said predetermined pressure on the hydraulic cushion.

14. In a briquetting press a reciprocating plunger, an opposed mould reciprocating in alignment therewith, a mechanical drive for the plunger and mould, means to limit the pressure exerted upon the plunger and upon the mould to a predetermined amount.

15. In a briquetting press a reciprocating plunger, an opposed mould reciprocating in alignment therewith, a mechanical actuating means for the plunger and mould, and means for limiting the pressure exerted upon the plunger and upon the mould to a predetermined amount and to maintain said pressure during the latter portion of the forward stroke and a portion of the return stroke.

16. In a briquetting press a reciprocating plunger, an opposed stationary mould block, a mould casing reciprocating on the mould block and means for moving the plunger and casing toward each other during the beginning of the plunger stroke and in the same direction as the plunger nears the end of its stroke.

17. In a briquetting press, a reciprocating plunger, an opposed stationary mould block, a mould casing reciprocating on the mould block, means for reciprocating the plunger to form a briquette in the mould casing and means for imparting a quick forward and return motion to the mould casing as the plunger moves away therefrom to forcibly eject the briquette by the impact thereof against the mould block.

18. In a briquetting press a reciprocating plunger, a reciprocating mould, means for moving the plunger forward and backward, means for moving the mould in a direction opposite to the direction of travel of the plunger during a portion of the stroke and in the same direction as the plunger during another portion of the stroke.

19. In a briquetting machine a reciprocating cross head carrying a plunger, a second reciprocating cross head carrying a mould, and means connecting the cross heads to impart to the second cross head two reciprocating movements for each reciprocating movement of the first mentioned reciprocating cross head.

20. In a briquetting machine, a reciprocating member, a second reciprocating member, connections between said members including a crank arm and link movable past dead center to impart an additional reciprocating movement to the second reciprocating member.

21. In a briquetting press a supply hopper, a plunger casing receiving material from the hopper, a reciprocating plunger in the casing, a stationary mould block spaced from the plunger casing, a reciprocating mould casing sliding on the mould block and means to impart a relatively slow initial movement to the plunger and a relatively fast initial movement to the mould casing.

22. In a briquetting press a plunger casing, a reciprocating plunger sliding therein, a stationary mould block spaced from the plunger casing, and a reciprocating mould casing sliding thereon adapted to bridge the space between the backing block and the plunger casing.

23. In a briquetting press, opposed reciprocating members comprising a plunger and mould, actuating means for the plunger and mould, direct mechanical connections for moving the reciprocating members in one direction and interposed hydraulic cylinders for actuating the reciprocating members in the opposite direction.

24. The apparatus set forth in claim 23 in combination with pressure limiting and maintaining means connected with the hydraulic cylinders.

25. The apparatus set forth in claim 23 in combination with a pneumatic pressure limiting and maintaining device connected with the hydraulic cylinders.

In testimony whereof, we hereunto affix our signatures in the presence of a witness.

FRANK H. SMITH.
A. K. NOWAK.

Witness:
A. H. BECHEL.