

E. R. SUTCLIFFE,
BLOCK PRESS.

APPLICATION FILED DEC. 4, 1916.

Patented Mar. 30, 1920.

1,335,303.

3 SHEETS—SHEET 1.

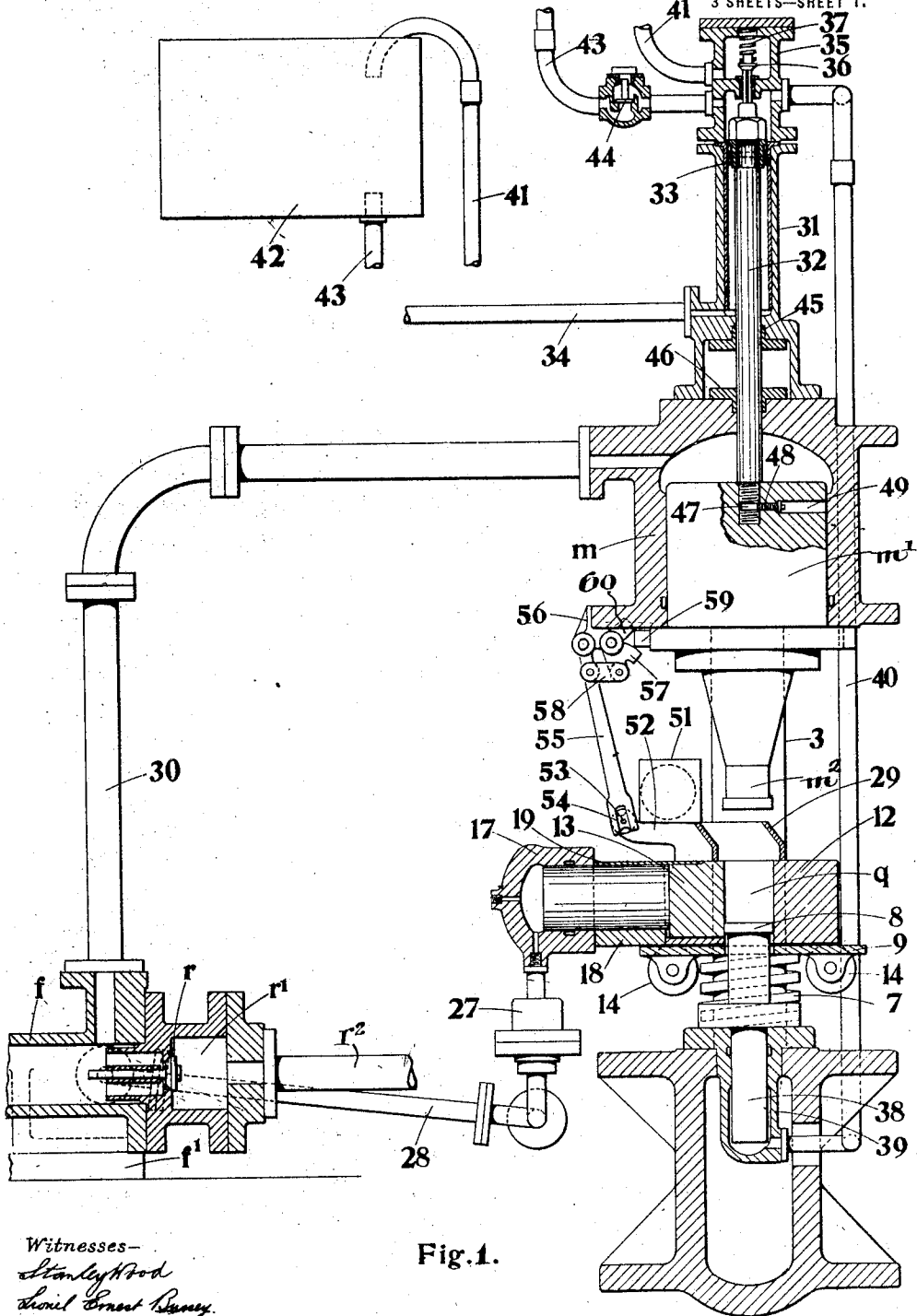


Fig. 1.

Witnesses—
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Charles Ernest Ramsey

Inventor
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by *W. E. Swaney* Attorney

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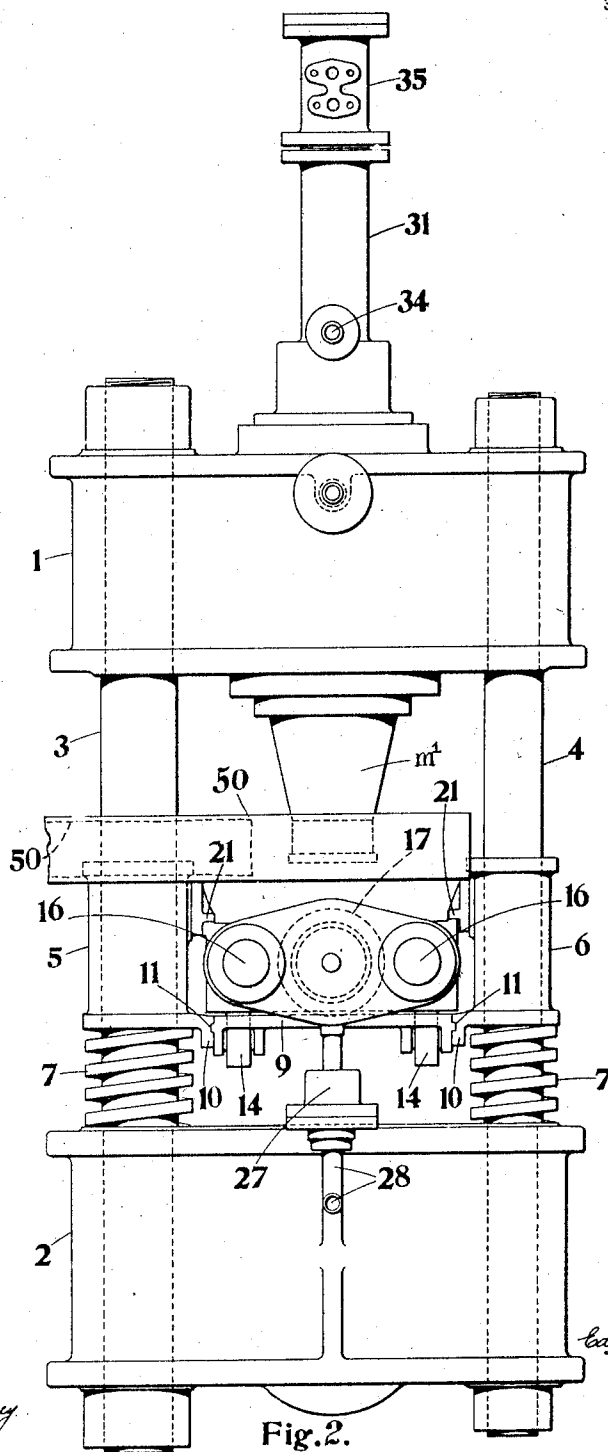


Fig. 2.

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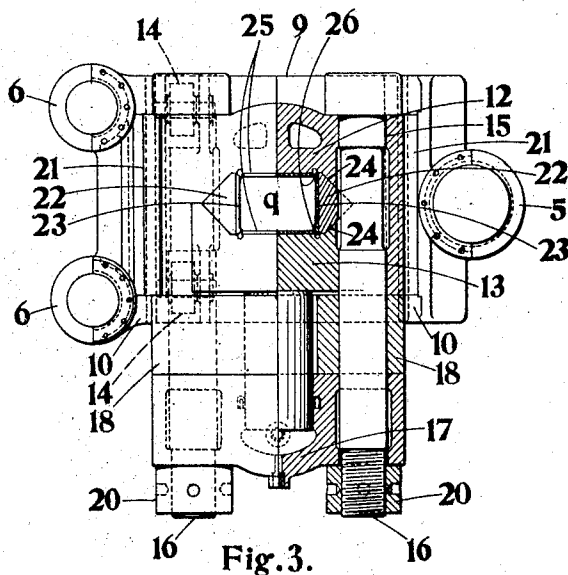


Fig. 3.

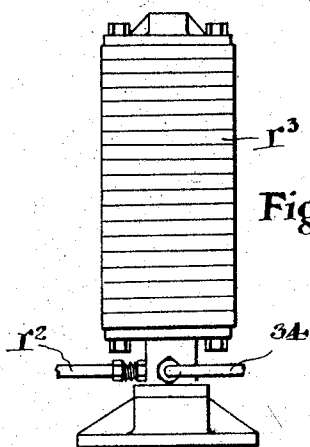


Fig. 4.

Witnesses—
Stanley Wood
David Grant Roney

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UNITED STATES PATENT OFFICE.

EDGAR ROUSE SUTCLIFFE, OF LEIGH, ENGLAND, ASSIGNOR TO PURE COAL BRIQUETTES LIMITED, OF CARDIFF, WALES.

BLOCK-PRESS.

1,335,303.

Specification of Letters Patent.

Patented Mar. 30, 1920.

Original application filed October 30, 1915, Serial No. 58,866. Divided and this application filed December 4, 1916. Serial No. 135,510.

To all whom it may concern:

Be it known that I, EDGAR ROUSE SUTCLIFFE, a subject of the King of Great Britain and Ireland, residing at Leigh, Lancashire, England, have invented certain new and useful Improvements Relating to Block-Presses, of which the following is a specification.

This invention relates to presses, and more especially to presses for the manufacture of briquets from coal according to the processes of the prior applications for patent Serial No. 17504 and 17505 dated 27th March, 1915, now Patents Nos. 1,267,711 and 1,283,354.

According to the invention hydraulic means are provided for lifting the press plunger after the compression stroke, means to equalize the pressure applied in the mold by the plungers, and hydraulic means for the application of pressure laterally of the mold and for the release of that pressure before the briquet produced is discharged.

The invention also comprises hydraulic means for raising the lower plunger or abutment of the press for the ejection of the briquet as well as the constructional features hereinafter described in a press constructed according to the invention.

The accompanying drawings illustrate apparatus constructed according to the invention for the production of briquets from coal or similar carbonaceous substances reduced to a condition of extreme fineness, by a process of simple compression without a binder as described in the specifications filed pursuant to the prior applications for patent aforesaid.

Figures 1 and 2 show in sectional side elevation and front elevation respectively the press employed.

Fig. 3 is a detail plan partly in section of the mold of the press.

Fig. 4 is a diagrammatic view of the accumulator employed in connection with the press.

In carrying the invention into effect, the press is constituted of two cross-heads 1, 2, one beneath the other and connected together at each side by bolts 3, 4, of ample sectional area, one bolt 3 being provided at one side and two 4 at the other side, while between the bolts 3, 4, connecting the respective cross-heads 1, 2 the mold q is mounted, being sup-

ported upon and between sleeves 5, 6 disposed upon the respective bolts, which sleeves support the weight of the mold q upon the lower cross head 2, through spiral springs 7 mounted upon the respective bolts 3, 4. The two bolts 4 provided upon one side of the press are disposed equidistant on each side of the center line, while the single bolt 3 on the opposite side is disposed centrally. By such means the weight of the mold q is taken upon the three sleeves 5, 6 and the mold q is adapted to move downwardly on the introduction of the main plunger m^2 carried by the hydraulic piston m^1 into the mold q , as the result of the friction set up in the sides of the mold, so that thus the pressures applied by the hydraulic piston m^1 and by the lower plunger or abutment 8 are equalized.

The mold q is supported upon a base plate 9 which is mounted at its respective lateral edges in brackets or integral extensions 10 at the lower end of the respective sleeves 5, 6. One bracket or extension 10 is formed upon or carried by the one sleeve 5 and the other upon or by the two oppositely disposed sleeves 6 referred to, while a ledge 11 (Fig. 2) on the respective sides of the base plate 9 engages in a corresponding groove within the respective brackets 10. The parts 12, 13 of which the mold q is formed are adapted to move upon the base plate 9 by providing thereon in determined positions rollers or wheels 14 whose upper peripheral parts protrude through holes or recesses formed on the base plate 9, for their reception and slightly above the upper face of the base plate, so that thus the mold parts 12, 13 are supported upon the protruding parts of the rollers or wheels 14. The mold q is made in two parts 12, 13, the main part 12 having provided within it in addition to the mold space, a recess on one side for the reception of a sliding or moving block 13, forming one wall of the mold space, by which the pressure upon the briquet is relieved laterally to permit of the lateral expansion of the briquet in the mold. The main part 12 of the mold is provided at the sides with parallel holes 15 of circular shape through which pass bolts 16, and these bolts 16 serve to carry a hydraulic cylinder 17 disposed in axial line with the sliding or movable block 13 aforesaid. Suitable

distance pieces or bosses 18 are mounted upon the respective bolts between the hydraulic cylinder and the main part of the mold. The bosses 18 are formed integral 5 and have the upper connecting part 19 extended forward over the top of the mold part 13, the latter being recessed at the top for its reception as indicated in Fig. 1. Nuts 20 are screwed upon the ends of the 10 bolts 16 by which the respective parts are held in position. The respective upper lateral edges of the main part 12 of the mold engage within angular shaped recesses provided in guide plates 21 which are mounted 15 upon the respective sleeves 5, 6.

At each side of the mold space wedge shaped blocks 22 are provided carrying the respective hardened steel end lining plates 23 of the mold space, the wedge blocks 20 being disposed in opposite positions and so formed with respect to the corresponding edges of the main part of the mold and the complementary sliding block or mold part, and so timed in operation that upon pressure being imposed by the hydraulic cylinder 17 aforesaid, the end wedge blocks 22 are forced inwardly by contact with the respective edges 24 of the mold parts 12, 13, so that by such means pressure is applied upon 30 the briquet at each side. The main part 12 of the mold is provided with a hardened steel lining plate 25 which is fitted flush into a recess in its front face and a similar hardened steel lining plate 25 is provided 35 in the front face of the complementary part 13 of the mold, while the lateral edges of the respective lining plates aforesaid are exposed so as to contact with the end lining plates 23 near their edges, where protruding 40 ridges 26 are provided to make tight contact with the exposed lateral edges of the front and rear lining plates 25.

The hydraulic cylinder 17 of the mold is connected to the smaller end of an intensifier 45 27 (Fig. 1) which need only be of a small capacity in view of the small extent of movement needed by the sliding or movable mold part 13, while the larger end of the intensifier is connected to the hydraulic 50 pump f by which the press is actuated, by means of a pipe 28. It will be understood that pressure in the hydraulic cylinder 17 of the mold g rises with the pressure in the hydraulic actuating pump f and is in direct 55 proportion to the pressure applied upon the briquet by the main plunger m^2 .

It will be understood that the main plunger m^2 and the lower plunger or abutment 8 are of a size and shape corresponding to the parallel sided mold space formed 60 by the main part 12 and the complementary part 13 of the mold, and the wedge blocks 22 referred to, and that the compression of the material to be briqueted is effected, by the 65 main plunger m^2 descending into this mold

space and pressing the material against the lower plunger or abutment 8. The movable mold part 13 during compression is forced inwardly, and on the main plunger being withdrawn from the mold space, pressure 70 upon the movable mold part 13 is relieved, so that the briquet produced may be lifted by the bottom plunger or abutment 8 to the level of the top of the mold and moved forward by the feed box 29 which then comes 75 to lie over the mold space for feeding a further quantity of material to be compressed, into the mold space.

An air chamber or receiver is provided connected in the hydraulic system, by which 80 any leakage is made good. Liquid is pumped into the receiver at for example from 20 to 50 lbs. per square inch, the charging pump coming into operation when the pressure falls below a predetermined degree. This 85 air chamber or receiver is directly connected to the hydraulic actuating pump f of the press, so that thus this pump f and the pipe 30 through which the liquid is passed to the main cylinder m of the press are always 90 maintained filled with liquid, while furthermore connection is made with the hydraulic cylinder 17 of the mold g so as to insure that this cylinder 17 also is fully charged with liquid. 95

It will be understood that check valves are provided in the connected pipe system so that when pressure is applied these check valves are automatically closed.

Again it will be understood that the accumulator r^3 and the pump by which it is 100 maintained, as well as the air chamber or receiver and the pump by which it is maintained, may be used and connected for any number of presses or hydraulic actuating 105 pump systems.

For the purpose of returning the piston m^1 and the main plunger m^2 to the uppermost position I provide a hydraulic cylinder 31 surmounting and in alinement with the main 110 cylinder m of the press, and I provide a piston rod 32 passing centrally through the head of the main cylinder m into the smaller hydraulic cylinder 31, and near its upper extremity I secure a piston 33. The lower 115 end of this smaller hydraulic cylinder is connected by means of a pipe 34 with the accumulator r^3 by which a constant pressure of for example 2 tons per square inch is maintained on the underside of the piston 33. 120 By such means the pressure under the piston 33 of the smaller hydraulic cylinder 31 comes into operation to return the piston m^1 and the main plunger m^2 , and in so doing to return the plunger of the hydraulic actuating 125 pump f to its initial position as well as the pistons of the operating motor.

Above the smaller hydraulic cylinder 31, a valve casing 35 is provided within which a one-way valve 36 is mounted and main- 130

tained upon its seat by means of a spring 37. The valve 36 is so disposed that on the piston 33 reaching its uppermost position the protruding extremity of the piston rod 32 opens the valve 36 so that by such means communication is possible from the space below the valve 36 to the space above the valve.

The lower plunger or abutment 8 has its lower end formed as a ram 38 by which it is adapted to be moved through the mold *g*, a hydraulic cylinder 39 being mounted in a central position on the lower cross-head 2 for the reception of the ram. The lower end of the hydraulic cylinder 39 communicates with the space beneath the one-way valve 36 through a pipe 40 of ample cross sectional area, so that upon the one way valve 36 referred to being opened in the manner described the weight of the lower plunger or abutment 8 and the ram 38 by which it is carried, comes into operation, at once forcing the liquid upwardly through the pipe 40 and through the one-way valve 36, thence through the space above the valve 36 and through an outlet pipe 41 into a reservoir 42 mounted in an adjacent position above the press. By such means it will be understood that the lower plunger or abutment 8 after delivery of the finished briquet descends when the main plunger *m*² nears its uppermost position.

The reservoir 42 last referred to is in communication through a pipe 43 with the space beneath the one-way valve 36, so that thus on the piston *m*¹ and the main plunger *m*² descending, liquid is drawn through this pipe 43 from the reservoir, a check valve 44 being provided upon the pipe 43 so that thus on the returning upward movement of the piston *m*¹ and the small piston 33 connected with it, the liquid above this piston 33 instead of being returned to the reservoir 42 is forced into the hydraulic cylinder 39 by which the latter is forced upwardly to the top of the mold for delivery of the finished briquet.

The cylinder 31 is at its lower extremity provided with a stuffing gland 45 to insure a liquid tight joint, while a similar stuffing gland 46 is provided at the head of the main cylinder *m* of the press.

Any suitable means for the connection of the piston rod 32 to the piston *m*¹ may be provided. For example the end of the piston rod 32 is screwed into position at the top of the piston *m*¹ and an annular groove 47 on the screwed extremity of the piston rod 32 is provided for the reception of the end of a fixing screw 48 passed in a transverse position through a radial hole 49, in the piston *m*¹ which is screw threaded at its lower end for the reception of the fixing screw 48.

Any suitable means may be provided for feeding the material to be compressed. A

conveyer 50 is provided to bring the material into position beside and above the mold *g* and a sliding feed box 29 is provided to slide upon the top of the mold *g* from a position immediately beneath the conveyer 50 to a position above the mold *g*.

The feed box 29 is formed open top and bottom and of a substantially rectangular or oblong shape corresponding to but a little larger than the opening in the mold *g* and its upper edges are provided to contact with the under face of the receptacle 51 into which the material to be compressed is discharged from the conveyer 50, while its lower edges slide upon the top face of the mold *g*. By such means in one position of the feed box 29, it is filled with material to be compressed while in the other the feed box is emptied of its contents.

The feed box 29 is provided with rearwardly extending arms 52 carrying a pin 53 upon which is mounted a block which is adapted to slide within an open slot 54 provided in the lower end of an operating rod 55 pivoted to a bracket 56 on the underside of the main cylinder *m*. A contact lever 57 which is also pivoted on the same bracket 56 is connected by means of a link 58 to the operating rod 55 aforesaid at a position a small distance beneath its upper extremity, and a pin or other member 59 is provided in a convenient position upon the outwardly protruding end of the piston *m*¹ for engagement with the contact lever 57 aforesaid, so that thus on the descent of the main plunger *m*² the lower end of the operating lever 55 is forced rearwardly, carrying with it the feed box 29, the feed box clearing the end of the plunger *m*² as the latter moves toward the mold *g*. The lower forward edge of the feed box 29, it will be understood levels off the loose material in the mold, and serves to force forward the finished briquets as they are delivered into a position in front of it upon the top of the mold.

The contact arm 60 is provided integral with the contact lever 57 and engages with the pin 59 on the return upward movement of the plunger *m*¹ so that thus the feed box 29 is again brought under the receptacle 51.

For effecting the operation of the press at high speed, I prefer to employ a motor as described in the specification of the application Serial No. 58866 of 1915.

I may provide means to insure that where for any reason the quantity of material compressed in the mold *g* is too small to produce a briquet of the required thickness the pressure applied shall nevertheless be sufficient to effect consolidation. These means preferably comprises a small valve *r* situated at the end of the hydraulic pump *f* opposite to that at which the plunger of the pump slides, and this valve *r* is so mounted that when the plunger has nearly reached the

end of its forward movement it, on contact with the plunger, opens communication with a space within a fitting r^1 communicating through the pipe r^2 with the accumulator r^3 ,
 5 loaded to a pressure for example of two tons per square inch, so that thus, if for any reason the required pressure, of for example ten tons per square inch has not been reached within the mold q of the press by the time
 10 the end of the plunger comes into contact with the valve r , direct communication is established between the accumulator and the main cylinder m of the press by which construction the deficiency in liquid is made good and the
 15 required pressure within the mold attained. It will, however, be understood that this valve r will be actuated only when the stroke of the pump plunger is slightly greater than the normal stroke, brought about by the
 20 abnormal conditions within the main cylinder m of the press, as the result of the too small quantity of material in the mold q .

I claim:—

1. An apparatus for pressing, comprising
 25 a hydraulic actuating pump, a hydraulic press, a connection between the said pump and the cylinder of the said press, means for operating the actuating pump to cause the operating stroke of the press plunger,
 30 and hydraulic means for returning the press plunger, said means consisting of a hydraulic cylinder, surmounting the cylinder of the press, a piston therein connected with the press plunger, a mold, said mold being divided into two parts movable laterally, hy-
 35 draulic means for operating them, coöperating end blocks adapted to be operated by the same hydraulic means, and an accumulator connected with the lower end of the
 40 said hydraulic cylinder to maintain a substantially constant pressure therein tending to lift the press plunger, substantially as described.

2. An apparatus for the production of
 45 briquets, comprising a hydraulic actuating pump, a main plunger, a mold having separable side and end walls of which the plunger forms one face, a hydraulic cylinder within which said plunger moves, a lower
 50 plunger or abutment forming the other face, a mold with which the said main plunger and the said lower plunger or abutment coöperate for the compression of the material to be briqueted, means for operating the ac-
 55 tuating pump to cause the operating stroke of the main plunger, and hydraulic means for returning the press plunger, and for moving the lower plunger or abutment for the delivery of the briquet, substantially as described.
 60

3. An apparatus for the production of briquets, comprising a hydraulic actuating pump, a main plunger, a hydraulic cylinder within which said plunger moves, a lower
 65 plunger or abutment, a mold with which the

said main plunger and the said lower plunger or abutment coöperate for the compression of the material to be briqueted, means for operating the actuating pump to cause the operating stroke of the main plunger,
 70 hydraulically moved sides and ends for the mold, hydraulic means for returning the press plunger and for moving the lower plunger or abutment for the delivery of the briquet, and means permitting of the lower
 75 plunger or abutment then immediately descending toward the bottom of the mold, substantially as described.

4. An apparatus for the production of briquets, comprising a hydraulic cylinder,
 80 a piston and a main plunger therefor, a mold within which the material to be briqueted is compressed, within the upper open end of which mold the said plunger passes, a second plunger or abutment adapted to pass
 85 within the lower open end of the said mold, hydraulic means for effecting the movement of the said main plunger for the compressing operation, for the return of the said main plunger after the compressing opera-
 90 tion, and for the movement of the said second plunger or abutment for the ejection of the finished briquet from the mold, the sides and ends being yieldable, substantially as described.
 95

5. An apparatus for the production of briquets, comprising a hydraulic cylinder,
 a piston and a main plunger therefor, a mold within which the material to be briqueted is compressed, within the upper open
 100 end of which mold the said plunger passes, a second plunger or abutment adapted to pass within the lower open end of the said mold, hydraulic means for effecting the movement of the said main plunger for the
 105 compressing operation, for the return of the said main plunger after the compressing operation, and for the movement of the said second plunger or abutment for the ejection of the finished briquet from the mold
 110 and for allowing of the descent of the said second plunger or abutment immediately after the delivery of the said finished briquet, the sides and ends of the mold being yieldable, substantially as described.
 115

6. An apparatus for the production of briquets, comprising a hydraulic cylinder, a main plunger therefor, a mold within which the material to be briqueted is compressed, within the upper open end of which mold
 120 the said main plunger passes, a second plunger or abutment adapted to pass within the lower open end of the said mold, a feed box adapted to slide upon the mold, means derived from the main plunger for effecting
 125 the movement of the said feed box from a position in which it is supplied with the material to be briqueted to a position over the upper open end of the mold, and for the return of the feed box and hydraulic means
 130

for moving the said second plunger or abutment for the ejection of the finished briquet from the mold, said mold being laterally yieldable, substantially as described.

7. An apparatus for the production of briquets comprising a hydraulic cylinder, a main plunger therefor, a mold within which the material to be briqueted is compressed, within the upper open end of which mold the said plunger passes, a second plunger or abutment adapted to pass within the lower open end of the said mold, a feed box adapted to slide upon the mold, means derived from the main plunger for effecting the movement of the said feed box from a position in which it is supplied with the material to be briqueted to a position over the open end of the mold and for the return of the said feed box, hydraulic means for effecting the movement of the said main plunger for the compressing operation and for the return of the said main plunger after the compressing operation, means for effecting the movement of the said second plunger or abutment for the ejection of the finished briquet and for allowing of the descent of the said second plunger or abutment immediately after the delivery of the said finished briquet, said mold being laterally yieldable, substantially as described.

8. An apparatus for the production of briquets, consisting of means for effecting the compression of the material to be briqueted, comprising essentially a mold, a main plunger and a second plunger or abutment, hydraulic means for the retraction of the main plunger after the compression has been effected, comprising a hydraulic cylinder and piston connected to the main plunger and means for moving the second plunger or abutment to eject the finished briquet, said mold being laterally yieldable, substantially as described.

9. An apparatus for the production of briquets, consisting of means for effecting the compression of the material to be briqueted, comprising essentially a mold having fluid actuated walls, a main plunger and a second plunger or abutment, hydraulic means for the retraction of the main plunger after the compression has been effected, comprising a hydraulic cylinder and piston connected to the main plunger and means for moving the second plunger or abutment to eject the finished briquet and thereupon to allow the said second plunger or abutment to fall, substantially as described.

10. An apparatus for the production of briquets, consisting of means for effecting the compression of the raw material to be briqueted, comprising essentially a mold and plunger, and means for the retraction of the said plunger after the compression has been effected, comprising a hydraulic cylinder, an accumulator, pressure responsive means in

connection with said accumulator whereby a substantially constant pressure is maintained within said hydraulic cylinder against a piston therein connected to the said plunger, substantially as described.

11. An apparatus for the production of briquets, consisting of means for effecting the compression of the material to be briqueted, comprising essentially a main plunger, a second plunger or abutment and a mold, hydraulic means for the retraction of the said main plunger after the compression of the material to be briqueted has been effected within the said mold, comprising a hydraulic cylinder and a piston moving within said hydraulic cylinder and connected to the said main plunger, means for effecting the movement of the said second plunger or abutment comprising a hydraulic cylinder within which hydraulic liquid is forced on the return movement of the main plunger, and a valve adapted to be opened upon the return of the main plunger to release the hydraulic liquid from within the cylinder of the lower plunger or abutment, substantially as described.

12. An apparatus for the production of briquets, consisting of means for effecting the compression of the material to be briqueted, comprising essentially a main plunger, a second plunger or abutment and a mold, hydraulic means for the retraction of the said main plunger after the compression of the material to be briqueted has been effected within the said mold, comprising a hydraulic cylinder and a piston moving within said hydraulic cylinder and connected to the said main plunger, means for effecting the movement of the said second plunger or abutment comprising a hydraulic cylinder within which hydraulic liquid is forced on the return movement of the main plunger, a valve adapted to be opened upon the return of the main plunger to release the hydraulic liquid from within the cylinder of the lower plunger or abutment, and a reservoir into which the said hydraulic liquid may pass on the consequent fall of the said lower plunger or abutment, substantially as described.

13. An apparatus for the production of briquets, consisting essentially of a main plunger, a second plunger and a mold, said mold being of a plurality of parts one only of which is movable, and means for the support of the said mold parts upon a base plate under spring resistance, substantially as described.

14. An apparatus for the production of briquets, consisting essentially of a main plunger, a second plunger and a mold, said mold being of a plurality of parts one only of which is movable, means for supporting the said mold parts consisting of a base plate, sleeves mounted under spring resist-

ance and carrying brackets within which the edges of the base plate are supported, substantially as described.

15 15. An apparatus for the production of briquets, consisting essentially of a main plunger, a second plunger and a mold, said mold being of a plurality of parts one only of which is movable, means for supporting the said mold parts consisting of a base
10 plate, sleeves mounted under spring resistance and carrying brackets within which the edges of the base plate are supported and means for guiding and supporting the upper lateral edges of the mold, substantially
15 as described.

16. An apparatus for the production of briquets, consisting essentially of a main plunger, a second plunger and a mold, said mold being of a plurality of parts one only
20 of which is movable in relation to the other, means for maintaining pressure upon the movable part of the mold proportional to the pressure applied upon the main plunger, substantially as described.

25 17. An apparatus for the production of briquets, consisting essentially of a main plunger, a second plunger and a mold the said mold being formed of a plurality of parts one only of which is movable in relation
30 to the other, a hydraulic cylinder and plunger for applying pressure to the movable part of the mold, a hydraulic actuating pump for the main plunger, and means for applying upon the movable part of the
35 mold a pressure proportional to the pressure applied upon the main plunger consisting essentially of an intensifier, substantially as described.

18. An apparatus for the production of
40 briquets, consisting of means for effecting the compression of the material to be briqueted comprising essentially a mold and plunger, hydraulic means for applying pressure upon the mold laterally to an extent
45 proportional to the pressure imposed by the said plunger and means for permitting the briquet produced to expand in the mold under the stresses imposed upon it by compression therein substantially as described.

50 19. An apparatus for the production of briquets consisting of means for effecting

the compression of the material to be briqueted comprising essentially a mold and plunger and a hydraulic actuating pump by which the said plunger is operated, means
55 for applying pressure laterally to the mold during compression comprising a hydraulic intensifier in communication with the said hydraulic actuating pump, substantially as described.

60 20. An apparatus for the production of briquets consisting of two cross-heads one disposed above the other and each carrying a hydraulic cylinder the one above for the main plunger, the one below for the second
65 plunger, bolts by which the said cross-heads are connected together, sleeves carried by the said bolts in corresponding positions thereon, a mold carried by said sleeves, said mold being formed of a plurality of parts
70 one of which is movable, and means for carrying the stationary part of the mold and the said sleeves so that the pressures of the main and second plungers upon the material to be briqueted are equalized, substantially
75 as described.

21. An apparatus for the production of
80 briquets consisting of two cross-heads one disposed above the other and each carrying a hydraulic cylinder the one above for the main plunger, the one below for the second plunger, bolts by which the said cross-heads are connected together, sleeves carried by
85 the said bolts in corresponding positions thereon, a mold carried by said sleeves, said mold being formed of a plurality of parts one of which is movable, means for carrying the stationary part of the mold, and the said sleeves so that the pressures of the main and second plungers upon the material to be briqueted are equalized, and means for feeding
90 the material to be briqueted into the mold, consisting of a sliding feed box, mechanism for moving the feed box to and fro, comprising a contact lever adapted to engage
95 the main plunger, an operating lever with which the said contact lever is connected by means of a link, and means for connecting the feed box to the end of the operating lever, substantially as described.

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