Aug. 26, 1941. W. C. GOSS 2,253,699

METHOD AND APPARATUS FOR MAKING FUEL BRIQUETTES

Filed Dec. 17, 1937 4 Sheets-Sheet 1

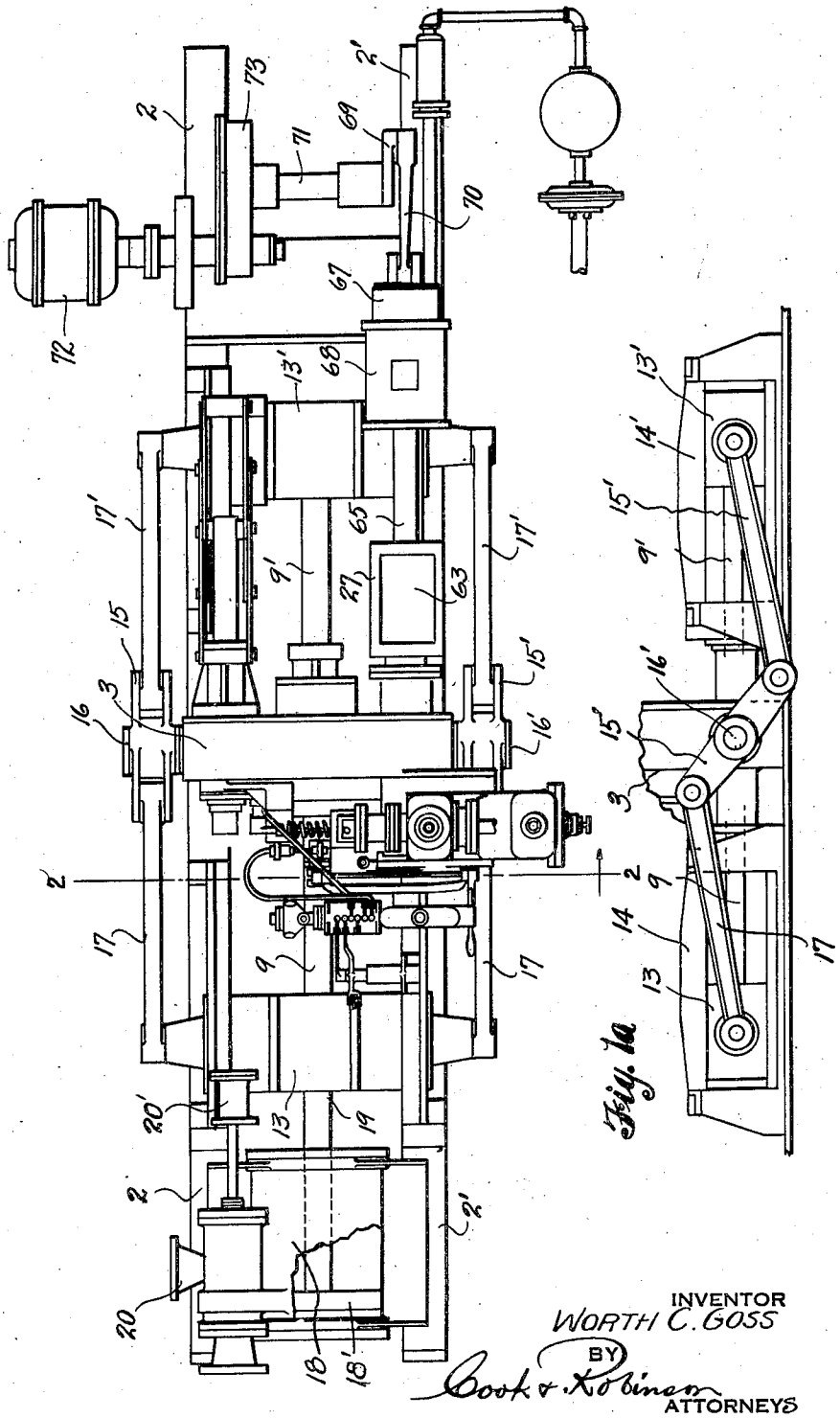


Fig. 1

Fig. 1a

INVENTOR
WORTH C. GOSS
BY
Cook & Robinson
ATTORNEYS

Aug. 26, 1941. W. C. GOSS 2,253,699

METHOD AND APPARATUS FOR MAKING FUEL BRIQUETTES

Filed Dec. 17, 1937 4 Sheets-Sheet 2

Fig. 2

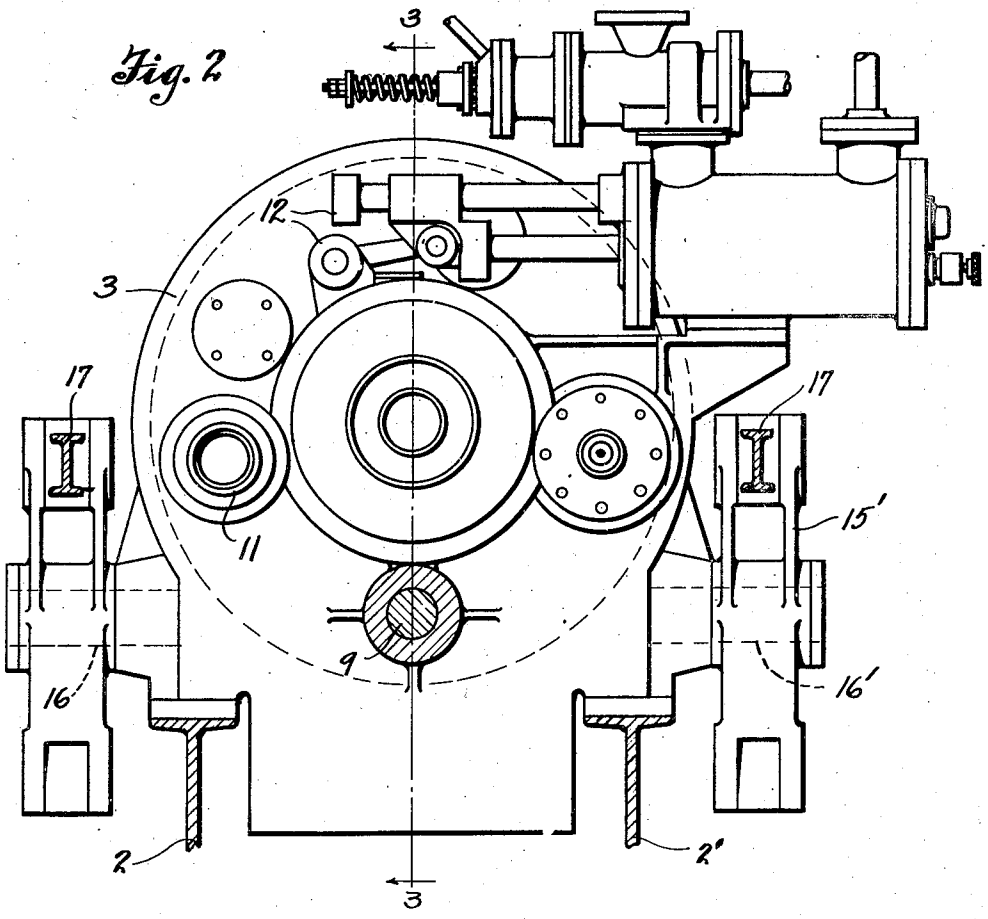


Fig. 3

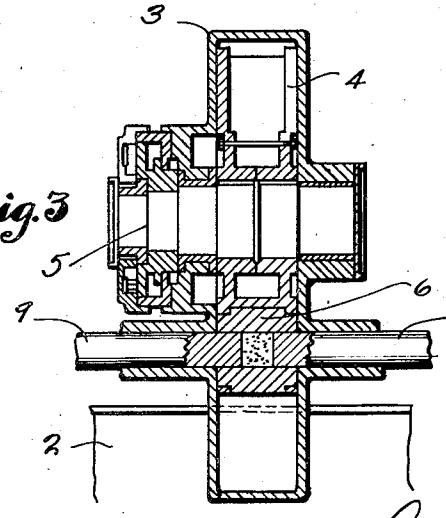
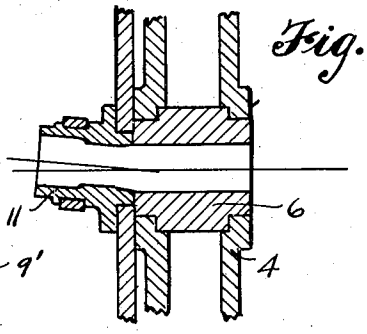


Fig. 10



INVENTOR
WORTH C. GOSS
BY
Cook & Robinson ATTORNEY

Aug. 26, 1941. W. C. GOSS 2,253,699

METHOD AND APPARATUS FOR MAKING FUEL BRIQUETTES

Filed Dec. 17, 1937 4 Sheets-Sheet 3

Fig. 4

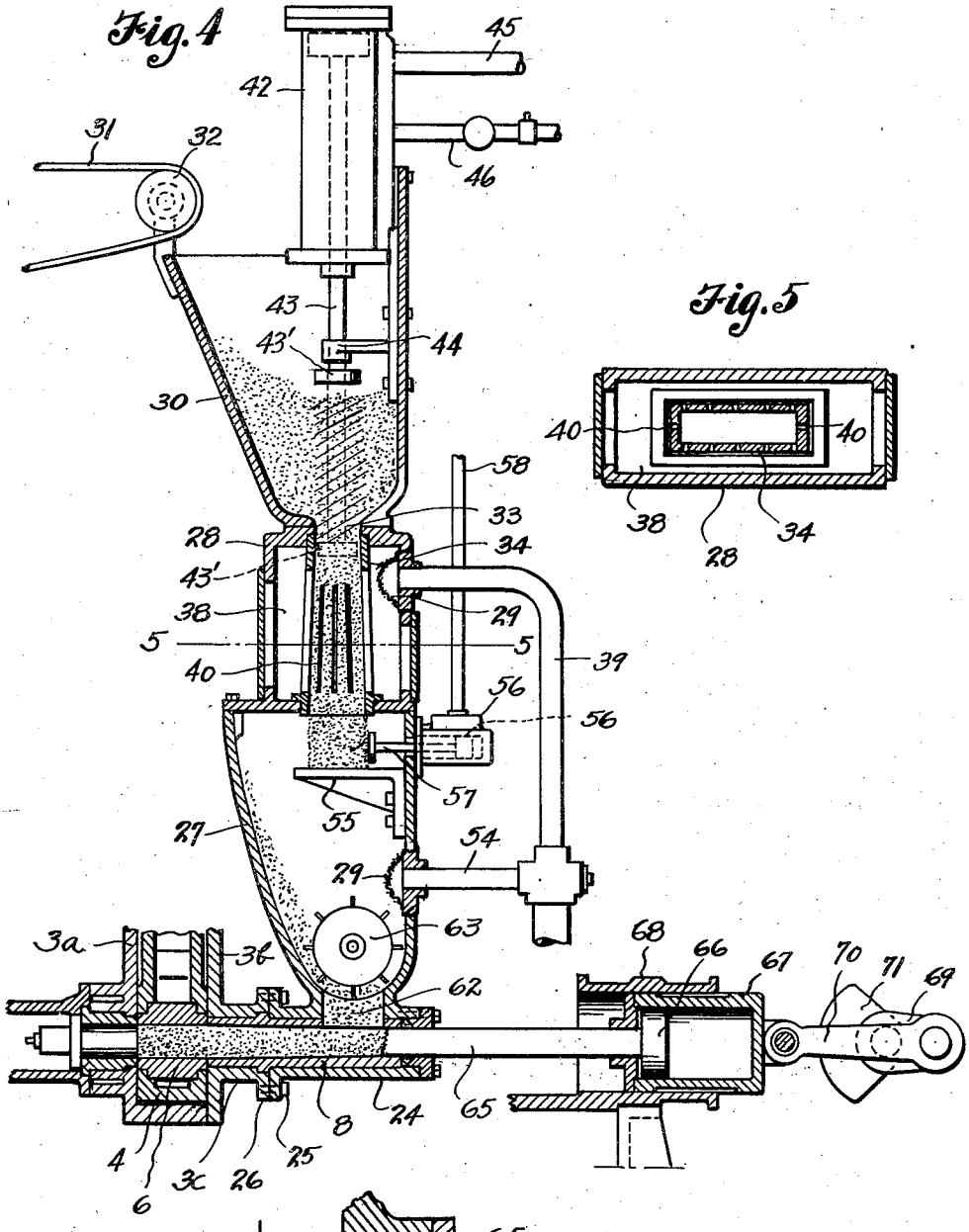
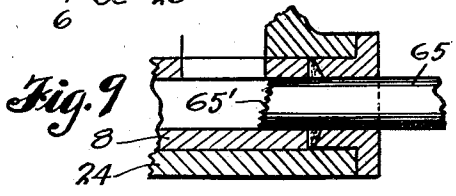


Fig. 5

Fig. 9



INVENTOR
WORTH C. GOSS
BY
Cook & Robinson
ATTORNEY

Aug. 26, 1941. W. C. GOSS 2,253,699

METHOD AND APPARATUS FOR MAKING FUEL BRIQUETTES

Filed Dec. 17, 1937 4 Sheets-Sheet 4

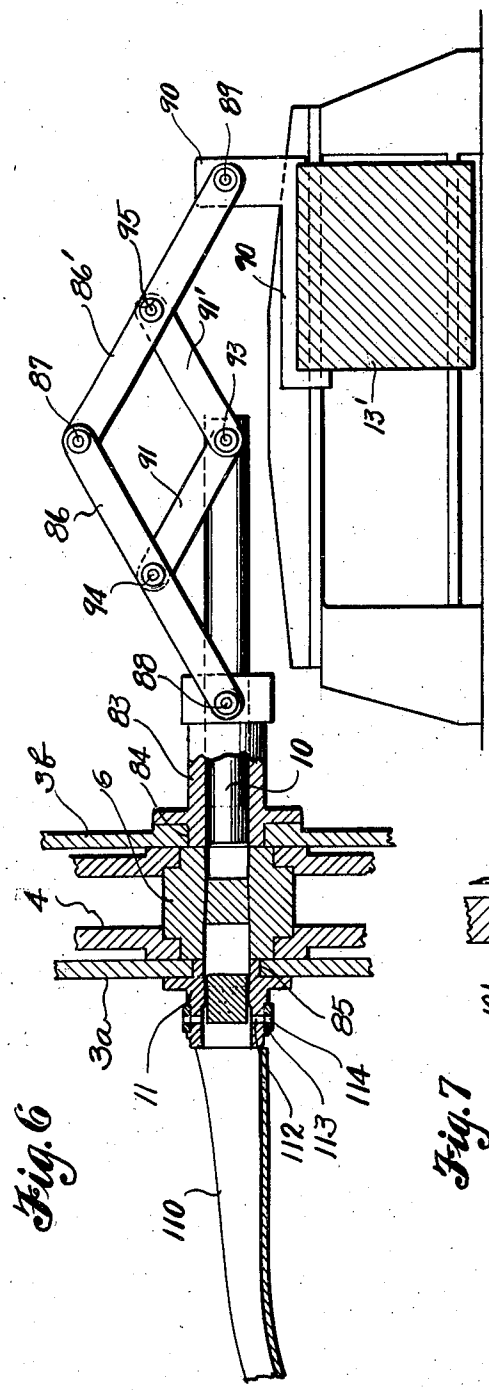


Fig. 6

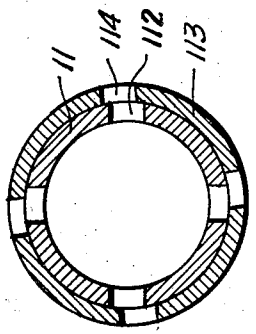


Fig. 8

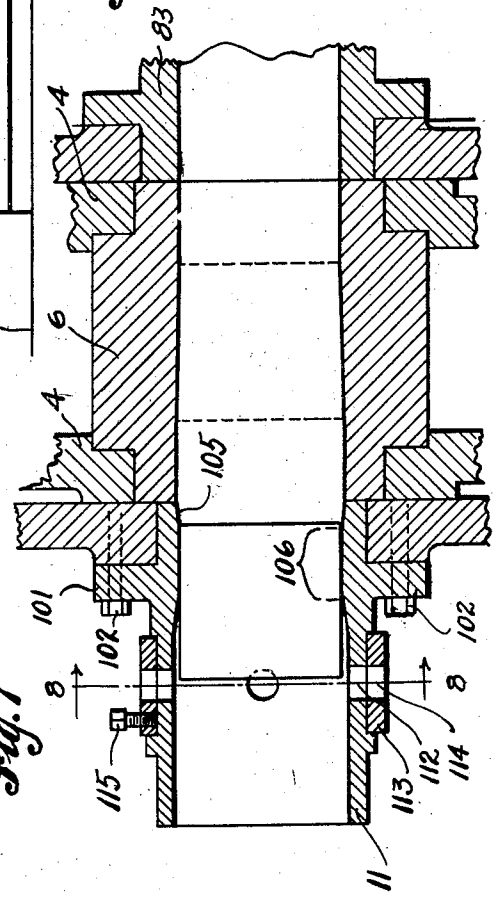


Fig. 7

INVENTOR
WORTH C. GOSS
BY
Cook & Robinson ATTORNEY

Patented Aug. 26, 1941 2,253,699

UNITED STATES PATENT OFFICE

2,253,699

METHOD AND APPARATUS FOR MAKING FUEL BRIQUETTES

Worth C. Goss, Seattle, Wash., assignor to Carlisle Lumber Company, Onalaska, Wash., a corporation of Washington

Application December 17, 1937, Serial No. 180,376

12 Claims. (Cl. 25—67)

This invention relates to improvements in briquette presses and has reference more particularly to those types of high speed presses wherein the formation of briquettes from comminuted wood material is by sudden impact, as differentiated from those types of machines wherein the briquettes are formed by a relatively slow application of pressure; one type of high speed impact press being described and illustrated in my application filed on January 4, 1936, under Serial No. 57,546, Patent No. 2,128,241, issued August 30, 1938, and it is to this machine that the present invention is directed.

Explanatory to the present invention, which embodies various improvements upon the device of my application for patent above mentioned, it will here be stated that in the machine of the application, the comminuted, or finely ground wood material which is to be formed into briquettes, is stored in a vacuumized hopper and is fed from the hopper into a die charging cylinder wherein a reciprocally actuated ram operates to advance charges of this material into briquette molding dies. The molding dies are arranged in a rotary carrier, or wheel, and are successively brought, by intermittent movements of this carrier, into registration with the charging cylinder, and, while in registration, are charged by the action of the reciprocating ram. As the dies are thus successively charged, the carrier is intermittently advanced, to register each die with a station at which a pair of reciprocating rams, or punches, are driven into the die from its opposite ends, thereby to compress the charge by sudden impact into a briquette. The dies are also successively registered with a discharge tube, and a ram, moving with the impact punches, operates through each die in proper timing with the intermittent advance movements of the rotary carrier, to eject the formed briquette therefrom and from the machine.

A feature of the machine of my above mentioned application, as well as being a feature of the present machine, is that provision is made whereby the finely divided wood material is evacuated of air and is maintained under vacuum from the time it enters the machine until the briquettes are formed and ejected. The present invention relates particularly to certain improvements in several of those features which have an important bearing on the maintaining of a desired degree of vacuum within the machine and the evacuation of air from the mass of comminuted material entering the machine, it having been proven to be essential to the successful manufacture of fuel briquettes by the present impact process, that all air be extracted from the material in order to produce a firm, durable and long burning briquette, as will well be understood by those familiar with this art.

Also, in the machine of my above mentioned pending application, provision was made for the comminuted wood to be received into a hopper which was divided into a plurality of separated compartments and means was provided for progressively advancing the supply of comminuted material in batches through the several compartments. Other means was provided whereby these compartments were vacuumized to different and progressively increased degrees. Thus, with a machine of that kind, when the material reaches the loading cylinder from the hopper, it is practically free of air, and when formed into a briquette, the solidity of the briquette will not be impaired by the trapping of any air therein.

In the actual building and use of a machine according to the teachings herein, there have been found to be various unforeseen and undesirable features, particularly with reference to the difficulty in preventing leakage in the hopper compartments, and the large size of vacuum pump required, since all air must be extracted from the comminuted material after it has been enclosed in the hoppers and must pass through the vacuum pump. Furthermore, it was required that the hoppers be of considerable size, and the various compartments involved a rather complicated and expensive series of valves and control devices which were necessary for the progressive advancement of material from one hopper compartment into the other, and the final delivery of material into the loading cylinder. Also, there has been disclosed a material disadvantage in the use of the briquette ejector ram moving at the speed of the opposedly acting rams which form the briquettes, for the reason that its high speed of travel literally shoots the briquette from the machine with a resultant damage thereto.

In view of the above and other disadvantages, or undesirable features found to exist in the machine of the aforementioned patent, it has been the principal object of this invention to overcome these disadvantages and undesirable features, first by the provision of improved details of construction whereby air, to the maximum degree, may be displaced from the briquette material prior to its actual entry into the vacuumizing chambers, thus avoiding the necessity of its being drawn through the vacuumizing pump system;

secondly, to do this by a less expensive and more effective mechanism, whereby the feeding of the material to the charging cylinder is expedited and less power is consumed in maintaining a high vacuum; thirdly, to provide means whereby the ejection of briquettes is effected without damage thereto and in a manner whereby each briquette serves, during a period of removal, to close the ejection passage of the machine against the inflow of outside air.

More specifically stated, one of the prime objects of the present invention resides in the provision of a hopper for a supply of material, in which a charging ram operates reciprocally to compress and deliver charges of material into a vacuumizing tube leading to a vacuumized hopper opening into the charging cylinder; the initial compression of the material by this charging ram being in the open air, and providing for the displacement of practically all air from the charge before it enters the vacuumizing tube.

Another object of the invention resides in the provision of a hopper and vacuumizing tube as above stated, wherein provision is made that the entering material shall serve as a closure medium at the entrance for retaining the vacuumized condition of the machine.

Still another object of this invention resides in the provision of means for lessening the velocity of the ejecting ram and thus decreasing the speed of ejection of the briquette from the die where the briquette was formed; this being desirable because the forces of disintegration are much reduced when the briquette leaves the die with low velocity.

A further object resides in the provision of a suction brake for the ejected briquettes whereby their final discharge velocity may be controlled to such an extent that all possibility of damage thereto may be overcome.

It is also an object of the invention to embody in the suction brake an improved form of ejection tube which provides that briquettes ejected therethrough will serve successively as a temporary closure for the ejection opening, thereby to prevent the loss of the vacuum within the machine by entrance of air at the discharge end.

Another object is in eliminating the possibility of the punches striking the die wheel, by reason of valve wear or breakage. This is accomplished by the particular spacing of the tip of the ejector punch.

Still another object of this invention resides in the provision of means for overcoming the tendency of briquettes to be chipped at one edge incident to ejection, by reason of a certain unevenness due to greater compactness of material at one side of the die than at the other.

Other objects deside in the details of construction of the various parts, in their combination and mode of operation, as will hereinafter be fully described.

In accomplishing these objects of the invention, I have provided the improved details of construction, the preferred forms of which are illustrated in the accompanying drawings, wherein—

Fig. 1 is a plan view of an impact press embodying the present improvements. Fig. 1a is a partial side elevation showing ram operating connecting rods.

Fig. 2 is a cross section in the vertical plane of line 2—2 in Fig. 1.

Fig. 3 is a vertical section of the die carrier and its enclosing housing, as seen on line 3—3 in Fig. 2.

Fig. 4 is a vertical, sectional detail of the loading hopper and devices associated therewith.

Fig. 5 is a cross section on line 5—5 in Fig. 4.

Fig. 6 is a view partly in side elevation and partly in cross section, showing the briquette ejection ram and the ejection tube structure, particularly disclosing the vacuum brake for the ejected briquette, and the location of ejector punch when withdrawn.

Fig. 7 is an enlarged sectional view of the ejection tube and the forming die alined therewith.

Fig. 8 is a cross section on line 8—8 in Fig. 7.

Fig. 9 is an enlarged view of the packing ram showing beveled end thereof corrugated to prevent briquette stratification.

Fig. 10 is a sectional view of the ejection tube showing angular tilting thereof.

Referring more in detail to the drawings—

In Fig. 1, I have shown, in plan view, a briquette press substantially like that disclosed in my previously mentioned patent but embodying the present improvements. Briefly described, this impact press comprises a substantial and rigid horizontal frame structure including the spaced, opposite side beams 2 and 2' on which is transversely fixed an air-tight housing 3 in which a die carrier, in the nature of a turret or wheel 4 is rotatably supported on an axle 5; the axle being mounted at its ends in bearings provided in the opposite walls of the housing 3. This wheel 4 mounts therein, at equally spaced intervals, a plurality of briquette dies 6 of cylindrical or other desirable cross sectional forms, open at opposite ends and adapted, by reason of intermittent advance movements of the wheel, to be brought successively into coaxial registration, firstly, with a charging cylinder 8 for receiving a charge of material; secondly, into registration with and between a pair of opposedly acting punches, or rams, 9—9' which enter the dies from opposite ends to compress the charges, and finally, into registering alinement with a reciprocally acting ejection ram 10 which drives each finished briquette into an ejection tube 11, presently described in detail, thus to serve temporarily as a closure plug for the ejection opening and from which tube the briquette is finally discharged incident to its displacement by the next ejected briquette.

The intermittent movement of the wheel or turret 4 is effected by means of an indexing mechanism which is not made the basis of claims in this application, since it was disclosed in detail in the previous application. It is believed sufficient to say that the indexing means herein used, like that of the previous application, operates automatically, and incident to the successive charging of dies with material from the cylinder 8, to advance the wheel through definite and predetermined intervals whereby the charged dies are successively registered with the line of travel of the impact rams for formation of the briquettes, and with the ejection tube for delivery by the ejection ram from the machine. This indexing mechanism is designated generally by reference character 12 and the details of its construction and mode of operation can be learned by referring to the above numbered application.

The briquette compressing rams 9—9' are fixed at their outer ends in heavy hammers 13—13' that are reciprocally movable in guideways 14—14' formed therefor in the main frame structure. These hammers are connected together for a synchronous, balanced action through the

mediacy of rocker levers 16—16', which are pivoted on axles 16—16' extended from opposite sides of the housing 3, and which rocker levers have opposite ends thereof connected by means of pivoted links 17 and 17' respectively with the hammers. The connections are so made that the hammers will be caused to move reciprocally inwardly and outwardly together and the inertial impact forces afforded thereby will be absolutely balanced through the interconnecting means.

The means for reciprocally actuating the hammers comprises a steam cylinder 18 having its piston 18' connected to hammer 13 by a rod 19. The admittance of steam to the cylinder from a source of supply admitted through a pipe 20 is under control of a valve mechanism 20' which may be like that of the aforementioned patent, or any other suitable kind, and, since it forms no basis of claims in this application, it will not be described in detail.

It will here be mentioned that the action of the control valve is controlled by an automatic means which, in turn, is under control of the die charging and indexing mechanism, so that the impact punches cannot be driven forward before a loaded die has been properly and accurately registered in the line of travel of the briquette forming rams.

Referring now to Fig. 4, 3a and 3b designate the opposite face plates of the air-tight housing 3 wherein the die carrying wheel 4, or turret, is contained, and 6 designates one of the molds or dies that is carried in the wheel and which is here shown as being in registration with the end of the charging tube, or cylinder, 8; this being in the nature of a tubular sleeve, or lining, in an enclosing housing 24 that is flanged at one end and attached by bolts 25 through this flange, to a flange 26 on a neck 3c extended from the main housing 3. Integral with housing 24 is an air tight hopper 27 upon which a vacuumizing housing 28 is mounted. This housing, in turn, mounts a receiving hopper 30 thereon. The hopper 30 is open at the top and is flared so as to receive and hold an appreciable amount of the briquette forming material which may be delivered thereinto by any suitable means, such as by the belt conveyer 31 operating over wheel 32.

At the base of hopper 30 is an opening 33 and leading downwardly therefrom through the housing 28 is a tubular member 34 which, at its lower end, opens directly into the top of the hopper 27. The tube 34 is rectangular in cross section, as seen in Fig. 5, and is surrounded in the housing 28 by a vacuum space or chamber 38 with which chamber a pipe 39 from a source of vacuum, not shown, connects to maintain a condition of vacuum in the chamber 38. The inner end of vacuum pipe 39 is covered with a fine screen 29 at least five times the area of the pipe, to prevent clogging with sawdust.

The tube 34 is formed, from near its upper end to near its lower end and about its surface, with narrow longitudinal slots 40 whereby vacuum in the chamber 38 is communicated to the interior of the tube 34 so that any air in material contained in the tube will be withdrawn. These slots are sufficiently narrow that the comminuted material itself will not, to any appreciable extent, be extracted or caused to clog therein.

Mounted upon the hopper 30 is the material feeding unit. This comprises a vertically disposed steam cylinder 42 with a piston rod 43 extending from its lower end and reciprocally contained in a guide bracket 44 fixed on the hopper wall. The piston rod is coaxially alined with the opening 33 and tube 34 and its function is that of a charging ram, the operation of which effects the advancement of material from the hopper into the tube. This steam cylinder, which is in trade known as a "Westinghouse Air Compressor Steam Cylinder," is of well known construction, and its mode of operation also is well known, and therefore it will not be described in detail. Steam is admitted to this cylinder through a pipe 45 and exhaust steam is exhausted through a pipe 46. In use of the device, the ram embodied by the piston rod reciprocates through the extent of travel indicated in Fig. 4. When the ram is fully extended, a shoe 43' forming a part of the ram and fixed on its lower end, and shaped to correspond to the shape of the opening 33, will enter into the upper end of the tube 34. When the ram is withdrawn from tube 34 to the full line position, as shown in Fig. 4, comminuted material from the hopper will fill in beneath the shoe; then, when the ram is driven downwardly, the shoe will first compress this material in the hopper and will then advance the charge downwardly into the tube, ultimately to deliver it into the hopper or housing 27.

A feature of this operation resides in the fact that when the ram moves downwardly, the material directly below the shoe will be compressed into a substantially solid charge from which the greater percentage of air will be ejected, by displacement, directly into open air in the hopper and thus the necessity for the large vacuum pump, as used in the machine of the prior application, is avoided. This compressed charge, designated by the shaded area in the hopper in Fig. 4, when pressed down into the upper end of tube 34, effectively seals that end of the tube against admittance of air. Then, as the charge is advanced down through the slotted part of tube 34, remaining air is extracted therefrom up to the extent of vacuum contained in the chamber 38. When the material finally enters the vacuumized housing 27, any air that may yet remain therein will be extracted by reason of this housing having a vacuumizing pipe connection 54 with the vacuumizing pipe 39.

The material that is advanced downwardly through tube 34 by the reciprocal action of the ram in hopper 30, enters into the upper end of hopper 27 in a rather compact column. This column of material advances under each reciprocal action of the ram, into contact with a horizontally extended bracket 55 that is fixed to the side wall of the hopper to serve as an abutment. In order that this column of material may be broken up, I have provided a steam cylinder 56 fixed in the hopper and having a piston rod 57 extended therefrom and adapted, incident to its being reciprocated, to engage and break up the column of material so that the material will fall into the base of the hopper in its original, finely divided condition.

The steam cylinder 56 is of an automatic type, whereby to effect the reciprocal actions of its piston rod in timing with advancement of the material from tube 34. In one construction, the rod has a piston actuated by exhaust steam from the compressor cylinder 42 through a pipe connection 58.

The material which falls to the base of hopper 27 is then fed through an opening 62 into

the charging cylinder 8; and it is fed to this opening by a revolubly driven wheel 63, disposed in the base of the hopper. The opening 62 is an elongated, relatively narrow passage, and the material, as it passes therethrough into the cylinder 8, is advanced under compression into the forming dies 6, as they are successively registered with the cylinder 8, by means of a reciprocally actuated ram 65 slidably fitted in cylinder 8. At its outer end, the ram 65 is fixed to a piston 66 that is fitted in a cylinder 67. Air pressure is maintained in the cylinder and against the piston so as to normally hold the ram fully extended, yet providing an air cushion for the ram. The cylinder 67 is reciprocally slidable in a guide 68 and is reciprocally actuated, thereby to similarly actuate the ram, by a rotating crank arm 69 which connects through the mediacy of a link 70 with the cylinder. The crank arm is fixed on a crank shaft 71 driven by an electric motor 72 through the mediacy of a gear reduction means designated at 73.

In order to facilitate the operation of advancing the comminuted material from the receiving hopper 27 to the molding dies, the vacuumizing tube 34 and the tube 8 would be tapered slightly, thus to be larger in diameter at their discharge ends than at the receiving ends, so as to prevent packing or clogging of material therein.

Assuming that the mechanism is so constructed, and assuming that comminuted material is being delivered into the hopper 30 and that the feeding ram is being reciprocated, it should be quite apparent that the comminuted material advanced into the upper end of the tube 34 will be packed sufficiently to operate as a closure plug for preventing the entrance of air. It will also be quite apparent that, as the column of packed material is advanced under pressure downwardly through the tube 34, air will be extracted therefrom to the extent possible by the vacuum maintained in chamber 38 and that this extraction of air is facilitated by reason of the material being packed in the tube, thereby forcing most of the air from the tube merely by displacement.

As the column of packed material passes from tube 34 into the lower hopper 27, it is broken up by the action of a horizontally reciprocating piston 57, and falls to the base of the hopper for delivery through the outlet 62 into the loading cylinder or tube 8.

Material delivered into the tube 8 from hopper 27 is advanced by the reciprocal action of the reciprocating ram 65 into the dies 6 as they are successively brought into charging position. After each die has been loaded, or charged with material, the turret is indexed one interval, whereby the loaded die is brought to rest in registering alinement with the impact rams 9—9'. While the die is at rest, the rams are actuated inwardly so that the charge of material is compressed into a briquette between their inner ends. On withdrawal of the rams from the die, the turret is indexed another interval and this brings the die with the formed briquette into registering alinement with the ejection ram 10 and the discharge tube; the construction of these parts being shown best in Figs. 6, 7 and 8.

Secured to one side plate of housing 3 is a tubular guide 83 in which the ejection ram 10 is slidably fitted. The inner end of the cylindrical guide extends through an opening 84 in the housing wall, and this opening is transversely alined with a similar opening 85 in the opposite wall of the housing in which the inner end of tube 11 is fitted. Each die 6, when brought to rest at the discharge station, is accurately axially alined with the tubes 11 and 83 for passage of the ram 10 therethrough for ejection of the briquette.

The ejection ram is actuated by connection with the hammer 13'; the connecting means, as shown best in Fig. 6, comprising a pantograph linkage having links 86 and 86' with inner ends pivotally connected together at 87 and their outer ends pivotally connected, respectively, at 88 and 89 with the fixed guideway 83 and a bracket 90 that is fixed on the hammer 13'. Also, the pantograph mechanism has a pair of short links 91 and 91' with inner ends pivotally connected by pivot bolt 93 to the outer end of the ram 10 and the other ends pivotally connected at 94 and 95, respectively, with the links 86 and 86'; the connections being such that the ram 10 is reciprocally actuated in timing with the hammer 13' but at a slower rate of travel and through a shorter distance, providing that the ram will move from a position at which its inner end is just withdrawn from the die, as seen in Fig. 6, to a position extended through the die for ejection of the briquette into the clear of the wheel 4 such as to the position in which the ejected briquette is illustrated in Figs. 6 and 7.

To facilitate the ejection of the briquettes from their dies 6, the opening through each die is slightly tapered to a large diameter toward its discharge end. In the actual machine which I have built, the die opening has a diameter of 4 inches at the end receiving the ejecting ram and a diameter of 4.022 at its opposite end, and this latter dimension is the same as the diameter of the tube 11 at its receiving end.

Fixed to the side wall of housing 3, and having its inner end fitted in the opening 85 is the ejection tube 11 into which the ejected briquettes are advanced by the ram 10 to seal the tube and thus prevent admittance therethrough of air into the vacuumized housing 3. This tube is flanged as at 101 for reception of attaching bolts 102 and it is accurately coaxially alined with the die and ejection ram. The receiving end of the passage through this tube is just slightly flared, as at 105, for an easy reception of the briquettes as ejected from the dies and then has a uniform diameter, for a short distance, as designated within the limits of bracket 106 in Fig. 7, that is of the same diameter as the die at its discharge end. Then through the remaining outer length of the tube 11, the diameter is substantially increased for free passage of the briquettes.

When a briquette is ejected from the die 6 by the ejector ram 10, it is pushed into the part 106 of smaller diameter of the tube where it is held by friction to close the passage and prevent entrance of air; it being understood that the natural tendency of the briquette to slightly expand when ejected from the die, will result in this air-tight seal.

When the next briquette is ejected, it advances the first briquette from the part of smaller diameter of tube, into the outer end portion of larger diameter and into a delivery trough 110.

It will be understood that the rate of travel of the ejector punch 10 would ordinarily cause the briquettes to be ejected with great force and that this would be damaging thereto. There-

fore, it is desirable to provide means for retarding the speed of ejection to a safe speed.

In the present instance, I have equipped the ejection tube 11 with a vacuum brake which I have illustrated best in Figs. 7 and 8, wherein it will be observed that the outer end of the ejection tube is equipped with a plurality of perforations 112 and a ring 113 is fitted for rotation on the tube over these perforations. The ring is also provided with perforations 114, which, by adjustment of the ring, may be moved into and from registration with the tube perforations 112, thereby to provide for admittance of air into the tube 11 to a greater or lesser extent to break the tendency toward creation of a vacuum back of the briquette as it is ejected; it being understood that since the briquette is just slightly less in diameter than the tube, its quick ejection would tend to create a vacuum in the inner part of the tube which might stop or retard the speed of ejection too much. However, by admitting air, the speed of ejection can be controlled to a desired degree depending upon how much air is admitted to break the vacuum.

A set screw 115 is threaded through the ring 113 and may be tightened against the tube to retain the ring at any position of adjustment.

It has been found in practise, in use of the machine of the aforementioned patent that there was a tendency for the briquettes to be slightly greater in length along the side which is at the bottom side of the dies at the charging station. It has been determined that this greater length is due to the fact that the material advanced into the dies naturally falls to the bottom and there will be greater compactness at the bottom side. This results in the very slight increase of length at that side in the finished briquette, and the disadvantage of this defect resides in the fact that when a briquette is ejected from its die, it will not engage flatly in end to end abutment with the next previously ejected briquette, but the two briquettes will have contact only at one edge. Thus, when one briquette is pushed out, the edge that is unsupported by the pushing briquette will chip or crack. This is not desirable and I have, in this machine, devised two ways by which the unevenness may be overcome. One way is to slightly bevel the end of the charging ram 65 so that it will have a longer length at its lower edge and thus form the charge in the die slightly shorter in its lower side to compensate for the greater compactness of material, with the result of an even length at both top and bottom of the finished briquette. This beveling of the end of the charging ram 65 is illustrated in Fig. 9 wherein 65' designates the beveled end portion; this being shown corrugated as used in practice. Another means of overcoming the disadvantages incident to uneven length is to slightly tilt the discharge tube 11 so that the end surface of each briquette advanced from the die will bear flatly against the end of the briquette being ejected thereby through tube 11. This tilting is accomplished by inclining the plane of the attaching flange 101 of tube 11 relative to the axial line of the tube. This has been illustrated in Fig. 10, which shows the degree of the tilt to an exaggerated degree for better understanding.

With the machine so constructed, I have overcome the disadvantages mentioned as existing in the previous machine, by the provision of a feeding means that displaces a greater part of the contained air in the material from the charges prior to their delivery into the machine; this being the result of compression of the charges in the open air in the hopper 30. Then, I have avoided the use of air valves or other complicated means for retaining vacuum in the housing by reason of the packed material in tube 34 serving as a closure plug for the entrance and by providing that each ejected briquette will temporarily seal the discharge opening.

Furthermore, in the event that air is still contained in the material after it enters hopper 27, this will be removed through the vacuum connection with the hopper.

Finally it will be noted that the tip of the ejector punch prevents any forward movement of the hammers except when a die opening is in alignment with both hammer punches and ejector punch. Thus any mis-stroke of the hammers is prevented which might otherwise strike the die carrier and result in severe damage to the machine.

Having thus described my invention, what I claim as new therein and desire to secure by Letters Patent is—

1. In a press, a vacuumized charging mechanism, a vacuum chamber, a hopper for comminuted material, a tube leading from the hopper to the charging mechanism, through the vacuum chamber; said tube having air slits in a portion thereof contained within the vacuum chamber, a ram reciprocally operable in the hopper to compress charges of comminuted material in the hopper and to push the compressed charges into the tube for vacuumization and a progressive advancement thereof to the charging mechanism.

2. In a press, a vacuumized charging mechanism, a vacuum chamber, a hopper for comminuted material, a tube leading from the base of the hopper and to the charging mechanism through the vacuum chamber; said tube being increased gradually in diameter from its receiving to its discharge end and having a plurality of vacuumizing slits lengthwise thereof within that part contained in the vacuum chamber, and a ram reciprocally operable in the hopper to compress charges of comminuted material and to advance the compressed charges into the tube for vacuumization in their passage through the vacuum chamber to the charging mechanism.

3. In a press, a vacuumized charging apparatus, a vacuum chamber, a hopper for comminuted material, a tube leading from the base of the hopper into the charging mechanism and having air passages in its walls in that portion thereof enclosed by the vacuum chamber, means for advancing material into the tube from the hopper in a compact mass as a means to seal the tube against passage of air therethrough to the charging mechanism, and an abutment in the charging apparatus spaced below the discharge end of the tube against which the pack of material, as discharged from the tube, will engage as an aid to its effectiveness as an air seal for the tube.

4. A device as recited in claim 3 including a mechanism operable against the material contacting with the abutment to displace it and cause it to be delivered therefrom in a loose condition.

5. In an impact press, a die charging means including a vacuumized receiving chamber, a vacuum chamber, a hopper for receiving com-

minuted material, a tube leading from the base of the hopper through the vacuum chamber and into the said receiving chamber; said tube having longitudinal slits therein in that part within the vacuum chamber, a ram reciprocally operable for compressing charges of comminuted material in the hopper and for injecting them, in compressed condition, into the tube for progressive advancement through the tube to the said receiving chamber, and means in the receiving chamber for causing a disintegration of the column of material as it is delivered from the tube into the chamber.

6. A device as in claim 5 wherein the vacuumized receiving chamber has an outlet, and means is provided in the chamber for feeding the comminuted material into the said outlet.

7. In an impact press, a die charging means including a vacuumized receiving chamber provided with an outlet, a die charging cylinder adapted to receive material from the said chamber through said outlet, a vacuum chamber, a hopper for receiving comminuted material, a tube leading from the hopper into the receiving chamber through the said vacuum chamber and having a plurality of air passages in that part contained in the vacuum chamber, a ram reciprocally operable for compressing charges of material in the hopper and for injecting the compressed charges into the tube for vacuumization and to form a closure plug of compact material whereby air is excluded from the receiving chamber, an abutment fixed in the receiving chamber, spaced from the end of the tube for support of the column of compact material as ejected from the tube, a reciprocating rod in the receiving chamber for effecting loosening and displacement of the compact material from the abutment as it is advanced, and a rotating means for feeding the loose material into the opening of the receiving chamber to the die charging cylinder.

8. In an impact press, a vacuumized housing, means in said housing for forming briquettes of like size, a briquette discharge tube leading from the housing, means for successively ejecting formed briquettes from the housing through said tube; said tube comprising a part of reduced diameter for temporarily containing each briquette in an air sealed fit, and opening abruptly into an outer portion of slightly larger diameter, into which each briquette will be ejected by the advancement into the part of reduced diameter of the next succeeding briquette.

9. In an impact press, a vacuumized housing, means in said housing for forming briquettes of like size, a briquette discharge tube leading from the housing, means for successively ejecting formed briquettes from the housing through said tube; said tube comprising a part of reduced diameter for temporarily containing each briquette in an air sealed fit, and having an outer portion of slightly larger diameter, into which each briquette will be ejected by the advancement into the part of reduced diameter of the next succeeding briquette; said tube being provided in the part of larger diameter and adjacent the part of reduced diameter with air ports and a damper for said openings adjustable to regulate the inflow of air therethrough.

10. An impact press comprising a vacuumized housing, a discharge tube leading from the housing, a movable die carrier in the housing, a briquette molding die mounted in the carrier, a die charging mechanism, a vacuum chamber, a hopper for receiving comminuted material, a tube leading from the base of the hopper through the vacuum chamber for delivery of material to the charging mechanism; said tube having vacuumizing slots within that portion contained in the vacuum chamber, a ram for advancing comminuted material from the hopper through said tube for vacuumization and in a compact mass to seal the entrance to the charging mechanism; said charging mechanism including an air-tight chamber for receiving the vacuumizing material, means for filling the die with vacuumized material, means for forming the material into a briquette in the die, means for moving the carrier to register the die with the discharge tube and means for effecting the ejection of the briquette from the die into the tube as a means for sealing the tube against admission of air into the housing.

11. In a briquette press including a stationary housing, a die carrier therein, briquette dies of cylindrical form and open at opposite ends mounted in the carrier, means for charging the dies, a reciprocating punch adapted to enter the dies to form briquettes therein, a reciprocating briquette ejector ram mounted in the housing, means for moving the carrier to register the dies with the path of travel of the ejector ram, a hammer reciprocally movable with the briquette forming punch and a pantograph linkage connected at its ends to the housing and hammer and having linkage connected with the ejector ram and first mentioned linkage to reciprocate the ram through a stroke reduced below that of the hammer.

12. The method of making fuel briquettes from comminuted material comprising forcing the comminuted material in a continuous column of compact mass through a vacuumizing chamber for the extraction of air from the material and whereby the column serves to seal the inlet and outlet of the vacuumized chamber, receiving the column of material after passing through the vacuumizing chamber within an air-free chamber, disintegrating the column, and then forming the material into briquettes.

WORTH C. GOSS.