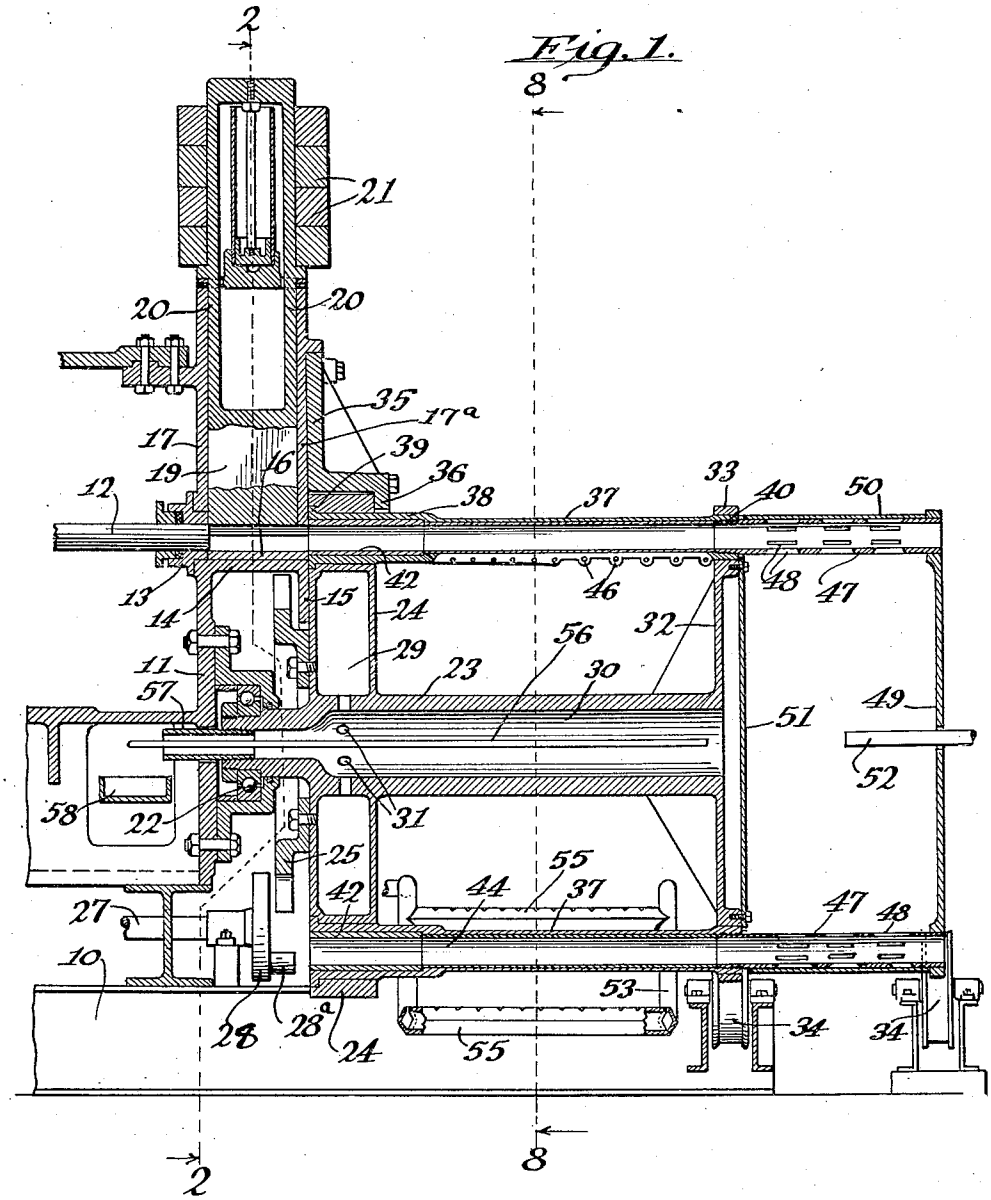
Aug. 18, 1931. W. C. CARPENTER 1,819,277

BRIQUETTE FORMING AND BAKING MACHINE

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Fig. 1.



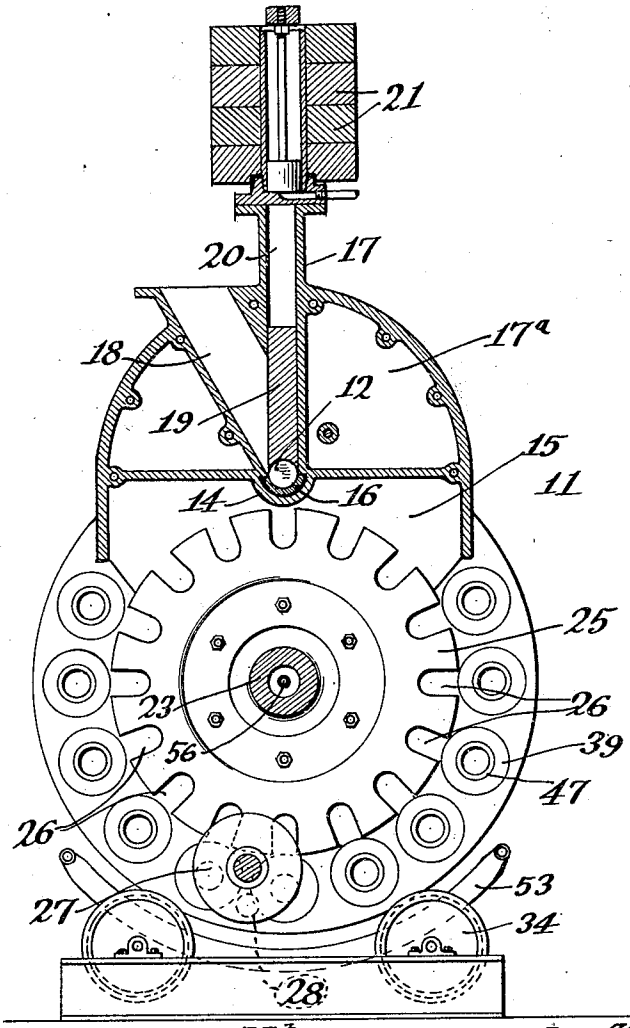
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BRIQUETTE FORMING AND BAKING MACHINE

Filed Oct. 9, 1929 3 Sheets-Sheet 2

Fig. 2.



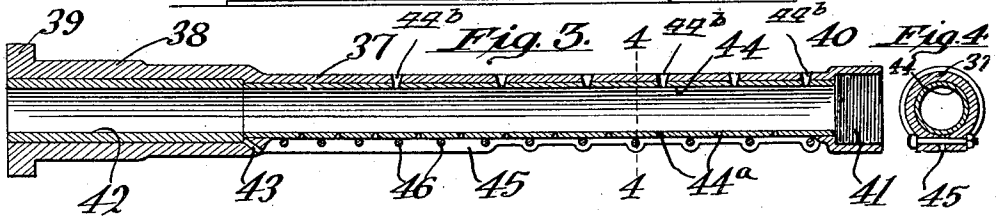


Fig. 5.

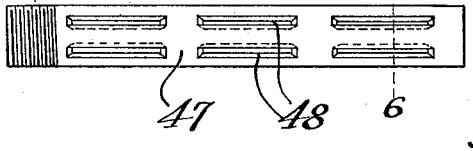
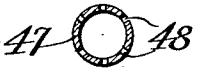


Fig. 6.



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Fig. 7.

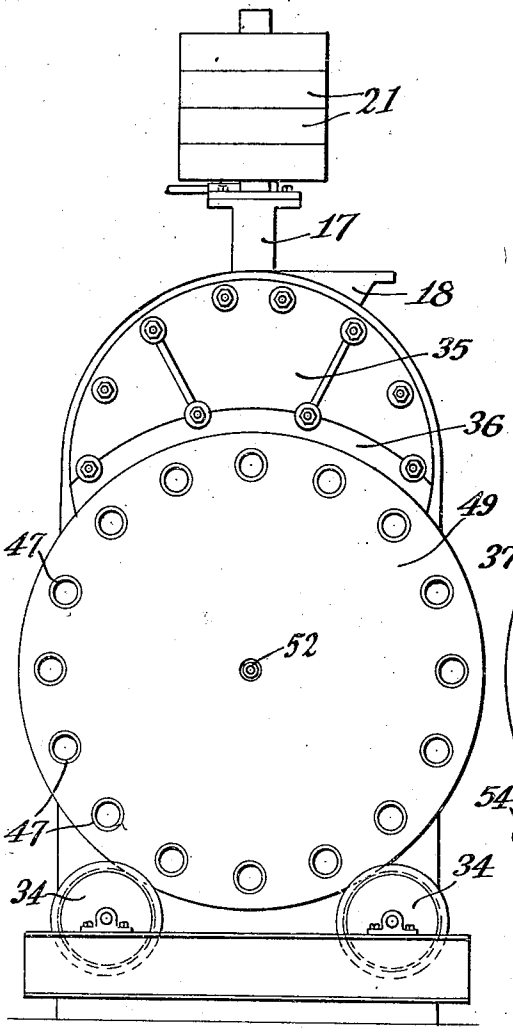
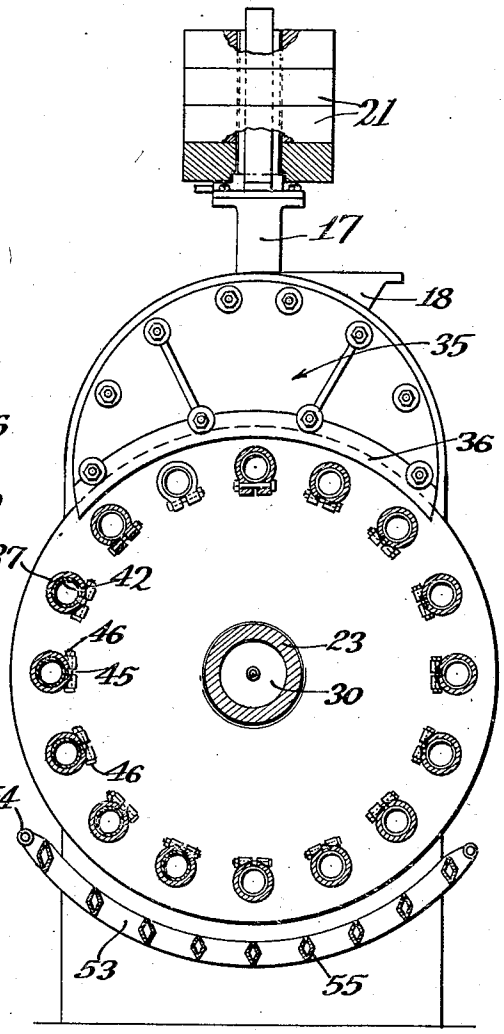


Fig. 8.



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Patented Aug. 18, 1931 1,819,277

UNITED STATES PATENT OFFICE

WILLIAM CLARENCE CARPENTER, OF SAN FRANCISCO, CALIFORNIA

BRIQUETTE FORMING AND BAKING MACHINE

Application filed October 9, 1929. Serial No. 398,520.

My invention relates to a fuel briquette forming and baking machine and has for its principal object, the provision of a relatively simple, practical and efficient machine that may be economically employed for the protection of fuel briquettes from comminuted cellulosic material such as sawdust, shavings, straw and the like.

My present invention is an improvement on the briquette machines set forth in U. S. Letters Patents issued to me January 10th, 1928, Nos. 1,655,534 and 1,655,535.

Further objects of my invention are, to generally improve upon and simplify the construction of the briquette machines set forth in my aforesaid patents, as well as other forms of similar briquette machines, to provide a machine wherein an intermittently rotating frame or member carries a series of tubular dies into which the pulverized briquette material is forced under pressure and which compressed material is intermittently forced through the dies as successive charges of compressed material are forced into the receiving ends of the tubular dies; further, to provide simple and efficient means for baking the compressed briquette material while the same is in the dies, which baking, carbonizes and hardens the surfaces of the bodies of compressed material within the dies, thereby providing the finished briquettes with comparatively hard, moisture-proof surfaces that will enable the briquettes to be handled and transported without breakage or disintegration and likewise enabling the briquettes to be stored for a considerable time, without being affected by varying temperatures and further, to provide a machine having a cooling chamber that is effective in materially reducing the temperature of the briquettes immediately after they are formed and baked, so that the briquettes may be conveniently handled immediately after they have discharged from the machine.

Further objects of my invention are, to provide improved means for feeding the comminuted cellulosic material to tubular dies as the same are brought successively into position in line with a reciprocating plunger; further, to provide simple and efficient means for regulating the pressure exerted by the jaw or plunger that forces the briquette material from the feeder into the path of travel of the compressing plunger; further, to provide means whereby the dies are provided with liners or bushings that are readily removable so that they may be renewed or replaced when they become worn or unfit for service, due to the high pressures employed in forcing the briquette material into and through the rotary dies; and further, to provide a briquette forming and baking machine that is continuous in operation and which will produce within a comparatively short period of time, a relatively large tonnage of finished briquettes.

A further object of my invention is to provide an improved briquette forming and baking machine, wherein a series of combined forming and baking dies are arranged in a rotary carrier and to mount and support said carrier so as to effectively resist the relatively high pressure strains that are developed by the plunger that forces the briquette material from the feeding chamber into and through forming and baking dies.

With the foregoing and other objects in view, my invention consists in certain novel features of construction and arrangement of parts that will hereinafter be more fully described and claimed and illustrated in the accompanying drawings, in which:

Fig. 1 is a vertical section taken lengthwise through the center of a briquette forming and baking machine of my improved construction.

Fig. 2 is a vertical cross section taken approximately on the line 2—2 of Fig. 1.

Fig. 3 is an enlarged longitudinal section taken through the center of one of the briquette forming and baking dies.

Fig. 4 is a cross section taken on the line 4—4 of Fig. 3.

Fig. 5 is an elevational view of one of the aubular members that forms an extension for the tubular dies and which member extends through the cooling chamber of the machine.

Fig. 6 is a cross section taken on the line 6—6 of Fig. 5.

Fig. 7 is a rear elevational view of my improved briquette forming and baking machine.

Fig. 8 is a cross section taken on the line 8—8 of Fig. 1.

Referring by numerals to the accompanying drawings, which illustrate a practical embodiment of my invention, 10 designates a base frame that supports my improved briquette forming and baking machine and supported on said frame is an upright plate 11, through which is formed an opening for a horizontally disposed plunger 12, which latter is utilized for forcing the briquette material into the tubular dies. This plunger may be reciprocated by any suitable means. Arranged around the opening in the plate 11, through which this plunger reciprocates, is a stuffing box 13 that is effective in preventing briquette material from discharging outwardly through the plunger opening while said material is under relatively high degrees of pressure.

Formed integral with and projecting outwardly from plate 11, directly below the opening for the plunger 12, is a U-shaped bracket 14 from the outer end of which depends a plate or flange 15. Arranged within the U-shaped member 14 is a channel-shaped bushing 16, against which the lower half of the plunger 12 engages during its reciprocating movements.

Positioned directly above the bracket 14 and the bearing 16 is a rigidly fixed vertically disposed housing 17 having a wide front plate 17*a* and leading upwardly from the side of said housing is an inclined chute 18, through which the comminuted briquette material feeds by gravity into the chamber within said housing.

Arranged for reciprocatory movement within the chamber in housing 17, is a material feeding plunger or head 19, and projecting upwardly from the ends of this head are arms 20 that extend a substantial distance above the upper end of said housing.

This feeding head or plunger 19 may be elevated in any suitable manner, either by mechanically operated means or by fluid pressure actuated means and after being elevated to permit a charge of briquetting material to pass downwardly through chute 18, said head or plunger lowers by gravity. The amount of pressure exerted by the head or plunger on its downward movement, is regulated by means of a series of weights 21, that are detachably arranged on the upper portions of the arms 20 and by varying the number of weights the degree or amount of pressure may be very accurately regulated.

The underface of the head or plunger 19 is formed with a half round groove or channel that cooperates with the corresponding channel in the lining or bushing member 16 and thus when the head or plunger is at its lower limit of travel, a charge of precompressed briquette material fills the cylindrical chamber between the lower end of the head or plunger 19 and the half round lining or bushing 16.

Arranged on the outer face of the plate 11, directly below the bracket 14, is a comparatively large anti-friction bearing 22, that supports the inner end of a tubular shaft 23.

Formed integral with or fixed to this shaft 23, adjacent to the bearing 22, is a disc 24 that serves as a support for the inner ends of the tubular dies, and secured to the face of this disc, adjacent to the bearing 22 is a smaller disc 25 that is provided in its edge with equally spaced notches 26.

Mounted for operation in suitable bearings below the plate 11, is a shaft 27 on which is secured a disc 28, the latter being positioned near the lower portion of disc 25, and projecting from said disc 28 is a pin 28ª that is adapted to successively enter the notches 26 in disc 25 as shaft 27 is rotated and as a result of this arrangement, intermittent rotary movement is imparted to the die carrier, comprising the shaft 23 and disc 24.

Disc 24 is provided with a cooling medium circulation chamber 29 which has communication with the chamber 30 in tubular shaft 23 through apertures 31 that are formed through the wall of said tubular shaft.

Formed integral with or fixed to the outer end of shaft 23 is a disc 32, the edge of which is widened to form a ring 33. This ring is supported for rolling movement on grooved wheels or pulleys 34 that are journaled in suitable bearings on the base frame 10.

In order to resist the relatively high strains that are imposed on the upper portion of disc 24 while plunger 12 is compressing the briquette material in the dies an arcuate plate 35 is rigidly fixed in any suitable manner, preferably by means of bolts to the outer face of the plate 17ª and formed on the outer lower edge of this thrust bearing plate is a depending flange 36 that engages over the edge of disc 24, (see Figs. 1, 7 and 8).

Removably seated in the outer portions of the discs 24 and 32 are the end portions of a series of briquettes forming and baking dies, each of which comprises an outer shell or housing 37 that is tubular in form and that portion of each tube that is seated in the disc 24 has its wall increased in thickness as designated by 38. Formed on the end of this portion of increased thickness is an integral flange 39. The opposite end of each shell or tube 37 is slightly enlarged, as designated by 40, said enlarged portion is seated in the

ring 33 and said enlarged portion is internally threaded as designated by 41.

Removably seated in the inner end portion of each shell or housing 37 and within the portion 38 of increased diameter is a removable liner or bushing 42 of relatively hard wear resisting metal and, it is within this liner or bushing, that the briquette material is compressed by the plunger 23 as it travels toward the bushing or liner 42 and which latter performs the functions of a forming die.

In order to permit the liner or bushing 42 to be removed in the event that it becomes worn or unfit for service, an aperture 43 is formed through the shell 37 at a point just beyond the inner end of the liner and which aperture is of sufficient size to receive a punch and which latter, when driven inwardly, will expel the liner from its shell.

Arranged within the housing or shell 37, between the inner end of the liner 42 and the internally threaded end 40, is a tubular liner 44 of relatively hard wear resisting material and in order that this liner may be readily inserted and removed when it becomes worn or unfit for service, a longitudinally disposed slot 45 is formed in the shell 37 between the enlarged end portion 38 and 40, and seated in the shell to the sides of this slot are bolts 46 which, when tightened, tend to contract the slotted portion of the shell, thereby clamping the inserted liner.

Formed through the wall of the liner 44 is a row of apertures 44^a that communicate with the slot 45 in the shell 37, which apertures are for the purpose of permitting the escape of gases and volatile matter that are liberated while the compressed briquette material is being baked during its passage through the tubular members.

If desired the shell 37 and liner 44 may be provided throughout their lengths with coinciding conical apertures 44^b for permitting escape of the gases and volatile matter from the briquettes while the same are being baked. (See Fig. 3.)

The tubular dies and chambers just described, are in direct radial alignment with the notches 26 in the disc 25 and the driving means for the rotary carrier is arranged so that one of the dies and baking chambers is brought into direct alignment with the plunger 12 and the U-shaped member 16 each time the rotary carrier is partially rotated.

Screw-seated in the outer end of each shell or housing 37 is a tubular member 47 that is provided throughout its length with short longitudinally disposed slots 48 and the outer ends of these tubes are seated in the outer portion of a disc 49. Surrounding the entire series of slotted tubes 47 is a sheet metal shell 50 that extends from the edge of disc 49 to ring 33 and secured to said ring 33 inside the circular row of tubes 47 is a sheet metal disc 51.

The chamber within shell 50, between the discs 49 and 51 and which is occupied by the slotted tubes 47 constitutes a cooling chamber for the briquettes as they pass through the slotted tubes and in order to accelerate cooling action air at normal temperatures, or artificially cooled, may be delivered into the cooling chamber through a suitably located supply pipe 52.

The briquettes upon being discharged from the outer open ends of the cooling tubes 47 may be received in a suitable receptacle or upon an endless conveyor (not shown).

Arranged beneath the rotary carrier and between the discs 24 and 33, is a heating appliance which may be of any desired form and construction, although I prefer to utilize a pair of curved headers 53 that receive gaseous fuel through a suitably arranged supply pipe 54 and connecting said headers are burner tubes 55, preferably diamond shaped in cross section and provided at their apices with jet openings. As a result of this arrangement direct heat from the jets of burning gas is delivered directly unto the tubes that contain the compressed briquette material and this heat is sufficient to carbonize the surfaces of the briquettes, which is one of the desirable results attained by my improved machine.

In order to counteract the high temperatures in the tubular shaft 23 and the disc 24 that carries the heads of the tubular dies and briquette baking members, a tube 56 that is connected to a suitable source of cooling fluid medium, either air or water, is extended axially into the chamber 30 within the tubular shaft 23, and this fluid cooling medium, after circulating through the chamber 30, apertures 31 and chamber 29, discharges outwardly through a short tube 57 that is seated in the open inner end of shaft 23. In the event that water is utilized as the cooling medium, a suitable trough 58 is located beneath the outer end of the discharge tube 57.

During operation of my improved briquette forming and baking machine, shaft 27 is continuously rotated and as a result of the engagement of pin 28^a in the notches 26, the rotary die carrier comprising shaft 23 and discs 24 and 32 is intermittently rotated and at each period of rest, one of the tubular dies and baking tubes is positioned in alignment with the reciprocating plunger 12.

The movement of the rotary die carrier is effected while the plunger 12 is being withdrawn and, while the plunger is at its limit of movement away from the die, the head or material feeding plunger 19 moves downwardly so as to force a partially compressed

charge of briquette material, which has entered the chamber within housing 17 through chute 18, into the substantially cylindrical chamber formed between the channeled underface of plunger 19 and the channel-shaped bushing 16.

On the forward movement of plunger 12, this charge of partially compressed material, will be forced with great pressure into the forming die comprising the enlarged end 38 of shell 37 and the liner 42 and the pressure of the material into the die will be yieldingly resisted by those charges of material previously forced into the dies.

These compressing operations or forcing of the charges of material into the dies, are continued in rapid succession and as the new charges are forced into the forming dies, those charges within the respective dies will be forced forwardly through the baking chambers of the dies comprising the slotted portions of the housing 37 and which slotted portions are lined with the tubular members 44.

As the compressed charges pass through the baking chambers, they are subjected to heat from the burner located below the rotary carrier and this heat is controlled by suitable means, so as to char and carbonize the surfaces of the briquettes to the desired degree and after being thus baked, the briquettes pass through the cooling tubes 47 to effect a material reduction in the temperature of said briquettes and finally said briquettes discharge from the outer ends of the tubes 47, into a suitable receptacle or onto an endless conveyer.

Inasmuch as the baking of the briquettes to carbonize their surfaces materially hardens said briquettes and particularly the charred or carbonized surfaces thereof, said briquettes will withstand comparatively rough usage while being handled or transported to the points of use and said carbonized surfaces will also afford protection for the briquettes against disintegration due to temperature changes.

While the briquettes are being baked, certain gases and volatile matter will be thrown off and such gases will find ready escape through the outlet apertures 47 and which latter are preferably tapered so that they increase in diameter outwardly, thus minimizing the escape of any of the briquette material through said apertures while said material is under pressure.

By making the burner tubes 55 diamond-shape in cross section, any briquette material that may drop downwardly unto the burner tubes will readily pass downwardly thereover without clogging the jet openings in the apices of said tubes.

The thrust bearing plate 35 that engages the upper portion of disc 24, serves to receive and effectually withstand the relatively high pressure resulting from the compressing movements of the plunger 12, as the same forces the briquette material into the forming dies and these strains and pressures are further resisted by the rolling supports 34 that are positioned beneath the rear portion of the rotary carrier.

An especially desirable feature of my invention is, the provision of a practically one piece rotary carrier comprising shaft 23, discs, etc. and said carrier serving as a support for the shells or tubular housings 37, each of which is provided with a removable forming die or liner 42 and with a removable liner 44 for the baking chamber, and further, each shell or housing has removably connected to its rear end, a slotted tubular member that functions as a cooling chamber for the briquettes after the same have been formed and baked.

It will be understood that minor changes in the size, form and constructioin of the various parts of my improved briquette forming and baking machine may be made and substituted for those herein shown and described without departing from the spirit of my invention, the scope of which is set forth in the appended claims.

I claim as my invention:

1. In a briquette forming and baking machine, a rotary carrier comprising a tubular shaft and a pair of discs, one of which discs is hollow, the chamber therein having communication with the chamber in the tubular shaft of the carrier, a series of combined briquette forming and baking dies carried by said discs and means for circulating a fluid cooling medium through the chambers within said tubular shaft and hollow disc.

2. In a briquette forming and baking machine, a rotary carrier comprising a tubular shaft and a pair of discs, one of which discs is hollow, the chamber therein having communication with the chamber in the tubular shaft of the carrier, a series of combined briquette forming and baking dies carried by said discs, means for circulating a fluid cooling medium through the chambers within said tubular shaft and hollow disc and a heater arranged beneath the rotary carrier and the dies carried thereby.

3. In a briquette forming and baking machine, a rotary carrier comprising a shaft and a pair of discs, a series of combined forming and baking dies carried by said discs, a bearing for one end of the shaft for said rotary carrier, means for successively feeding charges of briquette material into the forming and baking dies, means engaging a portion of the carrier for resisting the thrust strains developed by the material feeding means and a rolling support for the rear lower portion of the rotary carrier.

4. In a briquette forming and baking machine, the combination with a material

feeding means and a reciprocating plunger, of a rotary carrier, a series of combined forming and baking dies carried by said carrier, means for intermittently rotating said carrier to bring said dies successively into alignment with said plunger and a thrust bearing engaging the upper portion of said rotary carrier for resisting the strains developed by the plunger while forcing briquette material from the feeding means into the forming and baking dies.

5. In a briquette forming and baking machine, the combination with a material feeding means and a reciprocating plunger, of a rotary carrier, a series of combined forming and baking dies carried by said carrier, means for intermittently rotating said carrier to bring said dies successively into alignment with said plunger, a thrust bearing engaging the upper portion of said rotary carrier for resisting the strains developed by the plunger while forcing briquette material from the feeding means into the forming and baking dies and a rolling support for the lower rear portion of said rotary carrier.

6. In a briquette forming and baking machine, a rotary carrier, a series of combined forming and baking dies mounted on said carrier, a material feeding chamber, a plunger arranged for operation within said feeding chamber and means for regulating the downward pressure of said plunger.

7. In a briquette forming and baking machine, a rotary carrier, a series of combined forming and baking dies mounted on said carrier, a material feeding chamber, a plunger arranged for operation within said chamber and weights removably arranged on said plunger for regulating the downward pressure thereof.

8. In a briquette forming and baking machine, a rotary carrier, a series of combined forming and baking dies mounted on said carrier, a material feeding chamber, a plunger arranged for operation within said chamber, weights removably arranged on said plunger for regulating the downward pressure thereof, means for elevating said plunger and a plunger arranged for operation through the lower portion of the said box for forcing briquette material from said feed box into the forming and baking dies.

9. In a briquette forming and baking machine, a combined forming and baking die comprising a tubular shell, a bushing removably arranged in the receiving end of said die and a bushing removably arranged within the rear portion of said die.

10. In a briquette forming and baking machine, a combined forming and baking die comprising a tubular shell, a bushing removably arranged in the receiving end of said die and a bushing removably arranged within the rear portion of said die, which last mentioned bushing is perforated.

11. In a briquette forming and baking machine, a combined forming and baking die comprising a tubular shell, a bushing removably located in the receiving end of said die, the rear portion of the shell being slotted, a bushing removably located in the slotted portion of said shell and means for clamping the slotted portion of said shell around the bushing therein.

12. In a briquette forming and baking machine, a combined forming, baking and cooling die comprising a shell, a bushing removably arranged in one end of said shell, a bushing removably arranged in said shell to the rear of the first mentioned bushing and a slotted tube detachably connected to and projecting from the rear end of said shell.

13. In a briquette forming and baking machine, a combined forming and baking die comprising a shell having an enlarged end portion, a hardened metal bushing removably arranged in the enlarged end portion of said shell, a perforated bushing removably arranged in the remaining portion of the shell and means for clamping said perforated bushing within said shell.

14. In a briquette forming and baking machine, a combined forming and baking die comprising a shell having an enlarged end portion, a hardened metal bushing removably arranged in the enlarged end portion of said shell, a perforated bushing removably arranged in the remaining portion of the shell, means for clamping said perforated bushing within said shell and a perforated cooling tube connected to and projecting from the rear end of said shell.

15. In a briquette forming and baking machine, a rotary carrier comprising a hollow shaft and a pair of hollow discs, a plurality of combined forming and baking dies arranged on said carrier, means for intermittently rotating said carrier, a combined feeding and pre-forming chamber arranged in front of one of the discs of the carrier and coinciding with the path of travel of the combined forming and baking dies, a plunger arranged for operation through the lower portion of the combined feeding and pre-forming chamber and adapted to force charges of pre-formed briquette material from said chamber successively into the combined forming and baking dies, a plunger arranged for operation within the combined feeding and pre-forming chamber, means for heating the combined forming and baking dies, means for effecting a circulation of fluid cooling medium through the hollow shaft and hollow discs, a series of cooling dies projecting from the ends of the combined forming and heating dies and means for effecting a circulation of cooling medium

through the housing that surrounds the cooling dies.

16. In a briquette forming and baking machine, a rotary carrier, a series of combined forming and baking dies mounted on said carrier, a material feeding chute arranged above the path of travel of the inlet ends of said dies, the lower portion of which feeding chamber is V-shaped, a material feeding plunger arranged for operation within the feeding chamber and the V-shaped lower portion thereof, the underface of which plunger is formed with a half round channel, an oppositely arranged half round chamber shaped member arranged in the bottom of the V-shaped lower portion of the feeding chamber, means for moving the plunger downwardly within the feeding chamber until the half round channel thereing occupies a position directly above the channel-shaped member in the bottom of the feed chamber, a plunger arranged to move through the circular chamber formed between the underside of the reciprocating plunger and the half round member in the bottom of the feed chamber, which last mentioned plunger forces the pre-formed charge of briquette material from the lower end of the V-shaped chamber into the combined forming and baking dies mounted on the carrier.

17. In a briquette forming and baking machine, a combined forming and baking die comprising a shell having an enlarged end portion, a flange on said enlarged end portion, a hardened metal bushing fitting within the enlarged end portion of said shell, said bushing being removable, that portion of the shell to the rear of the enlarged end portion being slotted, a perforated liner fitting within the slotted portion of the shell, the perforations in said liner being funnel-shape with their smaller ends communicating with the chamber within said liner, means for clamping the perforated liner within the shell and an expansible perforated cooling member extending from the rear end of said shell.

In testimony whereof I affix my signature.

WILLIAM CLARENCE CARPENTER.