

Nov. 28, 1933.

W. H. TAYLOR

1,937,174

ART OF BRIQUETTING MATERIALS

Filed March 16, 1932

2 Sheets-Sheet 1

Fig. 2.

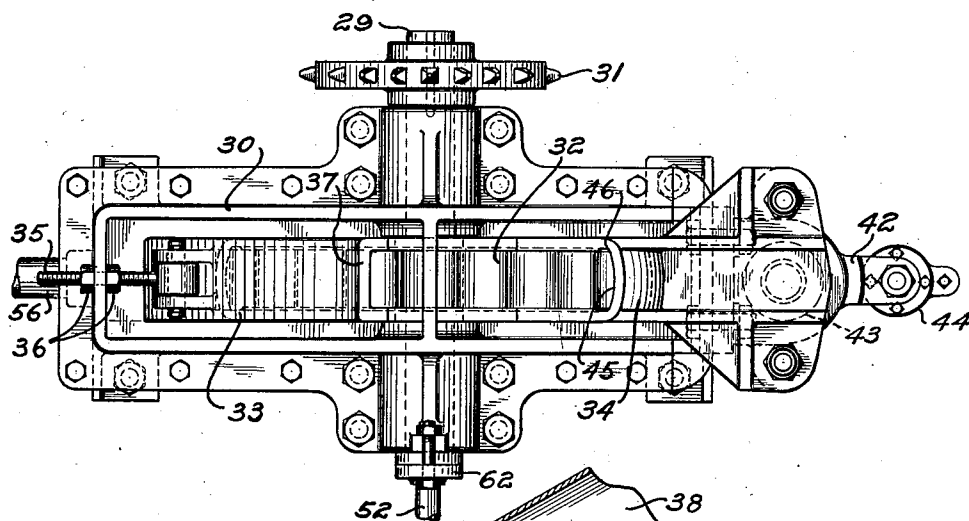
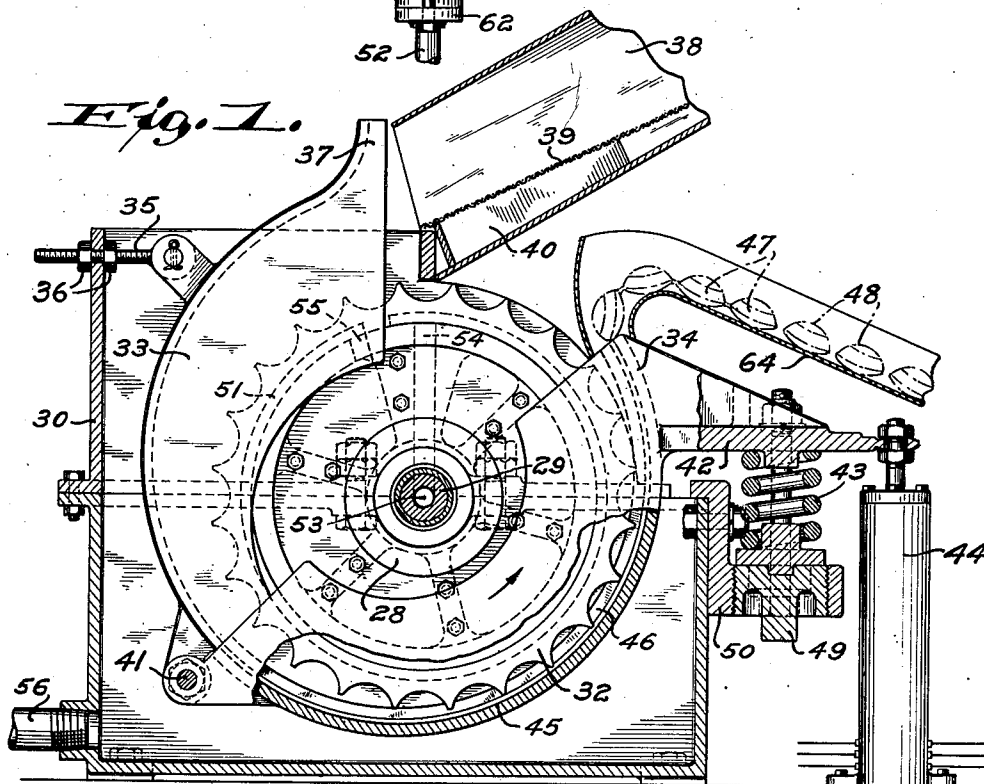


Fig. 1.



INVENTOR.

W. H. Taylor

BY

Morsell & Morsell

ATTORNEYS.

Nov. 28, 1933.

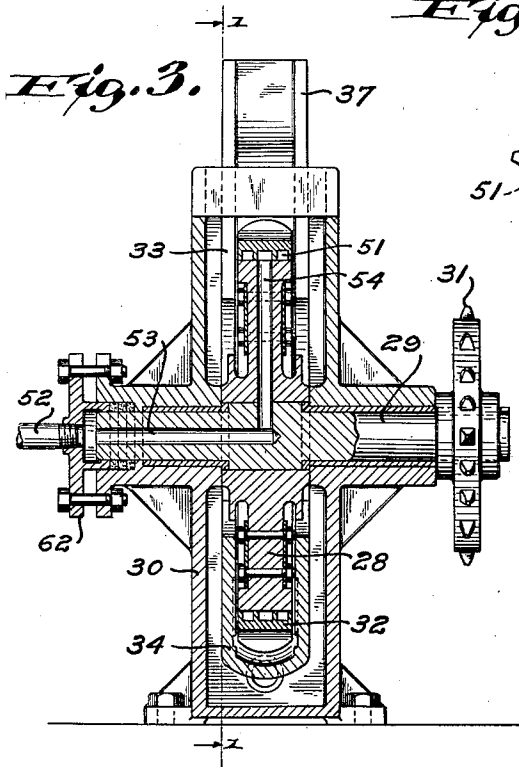
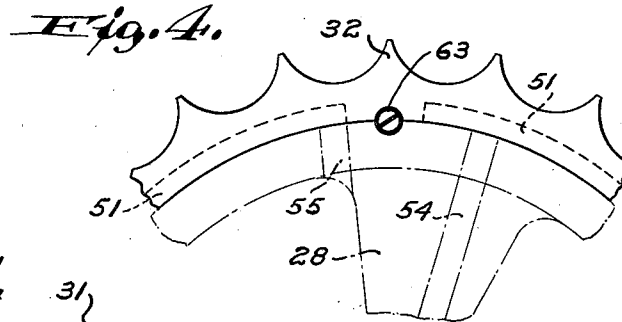
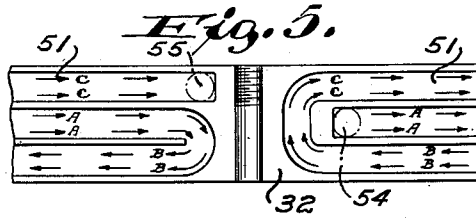
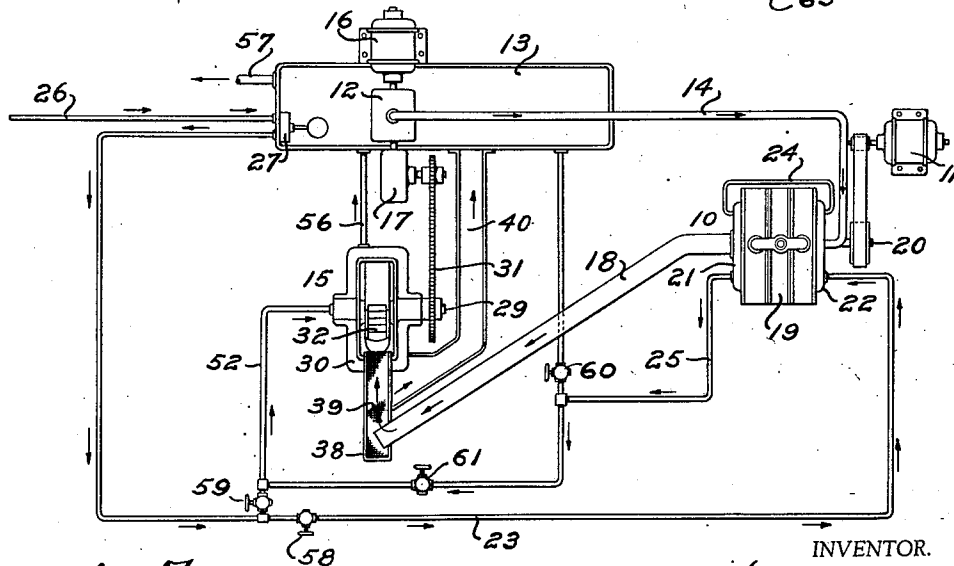
W. H. TAYLOR

1,937,174

ART OF BRIQUETTING MATERIALS

Filed March 16, 1932

2 Sheets-Sheet 2



INVENTOR.
W. H. Taylor
BY
Morsell & Morsell
ATTORNEYS.

UNITED STATES PATENT OFFICE

1,937,174

ART OF BRIQUETTING MATERIALS

William H. Taylor, Milwaukee, Wis., assignor to
The Vilter Manufacturing Company, Milwaukee,
Wis., a corporation of Wisconsin

Application March 16, 1932. Serial No. 599,191

29 Claims. (Cl. 62—172)

The present invention relates in general to improvements in the art of producing objects having predetermined characteristics, and relates more specifically to an improved process of and apparatus for pressing loose granular material such as slush ice, into briquets having substantially uniform size, shape and texture.

As shown and described in copending application Serial No. 488,295, filed October 13th, 1930, it has heretofore been proposed to compress material such as slush ice into a succession of briquets, to produce ice cubes or blocks having substantially plane outer faces. While this prior mechanism is relatively satisfactory, it lacks desirable capacity, and the plane faced briquets when brought in contact with each other tend to freeze together and can be separated only with extreme difficulty. In the prior briquetting machine, it is moreover difficult to effect rapid removal of the final briquets, and the mode of applying and of releasing the pressure did not sufficiently compress the material under all conditions of operation to produce the desired compactness, and tended to cause portions of the briquets to break away upon release of the pressure.

It is an object of the present invention to provide an improved method of pressing material such as snow or slush ice into briquets, and for effecting delivery of the finished objects from the briquet forming zone.

Another object of the invention is to provide an improved briquetting machine which is simple, durable and compact in construction, and which is moreover highly efficient in operation.

A further object of the invention is to provide mechanism for effecting rapid and automatic removal of briquets from a press, and for producing briquets of improved shape formed to prevent surface coaction of the completed objects when piled in a mass.

Still another object of the invention is to provide improved means for controlling the operation of a power driven press so as to permit maximum output with minimum power consumption.

Another object of the invention is to provide a machine which will deliver uniform briquets regardless of irregularities in the feed and all parts of which are readily accessible for inspection, adjustment, and operation.

A further object of the invention is to provide a briquetting machine especially adapted to form ice briquets, wherein the pressure is most effectively applied and released so as to pre-

vent destruction of the objects such as might result from the sudden release of the forming pressure.

Still another object of the invention is to provide various improvements in the details of construction and operation of briquet forming apparatus for producing briquets from any compressible granular solid substance, which will reduce to a minimum the cost of construction and operation and which will enhance to a maximum the utility of such devices.

These and other objects and advantages will be apparent from the following detailed description.

A clear conception of an improved briquetting process adapted for general application and of the construction of presses built in accordance with the present invention and especially adapted to produce ice briquets, may be had by referring to the drawings accompanying and forming a part of this specification, in which like reference characters designate the same or similar parts in the various views:

Fig. 1 is a part-sectional side view of an improved briquet forming machine, the section having been taken along the line 1—1 of Fig. 3;

Fig. 2 is a top view of the briquetting machine with the feed and discharge chutes omitted;

Fig. 3 is a central transverse section through the briquetting machine;

Fig. 4 is an enlarged fragmentary side view of a portion of the pressing ring of the rotor;

Fig. 5 is a development of a fragment of the pressing ring of the rotor;

Fig. 6 is an enlarged perspective view of one of the completed briquets; and

Fig. 7 is a diagram of a typical system for producing slush ice and for automatically compressing the ice into successive briquets.

Referring specifically to Fig. 7, the improved ice briquet forming system shown therein comprises in general a slush ice making machine 10 driven by an electric motor 11 and adapted to constantly produce ice from water delivered to the machine by a pump 12 from a supply tank 13 through a feed pipe 14; and a briquet forming press 15 driven by the pump driving motor 16 through reduction gearing 17 and receiving its supply of slush ice from the ice making machine 10 through a chute 18.

The ice making machine 10 specifically illustrated herein, is of the improved construction shown in copending application Serial No. 588,261, filed January 23rd, 1932, and comprises generally an internally grooved annular outer

casing 19 having therein means for cooling the groove surfaces below the freezing point of water, and a revolving ice film removing rotor driven by the motor 11 through a shaft 20 and having blades movable along and in close proximity to the groove surfaces of the casing 19 to constantly remove the ice films being deposited thereon. The ice thus formed and removed from the groove surfaces of the casing 19, is delivered with the excess water admitted to the casing through the feed pipe 14, to the press 15 through the chute 18 in the form of slush ice. The casing of the ice making machine 10 is also provided with end heads 21, 22 through which the fresh water supplied to the tank 13 is preliminarily circulated with the aid of pipes 23, 24, 25, the former of which is communicable with the primary fresh water supply pipe 26 past a float valve 27 the operation of which is effected by variations in level of the liquid within the supply tank 13.

The improved pressing mechanism shown in detail in Figs. 1 to 5 inclusive, comprises a rotor 28 mounted upon a main shaft 29 journaled in the main casing 30, the shaft 29 being drivingly connected to the reduction gearing 17 by means of a chain drive 31. The rotor 28 is provided with a peripheral transversely notched or recessed ring 32 which is revoluble in a counter-clockwise direction as viewed in Fig. 1, and which cooperates with a segmental casing 33 and with a breast plate 34 both located within the main casing 30. The segmental casing 33 is adjustably supported within the main casing 30 by means of a threaded rod 35 and adjusting nuts 36 co-acting with the rod, and has an upwardly projecting portion 37 against and into which the slush ice is delivered from a spout 38. The spout 38 may be inclined and has a screen 39 therein and above the inclined bottom thereof, this screen functioning to separate excess water from the ice particles. The ice particles are delivered by the screen 39 directly into the portion 37 of the casing 33, and the excess water is returned to the supply tank 13 over a sluice 40, in an obvious manner. The upper end of the spout 38 communicates directly with the chute 18 as shown in Fig. 7.

The segmental casing 33 gradually approaches the periphery of the rotor 28 as shown in Fig. 1 and has its lower extremity pivotally supported upon a supporting pivot 41 so as to permit adjustment of the casing 33 by manipulation of the nuts 36. The slush ice admitted to the casing 33 from the spout 38 is initially compressed so as to remove excess liquid therefrom, as it advances downwardly through the casing 33. The breast plate 34 is likewise swingably supported upon the pivot 41 and has an outwardly projecting horizontal arm 42 which reacts against an adjustable compression spring 43 and which also coacts with a rheostat 44 of the carbon disc type for the purpose of controlling the operation of the actuating motor 16. The breast plate 34 is provided with an arcuate compression surface 45 which gradually approaches and subsequently recedes from the peripheral recesses of the ring 32, the compression surface 45 being generated about a center located on the side of the axis of the rotor 28 opposite the breast plate 34. The side walls of the breast plate 34 are also provided with curved grooves 46 generated about the same center as that of the compression surface 45, and the function of these grooves 46 is to produce oppositely disposed projections 47 upon the final briquets 48 and to cooperate with these projec-

tions so as to automatically remove the successive briquets 48 from the forming pockets of the ring 32. The compression of the spring 43 may be readily varied by adjustment of a nut 49 coacting with a lug 50 attached to the main casing 30, thus providing means for varying the degree of compression of the successive briquets. The rheostat 44 may either be of the carbon disc type or of any other well-known type and the adjustment of this rheostat due to movement of the breast plate 34 will vary the speed delivered by the electric motor 16 in accordance with that required to produce briquets of the desired density.

In order to prevent the briquets from freezing to the surfaces of the recesses in the ring 32, this ring is provided with means for circulating water therethrough and for thus maintaining the briquet forming surfaces at a temperature above the freezing temperature of water. This anti-freezing system comprises an endless duct 51 clearly shown in Figs. 3, 4 and 5. Water derived either directly from the initial supply pipe 26 or from the pipe 25 communicating with the jacket of the head 21 of the ice making machine 10, may be delivered to the duct 51 through a pipe 52, a passage 53 in the main shaft 29, and a radial passage 54 in the rotor 28. Due to the circuitous formation of the duct 51, the water admitted thereto through the passage 54, must travel substantially all the way around the interior of the ring 32 three times before being eventually delivered through an opening 55 at the opposite end of the duct 51 into the space within the rotor 28 surrounding the spokes thereof. In its travel around the ring through the duct 51, the water first takes the direction indicated by the arrows A, then takes a reverse direction indicated by the arrows B, and finally takes the direction C which corresponds to direction A. The water thus delivered from the opening 55 intermingles with the excess water removed from the slush ice by the segmental casing 33, and is eventually returned to the supply tank 13 through a pipe 56.

The supply tank 13 may be provided with an overflow 57, and in order to permit circulation of the fresh water either through the ice making machine or through the briquetting machine 15, in series or in parallel, a system of valves 58, 59, 60, 61 may be provided. It will be apparent that by closing the valves 58, 59 no fresh water can be admitted to the system. By opening the valves 58, 60 and maintaining the valves 59, 61 closed, fresh water will be circulated through the ice machine 10 alone. By opening the valve 59 and maintaining the valves 58, 60, 61 closed, fresh water will be circulated through the briquetting machine 15 alone. By opening the valves 58, 59, 60 and maintaining the valve 61 closed, fresh water will be circulated through the machines 10, 15 in parallel; and by closing the valves 59, 60 and opening the valves 58, 61, the circulation of the fresh water through the machines 10, 15 will be in series.

The casing 30 should be provided with suitable bearings for supporting the main shaft 29 and a stuffing box 62 is also preferably provided for the purpose of preventing water from escaping from the pipe 52 without passing through the rotor duct 51. The recessed ring 32 should also preferably be secured to the rotor 28 by means of a set screw 63 as shown in Figs. 4 and 5, so as to avoid displacement of the inlet and outlet openings to and from the conduit 51. The briquetting machine may also be provided with

a discharge spout 64 shown in Fig. 1 for discharging the final briquets.

The briquets 48, as clearly shown in Fig. 6, are provided with curved surfaces 65 corresponding to the shape of the recesses in the ring 32, and are also provided with oppositely curved surfaces 66. The surfaces 65 have simple curvature, whereas the curvature of the surfaces 66 is complex. This particular formation of the briquets will obviously prevent surface contact between adjacent briquets 48 when the same are piled or arranged in a mass.

During normal operation of the system illustrated in Fig. 7, the tank 13 is normally supplied to the level of the overflow 57, with fresh water, and the pump 12 is operating to deliver water through the feed pipe 14 to the interior of the ice making machine 10. The slush ice produced by the machine 10 is delivered through the chute 18 to the spout 38 wherein the excess water is removed by the screen 39 and is returned to the tank 13 along the sluice 40 thus precooling the water in the supply tank.

The slush ice delivered from the lower end of the screen 39 passes downwardly through the segmental casing 33 by gravity aided by the revolving recessed rotor ring 32 and is initially compressed for the removal of excess water, as it approaches the lower inlet end of the breast plate 34. As the relatively dry slush ice enters and advances along the space between the rotor 28 and the breast plate 34, it is thoroughly and gradually compressed into successive briquets 48 of the shape shown in Fig. 6. When each briquet passes the point of narrowest distance between the compression surface 45 of the plate 34 and the ring 32, the pressing operation is complete and the pressure is thereafter gradually relieved by virtue of the increasing distance between the plate 34 and the ring 32 advancing toward the discharge. The opposite side projections 47 formed on the briquets by the grooves 46, then ride along these grooves which continue along the side walls of the plate 34, and the advancing briquets 48 are thus automatically removed from the forming recesses of the ring 32. The finished briquets 48 are subsequently automatically delivered into the discharge chute 64 by end coaction with each other and finally slide down the chute 64 and may be utilized as desired.

The degree of pressure to which the briquets 48 are subjected is dependent upon the quantity of slush ice admitted to the machine 15, the character of this ice, and the setting of the spring 43. By adjusting the position of the segmental casing 33 with the aid of the rod 35 and nuts 36, the degree of drying or initial compression of the pack ice may be varied. By varying the position of the spring 43 with the aid of the adjusting nut 49, the effectiveness of the plate 34 may be readily varied. As the breast plate 34 is moved due to variations in the pressure created by the revolving rotor 28, the rheostat 44 varies the speed delivered by the actuating motor 16, thus causing the speed to vary in accordance with the actual requirements. While the motor 16 also operates the pump 12, the power consumption of this pump is relatively small and remains practically constant, and will not be materially affected due to the regulation effected by the rheostat 44.

In order to permit ready withdrawal of the briquets 48 from the recesses of the ring 32, it has been found desirable to maintain the recess surfaces above the freezing temperature of water

during removal of the briquets. This is accomplished by circulating water through the duct 51 formed in the ring 32, and this water is returned to the tank 13 with the excess water removed from the slush ice during the pressing thereof, through the pipe 56 thus further pre-cooling the contents of the supply tank 13. The quantity of fresh water admitted to the system from the initial supply pipe 26 is controlled by the float of the valve 27, which rides upon the liquid in the tank 13 but does not deliver fresh liquid directly to the supply tank. All fresh water admitted, must circulate either through the ice making machine 10 or through the briquetting machine 15 either in parallel or in series, and thus is pre-cooled before entering the tank 13.

From the foregoing description it will be apparent that the present invention provides simple, compact, durable and highly efficient means for forming a succession of briquets having uniform characteristics. The briquets are gradually subjected to the maximum pressure which is thereafter gradually relieved so as to maintain the objects in the desired molded condition, and the successive completed briquets are automatically removed from the forming rotor and delivered from the machine by the grooves 46 formed in the breast plate 34. Any desired adjustment of the machine may be quickly effected during operation thereof if desired, and all parts of the mechanism are quickly accessible for inspection. The power for driving the machine is quickly and effectively varied by the rheostat 44 in accordance with the power requirements, and the shape of the final briquets is such that they may be massed without danger of excessive freezing of one briquet to the adjacent objects.

The present invention has proven highly satisfactory in actual commercial operation and by proper adjustment of the various parts and manipulation of the control valves, enormous capacity has been obtained with minimum power consumption. The entire system is automatic in its action and requires practically no attention after being placed in proper condition for operation.

It should be understood that it is not desired to limit the invention to the exact details of construction and to the precise steps of the method herein shown and described, for various modifications within the scope of the claims may occur to persons skilled in the art.

It is claimed and desired to secure by Letters Patent:

1. The process of producing briquets, which comprises, compressing granular material into bodies of definite shape, and utilizing the shape of the bodies to conduct the same in succession away from the compressing media.

2. The process of producing briquets, which comprises, compressing granular material to form bodies having guiding structure thereon, and utilizing said structure to lift the bodies in succession away from the compressing media.

3. The process of producing ice briquets, which comprises, compressing slush ice to form bodies having guiding projections at the opposite sides thereof, and utilizing said projections to lift and conduct the successive bodies away from the compressing media.

4. An article of manufacture comprising, a pressed ice briquet having oppositely curved faces and side projections for conducting the briquet along a definite path.

5. An article of manufacture comprising, a

pressed ice briquet having opposite faces one of which has only simple curvature in one direction and the other of which has compound curvature in several directions.

6. In combination, a pair of relatively movable members formed to press granular material delivered therebetween into a series of end coacting objects, and means on one of said members co-operable with opposite side portions of the successive objects to effect removal thereof away from the other of said members.

7. In combination, a rotor having peripheral recesses, a breast plate cooperable with said recesses to form a succession of briquets, and means on said plate cooperable with the briquets to remove the same from said recesses.

8. In combination, a rotor having peripheral recesses, a resiliently supported breast plate cooperable with said recesses to form briquets, and means on said plate for forming said briquets to effect removal thereof from said recesses during movement of said rotor.

9. In combination, a rotor having peripheral recesses, and a breast plate coacting with said rotor to gradually compress material within the successive recesses to produce a series of end coacting bodies and to thereafter gradually relieve the compressed material from pressure, said breast plate being formed to remove the bodies from the rotor recesses.

10. In combination, a rotor having an annular series of peripheral recesses, and a gradually curved breast plate coacting with said rotor to compress material within said recesses, the compression surface of said plate comprising an arc of greater radius than that of said rotor and being nearest the periphery of said rotor between the material receiving and delivery ends of said plate.

11. In combination, a rotor having an annular series of peripheral recesses, a breast plate having a gradually curved compression surface approaching and receding from the path of travel of said recesses, means for resiliently urging said plate toward said rotor, and means operable by said urging means for controlling the speed of said rotor.

12. In combination, a rotor having peripheral recesses revolvable about an axis, and a breast plate having an arcuate compression surface which approaches and recedes from the path of travel of said recesses, said surface being curved about a center located on the side of said axis opposite said plate.

13. In combination, a rotor having briquet forming recesses, means for maintaining the temperature of the recess surfaces above the freezing point of water, and a breast plate coacting with said recesses to compress material therein and to eventually withdraw the finished briquets from said recesses.

14. In combination, a rotor having briquet forming recesses, means for circulating water about the axis of said rotor in opposite directions to maintain the temperature of the recess surfaces above the freezing point of water, and a breast plate coacting with said recesses to compress material therein.

15. In combination, a rotor having briquet forming recesses, means for circulating water through said rotor to maintain the temperature of the recess surfaces above the freezing point of water, and a breast plate coacting with said recesses to compress material therein, said plate

being formed to effect automatic positive removal of the final briquets from said recesses.

16. In combination, a rotor, means for actuating said rotor, a compression member cooperable with said rotor to produce a succession of briquets, and means cooperating with said member to control said actuating means.

17. In combination, a rotor, a motor for actuating said rotor, a breast plate cooperable with said rotor to produce a succession of molded objects, and means associated with said plate for controlling the operation of said motor.

18. In combination, a rotor, an electric motor for driving said rotor, a movable breast plate cooperable with said rotor to produce a succession of molded objects, and means operable by movement of said plate for varying the power of said motor.

19. In combination, a rotor having an annular series of peripheral recesses, a breast plate cooperable with said rotor to produce a succession of molded objects, and means providing opposed curved grooves associated with said plate for forming projections at the opposite sides of the successive objects to remove the latter from said recesses.

20. In combination, a rotor having peripheral recesses, a breast plate cooperable with said recesses to form a succession of endwise interconnected bodies, and means on said plate cooperable with the successive bodies to remove the same from said recesses.

21. In combination, a rotor having peripheral recesses, a resiliently supported breast plate cooperable with said recesses to form a series of endwise interconnected bodies, and means on said plate for forming said bodies to effect successive removal thereof from said recesses during movement of said rotor.

22. In combination, a rotor having an annular series of peripheral recesses, a breast plate having a longitudinally smooth curved surface cooperable with said recesses to form a succession of bodies, and means on said plate cooperable with said bodies to remove the same in succession from said recesses.

23. In combination, a rotor, a breast plate cooperable with said rotor to form a series of bodies, and means for utilizing the pressure on said plate for controlling the operation of said rotor.

24. In combination, a rotor, a breast plate pivotally supported at one side of said rotor and cooperable therewith to produce a series of compressed bodies, and means cooperable with said plate at the opposite side of said rotor for controlling the operation of the latter.

25. In combination, a rotor having a series of peripheral recesses, a resiliently mounted breast plate pivotally supported at one side of said rotor and cooperable with said recesses to form a series of compressed bodies, and means operable by the resilient movement of said breast plate for controlling the speed of operation of said rotor.

26. The process of producing a series of compressed bodies, which comprises, compressing granular material into end coacting bodies of definite shape, and utilizing the shape and end coaction of the bodies to conduct the same in succession away from the compressing media.

27. The process of producing a series of ice bodies, which comprises, compressing ice crystals to form a series of end connected bodies having lateral guiding projections at the opposite sides thereof, and utilizing said end coaction and said

80

85

90

95

100

105

110

115

120

125

130

135

140

145

150

projections to conduct the successive bodies away from the compressing media.

28. The process of producing ice bodies, which comprises, compressing ice crystals to form a succession of bodies, and utilizing the degree of compression of said bodies to control the rate of production thereof.

29. In combination, means for continuously supplying ice crystals, a rotor for compressing the crystals into a succession of solid ice bodies, and means dependent upon the rate of supply of the crystals for controlling the operation of said rotor.

WILLIAM H. TAYLOR.

10	85
15	90
20	95
25	100
30	105
35	110
40	115
45	120
50	125
55	130
60	135
65	140