E. FERNHOLTZ.

MIXER AND DRIER FOR BRIQUET MATERIALS.

APPLICATION FILED SEPT. 14, 1909.

994,991. Patented June 13, 1911.

2 SHEETS—SHEET 1.

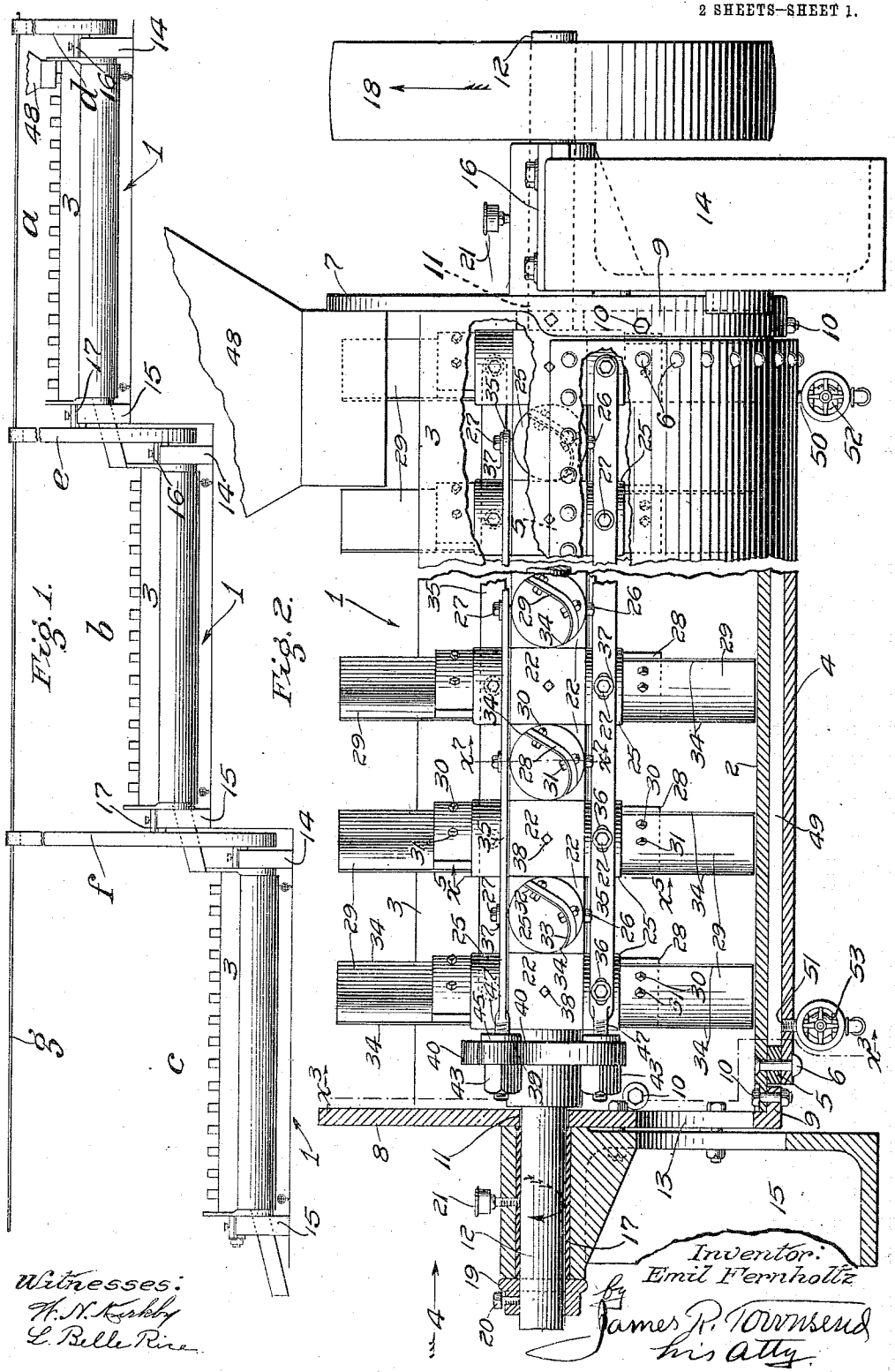

Fig. 1.

Fig. 2.

Witnesses:
H. N. Kirkby
L. Belle Rice

Inventor:
Emil Fernholtz
by James R. Townsend
his atty

E. FERNHOLTZ.

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2 SHEETS—SHEET 2.

Fig. 3.

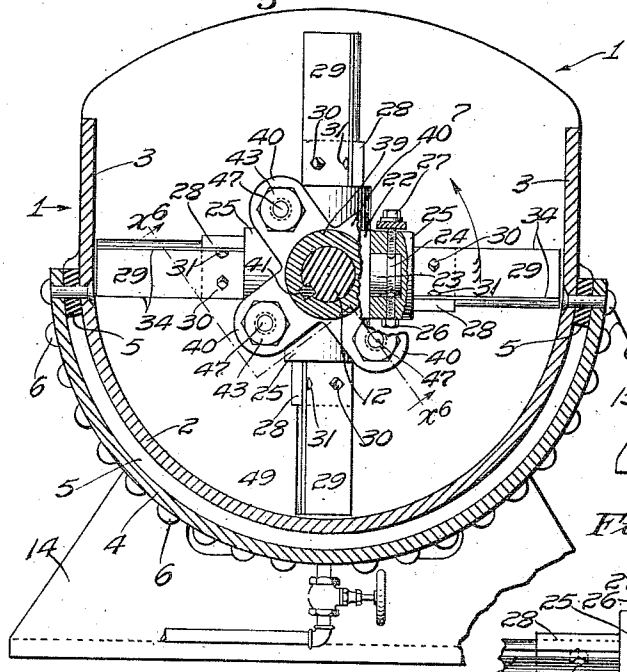


Fig. 4.

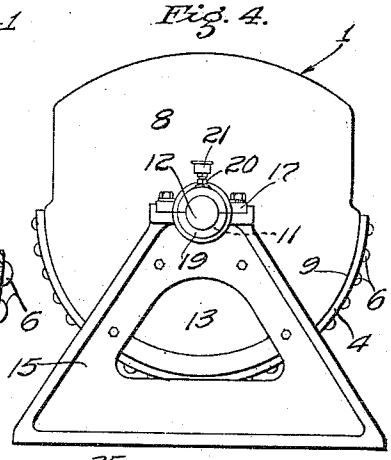


Fig. 5.

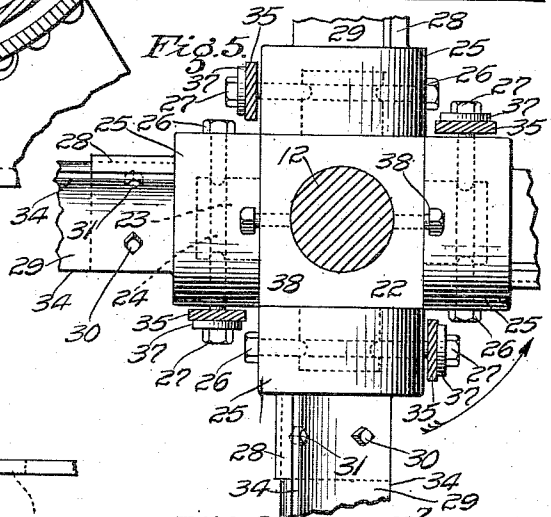


Fig. 6.

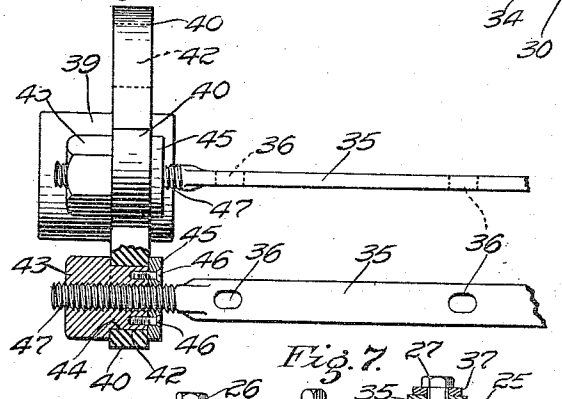


Fig. 7.

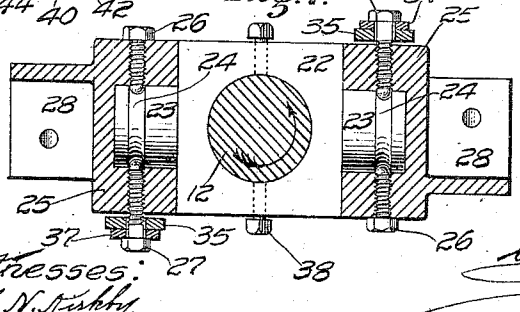
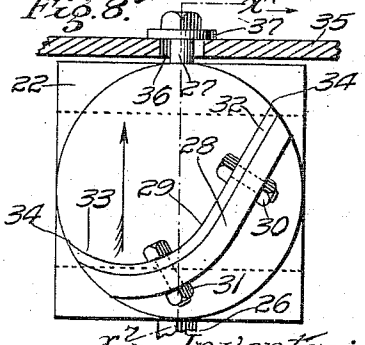


Fig. 8.



Witnesses:
H. N. Fiskby.
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Inventor:
Emil Fernholtz
by James R. Townsend
his Atty.

UNITED STATES PATENT OFFICE.

EMIL FERNHOLTZ, OF LOS ANGELES, CALIFORNIA, ASSIGNOR TO THE NATIONAL BRIQUETTING AND CLAY WORKING MACHINERY COMPANY, OF PHOENIX, ARIZONA TERRITORY, A CORPORATION OF ARIZONA TERRITORY.

MIXER AND DRIER FOR BRIQUET MATERIALS.

994,991. Specification of Letters Patent. **Patented June 13, 1911.**

Application filed September 14, 1909. Serial No. 517,723.

To all whom it may concern:

Be it known that I, EMIL FERNHOLTZ, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Mixer and Drier for Briquet Materials, of which the following is a specification.

This invention relates to a machine adapted to make lignite and peat ready for molding into briquets. It may also be used for making coal and other materials ready for briqueting.

It is desirable that materials for briqueting shall contain a certain amount of moisture,—say from 15% to 20%, in order that they may be compressed into compact briquets. Lignite and peat as they occur in nature usually contain too much moisture for briqueting, and it therefore becomes necessary to eliminate the surplus moisture.

An object of this invention is to effect this elimination in the most economical manner; and in this connection the invention includes a novel construction of mixer blades.

In this invention means are provided for simultaneously heating and stirring the material to be briqueted. The water material requires a longer period of treatment under a determined temperature than the drier material.

An object of this invention is to provide a machine which can be regulated to evaporate a determined amount of moisture from the material while it is passing through the machine, the operation of the machine being continuous so that when the material that is fed into the machine contains a uniform percentage of moisture the product discharged from the machine will contain a predetermined percentage of moisture. In practice it is usually desirable or necessary to use a battery of mixers and driers, the units of which successively operate upon the material to gradually remove the moisture.

The accompanying drawings illustrate the invention in the best form I at present contemplate embodying the same.

Figure 1 is a side elevation of a battery of mixers and driers embodying this invention. Fig. 2 is a broken side elevation of one unit of the apparatus partly in axial section. Parts of the shells are broken to expose interior parts. Fig. 3 is a section on line x^3, Fig. 2, looking toward the right; parts being broken for clearness of illustration. Fig. 4 is an elevation of the discharge end of one unit. Fig. 5 is a detail from line x^5, Fig. 2, looking toward the right. Fig. 6 is a detail partly in section on line x^6, Fig. 3, illustrating the means for adjusting the angle of the mixer wings. Fig. 7 is a detail partly in section on line x^7, Figs. 2 and 8, of a cross-head and socket for two of the mixer-wings, the cross-head being shown intact and the shovels or wings being omitted. Fig. 8 is an elevation of a cross-head with socket and shovel or wing attached. A fragment of the adjusting-rod is also shown in section.

Arrows on the various section-indicating lines show the direction of sight.

The mixing-trough 1 is a shell having a semi-cylindrical bottom 2 and terminating in upright side walls 3. Outside of the semi-cylindrical bottom 2 is a steam-jacket 4 spaced apart from the bottom 2 by spacers 5 and secured by rivets 6 passing through the bottom, the spacers and the jacket. The ends of the trough are formed by similar head and tail plates 7 and 8 which are provided with semi-cylindrical flanges 9 that receive the ends of the trough 1 and to which the trough is secured by bolts 10. The head and tail plates 7 and 8 are provided with orifices 11 in which a shaft 12 rotates, and the tail-plate 8 is provided with an outlet 13 at the bottom of the trough to allow the material to be discharged therefrom.

14 and 15 are stands that carry bearings 16 and 17 for the shaft 12. The shaft is rotated by a pulley 18 mounted on the shaft at the head of the mixer; and the shaft is held in place by said pulley at the head end and by a collar 19 and set-screw 20 outside the bearings at the discharge-end of the machine. Grease-cups 21 are provided in the bearings 16 and 17.

Inside the trough 1 there are fixed on the shaft 12, a plurality of cross-heads 22 each of which is provided with oppositely arranged pins 23 having annular grooves 24. Wing-sockets 25 are rotatably mounted on the pins 23 and are secured thereon by screws 26 and 27 extending into the grooves 24. Each socket is provided with a seat 28 that

projects from the end of the socket to securely hold the stirring wings or shovels 29 which are fastened in the seats by bolts 30 and 31. Said stirring wings are curved in cross-section and are oblique to the plane of their rotation. They are flat at their foremost portions 32 and concave at their rearward portions 33; the axis of the concavity being practically radial to the axis of the shaft and consequently to the axis of rotation. The front face of each wing being thus made concave and the edges 34 thereof may be cutting edges as shown so that the wings are adapted to act as scoops or shovels when the shaft rotates in the direction of the concave face of the wings, as indicated by the large arrows in Figs. 2, 3, 5, 7 and 8. One purpose of the wings is to lift the heated material from the mass in the trough and to drop the same above the shaft through the air, thus allowing the circulation of air to carry off the moisture. This purpose is effected by providing the wings with the concave portion arranged as stated. Another purpose of the wings is to advance the material toward the discharge-end of the machine at each revolution of the wing. That is to say, the wings act as conveyer-blades and the material will be shifted more or less rapidly toward the discharge-end of the machine, depending upon the pitch given the wings. Such pitch is given the wings by turning them on the pin. If the wing is turned with its edges in a plane that is parallel with the axis of the shaft, the tendency to shift the material toward the discharge-end is minimized, and such tendency will be increased as the angle increases between the axis of the shaft and the plane in which the edges of the wing lie; so that the speed of travel of the material through the machine can be regulated by turning the socket 25 on the pin 23 and thus changing the pitch of the wings. In order to adjust the wings for the purpose of increasing or decreasing the speed with which the material is conveyed through the machine, pitch adjusting-rods 35 are provided, the same having longitudinal slots 36 through which the screws 27 of the sockets extend. Any number of cross-heads 22 may be provided and they are preferably arranged successively at right angles with each other so that there are four rows of sockets extending along the shaft. An adjusting-rod 35 is provided for each row of sockets, and the screw 27 of each socket extends through and is movable along a slot 36 of an adjusting-rod; washers 37 being provided for the bolt heads. The several cross-heads are fixed against rotation on the shaft. This may be done by a feather or otherwise. In the drawings they are fixed by means of set-screws 38.

A hub 39 provided with four perforated spokes 40 is fixed against rotation by a key 41 on the shaft 12, and in each of the perforations 42 of the spokes 40, is journaled a nut comprising a head 43 and a cylindrical body 44 by which it is swiveled; the same being secured by a washer 45 fixed to the cylindrical end of the nut by screws 46 to hold the nut in the perforation 42. The swiveled threaded nuts screw onto screw-threaded portions 47 of the adjusting-rods 35, so that by rotating the nuts the adjusting-rods 35 will be moved endwise, thus to turn the sockets on their pins and change the pitch of the wings thereby regulating the speed with which material may be conveyed from the head of the machine to the discharge-end with a determined speed of revolution.

The material may be fed into the head of the machine through a spout or hopper 48.

Steam will be admitted to the steam-space 49 in the jacket through a steam-inlet 50, and will flow out through the outlet 51.

In practical operation the attendant may determine the speed at which the material must be run through the machine in order to expel the requisite amount of moisture. In case it is required to eliminate a small amount of moisture from the material as it passes through the machine, the adjusting nuts may be turned by their heads 43 to move the adjusting rods 35 toward the inlet end or head of the machine, thus turning the wings so that the concave portions of the lifting faces are directed toward the discharge-end of the machine. Then as the wings revolve the material caught on the straight, flat portions will be slid forward into the concave portions and from there will be dumped toward the discharge-end.

The steam-pipes are provided with valves 52, 53 so that the amount of steam admitted and the pressure maintained in the steam-chamber 49 can be accurately regulated to heat the material to the extent desired.

Any desired number of the machines may be arranged in succession so that partially dried material may be delivered from one machine to the next and so on until the material from the last machine contains the requisite amount of moisture.

In Fig. 1 a battery of three machines, *a*, *b*, *c*, is shown, the units being driven individually by belts *d*, *e*, *f*, from a line shaft *g*. The pitch of the wings of each of said machines may be regulated independently of the others and each of these machines may be regulated as to temperature independently of the others so that the material may be heated or cooled as desired at different stages of the operation.

I claim:—

1. A mixer and drier comprising a heating-trough having an outlet at one end, a shaft extending longitudinally of the trough, and wings fastened to the shaft to rotate

therewith, said wings having a concave portion, the axis of the concavity being practically radial to the axis of the shaft.

2. A mixer and drier comprising a heating-trough having an outlet at one end, a shaft extending longitudinally of the trough, and wings fastened to the shaft to rotate therewith; said wings having a concave portion the axis of which is practically radial to the axis of the shaft and means for changing the pitch of the wings.

3. In a mixer, a shaft, a pin mounted on the shaft to be revolved thereby, a socket rotatably mounted on the pin, and a concave wing fastened to the socket.

4. In a mixer and drier, the combination with a heating trough having an outlet at one end, of means to discharge material into the other end, a shaft extending longitudinally of the trough, pins on the shaft, wing sockets on the pins, wings in the sockets, adjusting-rods extending along the shaft, means connecting the adjusting-rods with the sockets, means for moving the adjusting rods endwise to turn the sockets on the pins to change the pitch of the wings, and means to regulate the heat of the trough.

5. In a mixer and drier, the combination with a steam-jacketed trough having an outlet at one end, of means to discharge into the other end, a shaft extending longitudinally of the trough, pins on the shaft, wing sockets on the pins, wings in the sockets, adjusting-rods extending along the shaft, a hub, and thrust nuts journaled to the hub and screwed on to the ends of the rods to move the same endwise.

6. In a mixer and drier, the combination with a rotary shaft, of a pin on the shaft the same being provided with an annular groove, a socket on the pin, screws in the socket extending into the groove, said socket being provided with a concave seat, a wing in said seat and adjustable means movable along the shaft to rotate the socket on its pin.

7. In a mixer and drier, the combination with a rotary shaft, of a pin on the shaft the same being provided with an annular groove, a socket on the pin, screws in the socket extending into the groove, said socket being provided with a concave seat, a concave wing in said seat and adjustable means movable along the shaft to rotate the socket on its pin.

8. In a mixer and drier, the combination with a rotary shaft, of a stirring wing on the shaft, said wing being curved in cross-section and oblique to the plane of its rotation, and being flat at its foremost portion and concave at its rearward portion.

9. In a mixer and drier, the combination with a rotary shaft, of stirring wings on the shaft, said wings being curved in cross-section and oblique to the plane of their rotation, and being flat at their foremost portions and concave at their rearward portions; and arranged along the shaft.

10. In a mixer and drier, the combination with a rotary shaft, of stirring wings curved in cross-section and oblique to the plane of their rotation, said wings being flat at their foremost portions and concave at their rearward portions and means for changing the pitch of the wings.

11. A mixer and drier comprising a plurality of steam-jacketed troughs, means to supply and exhaust steam to and from the jacket of said troughs independently of each other, shafts in said troughs respectively, wings on the shafts respectively, and means operable independently of each other for regulating the pitch of the wings on the shafts respectively.

12. A mixer and drier comprising a plurality of troughs, means for heating the troughs and regulating the temperatures thereof independently of each other, means in said troughs respectively, for stirring and conveying the material therein, said troughs being provided with outlets, means for conveying material from trough to trough successively, and means for regulating the speed of the conveyers in said troughs respectively, and independently of each other.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 25th day of August, 1909.

EMIL FERNHOLTZ.

In presence of—
JAMES R. TOWNSEND,
C. H. FERNHOLTZ.