(No Model.) 4 Sheets—Sheet 1.

H. S. ALBRECHT.

APPARATUS FOR MAKING ARTIFICIAL FUEL.

No. 510,228. Patented Dec. 5, 1893.

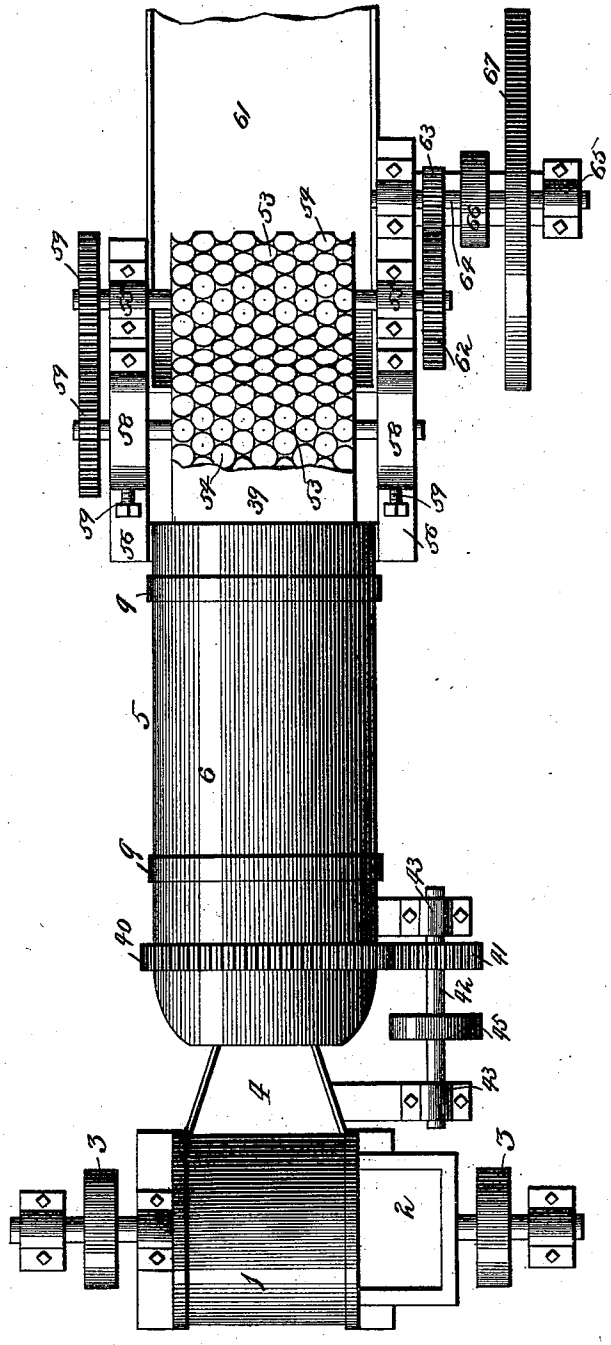

Fig. 1.

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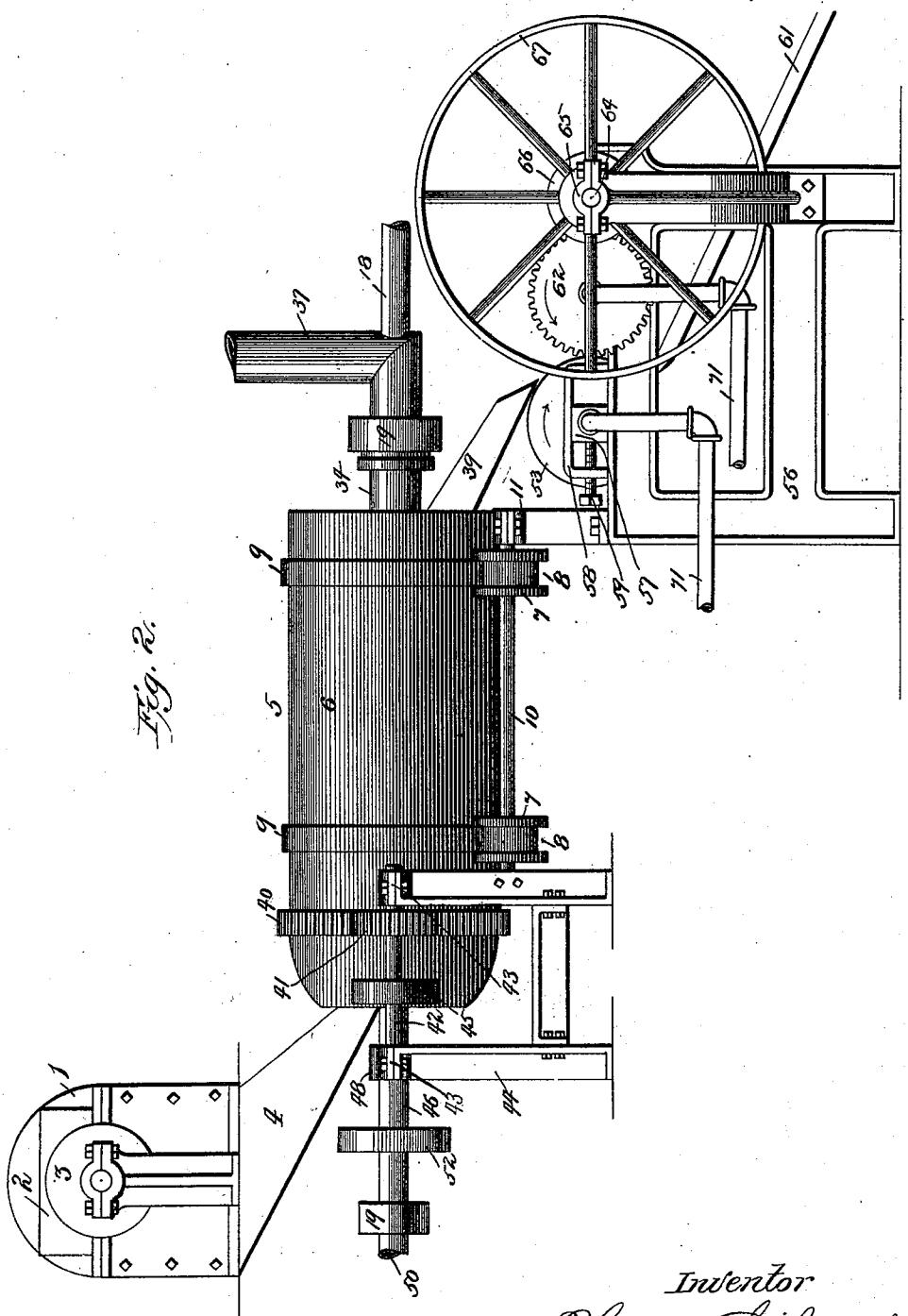

Fig. 2.

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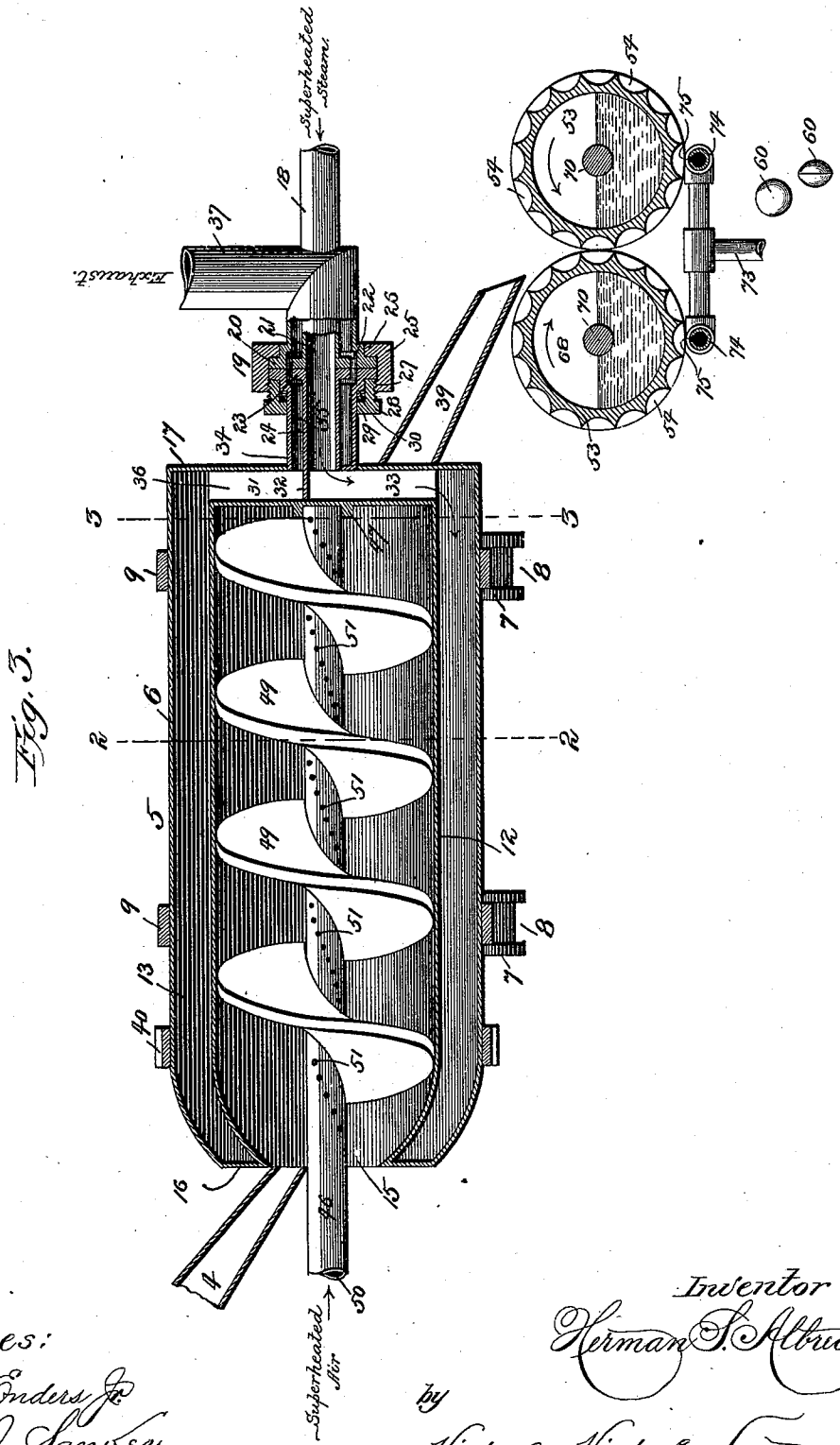

Fig. 3.

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Fig. 4.

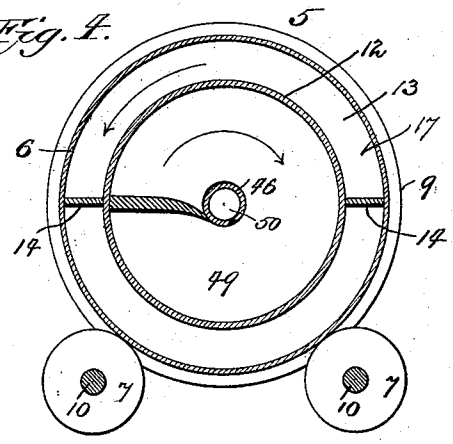


Fig. 5.

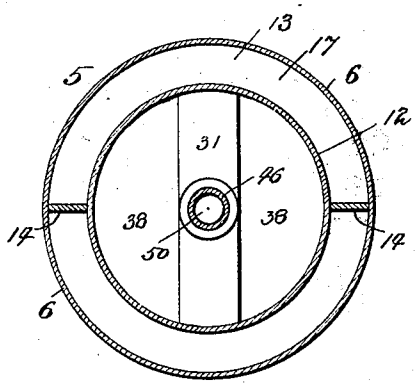


Fig. 6.

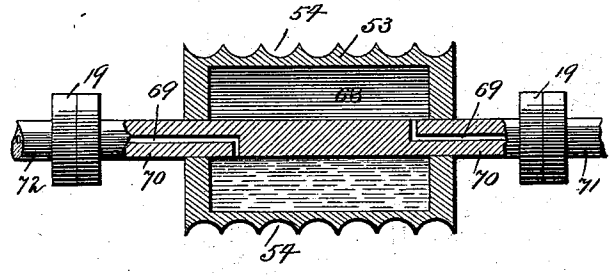


Fig. 7.

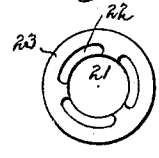
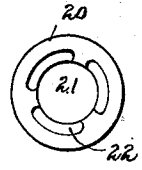


Fig. 8.



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UNITED STATES PATENT OFFICE.

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APPARATUS FOR MAKING ARTIFICIAL FUEL.

SPECIFICATION forming part of Letters Patent No. 510,228, dated December 5, 1893.

Application filed June 19, 1893. Serial No. 478,049. (No model.)

To all whom it may concern:

Be it known that I, HERMAN S. ALBRECHT, of the city of St. Louis and State of Missouri, have invented certain new and useful Improvements in Apparatus for Making Artificial Fuel, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part hereof.

My invention relates to an improved apparatus for making artificial fuel from coal, and other carbonaceous substances such as lignite, loam, peat or turf, as hereinafter described and designated in the claims.

The object of my invention is to provide an improved apparatus for such purpose, which shall be complete and simple in operation and highly efficient and economical in use.

In the drawings: Figure 1 is a plan view of the improved apparatus used in carrying out my invention. Fig. 2 is a side elevation of same. Fig. 3 is a sectional side elevation of a portion of such mechanism on an enlarged scale. Fig. 4 is a transverse sectional elevation taken on the line 2—2 of Fig. 3 and looking toward the right hand of said figure. Fig. 5 is a transverse sectional elevation taken on the line 3—3 of Fig. 3. Fig. 6 is a longitudinal section taken through one of the rolls used in carrying out the invention. Fig. 7 is a detail face view of a revoluble coupling flange used in the invention. Fig. 8 is a similar view of a fixed coupling flange.

In carrying out my invention I make use of any known form of disintegrator or grinding mill 1 which is provided with a hopper 2 and drive pulleys 3, and located in a plane above the plane in which the remaining portions of the apparatus are located, and into which the material, such as coal, lignite or loam is first introduced and ground or disintegrated or finely pulverized, and delivered upon the inclined chute, which carries it into the machine with which the next step of the method or process is carried out.

5 indicates a combined drier and conveyer, which is located in a plane below the disintegrator. For convenience in expression, I will hereinafter designate this combined drier and conveyer simply as a "drier." It is preferably constructed with an outer shell 6 preferably cylindrical in form, having a length a number of times in excess of its width or diameter, and mounted to revolve upon a series of rollers 7, the peripheries of which are provided with grooves 8 engaged by annular ribs or projections 9, which latter are fixed upon the outer surface of said outer shell a distance apart, so that said ribs engaging the grooves in said rollers will thereby guide the drier in its movements and cause it to revolve axially without longitudinal movement. The rollers 7 are fixed upon horizontal parallel shafts 10 which are mounted in suitable bearings 11 upon the frame of the machine. The drier is also provided with an inner shell 12, which is also cylindrical in form, but of smaller diameter and of less length than the outer shell 6, so as to form an annular space 13 surrounding said inner shell. This space is divided by a longitudinal partition 14, for a purpose hereinafter mentioned, but this partition does not extend to the front end of the annular space 13.

15 indicates the feed-end of the drier, which is open, and within which the free end of the chute 4 projects a short distance so as to delever the pulverized material therein. The feed ends of both shells 6 and 12 are preferably reduced in diameter or conical, as shown, so as to prevent the exit of material thereat during revolution of said drier. The ends of the annular space 13 are closed by heads 16 and 17.

Superheated steam from any common furnace (not shown) and having a temperature of about 700° is caused to circulate through the annular chamber surrounding the inner shell by entering a fixed pipe 18 and passing through a coupling 19 which is centrally located with respect to said drier adjacent to the tail-end thereof. This coupling is provided with a fixed coupling flange 20 having a central bore 21 and a series of ports 22 arranged radially about said central opening or bore 21 and is fixed upon the inner end of said pipe 18, so that its inner face will be contacted by a similar revoluble coupling flange 23, also having a central bore 21 and radial ports 22 which register with the central bore and radial ports of the fixed flange. The revoluble flange 23 is connected to the outer end of an inner pipe 24 which revolves with the drier.

The construction of the coupling 19 is such that superheated steam is passed inward through the pipes 18 and 24 and outward through the annular ports 22, while the drier is revolving. The two flanges 20 and 23 should be suitably held in contact so as to form a tight joint and yet permit movement of the revoluble flange and make a tight joint between the two flanges. This may be done in any known manner or by means of a ring 25 having a flange 26 projecting inward at one of its edges in engagement with the outer surface of the flange 20 and mounted upon the peripheries of both flanges and provided with an internal screw thread 27 at its edge which is opposite the flange 26. An annular gland 28 having an exterior screw thread and an inwardly projecting marginal flange 29, is screwed within the ring 25, and a suitable packing 30 is located between the revoluble flange 23 and the marginal flange 29 of said gland, so as to form a tight joint and make the desired coupling. This coupling 19 is connected to a hollow cross bar 31, the passage in which is divided at about the center of its length by a partition 32. The interior of the inner pipe 24 communicates with the passage 33 in one end of the hollow cross-bar 31. An outer pipe 34 surrounds the inner pipe 24 so that an annular space or passage 35 is formed between said inner and outer pipes, and said annular space is in communication with the radial ports 22 of the coupling 19 at its outer end and with the passage 36 in the hollow bar 31 on the side of the partition 32 which is opposite the passage 33. The passage 36 of the hollow bar communicates with the annular space 13 of the drier on one side of the longitudinal partition 14 thereof, while the space 33 in said hollow arm communicates with the said annular space of the drier on the opposite side of said partition.

37 indicates a fixed exhaust pipe which communicates with the radial ports 22 of the coupling, and carries off the exhaust steam from the drier. This exhaust pipe may be led to any desired point.

The material makes its exit from the drier through openings 38 in the tail-end thereof on opposite sides of the hollow bar 31, and passes into a second chute 39, which is inclined, so that its upper end is fixed closely adjacent the tail end of the drier for such purpose. The chute 39 has closed top and sides, but open opposite ends. The sides of this chute are closed for the purpose of confining the finely pulverized and dried material during its passage through said chute and preventing it being blown out by gusts of wind, &c.

Revoluble movement is imparted to the drier by means of a toothed ring 40 fixed upon the outer surface of said drier and engaged by a pinion 41 fixed upon a horizontal shaft 42, which shaft is in turn mounted in suitable bearings 43 upon the frame 44 of the machine, and said shaft is provided with a belt-pulley 45, by means of which it may be revolved. Located within the inner shell 12, and mounted in suitable bearings to revolve in a direction opposite that in which the shells of the drier revolve, is a horizontal conveyer-shaft 46. The inner end of this shaft is mounted in a bearing 47 carried by the hollow cross-bar 31, while the outer end of said shaft is located in any common bearing 48 upon the frame 44. This shaft carries a spiral conveyer 49 of any common form. This shaft is tubular having a bore 50. The outer end of the shaft 46 is open, but its inner end which is located in the bearing 47 is closed. Said shaft is provided with a series of small apertures 51 arranged spirally and located intermediate of the convolutions of the conveyer 49, so as to discharge superheated air throughout the length of said shaft which is within said inner shell of the drier in radial jets or screens during revolution of said shaft. One end of the shaft 46 projects outward through the open feed end 15 of the drier and is provided with a belt-pulley 52 or other suitable device for revolving said shaft, and this end is fitted with a coupling 19 previously described, or any common coupling by means of which said shaft may revolve and yet permit superheated air to be passed into said shaft from a common superheating furnace (not shown) during revolution of said shaft.

Located adjacent to the tail of the drier and in a plane below the same are a pair of hollow rolls 53, which have opposite lens-shaped recesses 54 in their faces. These rolls are properly mounted in suitable bearings 55, 57, upon the frame 56. The bearings 57 for one of said rolls are adjustable nearer to or farther from the bearings of the other roll so as to regulate the distance between the peripheries of said rolls, and for the purpose of regulating the pressure placed upon the material which passes between said rolls. The bearings 57 are preferably movable in a horizontal plane, being mounted to slide in horizontal guides 58. Bolts or screws 59 are threaded through one end of the guides 58 so that their inner ends will bear upon said movable bearings, their outer ends being provided with suitable angular heads to be engaged by any common form of nut or bolt wrenches. The rolls are geared together by means of gear-wheels 59 fixed upon the shafts of said rolls which project outward beyond said bearings, so that said rolls will revolve in the direction indicated by the arrows, and so that when material is passed between them from the chute 39, the same will be compressed and formed into circular cakes 60 which have their edges rounded as shown. After passing between the rolls and being formed into cakes the said cakes drop upon an inclined chute 61, the upper end of which is located directly beneath the space between the rolls. The cakes may be carried by this chute to any desired location and delivered into boxes or crates. Motion is communicated to the gear-

wheels 59 and to the shafts of the rolls by means of an additional gear wheel 62 fixed upon the projecting end of the shaft of one of the rolls. This gear wheel 62 is engaged by a pinion 63 fixed upon a shaft 64 which is mounted in suitable bearings 65 of the frame. There may also be fixed upon this shaft a belt pulley 66 and a fly-wheel or balance-wheel 67. As before stated the rolls 53 are hollow, each having a cylindrical chamber 68 formed upon its interior. (See Fig. 6.) During operation cold water is caused to circulate through the chambers by being passed through passages 69 formed in the shafts 70 of the rolls. These passages 69 extend to the outer ends of said shafts and open within said chambers at points closely adjacent to the ends of said chambers, so that cold water entering the passage 69 at one end of said shafts immediately passes into the chambers at one end thereof, then circulates therein and is caused to pass exterior of said shafts to a point adjacent to the opposite end of said chambers and make its exit through the passage 69 in the opposite ends of said shafts. Cold water is supplied to the shafts 70 by means of suitable couplings 19 or any common coupling which will permit said shafts to revolve and permit cold water to be supplied to the passages 69 by way of supply-pipes 71 during such revolution, and which will permit said water to be discharged through the passages 69 in the opposite ends of said shafts into similar couplings 19 and discharge pipes 72, during such revolution. The supply of cold water may be taken from any common source, such as a water tank or the hydrant of water works. (Not shown.)

73 indicates a supply-pipe for cold water which is provided with branch pipes 74 which are located directly beneath the rolls 53 and which branch pipes are provided with small jet orifices 75 in their upper sides, so as to discharge jets of cold water directly into the recesses 54 of the rolls immediately after the compressed cakes of material have been discharged therefrom, for a purpose hereinafter mentioned.

The operation is as follows: The raw material being supplied to the disintegrator 1 is thereby pulverized and falls upon the feed chute 4 and enters the open end of the drier, said drier being revolved in one direction and the conveyer 49 therein being revolved in an opposite direction. Said conveyer moves the pulverized material very slowly toward the tail end of the drier, while the revolutions of the drier in an opposite direction causes the said material to be picked up and rolled over and over. In the meanwhile, superheated air is being injected and interspersed among said material in said drier, being discharged through the jet orifices 51 in the conveyer shaft 46, and superheated steam is circulating around the inner shell 12 of the drier, entering the inner pipe 24 and the annular space 13, by way of the passage 33 in the hollow cross-bar 31, and passing thence toward the feed end of said drier and across the end of the longitudinal partition 14 and thence into the passage 36 of the hollow bar and making its exit through the annular space 35 surrounding said inner pipe, and through the radial ports 22 and into the exhaust pipe 37, and the pulverized material is thereby subjected to the action of the small jets of hot air and is simultaneously subjected to the action of the highly heated inner surface of the inner shell of said drier, thereby highly heating and effectually drying said material and causing it to assume a semi-plastic condition before it is discharged upon the tail chute 39, which is done. After this the semi-plastic material in this highly heated condition is gravitated to the rolls 53 and is by them compressed into cakes 60 of the form previously described. During the formation of the material into cakes it is rapidly cooled by the cold surfaces of the rolls, by reason of cold water being circulated through said rolls during the revolutions thereof. By reason of the rolls being thus kept cold the temperature of the cakes is thus reduced to such a degree before they are discharged from the rolls, that said cakes will be comparatively hard and unyielding, being removed from the semi plastic state by such action of the rolls. The jets of cold water issuing from the pipes 74 strike the recesses 54 in said rolls directly after the cakes are discharged therefrom, and act as a lubricant for said recesses, keeping them wet, and thereby preventing the cakes from adhering to said recesses, and greatly facilitating the discharge of the finished cakes. It will thus be seen that I first disintegrate the material, then pass it through a cylindrical drier revolving in one direction, simultaneously subject the material in said drier to the action of the heated walls thereof and to the action of escaping jets of superheated air and to the action of a conveyer revolving in a direction opposite that in which said drier revolves, thereby thoroughly drying said material and causing it to assume a semi-plastic condition, and then pass said semi-plastic material in a highly heated condition between revolving hollow rolls having opposite recesses in their faces, and press said material into cakes while in said highly heated condition and finally cooling the cakes thus formed while in the recesses in said rolls so that their temperature is greatly reduced before they are discharged from the rolls.

What I claim is—

1. In an improved apparatus for making artificial fuel, the combined drier and conveyer, having an outer shell cylindrical in form and mounted upon a series of rolls so as to be revolved during the operation, provided with an inner shell also cylindrical in form but of smaller diameter than the outer shell so as to form an annular space surrounding said inner shell, the ends of this annular space being closed, means for revolving the cylindrical drier in a given di-

rection, means whereby superheated steam or hot air may be caused to circulate through the annular space surrounding said inner shell, a tubular shaft extending longitudinally in said drier, a conveyer mounted upon said shaft, said shaft having a series of jet openings communicating with its interior and arranged to discharge hot air in said drier, means for revolving said shaft and said conveyer in the direction opposite to that in which the shell of the drier revolves, and means for supplying hot air to said tubular shaft and for discharging the same through said jet apertures while said shaft is revolving in said direction, substantially as herein specified.

2. The improved apparatus for making artificial fuel consisting of a disintegrator into which the material is first introduced, a combined drier and conveyer constructed with an outer shell cylindrical in form and mounted to revolve and provided with an inner shell of smaller diameter than the outer shell so as to form an annular space surrounding said inner shell, the ends of this annular space being closed, means whereby superheated steam or hot air may be supplied to said annular space while it revolves, a conveyer shaft mounted within said inner shell in suitable bearings to revolve, a conveyer mounted upon said conveyer shaft, said conveyer shaft being tubular and having a passage therethrough and provided with a series of small apertures communicating with its passage to discharge small jets of hot air in said inner shell, means for revolving said shaft and said conveyer in a direction opposite to that in which the shells of the drier revolve, means for supplying hot air to said tubular shaft while it is revolving, and a chute connecting with said disintegrator to discharge the disintegrated material into the drier, substantially as herein specified.

3. In an apparatus for making artificial fuel, the improved rolls for simultaneously pressing semi-plastic hightly heated material in the form of cakes and cooling same, said rolls being hollow and constructed with means for passing cold water therethrough while they are revolving, and having opposite lens-shaped recesses in their faces, so that when said material is passed between them the same will be compressed and formed into circular cakes having rounded edges, substantially as herein specified.

In testimony whereof I affix my signature in presence of two witnesses.

HERMAN S. ALBRECHT.

Witnesses:

EDWARD E. LONGAN,

JNO. C. HIGDON.