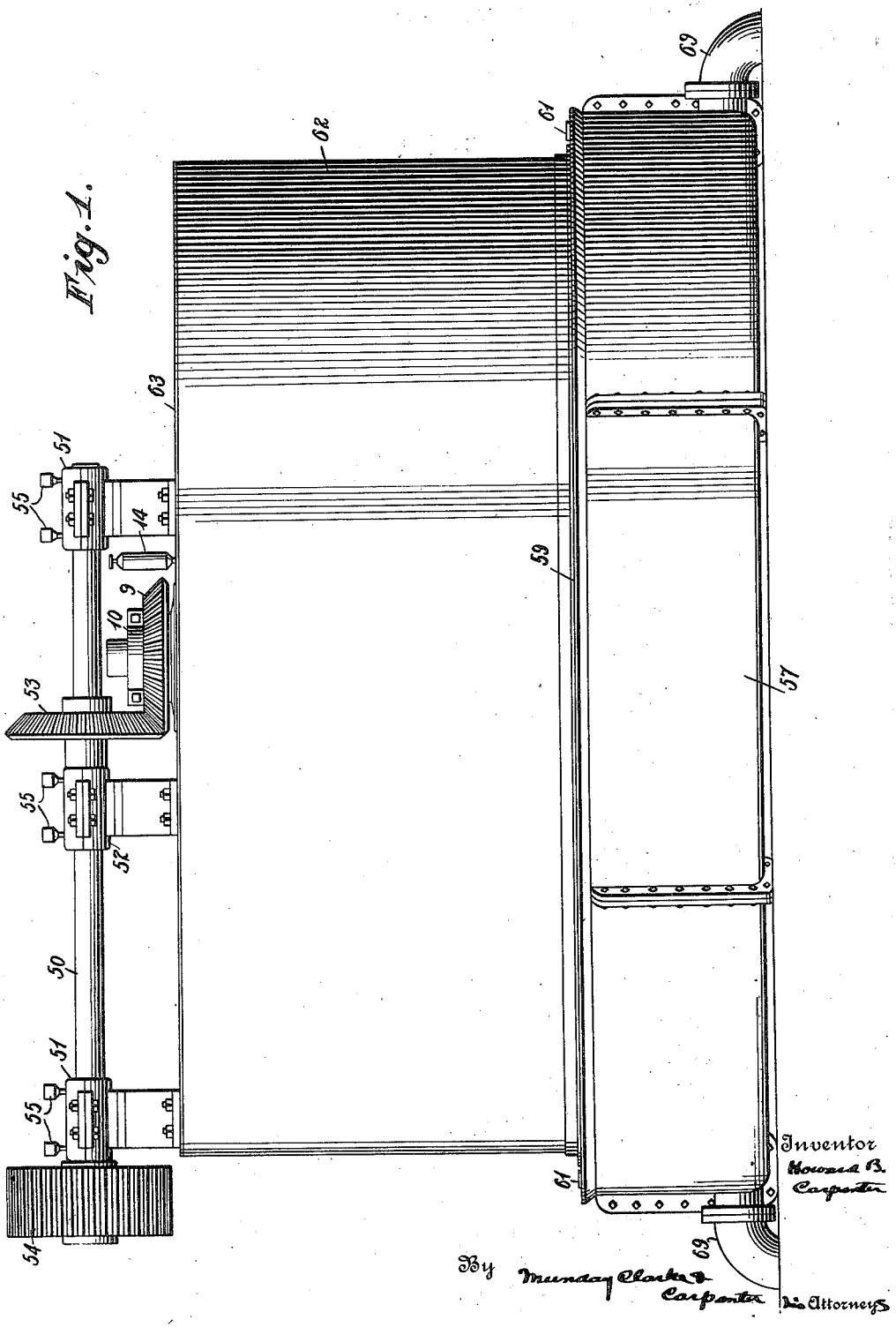
Nov. 22, 1927. 1,650,427

H. B. CARPENTER

COAL DRIER

Filed July 25, 1923 6 Sheets-Sheet 1

Fig. 1.



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Nov. 22, 1927. 1,650,427

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COAL DRIER

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Fig. 13.

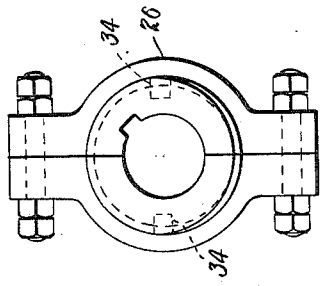


Fig. 14.

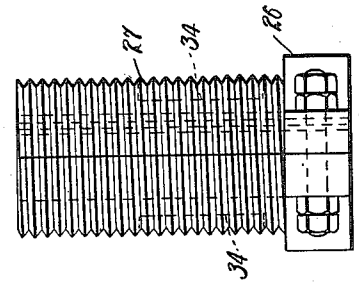
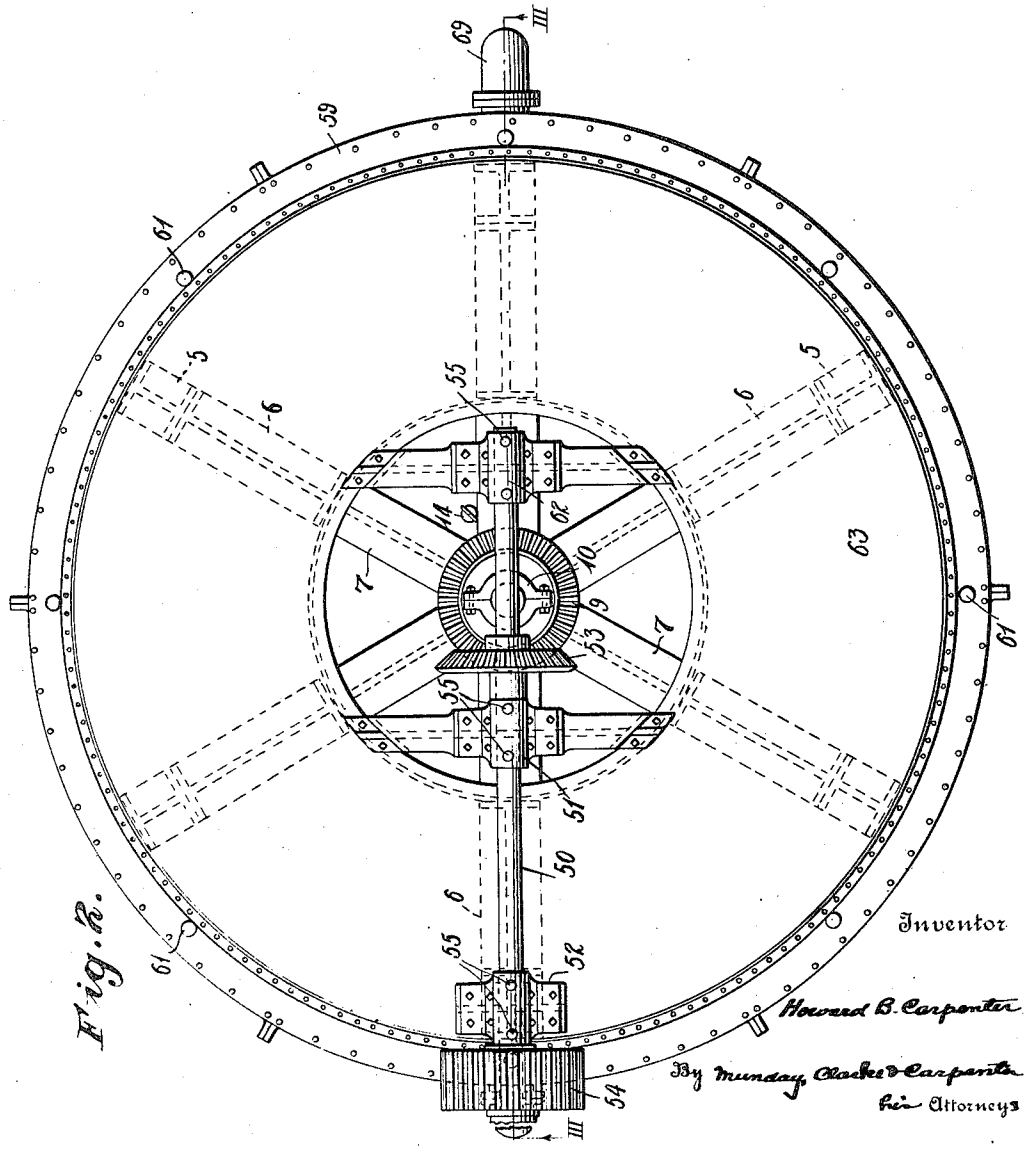


Fig. 12.



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Nov. 22, 1927. 1,650,427

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COAL DRIER

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Fig. 3.

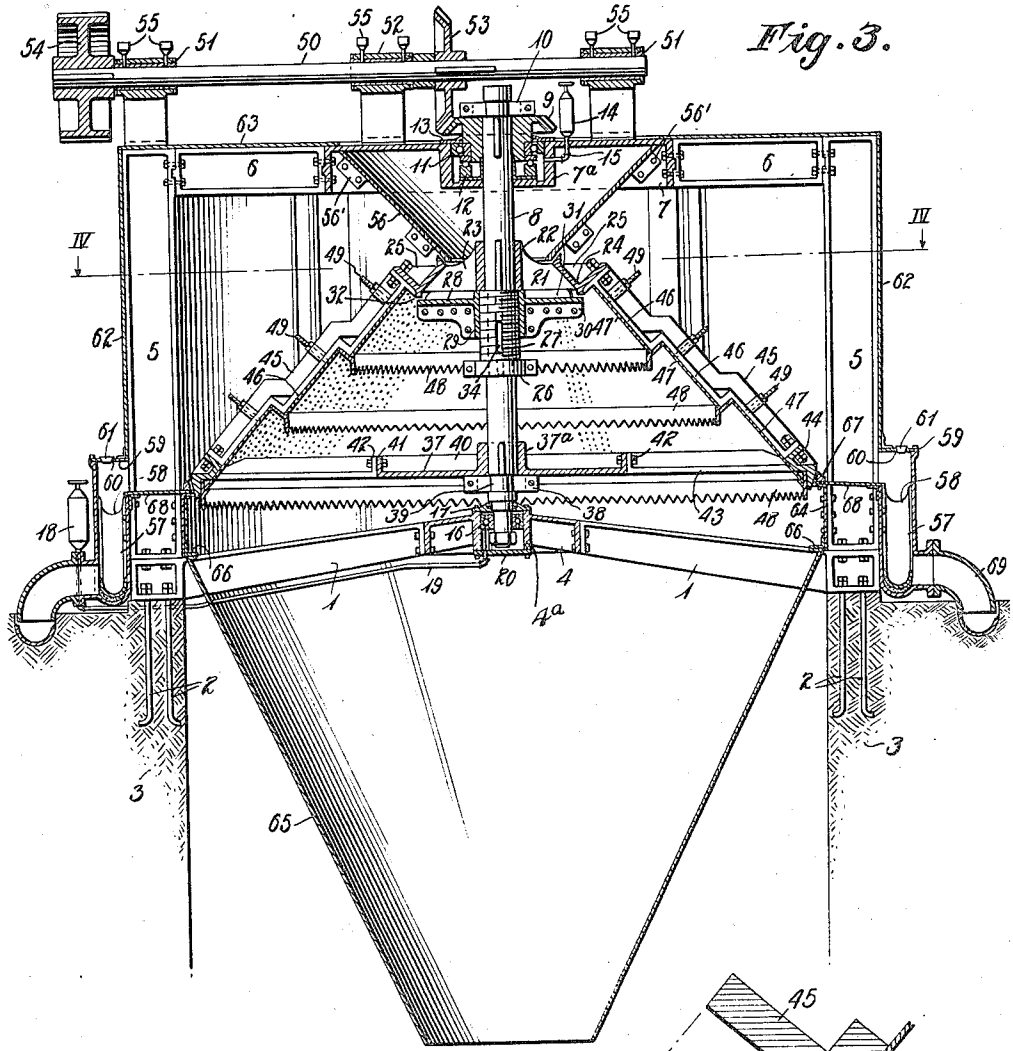
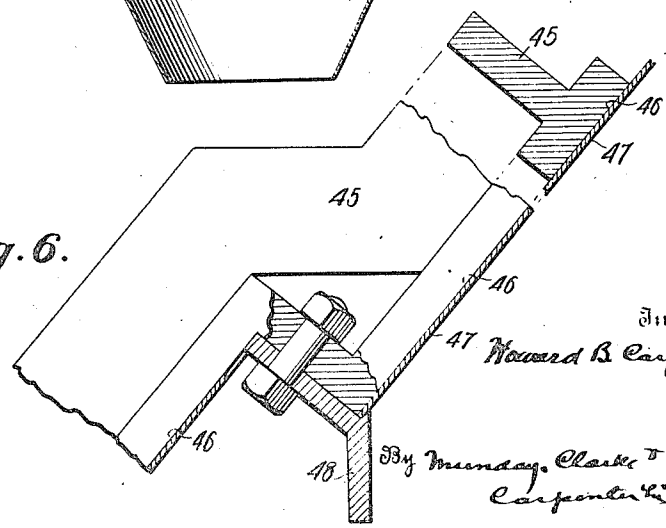


Fig. 6.



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Nov. 22, 1927. 1,650,427

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COAL DRIER

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Fig. 4.

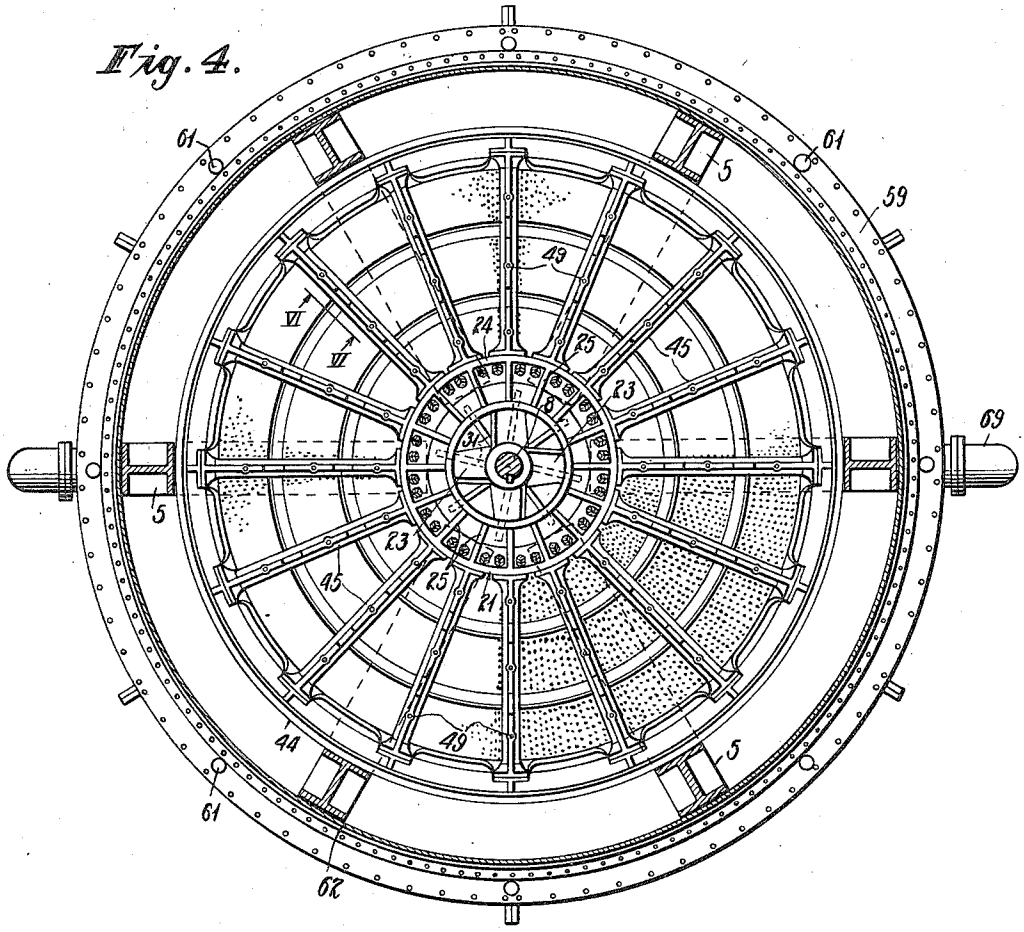
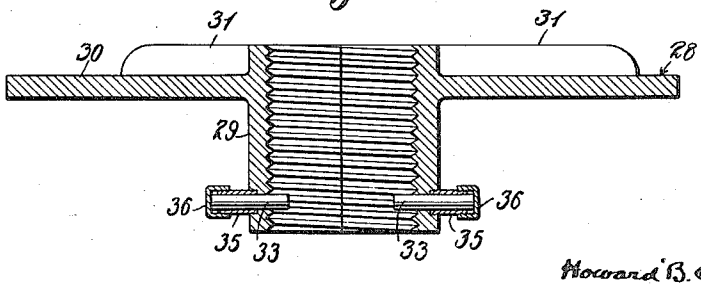


Fig. 12.



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Nov. 22, 1927. 1,650,427

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COAL DRIER

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Fig. 5.

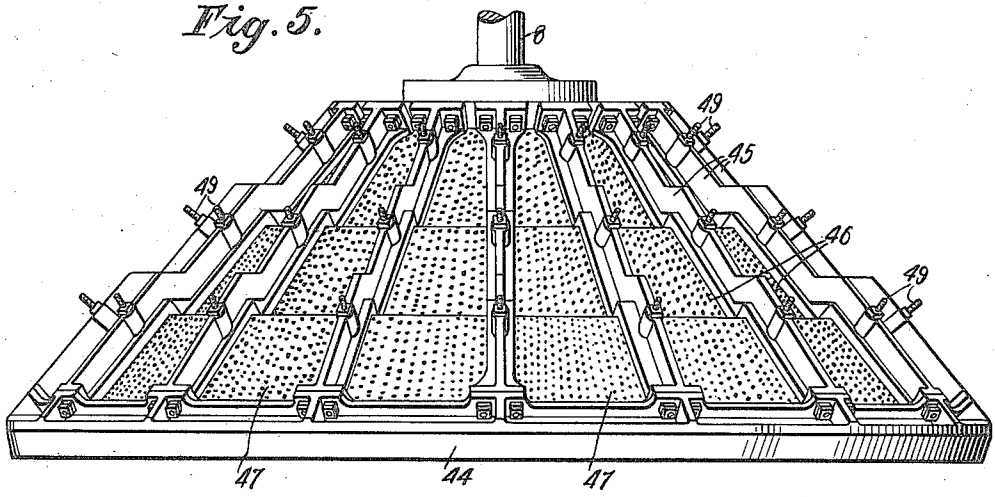


Fig. 7.

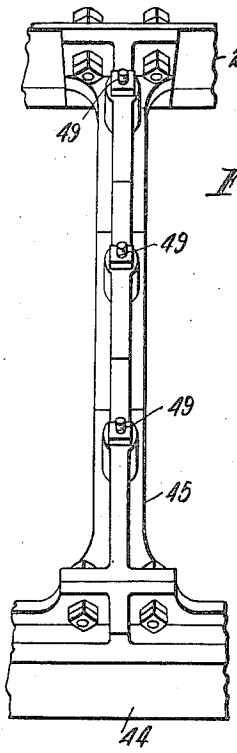
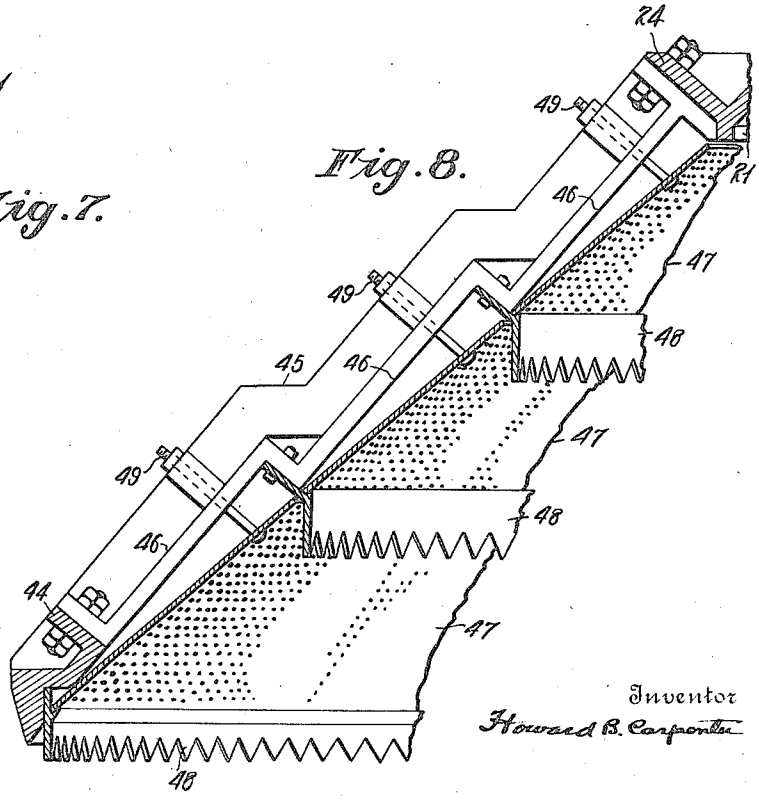


Fig. 8.



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1,650,427

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COAL DRIER

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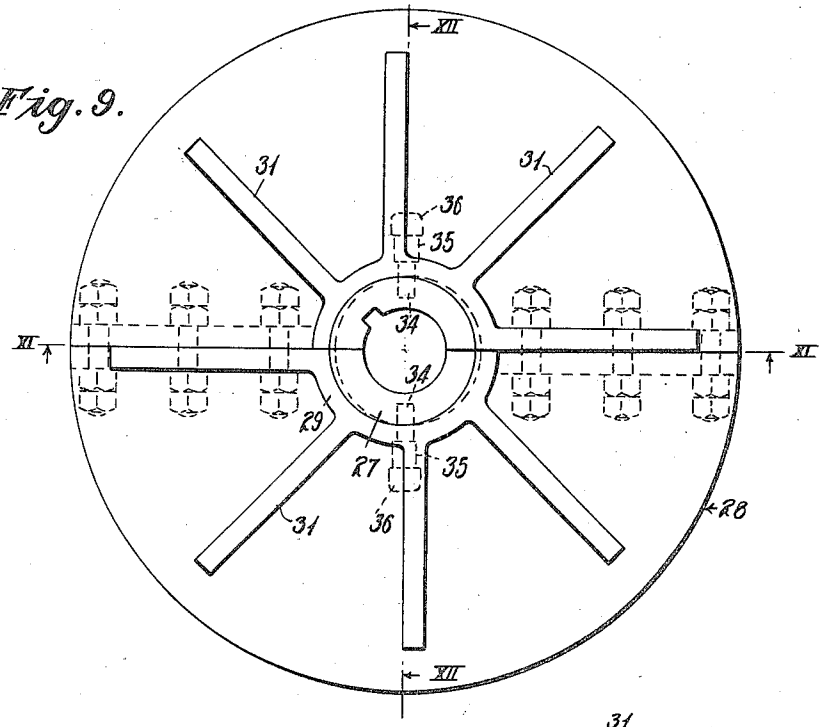
Fig. 9.



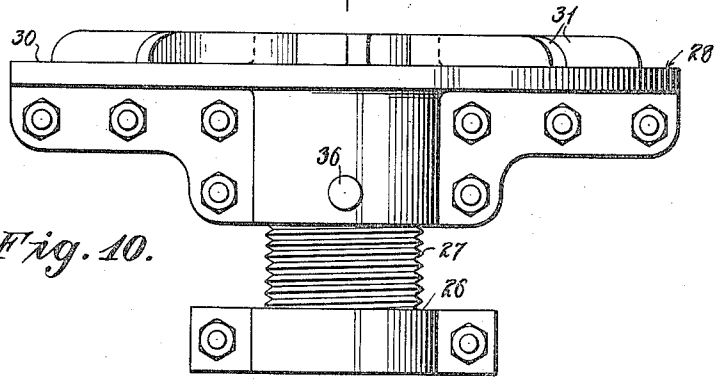


Fig. 10.

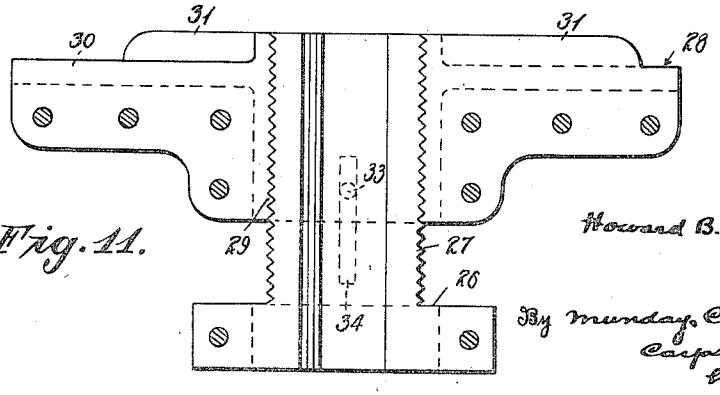


Fig. 11.

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UNITED STATES PATENT OFFICE.

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COAL DRIER.

Application filed July 25, 1923. Serial No. 653,770.

The invention relates to drying machines, and has particular reference to a continuous centrifugal machine for drying coal and other wet solids and materials, and has for its object to provide a drying machine embodying certain basic principles which are utilized to produce a method of drying superior and more efficient in many respects than obtained by similar drying machines now in practical use and which latter machines are characterized by the employment of centrifugal force alone.

In present centrifugal machines employed for drying, the material is dried by whirling, the liquid being extracted by centrifugal force alone. In the present apparatus utilization is made of the fact that while being dried by centrifugal action the material is being subjected to a static load. When the material is discharged against a screen with considerable force, with particles as the unit mass, the impact load is dynamic and the drying effect is much greater than that due to an equal static load. This principle, when applied to the particles of the material to be dried, creates great force on the particles, causing complete separation of the liquids from the solids and the action is practically instantaneous. Therefore, by projecting the material with considerable force against the screen during the whirling action of the material discharging elements, there is practically no time required for the drying operation, and consequently a machine of simple design may be constructed for the purpose described.

By effecting a continuous drying of the material, my invention is an improvement upon centrifugal driers now in use, and which are usually of the intermittent or batch type, and the operation of which must be discontinued periodically in order to remove the dried product.

In the past considerable difficulty has been experienced in the operation of continuous centrifugal driers due to the differential drive necessary to provide the time factor. In the type of continuous centrifugal driers at present in common use, the coal or other material to be dried is retained in the machine for definite periods of time while the centrifugal force removes the moisture or other liquid, and the partially dried product is finally discharged by mechanical means. The discharge of the dried product is usually accomplished by means of a conveyor or scraper rotating in the same direction but at a slightly different speed from the drier screen casing, and the tendency of which is to scrape the coal from the screens. Another method of discharge is the employment of traps or gates in the periphery of the drier screen which are opened intermittently by a controlling device rotating at a slightly different speed from the screen, and through which gates the material passes from the drier. A serious drawback to this class of drier lies in the fact that the action of the centrifugal force tends to pack the coal or other material firmly against the screen surface, quickly rendering the mass impervious to the passage of the liquid. The greater the force employed the more densely is the material packed against the periphery with the result that a higher amount of centrifugal force becomes necessary to force the liquid through this compacted mass. As a result the efficiency of the drier is greatly reduced. Not only is the material to be dried densely packed by the centrifugal force, but the mass offers an increased resistance to the passage of the liquid through it by the movement of the finer particles through the mass to the surface adjacent the screen. This causes a separation of the particles while retained within the mass and creates a great, restraining force, with a result of reducing the amount of liquid removed.

The amount of moisture or liquid in the material to be dried, or the initial liquid entering the drier with the material to be dried, greatly affects the efficiency of the continuous centrifugal drier, and causes a variation in moisture or other liquid in the dried product. Due to certain physical laws this latter type of continuous centrifugal drier is lowered in efficiency, as the mass of coal or other substance under these conditions holds moisture or other liquid due to capillary attraction, and which liquid cannot be removed regardless of the amount of pressure applied. The undried material contains voids which act as small passages or capillary tubes in the mass, the size of which depends upon the physical condition of the material to be dried, and which lowers the efficiency of the apparatus.

An object of the present invention is to provide a drying machine in which the material to be dried, preferably coal or the like, is projected with considerable centrifugal force consecutively against a series of frusto-conical screens arranged in stepped relation to one another, the force of impact of the material with the screens effecting a separation of the liquid from the material, and the arrangement being such that the liquids are projected through the perforations in the respective screen elements while the solid material is passed over the screens and subsequently discharged from the drying apparatus.

Certain forces may be employed for projecting or discharging the undried material at high velocity against the screen, such as air pressure, pump pressure, or centrifugal force, with a result that the water or other liquid is removed from the material by impact against the screen, and this separation is not dependent upon a whirling action or centrifugal force employed upon a motionless mass.

A further object of the invention is the removal of the time factor, the water or other liquid being removed from the material efficiently and instantaneously.

A further object of the invention resides in the fact that the force employed to remove the water or other liquid is directed upon the particles of coal or other material as the units, as distinguished from the application of the force to the mass of material as a unit, thereby eliminating the restraining forces due to the packing of the mass and the carrying of the finer particles through the mass by the liquid to the outer surface adjacent the screen, and preventing the formation of capillary tubes.

A further object of the invention resides in the provision of means for distributing or projecting the material to be dried over the area of the entire screen surface, the force being employed to create an impact at high velocity of the particles of undried material against the screen, and to thereafter move the particles progressively over a series of screens arranged in stepped relation, with a decreasing moisture content of the particles and with progressive impacts attended by increasing centrifugal force to remove a maximum amount of water or other liquid.

A further object of the invention resides in the provision of an apparatus of the character described which is of simple construction, which will be automatic in operation, and which may be readily varied and controlled at will according to the physical nature of the material to be dried.

A further object of the invention is the provision of an apparatus of increased drying efficiency and which may be readily and conveniently adjusted to accommodate a considerable range of sizes of coals or other materials, thus reducing the cost of maintenance and increasing the factors of performance and durability. The invention further provides a simple and efficient means for removing water or other liquids from various materials at a minimum cost.

In addition to the general objects recited above, the invention has for further objects such other improvements or advantages in construction and operation as are found to obtain in the structures and devices hereinafter described or claimed.

In the accompanying drawings, forming a part of this specification, and showing, for purposes of exemplification, a preferred form and manner in which the invention may be embodied and practiced, but without limiting the claimed invention specifically to such illustrative instance or instances:

Figure 1 is a side elevation of the drier apparatus in its preferred embodiment.

Fig. 2 is a plan view of the same on a slightly reduced scale.

Fig. 3 is a central vertical sectional view on line III—III of Fig. 2 and on a slightly smaller scale than Fig. 2.

Fig. 4 is a horizontal sectional view on line IV—IV of Fig. 3.

Fig. 5 is an enlarged side elevation of the screen cone basket.

Fig. 6 is an enlarged detail view on line VI—VI of Fig. 4, and showing particularly the location of one of the serrated distributing rim members 48.

Figs. 7 and 8 are detail views showing the arrangement of the inclined screen cone rib members 45, and particularly showing the method of adjusting the angle of the screen plates.

Fig. 9 is an enlarged plan view of the impact distributing disk 28.

Fig. 10 is a side elevation of the same together with the adjusting screw 26.

Fig. 11 is a sectional view on line XI—XI of Fig. 9.

Fig. 12 is a similar view on line XII—XII of Fig. 9.

Fig. 13 is a plan view of the adjusting screw 26.

Fig. 14 is a side elevation of the same.

Referring to the drawings, the frame structure of the drying apparatus consists of a plurality of radially extending bottom frame members 1, secured at their outer ends by foundation bolts 2 to a suitable base or foundation 3, preferably of concrete; and bolted at their inner ends to a centrally disposed annular bearing support 4. Each of the frame members 1 has bolted or otherwise secured to the outer end thereof a vertically disposed side frame member 5. A plurality of radially extending top frame members 6, corresponding in number to the

members 1, are bolted at their outer ends to the upper portion of the side frame members 5, and are bolted at their inner ends to a central annular upper bearing support 7.

A vertical shaft 8 is rotatably supported within the upper and lower bearing supports 7 and 4, and is provided with a pinion 9 keyed to the upper end thereof. The pinion 9 is retained in position on the shaft 8 by a collar 10 and rotatably supports the shaft by means of the upper radial bearing 11 and thrust bearing 12 contained within the hub portion 7^a of the upper bearing support 7. An annular dust collar 13 is removably secured to the bearing support 7 to prevent the access of dirt or foreign matter to the bearings 11 and 12, and lubrication is provided for the bearings by means of a grease cup 14 having a pipe 15 communicating with the interior of the hub portion 7^a of the bearing support. At its lower end the shaft 8 is rotatably mounted by means of a lower radial bearing 16 contained within the hub portion 4^a of the lower bearing support 4. Accumulation of dirt around the lower radial bearing is prevented by means of the dust collar 17, similar to the collar 13, removably secured to the hub portion of the lower bearing support, and lubrication is provided for the bearing 16 by means of a grease cup 18, connected by a pipe 19 to the interior of the hub portion of the lower bearing support. The latter is provided with a removable plate or cover 20 to facilitate the examination or removal of the lower radial bearing 16 or the vertical shaft 8.

An upper spider casting 21 is keyed to the shaft 8 at a point below the pinion 9, and comprises a hub portion 22, a plurality of radially extending feed vanes or web members 23, and an outer circumferential V-shaped rim member 24. The latter is provided with a plurality of radial reinforcing webs 25, of any desired number, and preferably formed as an integral part of the spider casting. An adjusting screw 26 is keyed to the shaft below the spider casting 21 and is provided with an externally threaded sleeve portion 27. An impact distributing plate or disk 28, having an internally threaded hub portion 29, is mounted upon the sleeve portion of the adjusting screw, and is vertically adjustable relative to the upper spider casting 21. The distributing plate or disk 28 further comprises a horizontal plate portion 30 having a plurality of radially extending raised distributing vanes or webs 31, which preferably terminate at a point adjacent the periphery of the plate portion 30. The threaded engagement of the adjusting screw 26 with the impact distributing plate 28 permits the raising or lowering of the latter, thereby decreasing or increasing the circumferential material-feeder opening 32 between the plate and the upper spider casting 21. The impact distributing plate or disk may be locked in any desired position by means of the pins 33 which are inserted into the slots 34 of the adjusting screw 26, and which pins are retained in locking position by means of pipe nipples 35 and caps 36.

An inner lower spider casting 37, having a central hub portion 37^a, is keyed to the lower end of the vertical shaft 8, and is retained in position thereon by means of a collar 38 secured to a recessed portion 39 on said shaft. The casting 37 further comprises radially extending reinforcing web members 40 terminating in an integral upstanding peripheral flange member 41, to which latter is bolted or otherwise secured the inner peripheral portion 42 of an outer lower spider casting 43, which latter is provided with an outer circumferential flanged rim portion 44.

Bolted or otherwise secured at their upper ends to the V-shaped rim 24 of the upper spider casting, and similarly secured at their lower ends to the flanged rim portion 44 of the outer lower spider casting 43, are a plurality of inclined screen cone rib members 45, of any desired number, and each of preference integrally formed to provide a series of stepped inner faces 46. The assembled arrangement of the inclined rib members 45 with the upper and lower spider castings is designed to form a stepped skeleton frame of frusto-conical configuration. A plurality of conical screens 47 are secured to the inner faces 46 of the inclined rib members 45 and comprise a series of perforated metal plates. The weight of the metal employed and the size of the perforations therein may be varied and are dependent upon the size and nature of the material to be dried. The conical screen plates 47 are of preference maintained in position upon the several steps of the inclined ribs 45 by means of a plurality of circumferential serrated distributing rim members 48 which are mounted intermediate the several stepped screen sections (Fig. 3), although various other means may be devised and employed for retaining the said plates in position. The adjustment of the angle of the screen plates 47 with respect to the vertical shaft 8, is obtained by means of a plurality of adjusting screws 49, of any desired number, and the threaded fixed and movable elements of which are respectively secured to the inclined rib members 45 and the several stepped screen plates.

Means for continuously rotating the vertical shaft 8 are provided in the nature of a horizontal shaft 50 supported upon the upper portion of the drier frame, and journaled in outer bearing supports 51 and an intermediate bearing support 52. A pinion 53 is keyed to the shaft 50, near the inner end thereof, and meshes with the pinion 9 keyed to the vertical shaft 8. The horizontal shaft 50 is rotated from any suitable source of

power (not shown), which is applied to the gear 54, keyed to the outer end of said shaft, and said rotation is transmitted to the vertical shaft 8 and the elements supported thereon, by means of the meshing pinions 9 and 53, described. Lubrication for the shaft 50 is provided by the grease cups 55 mounted on the several bearing supports of the horizontal shaft.

A hopper 56 of conical formation, is bolted or otherwise secured as at 56' to the upper bearing support 7, and is arranged to direct the coal or other material to be dried to the rotating material distributing disk or plate member 28 mounted on the vertical shaft 8 below the upper spider casting 21.

Water drain sluices 57 are bolted to the lower part of the side frame members 5 and are designed to carry away to a point of discharge the liquid separated from the coal or other material being dried. The water drain sluices 57 are preferably lined with terra cotta half-round tile 58 and are formed in two semi-circular sections, each of which sections slopes downwardly in the direction of rotation of the vertical shaft 8 and screen cones carried thereby, each sluice section extending half way around the periphery of the drier frame. The water sluices are provided with a suitable annular top housing plate 59, having any desired number of apertures or openings 60 normally closed by removable plugs 61. The purpose of the apertures 60 is to permit access when desired to the interior of the water sluice housing. Above the water sluice housing the frame members 5 are covered with a side housing plate 62 preferably of steel, and which extend entirely around to enclose the drier frame. The top of the drier frame has also secured thereto a housing plate 63, the inner portion of which terminates at a point adjacent the upper portion of the feed hopper 56. An annular retaining plate member 64 is bolted or otherwise secured to the inside of the side frame members 5, at the lower portion thereof, at a point adjacent to the discharge extremity of the lowermost screen plate 47. The plate 64 is designed to direct the dried material into the collecting hopper 65, which latter is of conical formation and is bolted by means of an annular material-retarding plate member 66, of L-shaped cross section, to the radially extending bottom frame members 1. Bolted to the top of the annular retaining plate member 64 is an annular sealing rim member 67 which is arranged to provide a seal against the admission of foreign matter to the hopper 65 from the exterior of the screen cone basket, there being sufficient clearance between the rim member 67 and the circumferentially flanged rim portion 44 of the outer lower spider casting 43, to permit of rotation of the latter and the screen cone basket on the vertical shaft 8.

The operation of the drying apparatus will be apparent from the foregoing description, and is as follows:

The shaft 50 is rotated at a speed of from two hundred to six hundred revolutions per minute, depending upon the size and quality of the material being dried, by means of a motor or other suitable power source, and this rotation is transmitted to the vertical shaft 8 and the screen cone by the pinions 9 and 53. Wet coal or other substances from which it is desired to extract liquids is delivered to the coal feed hopper 56 at a constant rate by means of a conveyor belt or other suitable device (not shown) and passes through the hopper by gravity, and between the feed vanes 23 of the rotating upper spider casting 21 to the impact distributing disk or plate 28. This impact distributing disc also functions in the capacity of a feeder, and its height has been previously adjusted by means of the adjusting screw 26 to give the desired clearance 32 between the top of the disc 28 and the bottom of the upper spider casting 21, and which clearance regulates the amount of coal to be passed into the drier. In the successful operation of this device it is necessary that the material to be dried shall contain no particles larger than will pass through this opening left between the disk and the upper spider casting.

The raised distributing vanes or webs 31 on the upper surface of the impact distributing disk which is rotating at high speed cause the coal or other substance to be thrown off the disk with considerable velocity and force to be impinged uniformly about the periphery of the upper screen plate 47, the impact driving a considerable portion of the water (or other liquid being extracted) out of the coal and through the perforations of the screen plates. The angle of these screen plates has previously been adjusted by means of the adjusting screws 49 to the correct angles at which the coal will slide over the screens at the desired speed and during which passage the coal is acted upon by the centrifugal force of rotation, resulting in more of its water content being removed. At the lower edge of this screen plate 47 is attached the serrated distributing rims 48 which tend to prevent the coal from passing from one screen to the next in the mass, but rather separate it into fine streams and cause its passage in quantities more nearly approximating single particles.

Passing the upper distributing rim 48 the coal impinges upon the second screen plate 47, and a portion of the water retained in the coal is here driven out through the screen by the impact; and the angle of the second row

of screen plates having likewise been adjusted to the proper position by the adjusting screw 49, centrifugal force again acts upon the coal as it passes down the screen plate and over the second distributing rim 48. As the coal passes downward over the screen plates and distributing rims in succession, the centrifugal force exerted upon it increases with the increased diameter of the screen cone and the force of impact of the coal upon the screen cone likewise increases. In like manner the coal passes over the third screen plate and is discharged from the cone at the lower end of this plate. The retarding plate 66 prevents the coal from falling directly into the dried material collecting hopper 65 from the screen basket. Instead a wall of coal is built up above the retarding plate 66 in front of the lower portion of the side frame members 5 and which wall prevents the coal at the high velocity of discharge from cutting into the framing. The coal then drops into the collecting hopper 65 from which it is carried to the storage bins by a conveyor belt or other suitable means (not shown). More screens than the three in series herein described may be used to advantage in cases where the desired result is not obtained with a stepped arrangement of but three rows of screen plates.

The water which passes through the screen plates 47 is thrown upon the side housing 62 and flows into the water sluice 57, being deflected into it by the water discharge plates 68. The water sluices slope towards the outlets 69 and in the direction of rotation of the screen cone casing; the water passing out of the outlets by gravity. The apertures 60 and removable plugs 61 are provided for the purpose of facilitating examination of the water sluice linings 58.

While I have herein illustrated and described the best form of my invention now known to me, it will be apparent to those skilled in the art that many changes in design and construction may be made without departing from the spirit of my invention. For example, the number of steps in the ring members 45 may be increased or diminished. Different methods of securing the necessary impact may be employed. For example, stationary screens may be used and with high speed distributing disks, air pressure or pump pressure used to discharge the material with great impact against the screens.

My invention is hereinabove set forth as embodied in one particular form of construction, but I do not limit it thereto or to less than all the possible forms in which the said invention as hereinafter claimed may be embodied and distinguished from prior devices.

What is claimed is—

1. A centrifugal drier for coal and like material, comprising in combination: a frame, a series of rotatable screen plates supported by said frame, means for rotating said screen plates, means for projecting the material to be dried upon the screen plates with sufficient force to separate the liquid from said material by the impact of said material with the screen, and means for projecting the material as it leaves each preceding screen plate of the series to another screen plate of the series; substantially as specified.

2. In a centrifugal drier, the combination of a frame, a screen of substantially conical shape supported for rotation thereon, said screen being composed of a series of two or more rows of screen plates arranged in stepped relation, means for rotating said screen and means for concussively projecting the material to be dried upon each row of the series of screen plates after it leaves a preceding row with a force sufficient to separate the liquid from said material by the impact with said screen, substantially as specified.

3. In a centrifugal drier for coal and like material, the combination of a frame, a rotatable screen supported by said frame, said screen being composed of two or more rows of screen plates arranged in stepped relation, a serrated distributing rim between said rows of screen plates, means for rotating said screen and means for forcibly projecting the material to be dried upon said screen, to separate the liquid from the material by the force of impact, substantially as specified.

4. In a centrifugal drier for coal and like material, the combination of a frame, a screen of substantially conical shape rotatably supported by said frame, said screen being composed of a series of two or more rows of screen plates disposed in stepped arrangement, a serrated distributing rim mounted between each row of screen plates, means for individually or collectively adjusting the angle of said rows of screen plates relative to the vertical axis of the screen, means for rotating said screen and means for projecting the material to be dried upon said screen plates with force sufficient to separate the liquid from the material, substantially as specified.

5. In a centrifugal drier, the combination of a frame, a screen member of substantially conical shape rotatably mounted on a vertical axis on said frame and disposed with the larger end downward, said screen member being composed of two or more rows of perforated plates carried in stepped arrangement, serrated distributing rims mounted between said rows of perforated plates, means for individually or collectively adjusting the angle of each row of said plates with respect to the vertical axis of said screen basket, a vertical shaft supporting said screen plates, a distributing disc mounted upon said shaft, and means for rotating

said screen member and distributing disc, substantially as specified.

6. In a centrifugal drier for coal and like material, the combination of a frame, a plurality of annular screens of varying diameters mounted on a vertical shaft and arranged in superposed relation with respect to each other with the largest screen in lowermost position, serrated distributing rims disposed between each of said screens, means for adjusting the angle of said screens relative to said vertical shaft, a plurality of distributing webs mounted on said vertical shaft, and means for rotating said screens and said distributing webs to project the material against said screens, whereby the liquid content is separated from said material, substantially as specified.

7. In a centrifugal drier for coal and like material, the combination of a frame, a vertical shaft rotatably mounted in said frame, a supply hopper carried by said frame, a screen member of substantially conical shape rotatably mounted upon said vertical shaft and disposed with the larger end downward, said screen basket being composed of a series of two or more rows of perforated plates arranged in stepped relation to successively receive concussive impact of the material passing from step to step, a material distributing plate rotatably mounted on said vertical shaft, and means for rotating said screen member and said material distributing plate, substantially as specified.

8. In a centrifugal drier for coal and like material, the combination of a frame, a vertical shaft rotatably mounted in said frame, a supply hopper carried by said frame, a screen member of substantially conical shape rotatably mounted upon said vertical shaft and disposed with the larger end downward, said screen basket being composed of a series of two or more rows of perforated plates arranged in stepped relation, a plurality of serrated material-distributing rim members located between said rows of screen plates, a material-distributing plate rotatably mounted on said vertical shaft, and means for rotating said screen member and said material-distributing plate to forcibly project the material against said perforated plates, whereby the liquid content is separated from said material, substantially as specified.

9. In a centrifugal drier for coal and like material, in combination: a frame, a vertical shaft rotatably supported by said frame, a supply hopper, a screen member of substantially conical shape rotatable upon said shaft and disposed with the larger end downward, said screen member being composed of two or more rows of perforate plates arranged in stepped relation, a plurality of serrated distributing rim members interposed between said rows of perforate plates, means for adjusting the angle of said perforate plates relative to said vertical shaft, a material distributing plate mounted on said vertical shaft, and means for rotating said screen member and said material distributing plate to project the material to be dried against the perforated plates of said screen member, substantially as specified.

10. In a centrifugal drier, the combination of a frame, a shaft rotatably supported within said frame, a rotatable screen casing of substantially conical shape supported on said shaft, a supporting spider fixed to the upper part of the screen casing, and comprising a plurality of legs inclined at an angle and serving to aid the flow of coal into the screen casing, an impact distributing device rotatably supported on said shaft and within the upper part of the screen casing, means for adjusting the height of the impact distributing device relative to the said upper supporting spider, the adjustable space thus left between the impact distributing device and the spider serving as an orifice to regulate the flow of coal into the drier, means for supplying coal to the drier and means for rotating the screen casing and impact distributing device, substantially as specified.

11. In a centrifugal drier for coal and like material, the combination of a frame, a rotatable screen casing of substantially conical shape mounted on said frame, such screen casing composed of a series of two or more rows of screen plates arranged in stepped relation, a supporting spider fixed to the upper part of the screen casing, and having a plurality of legs of the spider arranged at an angle to the vertical axis of the screen casing to aid the flow of coal into the drier, an impact distributing device mounted in the upper part of the screen casing, means for adjusting the height of the impact distributing device relative to the position of the upper supporting spider, the adjustable space between the impact distributing device and the spider serving as a feeder to regulate the flow of coal into the drier, means for supplying coal to the drier and means for rotating the screen casing and the impact distributing device, substantially as specified.

12. In a drying machine, the combination of a frame, a screen plate supported within said frame, a distributing plate mounted within said frame, means for supplying material to said distributing plate, and means for projecting the material concussively against said screen plate with a force sufficient to separate the water from the material by repeated impact of said material with said screen plate, substantially as specified.

13. In a drying machine for coal and like material, the combination of a frame, a series of screen plates supported within said

frame, a distributing plate mounted within said frame, means for supplying coal to said distributing plate and means carried by said distributing plate for projecting the coal concussively upon the screen plates with force sufficient to separate the water from said coal by repeated impact of the coal with said screen plates, substantially as specified.

14. In a drying machine for coal and like material, the combination of a frame, a series of adjustable screen plates arranged in stepped relation one above the other supported within said frame, each lower plate being spaced further from a common axis than the plate above, a rotatable distributing plate mounted within said frame, means for supplying coal to said plate, distributing vanes carried by said distributing plate for projecting said coal concussively against said screen plates with force sufficient to separate the water from the coal by the impact of said coal with said screen plates, and means in the path of the coal as it leaves each screen plate for redistributing the downwardly moving coal upon a subsequent plate, substantially as specified.

15. In a drying machine for coal and like material, the combination of a frame, a series of adjustable screen plates arranged in stepped relation supported within said frame, a rotatable distributing plate mounted within said frame, means for supplying coal to said plate, distributing vanes carried by said distributing plate for projecting said coal against said screen plates with a force sufficient to separate the water from the coal by the impact of said coal with said screen plates, and means for independently adjusting the angle of said screen plates, substantially as specified.

16. In a drying machine for coal and like material, the combination of a frame, a vertical shaft rotatably mounted in said frame, a series of rows of adjustable screen plates arranged in stepped relation supported within said frame, a rotatable distributing plate mounted on said vertical shaft and disposed within said frame, means for supplying coal to said plate, distributing vanes carried by said distributing plate for projecting said coal against said screen plates with a force sufficient to separate the water from the coal by the impact of said coal with said screen plates, material-distributing rims mounted between each row of adjustable screen plates, and means for independently adjusting the angle of said screen plates, whereby said material is successively projected in fine streams downwardly and outwardly from one row of screen plates to the next adjacent row of screen plates, substantially as specified.

17. In a centrifugal drier, the combination of a frame, a shaft rotatably mounted within said frame, a rotatable screen casing of substantially conical shape mounted within said frame, an impact distributing disc mounted on said shaft and disposed within the upper part of the screen casing and arranged to rotate co-axially with it, a material-distributing spider mounted to support the upper portion of said screen casing, a threaded sleeve member for adjusting the height of said impact distributing disc relative to the upper spider support of the screen casing to form a variable feeding orifice, means for supplying coal to the feeder, a series of material-distributing rims spaced from each other and mounted within said screen casing, and means for continuously rotating the screen casing and impact distributing disc, substantially as specified.

18. In a drying machine, the combination of a frame, screen plates supported within said frame, a distributing plate mounted within said frame, means for supplying material to said distributing plate, and means for repeatedly projecting the material concussively against said screen plates with a force sufficient to separate the water from the coal by the impact of said material with said screen plates, substantially as specified.

19. A centrifugal drier comprising a rotatable screen, means supplying the material to be dried, and means effecting repeated projection of such material concussively against said screen.

20. A drier comprising in combination: a rotatable screen; means for supplying material to be dried to said screen and means for causing said material to be repeatedly projected against said screen on its travel past said screen.

21. A centrifugal drier comprising a rotary screen, so constructed that the material to be dried suffers repeated projection concussively against the screen.

22. In a coal-drier, in combination: a distributor; a centrifuging screen-member; an impact screen-member; and means for discharging and throwing the coal from one to another of the screen-members; whereby the freer moisture is removed by centrifuging and further moisture by concussive impact.

23. In a coal-drier, in combination: a distributor; a centrifuging screen-member; a succession of impact screen-members; and means for discharging and throwing the coal from one to another of the screen members; whereby the freer moisture is removed by centrifuging and further moisture by concussive impact.

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