

July 5, 1927.

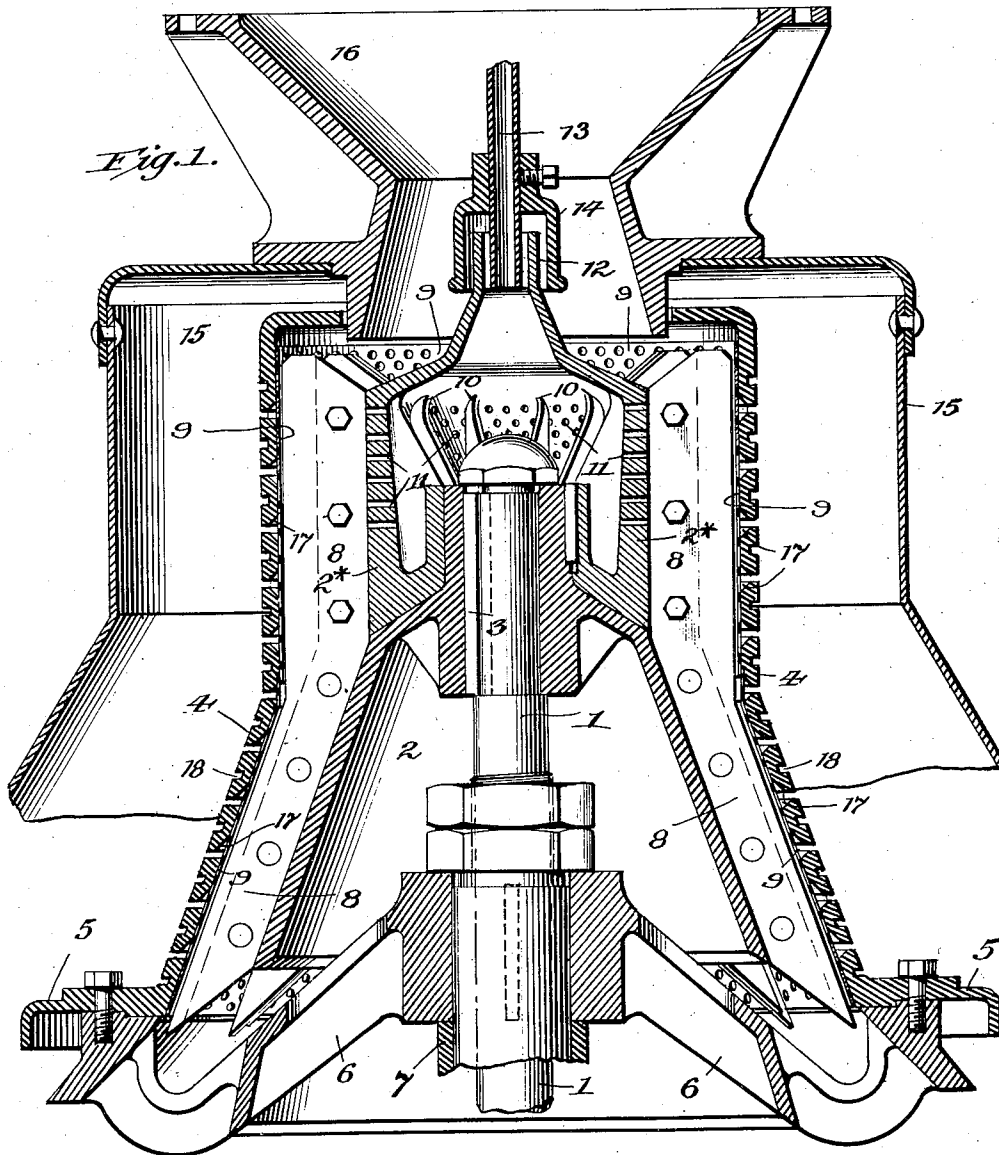
1,634,868

G. H. ELMORE

CENTRIFUGAL DRIER

Filed Feb. 18, 1922

2 Sheets-Sheet 1



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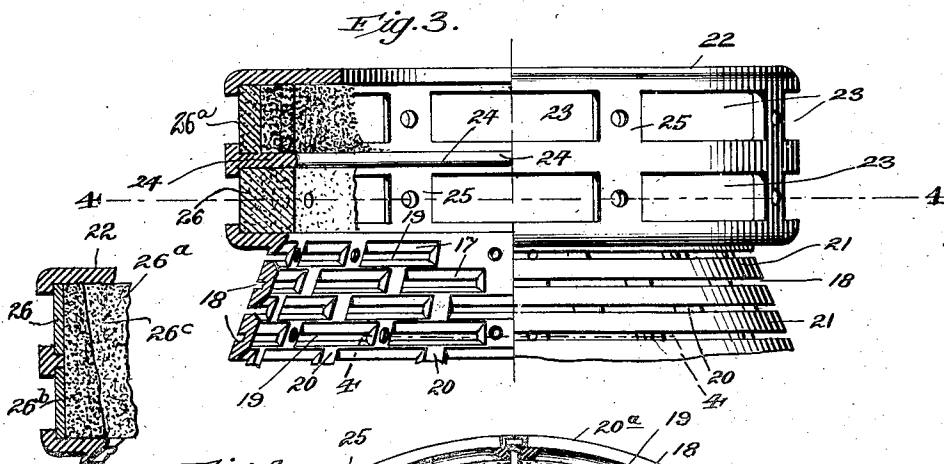
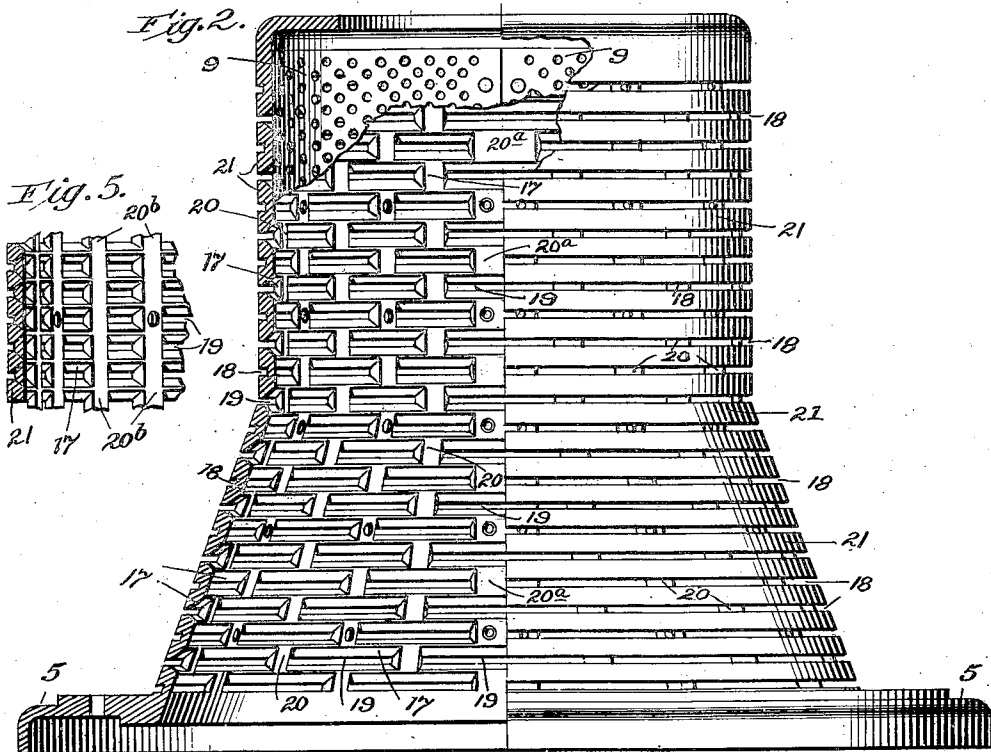
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UNITED STATES PATENT OFFICE.

GUY H. ELMORE, OF SWARTHMORE, PENNSYLVANIA.

CENTRIFUGAL DRIER.

Application filed February 18, 1922. Serial No. 537,627.

This invention pertains to centrifugal driers, and more particularly to the construction of the screen basket or shell of the rotor of such structures, whereby an extremely high speed of rotation may be effected and maintained without danger of distortion or rupture of such basket or shell; also in the method of producing such shell.

10 The novel features are here illustrated in a drier of the general type disclosed in Letters Patent No. 1,334,023, granted to me under date March 16, 1920, but may be embodied in driers of other types.

15 A preferred embodiment of the present invention is illustrated in the accompanying drawings, in which:

Figure 1 is a vertical central section through the rotor and a portion of the outer shell or casing of the drier, the central driving spindle being shown in full lines;

Figure 2 is an elevation, partly in section, of the outer screen basket or shell;

Figure 3 is a similar partly sectional elevation of a slightly modified form of the upper portion of a basket embodying the invention;

Figure 4 is a horizontal section on the line 4-4 of Fig. 3 on a somewhat larger scale than said figure; and

Figures 5 and 6 are detail sectional views showing certain modifications.

As above indicated, a leading object of the present invention is to produce a centrifugal drier capable of being safely driven at a sustained speed above that heretofore attainable by any construction known to me. It is well known that, other things being equal, the centrifugal force generated by rotation of the extracting rotor, and consequently the extractive capacity thereof, increases in a more rapid ratio than does the speed or velocity of the rotor. For like reasons, the bursting stress upon the rotor also increases in an equally rapid ratio. The effort hence is to produce an integral rotor, the outer or screen shell of which shall be capable of withstanding without rupture or distortion this high bursting stress, when the rotor is driven at speeds above those heretofore found practicable, and with a full charge of material. This I accomplish by the mode of construction here illustrated, coupled with the selection and use of a metal or alloy of great toughness or tensile

strength, such as manganese bronze, phosphor bronze, Monel metal, steel, or the like.

Referring to the drawings and first to Fig. 1 thereof, the general construction of the drier will be explained, and thereafter the specific construction of the outer shell or screen basket.

The numeral 1 indicates a vertical spindle which in practice is mounted in suitable bearings, and provided with a spur gear or pinion by which to receive rotary motion from any convenient prime mover as in my patent above referred to. Mounted upon the upper end of the spindle 1 is the inner core or shell 2 of the rotor, secured to said spindle, and caused by a feather or key 3 to rotate in unison therewith. This core is preferably made in two parts as shown in Fig. 1, the upper part or head 2* being, in the particular form of rotor illustrated, cylindrical and hollow, for a purpose hereinafter explained. The shell 2 is keyed to the hub of the base or lower section so that the two parts shall rotate in unison.

The upper end or face of the core or inner shell is fashioned to guide the material to be treated from the top surface to the circumferential walls of said core, and into the annular space between the core and a concentric outer shell or screen basket 4. The outer shell or basket 4 is here shown as of cylindrical form in its upper portion and conical form in its lower portion, or of a substantially bell shape, and has at its base a horizontal flange or skirt 5. This flange rests upon and is bolted or otherwise made fast to the arms of a spider 6 carried by a quill or tubular shaft 7 closely encircling the spindle 1, and like it, in practice preferably connected by toothed gearing with the prime motor which drives said spindle. The office of this flange or skirt 5 is to overhang an upstanding annular rib of the main frame of the machine, to prevent the dried material being thrown outward over said rib and again mingling with the extracted moisture, which is received in an outer trough concentric with said rib.

As in the patent above referred to, the gearing here used is advisably such as to produce a slight differential angular speed of rotation of the core and the outer shell, to the end that radial blades or wings 8 carried by the core or shell 2, 2*, and extending into close proximity to the inner

screen surface of the basket 4, may scrape off or remove any material tending to adhere to the surface of the screen or lining 9 of the basket or shell 4.

5 In Fig. 1 the upper portion or cylindrical head 2* of the core or inner shell 2 is shown as of hollow form, the interior space being divided by partitions 10 into separate cham-
 10 bers, and the outer wall being provided with radial perforations 11. The top or upper end of the shell or core 2 is here shown as terminating in a tubular neck 12 to receive a liquid-supply pipe 13, said pipe being pro-
 15 vided with a bell-shaped cap or collar 14 to encircle the neck 12 and guard against escape of liquid from the upper end thereof. The partitions 10 within the head 2* of
 20 shell or core 2 cause the liquid within such head to partake of the rotary motion of said shell or core, thereby imparting to the liquid a high centrifugal force, and causing it to
 25 be projected through the perforations 11 under high velocity and pressure, and hence to permeate the mass of material passing downward between the blades 8. These
 30 blades, in addition to their scraping action, also cause the material or substance treated to partake of the rotary motion of the shell 2, and to be given a strong outward tendency or centrifugal effect.

The rotor comprising inner and outer shells 2—2* and 4, with or without the liquid chamber for effecting a preliminary
 35 washing or wetting of the material or substance treated, is as usual mounted within a casing 15 of suitable construction and design, provided at its top with a feed hopper 16, and with any suitable means for causing
 40 a uniform flow of material to the head 2* of the inner shell or core 2, and thence into the space between the inner and outer shells and between the blades or wings 8.

Referring now to Fig. 2, the construction of the screen basket or shell 4 will be ex-
 45 plained. This shell or basket, which may be wholly cylindrical, wholly conical or partly cylindrical and partly conical as here represented, is cast of any sufficiently tough and strong metal or alloy and of the desired form
 50 or pattern, but always of circular form in cross section on any plane perpendicular to its vertical axis. The interior wall or surface of the shell 4 is provided with recesses or pockets 17, arranged in tiers or rows
 55 perpendicular to the axis of rotation of the shell, and of a depth approximately equal to one-half the thickness of the wall of the finished shell. The walls of the recesses or
 60 pockets 17 are preferably inclined at an angle of approximately 45° to the inner surface of the shell or basket, as shown in Figs. 1, 2 and 3. The shell or screen basket thus
 65 cast, including its lower flange or skirt, being of circular form in all parts on planes perpendicular to its axis, may be turned in a

lathe or otherwise made perfectly true and circular throughout, and thereby made to run in perfect balance when secured to its supporting spider in true concentric relation to its tubular driving shaft or quill 7. 70

Before or after being thus trued, said screen basket or shell has milled or otherwise cut in its circumferential surface, a series of grooves 18 in planes perpendicular to its axis of rotation, and of such depth as to
 75 open into or communicate with the pockets or recesses 17, thereby producing in the plane of each groove 18 a series of elongated horizontal openings or slits 19 communicating with the grooves 18. The bevel or in-
 80 clination of the walls of the pockets or recesses 17 causes them to present large openings at the interior surface of the basket, converging to the relatively narrow slits 19, thus causing the water or liquid passing
 85 through the screen or lining 9 in more or less separated particles to unite or coalesce, and to be projected with consequently greater force, owing to the increased weight and momentum. 90

It will be observed on reference to Figs. 2 and 3 that the recesses or pockets 17 of each horizontal row or tier are of equal length and equally spaced apart end to end, and that the proximate ends of any two
 95 recesses of a given tier or row are separated by a bridge or connecting piece 20, lying in each case opposite the midlength of the pockets or recesses 17 above and below it. These bridge pieces 20 hence constitute in-
 100 tegral connections between the rings or hoops 21 formed by the cutting of the circumferential grooves 18, and being in staggered relation in successive tiers or rows, give great strength to the shell or basket.
 105 4 without necessitating bolts, rivets, or other fastenings to make connection between the bridges and rings or hoops, which would at once tend to destroy the perfect balance of the shell or basket, and to permit the parts
 110 to play or weave and in time become separated. Some of the bridges may be provided with small perforations to receive screws by which to fasten the perforated lining 9 in place, but these need not be numerous, and
 115 being spaced at equal angular distances in each row or tier and turned flush with the inner and outer faces, will not affect the balancing of the shell or basket.

As seen in the upper part of Fig. 2 where
 120 a fragmentary portion of the screen or lining 9 is shown, said lining is formed in two semi-circular sections which meet at their up-
 125 right edges on bridges 20* which are of greater measurement in the direction of the circumference of the shell or basket than are the bridges 20, and are provided with two holes for screws or bolts, one for each of the two abutting edges of the screen.

While the staggered relation of the con- 130

necting members or bridge pieces 20 is preferred, I do not desire to be limited thereto, and said bridge pieces may stand in alinement in vertical series as indicated in Fig. 5, the bridge pieces in this instance being denoted by 20^b. Otherwise the construction is the same as that heretofore described.

By making the shell or basket 4 of a metal or alloy of great toughness or tensile strength, such as manganese bronze, phosphor bronze, Monel metal, steel, or the like, it may by reason of integral construction and perfect balance be rotated at very high velocity and with great extractive effect, without danger of distortion or bursting under outward pressure or stress due to centrifugal force generated in itself and in the material or substance within it.

Referring to Fig. 3, it will be seen that the head 22 of the screen basket or shell is made somewhat larger in diameter than the portion immediately below, and is formed with relatively large openings 23 in its upright walls, and preferably with an intermediate horizontal flange or ledge 24 to insure rigidity. This construction may be adopted where it is deemed desirable to employ for the preliminary extraction of liquid from the substance treated, a relatively thick filtering medium, for example, a porous mineral filtering body. I have used with success the material described by its manufacturers as an artificial porous stone consisting essentially of silica in the form of selected sand, graded, and bonded by a synthetic silicate. This may be conveniently applied to the inner walls of the cylindrical head or chamber 22 in segmental sections bolted or riveted to the vertical posts or bars 25 of said head as seen in Fig. 4, where the filtering medium is indicated at 26. The particular product known to the trade as "Filtros" is the most suitable at present known to me for this purpose. I do not, however, mean to restrict myself specifically to the use of "Filtros", but contemplate the use of any similar or suitable porous mineral filtering body.

Where a highly abrasive material is being treated in the apparatus, instead of employing a porous mineral filtering body solid plates of hard material such, for instance, as hardened steel may be substituted for the elements 26, these plates being indicated by 26^b in Fig. 6. The highly abrasive material will first impinge against these plates, forming a bed of its own matter on the inside of the plates as indicated at 26^c, and on which the continued feed of said material will impinge, thus avoiding excessive wear upon the plates themselves, it being a characteristic of this type of centrifugal machine that the greatest wear takes place where the material first impinges upon it.

In selecting a material or alloy for the construction of the screen basket 4, due regard

will of course be had for the particular use to which the drier is to be put, or the class of substances or materials to be treated, bronze or other suitable alloy being preferable where these are of a nature to cause corrosion of steel or the like.

As seen in Fig. 2, the pockets 17 of the lower or conical portion of shell or basket 4 are made progressively longer from the upper to the lower limits of the conical portion, so that the bridges 20 shall fall in direct alinement in each row or series. This is the preferred arrangement though it is not essential.

In practice it is preferred to employ toothed or spur gearing for imparting motion to the spindle 1 and quill or tubular shaft 7, in order to maintain a constant differential speed between the inner and outer shells, but other driving gear may be employed if desired.

The liquid-supply pipe 13 will be supported in any convenient manner to maintain it in axial alinement with the rotor.

Owing to the greater diameter and consequently greater speed of the lower as compared with the upper end of the shell or basket 4, greater centrifugal force is generated in the former. This, however, is effectively compensated for by the horizontal flange or skirt 5, at that point, and by attachment of the skirt to the arms of the spider 6, both tending to prevent rupture or distortion of the shell.

In order to permit the proper introduction of the filtering segments 26, one of the sections should have its end walls parallel with each other, and the sections at either side thereof should have their abutting ends parallel with the ends of such intermediate section, so that such intermediate section may be introduced after the others are in place, or the intermediate section may be slightly wedging in form, and the abutting end walls of the companion sections made parallel with those of the interposed section for the like purpose. Otherwise close joints could not be effected between them.

The provision for the introduction and use of a washing liquid where the material treated first enters the drier, is to wash off mother liquors, or liquors with which the substances to be dried, as various crystals, have been treated prior to entering the drier. In the treatment of paper pulp, for instance, caustic soda is deposited in or upon the pulp, and should be removed before the drying is effected. Still other substances to be dried often carry matter of a viscous or gummy nature, which it is desirable to remove prior to the drying operation. In these and in similar cases, the introduction of a suitable washing liquid as water, hot or cold, or a liquid containing some solvent of the particular deposit which it is desired to remove,

and the forcing of such liquid through the mass, effectually detaches and carries away such foreign or undesirable matter. The drying following immediately upon this treatment is thus more rapidly and effectively performed than would be possible were any gummy, viscous, or adhesive foreign agent, or other undesirable matter, left in or upon the substance treated. In other words, the washing liquid here performs the same office as the wash employed with filters of the pressure or vacuum types.

The lining 26, particularly when made of filtering material may be of a thickness to bring its inner face flush or substantially flush with and make it a continuation of, the inner surface of the screen lining in the portion of the shell below it, so that the material may flow smoothly and without obstruction from the one to the other surface. As an alternative construction it may be of a thickness less than the radial measurement of the ledge 24 as shown in the upper tier 26^a in Fig. 3, in which case a body of the material under treatment will be deposited upon the ledge 24. This of course may be done with either the upper tier 26^a or the lower tier 26, or with both.

What I claim is:—

1. A screen shell or basket for centrifugal driers, consisting of a circular casting provided with a plurality of rows or tiers of pockets or recesses in its inner surface spaced apart end to end, and a series of circumferential grooves in its outer surface of a depth to open into said pockets, the pockets and grooves being arranged in planes perpendicular to the axis of rotation of the shell or basket; whereby there is formed a perfectly balanced integral shell.

2. A screen shell or basket for centrifugal driers, consisting of a circular casting provided with a plurality of rows or tiers of pockets or recesses in its inner surface spaced apart end to end, and a series of circumferential grooves in its outer surface of a depth to open into said pockets, the pockets and grooves being arranged in planes perpendicular to the axis of rotation of the shell or basket; whereby there is formed a perfectly balanced integral shell, said shell being formed of a metal or alloy of great tensile strength to permit rotation at high velocity without danger of rupture or distortion.

3. A rotor for centrifugal driers, comprising concentric inner and outer shells spaced apart to form an annular chamber and having intermediate blades or wings to cause material passing through said annular chamber to partake of the rotary motion of the rotor, the inner shell having in its upper portion a liquid chamber with radial partitions to cause the liquid to rotate with the shell and with radial perforations for escape of the liquid, and the outer screen basket or shell having openings through its wall and provided with a screen lining; whereby liquid introduced into the chamber of the inner shell is caused by centrifugal action to move outward into and through the material under treatment.

4. A centrifugal drier comprising a suitable shell or casing; a rotor having inner and outer concentric shells spaced apart to form an annular passage for material, the inner shell having an internal liquid chamber and provided with internal partitions and external blades, whereby the contents of the liquid chamber and of the annular passage are caused to partake of the rotary motion of the rotor; and a liquid supply communicating with the liquid chamber of the rotor, substantially as described.

5. An integral cast metal shell or basket of substantially bell shape, for rotors of centrifugal drying machines, having an upper end of cylindrical form and of greater diameter than the adjacent portion of the flaring skirt or wall immediately below such enlargement, said cylindrical portion being provided on its interior surface with a porous mineral filtering body of thickness to lie substantially flush with and to form a continuation of the inner surface of the base below said lining.

6. An integral cast metal shell or basket for rotors of centrifugal driers, having its upper end of cylindrical form, and the portion below of flaring or conoidal form and smaller in diameter at the junction of the two parts than is the cylindrical portion, said cylindrical portion having an interior lining of porous mineral substance with which the material to be dried makes contact on entering the rotor.

In testimony whereof I have signed my name to this specification.

GUY H. ELMORE.