Feb. 15, 1949. T. H. REID 2,461,773

BALANCING CENTRIFUGAL MACHINE

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Fig. 1.

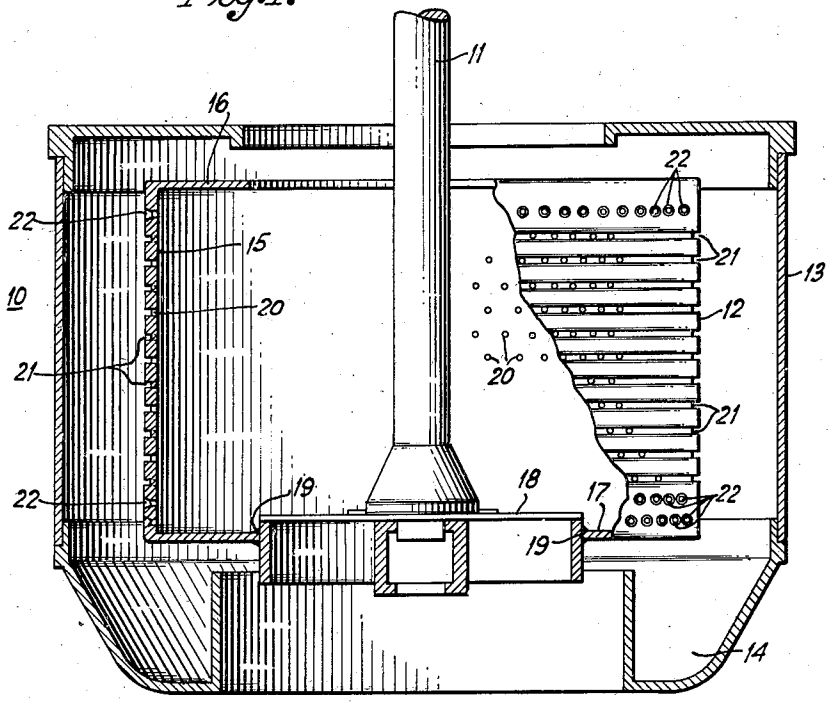
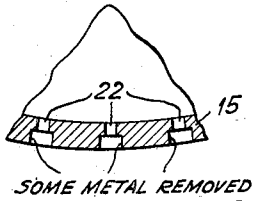
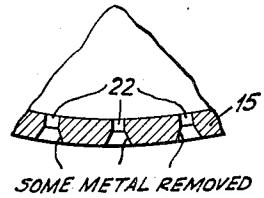


Fig. 3.



SOME METAL REMOVED FOR BALANCING PURPOSES

Fig. 2.



SOME METAL REMOVED FOR BALANCING PURPOSES

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BALANCING CENTRIFUGAL MACHINE

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1 Claim. (Cl. 210—76)

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This invention relates to the balancing of rotating devices and more specifically to the balancing of centrifugal machines used in the manufacture of sugar.

An object of this invention is to provide novel and improved means for balancing the rotating baskets of sugar centrifugal machines.

In modern sugar refinery practice, the centrifugal machines employed for purging crystalline sugar of mother liquor or the like are in substantially continual operation. The basket of each machine is loaded with a charge of sugar magma or massecuite, accelerated rapidly to high speed, and, after a few minutes, rapidly braked and unloaded in preparation for the next charge. It is very important that these baskets be very accurately balanced or the centrifugal force acting on the unbalanced mass will in time cause the machine to be torn to pieces. In low speed centrifugal machines, this balancing can be accomplished by soldering or welding small pieces of metal on the periphery of the basket (usually between adjacent reinforcing hoops surrounding the basket). In a high speed machine, however, such as that which employs a basket of the type disclosed in Patent 2,315,980 issued April 6, 1943 to Charles A. Olcott, for example, this means of balancing cannot be used as the small bits of metal fly off at the high speed. The present invention relates to means for balancing high speed sugar centrifugal machines which does not involve adding extra material.

In accordance with a specific illustrative embodiment of the present invention, this balancing is attained by the enlargement of at least the outer ends of certain of the apertures in the basket through which the liquids are ejected. The apertures in a basket are usually arranged in rings, with the holes in alternate rings preferably staggered so that the entire wall of the basket is covered with perforations. In the basket disclosed in the above-mentioned Olcott patent, external circumferential grooves are cut in the basket wall, each groove overlying and passing through one of the rings of holes. In order to provide maximum strength near the top and bottom of the basket where the shearing stresses are greatest, at least one of the rings of holes nearest the respective top and bottom basket heads is left ungrooved. These latter holes are usually flared as it has been found that centrifuged material passes through a tapered wall aperture more readily than through one of uniform diameter (the other holes are effectively flared by the circumferential grooves). It has been discovered that small bits of metal can be easily removed from certain ones of the flared holes in the upper and lower parts of the centrifugal wall, preferably by countersinking or increasing the flare, and that this removal of certain weight on one side or one portion of the basket can be used to effect balancing of the centrifugal machine. In cases where the holes are not flared, either countersinking or reaming can be used.

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The invention will be more readily understood by referring to the following description taken in connection with the accompanying drawing forming a part thereof, in which:

Fig. 1 is an elevation view, partly in cross-section, of a portion of a sugar centrifugal showing a basket which is balanced in accordance with the invention;

Fig. 2 is a horizontal cross-sectional view of a portion of the periphery of the basket of Fig. 1 showing certain holes in the basket countersunk to remove metal for balancing purposes; and

Fig. 3 is a horizontal cross-sectional view of a portion of the periphery of the basket of Fig. 1 showing certain holes in the basket reamed to remove metal for balancing purposes.

Referring more specifically to the drawing, Fig. 1 shows, by way of example for illustrative purposes, a sugar centrifugal machine 10 which is balanced in accordance with the invention. The machine 10 includes a vertically arranged spindle 11 driven by any suitable means (not shown), such as by a separate hydrau'ic or electric motor or by pulleys or gearing from a source of power common to a plurality of such centrifugal machines, and a basket 12 supported from the spindle and adapted to turn therewith within a casing 13. The casing is so shaped and arranged in well known manner that mother liquor, wash water and the like expelled through the foraminate wall of the basket flows down the inner face or curb of the casing into an annular trough 14 where it is collected and drawn off.

The basket 12 comprises a cylindrical wall 15, an upper head 16 comprising an integral annular flange and a corresponding lower head 17 of similar construction. This integral structure is preferably forged from a single pierced billet of steel and machined to final dimensions. To the lower head 17 is welded a steel hub 18 that is fitted to spindle 11 and firmly fastened thereto by any suitable means. The welded joint 19 lies in a region where the stresses incident to high speed operation are comparatively small.

The cylindrical wall 15 of the basket 12 has numerous holes 20 for the escape of centrifuged

molasses or the like. These are arranged in a multiplicity of circumferential rings of holes with the holes in alternate rings preferably staggered as in the arrangement shown in the drawing, so that the entire wall is pierced by perforations. As a specific instance of practice which may be borne in mind for better understanding of the invention, the inside diameter of the basket may be forty inches, its height twenty-four inches, and the holes one-quarter inch in diameter spaced apart one inch on centers in each ring with the rings one inch apart. As disclosed in the above-mentioned Olcott patent and as shown in the drawing, external circumferential grooves 21 are cut in the basket wall, each groove overlying and passing through one of the rings of holes. The grooves 21 are preferably of rectangular cross-section but rounded at the bottom or at the bottom corners, and the width of each groove is the same as, and in any case not substantially in excess of, the diameter of the diameter of the holes. Thus in the example set forth above, the groove width may be one quarter of an inch. As pointed out in the Olcott patent, the portions in the rings between the holes contribute very little to holding the basket together and hence they are reduced in mass (by grooving them) and therefore develop less centrifugal force to burden adjoining portions without a corresponding loss in strength. The present invention, however, is preferably not concerned with the apertures 20 in the grooved rings 21 but in the apertures 22 which are arranged in ungrooved rings in the upper and lower portions of the basket wall. These portions of the wall are left ungrooved so that shearing forces, which are greatest at top and bottom, can be better resisted. These holes 22 may already be tapered or countersunk as shown in Fig. 2 and small additional bits of metal are removed from certain ones of the holes 22 by countersinking when it is determined that the mass on the side nearest these certain holes is larger than it should be for perfect balancing. This can be determined by rotating the basket at high speeds on a machine called a "dynamic balancer" several makes of which are on the market.

The holes 22 to be enlarged are in general only at one side of the basket, at either the top or the bottom. This is caused by the fact that slight errors in machining or density of the metal generally result in the basket being heavier on one side than on the other (which would tend to make the machine run out of balance were it not corrected.) In dynamic balancing it is necessary to remove the weight at one side or the other in the right place, that is, if the weight should be removed from the holes at the top of the basket it would be unsatisfactory to remove it instead from the holes at the bottom of the basket, even though this might be on the same side. In short, to balance the basket, metal must be removed at the proper place and in the proper amounts. The "dynamic balancer" indicates

where the metal is to be removed. By gradually enlarging certain of the holes 22 and by rotating the machine after each enlargement, it can be determined when the machine is perfectly balanced.

As an alternative to countersinking, the outer ends of certain holes 22 can be reamed out, as shown in Fig. 3. This means can be used either with tapered or untapered holes.

The means of balancing described above has the advantages that (1) there are no parts to fly off at high speeds, (2) no new holes need be drilled, use being made of holes already having a function, and (3) the enlargement of the holes takes very little time and is simple and inexpensive.

It will be apparent that although the present invention has been described with reference to its preferred embodiments it will be understood that it is capable of embodiment in a variety of other forms within the spirit and scope of the claim, and that the specific proportions and dimensions hereinbefore set forth are illustrative and not limitative. While it is preferred that the apertures which are enlarged for balancing purposes be near the vertical extremities (top and bottom) of the basket, it will be readily apparent that they need not be so located.

What is claimed is:

A basket for a sugar centrifugal which is normally slightly out of balance comprising a bottom member, an upper head member and a cylindrical wall therebetween, said wall having a central portion with a plurality of grooved rings therearound and upper and lower portions adjacent the head member and bottom member, respectively, which are free of grooves, said grooved rings and said upper and lower portions each having a plurality of apertures arranged in at least one row around the circumference of the wall from which apertures the liquid from the sugar-bearing material carried by the basket during the centrifuging process is ejected during said process, the metal surrounding the outer end only of certain ones of the said apertures in at least one of said portions which are free of grooves being removed to such an extent that the said basket is balanced, said certain ones being on the side of said basket which would be the heavy side when it is rotating were it not for the said removal of metal.

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