

Nov. 19, 1968

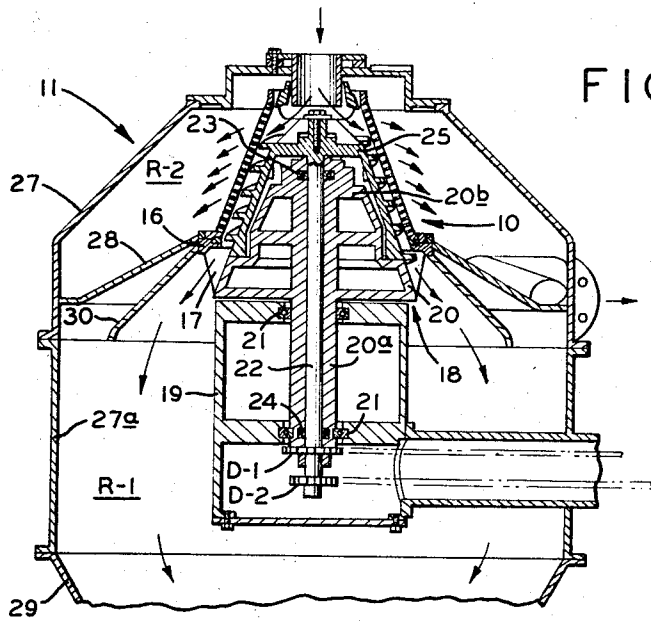
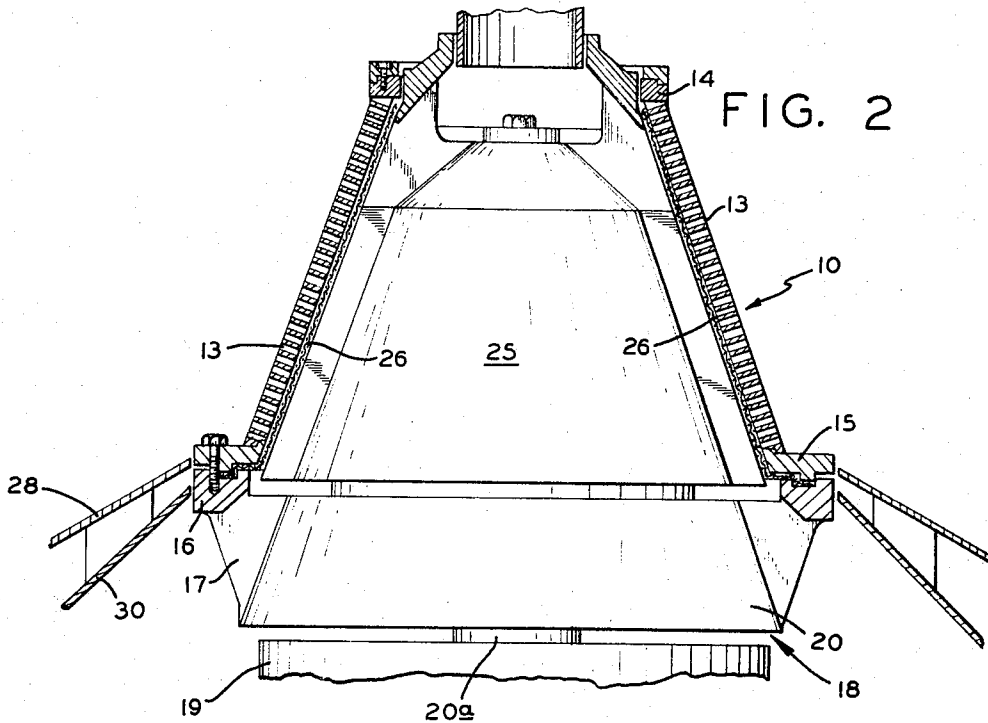
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SCREENING CENTRIFUGES

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4 Sheets-Sheet 1



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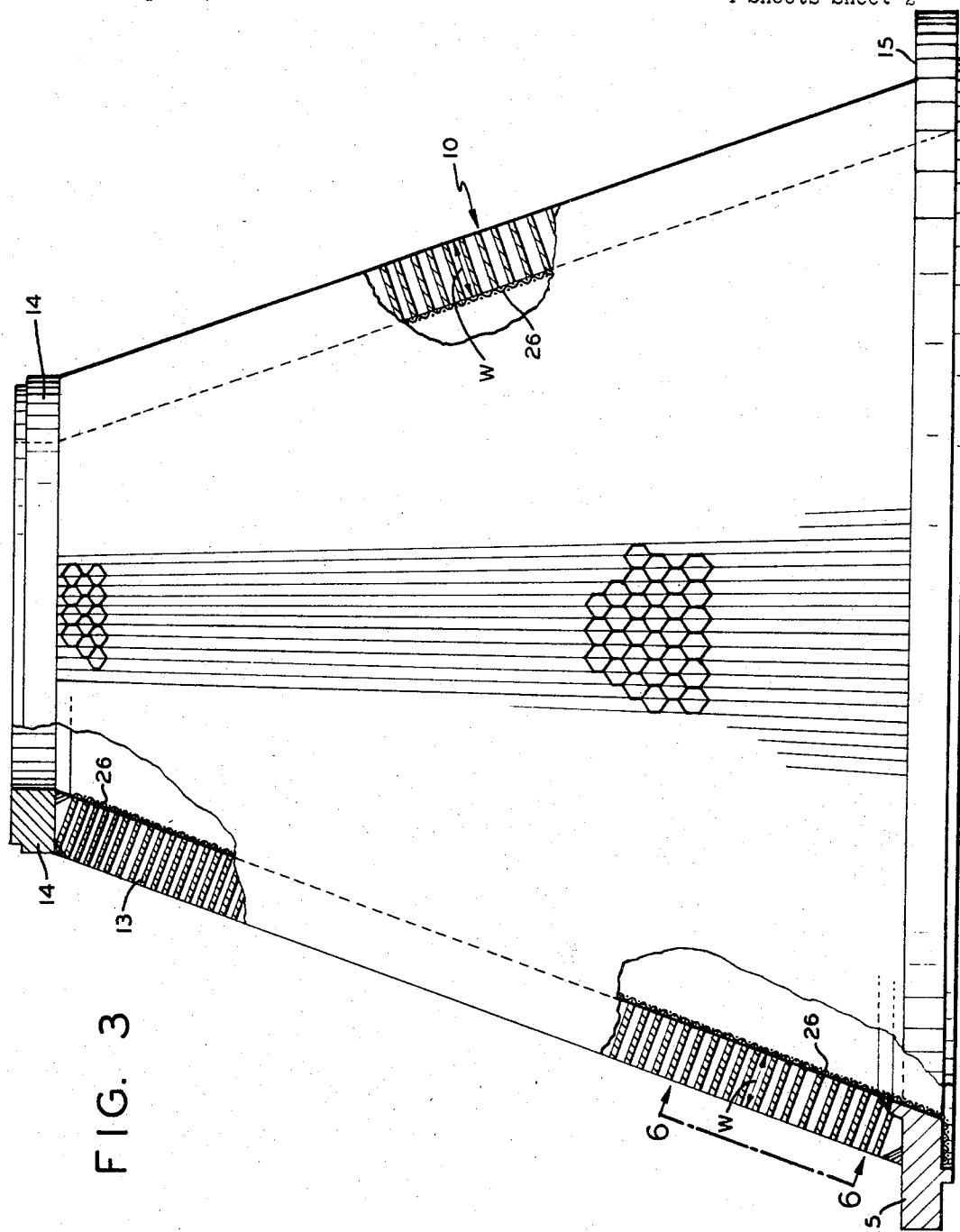
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4 Sheets-Sheet 2



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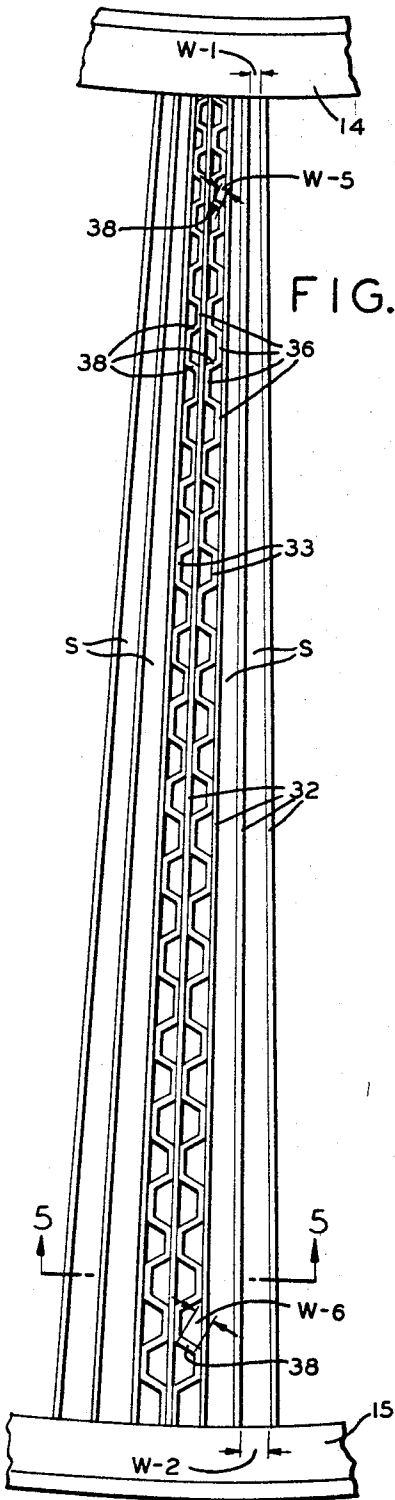


FIG. 4

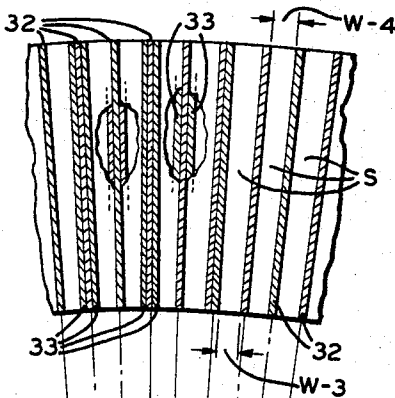


FIG. 5

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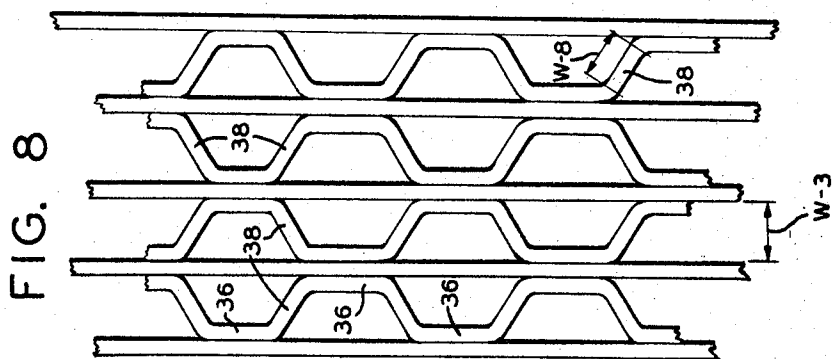
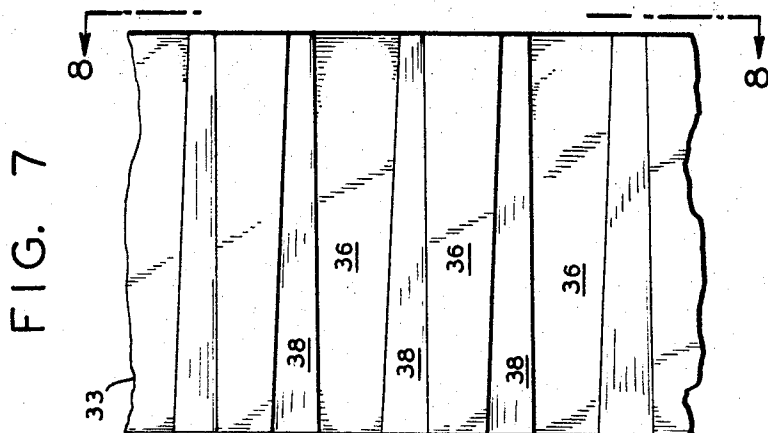
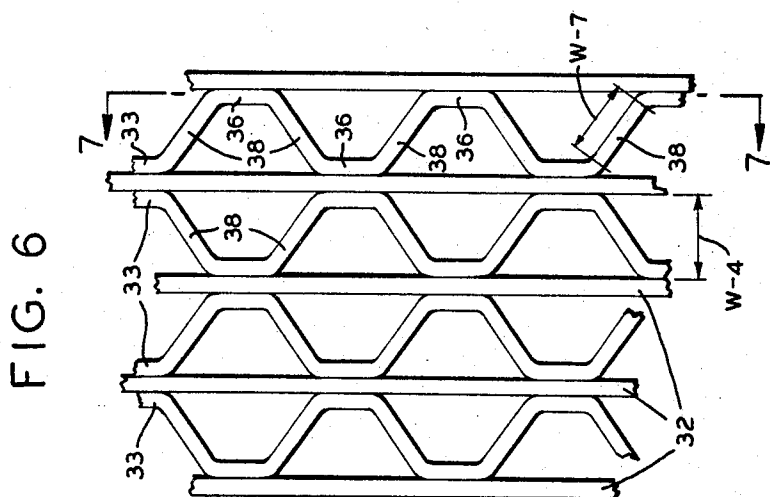
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SCREENING CENTRIFUGES

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ABSTRACT OF THE DISCLOSURE

A screen type centrifuge having a honeycomb-like cage as a support and backing wall for the separating screen.

This invention relates to centrifugal machines having a screen rotating at high speed to separate a solids suspension or slurry into a solids-containing cake fraction retained by the screen and a liquid fraction forced centrifugally through the screen.

More particularly, the invention relates to improvements in screening centrifuges which have a rotating cage providing a backing wall for a screen form-fitted into the interior of the cage. The screen thus contained by the cage may be in the nature of mesh or thin, flexible metal sheeting having innumerable minute openings therein.

It is among the objects of this invention to provide an improved light-weight cage for such screening centrifuges, the cage having a maximum open through-flow area which in turn allows a maximum effective screening area. At the same time, the novel cage provides improved backing support for the screen against the centrifugal forces acting thereon, so that the life of the screen is extended.

A further object is to provide an improved light-weight centrifuge cage having built into it suitable stress resistance for the forces of centrifugation acting thereon.

Another object of the present invention is to provide a centrifuge cage of the above desired qualifications and characteristics and containing a minimum of mass whereby it may be readily accelerated when starting and decelerated when stopping with a minimum of starting and stopping power.

A further object is to provide a light-weight centrifuge cage to minimize the weight to be handled when shipping or mounting the cage.

These objects of the invention are attainable by the provision of a novel cage comprising a set of corrugated strip elements shaped from flat high-strength strip material, for example stainless steel, with the flat faces extending generally radially, thereby presenting a minimum edge profile to the flow of liquid through the screen and cage. Preferably, the corrugated strip elements are shaped and arranged relative to one another in complementary fashion so as to constitute a honeycomb pattern or configuration.

Whereas the invention is applicable in cyclically-operated, batch, screening centrifuges, it is herein illustrated and exemplified in continuously operating screening centrifuges of the trunco-conical screen type. According to one embodiment of the invention, the cage for supporting the trunco-conical screen comprises a set of straight strip elements spaced from one another and diverging from the narrow end to the wide end of the cage and a set of corrugated strip elements arranged in alternation with the straight elements. The corrugated elements

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are formed with the corrugations differentially shaped in three dimensions along their lengths so as to have a closely adjoining relationship with the diverging straight elements. The corrugated elements thus fit into the slender double-wedge-shaped spaces between the straight elements and are fixed thereto at the high point of the corrugations, for instance by suitable welding, brazing, or silver-soldering operations. Preferably, the corrugations together constitute a honeycomb pattern interlaced with or traversed by the diverging straight elements and thus present a composite wall structure to support the screen. This composite honeycomb structure presents subdivided honeycomb openings which provide a more uniform support for the thin screen with a resultant increase in screen life. This composite structure is capable of effectively resisting the longitudinal as well as the hoop stresses of centrifugation while realizing the above stated objects of the invention.

The invention is advantageously applicable both to trunco-conical screening centrifuges having a helically-vaned conveyor operating coaxially within the screen and to screening centrifuges without such conveyors.

Other objects, features, and advantages of the present invention will appear from the following description and appended claims when read in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a general vertical section of a continuously operating screening centrifuge of the conical type in which the novel, light-weight cage of open lattice work or honeycomb structure according to the present invention is advantageously incorporated.

FIGURE 2 is an enlarged vertical section of the improved conical cage and associated elements of FIGURE 1.

FIGURE 3 is an enlarged, partially sectioned side view of the honeycombed cage of FIGURE 2.

FIGURE 4 is a further enlarged fragmentary side view of the cage of FIGURE 3 and shows the honeycomb construction in greater detail.

FIGURE 5 is an enlarged section of the honeycomb structure taken on line 5—5 of FIGURE 4.

FIGURE 6 is a greatly enlarged fragmentary outside view of the honeycomb structure as seen from line 6—6 of FIGURE 3.

FIGURE 7 is a vertical section taken on line 7—7 of FIGURE 6.

FIGURE 8 is a fragmentary inside view of the honeycomb structure as seen from line 8—8 of FIGURE 7.

Referring to FIGURES 1 and 2, a continuous screening centrifuge, illustrating one preferred embodiment of the invention, comprises an improved cage 10 mounted for rotation about a vertical axis in a housing 11. The cage 10 has a trunco-conical body portion or backing wall 13 of novel light-weight construction, and terminal rings 14 and 15 fixed concentrically to the respective narrow and wide ends thereof. The lower and larger terminal ring 15 is bolted to a rim 16 which has radial inwardly extending ribs 17 rigidly and concentrically connecting it to a hub 18 mounted for rotation about a vertical axis in a bearing box 19 which is fixedly mounted in housing 11.

The hub 18 has an intermediate wide portion 20 connecting with the ribs 17 and a downwardly extending shaft portion 20a mounted for rotation in bearings 21 in the bearing box. Hub 18 also has an upper end portion 20b extending into the interior of the cage member,

Concentric in hub 18 is shaft 22 rotatably mounted in upper and lower bearings 23 and 24. The upper end of this shaft has detachably fixed thereto a helically-vaned conical conveyor 25 shaped corresponding to the conicity of cage 18 and cooperating with a screen 26 form-fitted into and contained by the cage.

Cage hub 18 and conveyor shaft 22 are respectively driven at suitably differentiated speeds, as indicated by their respective chain and sprocket drives D-1 and D-2. The conical conveyor moves the solids or cake fraction collected centrifugally on the screen downwardly toward the wide discharge end thereof and into a lower receiving chamber R-1 of the housing. The centrifugally separated liquid fraction is forced radially through the screen into an upper receiving chamber R-2.

The housing of the machine comprises a conical top portion 27, which together with an annular shelf or partition 28 constitutes upper receiving chamber R-2, and an intermediate cylindrical portion 27a carrying the bearing box 19. The cylindrical portion has connected thereto a lower housing portion or hopper 29, constituting therewith the aforementioned solids receiving chamber R-1. A stationary annular deflector baffle 30 connected to the underside of annular partition 28 directs the ejected solids downwardly into hopper 29. The solids collected in the hopper may be discharged periodically through suitable operable closure means (not shown).

Referring to FIGURES 3 to 8, one embodiment of the improved novel cage 10 comprises the aforementioned lightweight trunco-conical wall 13 to which are concentrically fixed or welded terminal rings 14 and 15. Wall 13 is a composite structure consisting of numerous elements of flat strip material extending in generally longitudinal directions or in directions of the generatrix of the cone shape of the cage. The strip elements are so shaped, constructed, and connected to one another as to constitute open lattice work or honeycomb structure presenting a maximum of open through-flow area for the liquid fraction while providing effective support for the screen.

The flat faces of the strip elements extend radially, their width W (FIGURE 3) relative to the radii of the cage being such as to provide a light-weight structure of great stress resistance to the forces of centrifugation. This structure thus minimizes the rotating mass of the cage and correspondingly reduces the stresses of centrifugation.

As most clearly seen in FIGURES 4 and 5, in the preferred embodiment the light-weight composite or honeycomb structure comprises a set of divergent straight strip elements 32 extending radially to the axis of rotation. The divergent elements 32 are spaced equally about the axis of rotation, having between them double-wedge-shaped spaces S.

Viewed from the outside (FIGURE 4) these spaces are shown to be wedge-shaped longitudinally as indicated by a comparison of the width W-1 at the upper narrow end and the width W-2 at the lower end. In cross-section (FIGURE 5) these spaces are shown to be wedge-shaped radially as indicated by the narrow width W-3 at the internal surface of the cage and by the greater width W-4 at the external surface of the cage.

All these double-wedge-shaped spaces are occupied by correspondingly shaped corrugated strip elements 33 shaped from flat stock and three-dimensionally form-fitted into the spaces S. Preferably, corrugated strip elements 33 are formed and arranged relative to one another so as to constitute a honeycomb shaped pattern traversed longitudinally by straight elements 32. Both sets of strip elements 32 and 33 are connected fixedly and solidly to one another at their contact faces as by spot welding or the like.

The corrugated strip elements 33 include longitudinal portions 36 and angled portions 38. As shown most clearly in FIGURE 4, the longitudinal wedge-shaped configuration of the corrugated elements is created by progressively decreasing the width of angled portions 38 toward the

narrow end (upper end as shown in FIGURE 4) of the conical cage. This change in width of angled portions 38 is indicated by a comparison of widths W-5 and W-6 in FIGURE 4.

The radial wedge-shaped configuration of the corrugated strip elements is best illustrated in FIGURES 6, 7, and 8 which show a greatly enlarged fragmentary portion of the honeycomb structure. Thus, FIGURE 6 shows the outside spacing W-4 between the straight strips 32 as being greater than the corresponding inside spacing W-3 appearing in FIGURE 8. Accordingly, angled portions 38 of the corrugated elements are somewhat wider at the external surface of the cage (FIGURE 6) than at the internal surface (FIGURE 8). This variation in width is illustrated by a comparison of widths W-7 and W-8 in FIGURES 6 and 8 respectively. To compensate for the resulting trapezoidal shape of angled portions 38 which is best illustrated in FIGURE 7, flat portions 36 of the strip element have an inverse trapezoidal shape and are therefore wider at the internal cage surface (FIGURE 8) than at the external (FIGURE 6).

Whereas this invention has been illustrated and described herein as embodied in continuous centrifugal machines, the features of minimizing weight, mass, and power requirement of the rotating cage while improving the through-flow area and the screen supporting characteristics thereof, are also advantageous in cyclically-operating or batch-type basket centrifuges. Such machines are often automated and operated on short cycles (for example, a 3 minute cycle for loading, starting, spinning, stopping, and unloading). This usually requires a large drive motor which may be of a complex regenerative type to recover power during the stopping phase. The cage weight reduction realizable by this invention substantially simplifies and reduces such power requirements.

The present invention may be advantageously employed utilizing other honeycomb constructions. For example, in certain applications, the honeycomb cage may be constructed without the straight strip elements which are disclosed in the preferred embodiment. In such case, adjacent corrugated strip elements are rigidly connected directly to each other. Further, the invention contemplates cages of other than conical shape, for example cylindrical cages.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present embodiment is illustrative and not restrictive. The scope of the invention is defined by the appended claims rather than by the description preceding them, and all embodiments which fall within the meaning and range of equivalency of the claims are therefore intended to be embraced by those claims.

We claim:

1. In a continuously operating centrifugal machine, a rotary centrifugal screening structure of trunco-conical configuration comprising an annular, open-work cage having a wide end and a narrow end and screening means fitted and contained in said cage, said cage providing a backing wall for said screening means, said rotary structure being adapted to receive a feed suspension through said narrow end, to discharge a cake fraction from said wide end, and to discharge a liquid fraction outwardly through said screening means and said open work cage, said cage comprising a set of straight elements spaced from one another and diverging from said narrow end to said wide end, a set of corrugated strip elements formed from flat strip material with their flat faces extending radially and alternating with said straight elements, said corrugated elements being configured to have a double-wedge shape so as to have a closely adjoining relationship with said straight elements, and means for fixedly interconnecting said straight elements and said corrugated elements by connecting the straight elements with respective corrugations.

2. The rotary screening structure according to claim 1

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together with a trunco-conical conveyor form-fitted into and cooperating with the interior conical surface of said screening means and rotatable at a differential speed relative thereto for moving cake material towards the wide discharge end of the screening structure.

3. The rotary screening structure according to claim 1 wherein said straight elements in said cage consist of flat strip material, oriented with the plane of the strip material substantially radial, and diverging from the interior screen adjacent surface to the exterior surface.

4. The rotary screening structure according to claim 3 wherein said corrugated elements, said corrugated ele-

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ments are constructed and arranged relative to one another so as to constitute a honeycomb-like pattern.

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