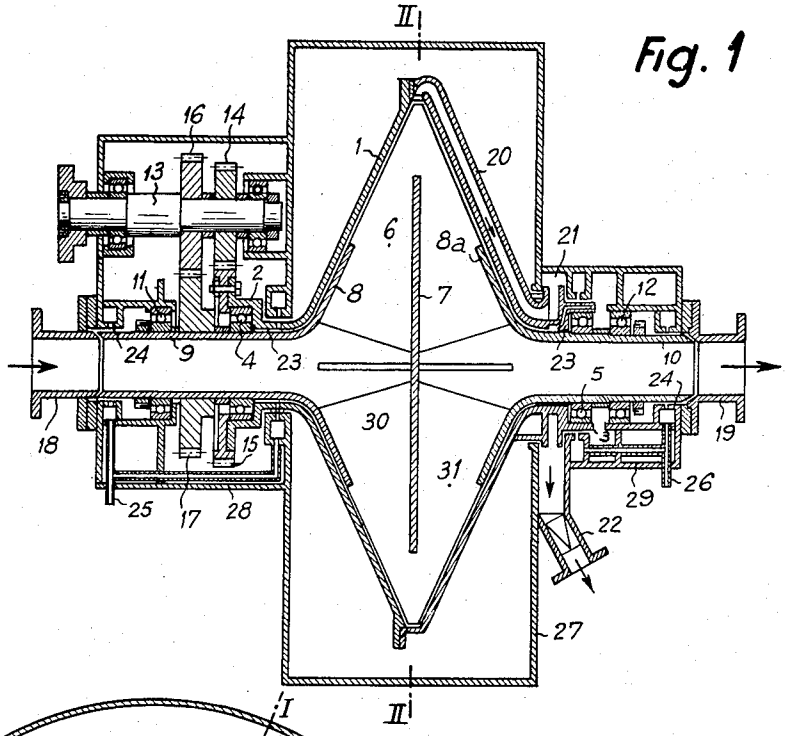
May 1, 1956 J. E. A. GRAAE 2,743,865

CENTRIFUGAL SEPARATOR

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Fig. 1



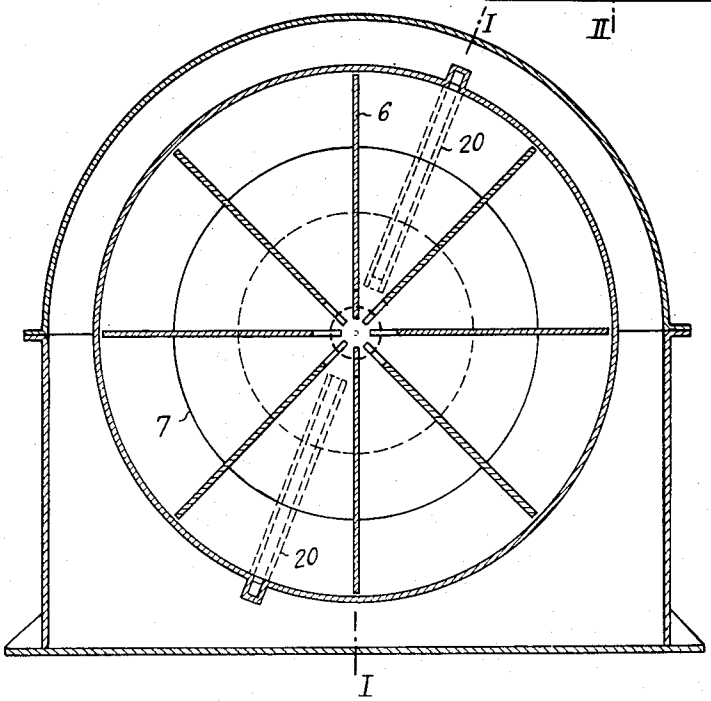


Fig. 2

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Fig. 3

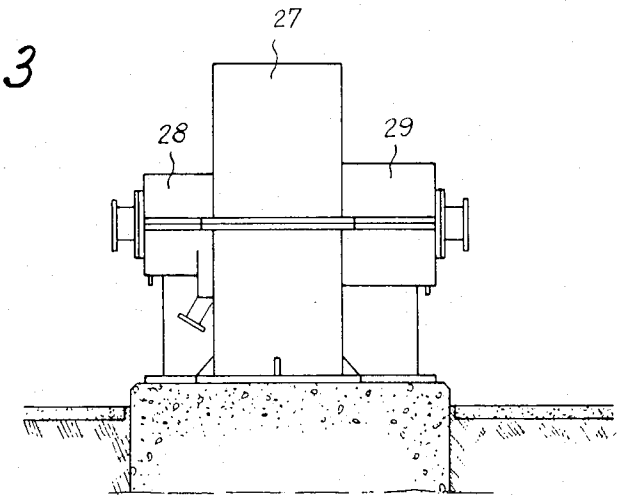
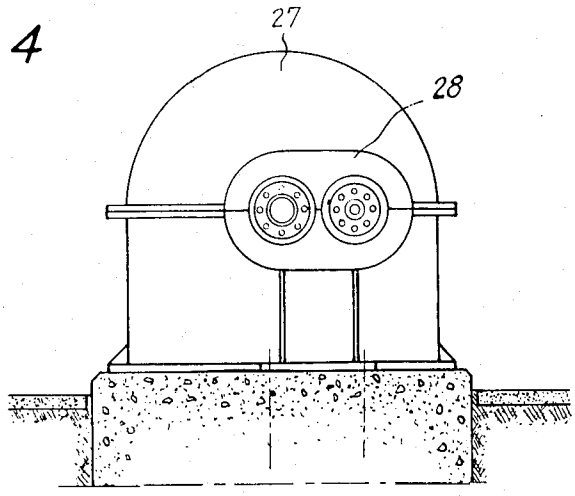


Fig. 4



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Fig. 5

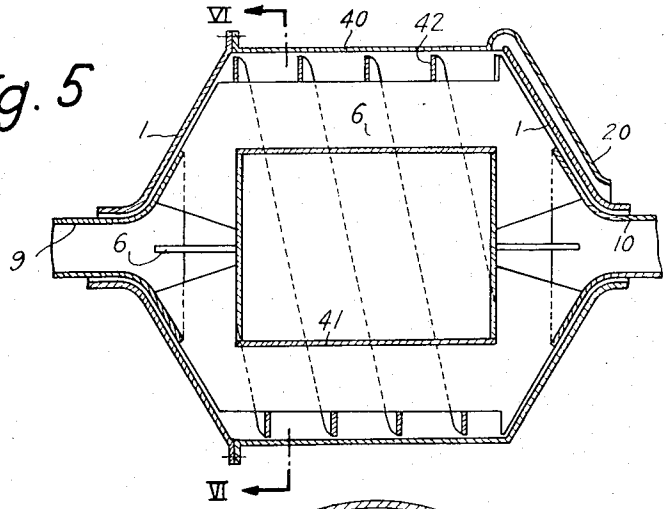


Fig. 6

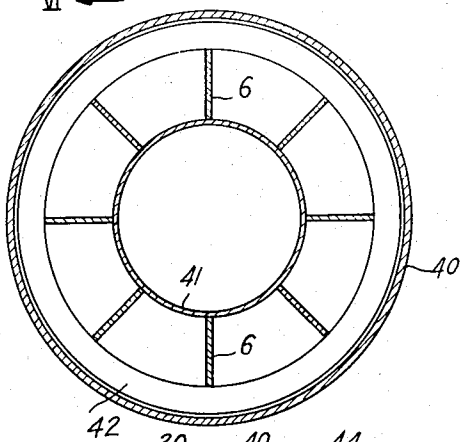
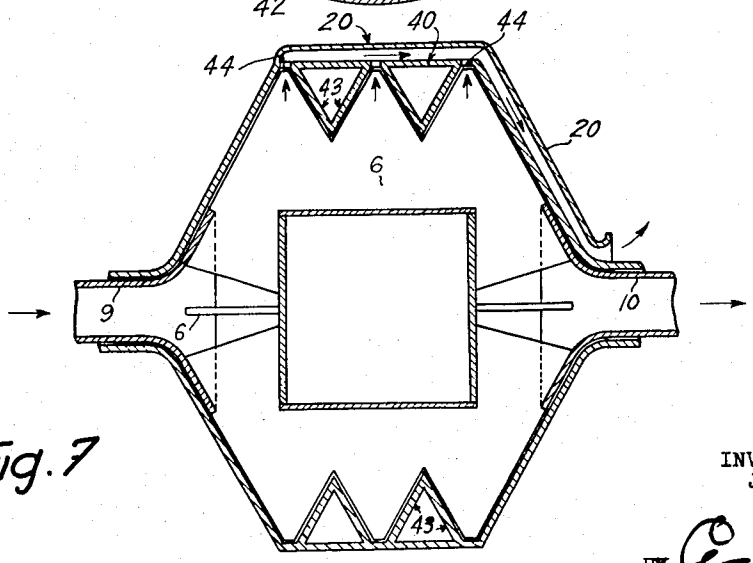


Fig. 7



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CENTRIFUGAL SEPARATOR

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7 Claims. (Cl. 233—7)

This invention relates to centrifugal separators and it has for its object to provide a centrifuging device for effecting the separation of mixtures of solids and fluids, constituting an improvement on the centrifugal separators hitherto in use.

The apparatus of this kind now on the market have the drawbacks of consuming a large amount of power for the driving thereof, of only slowly effecting the centrifuging, and of not permitting high working speeds.

One of the objects of the invention is to provide an apparatus with which a continuous flow of the separated constituents, and particularly of the denser or solid constituents, may be obtained.

Another object of the invention is to provide an apparatus of the kind referred to requiring but a relatively moderate expenditure of driving power.

Another object of the invention is to provide an apparatus of the kind referred to by means of which centrifuging may be carried out more quickly than with the similar apparatus in use.

The apparatus according to the invention essentially comprises a rotated centrifuge chamber within which are disposed rotating vanes turning at a speed which is slightly different from that of the chamber and so arranged that the said vanes scrape the surface of the chamber and detach from it the deposit of denser constituents which tend to collect at the periphery and bring them to outflow passages directed towards the axis of the apparatus, by means of which they are discharged.

In this apparatus, the vanes constitute two series of compartments in which the mixture subjected to centrifuging enters in succession, this mixture restoring in the second series of compartments, the energy which has been imparted to it in the first, thereby ensuring operation with a minimum consumption of energy.

In the apparatus which forms the object of the invention, the discharge of the denser constituents is obtained without any mechanical device, such as a conveying screw or other device. The discharge of the denser constituents, in apparatus embodying the present invention, results from the fact that the inlet for the mixture admitted to the centrifuge is disposed closer to the axis of rotation of the latter than is the orifice through which the denser constituents are discharged, thereby providing a driving potential or pressure gradient pushing the denser constituents out of the discharge orifice.

Referring to the accompanying drawings, which represent, by way of example only, preferred embodiments of the invention:

Fig. 1 is a vertical section through the axis of rotation along I—I of Fig. 2;

Fig. 2 is a section of Fig. 1 along II—II;

Fig. 3 is a side elevation on a smaller scale;

Fig. 4 is a corresponding end elevation;

Fig. 5 is a longitudinal sectional view along the axis of another embodiment of the persent invention;

Fig. 6 is a sectional view along VI—VI of Fig. 5; and

Fig. 7 is a sectional view along the axis of still another embodiment of the present invention.

As it is seen on these drawings, the improved apparatus comprises a centrifuge chamber **1** constituted by two cones having a common base, and provided with sleeves **2** and **3** mounted on ball bearings **4** and **5**. In this chamber **1** is housed a rotative asembly composed of a certain number of flat vanes or wings **6**, disposed in radial planes passing through the axis of rotaion, each vane having a contour such that it corresponds to the internal shape of the chamber **1**. These vanes **6** are rigidly secured together by a plate **7** arranged perpendicular to the axis of rotation and by cones **8** and **8***a* each provided with hollow shaft extensions **9** and **10**, respectively, and supported in bearings **11** and **12**, respectively. The said vanes **6** divide the internal capacity of the rotor into radial compartments.

A driving shaft **13**, driven in any suitable manner, drives the chamber **1** and the rotative internal assembly, by means of pinions **14**, **15** and **16**, **17** so that the rotor and the vanes revolve with slightly different speeds, gears **14** and **15** driving the chamber **1** at a slower speed than gears **16** and **17** drive the vane assembly in the form illustrated in Fig. 1.

A fixed neck **18** on the axis of rotation of the centrifuge chamber constitutes the inlet for the product to be subjected to centrifuging; another neck **19** on the same axis is the outlet through which the least dense constituents are discharged after centrifuging. Passages **20** lead from the periphery of the centrifuge chamber radially inward and terminate at locations spaced more or less from the axis of rotation to convey the denser constituents into an annular chamber **21**, whence they are discharged by a neck **22**.

Labyrinth packings **23**, **24**, protect the bearings and separate them from the product being treated; the protection of the bearings may also be achieved by means of liquids or fluids forming seals, introduced by pipes **25**, **26**.

All the members are enclosed in housings **27**, **28**, **29**, which protect the rotating parts and support the bearings.

The apparatus works as follows:

The product to be centrifuged, which may be a gaseous fluid loaded with dust, a liquid containing solid particles in suspension, a sludge, or the like, is introduced at the neck **18** and enters the radial compartments **30** situated between the vanes **6** and plate **7** through the hollow shaft **9**. The rotated vanes **6** carry the product along, and the denser constituents of the product are centrifugally driven towards the periphery of the chamber **1**.

In being displaced with respect to the chamber **1**, the vanes scrape the surface of the latter and bring the denser constituents to the entrance of the discharging passages **20** which conduct them to the chamber **21** whence they issue through the neck **22**.

Due to the fact that the inlets to compartments **30** are closer to the axis of the centrifuge than the outlets of the passages **20** there is a driving potential tending to discharge whatever enters at the inlet of the passages **20** through these passages.

By selecting a suitable distance from the axis for the outlets of passages **20** a suitable rate of discharge can be obtained and this can again be controlled by means of valves placed at the outlets of these passages.

A very accurate and steady control is possible as a consequence.

The valves may be controlled electrically, hydraulically or mechanically.

Since the discharge pressure can be reduced to any degree desired simply by selecting a suitable distance from the axis of the centrifuge for the outlets of passages **20**, the valves can have relatively large control-openings so that clogging can be avoided.

The least dense constituents pass into the compartments **31**, then issue through the hollow shaft **10** and the outlet neck **19**. In the compartments **31**, the product imparts to the centrifugal apparatus the rotational energy it had received in the compartments **30**.

Figs. 5 and 6 illustrate a different embodiment of the invention in which the two cones **1** are separated and connected through a cylindrical drum **40**. The vanes **6** are carried by a drum **41** which is smaller than the drum **40**. Around said vanes a helicoidal band **42** is wound which acts as a screw-conveyor scraping the inner surface of the centrifuge-bowl **40** and carrying the deposited solids toward the the discharge passages **20** (of which there are two (2) or more, diametrically opposed).

Fig. 7 illustrates another embodiment in which the centrifuge chamber is also composed of two cones **1** and a cylindrical drum **40**. Inside the drum are partitions **43** defining what may be called annular funnels.

The shape of the vanes **6** is designed to sweep the surface of the funnels. Openings **44** made in the bottom of the funnels permit the discharge of the denser products through the ducts **20** as in the previously described embodiments.

It is understood that the above particulars are only given in the way of examples and that the details of execution, shape, dimensions and materials employed may vary without departing from the scope of the invention.

What I claim is:

1. In a centrifugal apparatus for effecting the separation of mixtures of solids and fluids and to ensure a continuous discharge of the denser constituents of the mixtures; the combination of a rotated centrifuge chamber, vanes rotatably mounted within said chamber and having their peripheral edges closely adjacent to the internal surfaces of said chamber, means driving said vanes at a rotational speed slightly different than that of said chamber, inlet means for supplying a mixture to be centrifugally separated to said chamber at a location disposed adjacent the axis of rotation of said chamber, and discharge passages of substantial cross-sectional area extending radially inward from wide spaced apart locations at the periphery of said chamber toward said axis of rotation and terminating at locations radially outward with respect to said location of the inlet means so that said vanes scrape the deposits of the denser constituents of the mixture from the internal surface of said chamber and convey the scraped deposits into said discharge passages for discharge through the latter by reason of the difference in centrifugal potential at the radially outer and inner ends of said discharge passages.

2. In a centrifugal apparatus; the combination according to claim 1, wherein said vanes lie in planes extending radially from said axis of rotation, and further including a partition in said chamber perpendicular to said axis of rotation and intersecting said vanes, said partition and vanes defining two series of compartments between successive vanes at the opposite sides of the partition, said inlet means communicating with one of said series of compartments, and outlet means for the lighter

constituents of the mixer communicating with the other of said series of compartments, adjacent said axis of rotation, said two series of compartments communicating with each other adjacent the periphery of said chamber so that, as the mixture being centrifugally separated passes from said one series through said other series of compartments, the rotational energy imparted to the mixture in said one series of compartments is, at least in part, restored to said vanes by the mixture during passage of the latter through said other series of compartments.

3. In a centrifugal apparatus; the combination according to claim 1, wherein said chamber is defined, at least in part, by two mated conical walls concentric with said axis of rotation and tapering toward the latter in directions away from each other.

4. In a centrifugal apparatus; the combination according to claim 3, wherein hollow shafts extend axially from said conical walls to respectively define said inlet means and an outlet for the lighter constituents of the mixture, said discharge passages extending parallel to the conical surface of one of said walls, and a discharge chamber coaxial with the hollow shaft extending from said one wall and into which the inner ends of said discharge passages empty.

5. In a centrifugal apparatus; the combination according to claim 4, wherein said chamber is further defined by a cylindrical drum interposed axially between said conical walls, and further comprising a helical blade wound around the outer edges of said vanes to axially convey the deposits of the denser constituents along the inner surface of said drum toward said one conical wall and into said discharge passages.

6. In a centrifugal apparatus; the combination according to claim 4, wherein said chamber is further defined by a cylindrical drum interposed axially between said conical walls, and an axial series of annular members of V-shaped cross-sections arranged against the inside of said drum, said vanes having serrated outer edges closely adjacent to the inner surfaces of said annular members, and said drum having openings between the successive annular members and said conical walls which communicate with said discharge passages at the radially outer portions of the latter.

7. In a centrifugal apparatus; the combination according to claim 4, wherein said conical walls have a common base so that the centrifuge chamber has a diamond shaped diametric cross-section, said vanes being triangular and having their outer edges closely adjacent to the internal surface of the chamber.

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