

Sept. 26, 1944.

J. F. THOLL

2,358,779

CENTRIFUGAL SEPARATOR

Filed May 7, 1942

2 Sheets-Sheet 1

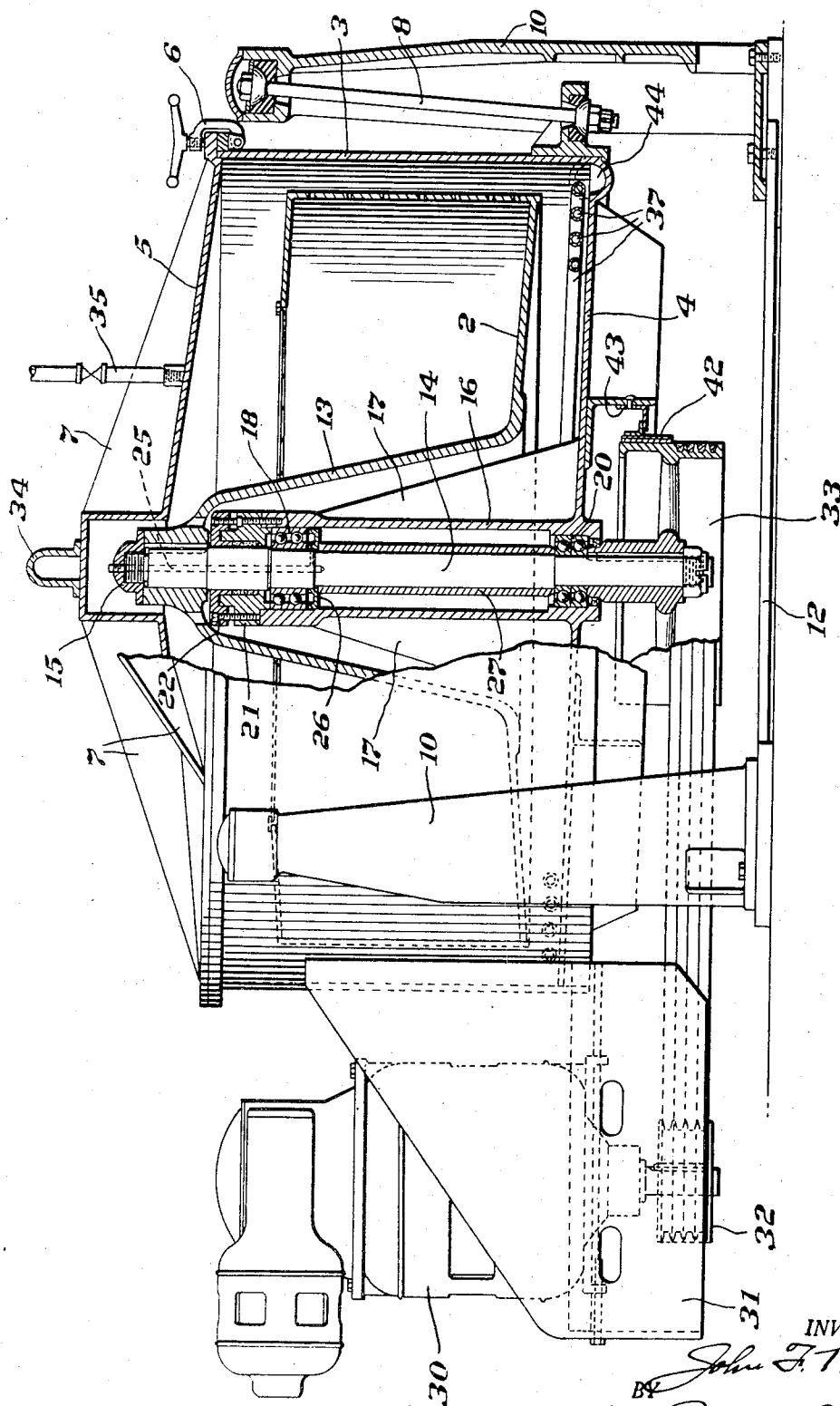


Fig. 1

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Fig. 2

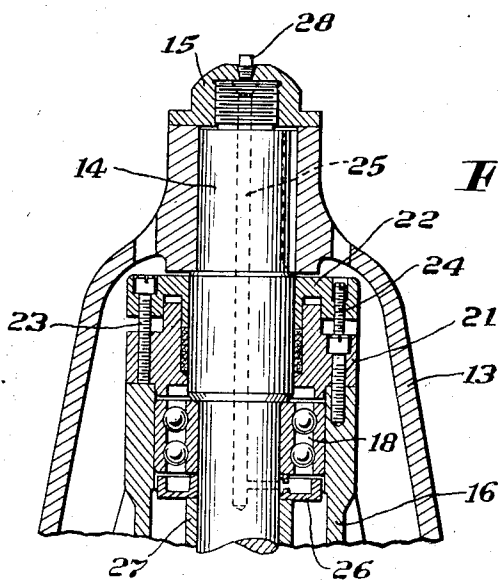
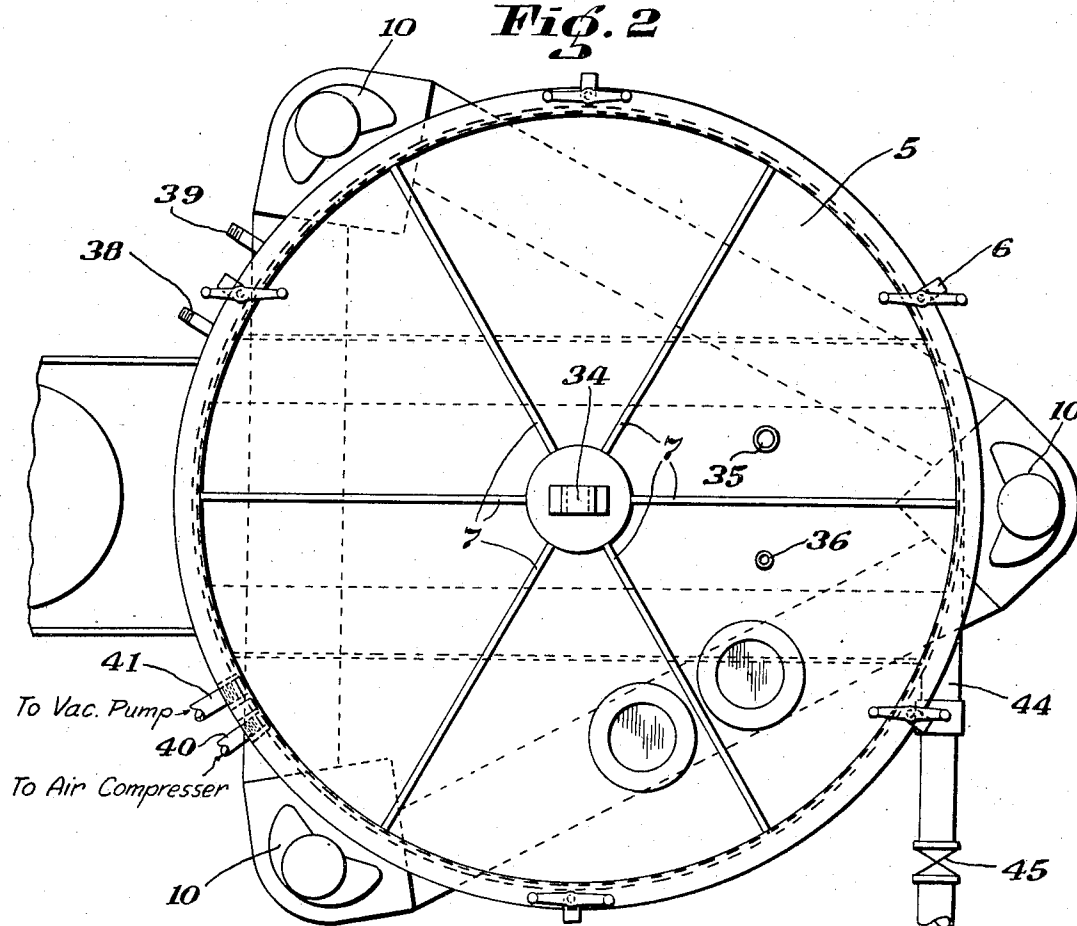


Fig. 3

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UNITED STATES PATENT OFFICE

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1 Claim. (Cl. 210-72)

This invention relates to centrifugal extractors and separators.

It is frequently desirable to perform the centrifuging or extracting operation in a gaseous atmosphere of a different composition from that of the surrounding air, or to perform it under a pressure higher or lower than atmospheric, or at other times to maintain a high pressure during a part of the operation and a vacuum during another step in that process. For example, some forms of synthetic yarns require treatment or impregnation with a liquid medium which is highly volatile so that such a process must be performed under pressure. Because it is desirable to recover the unused portion of the volatile liquid, both the impregnating and recovery process can readily be performed in a centrifugal separator or extractor. During the impregnating step the separator may act simply as a tank in which the material is allowed to soak under pressure. At the conclusion of this treatment the separator can be started up and the impregnating liquid extracted from the material by centrifugal operation. Finally the residual liquor can be extracted from the material by applying a vacuum to the basket chamber.

The present invention is especially concerned with these conditions, and it aims to devise a centrifugal separator with the aid of which processes of this character can be practiced and the conditions varied to suit the requirements of a variety of circumstances.

The nature of the invention will be readily understood from the following description when read in connection with the accompanying drawings, and the novel features will be particularly pointed out in the appended claim.

In the drawings,

Figure 1 is a view, partly in side elevation and partly in vertical section, illustrating a centrifugal separator embodying features of this invention;

Fig. 2 is a plan view of the centrifugal shown in Fig. 1; and

Fig. 3 is a vertical, sectional view on a larger scale showing details of construction at the upper end of the shaft which supports the basket.

Referring first to Figs. 1 and 2, the separator there shown comprises a basket 2, which may either be of the perforated or solid-wall variety, as desired. It is mounted to revolve in a casing that includes a curb sheet 3 surrounding the basket, a bottom sheet 4 welded or otherwise secured rigidly to the curb, and a cover 5 which is releasably secured in its closed position by a

series of swing bolts 6. Preferably this cover is upwardly dished, as best shown in Fig. 1, and it is provided with a series of radially disposed stiffening flanges 7 welded to it. The casing is suspended in its operative position by means of three links, one of which is illustrated in Fig. 1, and each of these links is hung from the upper end of a pedestal 10, three such pedestals being located at equally spaced angular distances around the casing. A base 12 connects and supports the pedestals.

For the purpose of operatively supporting and driving the basket, it is provided with a hollow conical centrally disposed section 13, integral with the bottom of the basket, and the upper end of this tapered section is keyed to the upper end of a vertical shaft 14. A cap 15 screw-threaded on to the top of the shaft forms a part of this connection and assists in taking the load of the basket and its contents. Encircling this shaft is a tubular housing 16 which preferably is welded to the bottom sheet 4 of the casing and is reinforced by a series of stiffening flanges 17. The shaft extends through this housing, projects both above and below it, and is operatively supported by upper and lower sets of ball bearings indicated at 18 and 20, respectively, these bearings being of an anti-friction variety adapted to take both the radial and vertical load of the shaft and the parts supported thereby.

It will be evident from the foregoing that the casing is adapted to be closed tightly against the leakage of air into it or out of it, and in order to prevent such leakage around the shaft or through the bearings, a stuffing box is mounted on the upper end of the housing 16. As best shown in Fig. 3, this box comprises a body 21 bolted to the upper end face of the housing, and a packing gland 22, closely encircling the shaft, slidable in said box and adapted to be tightened up by means of a series of bolts, one of which is shown at 23. A screw 24 is provided to lock the gland in its adjusted position, this screw, however, being illustrated in Fig. 3 in a position somewhat displaced angularly with reference to that normally occupied by it. Thus this arrangement provides a substantially air tight joint between the housing 16 and the shaft 14.

For the purpose of introducing oil or other lubricating material into the bearings while preventing the leakage of air therethrough, a central oil duct 25, Fig. 3, is drilled downwardly in the shaft from its upper end and communicates at its bottom with a lateral duct opening into the annular cup 26 which lies just below the

upper set of bearings 18 and is supported on the spacing sleeve 27. Thus lubricant may be forced through this duct into the bearing 18 and the surplus will flow around the edge of the cup 26 and down into the lower bearing 20. A screw-threaded plug 28 normally closes the upper end of the duct 25 against the leakage of air therethrough.

Such a mounting for the casing 3, as that illustrated, permits a limited gyratory or swinging motion of the casing and the parts supported by it and a driving mechanism for the shaft and the basket is provided which is so arranged as to be unaffected by this motion. For this purpose, an electric motor 30 is supported on a bracket 31 which is rigidly secured to the casing 3 at one side thereof. Preferably the motor 30 forms part of a two-speed driving unit of the character described and claimed in my prior Patent No. 2,112,430, and it is connected to the shaft 14 by a multi V-belt drive including pulleys 32 and 33, respectively. The brake band 42 is supported in position to engage the upper half of the basket pulley 33, this brake being supported by one or more brackets 43 secured to certain of the reinforcing ribs welded to the bottom sheet 4. With this arrangement any gyration or swinging movement of the casing, which is likely to occur at certain speeds with unbalanced loads, does not disturb the relationship of the driving unit 30 to the basket and, consequently, has no effect on the driving connections between these parts.

The material to be impregnated or operated on in any other way may be introduced into the basket through the central opening in its top after raising the cover 5, and a loop 34 is welded or otherwise rigidly secured to the top of the cover for this purpose. The impregnating liquid also may be introduced in this same manner but usually it will be found preferable to conduct it into the machine through a pipe such as that shown at 35, this pipe being equipped with one or more control valves. A vent 36, Fig. 2, affords an escape for the displaced air.

If desired, heating coils 37, Fig. 1, may be placed in the casing just above the bottom sheet and joined to suitable headers with which the supply and return pipes 38 and 39, respectively, Fig. 2, connect. Additional pipe connections 40 and 41, Fig. 2, run, respectively, to an air compressor and a vacuum pump, these connections including suitable valves for controlling the application of either pressure or vacuum to the casing.

With this arrangement such an impregnating and recovery process as that above referred to can be performed very conveniently. That is, the material to be impregnated is introduced into the basket, the casing is closed tightly by means of the swing bolts 6, and the impregnating liquid is led into the apparatus through the pipe 35. Usually in such a process the impregnating step is performed while the material is submerged in the liquid and the basket is either stationary or is revolved at a very slow speed, the valve 45 in the liquid discharging outlet from the casing being closed at this time. Suitable gaseous pressure conditions can be maintained in the casing, as above indicated. Or an inert gas may be introduced through the air compressor and its con-

nections. When the desired interval of time has elapsed to complete the treatment, the liquid discharge valve is opened, thus allowing the liquid to drain off into a suitable closed receptacle which, if the process has been conducted under pressure, will be maintained under the same pressure. After most of the liquid has drained off by gravity the speed of the basket is increased to a value sufficient to extract more of the liquor centrifugally. Finally, when most of the liquor that can be so extracted has been taken off, a vacuum may be applied to the basket chamber and the rest of the liquid recovered in this manner. The top 5 of the casing then is removed, the basket is unloaded, and the operations above described are repeated.

It should be observed that it is important not only to prevent the leakage of air through the bearings because of its effect on the pressure conditions which it is desired to maintain in the casing, but also because such leakage would, in addition, permit the flow of liquid, vapor or fumes from the basket chamber into the bearings where they might have an exceedingly objectionable action. This invention protects the bearings by extending the housing 16 up to a level above the maximum liquid level that can be maintained in the chamber and also by providing a stuffing box which produces an air tight and liquid tight joint between the bearings and the inside of the casing. This necessitates a considerable extension of the shaft above the level that otherwise would be necessary, and such extension is accommodated by the dome-like shape given to the cover 5.

While I have herein shown and described a preferred embodiment of my invention, it will be evident that the invention is not limited to embodiment in the particular form illustrated.

Having thus described my invention, what I desire to claim as new is:

In a centrifugal separator, the combination of a basket, an upright shaft on which said basket is mounted to revolve, a casing constructed to be closed air tight, said casing enclosing said basket and including a bottom sheet, a surrounding curb sheet, and a removable top, means for clamping said top in its closed position, a tubular housing for said shaft rigid with said bottom sheet, means supporting said casing for limited swinging movement, said housing extending upwardly approximately to the level of the top of said basket, the basket including a hollow tapered central section terminating in a hub mounted on said shaft at a point above said housing, bearings in said housing supporting said shaft, a stuffing box mounted on the upper end of said housing for tightly closing the space between said housing and said shaft above said bearings, said stuffing box including an adjustable packing gland encircling said shaft and bolts for adjusting said gland, said hub having holes therethrough in alignment with said bolts affording access to said bolts so that the latter may be operated to adjust said gland while the hub, basket and shaft remain in their normal assembled relationship, means below said bearings for driving said shaft, and means operable to maintain gaseous pressure conditions in said casing differing substantially from those outside the casing.

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