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APPARATUS FOR THE UNINTERRUPTED CLEANING AND SIFTING, IN PARTICULAR OF PAPER-MAKING STUFF
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Fig.1

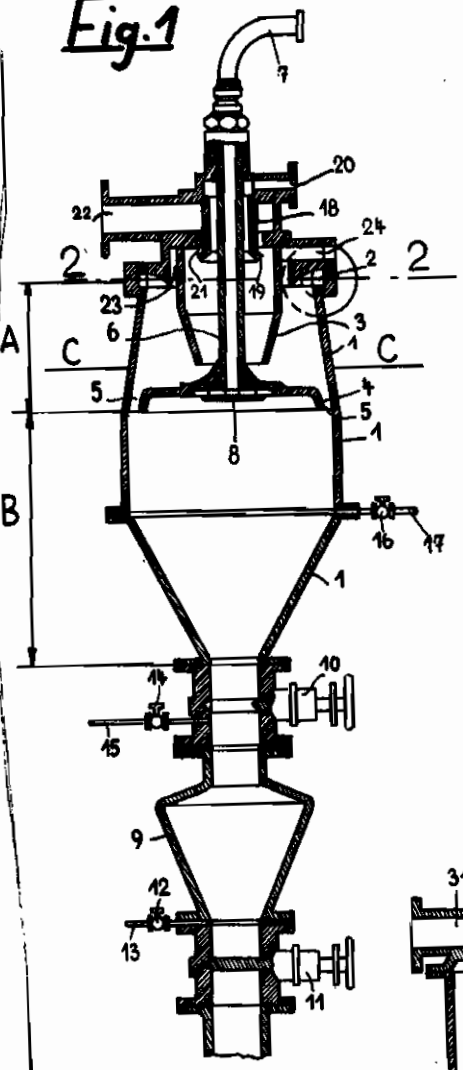


Fig.4

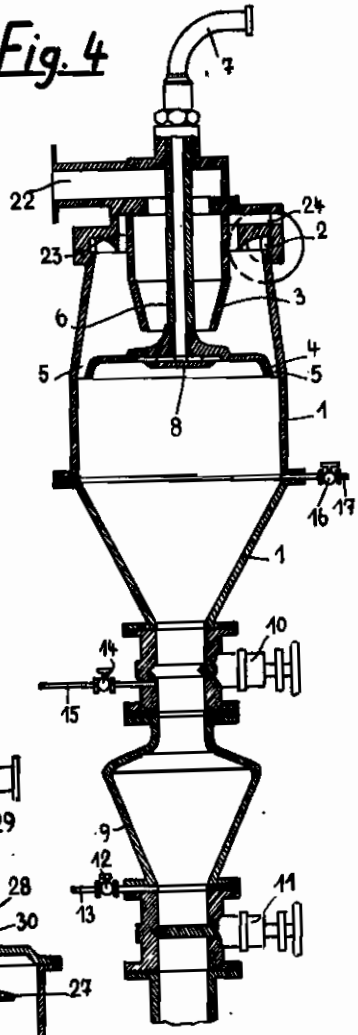


Fig.5

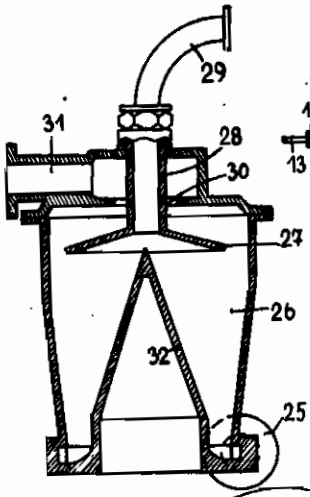


Fig.2

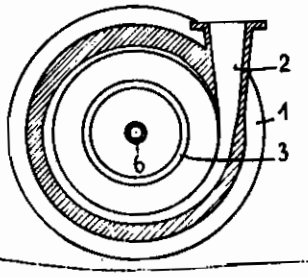
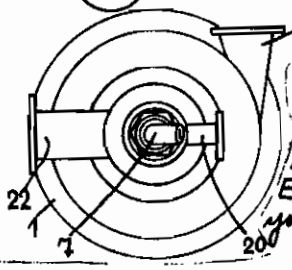


Fig.3



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ALIEN PROPERTY CUSTODIAN

APPARATUS FOR THE UNINTERRUPTED CLEANING AND SIFTING, IN PARTICULAR OF PAPER-MAKING STUFF

Andre Bergès, Lorp Par St. Lizier (Arriege), France; vested in the Alien Property Custodian

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The invention relates to an apparatus, for the uninterrupted cleaning and sifting in particular of paper-making stuff, and which is preferably inserted between the vats and the point of entry of the material into a paper making machine. Devices are known in which the material to be treated, after introduction tangentially into a container, is set in rotation at a high speed and is carried first downward and then upward, the cleaned material being carried concentrically upward, the lighter impurities also upward and the heavier impurities being carried away downward.

The invention relates to a particularly advantageous embodiment of such a device, in which by a suitable construction of the feed of the material and of the parts of the container, there takes place an effective and uninterrupted separation of the undesired matter contained in the material.

According to the invention, the inlet part which in cross-section has the form of a rectangle and the longer side of which is parallel to the axis of the container, is so fitted spirally on to the container that it is open towards the interior thereof and its outer wall merges, after approximately 360°, into the container wall, there being furthermore provided two container parts, both widening out at first in conical form and being then made cylindrical, from the point where the material enters, one in the downward direction, and the other in the upward direction.

The part of the container widening out from below upwards is arranged concentrically in the conical part of the container part widening out from the top downwards, and on to the cylindrical part of the outer part of the container there is connected at the bottom a furhter part becoming smaller conically downward. At the level of the transition of the upper conical part into the cylindrical part of the outer part of the container, there is concentrically arranged in this a hood open towards the bottom and leaving free a comparatively narrow but high annular gap, the centre of which hood merges into a centrally arranged pipe of comparatively small diameter carried upwardly out of the container. The opening of the hood is screened from below by a plate. Above the inlet there is provided an annular space having an exhaust or outlet. At the lower conical part of the outer container there is connected a sluice valve which consists of a separate container communicating at the top by a slide or the like with the lower part of the main container and which is closed at the lower part by a further slide or the like. There opens into the lower part of the sluice valve container a water supply pipe adapted to be closed and in its uppermost part an air pipe also adapted to be closed. There furthermore opens into the lower part of the main container a supply pipe, adapted to be closed, for dilution water.

If the separation both of the lighter, as also of the heavier, parts is to take place in the apparatus, there is provided concentrically within the cylindrical part provided at the top with an outlet, of the inner part of the container, and below the said outlet, a pipe merging at the bottom into a hood and carried at the top out of this part of the container.

If the apparatus is subdivided in such manner that on the one hand essentially the separation of the heavier constituents and on the other hand essentially the separation of the lighter constituents take place, then the two parts of the container are made as two separate containers only connected by a pipe if necessary provided with a pump. That one of these which essentially serves for the separation of the heavier constituents of the material is made according to the previous description but does not have the above mentioned pipe arranged within the inner part of the container. The other is provided at the bottom with a spirally shaped inlet for the material freed from the heavy constituents. It broadens out at first in conical form from below upward, then runs cylindrically and is provided at the top with an outlet which is arranged concentrically to a central pipe which runs within the cylindrical part downward in screen form and is carried out of the container at the top. Furthermore, the container is provided with a cone coming in from below, arranged concentrically and extending to the level of the screen, which is open to the outside and thus forms together with the outer container wall an annular space of cross-section increasing towards the top, the cone having at the bottom a cylindrical addition.

The invention is illustrated by way of example in the accompanying drawing in which,

Figure 1 is a vertical section through the apparatus,

Figure 2 is a horizontal section on the line 2—2 of Figure 1,

Figure 3 is a plan, and

Figures 4 and 5 are vertical sections through a subdivided apparatus, namely

Figure 4 a section through the apparatus which essentially serves for the separation of the heavier constituents, and

Figure 5 a section through the apparatus which essentially serves for the separation of the lighter constituents.

In height the outer container 1 is subdivided into two zones A and B of which the zone A is formed by the part opening out conically downwards, and the zone B by the cylindrical part and the part connecting on downward and becoming smaller conically downward. The separation of the heavy constituents takes place in the part A and the separation of the lighter constituents in the part B. The supply of material takes place through the inlet 2 which, in order to attain as high a velocity of the material as possible is made in nozzle form and has the cross-section of a rectangle, the long side of which is parallel to the axis of the container, and the shorter side of which is as short as possible, i. e., in this case just so that the impurities pass through. In practice the dimension may be about 15 mm. In order to obviate trouble with the column of material rotating in the container, the inlet is so made that the inflowing material rests on the outside of the rotating column of material and only in the course of a revolution of about 360° gradually merges completely into the rotating column of material. Inside the container 1 is concentrically arranged the container 3 first opening out from below upwards in conical form and then running cylindrically.

The heavy constituents of the column of material are, in consequence of centrifugal action, thrown on to the wall of the container 1 and sink corresponding to the direction of flow, the conical shape of the part A and gravity to below the opening of the part 3, i. e., to below the zone C—C, whilst the material freed from these constituents rises into the container part 3. The greater the centrifugal force, the more parts are separated. In consequence of the conical shape of the container zone A, an increasing centrifugal force can develop from the cross-section 2—2 to the zone C—C. The material and water in the zone A thus represents a column which rotates in all parts with like angular velocity and the circumferential speed of which is consequently greater in the zone C—C than in section 2—2.

The parts A and B of the container 1 are separated by the screen 4 which leaves free an annular gap 5. The annular gap 5 must be as narrow as possible, in order to have for effect that the liquid in the zone B of the container 1 shall be carried away to the smallest possible extent by the rotating liquid in the part A. The lower limit of its width is, however, fixed by the nature of the heavy constituents which have to pass through. Consequently, the screen wall forming one side of the gap is kept as high as possible. The screen 4 is supported by a centrally arranged tube 6 which is carried upwardly out of the container and is continued in a pipe 7. The heavy constituents pass through the annular gap 5 into the zone B of the container 1, where only a slow rotation of the column of material takes place and the centrifugal force is practically equal to zero and where these constituents if they are capable of suspension are drawn into the pipe 6 and are carried away through the pipe 7 which has a valve or the like for regulating the suction effect.

By the suction in the annular space 5, a feeble current is produced which is sufficient to draw into the zone B the heavier parts held by the centrifugal force below the zone C—C on the container wall and there slowly sinking in consequence of gravity, so that they do not collect in the zone C—C and do not pass into the container 3. The opening of the pipe 6 in the screen 4 is screened at the bottom by a plate 8 and, furthermore, the pipes 6 and 7 are here of comparatively small cross-section, so that the suction effect of the pipe 7 only extends to the circumference of the screen 4 and no eddies are produced in the part B of the container in which the portions which are not capable of floating, sink down. The heavy constituents can be removed through a sluice valve, which consists of a container 9 which is attached to the part B of the container 1 by means of a slide 10 and which is closed at the bottom by a further slide 11. In the lower part of the sluice valve there opens a water supply pipe 13 adapted to be closed by a valve 12, and in the upper part an air pipe 15 adapted to be shut off by means of a valve 14. These two pipes have for their object to permit the sluice valve to be always completely filled with water before the opening of the slide 10, so that no injurious air enters on the opening of the sluice valve, into the container 1. There furthermore opens into the container 1 a delivery pipe 17 for dilution water, this pipe being closed by a valve 16.

The separation of the material from the lighter constituents takes place in the container part 3, these collecting round the pipe 6 whilst the material collects more towards the wall of the container part 3 in which it rises following the flow. The lighter constituents pass into a pipe 19 broadening out at the bottom into a small screen or hood 18 arranged in the upper part of the container 3, and which is arranged concentrically to the tube 6, and are exhausted through the pipe 20 which is provided with a regulating valve, by which they are carried to a supplementary cleaner or stuff save-all. The cleaned material passes, carried outwardly by centrifugal force, round the screen 19 out through the annular space 21 and is exhausted through the pipe 22 to the paper making machine. A valve or slide is provided in the pipe 22 for regulating the discharge.

Directly above the inlet 2 there is provided an annular space 23 which communicates through an outlet 24 with a discharge pipe having for its object to remove any air which may enter, out of the apparatus. Material leaving through the outlet 24 is again returned to circulation in the apparatus.

The operation of the device is all the more favourable the smaller the diameter of the annular space 21 as compared with the diameter of the container 1 directly below the inlet. These two diameters determine the velocity and thus also the inherent energy in the liquid in the inlet zone or respectively in the outlet zone. Consequently, the force at disposal in the container is dependent upon the difference of these two diameters. If the force is greater than the frictional resistances, the excess of the liquid rotating in the container zone A imparts an angular velocity which is the same in the zone C—C as in vicinity of the inflow, but a circumferential velocity which is greater in the zone C—C. The centrifugal force is most effective in the zone C—C. The cross-section of the annular space 21 is thus kept as small as the construction and output of the apparatus permit. On the other hand, the diameter of the container below the inflow cannot be kept very large for the purpose of increasing the differences in diameters,

since the size or amount of the centrifugal force is inversely proportional to the radius.

The apparatus thus operates under the following conditions:

In the zone A, where the centrifugal force is a maximum, the separation of the heaviest parts is at its best. In the zone B, where a circular movement takes place which corresponds to a centrifugal force of practically zero, and which is favourable for the separation based on gravity, there is a certain proportion of impurities which have been thrown out by a centrifugal force and drawn into the zone B and which have no sufficient density to effect their precipitation. These impurities are carried away through the pipes 6, 7 and finally pass on to the paper making machine if they are not separated by a dilution taking place. The outflow from the pipes 6 and 7 is delivered in a diluted condition to the manufacturing return water. This is treated in one or more similar apparatuses. These after purifiers work with very great dilution; consequently the separation of the heavy constituents in the zone B is better therein and the exhaust flow from the pipe 7 of such an auxiliary purifier, which is carried into the material circulation and finally reaches the paper machine, contains considerably fewer constituents which cannot be precipitated. The light constituents drawn away through the pipe 26 are diluted with material return water before they come to a save-all device, and are sent through one or more supplementary cleaners where the light constituents are separated, and then they pass to the save-all.

As in the case of the apparatus described, the separation of the lighter constituents taking place in the container part 3 is less effective since the centrifugal force is less in the container part 3 than in the zone A of the container part 1, if an effective separation of the lighter constituents is desired, the apparatus can be subdivided. The subdivision takes place preferably by the provision for the separation of the heavier constituents of a device which only differs from the one hitherto described by it not having the centrally arranged pipe 18 with the screen 19 and the exhaust pipe 20 for the lighter constituents. The outlet 22 of this apparatus communicates with the inlet 25 of a second apparatus, this if necessary with the interposition of a pump. This second apparatus which is intended for the separation of the lighter constituents consists of a container 26 the shape of which corresponds to the container part 3. The inlet 25 is arranged at the bottom but otherwise in the same way as with the container 1. In the cylindrical portion of the container 26, there is a screen 27 corresponding to the screen 19 and a centrally arranged pipe 28 corresponding to the pipe or tube 18 and which is continued in a pipe 29 corresponding to the outlet 20. The outlet of the cleaned stuff takes place through an opening 30, concentrically arranged round the pipe 28, and through the pipe 31. In order to attain an effective separation of the lighter constituents, the container 26 is provided with a part 32 converging concentrically from below upwards and open to the outside, and which from the bottom upward is first made cylindrical and then conical and extends by its tip up to the level of the screen or hood 27 and thus forms with the outer container wall, an annular space.

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