July 16, 1957 H. E. B. SCOTT 2,799,208

VORTEX TYPE SEPARATORS

Filed April 29, 1955 3 Sheets-Sheet 1

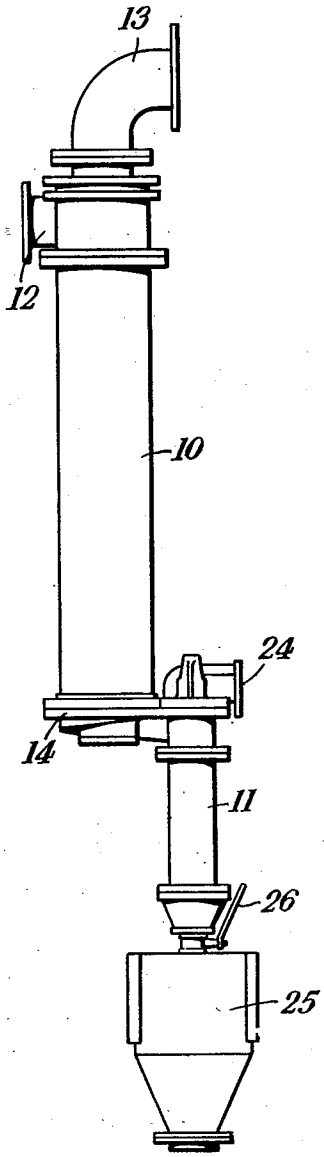

Fig. 1.

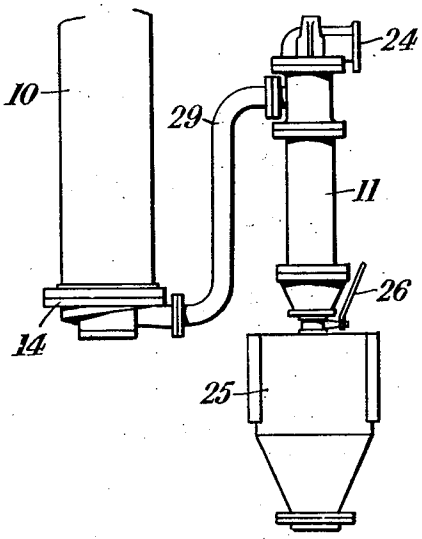

Fig. 4.

HAROLD ERIC BALIOL SCOTT,
INVENTOR.

By: Ross C Hurrey
ATTY

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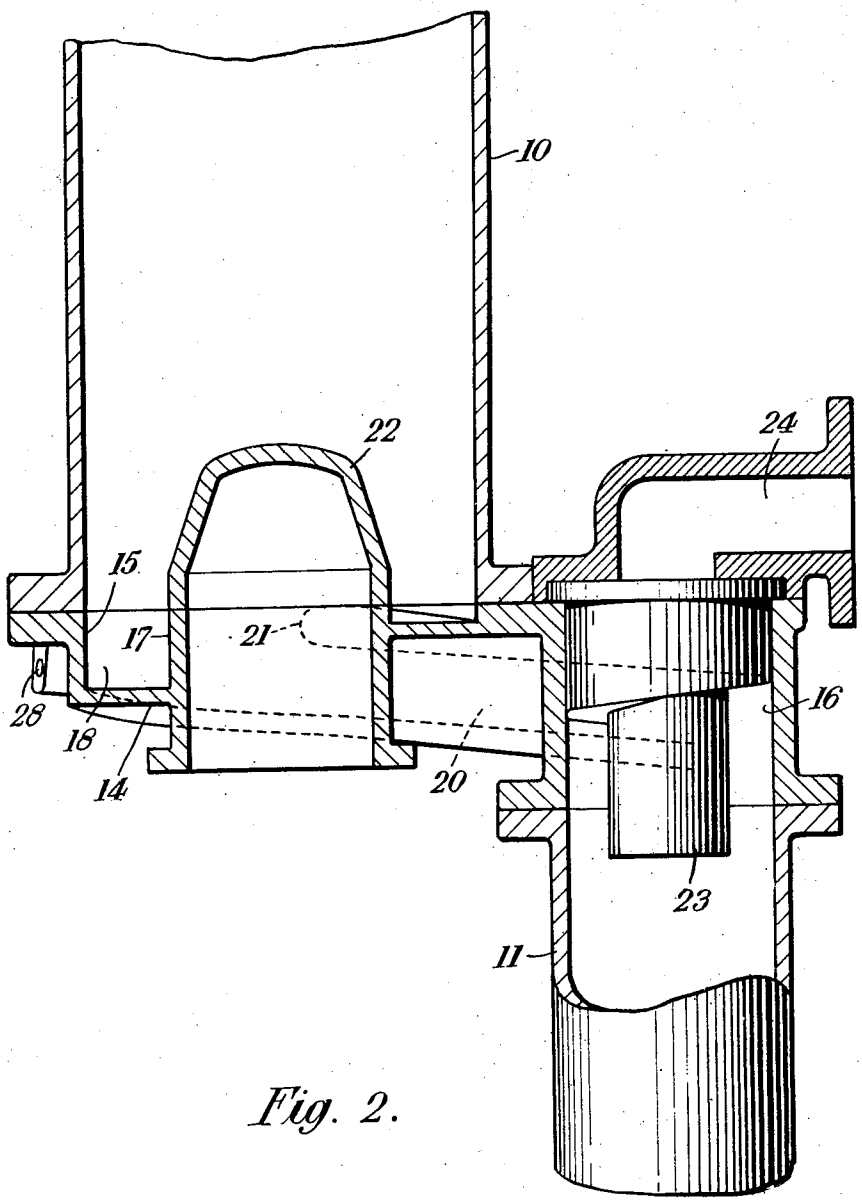

Fig. 2.

HAROLD ERIC BALIOL SCOTT
INVENTOR

By: Ross C. Hurrey
ATTY

July 16, 1957 H. E. B. SCOTT 2,799,208

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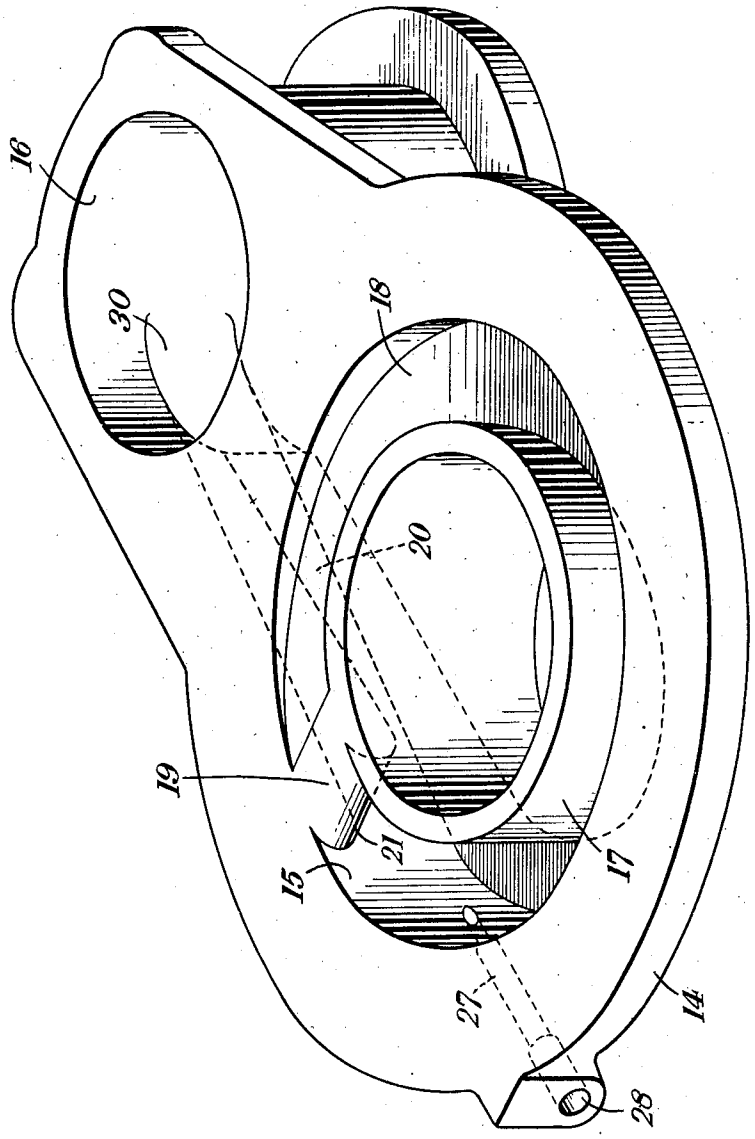

Fig. 3.

HAROLD ERIC BALIOL SCOTT,
INVENTOR

By: Ross C Burrey
ATTY.

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VORTEX TYPE SEPARATORS

Harold Eric Baliol Scott, The Heath, Weybridge, England

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14 Claims. (Cl. 92—28)

This invention relates to vortex type separators for cleaning paper pulp. Such machines comprise an upright vortex chamber of circular section, having at its upper end a tangential pulp inlet and a central pulp outlet for withdrawing purified stock upwardly from the vortex chamber. The impurities in the stock, herein termed "dirt," are thrown outwardly by centrifugal force towards the inner wall of the vortex chamber and are removed at the bottom of the vortex chamber. Vortex type separators are also known comprising a main vortex chamber of this kind and a secondary vortex chamber, the dirt and some good stock being discharged through a tangential outlet at the base of the main vortex chamber to the tangential inlet of the secondary vortex chamber for further purification and purified stock leaving the secondary vortex chamber through a central outlet at its upper end.

Experience has shown, however, that when a tangential outlet for the dirt is provided at the base of the main vortex chamber, some of the dirt fails to pass through the outlet and tends to accumulate in the base of the chamber and to swirl round causing wear by abrasion.

With a view to avoiding this disadvantage, the base of the main vortex chamber is provided according to the invention with a circumferential helicoidal groove of progressively increasing depth, constituting the outlet for the dirt and leading, without change of direction, into a transfer passage communicating with the secondary vortex chamber. Consequently, as the dirt, travelling in a helical path down the inner wall of the vortex chamber, reaches the bottom thereof it continues to travel downwards in a helical path along the inclined undersurface of the groove and so into the transfer passage. The dirt accordingly travels in a smooth manner and without change of direction until it has entered the transfer passage and is therefore prevented from remaining in and swirling round in the base of the main vortex chamber.

The subsidiary vortex chamber may be located remotely from the main vortex chamber and connected thereto by a pipe connecting the transfer passage and the inlet to the secondary chamber. Preferably, however, a common member, conveniently a casting, constitutes the base of the main chamber and the upper portion of the secondary chamber.

Two embodiments of vortex type separator according to the invention will now be described in more detail, by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a side elevation of the first embodiment of separator,

Fig. 2 is a vertical section on a larger scale through the base of the main vortex chamber and the upper portion of the secondary vortex chamber.

Fig. 3 is a perspective view, on a still larger scale, through the member, common to the two vortex chambers, through which dirt is discharged from the main to the secondary vortex chamber and

Fig. 4 is a side elevation of the second embodiment of separator.

Like reference numerals indicate like parts throughout the figures.

The separator shown in Figs. 1–3 comprises a main cylindrical vortex chamber **10** and a secondary cylindrical vortex chamber **11**. At the upper end of the main vortex chamber are provided the usual tangential inlet **12** for the pulp to be treated and central outlet **13** for upward withdrawal of purified pulp. The two vortex chambers are connected by a common casting **14** which, as shown most clearly in Fig. 3, is formed with a large hole **15** of the same diameter as the internal diameter of the main vortex chamber **10** and a laterally offset smaller hole **16** of the same diameter as the internal diameter of the secondary vortex chamber **11**. In the large hole **15** is an annular wall **17**, spaced inwardly from the wall of the hole **15** and defining with it a helicoidal circumferential groove **18**. The two walls are jointed by a radial member **19** flush with their upper ends and the groove **18** increases gradually in depth, starting at the right hand side of the member **19** (as seen in Fig. 3) and passing below the member, where it leads into a transfer passage **20** communicating with the smaller hole **16**. The member **19** thus constitutes the upper end of the inlet to the transfer passage **20**. As shown it has a rounded nose **21** presenting a convex surface towards the circumferential groove **18**. This is of value where the separator has to deal with long fibres.

As shown in Fig. 2, a central upstanding baffle **22** is provided at the base of the main vortex chamber in order to cause the vortex to terminate at a level above the base and so provide tranquil conditions at the entrance to the transfer passage **20**. The baffle **22**, which is fitted to the top of the annular wall **17**, may be of any known shape e. g. mushroom shape, and in the case of coarse paper or board stock it is conveniently, as shown, in the form of a truncated cone. The upper end of the baffle **22** is preferably of wear resistant material, as the vortex terminates on the upper end of the baffle.

As will be appreciated the dirt, whch is travelling in a helical path in the outer zone main vortex chamber **10** as the result of vortex formation thereon, continues to travel helically along the helicoidal groove **18** whence it passes, without change in direction, into the transfer passage **20** and so into the hole **16**. The dirt, carrying some good stock with it, enters tangentially at **30** (Fig. 3) an annular space between the inner wall of the secondary vortex chamber **11** and a head **23** fitted into the upper end of the chamber **11**. Further separation takes place by vortex formation in the chamber **11**, purified stock rising from the chamber **11** through the hollow interior of the head **23** and emerging through an outlet **24**. The dirt accumulates in a sump **25** and is periodically discharged from the sump by closing a valve **26** between the vessel **11** and the sump and opening a discharge valve in the base of the sump.

In the base of the main vortex chamber **10** is provided a nozzle **27** by means of which clean water, or what is known in the paper industry as "white" or "back" water, can be directed into the helicoidal groove **18**. The addition of water in this region dilutes the rejected dirt and suspect fibre and assists in the final separation of the dirt in the secondary vortex chamber **11**.

The jet of water which is directed into the helicoidal groove **18** also assists in keeping moving any large particles of the lighter grade of rejects, such as bundles of fibres or shreds of wet strength papers. If desired the water nozzle **27** may be extended so that it leads from the entry **28** at the periphery of the main vortex chamber **10** directly into the inlet of the transfer passage **20**. Then,

by using a higher water pressure, an ejector action is obtained which increases the rate of flow along the transfer passage 20 and also the velocity of the stock into the secondary vortex chamber 11. The higher velocity into the secondary vortex chamber 11 increases the centrifugal force which gives a better separation of the dirt.

The separator shown in Fig. 4 differs from that so far described in one respect only. The secondary vortex chamber 11 is disposed remotely from the main vortex chamber 10 and the dirt flows from the transfer passage to the inlet of the secondary vortex chamber through a pipe 29 connecting the two vortex chambers.

I claim:

1. A vortex type separator for paper pulp comprising: a main vortex chamber; a secondary vortex chamber having a tangential inlet; a transfer passage by which the lower end of said main vortex chamber communicates with the inlet of said secondary vortex chamber, said transfer passage being tangential with respect to said main vortex chamber, the base of said main vortex chamber having a circumferential, helicoidal groove of progressively increasing depth constituting an outlet for dirt and communicating with said transfer passage, the pitch of said groove being such that the bottom of the groove comes flush with the bottom of the transfer passage in substantially one turn of the groove around the main vortex chamber.

2. A vortex type separator according to claim 1, in which the secondary vortex chamber is remote from the main vortex chamber and the transfer passage communicates by means of a pipe with the inlet to the secondary vortex chamber.

3. A vortex type separator according to claim 1 in which the upper surface of the inlet end of said transfer passage is rounded to present a convex surface toward said groove.

4. A vortex type separator according to claim 1 including a central, upstanding baffle at the base of said main vortex chamber.

5. A vortex type separator according to claim 1 including a nozzle mounted in the base of said main vortex chamber for injecting dilution fluid into said circumferential groove.

6. A vortex type separator according to claim 1 including a nozzle mounted in the base of said main vortex chamber for injecting dilution fluid into said transfer passage beyond the inlet thereof.

7. A vortex type separator for paper pulp comprising: a main vortex chamber; a secondary vortex chamber having a tangential inlet; a transfer passage by which the lower end of said main vortex chamber communicates with the inlet of said secondary vortex chamber, said transfer passage being tangential with respect to said main vortex chamber, the base of said main vortex chamber having a circumferential, helicoidal groove of progressively increasing depth constituting an outlet for dirt and communicating with said transfer passage, said helicoidal groove and transfer passage being provided in a common member, constituting the base of the main vortex chamber and the upper portion of the secondary vortex chamber.

8. A vortex type separator according to claim 7 in which the upper surface of the inlet end of said transfer passage is rounded to present a convex surface toward said groove.

9. A vortex type separator according to claim 7 including a central, upstanding baffle at the base of said main vortex chamber.

10. A vortex type separator according to claim 7 including a nozzle mounted in the base of said main vortex chamber for injecting dilution fluid into said circumferential groove.

11. A vortex type separator according to claim 7 including a nozzle mounted in the base of said main vortex chamber for injecting dilution fluid into said transfer passage beyond the inlet thereof.

12. A vortex type separator for paper pulp comprising: an upright cylindrical vortex vessel, having at its upper end a tangential pulp inlet and a central pulp outlet for withdrawing purified pulp in an upward direction and having in its base a circumferential helicoidal groove of progressively increasing depth leading, without change of direction, into a tangential passage for discharging dirt, the pitch of said groove being such that the bottom of the groove comes flush with the bottom of said tangential passage in substantially one turn of the groove around said vortex vessel.

13. A vortex type separator according to claim 12 in which the upper surface of the inlet end of said transfer passage is rounded to present a convex surface toward said groove.

14. A vortex type separator according to claim 12 including a central, upstanding baffle at the base of said main vortex chamber.

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