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Trawinski

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[54] **HYDROCYCLONE ARRANGEMENT**

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[52] **U.S. Cl.** **210/322,** 210/512

[51] **Int. Cl.** **B01d 21/26**

[58] **Field of Search** 210/253, 322, 512; 209/211; 55/349

[56] **References Cited**

UNITED STATES PATENTS

2,781,907	2/1957	Fohtein	209/211
2,804,206	8/1957	Turpin	209/211
2,825,147	3/1958	Silver	55/349 X
3,034,647	5/1962	Giesse	209/211 X
3,313,413	4/1967	Delcellier	209/211
3,386,588	6/1968	Ades	209/211 X

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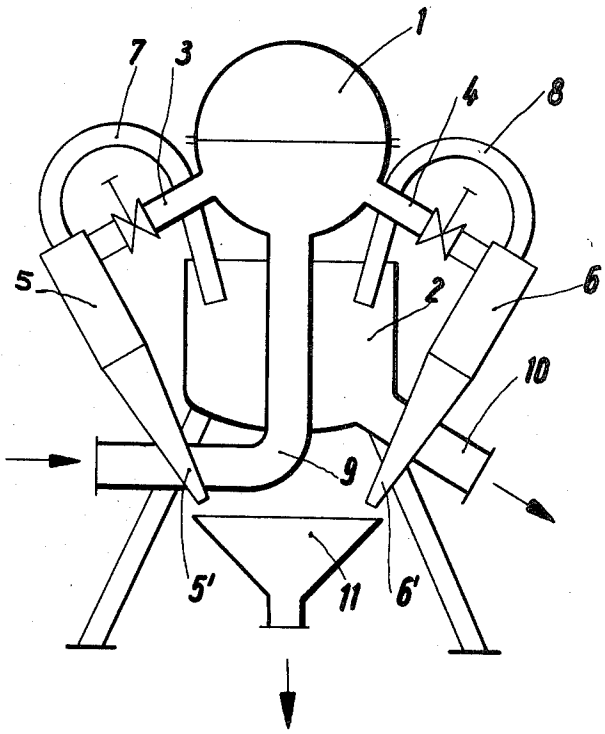
Attorney, Agent, or Firm—Toren, McGeady & Stanger

[57] **ABSTRACT**

In a hydrocyclone arrangement at least two hydrocyclones are spaced laterally apart with a filling chamber, an overflow chamber and an underflow chamber arranged centrically of the hydrocyclones. The filling chamber is aligned above the overflow chamber and the underflow chamber is aligned below the overflow chamber. The hydrocyclones are disposed obliquely of the vertical so that the underflow from each is directed into the underflow chamber. The filling chamber has a spherical configuration and a separate connection extends radially outwardly from the filling chamber to each of the hydrocyclones. A supply connection extends vertically upwardly into the filling chamber passing vertically through the overflow chamber and then extending horizontally outwardly or continuing to proceed vertically through the underflow chamber. Replaceable wear protection parts are positioned in the filling chamber and the filling chamber is constructed so that it can be opened for access to the wear protection parts. Further, the wear protection parts can be arranged to form enclosed wear indication spaces within the filling chamber connected through a tubular member with the outside atmosphere. Each of the filling chamber, overflow chamber and underflow chamber can be divided in two by vertical partitions for forming independent functional groups of the separate chambers each associated with a different hydrocyclone.

12 Claims, 8 Drawing Figures



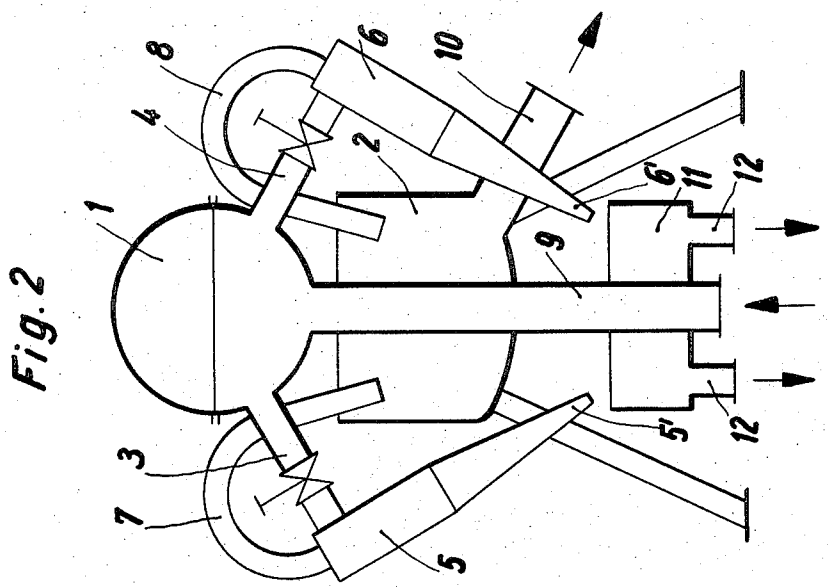


Fig. 2

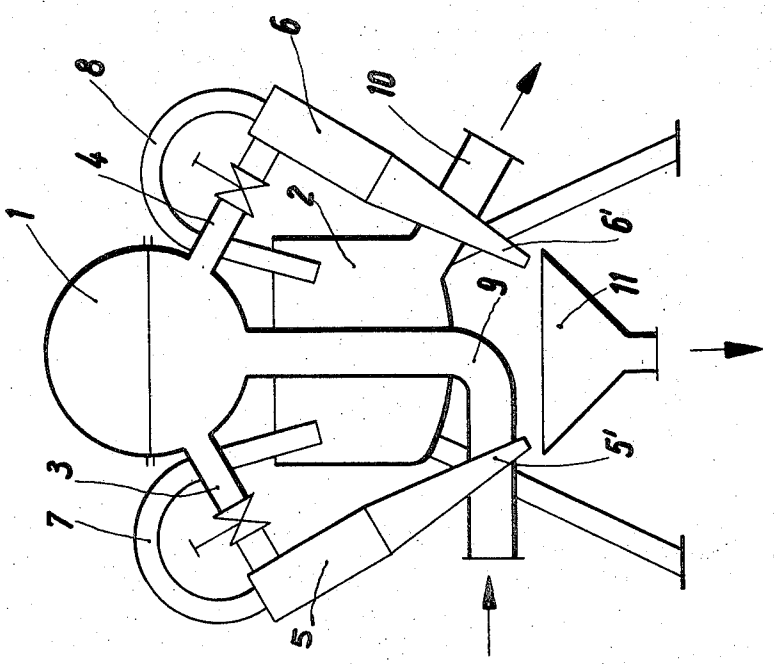


Fig. 1

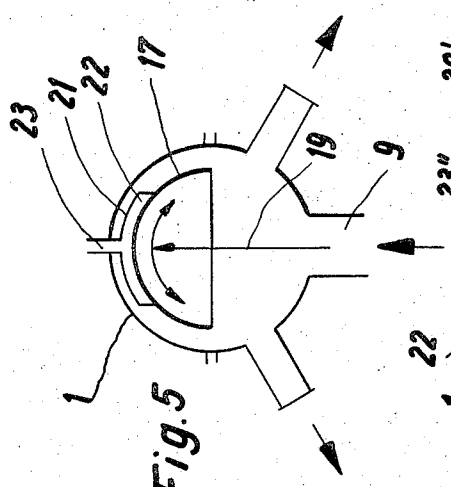


Fig. 5

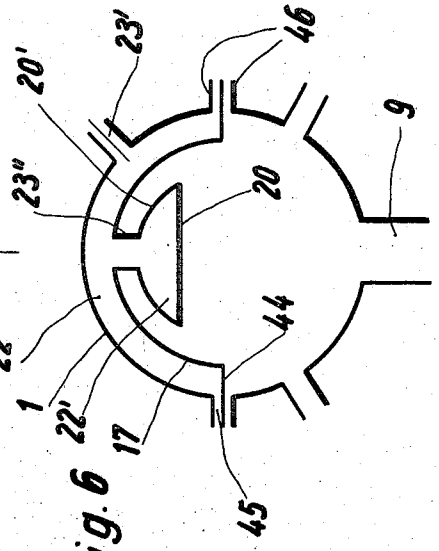


Fig. 6

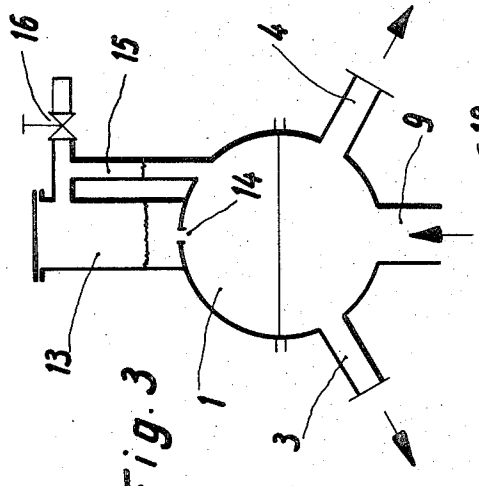


Fig. 3

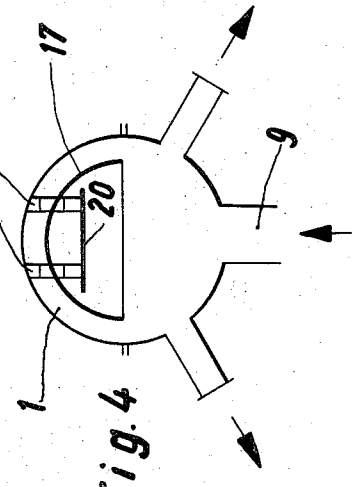
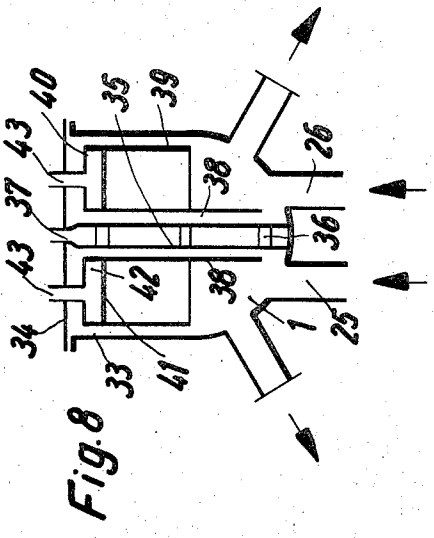


Fig. 4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34
1
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33
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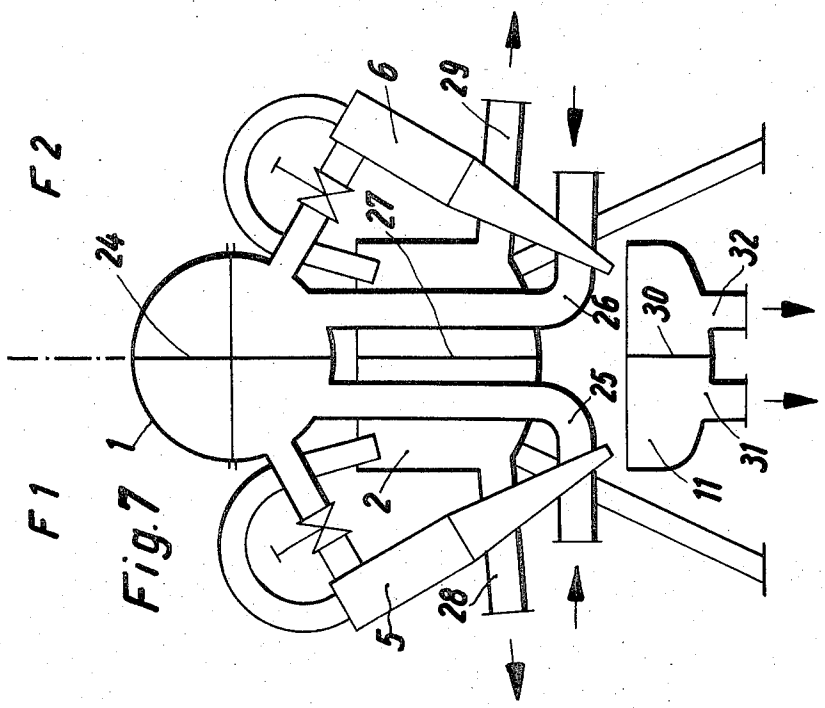
Fig.8


F2
6
29
24
27
32
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30
25
1
31
11
F1
2
5
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Fig.7

HYDROCYCLONE ARRANGEMENT

SUMMARY OF THE INVENTION

The present invention is directed to a hydrocyclone arrangement including two or more hydrocyclones and, more particularly, it concerns the arrangement of a common filling chamber, a common overflow chamber and a common underflow chamber disposed in vertical alignment and spaced centrically of the hydrocyclones. Further, the hydrocyclones are oriented at an angle to the vertical so that underflow from the hydrocyclones is directed into the underflow chamber located below the filling chamber and the overflow chamber.

In similar known hydrocyclone arrangements the filling chamber is positioned below the overflow chamber and, as a result the overflow extends over a relatively great height and the total pressure in the plant is very high. Further, the connections from the filling chamber to the hydrocyclones must be curved which, from a construction point of view, is expensive and results in increased wear.

Therefore, the primary object of the present invention is to afford an improved hydrocyclone arrangement which is less expensive to manufacture and avoids the difficulties previously experienced.

In accordance with the present invention, the filling chamber is located above the overflow chamber and the connections between the filling chamber and the hydrocyclones extend rectilinearly between the two of them. With the overflow chamber located below the filling chamber the energy required for pumping the overflow and the necessary pressure are very low. Further, the overall height of the hydrocyclone arrangement is reduced, since the filling, overflow and underflow chambers can be directly superposed and dead space between them is avoided.

In preferred embodiments of the hydrocyclone arrangement, the filling chamber can be formed of a spherical body so that the connections to the hydrocyclones extend radially outwardly in a rectilinear manner so that wear-causing bends are avoided. Further, the hydrocyclone arrangement affords a very compact construction which is inexpensive to produce and is rugged in operation.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive manner in which there are illustrated and described preferred embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is a schematic representation of a hydrocyclone arrangement embodying the present invention;

FIG. 2 is a view similar to FIG. 1 showing another embodiment of a hydrocyclone arrangement in accordance with the present invention;

FIGS. 3 to 6 schematically represent four possible embodiments of a filling chamber for use in the hydrocyclone arrangement of the present invention;

FIG. 7 is a schematic representation of a hydrocyclone arrangement in accordance with the present invention sub-divided into two functional groups; and

FIG. 8 is a schematic representation of another embodiment of a filling chamber which can be used in the hydrocyclone arrangement of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

In FIG. 1 a hydrocyclone arrangement is illustrated including a feed chamber 1 aligned vertically above an overflow chamber 2 and an underflow chamber 11 aligned below the overflow chamber. Several individual hydrocyclones 5, 6 are arranged symmetrically and concentrically about the filling, overflow and underflow chambers 1, 2 and 11. The filling chamber 1 is spherically shaped and connections 3, 4 extend radially outwardly in a rectilinear manner from the filling chamber to the upper ends of the hydrocyclones 5, 6. Overflow bends 7, 8 extend from each of the hydrocyclones into the upper end of the overflow chamber. Due to the position of the overflow chamber 2 below the filling chamber 1 the overflow bends 7, 8 are relatively short. At its lower end, the overflow chamber is provided with an overflow connection 10. A supply pipe 9 is connected to the lower end of the filling chamber and extends vertically downwardly through the overflow chamber 2 and then is bent horizontally passing between the lower end of the overflow chamber and the upper end of the underflow chamber. The longitudinal axes of the hydrocyclones 5, 6 extend obliquely to the vertical so that the underflow outlet 5', 6' of each is directed toward the upper end of the underflow chamber 11. Preferably, the filling chamber 1 is spherical in shape, as mentioned above, and is formed of two parts for gaining access to its interior.

In FIG. 2 the supply connection 9 extends vertically downwardly through both the overflow chamber 2 and the underflow chamber 11 and, as a result, the underflow chamber has its outlets located laterally about the supply connection 9. In FIG. 1 the outlet from the underflow chamber 11 is located centrally. Though not shown, it is also possible for the supply connection 9 to enter the filling chamber at its top and, in such an arrangement, the overflow chamber 2 and the underflow chamber 11 are free of any restrictions.

In FIG. 3 an arrangement is shown for the degasification of the filling chamber 1 which can be easily effected during operation. Mounted on and extending upwardly from the crown of the filling chamber 1 is a collecting chamber 13 for gases or air which communicates with the interior of the filling chamber through an opening 14. Spaced from the collecting chamber 13 and in communication with and extending upwardly from the filling chamber is a transparent control indicator tube 15. At the upper end of the tube 15 a valved connection 16 joins it to the collecting chamber 13 and provides an exhaust for gas or air.

Another feature of the invention is the arrangement of the filling chamber 1 for affording the installation of replaceable wear protection parts. As illustrated in FIG. 4, a hemispherically shaped wear protection part 17 is supported in the upper half of the spherically shaped filling chamber 1 by means of supporting bolts 18. Further, a wear plate 20 extends horizontally within the hemispherically shaped wear part 17 and is attached to the lower ends of the supporting bolts 18.

In FIG. 5 a wear indication assembly is shown which consists of the hemispherically shaped wear protection part 17 and an additional arcuately shaped plate 21 joined to the wear protection part 17 and located between it and the inner surface of the filling chamber 1. The wear protection part 17 and the plate 21 combine to form a space 22 to which a sealed pipe 23 is connected and extends outwardly from the filling chamber so that the space 22 is in pressure-free communication with the outside atmosphere. In this arrangement, if a part of the liquid jet entering through the supply connection 9 into the filling chamber should penetrate through the wear protection part 17 the leak would be immediately apparent due to the flow through the pipe 23. For replacement of the wear protection part 17, the filling chamber is formed of two parts or is provided with a removable cover for affording access to its interior.

Alternatively, the wear protection part 17 and the wear plate 20 can be held within the filling chamber 1 in the manner shown in FIG. 6 where the wear protection part 17 has an annular flange 44 extending into the joint 45 or between the connecting flanges 46 of the two halves of the filling chamber and forming a sealed space 22 between the wear protection part 17 and the inner surface of the chamber 1. By providing a connection 23' through the upper half of the chamber 1 into the space 22, a wear indicator is provided for observing any leakage into the space 22. In FIG. 6, the wear plate 20 is supported from the wear protection part 17 by means of an arcuately or cup-shaped member 20' and a tubular member 23'' which affords pressure equalization between space 22' formed between the plate 20 and the member 20' and the space 22.

In FIG. 7 the hydrocyclone arrangement is shown divided into two functional groups F_1 and F_2. Each of the filling chamber 1, the overflow chamber 2 and the underflow chamber 11 are divided by vertically extending partitions 24, 27 and 30, respectively, into two functionally independent halves. Each half formed by the corresponding partition is in communication with a different one of the hydrocyclones 5, 6. Additionally, separate supply connections 25, 26 are provided to each of the separate halves of the filling chamber, separate outlets 28, 29 are provided from each of the halves of the overflow chamber, and separate outlets 31, 32 are provided from the halves of the underflow chamber.

In FIG. 8 a different configuration of the filling chamber 1 is shown, formed by a lower hemisphere with a cylindrically shaped part extending upwardly from the upper end of the hemisphere. Accordingly, it should be appreciated that the hydrocyclone arrangement need not be limited to any particular configuration of the filling chamber. As with the arrangement shown in FIG. 7, the filling chamber is divided into two functionally separated halves by a double-walled partition 35 which, in turn, is designed as a wear indication means. Distance blocks 36 extend between the double walls of partition 35 and a tubular member 37 extends upwardly from the upper ends of the partition 35 through the filling chamber for forming a wear indicator open to the outside atmosphere. Arranged on both sides of the double-walled partition 35 are wear members formed of vertically extending plates 38, semi-cylindrically shaped walls 39 spaced from the plates and semi-circular plates 40 connecting the upper ends of the plates 38 and the walls 39. In addition, wear plates 41 are positioned between the semi-circular plates 40 within the space formed by the wearing member and forming additional wear indication spaces 42 between the plates 40 and 41. Tubular members 43, in communication with the spaces 42, extend upwardly from the plates 40 through the upper end of the filling chamber 1 into communication with the outside atmosphere for displaying any leakage into the spaces 42.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the inventive principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. Hydrocyclone arrangement, including at least two laterally spaced hydrocyclones, a common filling chamber, a common overflow chamber and a common underflow chamber positioned centrally of said cyclones with said underflow chamber located below said filling chamber and said overflow chamber, each of said hydrocyclones disposed at an angle to the vertical with its underflow outlet directed toward said underflow chamber for flow thereto, wherein the improvement comprises that said filling chamber is located above said overflow chamber with said filling chamber, said overflow chamber and said underflow chamber in vertical alignment, a separate feed connection extending directly between said filling chamber and each of said hydrocyclones with each said feed connection extending outwardly in a straight line from said filling chamber to said hydrocyclone to which it is connected, a supply pipe connected to the lower end of said filling chamber and extending centrally downwardly therefrom through said overflow chamber and said overflow chamber positioned laterally inwardly from said hydrocyclones.

2. Hydrocyclone arrangement, as set forth in claim 1, wherein said filling chamber is spherically shaped and said feed connections extend radially outwardly from said filling chamber to said hydrocyclones.

3. Hydrocyclone arrangement, as set forth in claim 1, wherein said supply pipe extends centrally downwardly through said underflow chamber, and said underflow chamber has outlet connections disposed laterally outwardly from said supply pipe.

4. Hydrocyclone arrangement, as set forth in claim 1, wherein means are arranged for forming a collecting chamber in communication with the upper end of said filling chamber for affording degasification of said filling chamber.

5. Hydrocyclone arrangement, as set forth in claim 1, wherein replaceable wear protection means are located within said filling chamber and said filling chamber is formed of separable parts for affording access to said wear protection parts.

6. Hydrocyclone arrangement, as set forth in claim 5, wherein wall means are positioned within said filling chamber and arranged in combination with said wear protection means for forming a closed wear indication chamber within said filling chamber, a tubular member extending through said filling chamber and communicating between the interior of said wear indication chamber and the atmosphere exteriorly of said filling chamber.

7. Hydrocyclone arrangement, as set forth in claim 5, wherein said wear protection means includes a hemi-

spherical shaped wear protection part spaced inwardly from the innver surface of said filling chamber.

8. Hydrocyclone arrangement, as set forth in claim **7**, wherein said wear protection means includes a horizontally arranged circular disc disposed within said hemispherically shaped wear protection part.

9. Hydrocyclone arrangement, as set forth in claim **7**, wherein an arcuately shaped wall is positioned between the upper part of said filling chamber and said hemispherically shaped wear protection part and is joined to said wear protection part for forming a closed chamber therebetween, and tubular connection means extending between said closed chamber and the outside atmosphere so that it is in pressure free communication with the outside atmosphere.

10. Hydrocyclone arrangement, as set forth in claim **1**, wherein a first vertical partition is positioned within said filling chamber and divides said filling chamber into two separate halves each associated with a different said hydrocyclone, a second vertical partition within said overflow chamber dividing it into two separate halves with each half associated with a different said hydrocyclone, and a third vertical partition positioned within said underflow chamber dividing it into two separate halves with each half associated with a different said hydrocyclone, a separate supply pipe connected to each of said halves of said filling chamber, a separate outlet from each of said halves of said underflow chamber, wear protection means located within each of said halves of said filling chamber, and said hydrocyclone arrangement providing two functional groups each including at least one different said hydrocyclone, one half of said filling chamber, one half of said overflow chamber and one half of said underflow chamber.

11. Hydrocyclone arrangement, as set forth in claim **1**, wherein an arcuately bent overflow connection extends from the upper end of each said hydrocyclone to said overflow chamber with the upper limit of said overflow connections located below the upper limit of said filling chamber.

12. Hydrocyclone arrangement, as set forth in claim **1**, wherein a portion of said supply pipe spaced below said overflow chamber extends horizontally outwardly from the portion which extends centrally downwardly through said overflow chamber and said horizontally arranged portion is located below said overflow chamber and above said underflow chamber.

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