Jan. 13, 1953 W. C. CONKLING 2,625,305

STREAM SPLITTER FOR DIVIDING GRANULAR MATERIALS

Filed June 2, 1950 2 SHEETS—SHEET 1

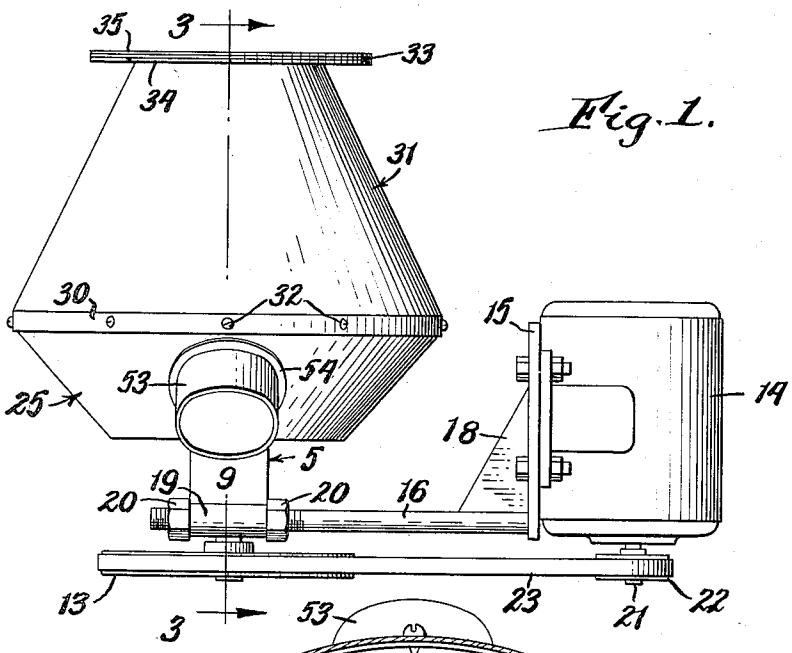


Fig. 1.

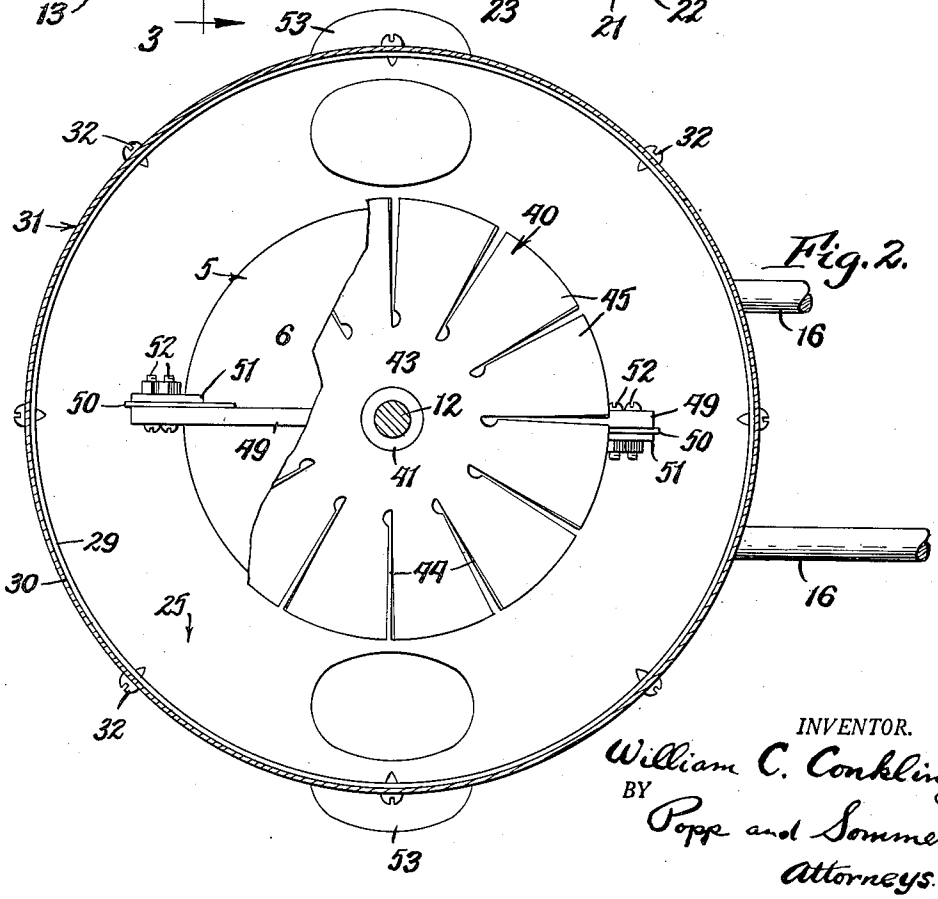


Fig. 2.

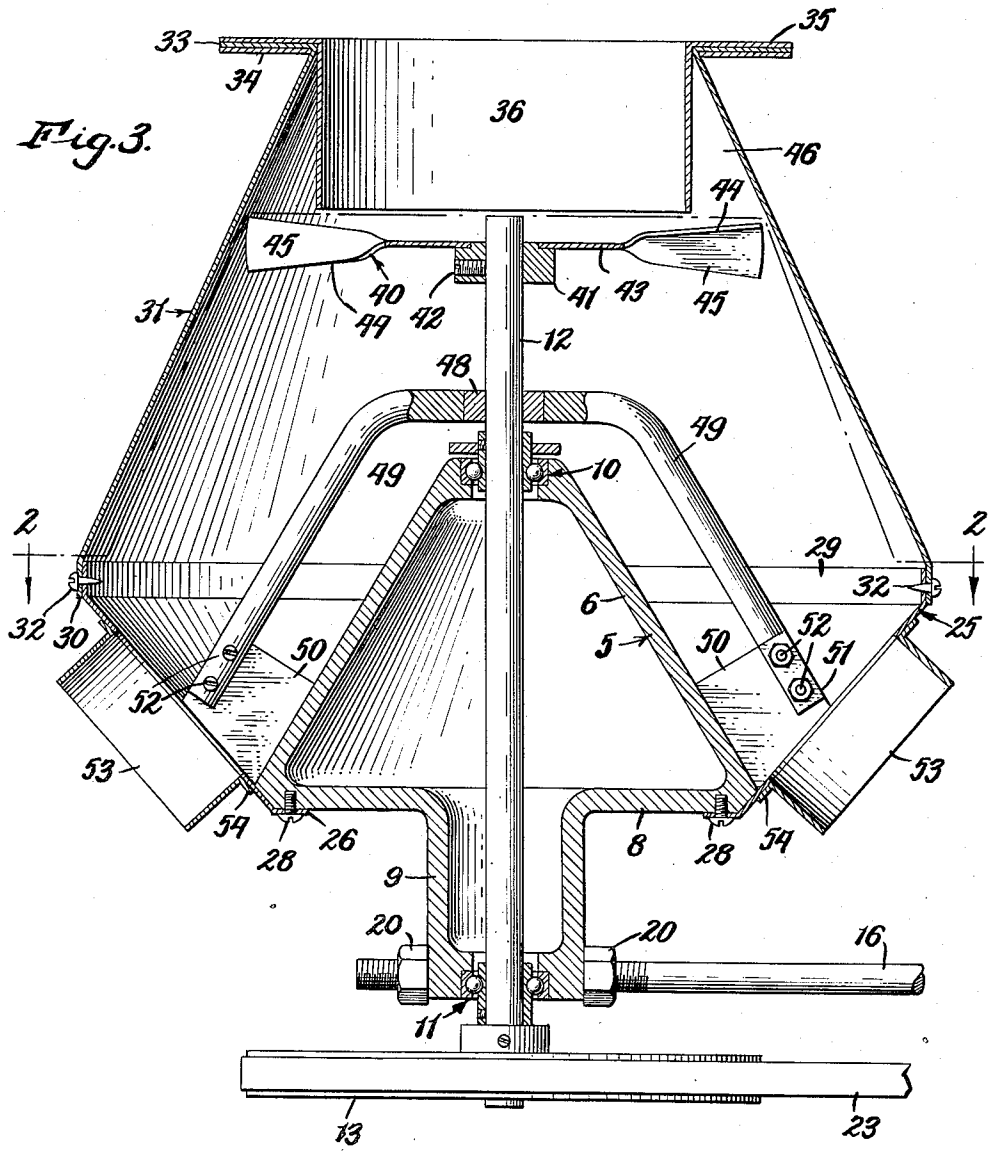
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Fig. 3.



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STREAM SPLITTER FOR DIVIDING GRANULAR MATERIALS

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6 Claims. (Cl. 222—330)

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This invention relates to stream dividers or splitters such as are used to divide a stream of solid materials, such as stock in a flour mill, into a plurality of streams each forming a predetermined percentage of the input stream, it being important that the division be made with a high degree of accuracy to insure, for example, uniform feed of the stock to opposite ends of a high speed sifter. Without such uniform feed of stock to the opposite ends of a high speed sifter, the sifter would be unbalanced and its screening efficiency greatly reduced.

Stream dividers or splitters of a type that can be designated as a pressure type of distributor have been proposed. These distributors depend upon a reservoir of material, the effective level in which is maintained by a mechanical device for retarding the discharge from the reservoir, or, conversely, a mechanical device is provided for discharging the material from the reservoir at a rate equal, on the average, to the rate of supply. The reservoirs are usually roughly cylindrical in shape and are mechanically agitated. In every case a second agitator tends to force the discharge of the material by centrifugal action in the form of a radial curtain of uniform thickness. The discharge spouting is arranged to catch various areas of the curtain in certain general percentages of the total flow. Such pressure types of distributors are susceptible to inaccuracies of division due to packing or fouling of the stock. Further the effective range of any size of such a distributor is limited; the capacity is also limited and the power consumption relatively high.

Stream dividers or splitters of a type that can be designated as a whirling distribution type of distributor have also been proposed. In such distributors devices are used to impart whirling motion to a vertically falling stream of stock in order to disperse it into a disk-like curtain of stock formed because of the tendency of the particles to take a radial path. The discharge spouting is arranged to catch certain percentages of the curtain and effect certain divisions of the total flow. Such whirling types of distributors have poor dividing accuracy at low rates. Although these dividers divide well when running at full capacity, when there is only a small stream of stock flowing off center it is picked up, whirled around in a concentrated mass, diffused some, but discharged to a large extent along a limited peripheral length of the rotating member. Further the effective range of any size of such a distributor is limited and the capacity is also limited.

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It is the principal object of the present invention to provide a stream splitter or divider which has a high degree of accuracy of the split or division at all rates of flow of the material being handled.

Another object is to provide such a stream splitter capable of handling a wide range of flow of stock and which also, in any one position of adjustment, also effects satisfactory division over a wide range of flow so that frequent adjustments with normal flow variations are unnecessary.

Another object is to provide such a stream splitter which for its size has high capacity.

Another object is to provide such a stream splitter which has low power consumption.

Other objects are to provide such a stream splitter which is simple in construction and which is not likely to get out of order or require repair under conditions of severe and constant use.

Other objects and advantages of the invention will be apparent from the following description and drawings in which:

Fig. 1 is a side elevation of a stream divider embodying the present invention.

Fig. 2 is a horizontal section taken on line 2—2, Fig. 3.

Fig. 3 is a vertical section taken on line 3—3, Fig. 1.

The stream divider or splitter embodying the present invention is shown as comprising a casting 5 having a conical upper part 6 which converges upwardly, a horizontal part 8 extending inwardly from the lower rim of the conical part 6 and a neck 9 projecting downwardly from the central part of the horizontal part 8. At the apex of the conical part 6 the casting 5 carries a ball bearing 10 and a similar ball bearing 11 is mounted in the lower end of the neck 9. These ball bearings are combined radial and thrust bearings and jointly support a vertical shaft 12 which is shown as driven through a pulley 13 secured to its lower end.

To drive the pulley 13 an electric motor 14 is carried by the casting 5. For this purpose the motor is secured to a bracket 15 having a pair of horizontal projecting rods 16, triangular reinforcing plates 18 being welded to the motor bracket 15 and each of the rods 16 to provide the necessary rigidity. The rods 16 straddle the axis of the depending neck 9 of the casting 5 and extend through a pair of horizontal bores through horizontal semicylindrical enlargements 19 provided on opposite sides of the depending neck

9. The free ends of the rods 16 are threaded and are secured to the depending neck 9 by a pair of nuts 20. The shaft 21 of the motor 14 carries a pulley 22 in line with the pulley 13 and connected therewith by a driving belt 23.

The casing or housing of the stream divider comprises a lower sheet metal conical section 25 which diverges upwardly and has its lower or small rim 26 extending under the conical portion 6 of the casting 5 and secured to the rim of the horizontal part 8 of this casting by an annular row of screws 28 or in any other suitable manner. The upper or large end of the conical section 25 is formed to provide an upwardly extending vertical rim 29 to which is secured the large depending rim 30 of an upper sheet metal conical section 31 which converges upwardly. The lower or large rim 30 of the upper conical section 31 is shown as fitting around the upwardly extending large rim 29 of the lower conical section 25 and as secured thereto by an annular series of screws 32. The upper small end of the upper conical section 31 is shown as being formed to provide an outwardly projecting annular flange 33 which can be reinforced by an annular sheet metal flat ring 34 disposed against its under side. This flange 33 also carries the outwardly projecting annular flange 35 of a short inlet tube 36 which extends downwardly into the small upper end of the upper conical section 31.

Immediately below the lower end of this short tube 36 there is an agitator or fan-like impeller 40 which is fast to the vertical shaft 12. This agitator or fan-like impeller 40 is shown as comprising a hub 41 secured to the shaft 12 by a set screw 42 and a sheet metal disc 43 suitably secured to this hub 41. As best shown in Fig. 2 this disc 43 of the agitator or fan-like impeller is provided at intervals with radial slits 44 extending inwardly from its periphery and the blades 45 so formed are each twisted at an angle of about 22 degrees relative to the horizontal so as to provide fan or impeller blades. The direction of rotation of the vertical shaft 12 is such that these blades tend to drive the stock being handled upwardly into the space 46 between the short inlet tube 36 and the upper end of the upper conical section 31 of the casing. It will also be noted that the set screw 42 permits of vertical adjustment of the agitator or fan-like impeller 40 with reference to the lower end of the short inlet tube 36.

Below the agitator or fan-like impeller 40 the vertical shaft 12 carries the hub 48 of a pair of sweep arms 49 which rotate with the shaft 12. These sweep arms extend downwardly in diverging relation to each other generally parallel with the conical part 6 of the casting 5. At its lower end each of these arms 49 carries a sweep 50 of leather or other suitable material, these sweeps being shaped to fit the corner between the conical part 6 of the casing 5 and the upwardly diverging lower conical section 25 of the casing of the stream divider. The sweeps 50 can be secured in any suitable manner as by flattening the ends of the arms and securing the sweeps by plates 51 and pairs of bolts 52.

The lower conical section 25 of the casing carries a plurality of spouts 53 the number and arrangement of which is determined by the number of streams desired and the desired proportion of each stream to the stream fed to the stream splitter or divider. In the form of the invention shown two oppositely located spouts 53 of equal size are provided and hence the stream splitter shown will divide the materials fed to it into two equal streams. However any desired number of spouts 53 can be provided to obtain an increased number of streams and further their spacing or size with reference to one another can be varied to obtain any desired percentage of the input through any particular outlet spout 53. The outlet spouts 53 are shown as projecting downwardly and outwardly from the lower conical section 25 of the stream splitter casing and as secured to this section by an outwardly extending flange 54 provided at the upper end of each of the spouts 53.

In operation the upper flange of the stream splitter or divider jointly provided by the parts 33, 34, and 35 can be secured to the usual spouting board (not shown) and the stock is fed into the upper end of the short inlet tube 36. The stock so entering this stream splitter is therefore confined at the center of the agitator or fan-like impeller 40 by the short inlet tube 36. This agitator or fan-like impeller 40 is rotating and hence its centrifugal action causes the stock being discharged from the lower end of the short inlet tube 36 to be moved outwardly. At the same time this stock is levelled out by the lower edge of the short inlet tube 36 so that a uniform distribution of the stock is obtained traveling radially outwardly from the space between the short inlet tube 36 and the agitator or fan-like impeller 40.

The blades 45 of the agitator or fan-like impeller 40 are pitched to drive the stock upwardly and hence as the stock reaches the tips of these blades 45 it is propelled upwardly and outwardly against the wall of the upper section 31 of the casing, some of it bouncing back for more agitation and some progressing down this wall of the upper conical section 31. Thus in the space 46 just above the tips of the blades 45 there is a churning or boiling of the stock. The stock is worked into a more or less suspended mass from which flows a conical curtain of stock of uniform thickness. Essentially the stream splitter embodying the present invention provides an upwardly churning reservoir of stock providing a high degree of diffusion and the discharge from which reservoir is a whirling conical curtain.

For any given rate of flow of stock into the stream divider or splitter, the efficiency of the split will depend to some extent on the position of the agitator or fan-like impeller 40 with respect both to the lower edge of the short inlet tube 36 and to the wall of the upper conical section 31 of the casing. These relations are adjusted simultaneously by loosening the set screw 42 and raising the agitator or fan-like impeller 40 for smaller input flow rates and lowering it for larger input flow rates. While a spring could be provided for supporting the agitator or fan-like impeller 40 on the shaft 12 to effect this adjustment automatically, it has been found satisfactory to position the agitator fan-like impeller generally to suit the input flow, this position being satisfactory for a considerable range of flow. Accordingly such adjustment is entirely satisfactory and readjustments are not required unless a very substantial change in input is made.

The whirling conical curtain jointly provided by the agitator or fan-like impeller 40, wall of the upper conical section 31 of the casing and the short inlet tube 36 descends into the lower conical section 25 of the casing where it is engaged by the rotating sweeps 50 and rapidly discharged through the spouts 53. Since the two

spouts of equal size are spaced diametrically opposite each other in the form of stream splitter shown, the streams issuing from each of the spouts will be equal in all respects.

With the stream divider of the present invention it will particularly be noted that the blades 45 are pitched to throw the stock upwardly as well as to impart a whirling motion thereby to provide a churning or boiling reservoir of stock above these blades and which escapes as conical whirling curtain. This churning incresaes diffusion at all rates of flow and hence greatly increases the accuracy of the split at all rates of flow as compared with the prior art devices.

It will also be seen that the present stream splitter is of high capacity for any one size. Comparing the inlet diameter of the present invention with the corresponding dimensions of the prior art devices, the present stream splitter has greater capacity in proportion to space requirements.

The present stream splitter requires less power than the above discussed pressure type of distributor.

From the foregoing it will be seen that the present invention provides an extremely simple and compact stream divider or splitter having low power requirements and a high degree of accuracy of split over a wide range of material flows and which will stand up under continuous use without service difficulties.

I claim:

1. A stream divider, comprising an enclosed round tubular casing having its axis vertically disposed, a vertical concentric inlet tube of smaller diameter than said casing secured to the top of said casing and having its lower end in spaced relation to the side wall of said casing to provide an annular diffusion chamber around the lower end of said inlet tube, an impeller having its hub arranged immediately below said inlet tube concentric with said axis and having blades extending outwardly to a position beyond the periphery of said inlet tube and under said annular diffusion chamber, said blades being pitched to effect vertical movement of the stock delivered to said impeller by said inlet tube, means arranged to rotate said impeller in a direction to drive said stock so delivered upwardly into said annular diffusion chamber, and a plurality of outlet spouts leading from the bottom of said casing.

2. A stream divider, comprising an enclosed round tubular casing having its axis vertically disposed and having an upwardly converging conical upper section, a vertical concentric inlet tube of smaller diameter than said casing secured to the apex of said conical upper section and having its lower end in spaced relation to the conical wall thereof to provide an annular diffusion chamber around the lower end of said inlet tube, an impeller having its hub arranged immediately below said inlet tube concentric with its axis and having blades extending outwardly to a position beyond the periphery of said inlet tube and under said annular diffusion chamber and in closely spaced relation to said conical wall, said blades being pitched to effect vertical movement of the stock delivered to said impeller by said inlet tube, means arranged to rotate said impeller to drive said stock so delivered upwardly into said annular diffusion chamber, and a plurality of outlet spouts leading from the bottom of said casing.

3. A stream divider, comprising an enclosed round tubular casing having its axis vertically disposed, a vertical concentric inlet tube of smaller diameter than said casing secured to the top of said casing and having its lower end in spaced relation to the side wall of said casing to provide an annular diffusion chamber around the lower end of said inlet tube, an impeller having its hub arranged immediately below said inlet tube concentric with said axis and having blades extending outwardly to a position beyond the periphery of said inlet tube and under said annular diffusion chamber, said blades being pitched to effect vertical movement of the stock delivered to said impeller by said inlet tube, means arranged to rotate said impeller in a direction to drive said stock so delivered upwardly into said annular diffusion chamber, a plurality of outlet spouts leading from the bottom of said casing, and means arranged to adjust said impeller and inlet tube vertically relative to each other.

4. A stream divider, comprising an enclosed round tubular casing having its axis vertically disposed and having an upwardly converging conical upper section, a vertical concentric inlet tube of smaller diameter than said casing secured to the apex of said conical upper section and having its lower end in spaced relation to the conical wall thereof to provide an annular diffusion chamber around the lower end of said inlet tube, an impeller having its hub arranged immediately below said inlet tube concentric with its axis and having blades extending outwardly to a position beyond the periphery of said inlet tube and under said annular diffusion chamber and in closely spaced relation to said conical wall, said blades being pitched to effect vertical movement of the stock delivered to said impeller by said inlet tube, means arranged to rotate said impeller to drive said stock so delivered upwardly into said annular diffusion chamber, a plurality of outlet spouts leading from the bottom of said casing, and means arranged to adjust said impeller vertically relative to said inlet tube and conical wall.

5. A stream divider, comprising an enclosed round tubular casing having its axis vertically disposed and having an upwardly converging conical upper section and a downwardly converging conical lower section joined at its enlarged upper end to the enlarged lower end of said conical upper section, a vertical concentric inlet tube projecting downwardly a short distance into the apex of said conical upper section and having its lower end in spaced relation to the conical wall thereof to provide an annular diffusion chamber between the lower end of said inlet tube and said conical wall, an impeller having its hub arranged immediately below said inlet tube concentric with its axis and having blades extending outwardly to a position under said annular diffusion chamber and in closely spaced relation to said conical wall, said blades being pitched to effect vertical movement of the stock delivered to said impeller by said inlet tube, means arranged to rotate said impeller to drive said stock so delivered upwardly into said diffusion chamber, and a plurality of outlet spouts leading from said conical lower section.

6. A stream divider, comprising a casting having an upwardly converging upper conical part, a vertical shaft journalled in said casting to rotate about an axis concentric therewith, an enclosed round tubular casing having its axis vertically disposed and having an upwardly converging conical upper section and a downwardly con-

verging conical lower section joined at its small lower end to the enlarged lower end of the conical part of said casting and joined at its enlarged upper end to the enlarged lower end of said conical upper section, a vertical concentric inlet tube of smaller diameter than said conical upper section secured to the apex of said conical upper section and having its lower end in spaced relation to the conical wall thereof to provide an annular diffusion chamber around the lower end of said inlet tube, an impeller having its hub fast to said shaft and arranged immediately below said inlet tube and having blades extending outwardly to a position beyond the periphery of said inlet tube and under said annular diffusion chamber and in closely spaced relation to said conical wall, said blades being pitched to effect vertical

movement of the stock delivered to said impeller by said inlet tube, means arranged to rotate said shaft and impeller to drive said stock so delivered upwardly into said diffusion chamber, and a plurality of outlet spouts leading from said conical lower section.

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