Oct. 2, 1928. 1,686,077

W. EVANS

DRY FEEDING AND MEASURING MACHINE

Filed Oct. 7, 1927 2 Sheets-Sheet 1

Fig. 1

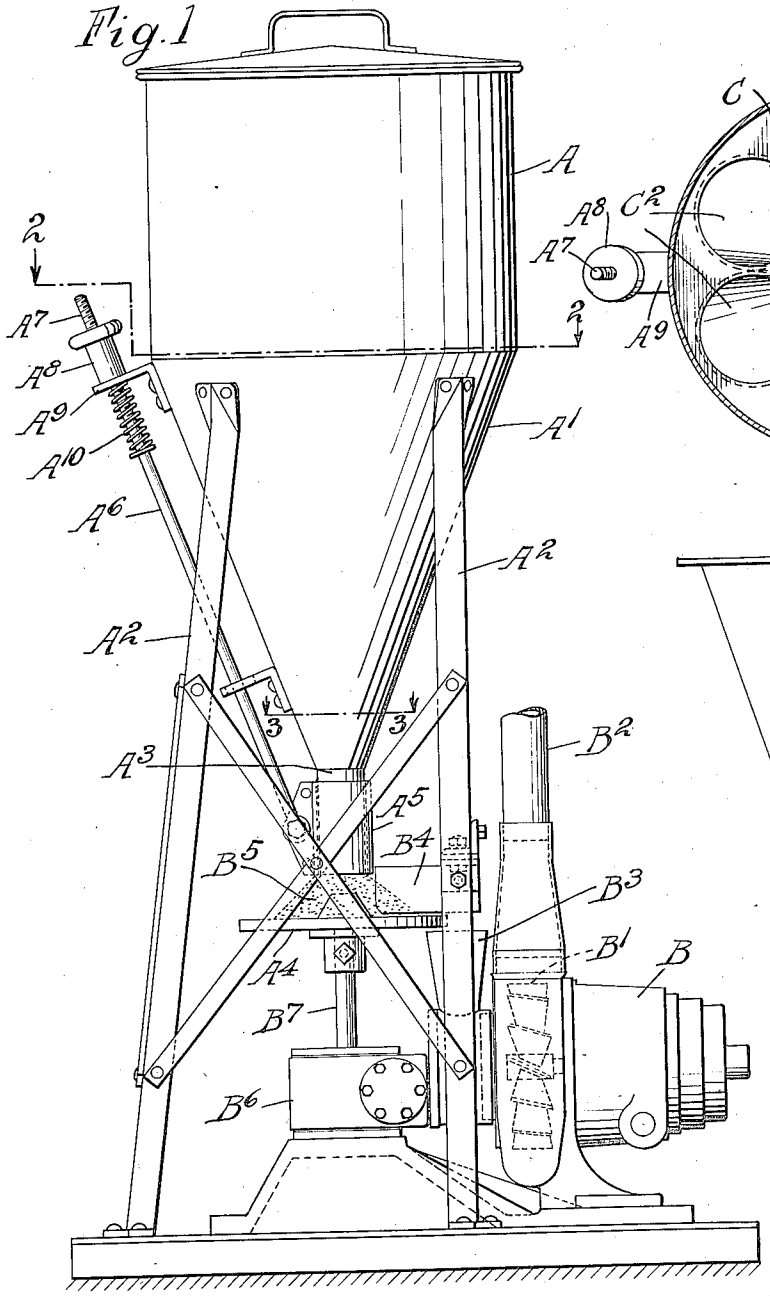


Fig. 2

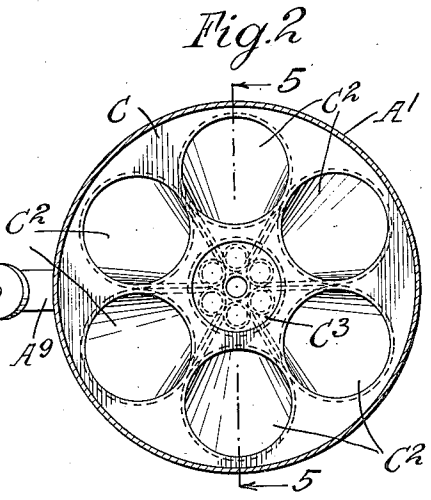
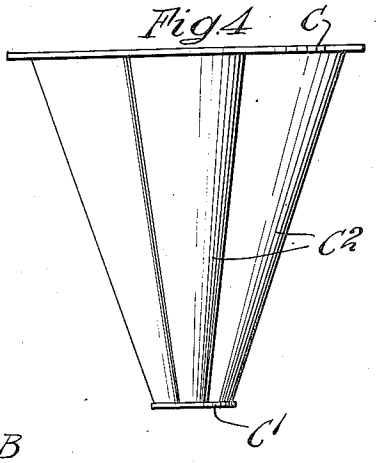


Fig. 4



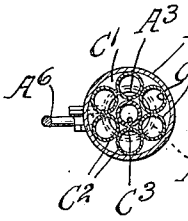


Fig. 3

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Fig. 5

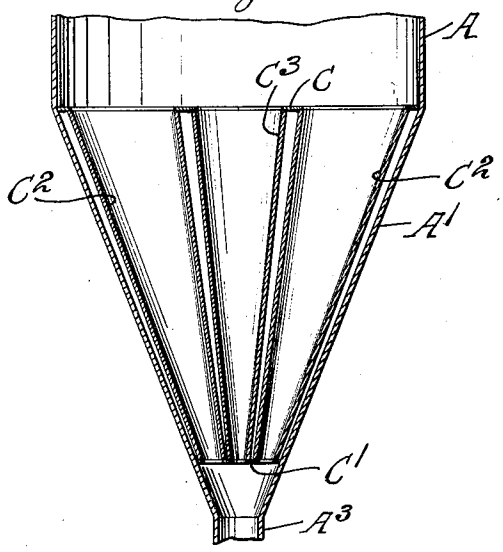


Fig. 6

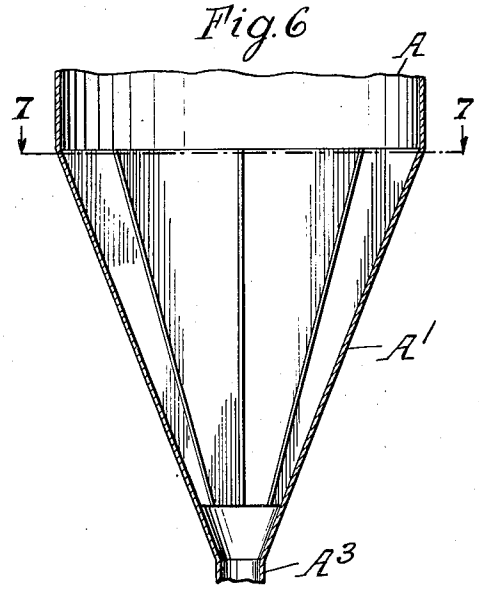
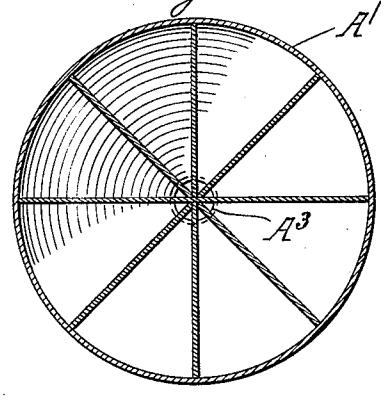


Fig. 7



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Patented Oct. 2, 1928. 1,686,077

UNITED STATES PATENT OFFICE.

WILSON EVANS, OF CHICAGO, ILLINOIS, ASSIGNOR, BY MESNE ASSIGNMENTS, TO NATIONAL ALUMINATE CORPORATION, OF CHICAGO, ILLINOIS, A CORPORATION OF DELAWARE.

DRY FEEDING AND MEASURING MACHINE.

Application filed October 7, 1927. Serial No. 224,597.

My invention relates to improvements in dry feeding and measuring machines. This invention is particularly well adapted to feeding such chemicals as sodium aluminate and other similar heavy chemicals having a very great angle of repose.

Sodium aluminate for instance when in the dry form is an exceedingly heavy powder like substance. Its coefficient of friction is so high that if a hopper filled with sodium aluminate having a conical bottom is opened at the apex of the cone, only that part of the mass of sodium aluminate immediately above the opening will fall out and you will then have a hopper filled with sodium aluminate with a cylindrical wall extending clear up from the mass through the discharge opening. If an effort is made to dislodge this mass of material a great amount of power is required owing to the high coefficient of friction and to the great weight of the material. Many efforts have been made to solve this problem, heavy paddles, vibrating machines, dragging chains, telescoping or moving funnels and the like have been tried, all of them perhaps with some measure of success but all of them involving great complication, special machinery and requiring relatively large power.

My invention is primarily intended to be used in connection with or feeding and conveying of sodium aluminate and similar finely divided chemicals where it is exceedingly desirable to take up as little room as possible with the apparatus, to have it as simple as possible and to have it require a minimum amount of power for operation.

I have illustrated my invention in connection with a feeding and conveying mechanism adapted for use in connection with water softening plants wherein my device measures out a pre-arranged quantity of dry chemical and supplies it to a conveying means, whence it is discharged into a water treatment tank. But it will, of course, be quite obvious that my feeder might equally well be adapted to any situation where dry feeding of materials liable to bridge or able to stand by themselves is involved.

In carrying out my invention I propose to add to the ordinary type of downwardly increasing conical bottom, a series of separate inwardly inclined and downwardly decreasing funnels or spouts. These funnels or spouts are preferably circular in cross section, preferably tapered downwardly but under some conditions it is conceivable that they might be bounded by plane instead of curved surfaces and they might be of constant cross section. In the preferred form, however, they are nested in the bottom of the hopper in such manner that each of these funnels has a relatively small lower discharge opening and a relatively large upper receiving opening, the size of the funnels or chutes being such that together they substantially fill the space at the bottom of the hopper leaving little if any area upon which a wall of material may stand at their upper ends and such that they substantially fill the bottom or discharge end of the apparatus.

My invention is illustrated more or less diagrammatically in the accompanying drawings, wherein—

Figure 1 is a side elevation of the feeding apparatus;

Figure 2 is a section along the line 2—2 of Figure 1;

Figure 3 is a section along the line 3—3 of Figure 1;

Figure 4 is a side elevation of the battery of funnels;

Figure 5 is a section along the line 5—5 of Figure 2;

Figure 6 is a modified form;

Figure 7 is a section along the line 7—7 of Figure 6.

Like parts are indicated by like characters throughout the several figures.

A is a cylindrical feed hopper having a downwardly tapered conical bottom A^1 which is mounted on the supporting legs or framework A^2. A^3 is a cylindrical discharge sleeve extending downwardly from the bottom of the hopper and discharging against a rotating plate A^4. A^5 is an adjusting sleeve slidable on the sleeve A^3 and capable of adjustment up and down by means of the connecting rod A^6 threaded at A^7 carrying an adjusting screw A^8 engaging a bracket A^9 with spring A^{10} tending normally to force the sleeve A^5 into the lower position.

B is a motor driving a fan B^1 which discharges dust laden air through a conveyer pipe B^2. B^3 is a funnel through which air

and dust is drawn into the fan. This funnel is located adjacent the periphery of the rotating disc A^4. B^4 is a blade extending inwardly toward the center of the disc and inclined to the radius of the disc so as to serve as a propeller blade to scrape material off the disc and discharge it into the funnel B^3. It will be noted that material piles up on the disc as indicated at B^5 when the blade scrapes off material as it comes around to supply the fan with a measured quantity of material. B^6 is a speed reduction gear driven from the fan and motor shaft and driving at low speed a shaft B^7 which carries the disc A^4, so that as the fan is driven by the motor the measuring disc A^4 is rotated and material is scraped off it at a fixed rate of speed, the amount of material being scraped off per revolution depends upon the height of the pile B^5 and the height of the pile is controlled by adjusting the height of the adjusting sleeve A^5 above the plate A^4.

With material such as sodium aluminate and without any additional means for insuring feeding of the material, a cylindrical column will drop out of the center of the hopper in line with and the same diameter as the column passing down out of the sleeve A^3. The remainder of the material will remain in the hopper and will not flow. It is to insure the flow of all the material that my invention is added to the elements above described.

C is a circular plate of the same substantially outside diameter as the inner diameter of the hopper A. C^1 is a circular plate of slightly larger diameter than the diameter of the funnel A^1 at its lower end. Both these plates are apertured, there being a central aperture on the axial line of each plate and a series of apertures arranged about the central aperture. The sizes of these apertures are such that each of the side apertures are substantially tangent to the central aperture and to the apertures on either side thereof. It does have in each plate a central aperture and in this case six or more apertures grouped around it, the apertures in the lower plate being much smaller than those in the upper plate. Joining the outer apertures are a series of funnels C^2 C^2 and joining the two central apertures a single funnel C^3. Preferably the single funnel C^3 is of slightly smaller cross sectional area throughout its length than the other funnels, the reason for this being that vertical flow through it is somewhat more rapid than through the inclined funnels. By having it somewhat smaller, flow throughout the entire area is equalized though it is not essential.

Experience shows that while such material as sodium aluminate and other types of similar material will pile up and not flow upon itself, yet it will flow along the smooth metal surface of the funnels. The result of this is that material is fed to the central discharge spout through all seven of the funnels from different parts of the hopper A. Since these funnels are tangent to one another there is no space upon which material can build up except the relatively small area of the upper plate surrounding the funnels. This area is so small that the weight of the material itself tends to break down any column structure which might otherwise be formed and the result is that as the rotating disc operates, material flows gradually out of the hopper A through the funnels into the fan and this flow is so regular and level and constant that the discharge through the fan may be accurately measured merely by measuring the difference in length of material in the hopper.

It is obvious that a different arrangement of funnels might under some circumstances be thoroughly efficacious. The essential feature is that in order to obtain smooth and regular flow of all the material out of a large reservoir through a small discharge opening, it is necessary to insure that material will be drawn constantly in separate streams from a sufficent number of sufficiently widely spaced points throughout the reservoir to prevent bridging or piling up of the material and it will be understood that my invention is not limited to the particular mechanism here shown for accomplishing that purpose.

In Figures 6 and 7 the separate discharge passages are formed in the conical bottom A' by the provision of a series of radial partitions, which radial partitions form a series of triangular passages, the cross-sectional area of which constantly diminishes downwardly. The effect is substantially the same as the effect of the conical downwardly decreasing discharge passages except that the means for providing them are different and except for the fact that by this arrangement there are no voids left in the cone as in the case with the preferred form shown in Figures 2, 3, 4 and 5.

I claim:

1. Feeding means for dry pulverized material comprising a receptacle, a series of gravital discharge passages leading therefrom at widely separated points and converging toward a common discharge point.

2. Feeding means for dry pulverized material comprising a receptacle, a series of gravital discharge passages leading therefrom, downwardly decreasing in cross sectional area and converging toward a common discharge point.

3. Feeding means for dry pulverized material comprising a receptacle, a series of gravital discharge passages leading therefrom arranged about the central axis thereof, downwardly decreasing in cross sectional area and converging toward a common discharge point.

4. Feeding means for dry pulverized material comprising a receptacle, a series of

gravital discharge passages leading therefrom, circular in cross section downwardly decreasing in cross sectional area and converging toward a common discharge point.

5. The process of discharging material by gravity from a receptacle which consists in withdrawing a plurality of separate streams of material from the underside of the receptacle at spaced points thereupon and converging said streams and discharging them at a common discharge point.

6. Feeding means for dry pulverized material comprising a receptacle, a series of gravital discharge passages leading therefrom, each passage being substantially tangent to those adjacent to it, downwardly decreasing in cross section and converging toward a common discharge point.

7. Feeding means for dry pulverized material comprising a receptacle, a series of gravital discharge passages leading therefrom, of circular cross section, each passage being substantially tangent to those adjacent to it, downwardly decreasing in cross sectional area and converging toward a common discharge point.

8. The combination with a cylindrical receptacle of an apertured bottom plate, a series of gravital discharge passages, one in register with each aperture in the plate, downwardly decreasing in cross sectional area and converging toward a common discharge point.

9. The combination with a cylindrical receptacle having a conical bottom of discharge means therein comprising an apertured plate located adjacent the largest portion of the conical bottom, a relatively small apertured plate located adjacent the discharge mouth of the conical bottom, a plurality of gravital discharge passages joining pairs of apertures in said plates and all discharging into the open mouth of the conical bottom.

10. The process of discharging material by gravity from a receptacle which consists in withdrawing a plurality of separate streams of material from the underside of the receptacle at spaced points thereupon and converging said streams and discharging them at a common discharge point, the cross-sectional area of each stream decreasing from the upper toward the lower end thereof.

Signed at Chicago, county of Cook and State of Illinois, this 5th day of October, 1927.

WILSON EVANS.