

Dec. 26, 1939.

H. W. PRICE

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APPARATUS FOR AGITATING FINELY DIVIDED POWDERS

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2 Sheets-Sheet 1

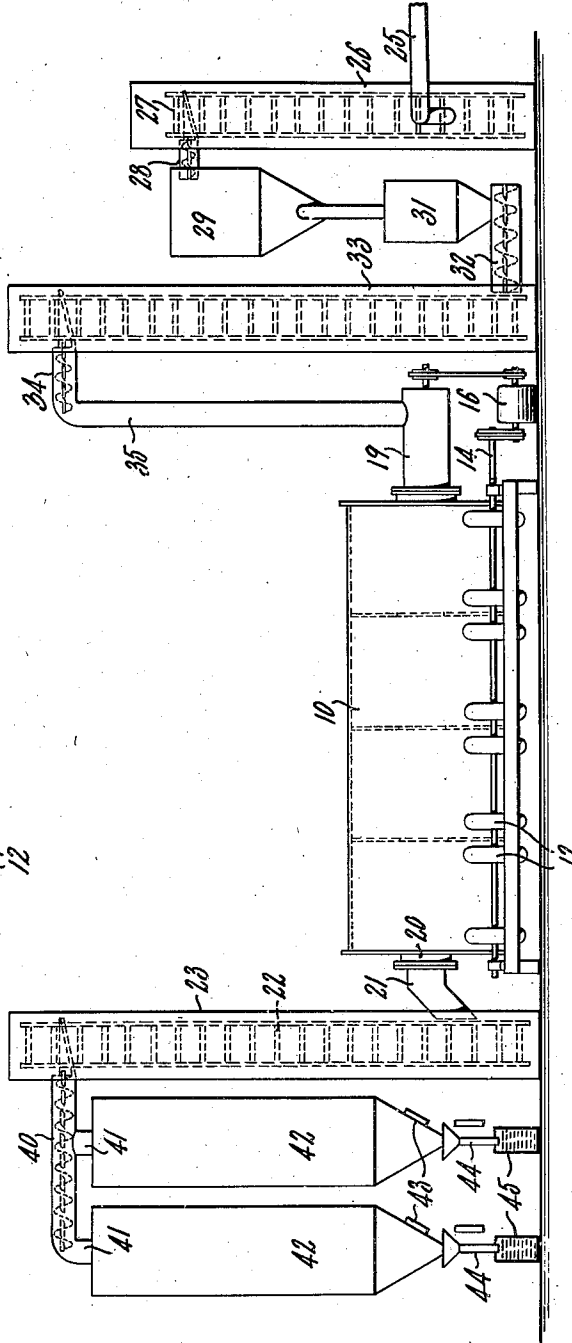
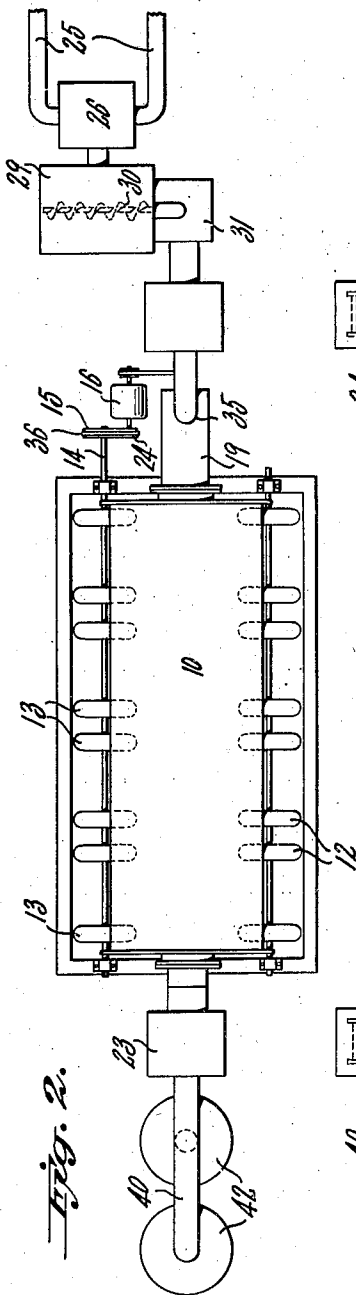


Fig. 1.

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2 Sheets-Sheet 2

Fig. 3.

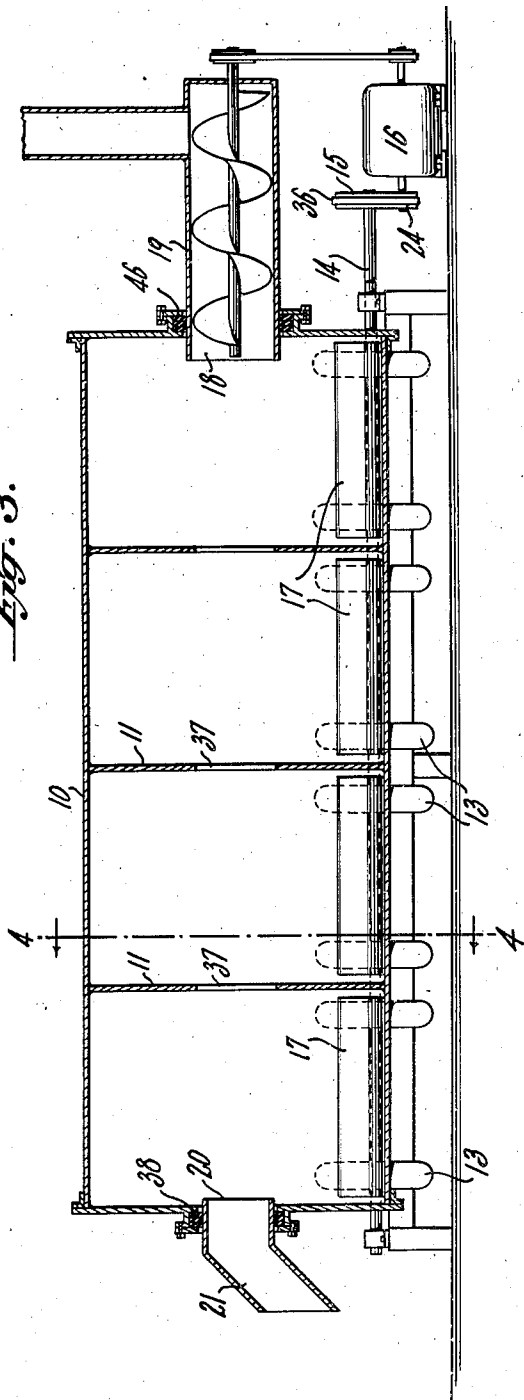
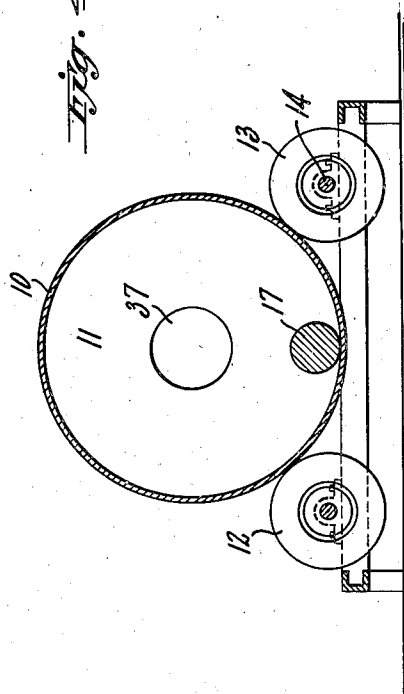


Fig. 4.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR AGITATING FINELY
DIVIDED POWDERSHoward W. Price, Borger, Tex., assignor to J. M.
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Application January 2, 1937, Serial No. 118,913

7 Claims. (Cl. 259—3)

This invention relates to the art of treating light flocculent powders and is particularly concerned with the agitation of light fluffy carbon black and other powders of like nature.

5 The invention includes an apparatus for agitating such light powders by which the same are very easily and quickly brought to the density at which it is desired to pack and ship the product, and by which such packing is accomplished.

10 This application is a continuation in part of my application Serial No. 706,909 filed January 17, 1934, now Patent 2,127,137, issued August 16, 1938. As stated in that application, carbon black as it comes from the channels of the hot
15 houses of a carbon black plant and passes through the sifting or bolting machines required to reduce the particles to a uniform standard of comminution and reduce grit and foreign matter, is exceedingly light and fluffy, and is difficult to
20 handle because this property renders it subject to being carried off by air currents. It is difficult to pack into commercially practiceable packages because of its great bulk. These and other considerations have made it necessary to
25 agitate the black, to reduce its bulk and increase its density, by driving out the air or gases which have been entrained with, adsorbed upon or occluded within the minute carbon black particles.

The most common,—in fact, practically the
30 only, form of machine heretofore utilized to accomplish this agitation, is what is called an agitator bin. This consists of a very large bin with sides generally slanting toward the bottom, in which are slowly revolved one or more shafts
35 carrying numerous pins or blades. Each shaft requires ten horse power or more and as two shafts are usually required and several bins are necessary to accommodate the output of one group of burning houses, the total power re-
40 quired to handle such output is sixty horse power or greater. These pins or blades disturb and agitate the light flocculent black in the bin and gradually eliminate a large part of the gaseous constituents thereof, thus increasing the density
45 to the desired point,—to about ten pounds per cubic foot in the case of ink black and from twelve to fifteen pounds per cubic foot in the case of rubber black. After the black has been brought to the desired density, it is packed off
50 through openings in the bottom of the bins, in which openings are arranged helical screw devices working in vertical tubes, the same being called packers. These pack the black, through suitable arrangements, into bags whose volume
55 is calculated to hold in the neighborhood of

12–15 lbs. of black at the density to which it has been brought by the agitator bin treatment. Rubber black is further compressed in hydraulic or mechanical presses to about twenty-five
5 pounds per cubic foot.

I have found that carbon black may be agitated and brought to the desired density much more quickly, more easily and with the use of much less power by the use of the apparatus of the present invention. I have found further
10 that by utilizing this apparatus and by modifying the steps by which the black is processed from the channel irons to the ultimate bags in which it is packed, I can provide a flexible and continuous treatment by which rubber or ink
15 black of any practicable density may be quickly and easily obtained. The achievement of these ends is the object of the present invention.

Another object is the construction of an agitator bin having no agitating pins or blades.

Other objects and advantages of the apparatus will more clearly appear when reference is had to the following specification and accom-
20 panying drawings.

In the drawings, Fig. 1 is a side elevational
25 view of a series of instrumentalities, including the bladeless agitator bin of the invention, by means of which the process may be carried out; Fig. 2 is a plan of the same instrumentalities that are shown in Fig. 1; Fig. 3 is an enlarged
30 longitudinal section of the bladeless agitator bin itself; and Fig. 4 is a section taken along the line 4—4 of Fig. 3.

The novel agitator bin will be first described. By reference to the drawings, this will be seen to consist simply of a drum or drums
35 10 divided into compartments by annular partitions 11 suitably mounted for rotation upon wheels 12 and 13 acting as roller bearings 12 and 13, the wheels or bearings 13 being arranged to impart rotation
40 to drum 10 by frictional contact with the surface of the drum. Rollers 13 may be mounted on shaft 14 and driven through sprockets or pulleys 15 and 24, and chain or belt 36 by motor
45 16. This source of power may also be arranged to drive screw conveyor 19 as indicated in Figs. 1, 2 and 3.

In each of the sections or chambers of the drum 10 is disposed a free roller 17, secured
50 against horizontal movement by the partitions 11 which need be wide enough only for this purpose and which carry openings 37 through which the product passes. These rollers are preferably made so that they may be filled with a liquid, sand or other material in order that their
55

weight may be adjusted. The feed end of the drum has an opening 18 through which the carbon black is delivered by a short length screw conveyor 19. The delivery end has an opening 20, provided with suitable packing 38 about conveyor tube or chute 21, by means of which the processed black is directed to the flights 22 of an elevator 23 (Fig. 1) as will hereinafter be described. The drum 10 is preferably made of metal of strength adequate to stand up under long continued use. The inner sides of the drum are smooth but under certain conditions may be roughened as by lining them with wire mesh.

For efficient, continuous production the black may be carried to and from the bin as follows: Screw conveyors 25 from the hot houses carry the black to an elevator 26 in which it is elevated to 27 where a short conveyor or chute 28 drops it into bin 29. This bin is preferably designed to hold several hours' factory production in order that the apparatus further along in the series may be repaired or serviced without shutting down the hot houses.

From bin 29 a conveyor 30 carries the black into the top of a bolter 31 from whence the black is forced into horizontal conveyor 32 which carries it to elevator 33. At the top of 33 the black is emptied into another horizontal conveyor 34 which is arranged to drop it down chute 35 into conveyor 19 at the feed end of the bladeless agitator bin 10.

After passing from the delivery end 20 of this device and into elevator 23 the agitated black is emptied into screw conveyor 40 which may be connected to one or both of the tubes 41 leading to conical-bottomed bins 42, each of which is provided with a suitable vibrating device 43. The vibrator may be constructed by affixing to the side of the bin the armature of a solenoid and suitably fixing the plunger so that an alternating current will cause the armature to vibrate vigorously and shake the bin sufficiently to dislodge the carbon black within it and cause it to drop down into the flights of an ordinary packer 44, from which it may be packed into bags 45 in well known manner.

Black passes through the system as follows: Carbon black from the hot houses is fed into the system through conveyor 25 and carried by and through the various means illustrated, to bolter 31 where it is brought down to an extremely fine state of subdivision while at the same time grit and foreign particles are eliminated. From the bolter the black is conveyed and elevated as shown until it is carried into the agitator bin by screw 19. The housing for the screw 19 is mounted against the end of drum 10 in such fashion as to make a substantially gas-tight connection without impeding the rotation of the drum. Gaskets and packing, as indicated at 46, of well known type and construction are provided for this purpose.

As the black is fed into the drum 10 at 18, the drum being rotated slowly at from 6 to 10 R. P. M., it is rolled and pressed by the action of rollers 17 and is tumbled by being carried up the sides of the inner cylindrical surfaces of the drum 10 and tumbled down the same. As more and more black is fed into the first compartment, a "head" or pressure is put upon the black and the same caused to flow through the apparatus through openings 37 toward the discharge end 20. As the black progresses through the bin, the rolling, pressing and tumbling is continued, the entrained gases eliminated and the density increased.

While, as indicated in my copending application Serial No. 706,909, filed January 17, 1934, the conditions of operation of apparatus of this general type may, by the addition of drums without rollers, and by the regulation of other factors, be adjusted in order to cause the finely divided material to form into discrete granules or pellets, I have found that these conditions may likewise be adjusted in order to keep down and inhibit the production of these granular agglomerates. Thus, for the purpose of obtaining increased density of flocculent carbon black with the least possible quantity of granules or agglomerates, none of which are hard in texture, I eliminate the drums without rollers and instead of the relatively light rollers of the apparatus described and claimed in my said copending application, I provide relatively heavy rollers 17 in the drums which have rollers. The weight of these rollers is such that any agglomerates which form or tend to form by tumbling about in the drum are partially broken up and crushed by the weight of the roller, and in so doing the entrained or absorbed gases are eliminated. This action may be accentuated by decreasing the speed of rotation of the drums, and by further increasing the weight of the rollers. The formation of granules or agglomerates may also be decreased without changing the speed of the drum or weight of the rollers by increasing the quantity of material passing through the apparatus. Owing to the fact that there are no rollerless drums in which the material is freed from the pressure exerted by the rollers and given free play to follow its natural tendency to coalesce, the formation of granules is kept down and inhibited.

As a specific example, I find that in a drum having a 6 foot diameter it is satisfactory to use a roller 12 inches in diameter and about 70 inches long, this length being just short of the length of a section or compartment into which the drum may be divided. I construct a steel cylindrical roller so designed that it may be filled or partially filled with water, sand or other suitable weighting material. In this manner I may adjust the weight of the rollers. For black to be agitated to a density of around 12 pounds per cubic foot, I have found that a drum 6 feet in diameter and 24 feet long divided into four compartments and provided with rollers of the type described filled so that each of the four rollers weighs approximately 550 pounds is eminently satisfactory when operating at a speed of 6 R. P. M., with a material flow through the apparatus of approximately 15,000 pounds in 24 hours.

As previously indicated, the speed of revolution is an important factor in the operation and performance of the novel bin and I have found that as little difference as 1 R. P. M. makes considerable difference in the amount of production which may be handled and in its density characteristics.

After delivery from the agitator bin 10 it is desirable to convey and elevate the black to one of several storage bins 42 provided with conical bottoms having relatively large openings at the lowermost ends. The vibration means 43 on each such bin causes the black to fall down into the packing tubes where it is packed in the usual manner.

While, as above indicated, it is possible by increasing the number of compartments and the length of the drum 10, by increasing the weight

and length of the rollers 17, and by decreasing the speed of rotation of the drum, to increase the density of the black obtained at the discharge end of the machine, it is also true that by decreasing the number of compartments, the length of the bin, the weight of the rollers, and increasing the speed of rotation of the machine, less density may be obtained. Consequently, by variation of the structure and manner of operation of the apparatus, it is possible to obtain a standard grade of carbon black anywhere from 12 lbs. per cubic foot or lower, such as black desired for use in making inks, paints, etc., to 25 or more pounds per cubic foot, such as that desired for use with rubber. The latter type black is obtained in a form equivalent in weight to ordinary compressed black, but which, unlike compressed black, is in the form of a finely divided powder of uniform characteristics and does not contain in any substantial amount the lumps, pellets or flakes usually found in compressed black when the same is broken up for the mill.

Advantages of the invention are as follows: The desired density of product may be obtained much more quickly and easily than by the ordinary method of agitation in agitators with blades. A remarkable saving of power is effected; for instance, whereas the ordinary agitator bin requires 50 or 60 horse power or more in order to turn the pins or blades through the large mass of black within the two large bins required to handle 20,000 lbs. of black in 24 hours, the present bladeless agitator bin requires only from 5 to 7 horse power to bring the same amount of black to the same condition within the same period of time.

The operation is continuous and contrasts sharply with the intermittent procedure required by present methods of agitating in bins and packing off the black.

As to speed of packing, the black made according to the present invention may be packed uniformly in 15 seconds.—that is, an ordinary 25 lb. bag of black may be completely filled within this time. With prior methods, packing from the bladed agitator, it was impossible to obtain uniform packing conditions because of the various states in which the black to be packed was obtained. Relatively heavy agitated black could be packed off quickly, yet black which had apparently been treated long enough, was often found not to have been agitated sufficiently and required 60 seconds or more to complete the packing of a single 25 lb. bag. With the present invention both heavy and light blacks can be packed off very quickly for the reason that the black is uniform in density and for the further reason that by the invention, including the vibrating devices in the packing bins, the black is fed uniformly and positively into the packers.

Saving of power is also accomplished by the apparatus of the invention by reason of the fact that when heavy rubber black on the order of compressed black is desired, the same may be obtained directly without the use of heavy and power-consuming equipment required to accomplish pressing.

Furthermore, the apparatus of the present invention involves savings in labor, savings in bags in that smaller bags may be used without compressing, and with heavy blacks, savings in carbon black caught within the wrinkles of the bags. It is known that with black compressed in hydraulic or mechanical presses the bags are heavily wrinkled during the compressing operation and a considerable quantity of black per bag is caught

within the wrinkles and can not be wholly freed even with the most vigorous shaking. With the present invention this loss is avoided.

Other advantages include the elimination of fire hazard such as is present in agitating bins, due to the frictional heat generated when the viscosity of the mass is increased, elimination of broken bags in pressing, speed of handling, reduction of mechanical equipment necessary to store and pack the product. For instance, whereas the old agitator bin, a huge structure, required five packers to handle approximately 10,000 pounds in 24 hours treated therein, the present bladeless agitator bin is relatively compact in nature and only requires one packer to handle 15,000 pounds or more.

What I claim is:

1. A bladeless agitator bin for increasing the apparent density of light, flocculent, finely divided material which consists of a drum rotatable about a horizontal axis, annular partitions spaced longitudinally of said drum and forming compartments therein, and a single weighted roller in each compartment.

2. A bladeless agitator bin for increasing the apparent density of light, flocculent, finely divided material which consists of a rotatable drum provided with annular partitions forming compartments therein and a single roller within each compartment.

3. A bladeless agitator bin for increasing the apparent density of light, flocculent, finely divided material which consists of a drum rotatable about a horizontal axis, annular partitions spaced longitudinally of said drum and forming cylindrical compartments therein, and a single weighted roller disposed within each compartment extending substantially the entire length thereof.

4. A bladeless agitator bin for increasing the apparent density of light, flocculent, finely divided material which consists of a rotatable drum provided with annular partitions forming cylindrical compartments therein and a single roller disposed within and extending substantially the entire length of each of said compartments.

5. A bladeless agitator bin for increasing the apparent density of light, (flocculent, finely divided material consisting of a rotatable drum divided into cylindrical compartments longitudinally thereof by partitions, means for feeding finely divided material into the first compartment, central openings in the partitions whereby the material supplied to the first compartment is allowed to overflow into the next and successive compartments from one end of the drum to the other upon rotation thereof, and a free roller within each compartment, also operable upon rotation of said drum.

6. A bladeless agitator bin consisting of a rotatable drum divided into cylindrical compartments longitudinally thereof by partitions, means for feeding finely divided material into the first compartment, central openings in the partitions whereby the material supplied to the first compartment is allowed to overflow into the next and successive compartments from one end of the drum to the other upon rotation thereof, and a free roller within each compartment, also operable upon rotation of said drum.

7. An agitator bin for increasing the apparent density of light, flocculent, finely divided material which consists of a rotatable drum provided with annular end walls and a single roller within said drum.