Oct. 20, 1942. L. E. HARPER 2,299,623

DUST REMOVING MEANS FOR FEEDERS

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Fig. 1.

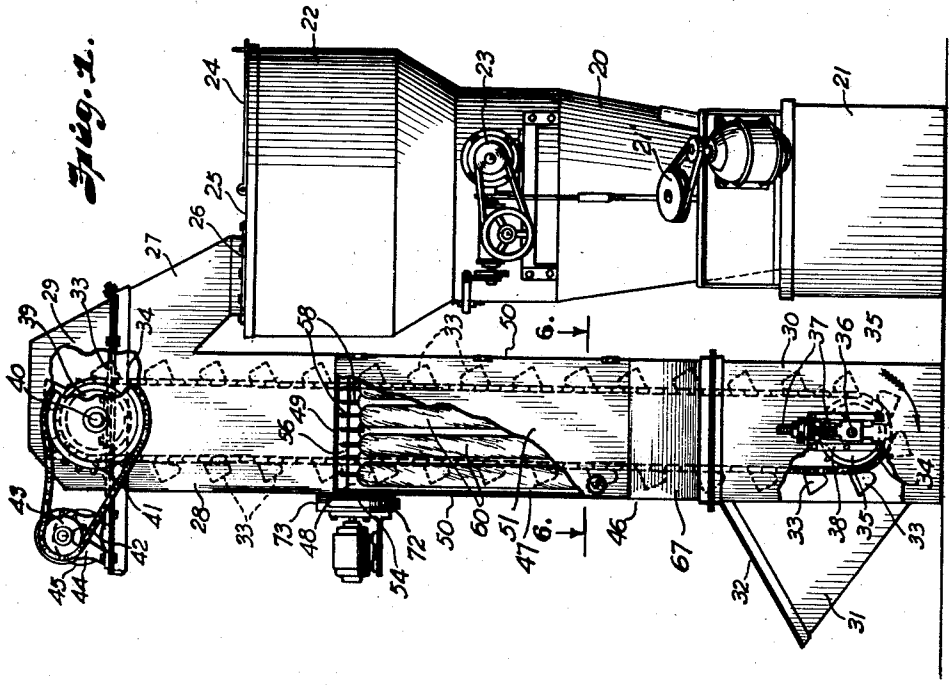


Fig. 2.

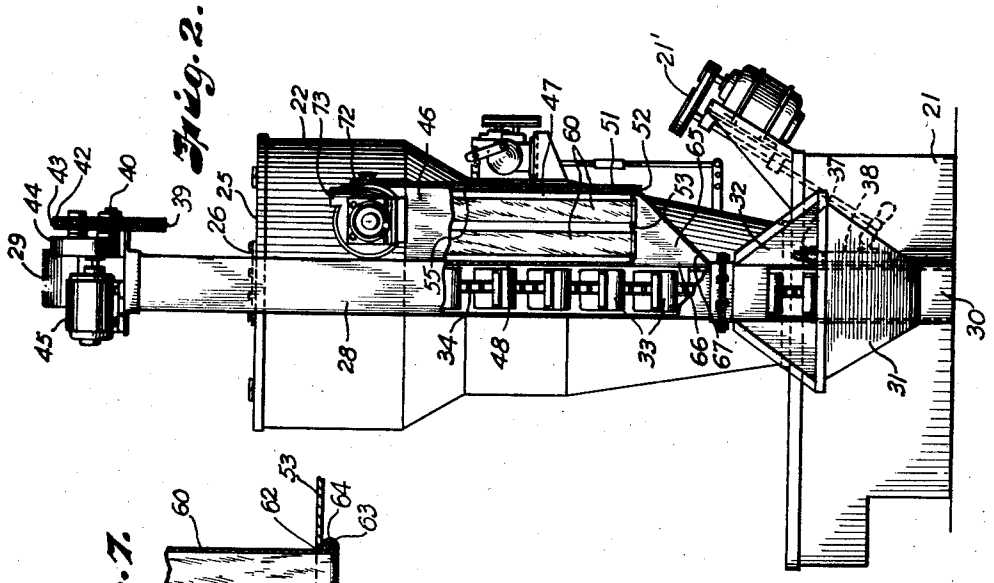
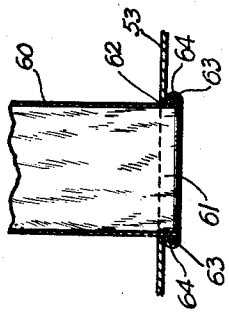


Fig. 7.



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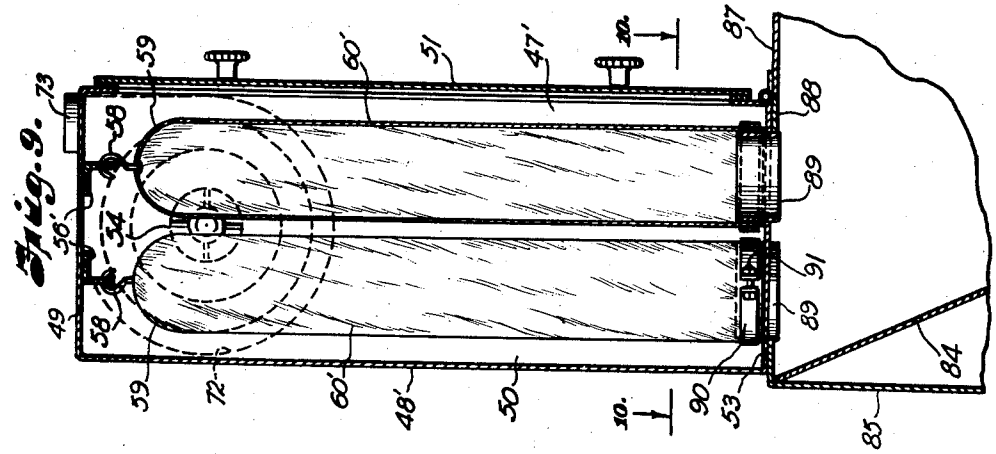


Fig. 9.

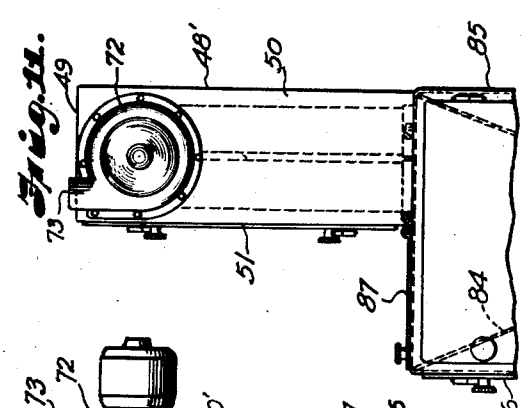


Fig. 11.

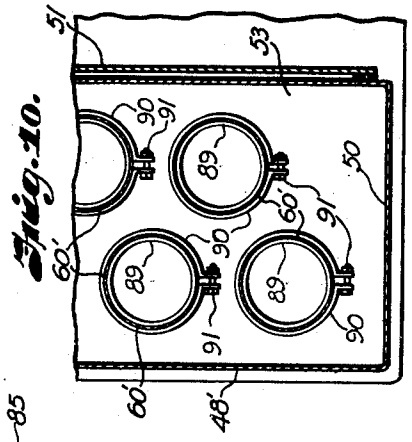


Fig. 10.

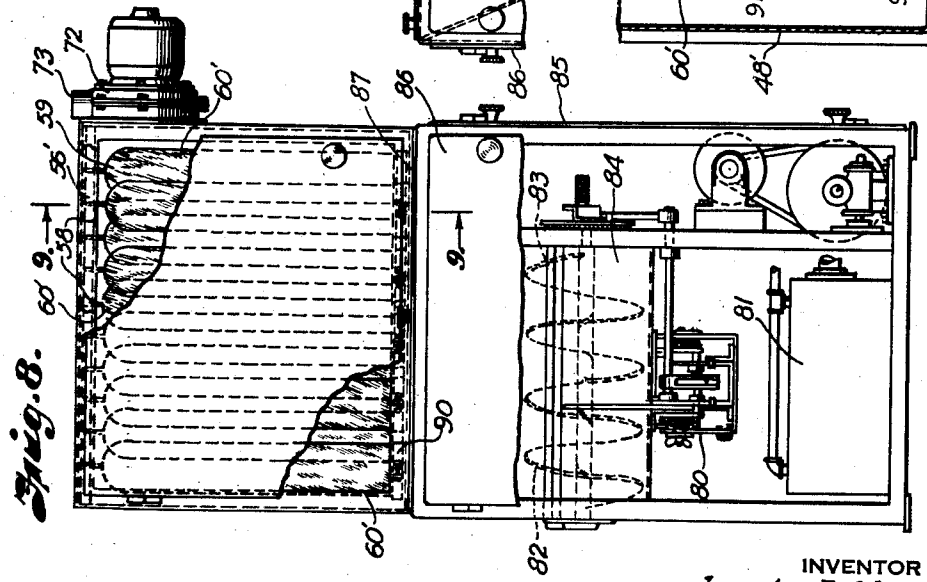


Fig. 8.

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Fig. 5.

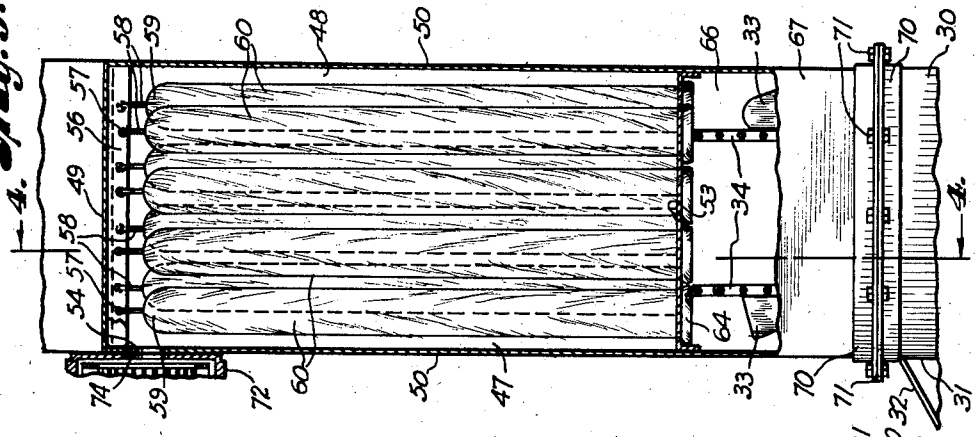


Fig. 4.

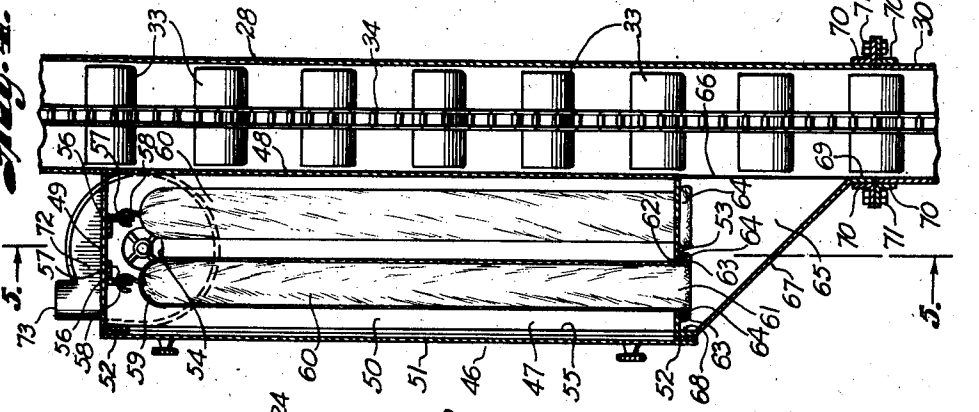


Fig. 3.

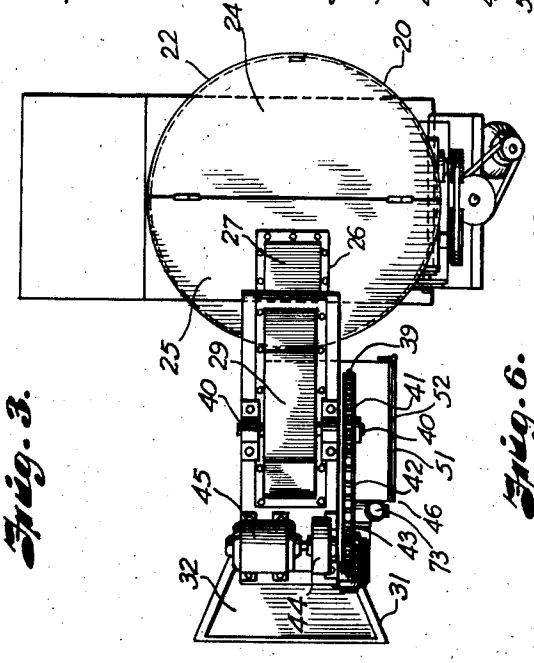
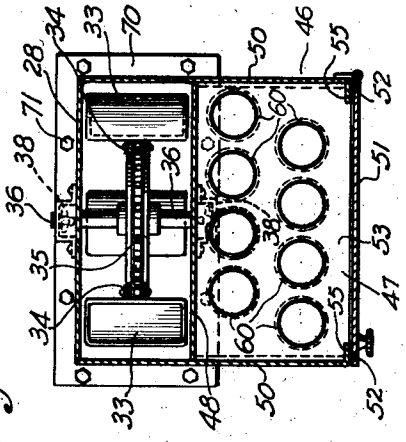


Fig. 6.



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UNITED STATES PATENT OFFICE

2,299,623

DUST REMOVING MEANS FOR FEEDERS

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Application June 5, 1940, Serial No. 338,917

4 Claims. (Cl. 209—247)

My invention relates to devices for feeding dry materials, such as chemicals and other solid materials, in a finely divided form, and particularly to dust removing means for such feeding devices.

In feeding devices such as the type shown in the patent to Elmer E. Harper, No. 1,783,423, patented December 2, 1930, the material is fed by gravity to the feeding device from a hopper, which hopper is provided with means for agitating the material that is contained therein, said feeding means being adjustable to provide a desired rate of feed of the material from the hopper to a suitable receptacle where the material is acted on in some manner, as, for example, by a liquid contained therein, to form a solution of the solid material in the liquid, or to slake lime, for example. The hopper is either continuously or periodically filled with the finely divided, or otherwise broken up, dry material and the filling of the hopper is usually accomplished from above the top of the hopper of the feeding device, by gravity. This necessitates the provision of storage facilities for the material to be fed at a level above the top of the feeding device, so that said material can be readily supplied to the hopper thereof. The provision of such storage facilities is often found to involve considerable expense, and also in some regions it is not desirable to store heavy loads of materials at a considerable elevation above the ground level. It is accordingly one of the purposes of my invention to provide a feeding apparatus that is provided with means whereby material can be supplied to the same from substantially the level of the surface upon which the feeding device is mounted, such as a floor that may be, for instance, at the ground level.

Whether the material is supplied from above the feeding device by gravity, or supplied from the level of the supporting surface for the feeding device by suitable means to the top of the hopper that forms part of the feeding device, and whether it is finely divided or is in larger particles, considerable dust is created in the handling of the dry material and supplying the same to the feeding device. It is accordingly necessary to collect the dust that is created or to carry it away in some manner, so that it does not cause undesirable conditions around the feeding apparatus, and it is a purpose of my invention to provide dust collecting means for feeding apparatus for such dry finely divided materials, or other dry materials that contain dust, that prevents the loss of any of the material that may be carried in dust-laden air within the feeding apparatus, including the hopper and the means for supplying finely divided, or other dry material particles, or pieces, to the hopper from the ground level, or floor, upon which the feeding apparatus is mounted.

It is a further purpose of my invention to provide dust collecting means of the above mentioned character, that is simple in construction and which comprises tubular fabric members of a bag-like character that receive the dust-laden air within the same, said air being drawn through the fabric of said members by suitable means for inducing a draft therethrough, such as an exhaust fan, the dust collecting, or remaining, on the interior of the tubular or bag-like members, and the air cleaned of dust passing through the walls thereof and out through the air exhausting means. It is a particular feature of my invention to provide such tubular, or bag-like, members so mounted relative to the feeding apparatus and the means for supplying the dry solid material thereto, that any dust collected therein will be returned to the supplying means for the solid dry material, and carried into the feeding means along with the other material that is ordinarily fed by the machine.

It is another important purpose of my invention to provide means for elevating dry finely divided solid material, or broken up dry material containing larger particles, from a level substantially the same as the base of the feeding apparatus, to a point above the upper end of the hopper means provided for the feeding apparatus, together with means for conveying said material by gravity, after the same has been elevated, into said hopper that supplies the feeding means, my improved apparatus being particularly adapted for use where the broken up or finely divided dry solid material is supplied in packages, or bags, and these have to be emptied into the apparatus to fill the hopper of the feeding means.

It is a particular purpose of my invention to provide means for preventing dust from escaping from the point at which the material is supplied to the elevating mechanism, as well as preventing escape of dust from the elevating mechanism, or from the hopper of the feeding mechanism, so that the dust-laden air in the apparatus, including the hopper above the feeding means, the elevating and conveying means and the hopper at the lower end of the elevating means, is carried to dust collecting means and the dust there separated from the air and collected so that the dust is not lost and any undesirable dusty condition that would otherwise exist around the

apparatus is avoided. This is accomplished by providing a housing that extends from the hopper at the bottom of the elevating means to the hopper for the feeding means, and enclosing said hopper for the feeding means, so that suction created by air exhausting means, and the dust collecting means that is connected with the housing for the elevating means, will be effective throughout the housed apparatus above referred to, to cause dust-laden air to be drawn toward and into the dust collecting means.

It is another purpose of my invention to provide dust collecting means mounted above the hopper of a feeding device of the above mentioned character, that is not provided with elevating means, so that any dust that is collected therein can be discharged directly into the hopper by gravity and not lost, said dust collecting means withdrawing all the dust-laden air from the hopper after the material is emptied into the same through a suitable opening in the top thereof.

Other objects and advantages of my invention will appear as the description of the drawings proceeds. I desire to have it understood, however, that I do not intend to limit myself to the particular details shown or described, except as defined in the claims.

In the drawings:

Fig. 1 is a view in side elevation, partly broken away, of my combined elevating, dust removing and feeding means for dry finely divided solid or dusty materials.

Fig. 2 is a view in elevation, taken at right angles to Fig. 1, as viewed from the left side of Fig. 1.

Fig. 3 is a top plan view of the device shown in Fig. 1.

Fig. 4 is a fragmentary vertical sectional view through a portion of the elevator and the dust collecting means, on an enlarged scale, said section being taken substantially on the line 4—4 of Fig. 5.

Fig. 5 is a section taken on the line 5—5 of Fig. 4.

Fig. 6 is a horizontal section, on an enlarged scale, taken substantially on the line 6—6 of Fig. 1.

Fig. 7 is a fragmentary vertical sectional view on an enlarged scale, of the lower end portion of one of the dust collecting bags.

Fig. 8 is a view in vertical side elevation of a modified form of my apparatus, partly broken away.

Fig. 9 is a section taken on the line 9—9 of Fig. 8 on an enlarged scale.

Fig. 10 is a fragmentary section taken on the line 10—10 of Fig. 9, and

Fig. 11 is a fragmentary elevational view taken at right angles to Fig. 8, as viewed from the right of Fig. 8.

Referring in detail to the drawings, in the form of the invention shown in Figs. 1 to 6, inclusive, is shown a feeding device 20, which is of the general type shown in the patent to Elmer E. Harper, No. 1,783,423, patented December 2, 1930, said feeding device having a base portion 21, which may be mounted on any suitable support and which may constitute a slaking vessel having stirring means 21'. Said feeding device has a hopper 22, from which dry dusty finely divided or broken up solid material is fed by gravity to the feeding mechanism, which feeding mechanism is actuated by suitable means, such as the motor 23. While the feeding means described in the above mentioned patent is referred to herein, by way of example, it is obvious that any adjustable feeding device that supplies controlled quantities of a solid finely divided material, or dry dusty broken up material, can be used as part of my invention.

The hopper 22 is provided with a hinged closure member 24, by means of which access can be had to the top of the hopper and material can be fed into the same from above, if desired, or the contents of the hopper can be inspected through the opening controlled by said closure member 24. Connected in dust tight relation with the top wall 25 of the hopper 24 is the discharge end 26 of an enclosed chute 27, which in turn is connected in dust tight relation with a conveyor housing 28 in any suitable manner, the same being shown as being made a permanent part of the conveyor housing 28 in the drawings, said conveyor housing having a cap, or top end portion 29, which is detachably mounted on the vertical housing 28 at the top thereof, by means of flanges on said members 28 and 29 and on the chute 27, as illustrated in the drawings.

The conveyor housing also has a lower or bottom section 30, which is similarly connected with the main body portion 28 of the housing. Said low section 30 is provided with a hopper 31, commonly referred to as a "boot," which has an opening 32, through which finely divided or other dry material can be supplied to the elevating means within the conveyor. The bottom section, or base member, 30 of the housing may be mounted on a common base, with the base portion 21 of the feeding device 20, so that the entire apparatus may be made portable, as shown in Figs. 1, 2 and 3. It is, of course, to be understood that the material dumped into the hopper, or boot, 31 will collect in the bottom of the lower or bottom section 30 of the conveyor housing, which thus serves as part of the hopper for the material that is to be elevated.

The elevating means comprises a plurality of bucket members 33, which are mounted on a chain 34 in a well known manner, said bucket conveyor, or elevator, operating in the direction of the arrow shown in Fig. 1, so as to carry the material from the hopper made up of the boot portion 31, and the lower section 30 of the elevator housing to the top of the housing into the top member 29, where said bucket members 33 are tilted or dumped so as to discharge the contents thereof by gravity into the chute 27 and thus by gravity into the hopper 22. Suitable adjusting and driving means is provided for the elevator, comprising a lower sprocket 35 over which the conveyor chain 34 operates, which is mounted on a shaft 36 that is adjustable by means of an adjusting screw 37 mounted in a suitable bracket 38 for adjusting the tension on the chain 34. Said sprocket chain 34 also operates over an upper sprocket wheel 39, which is mounted on a shaft 40 that has a sprocket 41 mounted thereon, driven through the chain 42 operating over the sprocket 43 provided on a speed reduction device 44, which is driven by the motor 45.

It will be obvious from the above that from the mouth 32 of the boot 31 to the hopper 22 of the feeding device 20, the entire conveying mechanism is enclosed within a housing and that this housing is connected substantially dust tight with the housing of the feeding device 20 at the hopper 22. Accordingly any current of air creating a suction in the vertical housing 28 of the elevator will also create a suction, or draft, in the

feeding device, the gravity conveyor 27 and the boot 31, that will cause any dust-laden air to travel toward the means creating the suction, or draft. Accordingly, dust collecting means associated with such suction, or draft, creating means will serve to carry all dust-laden air away from all parts of the mechanism, through which the same could escape, such as the opening 32 and the door, or closure, 24 for the hopper 22.

My improved dust collecting means 46 is mounted adjacent one side of the vertical housing 28 of the elevator and comprises a chamber 47 separated from the housing 28 by a wall 48. The chamber 47 is provided with a top wall 49, with end walls 50, and with a door 51 that is provided with suitable gasket means 52, to provide a chamber that is substantially fluid tight, except for certain inlet openings in the bottom wall 53 thereof, and a discharge opening 54 in one of the end walls 50, said door, or closure, 51 being shown as being hinged to one of the walls 50 and engaging a flange 55 on the other wall 50.

The top wall 49 is provided with a plurality of brackets 56, made in the form of angle bars, which have openings 57 therein for receiving the hook-like members 58 that are provided, extending from the closed top ends 59 of the tubular bag-like members 60. It will be noted upon reference to Figs. 4 and 5 that the bag-like members 60 are arranged in staggered relation to each other, and that the same have open ends 61, which extend through inlets 62, provided in said bottom wall 53. The construction of the open lower end portion of the bag-like member 60 and its connection with the inlet 62 is shown more in detail in Fig. 7. Said bag-like member 60, preferably, has a stiffening ring 63 provided in a pocket 64 that is sewed into the lower open end edge of the member 60, which can be forced through the inlet opening 62 in the wall 53, the cloth of which the bag-like member 60 is made serving as gasket means to provide a substantially dust tight connection between the outer surface of the mouth portion 61 of the bag-like member and wall of the opening 62.

Below the chamber 47 the dust collector is provided with a conduit 65, which is connected with the elevator housing 28 through an opening 66, and which has an inclined wall 67 that extends from a connection with a downwardly directed flange 68 on the chamber 47 to the housing 28. Preferably, the wall 67 connects directly with a vertical wall portion 69, which is part of the housing 28, and which terminates in the flange by means of which the housing 28 is connected with the lower housing portion 30, the connection being shown in Fig. 4 as being made by means of angle members 70, fastened in fixed relation on the conveyor housing sections and bolted together by means of the securing elements 71.

Secured to the dust collector against the wall 50 thereof having the opening 54, is an exhaust fan 72 of the rotary blower type having a discharge outlet 73 and an intake opening 74, which is aligned with the opening 54. The exhaust fan 72 will withdraw air from the chamber 47 through the opening 54. The tubular fabric members 60 having the closed ends 59 and the open ends 61 are made of a fabric material that is readily pervious to air, but substantially impervious to dust of the character resulting from the handling of the finely divided solid material acted on by the apparatus. Accordingly the action of the exhaust fan 72 will cause the tubular bag-like member 60 to be distended while the same is operating, but these will have a tendency to collapse, due to the fact that the same are merely hung from the brackets 56 by means of the hooks 58, except at their lower ends 61, where the opening therein will be maintained in distended position by means of the stiffening ring 63. Accordingly, when the exhaust fan 72 is operating dust-laden air will be withdrawn from the vertical elevator leg, or housing, 28 from the housing portion 30, the boot 31, the gravity conveyor, or chute, 27 and the hopper 22, through the conduit 65 and into the bag-like members 60, where the dust will adhere to the walls of the bag-like members 60 and the air will pass therethrough and through the opening 54 and the exhaust fan to be discharged from the discharge opening 73. However, when the exhaust fan is halted, the bag-like members 60 will collapse and the dust therein, which has been adhering to the fabric walls thereof, because of the suction exerted by the exhaust fan, will drop off and pass through the bottom open ends 61 of the bag-like members and down the inclined wall 67 of the conduit 65 into the conveyor housing 28, and from that into the portion 30 thereof and the hopper formed thereby in the bottom of the conveyor housing to be picked up by the buckets 33 and carried to the feeding apparatus. Thus none of the material that is collected by the dust collecting means will be lost, but it will pass into the feeding device and be utilized with the other material that passes into the hopper 22 in said feeding device 20.

In the form of the invention shown in Figs. 8 to 11, inclusive, feeding means 80 for feeding finely divided solid material into a trough, or similar member, 81 at a controlled rate is shown, said means comprising a pair of oppositely directed conveyor screws 82 and 83, which are mounted in the lower portion of a hopper 84, which hopper is mounted within a housing 85 for the entire feeding apparatus, which is closed by means of a door 86 providing access to the feeding apparatus for adjusting and similar purposes, said housing being also provided with a hinged closure 87 on the top thereof, through which finely divided solid material can be supplied to the hopper 84. The top wall 88 of the housing 85 is provided with openings in which the sleeve-like members 89 are mounted in fixed position. Said sleeve-like members 89 are fixed to the bottom wall 53 of a dust collector, which is mounted in fixed position on the top wall 88 with the sleeve-like members 89 extending through openings in said top wall 88, and said sleeve-like members 89 are mounted in openings in the bottom wall 53 of the dust collector, by welding or in any other desired manner, and serve as inlets into the dust collector bags, or tubular members, in a similar manner to the inlets 62.

The dust collector housing is provided with a wall 48', the top wall 49 and a closure member 51, corresponding substantially to the parts correspondingly numbered in Figs. 1 to 6, inclusive. Said dust collector further has end walls 50, one of which has an opening 54 therein leading to the exhaust fan 72 in the same manner as previously described, said exhaust fan having the discharge or outlet conduit 73. A slightly different mounting and arrangement of bag-like members is shown in Figs. 8 to 11, inclusive, however, said bag-like members being mounted by means of brackets 56', similar to the brackets 56, and by means of hook-like members 58 that are provided on the tubular fabric members 60', which

have closed top ends 59, just as do the members 60 described in connection with Figs. 1 to 7, inclusive. However, the members 60' are shown as being shorter and somewhat larger in diameter than the members 60. Also said members 60' are connected in a different manner with the sleeve-like members 89 than the tubular members 60 are with the inlet openings 62. A split clamping ring 90 surrounds the lower open end of each tubular member 60', said tubular member passing over the sleeve-like member 89 to surround the same, and the clamping ring 90 is then tightened up around the lower open end of said tubular member 60' by means of suitable clamping means, such as the bolt and nut 91, passing through suitable perforated ears in the clamping ring 90, so as to provide a substantially dust tight joint between the sleeve-like members 89 and the lower open end of the bag-like member 60' associated therewith. The membr 60' is, however, of a tubular character and elongated similarly to the member 60 and is made of similar material and operates in substantially the same manner when suction is created through the opening 54 by means of the exhaust fan 72, which is driven by means of a suitable motor, as illustrated. It will also be obvious that any dust-laden air will be drawn out of the hopper 84 within the housing 85 through the passages in the sleeve-like members 89 into the bag-like members, and that the air will pass through the walls of the bag-like members and the dust will adhere to the inner faces of said bag-like members, the air with the dust removed therefrom passing into the chamber 47' and through the opening 54 and out through the discharge pipe 73 of the exhaust fan. It will be obvious that the members 60' are held distended in a similar manner to the members 60 when the exhaust fan is operating and will collapse in a similar manner when the exhaust fan is stopped, so as to permit the dust that has adhered to the interior of the tubular fabric members 60' to drop through the fabric members 89 into the hopper 84 to be utilized along with the material in the hopper 84 to be acted on by the feeding means 80 along with the material that has been otherwise placed in the hopper 84.

What I claim is:

1. A portable self supporting unit for feeding finely divided solid material to a liquid from a point lower than the surface of said liquid, comprising an upstanding housing having means therein for feeding said material to said liquid by gravity at a controlled rate, means for supplying said finely divided solid material to said feeding means, comprising a lower hopper adjacent said housing but spaced therefrom, an elevator comprising an endless series of buckets, a vertical housing for said elevator in which said buckets travel fixed to and extending upwardly from said lower hopper to above the top of said elevator, the upper end of said vertical housing being closed, said buckets receiving finely divided solid material from said lower hopper, an upper hopper within said upstanding housing above said feeding means, said elevator extending above said upper hopper, and an enclosed chute fixedly connected with said vertical housing and with said upstanding housing and extending obliquely downwardly from one side of said vertical housing near the top thereof to said upstanding housing and discharging into said upper hopper, said chute receiving material discharged from said buckets and conveying said material to said upper hopper by gravity, said upper hopper discharging said material into said feeding means by gravity, said chute holding said housings in relatively fixed side by side spaced relation for mounting the bottom of said upstanding housing and said lower hopper at a common level on a common support.

2. In an apparatus of the character described, means for feeding dry material containing dust at a controlled rate to a liquid including an upper hopper, means in the bottom of said upper hopper for controlling discharge from said upper hopper to said liquid by gravity, a lower hopper below and at one side of said upper hopper, means for supplying said material to said lower hopper, an upstanding elevator housing on said lower hopper extending above said upper hopper, an elevator in said upstanding housing, an enclosed chute in open communication and dust tight connection with said elevator housing, said upper hopper having an enclosure leading to said enclosed chute, said chute being in open communication with said upper hopper and in dust tight connection with said enclosure, and a dust collecting device comprising a chamber having dust collecting means therein and having dust laden air inlet means leading from said elevator housing, said dust collecting means comprising filters positioned above said air inlet means, suction means for drawing dust laden air through said air inlet means and through said filters and means for cutting off said suction means, said filters being so constructed and arranged that when said suction means is operating dust will be retained on said filters and when the suction is cut off the collected dust will drop from said filters through said inlet means into said elevator housing.

3. The combination with means for feeding finely divided solid material at a controlled rate by gravity, of means for supplying said finely divided solid material to said feeding means comprising an elevator, means for supplying said material to said elevator and a hopper for said feeding means into which said elevator discharges, housing means for said feeding means, hopper and elevator in continuous open communication and dust tight connection with each other, and a dust collecting device connected with the housing means for said elevator, said dust collecting device comprising a chamber adjacent said elevator housing, means having dust collecting means therein open to discharge dust at the bottom thereof, and a combined dust-laden air and collected dust conduit leading laterally and upwardly from said elevator housing means into the open bottom of said dust collecting means, said dust collecting means comprising filters positioned above said conduit, suction means for drawing dust-laden air through said conduit and filters, and means for cutting off said suction means, said filters being so constructed and arranged that when said suction means is operating dust will be retained on said filters, and when the suction is cut off the dust will drop from said filters through said conduit into said elevator housing.

4. The combination with means for feeding dry material containing dust, of means for supplying said dusty dry material to said feeding means, a lower hopper, an elevator comprising an endless series of buckets, a vertical housing for said elevator in which said buckets travel, said buckets receiving material from said hopper, an upper hopper, a housing for said feeding means and

upper hopper, said elevator extending above said upper hopper, enclosed means conveying material discharged from said buckets to said upper hopper by gravity, said enclosed means providing a conduit in open communication with said housing, said upper hopper discharging said material into said feeding means by gravity, a chamber adjacent said housing, a conduit leading from said vertical housing and continuously open thereto having a bottom wall inclined toward said housing, and dust collecting means in said chamber open at the bottom thereof to said conduit above said inclined bottom wall and discharging collected dust into said housing through said conduit down said inclined wall by gravity, said dust collecting means comprising filters positioned above said conduit, suction means for drawing dust-laden air through said conduit and filters and means for cutting off said suction means, said filters being so constructed and arranged that when said suction means is operating dust will be retained on said filters, and when the suction is cut off the dust will drop from said filters through said conduit into said elevator housing.

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