July 9, 1940. J. A. CHATER 2,206,876

DUSTING MACHINE

Filed April 2, 1936 6 Sheets-Sheet 1

Fig. 1.

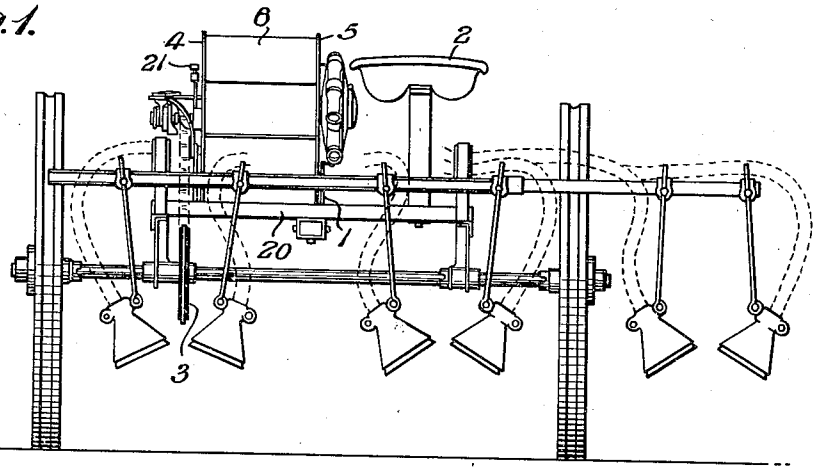
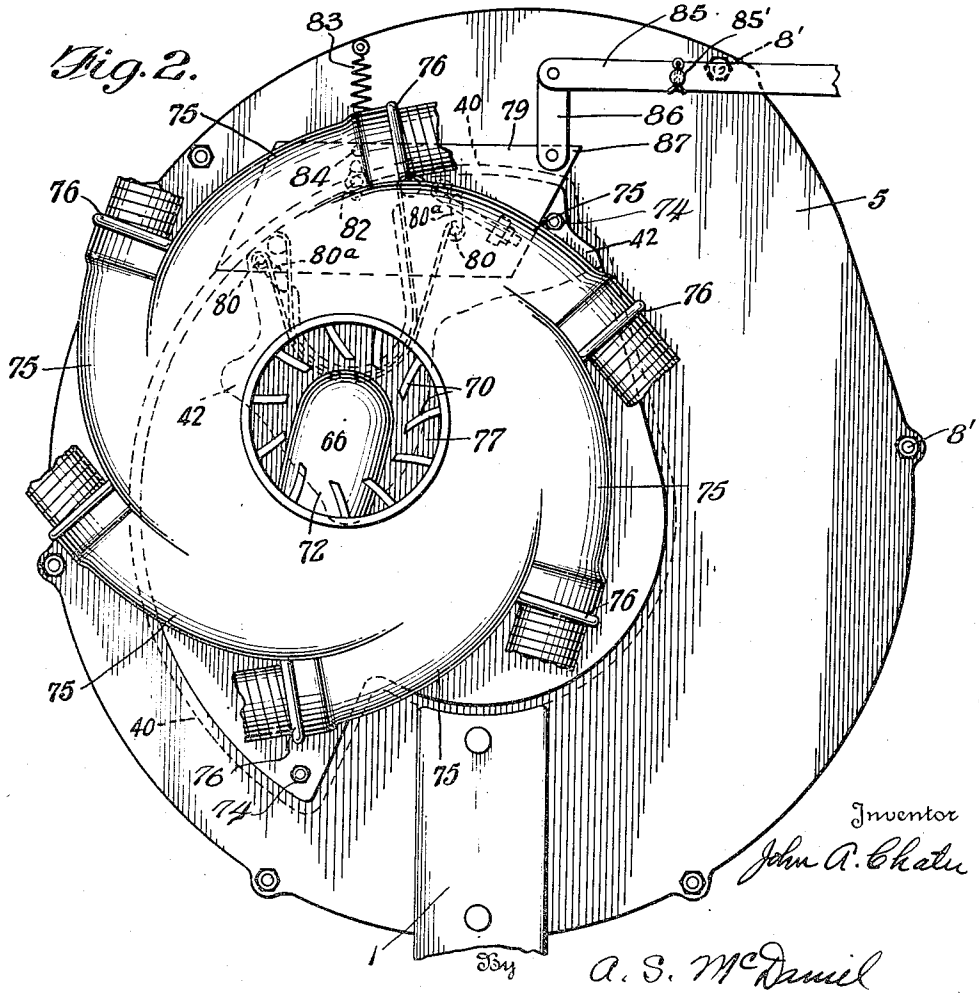


Fig. 2.



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DUSTING MACHINE

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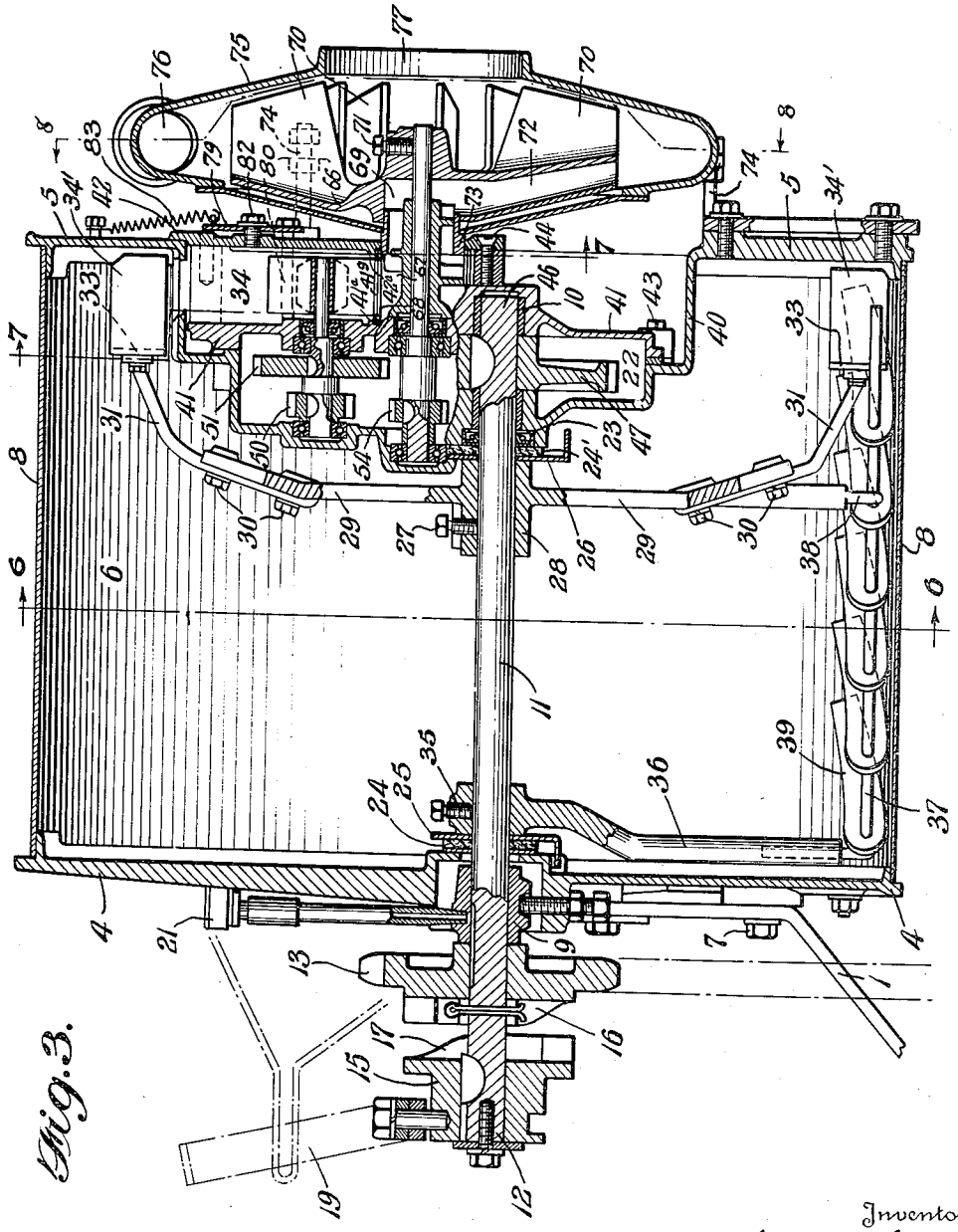


Fig. 3.

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DUSTING MACHINE

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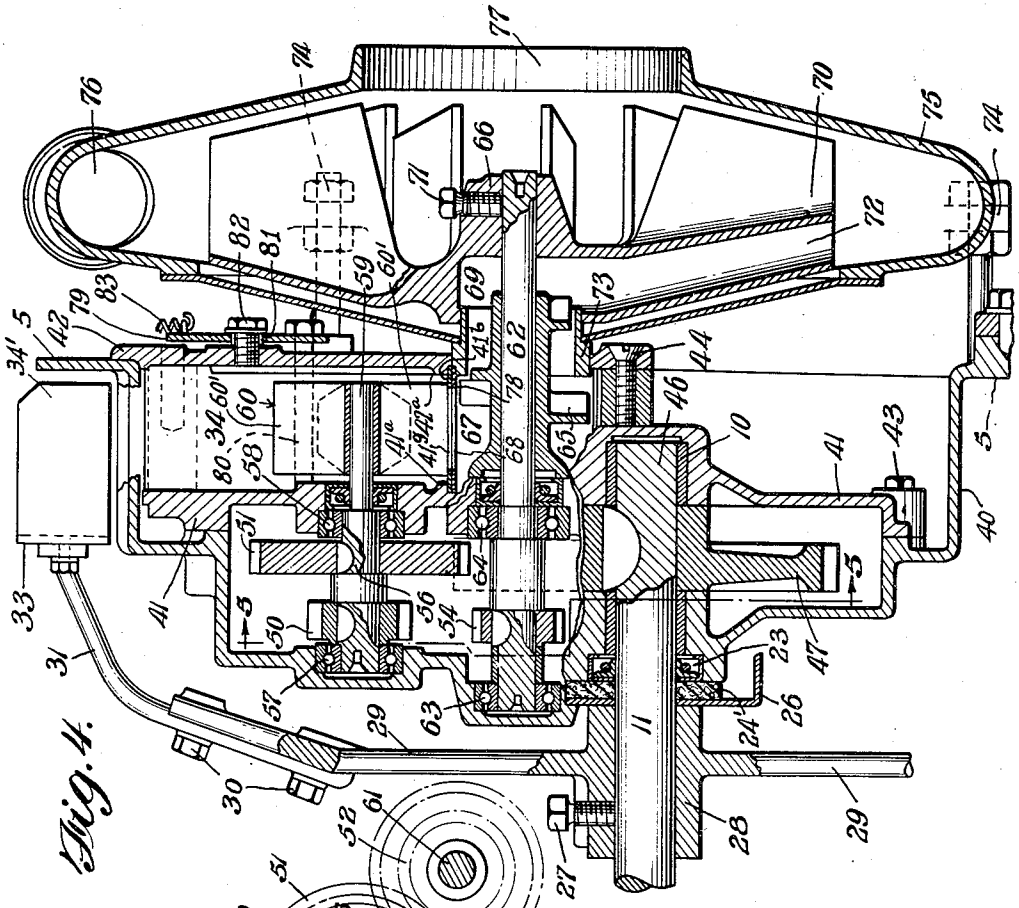


Fig. 4.

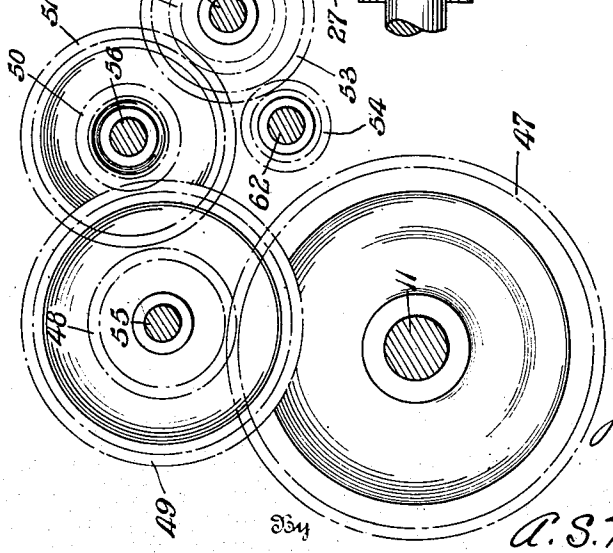


Fig. 5.

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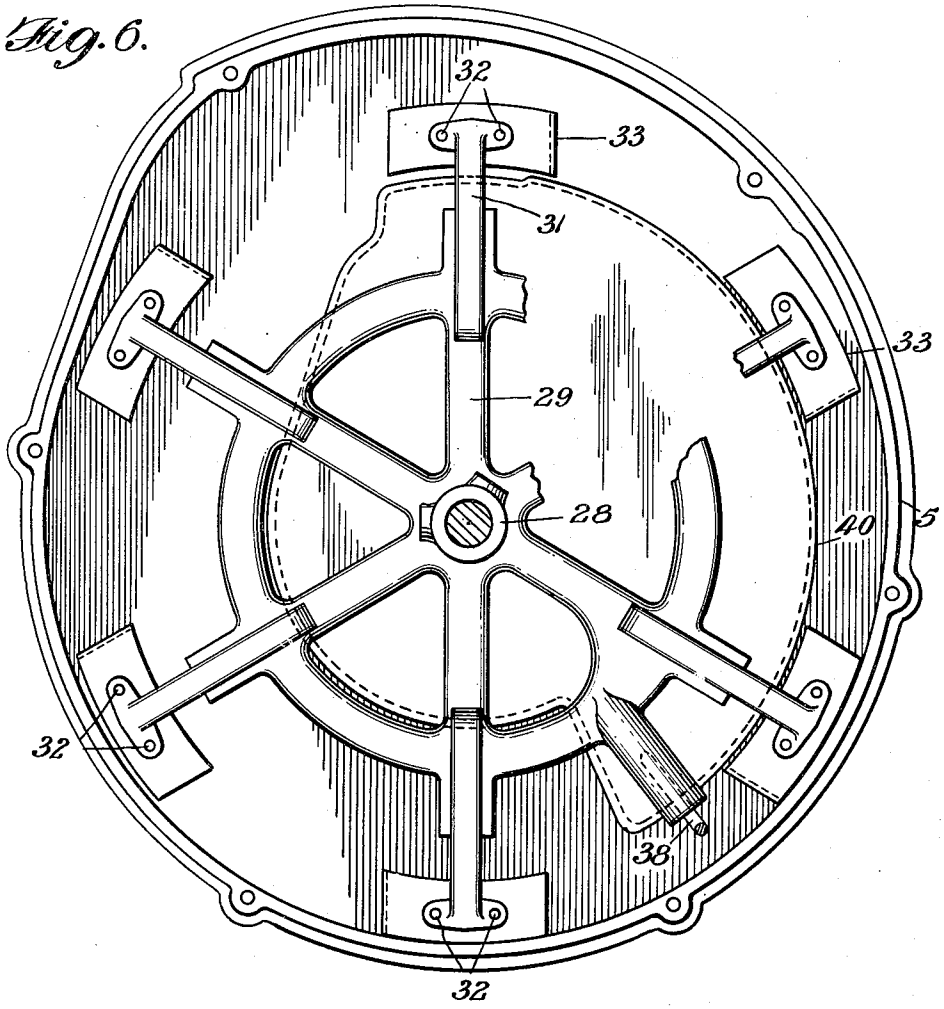
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DUSTING MACHINE

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Fig. 6.



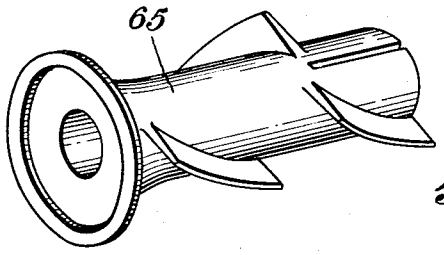


Fig. 9.

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DUSTING MACHINE

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Fig. 7.

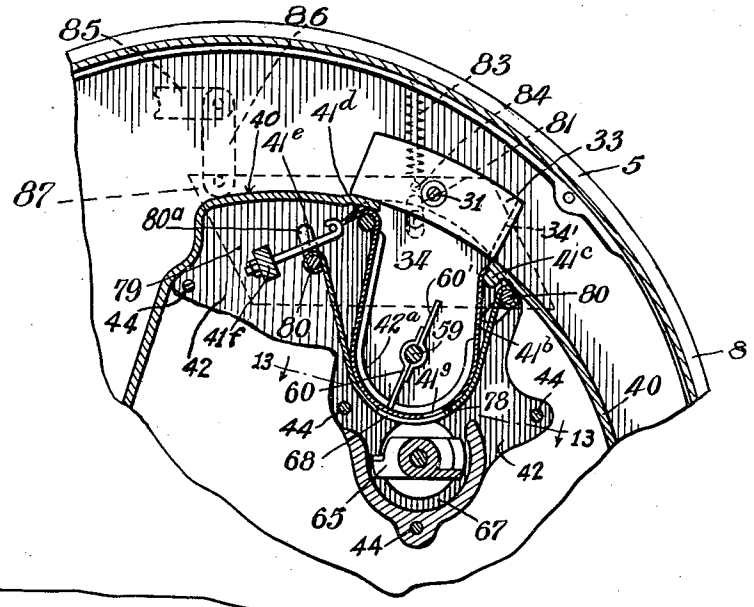
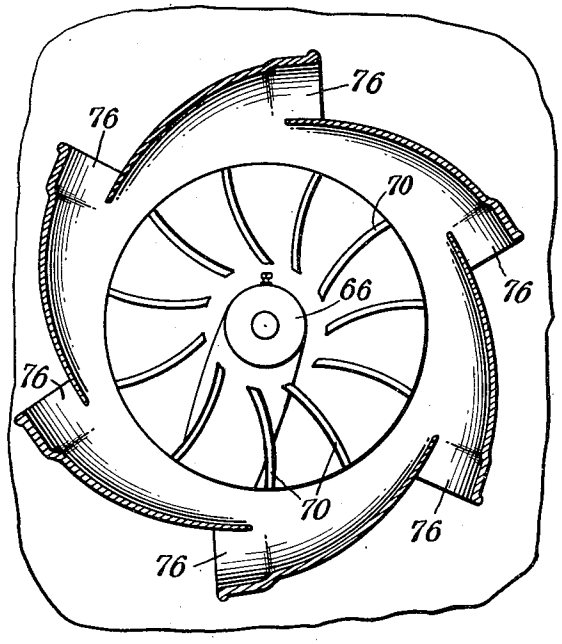


Fig. 8.



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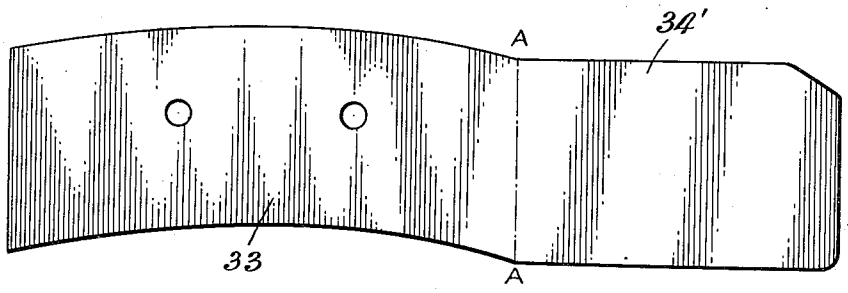
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DUSTING MACHINE

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Fig. 10.



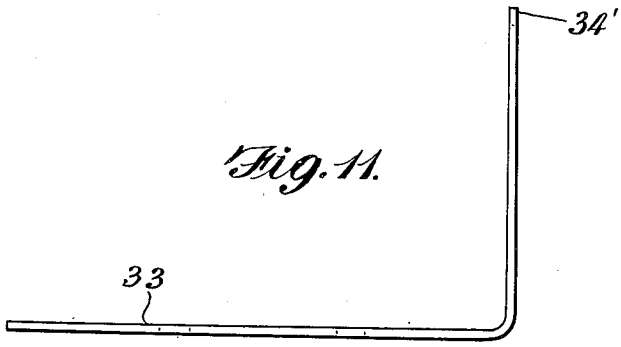


Fig. 11.

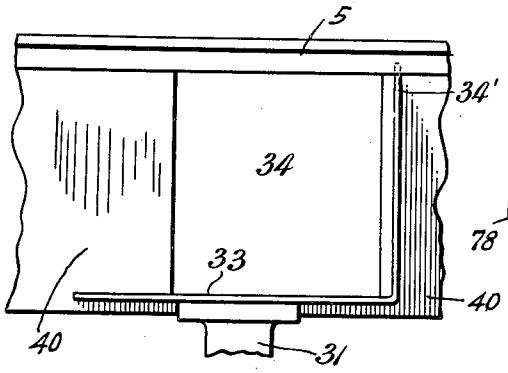


Fig. 12.

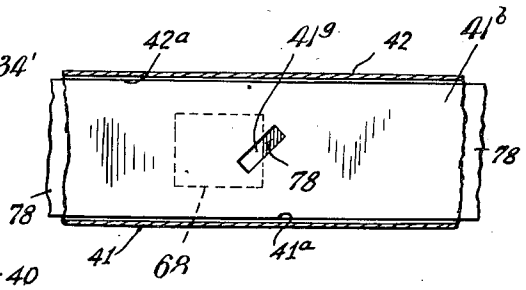


Fig. 13.

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Patented July 9, 1940

2,206,876

UNITED STATES PATENT OFFICE

2,206,876

DUSTING MACHINE

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Application April 2, 1936, Serial No. 72,405

11 Claims. (Cl. 43—148)

This invention relates to dusting machines and more particularly to machines of the multiple outlet, constant rate discharge type from which insecticidal and fungicidal powders may be discharged while entrained in an air blast for deposition upon vegetation.

Due to the rapid increase in the use of insecticidal and fungicidal powders during recent years it has become highly important that the difficulties in discharging a regulated amount of the powders be overcome by both efficient and effective means. Means have been provided with the view to overcoming many of the difficulties which have been encountered but so far as I am aware the difficulties arising in feeding a regulated supply of the powders into the fan housing, from which the powder is discharged through nozzles for the deposition upon vegetation, have only partially been overcome; and the use of machines of this type as a result thereof has been somewhat limited.

It is further highly important that machines of this type be so designed that effective operation thereof is not curtailed even when the dusting mechanism is mounted on a moving vehicle. Due to the necessity for loading hoppers of such dusting mechanisms with such a large supply of powder, a prohibitive weight is placed on the operating mechanism of the powder feeding means which results in a non-uniform discharge of the powder.

Prior to this application no simple and efficient method has been known whereby the weight of the column of powder which is impressed upon the feeding mechanism can be kept substantially constant as long as powder remains in the hopper of the machine.

It is an object of the present invention to overcome the difficulties referred to above and to provide a machine of the type referred to wherein a constant head of powder is maintained on the feeding mechanism as long as powder remains in the hopper.

A further object of this invention is the provision of a dusting machine from which the powder is fed to the discharge mechanism at a predetermined rate.

Still another object of this invention is the provision of a machine having a small auxiliary hopper positioned within and near the top of the main hopper and means whereby the powder is carried from the main hopper and emptied into the auxiliary hopper.

This invention further contemplates novel feed mechanism for conveying the powder from the auxiliary hopper to the fan housing from whence it is discharged.

This invention also contemplates the provision of a cylindrical hopper for the material to be dusted and means in said hopper which tend to agitate as well as force the powder toward one end thereof where it can be scooped up by adequate buckets, carried upwardly, and dumped into the auxiliary hopper which is provided, in turn, with fluffing means that will prevent the powder from packing.

Still a further object of this invention is the provision of novel means whereby the dust is caused to be entrained in an air stream.

Further objects and advantages will be apparent from the following detail specification when considered in connection with the accompanying drawings wherein:

Fig. 1 is a rear elevation of a vehicle showing the apparatus mounted in operative position thereon;

Fig. 2 is an end elevation of the discharge end of the machine;

Fig. 3 is a longitudinal section of the entire machine;

Fig. 4 is an enlarged longitudinal section of the gear case, auxiliary hopper and fan;

Fig. 5 is a diagrammatic showing of the gear train and taken substantially on line 5—5 of Fig. 4;

Fig. 6 is a transverse section on the line 6—6 of Fig. 3 but omitting illustration of the side wall 8 of the hopper and of the impeller vanes 39;

Fig. 7 is a transverse section on the line 7—7 of Fig. 3;

Fig. 8 is a transverse section on the line 8—8 of Fig. 3;

Fig. 9 is a detail perspective view of the feed propeller;

Fig. 10 is a detail view of the blank from which the bucket is formed;

Fig. 11 is a detail view of the bucket;

Fig. 12 is an enlarged fragmentary top plan view of the hopper showing the bucket in position at the opening therein to discharge into the auxiliary hopper 34;

Fig. 13 is an enlarged detail view of the bottom of the auxiliary hopper showing the adjustable orifice 41g.

In referring to the drawings in detail, particularly Fig. 1, one form of apparatus is indicated with which the present invention is adapted to be employed. The apparatus is formed with a supporting frame 1 mounted on the frame of a cart, trailer, or other type of vehicle 2 and may

depend for its driving power on a sprocket wheel 3 mounted on and adapted to turn with the axle shaft that is driven by the cart wheels. Supports 1 are secured to the end walls 4 and 5 of a cylindrical hopper 6 by suitable bolts 7. The end walls of the hopper are preferably formed by cast metal while the side wall 8 is formed of relatively thin sheet metal. The end walls are held in assembled relationship with the cylindrical side wall 8 by tie rods 8'. Journaled in bearings 9 and 10 positioned respectively in the approximate center of the end walls 4 and 5 is a drive shaft 11. The end 12 of drive shaft 11 extends through wall 4 far enough that a sprocket wheel 13 and clutch assembly 15 may be mounted thereon. Sprocket wheel 13 is mounted to turn loosely on shaft 11 and has formed integrally therewith teeth 16. Teeth 16 are adapted to engage similar teeth 17 on the clutch casting 15 that is keyed to and adapted to slide, by movement of a suitable actuating lever 19, on shaft 11 for engagement with the sprocket wheel 13. Sprocket wheel 13 is adapted to be driven through the medium of a chain.

Oil or grease is supplied to bearing 9 by means of the grease fitting 21, and to bearing 10 from the gear case 22. The oil or grease is prevented from seeping into the hopper along the shaft 11 by oil retainer 23. Felts 24 and 24' are used to prevent the dust from leaking out of the hopper along shaft 11 while it is turning and to prevent the dust from seeping into the gear case respectively. Felts 24 and 24' are held in operative position by retainers 25 and 26 respectively. Secured to shaft 11 by set screw 27, and adapted to rotate therewith, is a spider 28 having a plurality of radial legs 29. Legs 29 have fastened to their outer ends by means of bolts 30, bracket arms 31. On the opposite ends of arms 31 are secured by suitable bolts or rivets 32 buckets 33 which convey dust reposing in the hopper 6 to the auxiliary hopper 34. Buckets 33 as shown in detail in Figs. 10 and 11 are preferably constructed of sheet metal. The sheet metal is first cut to the desired length and shape as shown in Fig. 10, then the straight end 34' is bent along the line A—A at substantially right angles to the plane of the metal thereby forming a bucket having one end and one side. Also secured to shaft 11 by set screw 35 is an arm 36 to the outer end of which is secured one end of rod 37. Rod 37 is fastened at a point near the opposite end thereof, by suitable coupling means 38, to the outer end of one leg of the spider. Secured to rod 37 in parallel, spaced relationship are agitating and impeller vanes 39 so shaped that at all times they tend to agitate as well as impel the dust reposing in hopper 6 toward one end thereof where it can be picked up by buckets 33 and conveyed to the auxiliary hopper 34.

The hopper end wall 5 is stepped inwardly in the region of the center to form the inner wall of a gear box and auxiliary hopper assembly and, as shown in Fig. 3, a portion 40 cooperates with the sheet metal wall 8 to form a confined area through which the dust is elevated by buckets 33 to the auxiliary hopper 34, the dust being also confined between the end of the hopper and the two legs of the bucket 33. With such an arrangement should dust be carried up by the bucket at a rate in excess of the amount discharged, the buckets would drag the dust over the hopper opening where it would be returned to the main hopper.

Casting 41 forms the outer wall of the gear box but the inner wall of the auxiliary hopper and is secured in operative position by screws 43. The outer wall of the auxiliary hopper is formed by casting 42 and is secured in operative position by screws 44. As shown in Figs. 3, 4 and 7, the faces of these castings that are presented to the inside of the auxiliary hopper are provided with small flanges 41*a* and 42*a* against which the edges of a sheet metal strap 41*b*, that may be formed of brass or any other suitable metal, are adapted to bear when drawn into position to form the bottom and remaining side walls of the auxiliary hopper. One end of the strap 41*b* is secured to a lug 41*c* made integrally with or secured to the casting 41. Then the strap is bent to substantially U-shaped contours with the edges resting against the small flanges 41*a* and 42*a* and the free end brought over a second lug or pin 41*d* and secured to a hook 41*e* that is adjustably anchored to a lug 41*f* projecting from the casting 41. As shown in Fig. 7 and in detail in Fig. 13, the strap is provided with an opening 41*g* through which dust elevated to the auxiliary hopper is discharged. By forming the bottom of the auxiliary hopper of thin sheet metal, the thickness of the metal edges defining the discharge opening will be sufficiently reduced so that there will be no necessity for wiping the dust through the opening as is necessary where a thick casting is used to form the bottom of the auxiliary hopper.

Casting 41 has provided therein a bearing 10 in which end 46 of drive shaft 11 is journaled and adapted to rotate. A gear 47 is keyed or otherwise secured to and adapted to be driven with the drive shaft 11. This gear serves as a driving gear for the gear train composed of gears 48, 49, 50, 51, 52, 53 and 54. Idler gear 48 which meshes with the driving gear 47 is carried by a shaft 55 that is journaled in bearings not shown mounted in the hopper wall 5 and the casting 41 respectively. Gear 48 is secured to in axial alignment and adapted to drive a larger gear 49 which in turn meshes with a smaller gear 50. Gear 50 is adapted to be driven by the gear 49 and is mounted on a shaft 56 that is journaled in bearings 57 and 58 disposed in alignment in the castings 5 and 41 respectively. End 59 of shaft 56 of reduced diameter extends through the casting 41 into the auxiliary hopper 34. A two vane fluffer 60 is secured to the end of the shaft projecting into the auxiliary hopper 34 and is adapted to be driven thereby. Vanes 60 and 60' are of sufficient length so that they extend to the bottom of the auxiliary hopper 34 and wipe over the discharge opening 41*g*.

Gear 51 which is made integral with or secured to gear 50 in axial alignment, drives an idler gear 52 that is mounted on shaft 61. Idler gear 52 is made integral with or secured to gear 53 which drives gear 54 that is keyed to and adapted to drive shaft 62. Shaft 62 at its inner end is journaled in bearings 63 carried by the hopper wall 5 and at a point remote from the inner end thereof by bearing 64 carried by wall 41. The respective sizes of gears 47, 48, 49, 50, 51, 52, 53 and 54 are so selected that while the drive shaft 11 is being driven at about 40 R. P. M. the fluffer 60 will be driven at about 360 R. P. M. and the screw conveyor 65 and fan runner 66 at about 2300 R. P. M.

A portion of shaft 62 of reduced diameter extends outwardly a sufficient distance to accommodate a dust feed propeller 65 and the hub of the fan 66. The dust feed propeller 65 is in the form of a screw conveyor and has a sleeve type hub which is secured to and turns with shaft 62.

The propeller is positioned in chamber 67 which is immediately below and separated from the auxiliary hopper 34 by the metal strap member 41b having the orifice 41g therein so that dust fed from the auxiliary hopper 34 into the chamber 67 will be conveyed to the hollow hub 69 of the fan runner 66. Fan runner 66, secured to the outer end of and adapted to turn with shaft 62 by set screw 71, is provided with a plurality of radial blades or vanes 70 and a radial duct 72 through which dust, by centrifugal force and air suction, is thrown out at the periphery of the runner and entrained in the outgoing air stream. A stepped sleeve 73 forms a passageway for the dust conveyed from chamber 67 to the hollow hub 69 of the fan runner. The end of sleeve 73 having the greater diameter is secured to the casting 42 while the reduced portion extends into and in close relationship with hollow hub 69. Mounted concentrically and in contact with the step of sleeve 73, and secured to the end wall 5 of the hopper by suitable bolts 74, is a fan casing 75 having a plurality of equally spaced discharge outlets 76. Outlets 76 are so designed that flexible hoses may be attached to them. The fan housing and fan blades 70 are so designed that air will be drawn in through the central opening 77 provided in the outer wall of the housing and blown out through the peripheral outlets 76 with the dust from the radial duct 72 entrained therewith.

In order to effect a predetermined discharge of dust, provisions are made by varying the size of the orifice 41g which connects the auxiliary hopper 34 with the chamber 67. The bottom 41b of hopper 34, as seen in Fig. 7, is rounded so that a flat, relatively thin sheet metal strap 78 will fit close to the bottom surface thereof. Strap 78, near the center thereof, as shown in Fig. 13 is provided with an elongated rectangular opening 68 which by movement of the strap will register in varying degrees, depending on the size of orifice desired, with the opening 41g in the bottom of hopper 34. The ends of strap 78 are secured to a retainer and adjustment plate 79 by pins 80 extending through slots 80a in the plate or wall 42, see Figs. 2 and 7. As shown in Fig. 7 plate 79 is provided with an elongated opening 81 at a point above and approximately midway between pins 80. The plate is loosely and pivotally secured to the outer wall 42 of hopper 34 by bolt 82 which is passed through opening 81 and tapped into the wall. A coil spring 83 having one end secured to the end wall 5 of the hopper 6 at a point immediately above the elongated opening in the plate 79, is secured to the plate 79 at its opposite end by a pin 84 (see Figs. 2, 3 and 7). This functions to keep the strap 78 up tight against the bottom of hopper 34 where it is frictionally held in adjustment. To effect an adjustment of the orifice a lever 85 is pivotally mounted at 85' on the end wall 5 of the main hopper is connected by suitable linkage 86 to the extended portion 87 of plate 79 by means of which strap 78 can be moved relative to the bottom of the hopper to obtain the desired orifice. The lever 85 may be held in adjusted positions by any suitable means (not shown) or may be held in the hand of the operator while the device is in operation so as to readily vary the amount of dust discharged.

In operation a quantity of the material to be dusted is placed in the main hopper 6 where it is continually agitated by the impeller vanes 39 which tend to force the material toward the end of the hopper where it can be scooped up by the buckets 33 and elevated to the mouth of the auxiliary hopper 34. The buckets will, as long as there is dust in the main hopper, keep a constant head of dust in the auxiliary hopper. Should dust be fed to the auxiliary hopper in excess of the quantity being discharged, the dust will be carried on by the mouth of the auxiliary hopper and returned to the main hopper 6. The fluffer 60 which is caused to rotate at about 360 R. P. M. within the auxiliary hopper will prevent the dust from packing and insure uniform feeding through the adjusted orifice 41g—68 in the bottom thereof. The dust which is continuously fed through the orifice to the feed propeller chamber 67 is conveyed to the hollow hub 69 of the fan runner 66 by means of propeller 65 and discharged by centrifugal force and air suction through the radial duct 72 in the fan runner to the multiple outlets 76 in the fan housing. In this manner, in contrast with that type of runner used heretofore, the dust is fed successively to the discharge outlets at a uniform rate.

What I claim is:

1. In a dusting machine a main hopper for material to be dusted, common means for both agitating and impelling the material in the hopper toward one end thereof, an auxiliary hopper having a curved bottom surface positioned within and at a point near the top of the main hopper, means for delivering the material from said one end of the main hopper to said auxiliary hopper said auxiliary hopper having a discharge orifice in the curved bottom thereof, a flexible sheet strap operably positioned in contact with the entire curved portion of the bottom surface of said auxiliary hopper and having an opening therein for registry with the discharge orifice in the curved bottom of the auxiliary hopper, means for moving said strap relative to the curved bottom of the auxiliary hopper whereby the discharge orifice may be varied in size to effect a predetermined rate of discharge, means defining a passageway disposed below the bottom of the auxiliary hopper that communicates with the discharge means, discharge means for effecting a discharge of the material from the apparatus and rotating means disposed within said passageway for conveying the material from the orifice in the auxiliary hopper to the discharge means whereby the material is fed at a predetermined rate to said discharge means.

2. In a dusting machine a main hopper for the material to be dusted, common means for both agitating and impelling the material in the hopper toward one end thereof, an auxiliary hopper within and positioned near the top of the main hopper at said last mentioned end thereof, a drive shaft extending through the main hopper, a spider on said drive shaft, a plurality of buckets carried by the spider for elevating the dust from the main hopper to the auxiliary hopper, a fan housing having a plurality of equally spaced outlets through which the material from said auxiliary hopper is discharged, and a fan in said housing having a single radial duct therein adapted to discharge dust successively to the multiple equally spaced discharge outlets, and means connecting the auxiliary hopper with said radial duct in said fan.

3. In a dusting machine a main hopper for the material to be dusted, common means for both agitating and impelling the material in the hopper toward one end thereof, an auxiliary hopper within and positioned near the top of the main hopper at said last mentioned end thereof, a drive shaft extending through the main hopper, a spider on said drive shaft, a plurality of buckets

carried by the spider for elevating the dust from the main hopper to the auxiliary hopper, a fan housing having a plurality of equally spaced outlets through which the material from said auxiliary hopper is discharged, a fan in said housing having a single radial duct therein adapted to discharge dust successively to the multiple equally spaced discharge outlets, means defining a communicating passageway between the bottom of the auxiliary hopper and said duct in said fan, and propeller means disposed within said passageway whereby material is fed from the auxiliary hopper to the fan at a predetermined rate.

4. In a dusting machine a main hopper, an auxiliary hopper disposed within the main hopper, means for driving the dust material from the main hopper to the auxiliary hopper said auxiliary hopper having a curved bottom and two side walls thereof formed of thin sheet metal, said auxiliary hopper having an orifice in the bottom thereof, a thin resilient sheet strap in contact with the entire curved bottom portion of the auxiliary hopper and having an orifice therein adapted to register with the orifice in the bottom of the auxiliary hopper, resilient means adapted to maintain the flexible sheet metal strap in contact with the entire curved portion of the bottom of the auxiliary hopper, and means connected to the ends of said strap and pivotally secured to a relatively fixed part of the machine whereby an adjustment of the strap relative to the bottom of the auxiliary hopper may be effected to define an orifice of predetermined cross-sectional area.

5. A dusting machine comprising in combination a main hopper, a drive shaft extending through the main hopper, radial arms extending from said drive shaft, a plurality of propeller vanes carried by said arms and adapted to move the dust in the main hopper toward one end thereof, a spider member secured to and adapted to be rotated by the drive shaft, an auxiliary hopper mounted within the main hopper and at one end thereof, buckets carried by said spider member to elevate dust from the bottom of said hopper to and discharge it into the auxiliary hopper, a fluffer operatively disposed within the auxiliary hopper, said auxiliary hopper having a discharge orifice in the bottom thereof, means for varying the size of said orifice, a fan housing, means disposed below the auxiliary hopper for defining a passageway which communicates with the fan housing, a propeller rotatably mounted in said passageway, and a fan runner mounted in said fan housing, said fan runner having a radial duct therein in communication with said passageway adapted to discharge by centrifugal force dust fed thereto toward the outer peripheral wall of the fan housing, said fan housing having a plurality of equally spaced discharge openings therein whereby air and entrained dust may be discharged from the dusting machine.

6. In a dusting machine a main hopper, an auxiliary hopper disposed within the main hopper and having communication with the latter to receive material therefrom, said auxiliary hopper having the bottom thereof formed of thin material, said auxiliary hopper having an orifice in the bottom thereof, a strap of thin material having an orifice therein adapted to register with the orifice in the bottom of the auxiliary hopper drawn about two sidewalls and the bottom of said hopper, resilient means adapted to maintain the said strap in contact with the bottom of the hopper, operable means connected to the ends of said strap and pivotally secured to a relatively fixed part of the machine whereby an adjustment of the registry of said orifices may be effected to cause a predetermined rate of discharge of a powdered medium from the auxiliary hopper.

7. In a dusting machine, a main hopper for material to be dusted, means for effecting the discharge of the material from the apparatus in the form of dust entrained in air, means for maintaining a substantially uniform pressure upon the dust entering into said dust discharging means, comprising an auxiliary hopper to receive the dust from the main hopper and delivering said dust to said discharge means, and means for conveying the dust from the main hopper to the auxiliary hopper which includes a conveyor which comprises a channel surface opening into said auxiliary hopper and operable flights for conveying the dust from the main hopper through said channel to said auxiliary hopper and which flights pass over the opening into the auxiliary hopper and will carry the dust back to the main hopper when the auxiliary hopper is filled.

8. In a device of the character described, a hopper for containing material, an auxiliary hopper within the main hopper, means for conveying the material in the main hopper to the auxiliary hopper comprising a channel extending from the bottom of the main hopper to the auxiliary hopper, and a movable means comprising flights movable from the bottom of the main hopper along said channel and back to the bottom of the main hopper, the bottom of said channel forming the conveying surface of the material over which the flights pass.

9. In a device of the character described as set forth in claim 8, wherein said channel comprises walls forming a side wall of the conveying means and the bottom wall of the conveying means, and wherein the flights comprise two walls, one forming a spaced side wall in cooperation with the side wall of the channel and its other wall forming a rear wall.

10. In a device as set forth in claim 8, further characterized by the flights being mounted on radially extending arms projecting from a rotatable member, and means carried by said rotatable member for agitating and advancing the material in the main container into the path of the movement of said flights.

11. In a dusting machine of the type described, comprising a source of dust supply, means for distributing from the apparatus dust entrained in air and receiving the dust from the source of supply in quantities at a predetermined rate, said dust distributing means comprising a fan and a housing therefor, said fan having a single radial duct communicating at its inner end with the dust supply and adapted to discharge by centrifugal force the dust fed thereto toward the outer peripheral wall of the fan housing, said housing having a plurality of substantially equally spaced discharge openings therein whereby air and entrained dust may be discharged from the dusting machine.

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