Feb. 21, 1967

C. E. JOHNSON

3,305,140

DRY CHIP SPRAYER

Filed March 26, 1965

3 Sheets-Sheet 1

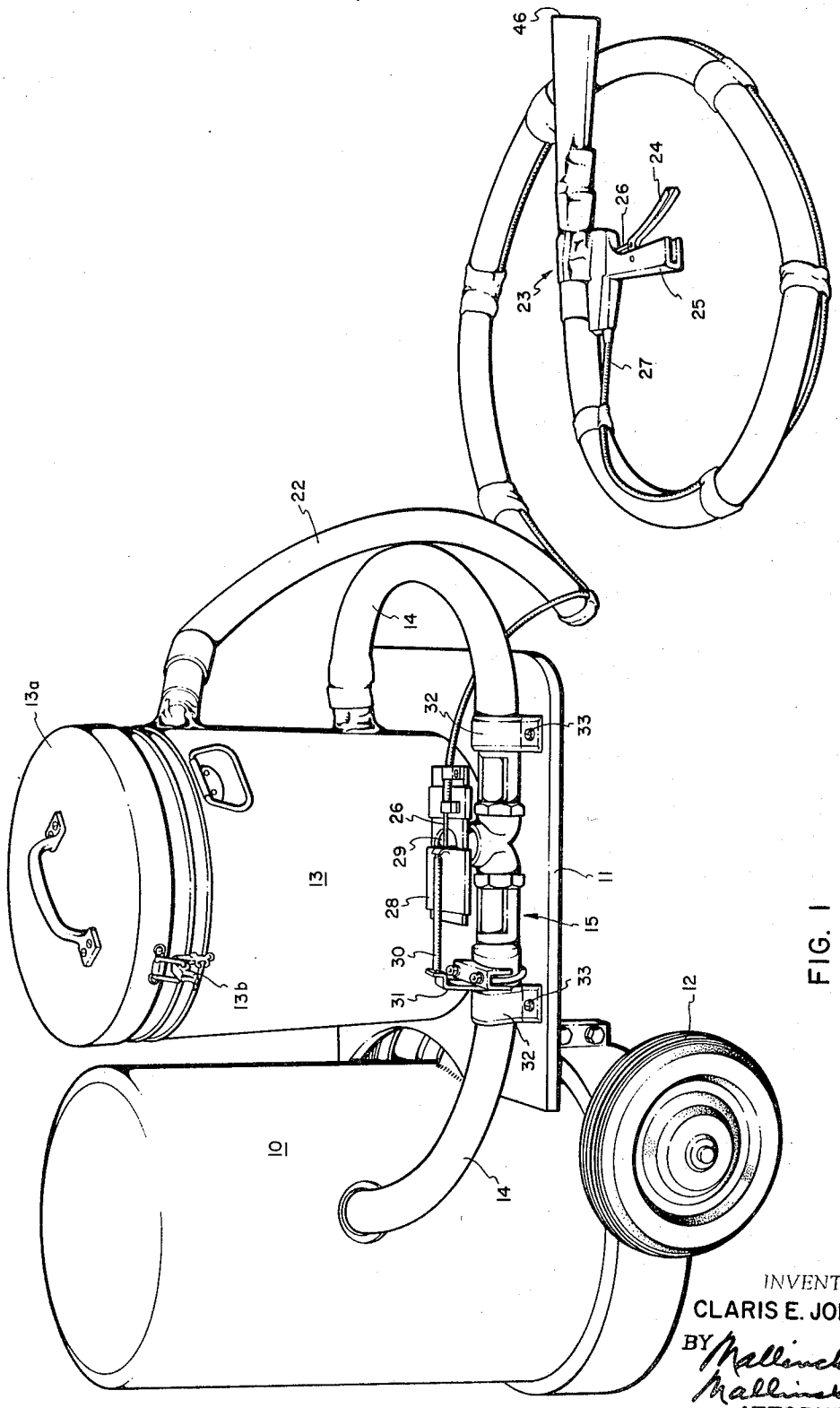


FIG. 1

INVENTOR.
CLARIS E. JOHNSON
BY Mallinckrodt & Mallinckrodt
ATTORNEYS

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3 Sheets-Sheet 2

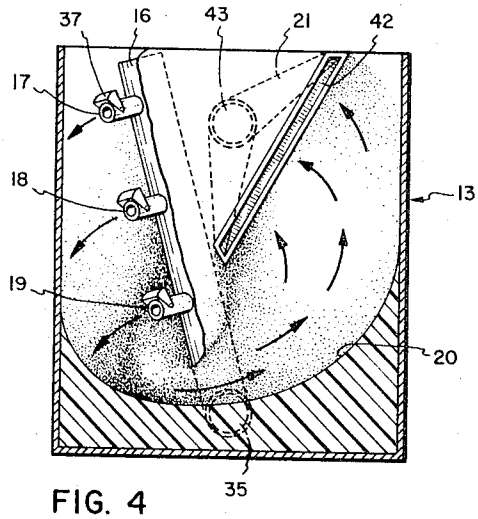


FIG. 4

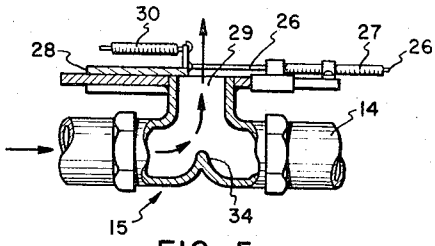


FIG. 5

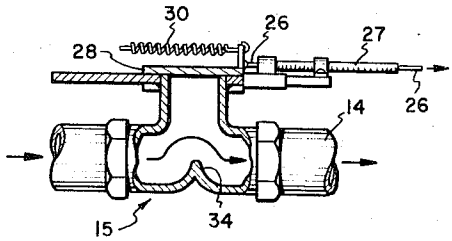


FIG. 6

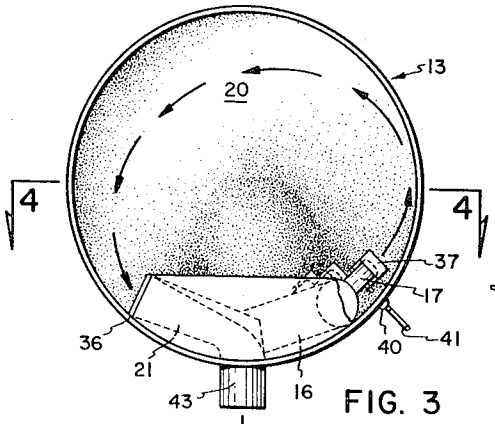


FIG. 3

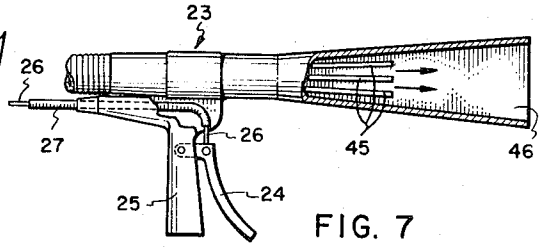


FIG. 7

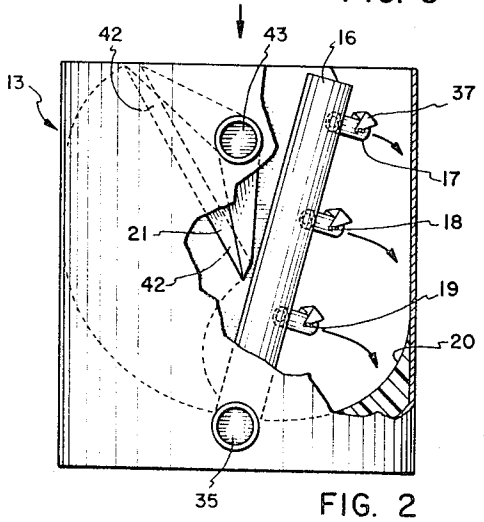


FIG. 2

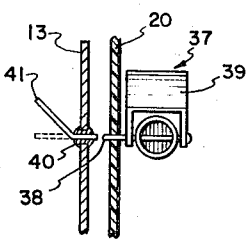


FIG. 8

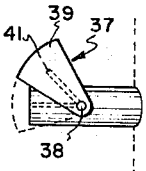


FIG. 9

INVENTOR.

CLARIS E. JOHNSON

BY Mallinckrodt and Mallinckrodt

ATTORNEYS

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DRY CHIP SPRAYER

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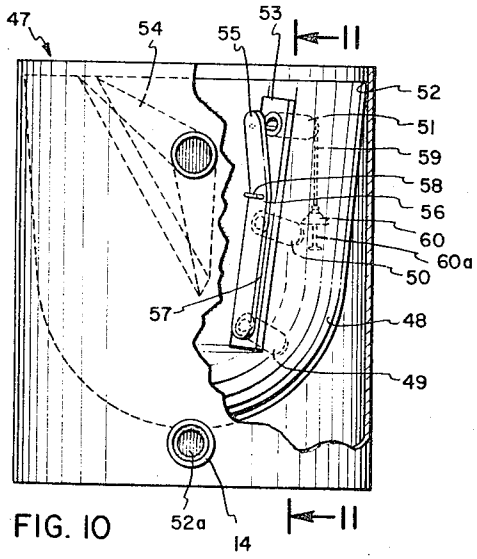


FIG. 10

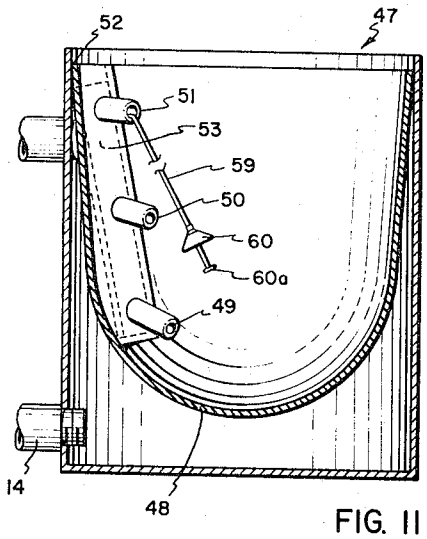


FIG. 11

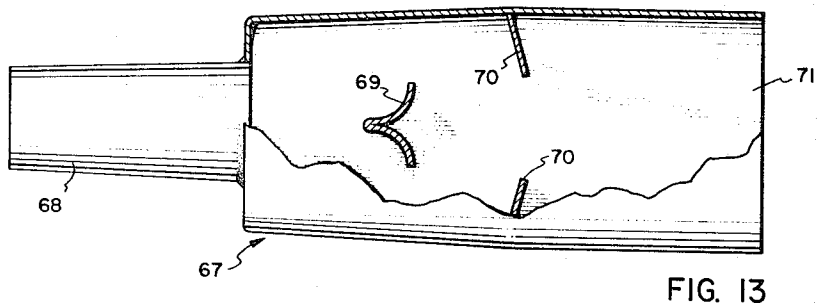


FIG. 13

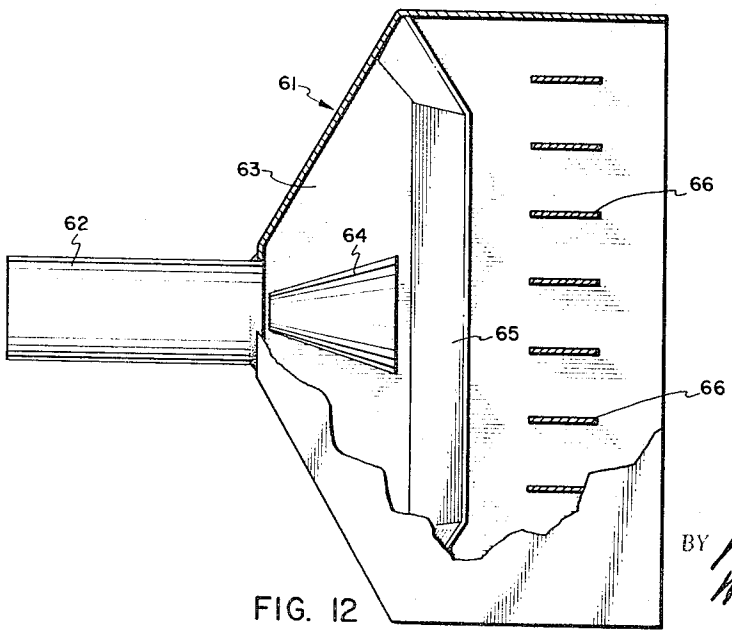


FIG. 12

INVENTOR.
CLARIS E. JOHNSON
BY Mallinckrodt and Mallinckrodt
ATTORNEYS

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3,305,140

DRY CHIP SPRAYER

Claris E. Johnson, % 3701 Washington, Blvd., Ogden, Utah 84403

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10 Claims. (Cl. 222—193)

This invention relates to machines for spraying dry chips into a binder material that has been previously coated on objects such as floors, walls, and the like.

Other machines have been developed for the purpose in the past. Some of these are shown in U.S. Patents Numbers 2,187,376, 2,341,036, and 2,391,048, but it has been my experience that machines of the several types shown in such patents are not satisfactory. This is especially true when the binder material is a liquid plastic having poor adhesive properties and when the chips are dry plastic or metallic particles that vary considerably in both size and weight and that tend to adhere to one another and to form clumps.

These previously known spraying machines have proven unsatisfactory because they do not uniformly dispense the chips on the area being sprayed at a controlled rate. Furthermore, they do not provide adequate means to vary the volume of air and application pressure. As a result the chips frequently bounce off the surface to which they are applied, and the impinging air stream distorts the binder coat previously applied to the surface.

It is a principal object of the present invention to provide a dry chip sprayer that separates and uniformly dispenses dry chips in such a manner that they firmly adhere to a binder material without the carrying air supply distorting the surface to which the chips are applied.

Further objects are to provide a chip sprayer that will evenly distribute a supply of chips, even though the volume of chip material available in a supply tank of the sprayer will vary as the chips are distributed, and to provide for such distribution when either manual or automatic controls are used.

In accomplishing these objects I utilize a conventional source of air under pressure and means to regulate the volume and direction of application of the air into a chip receptacle that is specially designed so that the entering air will gently agitate the chips therein. Regardless of the volume of chips in the tank, they are picked up by the air and carried in the continuous pre-mixed, size and weight ratio to a vaned distribution nozzle. The nozzle further insures uniform application of chips onto the area sprayed, at a reduced velocity so that the chips will properly adhere to the binder surface.

There are shown in the accompanying drawings specific embodiments of the invention representing what are presently regarded as the best modes of carrying out the generic concepts in actual practice. From the detailed description of these presently preferred forms of the invention, other more specific objects and features will become apparent.

In the drawings:

FIG. 1 is a perspective view showing the general assembly of the dry chip sprayer;

FIG. 2, a side elevation of one form of chip tank, partially broken away to show the positions of the manually controlled air inlet and discharge ports;

FIG. 3, a top plan view of the chip tank of FIG. 2, with the lid removed;

FIG. 4, a vertical section taken on the line 4—4 of FIG. 3, but revolved 180° for clarity;

FIG. 5, a side elevation, with the control valve partially cut-away to show its interior details in the open position;

FIG. 6, another cut-away side elevation view showing the control valve in its closed position;

FIG. 7, a side elevation of one form of a distributing nozzle, partially broken away to show its interior details;

FIG. 8, an end elevation of a typical manually operated air inlet cover for the air inlet ports;

FIG. 9 a side elevation view showing the same cover;

FIG. 10, a view like FIG. 2, but showing another embodiment of chip tank that includes an automatic control for the air inlets;

FIG. 11, a vertical sectional view taken on the line 11—11 of FIG. 10;

FIG. 12, a partially cut-away, greatly enlarged, side elevation of another form of distributing nozzle; and

FIG. 13, a similar view of still another form of nozzle.

Referring now to the drawings:

In the preferred embodiment the dry chip sprayer includes a source of air under pressure. As illustrated, the source comprises a readily available commercial type electrically powered vacuum cleaner **10**, mounted on a platform **11**, that for ease of mobility is fitted with wheels **12**.

A special tank **13** is also mounted on platform **11** and serves as a receptacle for the dry chips to be sprayed.

Air from the discharge opening of the vacuum cleaner **10** is supplied through a hose **14** and a control valve **15** to a header **16**, FIGS. 2–4, positioned within tank **13**. The air is then directed through one or more of the nozzles **17**, **18**, and **19** of header **16** that comprise an inlet port means for the tank, toward the curved interior surface of the tank, and out of the tank through a discharge vent **21** forming an entrance to a discharge port from the tank, hose **22**, and distributing nozzle **23**.

The volume of air that is supplied tank **13** is regulated by squeezing trigger **24** and handle **25** to pivot the trigger toward the handle. Cable **26** is connected to trigger **24** so that such squeezing will pull the cable through its cable housing **27**, thereby moving a slide **28** that is connected to the other end of the cable to close an exhaust opening **29** of the control valve **15**. When the trigger is released the slide is moved away from exhaust opening **29** by a spring **30** that interconnects slide **28** and an upstanding bracket **31** fixed to one of a pair of collars **32** surrounding hose **14**. Collars **32** are anchored to platform **11** by screws **33**.

When trigger **24** is released and exhaust opening **29** is uncovered air from vacuum cleaner **10** is diverted upwardly by a baffle **34**, FIG. 5, formed in the valve, and is exhausted to the atmosphere. If the opening is closed, however, the air will pass over baffle **34** and enter tank **13**, in the manner illustrated in FIG. 6. Obviously, the amount of pressure applied to trigger **24** will control the extent of opening of exhaust port **29** and the proportionate amounts of air that will be diverted to atmosphere and passed into the tank.

Referring again to FIGS. 2–4, air enters tank **13** through an inlet opening **35** of header pipe **16** and is directed by one or more of the nozzles **17**, **18**, and **19** toward and around the curved interior surface of lining **20**.

The lining is curved downwardly away from the walls of the tank to a low point adjacent the lower nozzle **19**, with the surface forming a smooth transitional curve from the low point up to the vent **21**, and around the inside of the tank from the nozzles to the vent.

Nozzles **17**, **18**, and **19** are provided with covers **37**, FIGS. 8 and 9, that are fixed on rods **38** extending through the nozzles. The covers include curved plates **39** that are fixed to rods **38** and that are adapted to be swung into a position substantially blocking their respective nozzles. Each rod **38** is tightly journalled through lining **20** and a grommet **40** in the wall of the tank, and terminates in an operating handle **41** outside the tank by which the rod is rotated to position the curved plate. The tight fit between each grommet **40** and its associated

rod **38** provides a frictional resistance that maintains the cover connected to the rod in any set position.

Vent **21** has an elongate mouth **42** that rests flat against surface **36** such that chips carried by the air stream as it follows the contour of lining **20** will be directed into the mouth. From the mouth the vent converges toward an outlet opening **43** to which hose **22** is attached.

In operation, tank **13** is filled with mixed dry chip material, such as solid plastic or metallic chips of varying size and weight, and the vacuum cleaner **10** is turned on. Trigger **23** is squeezed and slide **28** is moved to close, or partially close, port **29**, thereby directing air into tank **13**. When the tank is full, or substantially full, nozzles **18** and **19** are closed by manipulating their associated handles **41** to pivot their covers **37** into position blocking the nozzle openings. The entering air must then pass through the upper nozzle **17** to gently agitate the separate the chips in the upper part of the tank. If, after the volume of chips in the tank has decreased, fewer chips are picked up by the air stream, upper nozzle **17** is closed and one or both of the nozzles **18** and **19** are opened to direct the air supply into the remaining chips. If chip volume is very low it may be desirable to close nozzle **18**, thereby leaving only nozzle **19** open to direct a maximum volume of air toward the low point in the tank.

After passing through outlet opening **43** the chip entrained air passes through hose **22** and distributing nozzle **23** onto the surface being sprayed.

Nozzle **23** includes vanes **45** that separate particles that have clumped together following the agitation in the tank and directs the chips uniformly throughout the sprayed area. An enlarged opening **46** at the discharge end of the nozzle directs the air stream toward the surface to be sprayed and decreases air stream and particle velocity.

As the chips are agitated in tank **13**, those that are not picked up and carried by the air stream are deposited back on the curved interior surface where they slide down into position to again be agitated, until all of the chips in the tank have been distributed at a uniform rate.

In FIGS. 10 and 11, there is illustrated another form of chip tank, **47**, that includes the same type of curved liner **48** as has been disclosed in connection with tank **13** above. In this embodiment, however, no header pipe is employed, and automatic control apparatus is used to regulate flow through the plurality of inlet orifices **49**, **50**, and **51**. The upper edge of the liner is completely sealed to the tank at **52** and air entering the tank from hose **14**, and intake opening **52***a* is directed through upper inlet nozzle **51** or through the inlet nozzles **49** and **50**. The inlet nozzles are preferably carried by a backing member **53** that is cemented to the back side of liner **48** and extend through the liner where they are directed toward the curved interior surface in the manner previously disclosed. Also, as in the previously disclosed embodiment, a vent **54**, having a wide elongate mouth, is positioned to receive particle entrained air and to direct it toward a distributing nozzle.

The automatic control for orifices **49**, **50**, and **51**, consists of an elongate plate **55** that is mounted on backing member **53** and that overlies the intake openings of the inlet nozzles. Plate **55** is bent at **56** between upper nozzle **51** and middle nozzle **50** such that the portion of plate **55** overlying nozzle **51** is angled away from the backing member when the plate rests on the intake openings of inlet nozzles **49** and **50**. If desired a gasket, not shown, can be positioned beneath the edge of plate **55**, and under bend **56**, to better seal off flow through the nozzles when the plate rests on them. Hooks **58** at opposite sides of plate **55** extend over the plate at the bend and provide an axis about which the plate can pivot.

A flexible wire **59** is fixed to the upper end of plate **55** and extends through upper nozzle **51** and inside the tank where a weight **60** is affixed to its opposite end.

When the tank is filled with chip material weight **60** is lifted and the weight of the portion of the plate **55** that covers the intake openings of inlet nozzles **49** and **50** is sufficient to pivot the plate into sealing engagement with these nozzles.

After the tank has been filled the weight **60** is set on top of the chip material, with anchor **60***a* inserted into the chip material to keep the weight from being blown around inside the tank by the entering air.

Air entering through intake opening **62***a* into the space between the tank and the liner can then only pass through nozzle **51**, the air itself acting on plate **55** to hold it tightly against the intake openings of inlet nozzles **49** and **50**. However, when the level of the chips falls, so that the weight **60** pulls on plate **55**, the plate will pivot to close nozzle **51** and to open nozzles **49** and **50**. Thus, the chips are continually picked up by the air stream and carried out vent **54** to a distribution nozzle.

In either illustrated embodiment the air stream gently agitates and separates the particles before picking them up and carrying them through an outlet vent to a distribution nozzle, and if the chips having varying sizes and weight are thoroughly mixed when they are placed in the tank they will be entrained by the air and continuously distributed in the same mixed size and weight ratio. The lighter particles will not be distributed before the heavier ones, or vice versa.

The enlarged outlet opening of the distributing nozzle governs chip velocity and determines the pattern to be sprayed on the surface area to be covered. The details of this nozzle will vary, depending upon the distance between the nozzle and the surface to be sprayed and the nature of the surface.

For normal operations the distributing nozzle **23** illustrated in FIGS. 1 and 7 has proven highly satisfactory. Because of its gradual flared configuration, and the dividers in its outlet nozzle **23** separates the chips but maintains them in a sufficiently close group that they will carry over a rather long range before being deposited in an evenly spaced pattern. However, for application of chips to a floor surface, the distributing nozzle **61** shown in FIG. 12 serves to better reduce velocity so that the chips gently fall onto the surface. Nozzle **61** includes an inlet **62** that is rather abruptly flared to an enlarged outlet portion **63**. Chips passing through inlet **62** must go through, or around, funnel shaped diverter **64**. If they by-pass the diverter they are directed against the wall of outlet portion **63**, and if they pass through the diverter they contact a baffle **65** and are then directed against the outlet portion wall and into the path of those chips by-passing the diverter to create a turbulence. The abrupt enlargement of the nozzle between inlet and outlet portions causes a rapid decrease in velocity of the chip entrained air stream and this is further decreased by the turbulence set up by dividing and recombining the stream. The vanes **66** provide a final means of separating the chips before they are applied. With this nozzle the chips are applied at a very low pressure.

For vertical wall surfaces and ceilings the nozzle illustrated in FIG. 13 has been found to be most useful. This nozzle, shown generally at **67**, includes an inlet **68** and a diverter **69** for dividing the air stream and for directing the divided flows toward baffles **70** to reduce the overall velocity. The divided flow is recombined and is guided through a slightly enlarge outlet portion **71** for application. Since the change in cross-sectional area from the inlet portion **68** to the outlet portion **71** is not as great as with the other disclosed nozzles the velocity decrease is less. Furthermore since no vanes are provided the particles tend to form a more coherent mass that is easily directed toward those portions of the walls and ceilings that are not easily reached from the ground or a workman's scaffolding, etc.

Whereas there are here illustrated and specifically described certain preferred constructions of apparatus which are presently regarded as the best modes of carrying out

the invention, it should be understood that various changes may be made and other constructions adopted without departing from the inventive subject matter particularly pointed out and claimed herebelow.

I claim:

1. A dry chip sprayer, comprising a source of air under pressure; a closed tank adapted to hold chips to be sprayed and having an inlet port means thereto, discharge port means therefrom and a curved interior surface having a low point in the path of air entering the tank through the inlet port means, said surface curving upwardly from said low point to said discharge port means; conduit means interconnecting said source of air and the inlet port means of the tank whereby air from said source is directed into the tank; a distributing nozzle, a hose interconnecting the outlet port means from the tank and the distributing nozzle, whereby air and entrained particles leaving the tank pass through the nozzle; and means for diverting a selected amount of the air passing through the conduit means to atmosphere, including a trigger positioned adjacent the nozzle, a valve in the conduit, said valve having an exhaust port therefrom and a baffle therein directing flow of air toward said exhaust port, a slide adapted to cover said exhaust port, means biasing the slide to a position uncovering said exhaust port, and a cable having one of its ends connected to said slide and its other end fixed to the trigger, whereby pivoting of said trigger pulls the cable to move the slide into position blocking said exhaust port.

2. A dry chip sprayer, comprising a source of air under pressure; a closed tank adapted to hold chips to be sprayed and having inlet port means thereto and discharge port means therefrom and a curved interior surface having a low point in the path of air entering the tank through the inlet port means, said surface curving upwardly from said low point to said discharge port means and said inlet means including a header extending from a point adjacent the low point of the curved interior surface upwardly toward the top of the tank and having a plurality of spaced nozzles along its length, said nozzles being directed toward the curved interior surface; conduit means interconnecting said source of air and the inlet port means of the tank whereby air from said source is directed into the tank; a distributing nozzle; a hose interconnecting the outlet port means from the tank and the distributing nozzle whereby air and entrained particles leaving the tank pass through the nozzle; and means, including a trigger positioned adjacent the nozzle, for diverting a selected amount of the air passing through the conduit means to atmosphere.

3. A dry chip sprayer according to claim 2, further including means to regulate flow through each of the nozzles, said means including operating means extending through the wall of the tank.

4. A dry chip sprayer according to claim 3, wherein the discharge port means from the tank includes a vent positioned against said curved interior surface and having an elongate mouth opening in a direction generally opposite flow from the spaced nozzles, the interior surface

curving upwardly from the low spot to the vent and circularly around the inside of the tank from the nozzles to the vent.

5. A dry chip sprayer comprising a source of air under pressure; a closed tank adapted to be filled with and to hold chips to be sprayed, and having inlet port means thereto, and discharge port means therefrom, and a liner having a curved interior surface with a low point in the path of air entering the tank through the inlet port means and curving upwardly from said low point to a point where said liner is nearest to said discharge port means; conduit means interconnecting said source of air and the inlet port means whereby air from said source is directed into said tank and out through the discharge port means; and means for diverting flow through said conduit means to atmosphere.

6. A dry chip sprayer according to claim 5, further including means to regulate flow through the inlet port means.

7. A dry chip sprayer according to claim 6, wherein the inlet port means includes a header fixed to the outside of the liner and having a plurality of spaced nozzles along its length, said nozzles extending through said liner and at least one of said nozzles being directed toward the low point and the remainder of said nozzles being positioned thereabove; and wherein the means to regulate flow through the inlet port means comprises a pivoted cover on each nozzle and means for manually moving said pivoted cover into and out of nozzle closing position.

8. A dry chip sprayer according to claim 6, wherein the liner is sealed at its upper edge to the wall of the tank and wherein the inlet port means includes an inlet opening through the wall of the tank, and a plurality of nozzles extending through said liner.

9. A dry chip sprayer according to claim 8, wherein the means to regulate flow through the inlet port means comprises valve means adapted to block flow through the nozzles, and actuator means automatically responsive to the level of chips in the tank to selectively close the nozzles.

10. A dry chip sprayer according to claim 9, wherein the valve means includes a bent plate pivotally mounted to rest against said nozzles, with at least one nozzle being open in each pivoted position of the plate; and wherein the actuator means comprises a weight adapted to be positioned on the chips in the tank and a flexible wire extending through one of said nozzles and interconnecting the weight and the plate.

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ROBERT B. REEVES, *Primary Examiner.*

STANLEY H. TOLLBERG, *Examiner.*