

March 16, 1948.

J. C. MOORE

2,437,831

APPARATUS FOR APPLYING INSULATION

Filed May 9, 1940

5 Sheets-Sheet 1

Fig. 1.

Inventor
J.C. Moore
By
A. J. Anderson
Attorney

March 16, 1948.

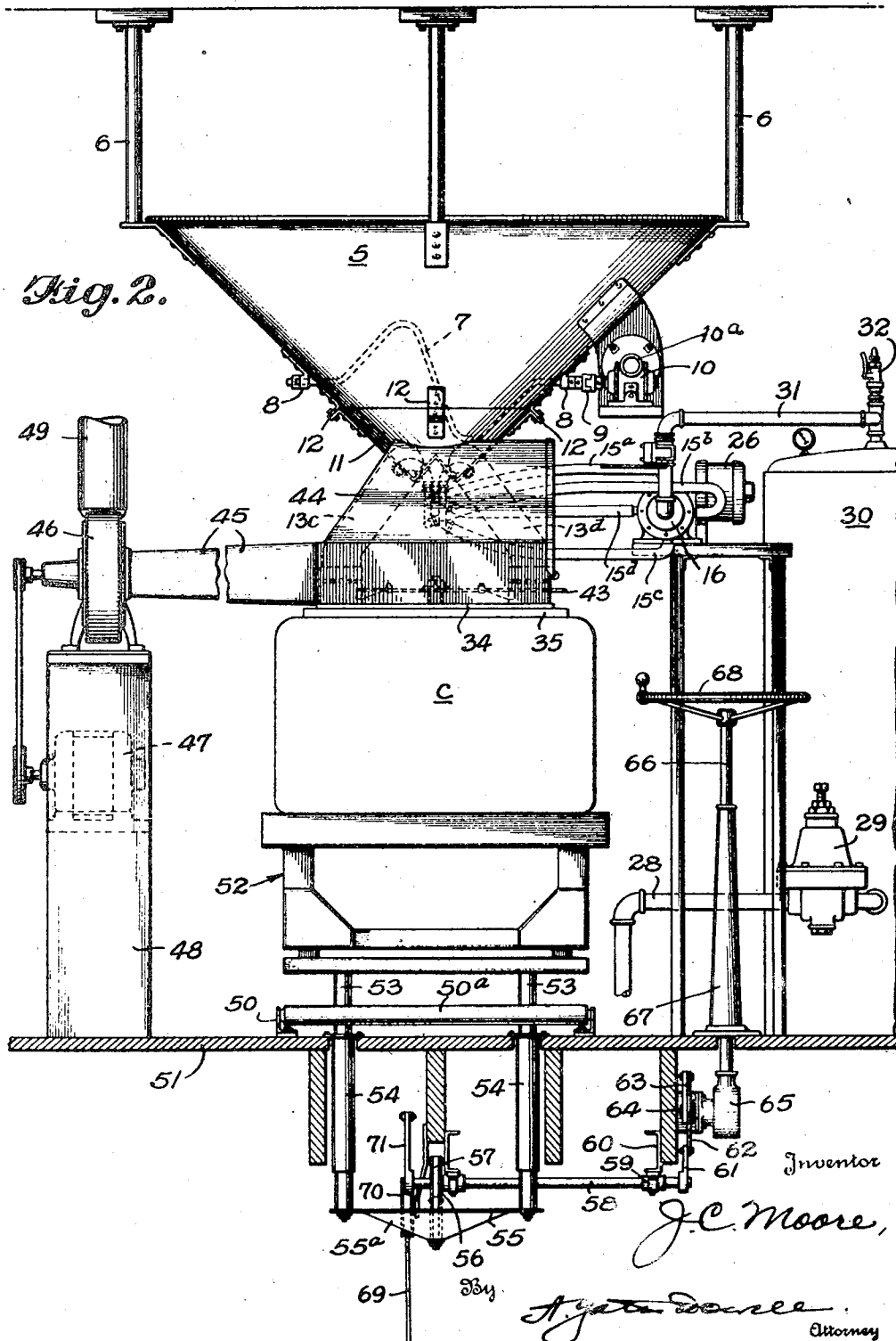
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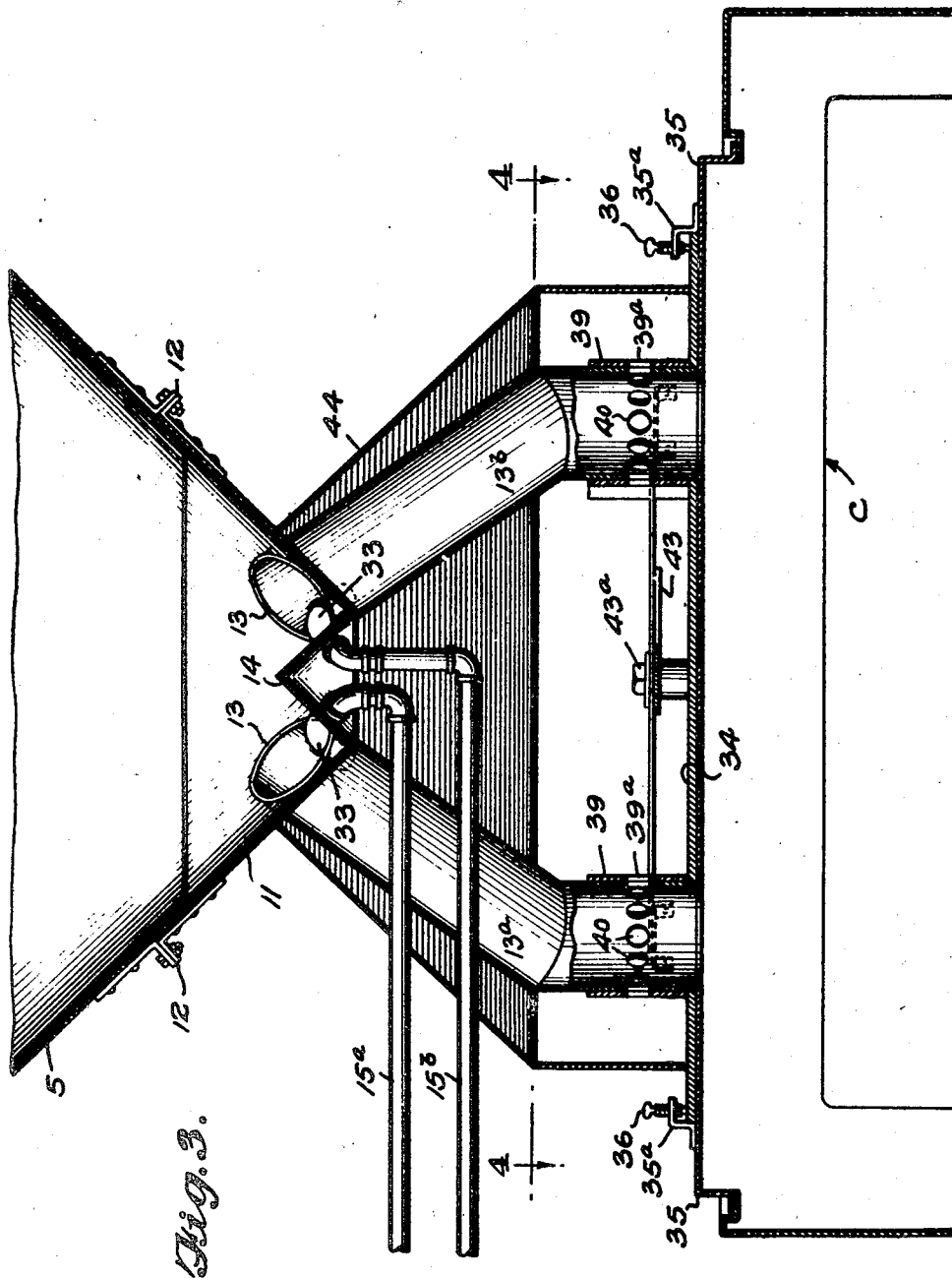


Fig. 3.

Inventor
J. C. Moore,

334
H. J. Doree,
Attorney

March 16, 1948.

J. C. MOORE

2,437,831

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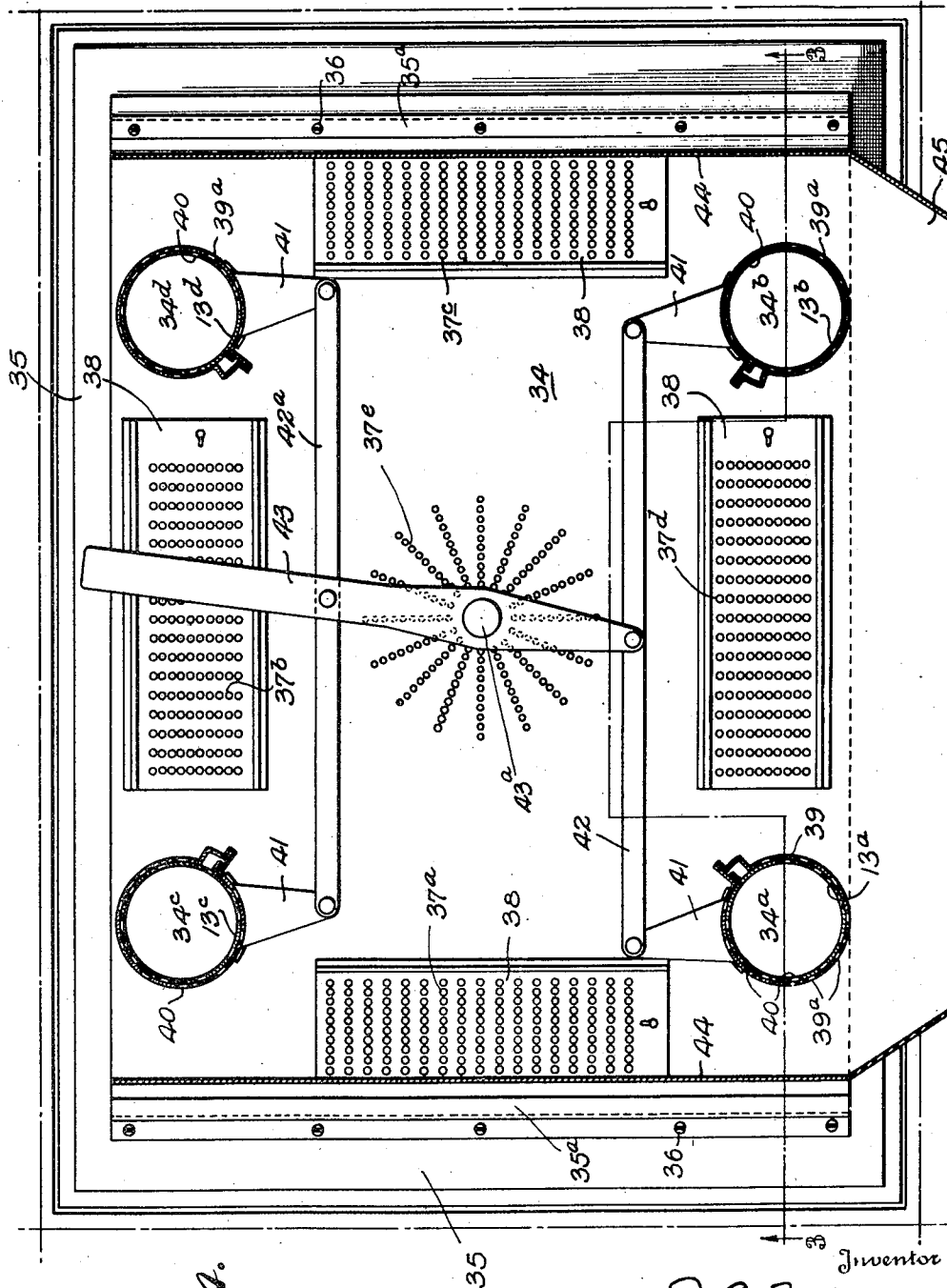


Fig. 4.

J. C. Moore,
Inventor

Hyatt Douse,
Attorney

March 16, 1948.

J. C. MOORE

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Fig. 5.

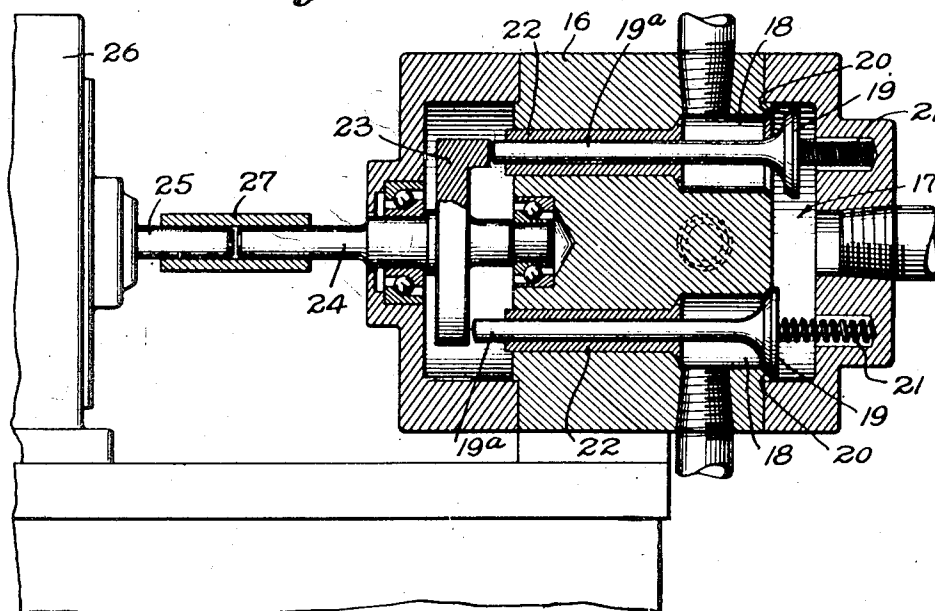
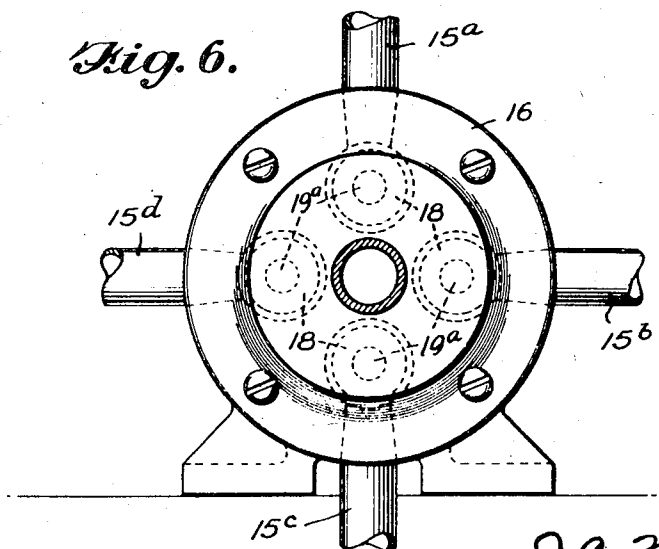


Fig. 6.



Inventor

J.C. Moore

By

A. J. Danne

Attorney

UNITED STATES PATENT OFFICE

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APPARATUS FOR APPLYING INSULATION

John C. Moore, Connersville, Ind., assignor to
Rex Manufacturing Company, Inc., Conners-
ville, Ind., a corporation of Indiana

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This invention relates to an apparatus for applying insulation material between spaced walls or like compartments, particularly between the outer and inner walls of refrigerator cabinets.

Loose insulation material has certain advantages over insulation of the packaged type, provided it is properly applied, that is, evenly and of constant density throughout the compartment to be insulated. Heretofore, as far as known, the stuffing of loose insulation material between the outer and inner walls of refrigerator cabinets has been done manually. Outside of the labor and time involved and consequent increased cost of the cabinet, there was the added objection that the insulation was oftentimes improperly applied, the fault generally being that the material would pack or stuff unevenly, leaving loose spaces or pockets and areas varying in density, and the fibres would not "felt" together or interengage properly, with the result that certain cabinets might be well insulated while others would have an inferior insulating job.

The usual practice in manually insulating the space between the outer and inner walls of a refrigerator cabinet is to stuff the insulation in from the back of the cabinet before mounting the back plate. The cabinet is laid on its face and the depth of the space to be insulated is therefore substantially equal to the width of the cabinet. Since the opening at the back between the food compartment liner and outer wall is relatively small, it is practically impossible for a workman to gain access with his hands to the full depth of the compartment to be insulated. This handicap also tends to an inefficient insulation job.

The primary object of the present invention is to provide a method of and apparatus for automatically applying or stuffing insulation material between spaced walls or like compartments, more especially between the outer and inner walls of refrigerator cabinets, in a manner such as to obtain even and efficient insulation throughout the space or compartment to be insulated.

Other objects include features of novelty and advantage incident to a machine for carrying out the method, and which objects and advantages will become apparent in view of the following description taken in conjunction with the drawings, wherein:

Fig. 1 is a view in elevation of a machine for insulating refrigerator cabinets constructed in accordance with the features of the present invention, the view being taken from the side of the conveyor on which the cabinets are carried to the machine;

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Fig. 2 is a view in elevation taken opposite that of Fig. 1, the conveyor and supporting frame structure being shown in transverse section;

Fig. 3 is an enlarged transverse vertical sectional view taken through the lower end of the feed hopper and induction feed tubes and adjacent parts;

Fig. 4 is a horizontal section taken substantially on the line 4—4 of Fig. 3;

Fig. 5 is a substantially central longitudinal section taken through the air distributor which controls the application of air under pressure to the induction feed tubes; and

Fig. 6 is a view in end elevation of Fig. 5.

Generally stated, the method consists in conducting loose insulation material to the compartment or compartments to be insulated through one or more feed or induction conduits and applying air under pressure intermittently or in a series of pulsations to the material passing through said conduits to obtain a more even and dense packing of the material and intermesh of fibres and to also draw or induct the material into the conduits, and relieving air from the compartment during the insulating operation in a manner such as to avoid back pressure and formation of pockets or spaces of uneven density and to ensure complete filling of the compartment.

Referring to the drawings in detail, and first to Figs. 1, 2 and 3, a hopper 5, preferably of cone shape, is suspended from suitable overhead supporting structure by means of depending hanger brackets or rods 6, the insulation material being delivered to the hopper direct from the conveyor of a shredding machine, not herein shown and forming no part of the present invention.

Any suitable type of loose insulation material may be used, such as balsam wool fibre, and the like.

The hopper 5 serves as a support for other parts of the machine, as will be noted. In the lower extremity of the hopper is mounted an agitator 7 which at its opposite ends terminates in shaft portions supported in bearings 8. At one end, the agitator shaft is provided with a coupling 9 which connects the agitator with a suitable driving means, such as the motor 10, the latter being provided with switch 10^a. This agitator serves to prevent packing or bridging-over of the insulation material while the machine is in operation.

Connected to the lower end of the hopper 5 by means of brackets 12 is what is herein termed an induction head 11 which is also preferably cone-shaped and in effect forms a continuation

of the hopper. The lower extremity of the induction head is provided with a plurality of holes or openings 12, there being four in the present instance, to which are connected induction tubes 13^a, 13^b, 13^c and 13^d, which lead downwardly and project into a master plate to be described. The lower end of the induction head is closed by an inverted cone 14 which projects upwardly into the head and serves to properly direct or guide the material and also provides an anchor for a plurality of air tubes 15^a, 15^b, 15^c and 15^d, there being one for each of the induction tubes 13^a—13^d.

The tubes 15^a—15^d connect at one end with what is herein termed an air distributor, generally indicated at 16, note Figs. 5 and 6. This distributor comprises a housing formed with an air chamber 17 which has in communication therewith a series of ports 18, each of which is controlled by a valve 19 adapted to engage a seat 20, each valve being normally urged to seated position by air pressure and also by spring 21. The valves are each provided with a stem 19^a which has movement in a guide 22.

The valves 19 are intermittently or periodically opened or lifted by means of a cam 23 fixed on a shaft 24, which has a driving connection with armature shaft 25 of motor 26 through flexible coupling 27.

It will be seen that as cam 23 is rotated, it successively contacts or wipes the lower ends of the stems 19^a, successively raising the valves 19 from their seats 20 and admitting air into the ports 18.

Air under pressure may be generated by any suitable means, such as a conventional pressure unit, and passed through conduit 28 and thence through regulator 29 into pressure tank 30. The regulator may be adjusted to maintain the pressure constant while the reserve or equalizing tank functions to prevent surging in a manner well understood in the art. From the tank 30 the air passes through conduit or pipe 31 into the chamber or space 17 of the distributor 16, note Fig. 2 in conjunction with Fig. 5. Tank 30 may be provided with a safety valve 32.

Each of the tubes 15^a—15^d communicates with one of the conduits or tubes 13^a—13^d through nozzle 33, the latter being reversely bent or turned to direct pulsating blasts of air downwardly through its coacting induction tube or conduit.

At the lower ends of the induction conduits or tubes 13^a—13^d is a master plate 34 provided with holes 34^a, 34^b, 34^c and 34^d into which the lower open ends of the conduits project, the plate and conduits being connected as by welding. This master plate is adapted to fit over the space to be insulated at the back of the refrigerator cabinet, generally indicated at C, the cabinet being elevated against the plate in a manner to be described.

Coacting with the master plate is an adaptor plate 35 provided with guides 35^a arranged to slide on the marginal edges of the master plate 34 and be adjustably clamped thereto by means of screw clamps 36. The function of this adaptor plate is to adapt the master plate 34 to varying sizes of cabinets, this being the only change necessary when a line of cabinets of a different size is being insulated. The adapter plate 35 is of course provided with openings corresponding to and in alignment with the openings in the master plate. In other words, there are four openings corresponding to the openings 34^a, 34^b, 34^c, and 34^d to permit the discharge of insula-

tion from the pipes 13^a, 13^b, 13^c, and 13^d and likewise there are openings corresponding to the openings 37^a, 37^b, 37^c, 37^d and 37^e and the plates 38 respectively. The same master plate is used in filling cabinets of varying sizes with an adapter plate corresponding to the size of the cabinet, the master plate being secured to the adapter plate with the openings of each in registration, the screws 36 through the brackets 35^a clamping the master plate to the adapter as stated.

In order to fill or stuff the cabinet with insulation material evenly and of constant density throughout the compartment, it is important that all back pressure be relieved during the insulating operation, and it has also been found important that this release take place as near as possible to the source of induction. With this in view, the master plate 34 is provided with groups of air release holes or vents 37^a, 37^b, 37^c, 37^d and 37^e. These groups are arranged in a particular manner with respect to the sides and ends of the cabinet with the central group 37^c functioning as a buffer to prevent the material from blowing across from one side to the other. Since the induction period is relatively short, it is necessary to have a longer period of release, this period being governed by the size and number or exhaust capacity of the holes in the master plate 34.

In order to regulate the air release to obtain the most efficient operation of the machine, each group of holes 37^a—37^e may be provided with an adjustor plate 38, which may, if desired, be adjusted while the machine is in operation.

In order to ensure complete filling of the compartment to be insulated with insulation material, means are provided for releasing air pressure from the tubes when the cabinet has been substantially completely insulated, such means being in the form of sleeves or collars 39 which are telescoped over and rotatably mounted around the lower end of each of the induction tubes 13^a—13^d, each sleeve 39 being provided with a series of holes 39^a adapted to register with like holes 40 formed in the side walls of the induction tubes, note particularly Fig. 3. These sleeves are provided with arms 41 connected in pairs by links 42 and 42^a, the said links in turn being pivotally connected to an operating lever 43 pivotally mounted or fulcrumed on a stud 43^a projecting upwardly from the master plate 34. By adjusting the lever 43, the time and degree of air release may be accurately regulated to obtain complete insulation of each cabinet.

To maintain the insulation material as well as the surrounding atmosphere free of dust at all times and to also ensure complete evacuation of air from the space being insulated, a shield or hood 44 is applied over the induction head 11 and connects through conduit 45 with suction fan 46 driven by motor 47 mounted on pedestal 48, the dust laden air being discharged through conduit 49.

The cabinets to be insulated are brought to and taken from the machine on a conveyor 50 provided with rollers 50^a, note Figs. 1 and 2, and adjacent the machine a platform 51 is provided to accommodate an operator or operators and to support the hoist and elevating mechanism for the cabinets. This mechanism as herein shown comprises a carriage, generally indicated at 52, made up of a pair of channel bars 52^a and 52^b of substantially inverted U shape arranged parallel with the conveyor rolls 50^a. Secured as by weld-

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ing adjacent the ends of said channel bars are steel tubes 53 arranged for vertical sliding movement through guides 54, the sliding tubes 53 at their lower ends being bolted to lifting plate 55 provided with truss members 55^a to form a rigid structure. The central portion of the plate 55 has connected thereto the lower end of a connecting rod 56, the upper end of the latter being pivotally connected to lever 57 which is secured on rock shaft 58 rotatably mounted in bearings 59 suspended from channel frame members 60. The outer end of the shaft 58 has secured thereon arm 61 which connects through link 62 with arm 63 mounted on stub shaft 64 which projects into gear box 65 in which is mounted worm drive gearing of conventional construction. An operating shaft 66 projects vertically from the gear box 64 through platform 51 and pedestal bearing 67 and is provided on its upper end with a hand-wheel 68.

It will be seen that when the hand wheel 68 is rotated, rotation is transmitted to rock shaft 58 which pulls upwardly on the trussed plate 55 and elevates the carriage 52. If desired, a power drive may be substituted for the handwheel 68.

The lifting or hoisting mechanism is preferably counterweighted, the counterweight (not shown) being connected to the end of a cable 69 which is passed over a pulley 70 and connects at its one end with a lever 71 secured on the rock shaft 58. This lever is secured on the shaft 58 in a manner such that the outer end of the lever to which the cable is attached is slightly below the center line of the shaft when lowered to prevent the pull of the cable from exerting a lifting force on the carriage when the cabinet is removed.

The machine operates as follows:

Refrigerator cabinets are insulated between the spaced outer and inner walls thereof, the inner wall being defined by the food compartment liner, the back wall of which is exposed at the back of the cabinet when the cabinet is ready for the insulating operation with a space between the marginal edges of the outer wall and liner, as is well understood by those having a knowledge of this particular art.

The cabinets, having been assembled to this point, are brought to a position adjacent to carriage 52 on the conveyor 50, face down, and then placed on the carriage and elevated against the master plate 34. This master plate constitutes in effect a temporary back plate or closure in spaced relation to the back wall of the food compartment liner. The position of the cabinet with respect to the master plate is such that there will be one of the holes 34^a—34^d communicating with the compartment to be insulated adjacent each corner thereof.

The machine is preferably provided with one control for turning on the air and starting the motors 10, 26 and 47. Thus when the air is turned on, cam 23 of the air distributor 16 is caused to rotate to successively lift the valves 19 and permit air under pressure to pass into and through the tubes 15^a—15^d and thence through nozzles 33 into the induction tubes 13^a—13^d. The air blast through each induction tube is intermittent or pulsating, causing the material to be forcefully ejected in batches from the discharge ends of the induction tubes 13^a—13^d through the holes 34^a—34^d in the master plate 34. This action has proved to be highly efficient in causing the loose insulation to pack to a constant density and the fibres thereof to "felt" together or intermesh; it might be compared to a careful man-

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ual job of detaching or picking off small batches of substantially constant or uniform size and tamping the batches as they are laid in place.

The air blast not only forces the insulation through the tubes 13^a—13^d and into the compartment to be insulated but also draws or inducts the material from the hopper and induction head into the tubes.

The capacity of the air release holes 37^a—37^d in the master plate 34 should be such as to prevent any tendency toward back pressure, permitting the insulation fibres to pass freely into the compartment to be insulated.

The lever 43 is maintained in a position such that the holes 40 in the lower extremities of the induction tubes 13^a—13^d will be closed until the insulating operation is substantially completed, at which time the lever is moved to uncover said openings or holes 40 and permit the air to be released as the insulation banks up close to the master plate.

The machine is then stopped, the carriage 52 lowered and the cabinet removed. Should there be any unfilled spaces or areas at the back of the cabinet, these may be readily insulated manually, since they would be completely exposed and accessible. The back plate is then applied and the joint around the latter sealed, completing this phase of the fabricating and assembling operation.

Actual experience has demonstrated that cabinets may be insulated more rapidly and more efficiently than can be done manually.

It will be understood that the invention contemplates changes in structure and design to adapt the machine to different types of insulation jobs and to conform to conditions at the place of installation and use without departing from the spirit or scope of the inventive concept as defined by the appended claims.

I claim:

1. In a machine for insulating the space between outer and inner walls of a refrigerator cabinet, a conduit communicating with a source of loose insulation material and said space, a cover plate overlying said space and adapted to substantially close the latter around the conduit, means for delivering air under pressure to material in the conduit to forcefully eject the material therefrom into said space, the discharge extremity of the conduit being provided with one or more air release ports or openings, and means for selectively closing and opening said ports and whereby when the space has been substantially completely filled to a point within the discharge area of the conduit air may be vented from said ports to permit complete filling of the space.

2. In a machine for thermally insulating the space between inner and outer walls of refrigerator cabinets, a hopper, a series of conduits communicating with said hopper to said space, said conduits at their discharge ends being disposed to deliver material at different points over the space, a master plate adapted to substantially close off the space around said conduits, an adapter mounting said master plate for accommodating different sizes of cabinets, a source of air under pressure, means for conducting air from said source to said conduits and causing the air to be discharged into the conduits towards said space, means for interrupting the flow of air to thereby cause the material to be intermittently discharged from said conduits and in batches, and means for venting air from said space to

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prevent building up of back pressure therein during the insulating operation.

3. In a machine for transferring loose insulation material to a space to be insulated, a hopper, a series of conduits communicating with said hopper and said space, a source of air under pressure, pipes or tubes communicating with said source and arranged to direct air under pressure directly into the material in said conduits towards the discharge end of the latter to provide a combined injecting and inducting operation, and an air distributor operating to interrupt the flow of air periodically and successively with respect to the respective conduits to thereby cause the material to be forcefully delivered from said conduits in batches distributed over the space.

4. In a machine for transferring loose material to a space to be insulated, a plurality of conduits communicating with a source of material and said space, a source of air under pressure, means for directing air from said source on the material in said conduits, an air distributor interposed in said last named means and having a series of valves to control the admission of air into said conduits and a valve actuating member operative to move said valves to air-release position successively and intermittently to thereby cause the material to be ejected from said conduits into said space in batches and in successive order with respect to said conduits.

5. In a machine for transferring loose insulation material to a space to be insulated, a hopper containing a mass of material, one or more conduits communicating said hopper with said space, a source of air under pressure, a pipe or tube communicating with said source and disposed to discharge air into said conduit towards said space to thereby cause the material to be discharged from the conduit and to also induct material into the conduit from the hopper, a master plate adapted to overlie said plate and substantially close off the space around the conduit, a series of air relief vents in said master plate to prevent back pressure from building up within the space, the lower extremity of said conduit being also provided with air-release means, and means for selectively controlling said latter air-release means to avoid back pressure when the space has been filled with insulation material to a point within the discharge area of the conduit.

6. In a machine for transferring loose insulation material to a space to be insulated, a hopper, a series of conduits communicating with said hopper and said space, said conduits having their discharge ends disposed to deliver material into said space at different points over the latter, a master plate overlying said space and substantially closing off the latter around said conduits, an adapter mounting said master plate to accommodate said plate to different sizes and shapes of articles to be insulated, a source of air under pressure, means for conducting air from said source and applying it to the material in said conduits towards the discharge end of the latter, means for periodically interrupting the flow of air into said conduits successively with respect to the conduits to thereby cause the material to be discharged from said conduits in batches distributed over the space, and means for relieving air from the space to be insulated to avoid back pressure during the insulating operation.

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7. In a machine for transferring loose material to a space to be insulated a plurality of conduits communicating with a source of material in said space, a source of air under pressure, pipes communicating with said air source and each of said conduits, means attached to said pipes and disposed in said conduits, said means comprising tubular extensions extending longitudinally of said conduits and serving to direct air from said pipes on the material in said conduits and in the direction of movement thereof, an air distributor disposed in said pipes and having a series of valves to control the admission of air into said conduits and, a valve actuating member operative to move said valves to air release position successively and intermittently to thereby cause the material to be ejected from said conduits into said space in batches and in successive order with respect to said conduits.

8. In a machine for transferring loose insulation material to a space to be insulated, a hopper, a series of conduits arranged to direct material from said hopper to said space, said conduits having their discharge ends arranged to deliver material into said space at different points over the latter, a master plate overlying said space and substantially closing off the latter around said conduits, an adapter mounting said master plate to accommodate said plate to different sizes and shapes of articles to be insulated, a source of air under pressure, means for conducting air from said source and applying it to the material in said conduits towards the discharge end of the latter and means for periodically interrupting the flow of air into said conduits to thereby cause the material to be discharged from said conduits in batches distributed over the space.

JOHN C. MOORE.

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