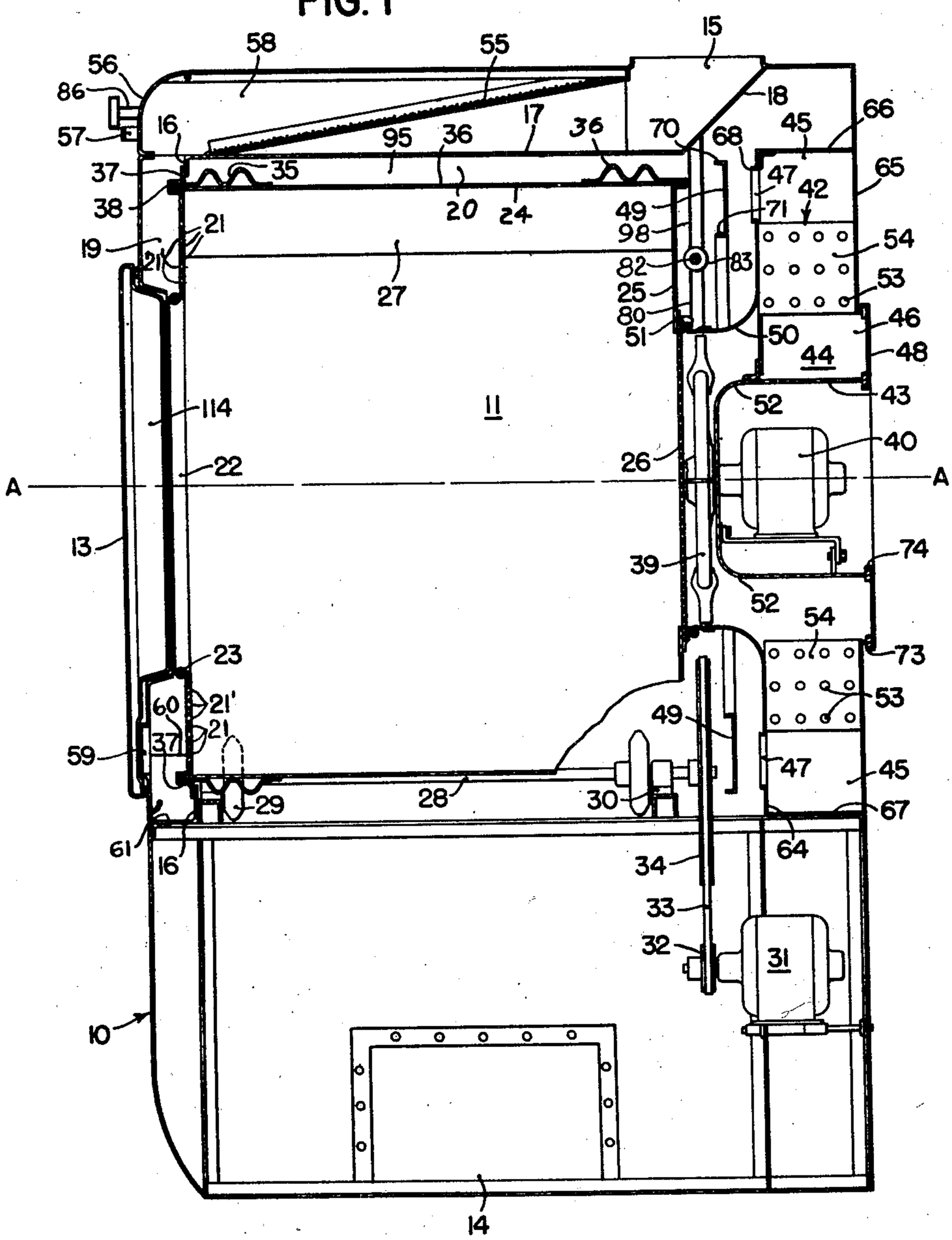
Oct. 25, 1949. G. A. PATTERSON ET AL 2,486,058

AIR DRYING TUMBLER FOR LAUNDRY

Filed March 16, 1945 4 Sheets-Sheet 1

FIG. 1



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AIR DRYING TUMBLER FOR LAUNDRY

Filed March 16, 1945 4 Sheets-Sheet 2

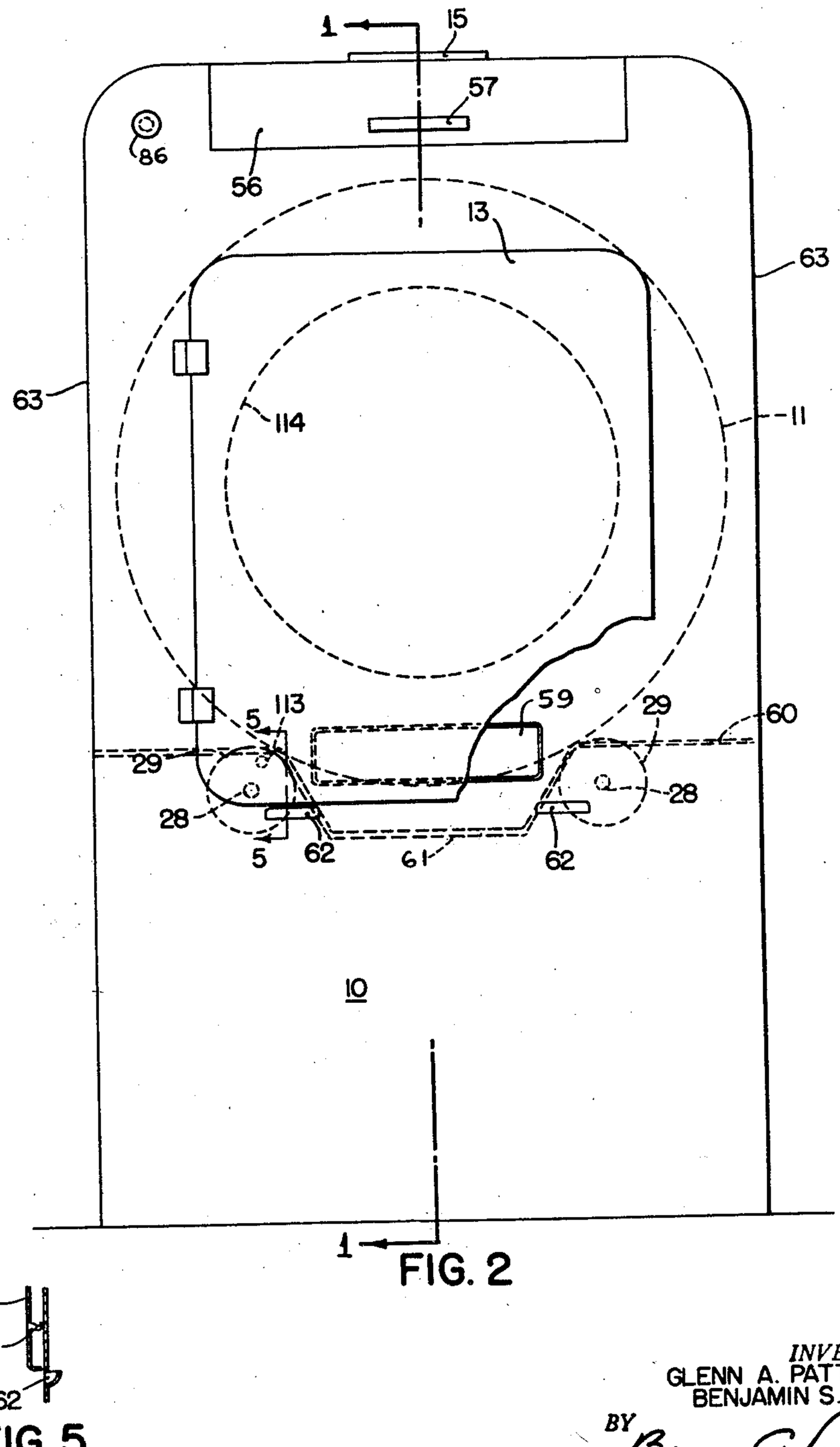

FIG. 2

FIG. 5

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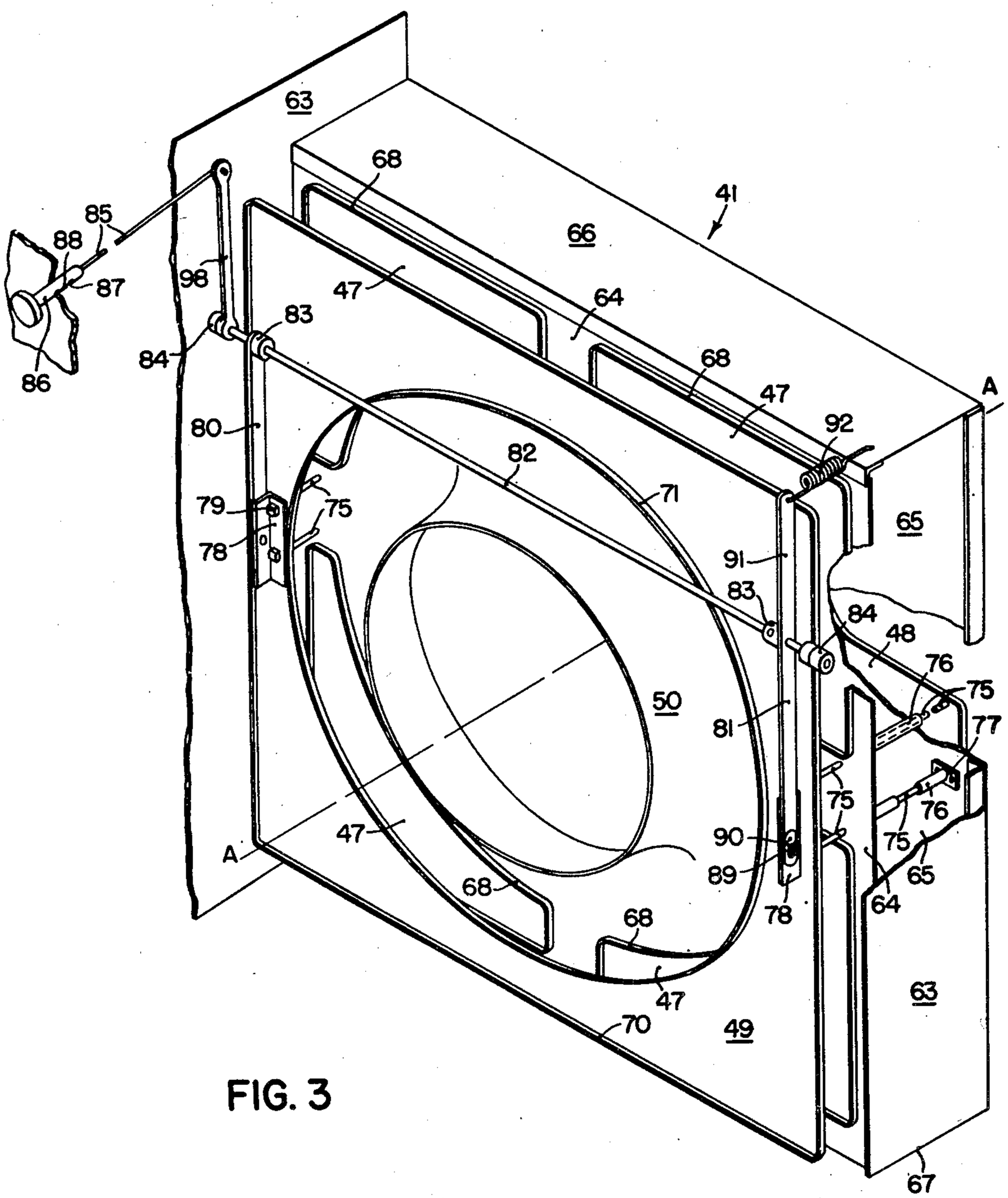

FIG. 3

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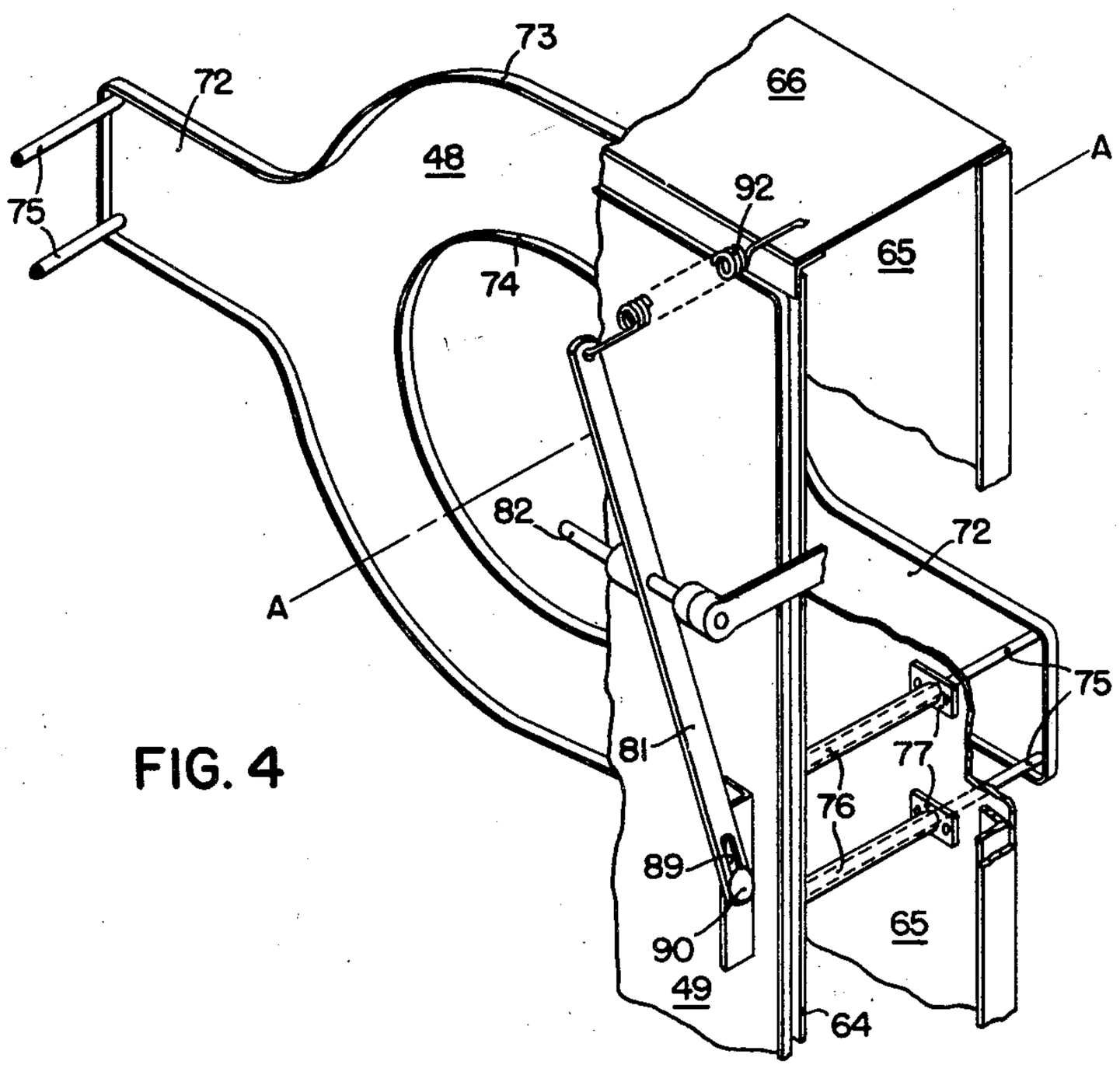

FIG. 4

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UNITED STATES PATENT OFFICE

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AIR DRYING TUMBLER FOR LAUNDRY

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Application March 16, 1945, Serial No. 583,034

9 Claims. (Cl. 34—82)

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This invention relates to drying tumblers and more particularly to that type of drying tumblers in which the drying air is passed axially through a revolving drum having an imperforate or solid cylindrical surface.

It is an object of the invention to provide a drying tumbler with a fan pressing air substantially axially through the revolving drum from one end thereof to the other and to arrange this fan co-axially with the drum and in alignment with an air chamber housing an annular heater.

A further object of the invention is to provide a drying tumbler of the kind referred to having easily removable delinting means of large size within the casing, preferably near the top thereof.

Another object of the invention is to provide a drying tumbler of the kind referred to whose casing is partitioned into two sections, one of these sections connecting with an air outlet at the top of the casing and the other section connecting an air inlet in the lower part of the casing with an opening leading to the aforementioned heater in the air chamber.

A further object of the invention is to provide a drying tumbler of the kind referred to wherein the rotatable dsum extends through a partition parallel to the front of the casing and the fan draws air into the bottom of the casing and drives it through the drum past the partition to the air outlet at the top of the casing.

A further object of the invention is to arrange the partition walls within the casing and the fan in such a manner as to force at least part of the air coming through the air inlet in the lower part of the casing to flow around the rotating drum, the air thus becoming preheated before entering the air chamber containing the heater.

Another object of the invention is to provide the air chamber mentioned above with two air inlets, one ahead of the heater and the other past the heater with respect to the fan arranged between the air chamber and the rotatable drum and co-axially to both, damper means being provided for both said air inlets.

Still another object of the invention is to place the motor driving the fan within the air chamber containing the annular heater. To that end the air chamber is provided with a central well in which the motor is arranged co-axially with the rotatable drum as well as with the annular heater, an annular space surrounding said well being interposed between the heater and the fan and being provided with one of the above-mentioned, damper-controlled air inlets.

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Other objects and advantages of the invention will appear as the description proceeds, reference being had to the accompanying drawings in which:

Fig. 1 shows a vertical section along line 1—1 in Fig. 2 of the tumbler with a part of the drum broken away;

Fig. 2 is a front view of the tumbler with part of the door broken off;

Fig. 3 is an isometric view of a heating chamber and a damper mechanism controlling openings in this heating chamber; and

Fig. 4 is a fragmentary isometric view of some of the parts shown in Fig. 3, the damper mechanism being in a position opposite to that shown in Fig. 3.

Fig. 5 is a section along line 5—5 of Fig. 2 showing details of the door construction.

Referring first to Figs. 1 and 2, 10 denotes a stationary casing and 11 a drum rotatable within said casing. At the front of the casing 10 there is a circular opening having an inwardly extending flange 12. This opening is closable by means of a door 13 having a circular cone 114 which, when the door is closed, fits loosely into the circular flange 12. The casing 10 has the form of a substantially rectangular box having an air inlet 14 in its lower part, and an air outlet 15 at its top. A partition, which in the example shown consists of a vertical wall 16, a horizontal wall 17 and an inclined wall 18, divides the casing into two sections 19 and 20 in order to secure a certain flow of air as will be described later. Within that portion of the casing section 19 which is contained between the horizontal partition 17 and the top plate of the casing and thus forms a channel 58 connecting the space 19 behind the front wall of the casing 10 with the air outlet 15, a lint screen 55 is arranged. The screen 55 forms part of a drawer 56 which by means of a handle 57 can be drawn out of the casing, such as for the purpose of cleaning the lint screen 55. The vertical partition wall 16 has a circular opening through which the front end of the drum 11 penetrates. The front wall 21 of the drum 11 is perforated, as at 21', so that the interior of the drum is in communication with the forward section 19 of the casing and thereby also with the air outlet 15 at the top of the casing. Furthermore the front wall 21 has a central opening 22 through which the drum 11 may be loaded with laundry or unloaded when the door 13 is open. The opening 22 is surrounded by a circular bead 23 which extends outwardly to a point close to the inner surface of the cone 114 when

the door 13 is closed, which arrangement prevents laundry contained in the drum from falling out at the front end of the drum while the tumbler is operating. The cylindrical wall 24 of the drum is imperforate and so is the rear wall 25 of the drum with the exception of its central portion 26 which is sufficiently open to permit air to pass and, for example, may consist of a perforated disc, a screen, or the like. At the inside the drum is provided with a number of ribs 27 which, in the example shown in the drawing, are of the conventional relatively short radial length. It will be noted, however, that instead of the ribs 27 partitions may be used which extend diametrically across the whole drum, dividing the latter into a number of separate compartments.

Two shafts 28 support the drum 11 through the intermediary of rubber-treaded rollers 29 and 30. One of these shafts is driven from a motor 31 through a belt drive 32, 33, 34. The rubber-covered rollers 29 of both shafts 28 engage a track 35 formed by a corrugated ring rigidly attached to one end of the drum cylinder 24, whereas the rollers 30 of said shafts co-operate with a similar track 36 at the other end of the cylinder 24. The rollers 29 and 30, in engaging the tracks 35, 36, rotate the drum about its axis at a low speed and at the same time prevent the drum 11 from endwise movements.

A flexible ring 37 of felt or the like forms a seal between the vertical partition wall 16 and a projecting portion 38 of the drum 11 in order to prevent air in the casing section 19 from flowing into the section 20. The ring may be attached to either of said parts 37, 38, while bearing against the other.

Near the central opening 26 in the rear wall 25 of the drum 11 and co-axially with that opening there is provided an axial-flow fan 39 which is driven by a motor 40. The fan 39 is arranged in a stationary duct formed by a housing 41 shown in perspective in Figure 3. This housing is formed by plates 63, 65, 66 and 64 with its extended part 50 which also encloses a heater generally indicated at 42. The central portion 43 of the housing 41 is cup-shaped so as to form a well in which the fan-motor 40 is located. A space 44 in the housing 41 situated between the heater 42 and the fan 39 surrounds the well 43 whereas another space 45 in the housing is formed outside of the heater 42, that is ahead of this heater with respect to the fan 39. The space 44 has an air inlet opening or openings 46 and the space 45 an air inlet opening or openings 47. The opening or openings 46 are closable by damper means 48 and the opening or openings 47 by damper means 49. The outer wall of the housing 41 has a forwardly extending cylindrical part 50, between which and the rear wall 25 of the drum 11 an annular sealing element 51, preferably of resilient nature, is provided. The cup-shaped portion 43 of the housing 41 which separates the motor 40 from the fan 39 has small openings 52 through which the fan can draw cold air from the outside over the motor 40 at all times to keep this motor cool.

The heater 42 is preferably of annular shape and consists in the example shown of co-axial circular pipes 53 which may be connected so as to form one or more heating coils, as desired. The pipes 53 are supported by radial plates 54 carried by the housing 41.

The door 13 provided at the front of the casing 10 to close the circular opening 12 in the casing as well as the central opening 22 in the

front wall of the drum 11 is of rectangular shape and extends downwardly far enough to cover, when in its closed position, a lint removal opening 59 in the front wall of the casing. The lower part of the rectangular door 13 carries at its inner side means adapted to support a bag for dried laundry while the door is open for unloading the drum 11. In the drawing two hooks 113 are shown as such bag-supporting means. A shelf 60 connects the vertical partition wall 16 with the front wall of the casing 10 thus delimiting the casing section 19. A pocket 61 in which lint may accumulate is formed and from which this lint may be removed through the opening 59 is formed in shelf 60. Below the shelf 60 two openings 62 are provided in the front wall of the casing through which openings the fan 39 may draw a small quantity of outside air into the casing section 20.

The lint screen 55 in the channel 58 leading to the stack exhaust at the top of the casing has an inclined position and since substantially the whole width of the casing 11 is available for this screen, it may have a very large area which will not be plugged up easily. Cleaning of the lint screen in relatively long intervals will, therefore, still be sufficient to insure satisfactory delinting as well as to avoid the back pressure which frequently has reduced the flow of air and increased the consumption of power in cases where lint screens of small dimensions had to be used.

As has been mentioned before, the openings 46 and 47 in the heating chamber 41 are closable by damper means 48 and 49, respectively. The two dampers 48 and 49 are interconnected so as to move in unison, with the one damper being in the open position when the other is closed. Figs. 3 and 4 show a preferred form of the dampers and the mechanism for actuating them. The chamber 41 extends between the two side walls 63 of the casing 10 and has a front plate 64 ending in the cylindrical portion 50, a rear wall 65, a top plate 66, and a bottom 67. The front plate 64 is provided with a number of air inlet openings 47, in the example shown in Fig. 3 there being four such openings symmetrically placed around the axis A—A of the cylindrical portion 50 which is also the axis of the drum 11. Each opening 47 is surrounded by an upturned flange 68, which flanges not only reinforce the plate 64 but also provide a seat for the damper 49, which is in the form of a square plate having a central circular hole. The damper plate 49 may be stiffened by flanges 70 and 71. The damper 48, which controls the opening 46 in the rear wall 65, comprises an annularly shaped plate with two extensions 72 at diametrically opposed points. Upturned flanges 73 and 74 extending along the edges of the plate 48 reinforce this plate.

The damper plates 48 and 49 are rigidly connected to each other by means of rods 75 which are slidably mounted in tubes 76, each of these tubes being fastened to the two parallel walls 64 and 65 of the housing 41 by means of a plate 77 welded to the end of the tube. The plates 77 may be secured in any suitable manner, such as by riveting or welding, to the walls 64 and 65. The tubes 76 with the rods 75 sliding therein are arranged at diametrically opposed sides with respect to the axis A—A of the cylindrical portion 50 of the housing 41. While it will be sufficient to provide one guide 76 and rod 75 to each side of said axis, it is preferable to arrange two such guides and rods at each side as shown in

Figs. 3 and 4. The rods 75 pass through the damper plate 49 and through reinforcing angles 78 attached to that damper plate and are fastened by means of nuts 79. Engaging the angles 78 are arms 80 and 81, each having a pin 90 passing thru a slot 89 in the respective angle 78. The arms 80, 81 are keyed to a rock shaft 82 by means of hubs 83. The rock shaft 82 which is journaled in bearings 84 carried by the side walls 63 of the casing 10 may be turned through a small angle by means of a lever 98 which is actuatable from the outside of the machine by means of a rod 85 extending through the front wall of the casing 10 and ending in a handle 86. One or more notches 87 may be provided in the handle 86 to engage the edge of a hole 88 in said front wall and thereby to fix the shaft 82 in one or the other of two positions. One or both levers 80, 81 may have an extension 91 upon which a spring 92, whose other end may be attached to the top plate 66 of the housing 41, may act in order to bias the damper plates in one direction or the other. In the example shown, only the lever 81 is loaded by a spring 92 and the arrangement is such that the spring tends to hold the damper plate 49 in the open position and the other damper plate 48 in the closed position. It will be seen that by turning the rock shaft 82 both damper plates 48 and 49 are moved parallel to themselves with the moving force acting upon the plates being equally distributed to both sides of the axis A—A in or close to the horizontal plane containing said axis. Thus all the four rods 75 will slide in their guides 76 at the same rate and move the dampers 48 and 49 squarely toward or away from the openings 46 and 47 respectively controlled thereby.

The fan 39 draws air into and through the space 44 in the heating or air chamber 41. Depending on the position of the interconnected dampers 48, 49 the space 44 receives either cold air directly from the outside through the opening 46 if the damper 48 is open, or hot air via the heater 42 if the damper 49 is open. As has been mentioned before, if either damper is open the other is closed.

Assuming the damper 49 is open and the damper 48 closed, the fan 39 will suck in air through the bottom opening 14 of the casing 10 into the casing section 20. From there the air flows in two streams to the openings 47 leading to the space 45 in the heating chamber 41 ahead of the heater 42.

Some of the air will flow from the bottom portion of the casing 10 directly into the heating chamber 41, whereas another portion of the air will reach this chamber after flowing around the revolving drum 11 and passing through a channel 95 formed between the outer surface of the drum cylinder 24 and the horizontal partition wall 17. While the partition 17 separates the channel 95 from the channel 58 leading to the exhaust opening 15. said channel 95 is separated from the casing section 19 through the vertical partition wall 16. The air passing the channel 95 becomes preheated while passing along the cylindrical wall of the drum and thus enters the heating chamber 41 in already preheated condition. This preheating of the air saves fuel, keeps the outside of the tumbler cool, and improves its performance in general.

The air which, under the action of the fan 39, enters the heating chamber 41 through the openings 47 is drawn through the annular coil heater 42, where it is heated up to the desired temperature, into the space 44 of the heating chamber. From the space 44 the fan 39 forces the heated air through the screened central opening 26 of the rear wall 25 of the drum 11 into and substantially axially through said drum which it leaves through the perforations 21' of the front wall 21 of the drum. Since the openings 21' of the wall 21 are arranged in a ring surrounding the cone 114 of the door 13 when the latter is closed, the air has to spread out conically while traveling through the revolving drum. The air leaving the drum through the perforated front wall 21 enters the casing section 19 and passes from here through the channel 58 containing the lint screen 55 into the stack exhaust 15.

If the tumbler is to be supplied with cold air instead of with heated air, the handle 86 is pulled forward so as to bring the rear notch 87 into engagement with the edge of the hole 88 in the front wall of the casing, turning thereby the shaft 82 against the action of the spring 92 for an amount sufficient to move the damper 49 to its closing position and the damper 48 into the open position. Now the fan 30 draws air through the opening 46 directly from the outside with the heater 42 being cut out of the air circulation. The air entering the space 44 is forced lengthwise through the drum 11, into the casing section 19, through the channel 58 and out to the exhaust through the opening 15 in the same manner as has been described for the flow of the heated air after its passage through the heater 42.

The air entering the casing section 20 through the bottom opening 14 flows over the traction rollers 30 at the right end of the shafts 28 (as viewed in Fig. 1), thoroughly cooling these rollers. The rollers 29 at the end of the shafts 28 near the vertical partition wall 16, however, are liable to receive too small a portion of the air passing through the bottom opening 14 as to remain cool during the operation of the tumbler. The effective cooling of the front rollers 29 is however taken care of by outside air which the fan 39 draws through the openings 62 in the front wall of the casing which air flows directly over said front rollers 29.

As long as the hot air damper 49 is closed, there is no air flow through the casing section 20 and the channel 95. Regardless of the position of the dampers 48, 49, there is always a flow of air through the openings 52 in the cup-shaped portion 43 of the housing 41 for cooling the fan motor 40.

It will be appreciated that, since the heating coil 42 is placed near the fan 39 and the fan in turn is positioned quite close to the drum 11, a very good thermal economy will be obtained. This economy is still improved by the fact that the hot air entering the drum at its rear end is forced through the whole length of the drum to leave this drum at the front end thereof, so that not only those pieces of the laundry to be dried in the tumbler will be acted upon thoroughly by the hot air which are tumbling down near the inlet opening 26, but also those pieces which are tumbled in planes near the front end of the drum.

While we have shown in the drawing one particular embodiment of our invention, it is to be understood that this embodiment has been given by way of example only and that various changes, rearrangements and modifications may be made in the details of the construction shown without departing from the spirit of the invention or from the scope of the appended claims.

What we claim is:

1. A drying tumbler comprising, in combination, a stationary casing provided at the front with loading opening, an air inlet opening, an air exhaust opening at the top, a door closing said loading opening, a partition in the casing separating the space adjacent to the door from the rest of the casing, a horizontal passage at the top of the casing connecting said separated space with the air exhaust opening in the top of the casing, a drawer slidable toward the front of the casing filling said horizontal passage, an inclined lint screen forming the bottom of said drawer, a cylindrical drum having an imperforate side wall rotatable about its horizontal axis and projecting through said partition toward said door, a rear wall for said drum having a central opening, a front wall for said drum having a central loading opening proximate to said door, perforations in said front wall surrounding said loading opening, a fan disposed on the axis of said cylinder adapted to draw air through the inlet opening in said casing and to drive it through said cylinder into the space between the partition and the front of the casing, thence through the inclined lint screen in the bottom of said drawer and out through said air exhaust opening.

2. A drying tumbler comprising, in combination, a stationary casing provided at the front with a loading opening, an air inlet opening near the bottom of the casing, an air exhaust opening at the top, a door closing said loading opening, a partition in the casing separating the space adjacent to the door from the rest of the casing, a horizontal passage at the top of the casing connecting said separated space with the outlet in the top of the casing, a drawer slidable toward the front of the casing and filling said horizontal passage, an inclined lint screen forming the bottom of said drawer, a cylindrical drum having an imperforate side wall rotatable about its horizontal axis and projecting through said partition toward said door, a rear wall for said drum having a central opening, a front wall for said drum having a central loading opening proximate to said door, perforations in said front wall surrounding said door, a fan housing inside the casing adjacent the central opening of said rear wall of the drum, an axial flow fan in said housing adapted to draw air through the inlet opening of the casing and over the outside of said drum projecting the air through said cylinder into the space between the partition and the front of the casing, thence through the bottom of said drawer out through said top opening.

3. In a drying tumbler, a drum rotatable about its axis, perforations on one end of the drum, a central air inlet on the opposite drum end, a stationary duct aligned with said central opening, an annular heater concentric with said duct, a fan in said duct forcing air into the drum, a housing connected with the duct and surrounding the heater, openings in said housing permitting air to flow to the fan by traversing the heater, other openings in said housing through which air can flow to the fan without passing through the heater coil, dampers for each group of openings, means connecting said dampers so that one damper is closed to the extent that the other damper is opened.

4. A drying tumbler comprising, in combination, a rotatable horizontal imperforate cylinder, a central opening in one end of the cylinder openings in the other end of the cylinder, a stationary annular heating chamber having two parallel end walls, a duct from said chamber to said opening, a fan in said duct, a motor for driving said fan, a well for said motor located in the center of said annular heating chamber, an annular heating coil in the chamber, an opening in one of said chamber end walls leading into the space within the annular coil, a second opening located in the other end wall outside of said annular coil, dampers for said openings.

5. A drying tumbler comprising, in combination, a rotatable horizontal imperforate cylinder, a central opening in one end of the cylinder, openings in the other end of the cylinder, a stationary annular heating chamber having two parallel end walls, a duct from said chamber to said opening, a fan in said duct, a motor for driving said fan, a well for said motor located in the center of said annular heating chamber, an annular heating coil in the chamber, an opening in one of said chamber end walls leading into the space within the annular coil, a second opening located in the other end wall outside of said annular coil, dampers for said openings, stationary hollow guides extending between said parallel end walls, elements shiftably supported in said guides supporting and spacing said damper plates, actuating means for shifting said elements and thereby moving said damper plates in unison.

6. A drying tumbler comprising, in combination, a stationary casing, a partition dividing said casing into two compartments, an air inlet in the lower part of said casing to one compartment, an air outlet at the top of said casing connecting with the other compartment, a horizontal drum passing through an opening in said partition, air outlets into one compartment at one end of said drum, a central air inlet at the other end of said drum located in the other compartment, an air chamber within said casing, a duct extending from said chamber aligned with said central air inlet, a fan in said duct, an annular coil heater in said air chamber, openings in said air chamber adapted to permit the flow of air from said inlet through the heater to the fan and thence into the drum, other openings in said casing permitting the flow of air from the outside of said casing to the fan without passing through said heater, closures for each group of openings, interconnected means for closing one damper when opening the other damper.

7. A drying tumbler comprising in combination: a stationary casing provided at the front with a door; a drum rotatable within said casing and having an imperforate cylinder, a front wall and a rear wall; a central opening in said front wall of said drum permitting the loading and unloading of said drum when said casing door is open; air passages in the center of said rear wall and near the periphery of said front wall; a partition dividing said casing into two sections, an opening in said partition through which the drum extends, a fresh air inlet in the lower part of said casing leading to one section; a stack exhaust at the top of said casing connected to the other section; an axial flow fan disposed next to and coaxially with said air passages in the rear wall of said drum for forcing air through that opening into and substantially axially through said drum; two air channels within said casing, one of said channels surrounding directly at least part of said cylinder and forming part of an air path leading from said fresh air inlet over the surface of said cylinder to said fan, and the second of said channels communicating with the air passages in said front wall of said drum and leading to said stack

exhaust; an annularly shaped heater interposed in said first named air path so as to heat the air which is drawn through said air path by said fan and of which part at least is already preheated by its contact with said cylinder; a direct connection between the suction side of said fan and the outside air; and a pair of damper means, one damper means controlling the flow of air through said air path which includes said heater, and the other damper controlling said direct connection between the suction side of said fan and the outside air, said pair of damper means being connected so as to move in unison with the one damper means closing while the other is opening and vice versa.

8. In a drying tumbler in combination: a stationary casing; a partition parallel to the front wall of said casing; a shelf connecting said partition to said front wall; a horizontal imperforate drum having openings at both ends extending through said partition; shafts within said casing carrying rubber treaded traction wheels for supporting and revolving said drum; drum heating means including a heater within said casing and a motor driven fan driving the air heated by said heater through said drum; means for cooling the rubber treads of said wheels including openings in said front wall below said shelf through which cold air is drawn alongside the outside of the drum to the heater; a depressed portion of said shelf forming a lint pocket; an opening in said front wall for removing lint from said pocket; aligned loading openings in said front wall and in said drum; a door carried by said casing for closing said loading opening, an extension on said door closing said lint removal opening.

9. In a unit adapted to deliver a warm air blast, in combination, a casing; a chamber in said casing having parallel front and rear walls; a central discharge opening in the front wall of said chamber, an axial flow fan in said discharge opening; openings in said wall symmetrically spaced about the central discharge opening, sliding bars ex-

tending normally to the parallel walls; these bars and the fan axis being substantially in the same plane; a plate rigidly attached to and supported by said sliding bars adapted to close said symmetrically spaced openings; means engaging said plate at points substantially in line with the sliding bars and adapted to move both sides of the plate equally; additional openings in said rear wall; a second plate carried by said sliding bars and adapted to close said last named openings; and means extending through the casing for manually moving from the front of the case either of said plates into position to close its associated opening while removing the other plates from the openings which it is adapted to close.

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