

[54] HEATING SYSTEM

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34/230-234, 236; 53/30, 184

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[57]

ABSTRACT

Shrink wrap apparatus includes a heating chamber, an air heater mounted alongside thereof and a forced air recirculation system for blowing hot air into the bottom of said chamber and extracting cool air from the top.

1 Claim, 5 Drawing Figures

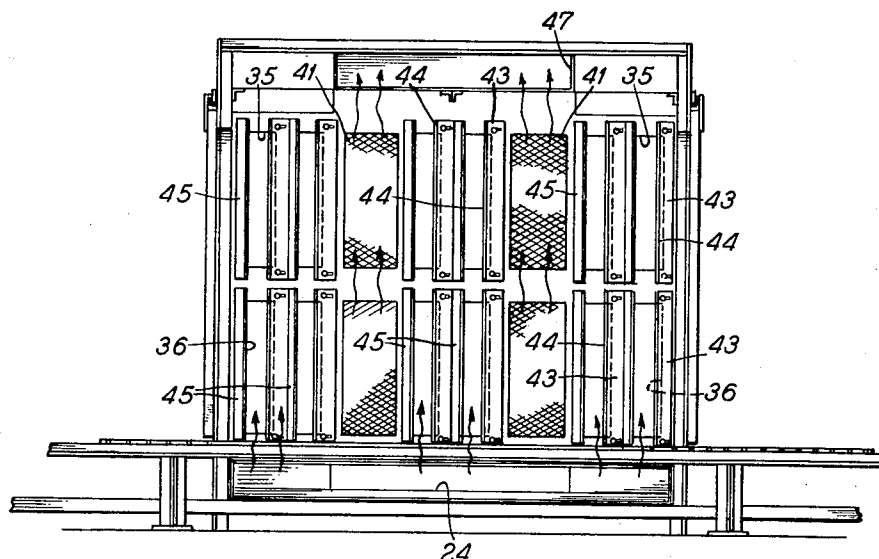


Fig. 1

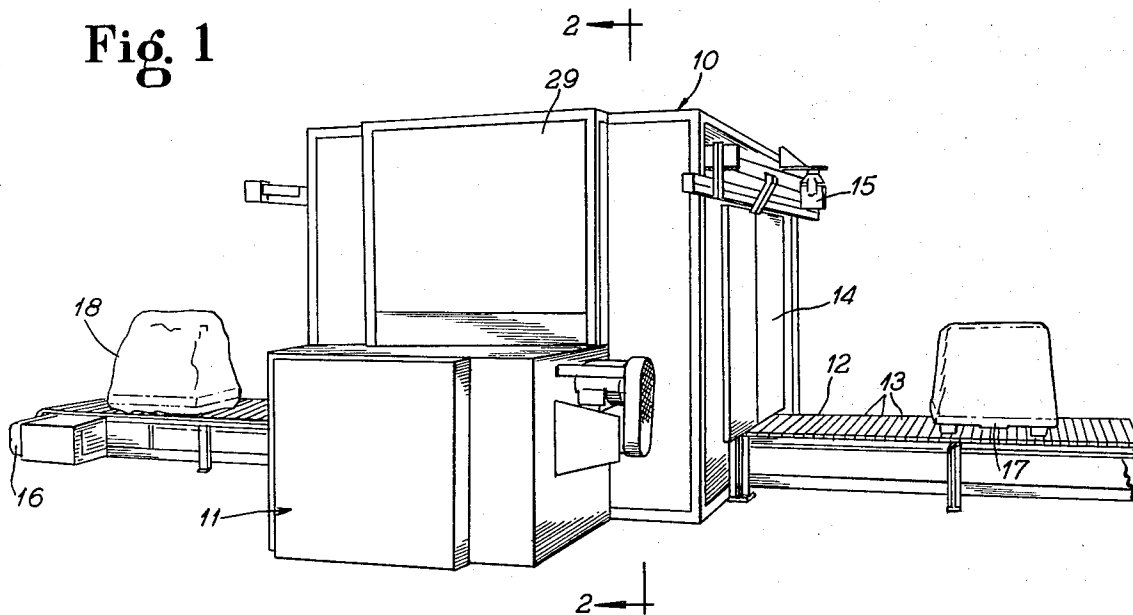
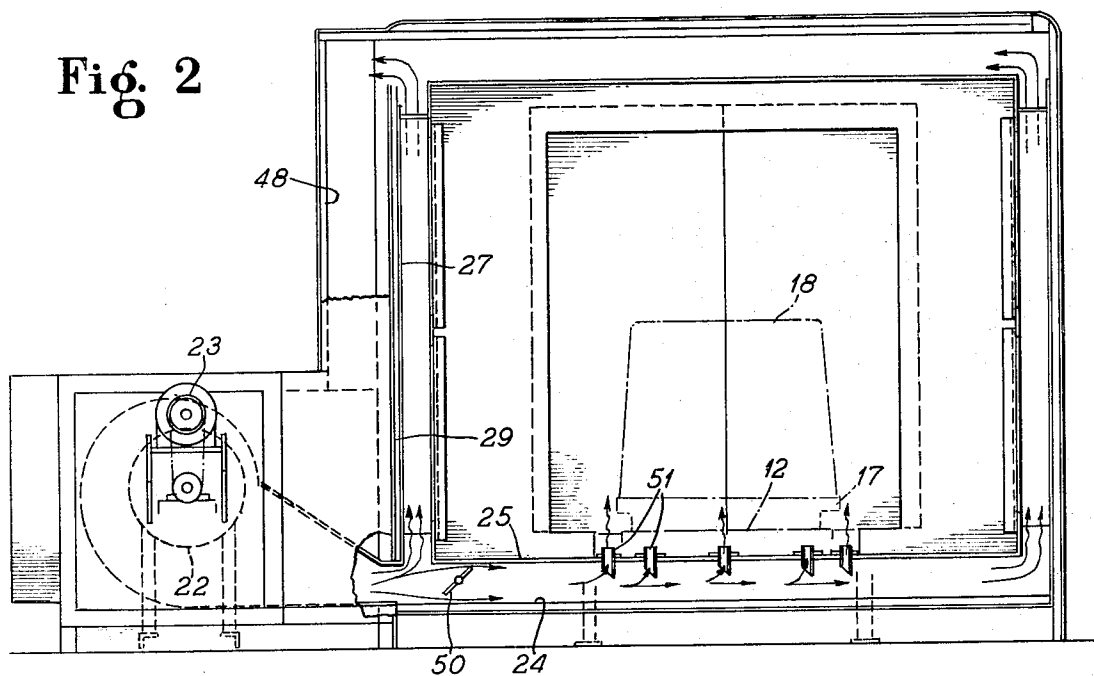


Fig. 2



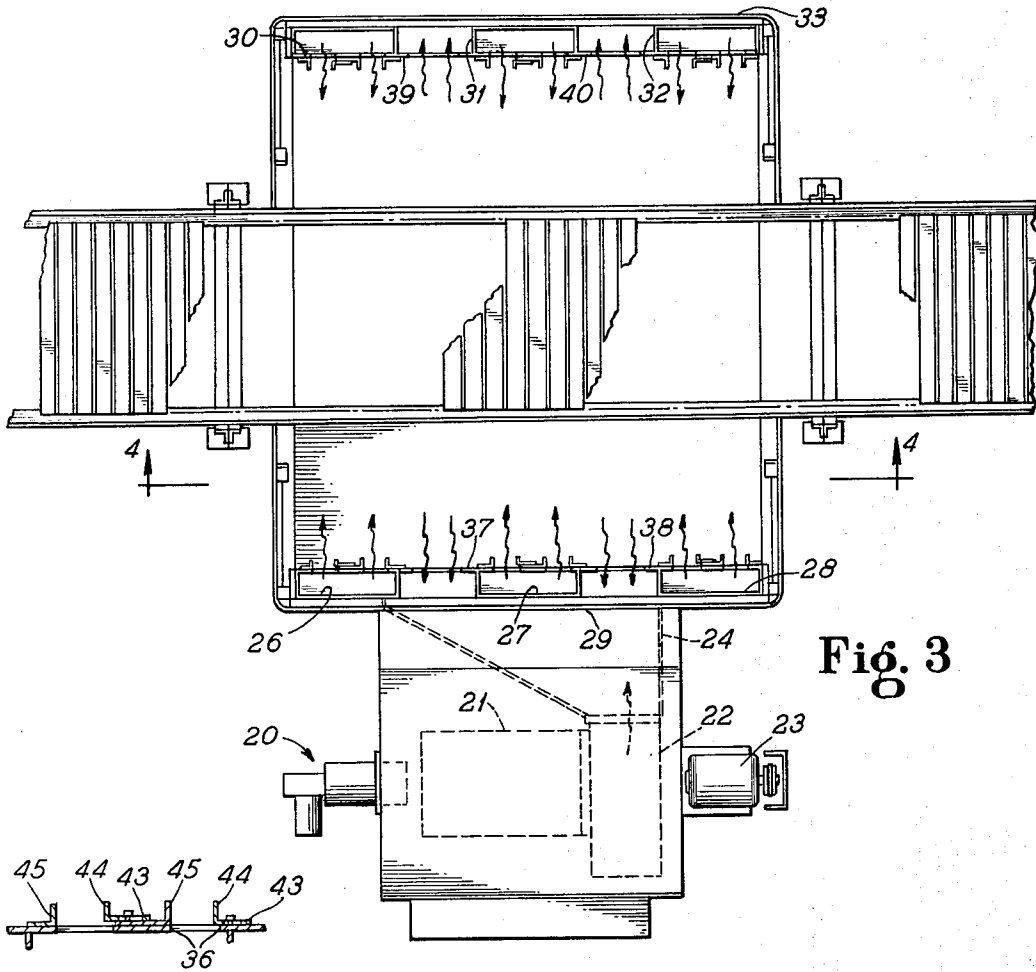


Fig. 3

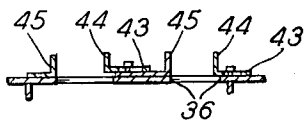


Fig. 5

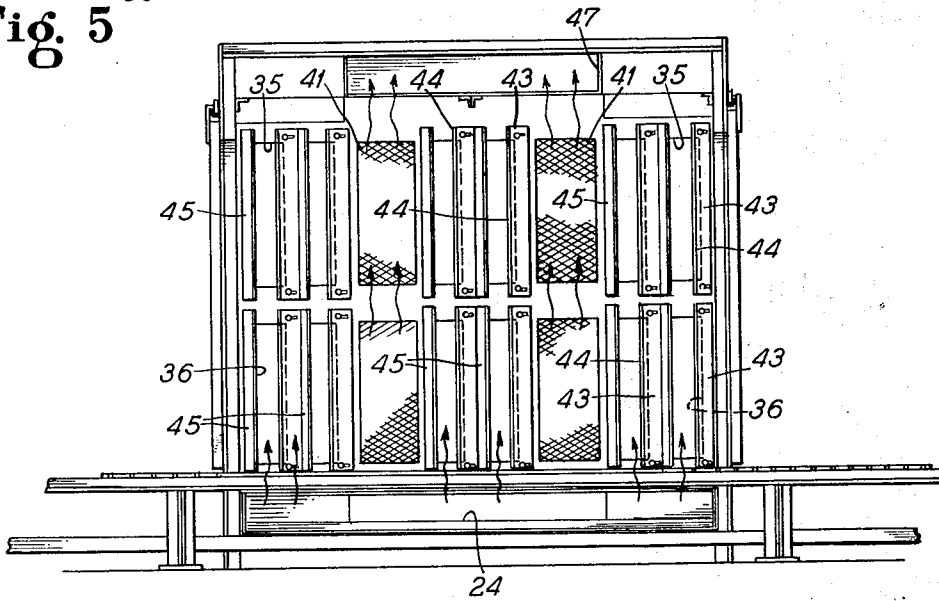


Fig. 4

HEATING SYSTEM

The present invention relates in general to a system for recirculating air between an air heater and a heating area, and it relates more particularly to an apparatus and method for wrapping articles such as pallets with a heat shrinkable plastic film.

BACKGROUND OF THE INVENTION

The use of heat shrinkable plastic film for packaging various types of articles is well known, and such film has also been used to enclose and secure separate articles or other material on pallets in manufacturing and warehouse facilities. The equipment thus far available for heating and shrink wrapping such large size packages has not been particularly satisfactory.

OBJECTS OF THE INVENTION

Therefore, an object of the present invention is to provide a new and improved method and apparatus for applying heat to a plastic material.

Another object of this invention is to provide a new and improved heating tunnel adapted for handling large items to be shrink wrapped.

A further object of this invention is to provide a new and improved shrink wrap system adaptable for use with pallets.

SUMMARY OF THE INVENTION

Briefly, the above and further objects may be realized in accordance with the present invention by providing a heating tunnel through which articles loosely covered with an inverted bag formed of heat shrinkable plastic film are carried by an intermittently driven conveyor belt, and an air heater and blower mounted adjacent to the tunnel and for circulating hot air from bottom to top in the tunnel and for recirculating the air from the tunnel through the heater. Doors are provided at both the entrance to and the exit from the tunnel, and these doors are automatically operated in synchronism with the conveyor belt to minimize the loss of heat to the surrounding area.

BRIEF DESCRIPTION OF THE DRAWINGS

Further objects and advantages and a better understanding of the invention may be had from the following detailed description taken in connection with the accompanying drawings, wherein:

FIG. 1 is a perspective view of a shrink wrap machine embodying the present invention;

FIG. 2 is a vertical section of the machine of FIG. 1 taken along the line 2—2 thereof;

FIG. 3 is a plan view of the machine of FIG. 1, the ends of the conveyor being omitted; and

FIG. 4 is a vertical section of the machine taken along the line 4—4 of FIG. 3;

FIG. 5 is a horizontal sectional view of the air inlet control of FIGS. 3 and 4.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring now to the drawings and particularly to FIG. 1 thereof, a shrink wrap machine includes as its principal parts a heating tunnel 10 enclosing a heating chamber, an air heater and recirculating unit 11, and a conveyor belt 12 for carrying the articles to which heat is applied within the heating chamber. As illustrated in FIG. 1 the conveyor 12 incorporates a plural-

ity of spaced apart transverse members 13 and travels from left to right through an entrance (not visible) at the left into the tunnel 10 and out of the tunnel through the exit at the right. Pairs of motor operated doors 14 are provided for the entrance and exit openings and are opened and closed in unison by electric motors 15 which are energized in synchronism with one or more electric motors 16 which drive the conveyor 12.

As shown in FIG. 1, the machine is being used to wrap pallets 17 of the type commonly used in factories and warehouses and transported by fork lift trucks. The loaded pallet at the left is loosely covered by a heat shrinkable plastic bag 18 with the sides of the bag overhanging the deck of the pallet. While in the tunnel hot air is blown onto the bag which causes it to shrink and thus tightly engage the pallet and its load to provide a tightly wrapped unit as shown at the right in FIG. 1.

Referring more particularly to FIGS. 2, 3 and 4, the heater section includes a burner 20 which directs a flame into a heat exchange or firing tube 21 across the hot surface of which return air from the heating chamber is drawn by a blower 22 driven by an electric motor 23. The thus heated air is forced by the blower 22 into a duct 24 lying beneath the floor 25 of the tunnel 10. The duct 24 underlies the entire floor 25 which is heated by the hot air and radiates heat upwardly into the heating chamber. Three inlet ducts 26, 27 and 28 are spacially positioned in the front sidewall 29 of the tunnel and three similar ducts 30, 31 and 32 are positioned in the rear sidewall 33 directly opposite the ducts 26, 27 and 28. All of these vertically disposed inlet ducts open at the bottom onto the bottom duct 24 and are closed at the top, and are each provided with a pair of upper rectangular openings 35 and a pair of lower rectangular openings 36 from which the hot air enters the heating chamber. Respectively mounted within the walls between the vertical inlet ducts are a plurality of outlet ducts 37 and 38 at the front end 39 and 40 at the rear. The outlet ducts are provided with upper and lower rectangular inlet openings covered by screens 41 for preventing foreign materials from entering the air circulating and heating system.

In order to enable high speed operation of the machine it is important that the hot air be directed against the plastic film and that a minimum of hot air escape from the tunnel while the doors 14 are open. To this end a horizontally slidable baffle 43 is provided for each opening 35 and 36 and each baffle has a flange 44 extending into the chamber. Similar flanges 45 are fixedly positioned along the opposite edges of the air inlet openings whereby air entering the heating chamber travels in a direction perpendicular to the front and rear sidewalls 29 and 33. Where desired, the movable baffles may be positioned to completely close off the associated openings. Where, for example, only one pallet is being wrapped at a time as shown in FIG. 2, the baffles 43 covering the openings in the inlet ducts 26, 28, 30 and 32 may be closed. The flanges 44 and 45 also prevent the hot air from short circuiting the chamber and passing directly from the outlet openings into the inlet openings.

The air outlet ducts 37 and 38 are closed at the bottom and open at the top into a return air duct 47 which extends across the top of the tunnel 10 and connects to a return air duct 48 which opens at the bottom into the chamber housing the firing tube 21. In order to provide equal distribution of hot air to both sides of the heating

chamber, an adjustable butterfly valve 50 is mounted across the inlet side of the duct 24 downstream of the ducts 26, 27 and 28.

It is important that the lower edges of the bag 18 surrounding the opening therein be heated more quickly than the upper portions so that the mouth of the bag shrinks onto the pallet before the top shrinks and pulls the mouth portion away from the pallet. For many applications the flow of hot air from bottom to top through the tunnel together with the radiation from the floor provides the desired heat differential. Where necessary, however, auxiliary hot air inlets 51 are provided in the floor 25 beneath the conveyor 12 for blowing hot air directly onto the bottom of the pallet through the openings in the conveyor between the members 13. These auxiliary inlets are provided by tubes cut on a bias at the bottom and rotatably mounted in the floor 25 between the illustrated position wherein air is directed upwardly through the open conveyor belt, and adjacent thereto and the opposite position wherein no air is blown therethrough toward the conveyor belt.

OPERATION

In operation, the doors 14 are closed and the burner 20 and blower 22 are energized until the air being circulated through the tunnel reaches a temperature of about 350°F. Loaded pallets may then be placed on the loading side of the conveyor belt, heat shrinkable bags are then loosely draped thereover and the drive system is actuated to open the doors 14 and drive the conveyor to carry the pallets into the tunnel. The conveyor then stops and the doors close for about seven seconds during which time hot air is directed against the bags on the one or more pallets positioned in the tunnel. Under the control of a timer the doors then open and the conveyor carries the completed pallets out of the tunnel and simultaneously carries one or more additional loosely wrapped pallets therein. This machine is readily adaptable to fully automatic or semi-automatic operation and features thereof may be used for purposes other than shrink wrapping.

While the present invention has been described in connection with a particular embodiment thereof, it

will be understood that those skilled in the art may make many changes and modifications without departing from the true spirit and scope thereof. Accordingly, the appended claims are intended to cover all such changes and modifications as fall within the true spirit and scope of the present invention.

What is claimed is:

1. Apparatus for wrapping pallets with heat shrinkable plastic film, comprising
 - a heating chamber having a floor, mutually parallel side walls, and an imperforate ceiling,
 - duct means positioned directly beneath said floor in heat conductive relationship therewith,
 - means for passing heated air through said duct means to heat said floor,
 - first and second sets of ducts extending in a vertical direction in opposite ones of said side walls,
 - said first set of ducts being connected at the respective bottoms to said duct means,
 - a controllable damper mounted in duct means for controlling the distribution of heated air to the ducts in said first set,
 - duct means disposed above said ceiling and connected to the tops of said second set of ducts,
 - said first set of ducts being separated from one another by said second set of ducts,
 - a plurality of openings in each of said first and second sets of ducts communicating said ducts to said chamber,
 - a plurality of vertically disposed elongated baffles respectively disposed on said side walls between adjacent ones of said openings to direct air entering said chamber in a direction perpendicular to said side walls,
 - a perforate conveyor disposed on said floor for supporting a pallet in close proximity to said floor, and
 - a plurality of spaced apart conduit means mounted in the upper wall of said first mentioned duct means directly beneath said conveyor for controllably directing separate streams of air upwardly toward the pallet.

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