

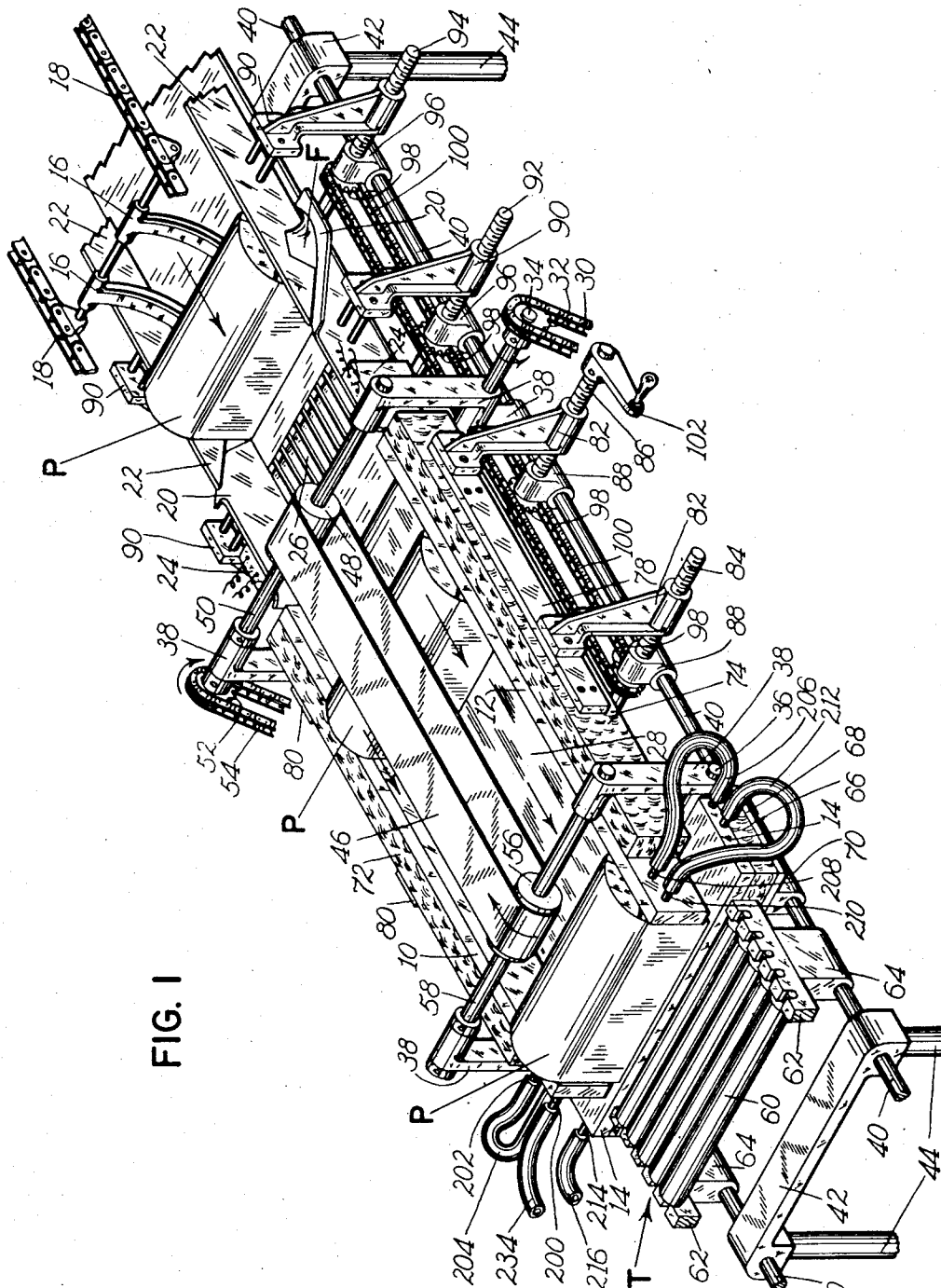
Aug. 14, 1951

J. J. MCGINLEY ET AL
HOT SEAL COOLING MECHANISM

2,563,858

Filed July 9, 1945

3 Sheets-Sheet 1



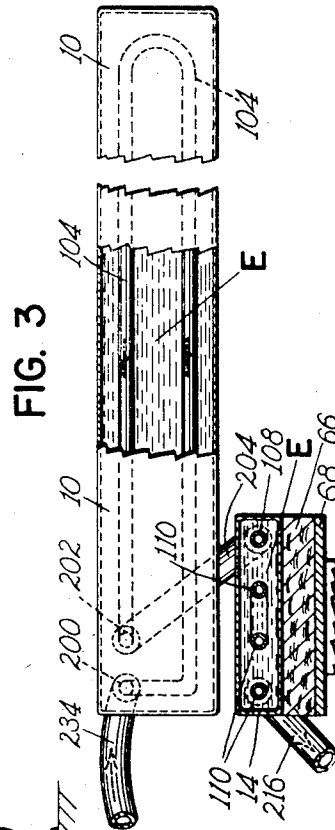
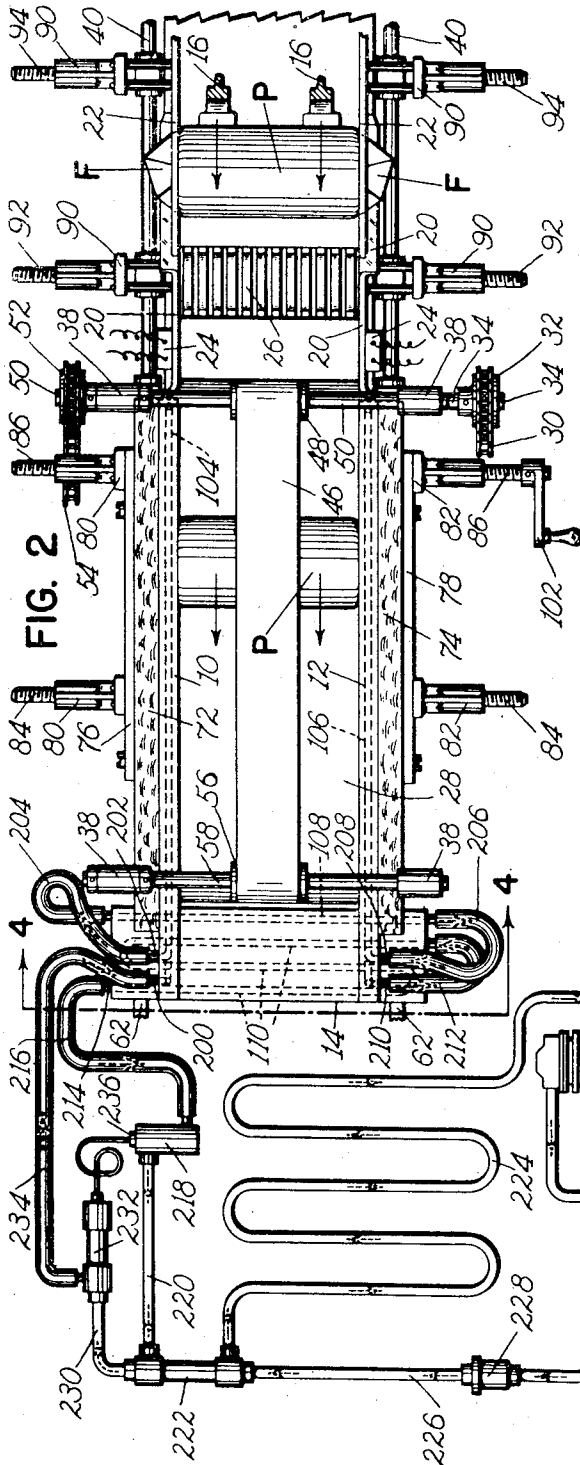
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3 Sheets-Sheet 2



INVENTOR
JAMES J. McGINLEY
BY WILLIAM C. DIPAOLO
James J. McGinley
ATTORNEY

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FIG. 4

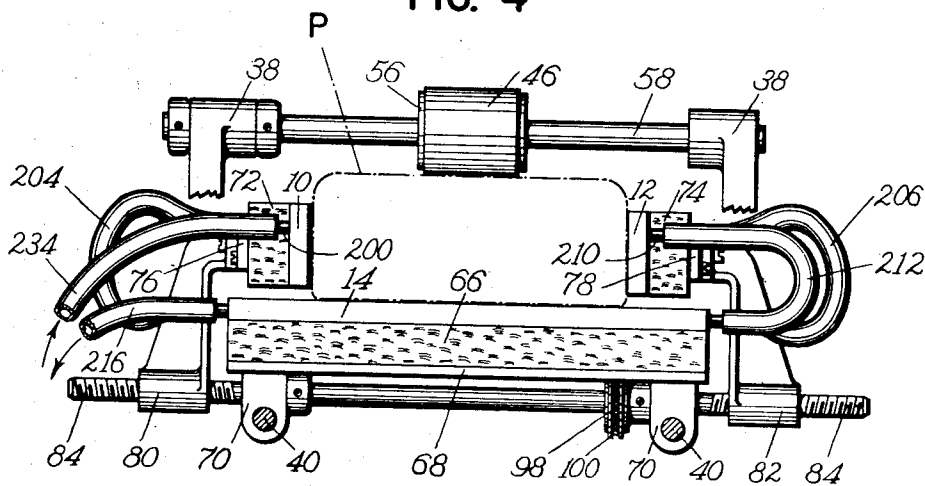
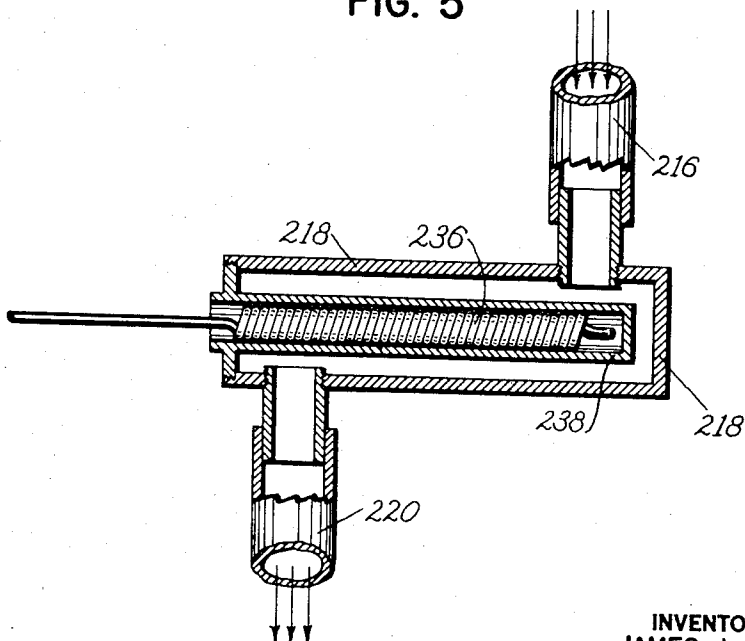


FIG. 5



INVENTOR
JAMES J. MCGINLEY
BY WILLIAM G. DiPAOLA
George S. Washington
ATTORNEY

UNITED STATES PATENT OFFICE

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HOT SEAL COOLING MECHANISM

James J. McGinley, Williston Fark, and William C. Di Paola, Brooklyn, N. Y., assignors to American Machine and Foundry Company, a corporation of New Jersey

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1 Claim. (Cl. 154—42)

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This invention relates to improvements in hot seal cooling devices for wrapping machines which operate upon the hot seals of packages enclosed in wrappers having thermoplastic sealing coatings as they issue from the heat sealing mechanism of a wrapping machine in order to rapidly and completely cool and solidify the heat energized coating present upon the hot seals and thereby produce packages having better, more efficient, and rugged seals.

Hot seal cooling mechanisms are known in the wrapping and packaging art. These mechanisms include cold air or water, or mechanically operated refrigerating units which are employed in conjunction with wrapping machines for the purpose of completing the formation of end and bottom seals in the packages being formed. One of the main problems arising with the use of such devices is that of maintaining at all times during operation constant low temperature in the tanks or plates which engage the end and bottom package hot seals.

In mechanisms where brine is used as the cooling medium, it is necessary to employ pumps for circulating the brine through the refrigerating system. This type of construction experiences much trouble from leakage, and from electrolysis which causes corrosion of the copper tubing submerged in the brine. In brine systems it is also difficult and somewhat expensive to maintain the proper cooling temperature. This is because even when the wrapping machine with which it is associated is not in use, it is necessary to keep the cooling mechanism in operation at all times in order that the brine temperature can be such that the wrapping and sealing operations can be carried out whenever desired.

It is also evident that in the brine system in order to continue the circulation thereof through the coils, it is necessary to maintain the brine a fluid in order that it can be pumped through the cooling system.

In devices employing direct expansion where a refrigerating gas is circulated through the system, although it is possible to obtain a predetermined low temperature on the cooling plates or tanks such that a layer of frost will form thereon, experience has shown that when packages having hot seals are moved in succession out of a wrapping machine and brought into contact with the cooling plates for sealing the seals, that is, when the "shock" load is applied, the effect is such that the temperature of the cooling plates rises rapidly with a concurrent disappearance of the desired ice or frost thereon. It is obvious that

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this condition is undesirable from a point of view of forming the best type of seals. Such condition contributes to the formation of non-uniform packages in which some seals are relatively strong and others relatively weak, because the refrigerating gas being circulated cannot dissipate the heat concentrated in the hot seals in a succession of packages moving through the machine with sufficient rapidity to maintain a desired constant low temperature in the cooling plates or tanks.

A direct expansion system is also subject to leakage of gas because it is relatively difficult to form connections and joints which are free of gas leakage.

The device of the present invention has proved to be a solution of the above problems because of the fact that the mechanism employed is so constructed and arranged that at substantially all times during the operation of the wrapping machine with which it is associated whenever hot seals are to be cooled, substantially all heat in the seals can be dissipated quickly with the result that deep cooling results in solidly frozen wrapper coatings and hence extremely firm and rugged seals are formed.

According to the present invention, we employ vacuum eutectic tanks of the type shown in Kleist Patent No. 2,217,702, issued October 15, 1940, connected in the refrigerating circuit as refrigerating plates between and over which packages with hot end and bottom seals are moved from a wrapping machine to a delivery table. This mechanism furnishes the means by which the heat in the bottom and end seals of packages being handled is rapidly and substantially completely dissipated with a concurrent solidification of the fluid or fluid coating on the package wrappers to form the desired seal.

Each of the vacuum eutectic tanks forming the end and bottom sealing members has enclosed therein a coil containing "Freon" or other suitable refrigerant. Each tank is filled to a predetermined level with a eutectic solution and evacuated to substantially a complete vacuum so that when the eutectic is frozen it can expand within the tank without buckling, or damaging the walls of the tank.

Vacuum eutectic refrigerating members of the type described have proven to be especially valuable in a hot seal cooling mechanism for wrapping machines because it is always possible to maintain a substantially constant low heat dissipating temperature in each seal cooling plate or tank due to the fact that the eutectic fluid in each tank when in use is actually frozen. The

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freezing temperature of the eutectic fluid is determined in advance and so controlled that suitable ranges can be maintained. If, for instance, a suitable temperature range is 8-18° F.; below 18° F. the eutectic is solidly frozen, a layer of frost or ice forms on the exterior of each plate or tank and the compressor which circulates the Freon through the coil of the refrigerating systems cuts out at 8°. When the cooling tanks or plates have absorbed sufficient heat as the result of a succession of packages having hot seals passing therebetween and thereover to melt the layer of ice formed on the exterior heat dissipating faces of the tank or plates and the temperature reaches 18° F. the compressor is automatically cut in and the cycle is continued in operation, the automatic control is such that a layer of ice is maintained constantly on the package engaging faces of the tanks or plates.

This arrangement increases the efficiency of the mechanism, and adds to the life of the compressor because of the provision of what can be termed a "hold-over." That is, the on and off periods of compressor operation are controlled according to the temperatures fixed by the thermostats and a hold-over layer of ice or frost on the tanks or plates results. In order to maintain a high efficiency of operation the high of the temperature range is set to cut in the compressor before the eutectic returns to fluid state. The operating efficiency is higher because of the expenditure of less energy than would be required to convert a fluid eutectic back to frozen state.

It is an object of our invention to provide an improved hot seal cooling mechanism for use with wrapping machines in which vacuum eutectic cooling tanks are employed and wherein there are provided controls for maintaining eutectic fluid frozen during the operation of the wrapping machine and while wrapped articles having hot seals are moving through the machine in order that a layer of ice or frost may be formed upon the package seal engaging face of the tanks or plates for the formation of deep and completely cooled end and bottom seals.

It is an object of our invention to provide a hot seal cooling machine for use with a wrapping or packaging machine having mechanism for providing a substantially low constant temperature in the tanks or cooling plates employed for sealing.

It is a further object of our invention to provide a novel hot seal cooling apparatus for use in connection with a wrapping machine having means for energizing heat sealable adhesive on wrappers enclosing articles being packaged and to provide vacuum eutectic cooling tanks or plates as the means for maintaining a constant low heat dissipating temperature in the tanks or plates for effecting rapid and substantially complete dissipation of the heat in the package seals in order to effect deep and substantially complete solidification of the sealing medium on the wrappers.

With these and other objects not specifically mentioned in view, the invention consists in certain combinations and constructions which will be hereinafter fully described, and then set forth in the claim hereunto appended.

In the accompanying drawings which form a part of this specification, and in which like characters of reference indicate the same or like parts:

Figure 1 is a perspective view showing the hot seal cooling mechanism in operative relationship

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with the final folding heat sealing and article delivering section of a wrapping machine;

Figure 2 is a plan view of the final folding and cooling mechanism of a wrapping machine and a diagrammatic disclosure of the hot seal refrigerating unit connected therewith;

Figure 3 is a side elevation of an end seal cooling unit and a sectional end elevation of the bottom hot seal cooling unit;

Figure 4 is an end elevation of the hot seal cooling mechanism as seen from line 4-4 of Figure 2; and

Figure 5 is an enlarged sectional side elevation of capillary bulb supporting housing and chamber.

The hot seal cooling mechanism constituting the present invention may form an integral part or an adjunct for a package wrapping machine of the type in which wrapped packages moving in succession through the wrapping machine pass between and over heat sealing mechanisms which melt or activate heat sealable coatings on the wrappers such that when subjected to cooling these materials solidify and secure the end and bottom folds of the packages being formed.

With reference to Figures 1, 2, 3 and 4, which show a preferred embodiment of the invention, there is provided a hot seal cooling assembly consisting of two spaced laterally adjustable vacuum eutectic side tanks or plates 10, 12 and a bottom vacuum eutectic tank or plate 14 extending across and beneath the path of travel of packages P moving between side plates 10, 12. Figures 1 and 2 show a portion of the article conveying mechanism of the wrapping machine which has pushers 16 secured to chains 18. Pushers 16 operate in a known manner to move a succession of partially wrapped articles P, such as loaves of bread enclosed within wrappers provided with heat sealable coatings, through sets of conventional folder plates 20 and 22 which complete the folding of the end flaps F of the wrapper of each package upwardly against the package ends. Folder plates 20 are provided with suitable heating elements 24 for the purpose of activating the wrapper coatings. In the case of wax paper, for example, the wax coating is melted so that when the end and bottom folds are cooled the congealing of the wax forms a firm seal. The bottom portion of each package moving through the folding and sealing mechanism passes over a number of electrically heated bottom heat sealing fingers 26, which energize the coating on the bottom fold of the package. Each package P upon emerging from between plates 20, 22 and bottom sealing fingers 26 is moved by pushers 16 onto an endless bottom conveyor belt 28 and conducted thereby between the above-mentioned end cooling plates or tanks 10, 12.

Conveyor belt 28 is driven from the main drive of the wrapping machine (not shown) by means of chain 30 (Figures 1 and 2) which runs on a sprocket 32 mounted on shaft 34 provided with a suitable driving roller (not shown) for driving the bottom belt 28 which runs on a suitable idler roller (not shown) mounted on an idler shaft 36 (Figure 1) near the discharge end of the machine. Shafts 34 and 36 are supported in suitable bearing lugs 38 secured to a pair of supporting rods 40 held by a pair of bridge bars 42 mounted on support pedestals 44.

In order to assist in the proper movement of a succession of packages from the heat sealing mechanism to and through the hot seal cooling mechanism, there is provided a top hold-down

belt 46 which coacts with belts 28. Belt 46 is driven at the same rate of speed as bottom belt 28 by means of a pulley or roller 48 mounted on shaft 50 supported in bearing lugs in brackets 38. Shaft 50 carries a sprocket 52 which is tracked by a sprocket chain 54 driven from the main drive of the wrapping machine (not shown). Top hold-down belt 46 also runs on an idler roller 56 mounted on a shaft 58 rotatable in a pair of bearing lugs formed in the upper ends of brackets 38.

Each package discharged by conveyor belt 28 is deposited on bottom heat seal cooling plate or tank 14 which effects the rapid solidification of the coating material on the wrapper of the previously heated bottom seam of the package. Each package remains positioned on plate 14 until it is pushed therefrom by the next succeeding package onto a take-off table T (Figure 1) which in the illustrated embodiment consists of a plurality of rollers 60 loosely supported in spaced bearing frames 62 mounted on rods 40. Rollers 60 function to reduce the friction of the accumulating packages being moved out of the machine and also tend to prevent freezing of the packages to the table since there is a possibility of a slight ice coating forming on the bottom surface of packages being sealed. The rotation of rollers 60 eliminates this danger.

Bottom seal cooling plate 14 is attached to an insulating block 66 (Figures 1 and 4) such as cork or other well known insulating material which in turn is fastened to a supporting plate 68 secured to a pair of lugs 70 mounted on rods 40. The vertical end seal cooling plates 10, 12 are also attached to insulating blocks 72, 74, respectively, also made of cork or other suitable well known insulating material. Insulating blocks 72, 74 are secured to supporting bars 76, 78, respectively. Bar 76 is secured to brackets 80 and bar 78 is fastened to a pair of similar brackets 82. Each bracket is provided with a threaded hub mounted on the threaded ends of rods 84, 86. One end of each of the rods 84, 86 is provided with a left-hand thread, and the other end is provided with a right-hand thread. Both rods are loosely supported in suitable bearing lugs 88 secured to the two supporting bars 40. Each folder plate 20 and 22 is also secured to an upright bracket 90, of the same design and construction as brackets 80, 82, which are provided with threaded hubs coacting with right-left handed threaded rods 92, 94 for adjusting the plates to and from each other. Each of the rods 84, 86, 92 and 94 carries a sprocket 98 which coacts with a suitable endless chain 100 so that when a crank handle 102 fixed to rod 86 is rotated, it will effect an inward or outward movement of all brackets 80, 82 and 90 and a simultaneous adjustment of the positions of the end folding and sealing plates 20, 22 and the hot seal cooling plates or tanks 10, 12.

As mentioned hereinabove, the hot seal cooling plates or tanks are of the vacuum eutectic type which insure a constant low temperature for the dispersion of heat in the hot seals during the entire operation of the machine. Tanks 10, 12 and 14, which are evacuated to a relatively high vacuum are filled with a suitable eutectic E. A tube 104 extends into tank 10 and forms a loop therein; a similar tube 106 extends into tank 12 and forms a loop in the same. The bottom hot seal cooling plate 14 also comprises a tank filled with eutectic E provided with a main refrigerating coil 110 and a by-pass refrigerating conduit or tube 108. The several refrigerating pipes

employed are provided with end connections to the outside while the loops and coils are enclosed in the respective tanks.

As the hot heat seals ends and bottom seams of each package contact, the side tanks 10, 12, and move over the bottom tank 14, the heat present in the seals is rapidly dissipated by being transmitted to the eutectic in the tanks which in turn transfer the heat to the refrigerating tubes where it is taken up by the Freon or refrigerant and carried to the condensor 112 to be dissipated by either air or water (Figure 2). Experience has shown that a suitable eutectic solution such as calcium chloride gives satisfactory results especially when the concentration is such that the eutectic solution freezes or changes state at 18° F. and remains thus frozen as long as the temperature is maintained at or below 18° F. With such a concentration during substantially the entire operation of the wrapping machine and a rapid procession of packages with hot seals out of the wrapping machine and into the cooling mechanism it is possible to maintain the eutectic solution frozen and also insure that a layer of ice or frost will be present on the cooling plate or tank surfaces during the operation of the wrapping machine.

A schematic layout of the refrigerating system is shown in Figure 2. The refrigerant, such as Freon, is piped through the tanks starting at the opening 200 passing through tube loop 104 in tank 10 thence through an opening 202 passing through a flexible hose 204 into by-pass conduit 108 in tank 14 through another flexible hose 206 to an opening 208 into tube loop 106 in tank 12 and thence through the tube loop in tank 12 out of opening 210 where by means of a flexible tube 212 it is directed into the refrigerating coil 110 in the bottom tank 14.

The passage of the refrigerant through the several tubes is completed as it emerges from tank 14 through opening 214 whence it passes through another flexible tube 216 connected to a capillary bulb chamber 218. From chamber 218 the Freon vapor is directed by means of a tube 220 through a conventional heat exchanger 222 and then conducted through a coil 224 back to the compressor C which pumps the refrigerant into condenser 112 where the vapor is converted into a liquid stage. In the operating cycle, the refrigerant travels from the condenser through a tube 226 passing a dehydrator 228 and the heat exchanger 222 from which by means of a tube 230 the refrigerant is conducted through a thermostatic expansion valve 232 which through a flexible hose 234 is connected with the opening 200 of the loop 104 in tank 10.

Thermostatic expansion valve 232 is actuated by means of the expansion and contraction of a capillary bulb or tube 236 removably mounted in the capillary valve chamber 238 which consists of an elongated hollow tube member closed at one end and projecting into gas chamber 218 as disclosed in Figure 5. Valve chamber 238 is fixedly mounted in gas chamber 218. The unique design and arrangement of the valve or bulb chamber 238 makes it possible to change the position of the capillary tube 236 whenever desired and also allows the tube to be withdrawn from valve chamber 238 if the thermostatic valve 232 becomes defective during operation. It will be seen that tube 236 can be removed or its position adjusted in valve chamber 238 without necessitating the removal of chamber 238 which would result in loss of refrigerant. This is because tube

236 is not in direct contact with the refrigerant and also because valve chamber 238 forms a part of a sealed closed valve unit.

The thermostatic expansion valve 232 functions to shut off the supply line 230 when the refrigerant returning from cooling plate 14 through line 216 reaches a predetermined low temperature. The heat exchanger 222 serves for the same purpose as most refrigerating units, namely to increase the economy of each unit. A conventional dehydrator 228 is employed to arrest any moisture which might develop in the refrigerant. In order to insure long life and prevent loss of refrigerant, the flexible refrigerant tubes 202, 204, 206, 212, 216 and 234 are plastic lined.

As shown in Figures 2 and 3, side tanks 10, 12 each contain a single coil 104, 106, respectively. Bottom cooling tank 14 contains a coil 110 and a bypass conduit 108. The reason for this arrangement is that it is desirable that the refrigerant be pumped as rapidly as possible from side tank 10 into side tank 12 and for this reason it flows out of tank 10 through flexible pipe 204 through bypass 108 in bottom tank 14 thence into coil 106 in tank 12 thence from tank 12 through conduit 204 into coil 110 and back to the compressing system through flexible conduit 216. In this manner side tanks 10, 12 are actually somewhat colder than bottom tank 14 because of the fact that they are responsible for congealing the energized coating on a plurality of flaps whereas bottom tank or plate 14 effects a cooling of the wrapper coating along a single seam made up of two overlapping laps. Bypass 108 therefore performs two functions in that it provides a simple means for quickly transferring the refrigerant from one side tank to the other and also it functions as an auxiliary refrigerating member in tank 14.

The invention above described may be varied in construction within the scope of the claim, for the particular device, selected to illustrate the invention, is but one of many possible concrete embodiments of the same. It is not, therefore, to be restricted to the precise details of the structure shown and described.

What we claim is:

In a sealing mechanism for a wrapping machine having an article guideway, oppositely dis-

posed heat sealing members located at a predetermined point in said guideway for heat sealing the end folds of wrapped packages as they move along said guideway, a horizontally arranged heat sealing member disposed at a predetermined point in said guideway to heat seal the bottom folds of said wrapped packages, oppositely disposed longitudinally extending vacuum eutectic tanks adapted to engage the hot end seals of wrapped packages, a bottom vacuum eutectic tank arranged to be engaged by the hot bottom seal of packages moved along the length of said article guideway, means mounting said tanks to form a continuation of said article guideway, said tanks being filled with a eutectic solution, a refrigerating coil mounted in each of said tanks, a refrigerating system for circulating a refrigerant through said tanks to freeze said eutectic to provide a reservoir of heat absorbing capacity to cool the hot seals coming into direct contact with said tanks, flexible connections joining said spaced tanks to said refrigerating system, a continuously operating conveyor means for moving wrapped packages along the length of said article guideway in sliding contact past said heat sealing members and in sliding contact past said eutectic tanks, and control means for maintaining the eutectic solution in a solid state during the major portion of the operation of said mechanism.

JAMES J. MCGINLEY.
WILLIAM C. DI PAOLA.

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