Jan. 9, 1951 H. MORTENSEN 2,537,314

REFRIGERATOR HAVING A HEAT TRANSFER DEVICE ABOUT DOOR OPENING

Filed Nov. 2, 1948 2 Sheets-Sheet 1

Fig. 1

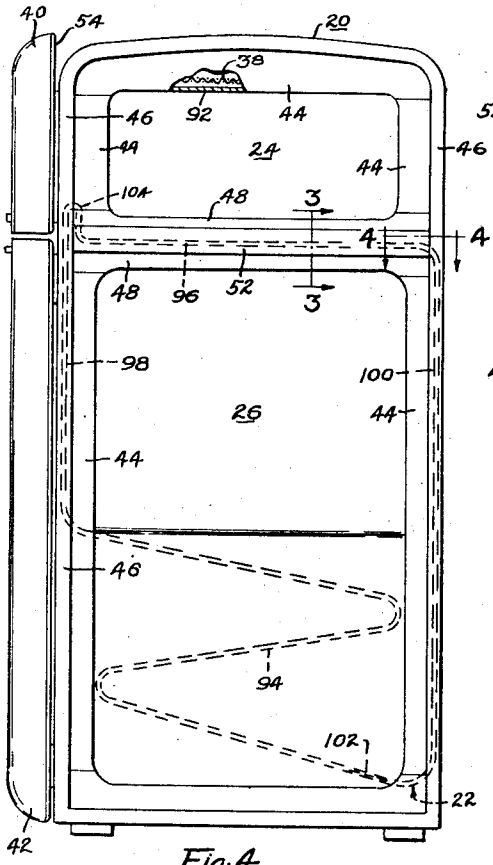


Fig. 2

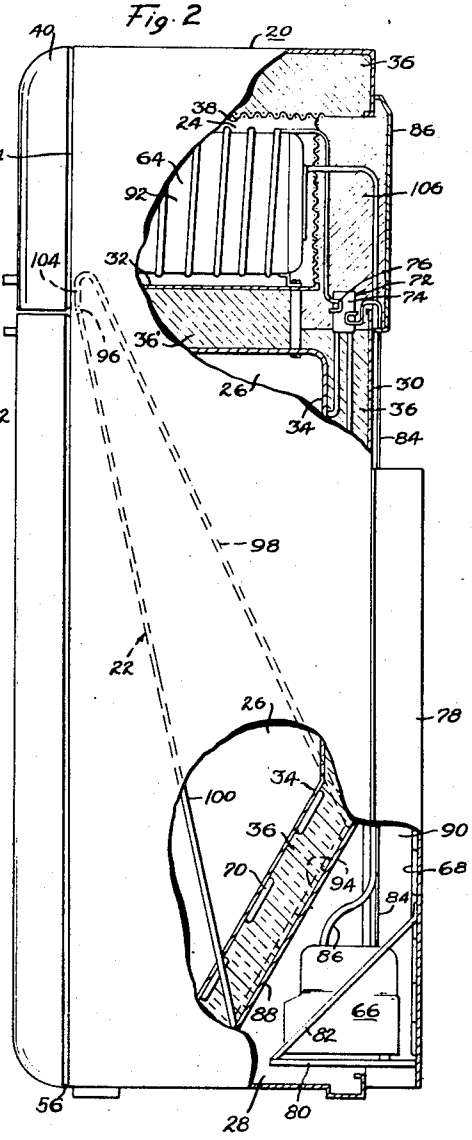
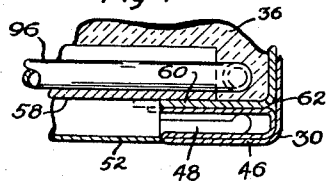


Fig. 4



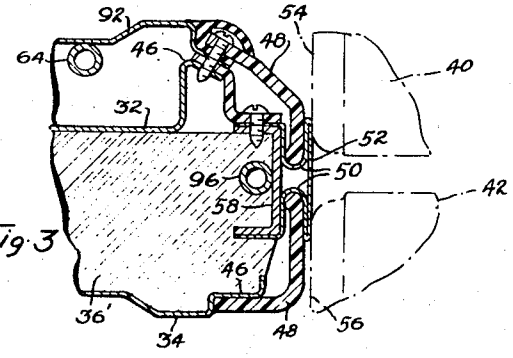


Fig. 3

INVENTOR.
HENRY MORTENSEN
BY
Ralph E. Baker
ATTORNEY

Jan. 9, 1951 H. MORTENSEN 2,537,314

REFRIGERATOR HAVING A HEAT TRANSFER DEVICE ABOUT DOOR OPENING

Filed Nov. 2, 1948

2 Sheets-Sheet 2

Fig. 5

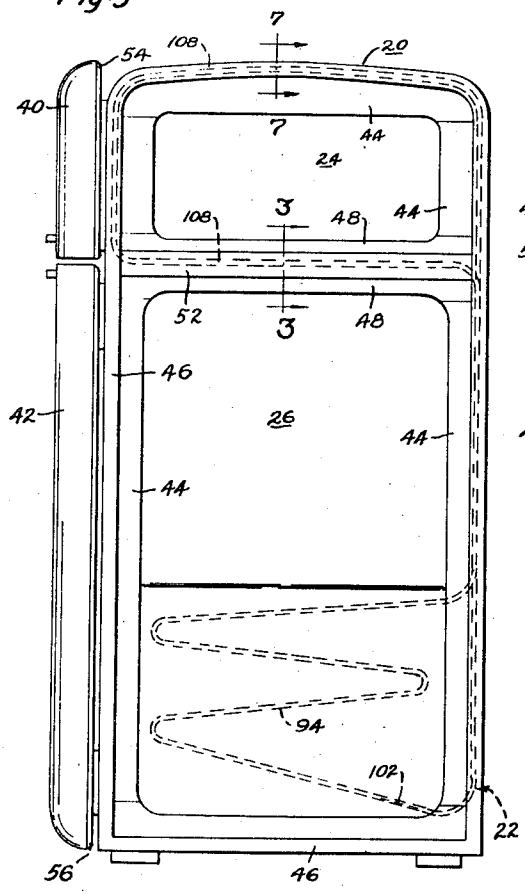


Fig. 6

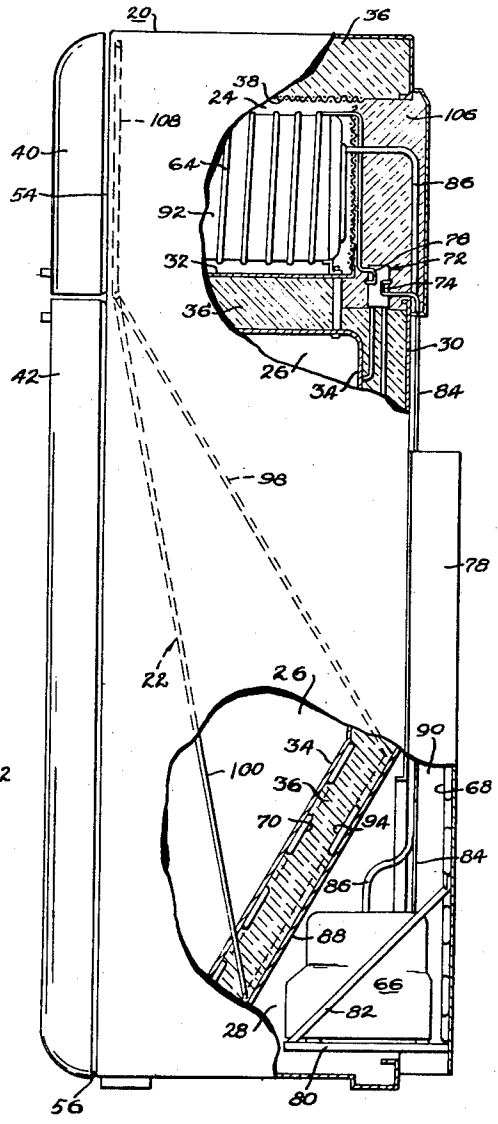
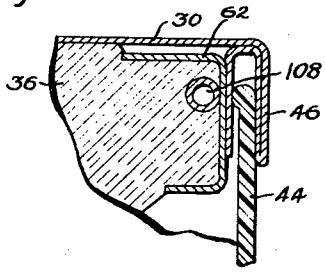


Fig. 7



INVENTOR.
HENRY MORTENSEN
BY
Ralph E. Baker.
ATTORNEY

Patented Jan. 9, 1951

2,537,314

UNITED STATES PATENT OFFICE

2,537,314

REFRIGERATOR HAVING A HEAT TRANSFER DEVICE ABOUT DOOR OPENING

Henry Mortensen, Detroit, Mich., assignor to Nash-Kelvinator Corporation, Detroit, Mich., a corporation of Maryland

Application November 2, 1948, Serial No. 57,944

7 Claims. (Cl. 62—89)

1

This invention relates generally to refrigerating apparatus and more particularly to household type refrigerators.

It is an object of the present invention to provide a household refrigerator having an improved arrangement of a heat transference medium circulatory system for preventing accumulation of moisture and frost on surfaces adjacent the door opening of the refrigerator cabinet.

Another object of the invention is to provide a refrigerating apparatus of the above mentioned character having an improved arrangement of a heat transference medium circulatory system in heat absorbing relationship with a condensing unit of a refrigerating system without impeding ready removability of the system from the cabinet.

Another object of the invention is to accomplish the above mentioned results in a two temperature, primary-secondary type of refrigerating system.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the invention is clearly shown.

In the drawings:

Fig. 1 is a front view of a household refrigerator shown with its doors open, embodying features of the present invention;

Fig. 2 is a side view of the refrigerator of Fig. 1 with the doors shown closed and with parts of the cabinet broken away and in section to show certain details of construction and arrangement;

Fig. 3 is a vertical cross sectional view of the refrigerator cabinet, taken along the lines 3—3 of either Fig. 1 or Fig. 5;

Fig. 4 is a horizontal cross sectional view of the cabinet, taken along the line 4—4 of Fig. 1;

Fig. 5 is a front view of another household refrigerator, similar to Fig. 1, showing a modification of the invention;

Fig. 6 is a side view of the refrigerator of Fig. 5 with parts broken away and in section showing details of construction and arrangement of parts; and

Fig. 7 is a vertical cross sectional view of the refrigerator cabinet, taken along the line 7—7 of Fig. 5.

Referring to the drawings by characters of reference, the refrigerating apparatus shown comprises, in general, a cabinet 20, a refrigerating system, and a heat transference medium circulatory system 22. The refrigerating system is arranged to absorb heat from a freezing compartment 24 and from a cooling or storage compartment 26 of the cabinet and to dissipate the heat in a machinery compartment 28 of the cabinet 20. The heat transference medium circulatory system 22 is arranged to absorb heat from the machinery compartment 28 and to give up some of the heat in the vicinity of the freezing compartment 24, adjacent the front thereof to prevent accumulation of moisture and frost on adjacent cabinet surfaces.

2

The cabinet 20 may comprise an outer metal casing 30, an upper metal liner 32, and a lower metal liner 34. Insulation 36, which may be of any suitable type, is preferably interposed between the liners 32, 34 and the casing 30 to decrease the rate of heat leakage into the cabinet interior. Also, the insulation 36 is interposed between adjacent bottom and top walls respectively of the liners 32, and 34, providing a horizontal partition 36' which separates and insulates the liners from each other. The upper liner 32 and the lower liner 34 respectively form the freezing compartment 24 and the cooling or storage compartment 26.

In the present construction, screening 38 is used to form the top, sides, and back of the upper liner 32, the screening 38 primarily functioning as a spacer for the insulation 36. The ultimate purpose of using the screening 38 is to prevent collection of moisture, within walls of the cabinet, entrained in room air which leaks into the cabinet through casing panel joints. The screening 38 allows the moisture entrained air to flow into the freezing compartment 24 where the moisture is frozen out of the air instead of wetting and reducing the efficiency of the insulation 36. This screening feature is not part of the present invention and is disclosed, described and claimed in the application of Lawrence A. Philipp, Serial No. 50,472, filed September 22, 1948, for Refrigerating Apparatus. The compartments 24 and 26 have individual access openings in the front of the cabinet which are closed respectively by vertically spaced doors 40 and 42 which may be hinged to a side wall of the cabinet.

Preferably, the door openings of the freezing compartment 24 and of the cooling compartment 26 have breaker-trim strips 44 which overlap marginal portions 46 of the outer casing 30 and of the liners 32, 34 around the door openings. Between the door openings, a pair of horizontally spaced, breaker strips 48 have adjacent, marginal side portions retained respectively in channels 50 of a metal, door bumper strip 52 which extends across the front of the cabinet. This metal, door bumper strip 52 and the marginal portions of the

outer casing 30 are substantially co-planar providing an outer surface engageable by sealing gaskets 54 and 56 respectively carried by the doors 40 and 42. Behind the metal bumper strip 52, a horizontal reinforcing channel member 58 is preferably provided to which the bumper strip 52 may be welded or be otherwise suitably secured. Opposite ends of the reinforcing channel 58 may be welded, as at 60, to opposite side members 62 of a metal frame of the cabinet front wall (See Fig. 4).

The refrigerating apparatus may be the same as that shown and described in the patent to L. A. Philipp, No. 2,361,792, issued Oct. 31, 1944. Like the refrigerating apparatus of the patent, applicant's apparatus comprises generally, a primary refrigerating system including a refrigerant evaporator 64 and a refrigerant condensing element comprising a motor-compressor unit 66 and a condenser coil 68. A secondary cooling system includes a refrigerant evaporator 70 and a heat exchanger 72. The heat exchanger 72 comprises a condenser or container 74 and an evaporator coil 76. The container 74 is connected in the secondary system or to the secondary evaporator 70 and heat is absorbed from the container by the evaporator coil 76 for ultimate dissipation by the primary system condenser 68. As shown, the freezing evaporator 64 is disposed in the cabinet freezing compartment 24 and the evaporator 70 is arranged to cool the food storage compartment 26. The refrigerant evaporators 64 may be suspended from the top wall of the cabinet liner 32 by suitable brackets whereas the secondary refrigerant evaporator 70 may be secured to the outer surface of the liner 34 in good heat transfer relationship therewith.

The motor-compressor unit 66 and the refrigerant condenser 68 are mounted on a removable panel or flue member 78 which may be secured to the back of the cabinet by screws, or by other suitable means so that the condensing element may be readily attached and/or removed from the cabinet as a unitary structure with the flue. The motor-compressor unit 66 is supported within the machinery compartment 28 on a base member 80 which is carried by the flue member 78 and is preferably reinforced by braces 82. In the form of a conduit or coil, the condenser 68 is secured, such as by cement, to the inner surface of the flue member 78 so as to utilize this large surface for dissipation of the heat of condensation. From the condenser 68, liquid refrigerant is supplied through a capillary tube 84 to the evaporator 64; the refrigerant first passing through the heat exchanger evaporator coil 76 where some heat is absorbed from the secondary system. From the evaporator 64, refrigerant vapor is withdrawn by the motor-compressor unit 66 through a return conduit 86.

The machinery compartment 28 is preferably located at the bottom of the cabinet 20, behind the storage compartment 26. To form this compartment 26, the outer casing rear wall is provided with a lower, inclined portion 88 extending inwardly and downwardly to the cabinet bottom wall, and the sides of the outer casing 30 are extended downwardly, as at 90, to form the sides of the machinery compartment 28. The bottom of the machinery compartment 28 is open for circulation of air upwardly through the compartment to carry away the heat of condensation and heat generated by the compressor motor.

Sheet metal material form top, bottom, rear and side walls of a box-like structure 92 around which the evaporator coil 64 may be wound, as shown in Fig. 2, the evaporator coil being in good heat exchange relationship with the walls of the container. This box-like structure 92 occupies substantially the entire space within an upper region of the liner 32, providing a large capacity container for the storage of foods and other articles to be frozen. The front of the box-like structure 92 is open, as shown, and this opening is normally closed by the upper cabinet door 40 and sealed by the door gasket 54 engaging against the marginal portions of casing 20 around the top and sides thereof and engaging against the bumper strip 52 between the door openings.

Because of the need for maintaining the evaporator 64 at relatively low temperatures in view of the large capacity of the freezing compartment, moisture has collected under certain conditions in the past, on the cabinet surfaces adjacent the freezing compartment door openings. To prevent this, I arrange the heat transference medium circulatory system 22 to transfer some of the heat of condensation from the machinery compartment 28 to the region of the freezing compartment at the front thereof to keep the temperature of the surfaces adjacent the cabinet front somewhat above the dew point. The heat transference medium circulatory system 22 is preferably a closed or endless conduit containing a volatile fluid, such as refrigerant. The circulatory system comprises, a heat absorbing or cooling portion 94 and a heating portion 96 interconnected by a supply conduit 98 and a return conduit 100. Adjacent the low portion of the heat absorbing portions 94 of the circulatory system, I provide an ebullition initiator or ebullator 102.

The heat absorbing portion 94 of the heat transference system 22 is secured against the inner surface of the machinery compartment inclined wall 88 to absorb heat therefrom for transference to the surfaces adjacent the doors. By arranging the heat transference system 22 to absorb heat from the machinery compartment 28 instead of directly from the motor-compressor unit or some other part of the system, it will be seen that the presence of the heat transference system does not interfere with removability of the refrigerating apparatus from the cabinet. The heat absorbing portion 94 of the heat transference system 22 extends upwardly from adjacent the bottom of the cabinet and is of sinuous or serpentine form with the runs angularly disposed along the machinery compartment inclined wall 88. I have found that by arranging the heat absorbing portion 94 of the heat transference system so that the runs thereof are angularly disposed, as shown in Fig. 1, that circulation of the heat transference medium is improved with an accompanying increase in efficiency. Adjacent the juncture of the inclined wall 88 with the cabinet upper, vertical rear wall portion, the conduit 22 extends to and up one side wall of the cabinet to the heating portion 96 and from the heating portion 96 down the other side of the cabinet, back to the heat absorbing portion 94 of the heat transference system. At the juncture of the supply run with the heating portion 96, a reverse loop portion 104 is provided to check reverse flow of the refrigerant. The heating portion 96 is secured against the inner surface of the channel reinforcement member 58 and preferably extends therealong, slightly inclined downwardly to the return run so as to induce flow in this direction.

Preferably, the primary refrigerating system is removable from the cabinet 20 as a unit, without need of disconnecting refrigerant conduits, so that the system may be taken to a shop or factory where repairs may be made conveniently. One type of cabinet construction which provides for removability of the refrigerating system is shown in the above mentioned patent to L. A. Philipp, No. 2,361,792, issued July 28, 1942 in which the cabinet is provided with a removable closure member in the rear wall thereof immediately behind and through which the freezing evaporator may be removed from the cabinet. Also, the condensing unit is removable from the cabinet without disconnecting refrigerant supply and return lines to the freezing evaporator by first detaching the secondary evaporator 76 from the heat exchanger container 74. Irrespective of the manner in which the refrigerating system may be removed as a unit from its cabinet, it will be seen that my heat transference system 22 need not be disturbed, since it is not directly attached to any part of the refrigerating apparatus.

In Figs. 5 to 7 inclusive, showing a modification of the invention, the cabinet and refrigerating system are the same as those above described and therefor like parts are given like numerals to avoid unnecessary repetitious description. The refrigerating apparatus of Figs. 5 to 7 inclusive differs from the previously described refrigerating apparatus in that I use a heat transference system, having a longer conduit for the heating portion, as at 108, of the heat transference system and extend this conduit heating portion across the top of the cabinet casing, as at 108, and down the opposite side thereof so that the freezing compartment 34 is completely surrounded by the heating portion or loop 108 at the front of the cabinet. As before, the heating portion or loop 108 is secured to the inner surface of the cabinet outer casing in good heat transfer relationship therewith. Also, in the modification of Figs. 5 to 7 inclusive, both feed and return runs of the heat transference system conduit, connecting the heat absorbing portion and heating portion are secured against the same side of the cabinet outer casing.

From the foregoing description, it will be noted that I have provided improved arrangements of heat transference medium circulatory systems for utilizing the heat of condensation of refrigerating systems to prevent accumulation of moisture on front surfaces of refrigerator cabinets adjacent access door openings thereof. Also, it will be noted that my arrangements of the heat transference systems is such as not to interfere with ready removability of the refrigerating systems as units from the cabinets. Furthermore, the ebullition initiator 102 may be of the type disclosed in the patent to L. A. Philipp, No. 1,931,268 issued Oct. 17, 1933. This initiator 102 aids in causing the refrigerant to boil at the proper temperature. When the refrigerant begins to evaporate, the evaporated refrigerant moves upwardly through the heat transference system and when the evaporated refrigerant comes in contact with the colder surface of the circulatory system about the front of the cabinet, the evaporated refrigerant condenses and returns through the return conduit 84 to the lower part of the refrigerator to absorb heat and repeat the cycle. Upon condensing, the refrigerant, of course, gives up its heat to the adjacent structure including the front surfaces of the cabinet near the door openings and in this manner prevents condensation on these surfaces.

Although preferred and modified forms of the invention have been illustrated, and described in detail, it will be apparent to those skilled in the art that various modifications may be made therein without departing from the spirit of the invention or from the scope of the appended claims.

I claim:

1. In a refrigerating apparatus, an outer metal cabinet casing having an inclined portion thereof forming part of a machinery compartment, a cooling element within said casing for cooling a storage compartment therein separated from said machinery compartment, an access opening in said casing to said storage compartment, a door closing said opening, and a heat transference medium circulatory system having a serpentine cooling portion extending along and in contact with said inclined portion externally of said machinery compartment and having a heating portion in heat transfer relation with said casing adjacent said access opening.

2. In a refrigerating apparatus, an outer metal cabinet casing having an inclined wall forming part of a relatively high temperature machinery compartment, a cooling element within said casing for cooling a relatively low temperature storage compartment therein separated from said relatively high temperature machinery compartment, an access opening in said casing to said relatively low temperature storage compartment, a door closing said opening, and a heat transference medium circulatory system having a cooling portion in contact with said inclined wall and having a heating portion in heat transference relation with said casing adjacent said access opening.

3. In a refrigerating apparatus, an outer metal cabinet casing having adjacent storage compartments therein, individual access openings for said compartments, doors respectively closing said opening, a trim strip between and adjacent said openings and said doors, refrigerant evaporating means within said casing for cooling said storage compartments, a refrigerant motor-compressor unit operatively connected to said refrigerant evaporating means, and a heat transference medium circulatory system having a cooling portion in heat absorbing relation with said machinery compartment and having a heating portion in contact with said trim strip.

4. In a refrigerating apparatus, an outer metal cabinet casing having adjacent upper and lower storage compartments therein, individual access openings in said casing for said storage compartments, a metal trim strip disposed between and adjacent said openings, doors respectively closing said openings and sealing against said metal trim strip, refrigerant evaporating means within said casing for cooling said storage compartments, a machinery compartment within said casing separated from said storage compartments, a refrigerant motor-compressor unit in said machinery compartment operatively connected to said refrigerant evaporating means, and a closed heat transference medium circulatory system having a cooling portion in heat absorbing relation with said machinery compartment and having a heat dissipating portion in contact with the rear surface of said trim strip.

5. In a refrigerating apparatus, an outer metal cabinet casing having adjacent freezing and cooling compartments therein, a partition separat-

ing said freezing and cooling compartments from each other, a refrigerant evaporator within said freezing compartment, a refrigerant evaporator within said casing for cooling said cooling compartment, individual access openings in said cabinet casing for said freezing compartment and said cooling compartment, doors respectively closing said freezing compartment and said cooling compartment, a finish strip extending along said partition adjacent said access openings to said casing, a refrigerant motor-compressor unit operatively connected to said evaporators, and a heat transference medium circulatory system having a cooling portion in heat exchange relation with said motor-compressor unit and having a heating portion engaging the inner surface of said finish strip extending longitudinally thereof.

6. In a refrigerating apparatus, a cabinet having adjacent freezing and cooling compartments therein, a partition separating said compartments from each other, a refrigerant evaporator in said freezing compartment, a refrigerant evaporator within said cabinet for cooling said cooling compartment, individual access openings in said cabinet for said freezing compartment, doors respectively closing said openings, a refrigerant motor-compressor unit operatively connected to said evaporators, and a heat transference medium circulatory system having a cooling portion in heat exchange relation with said motor-compressor unit and having a heating portion surrounding said freezing compartment adjacent the access opening thereof.

7. Refrigerating apparatus comprising a cabinet having a front wall and a machine compartment, a refrigerant evaporating element within said cabinet for cooling the interior thereof, a heat dissipating element within said machine compartment and being operatively connected with said evaporating element, a closed refrigerant containing system in heat exchange relation with said front wall and in engagement with a wall of said machine compartment but spaced from said heat dissipating element and an ebullition initiator in said system near the lower part thereof.

HENRY MORTENSEN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,992,011	Knight	Feb. 19, 1935
2,317,082	Philipp	Apr. 20, 1943
2,444,667	Philipp	July 6, 1948