June 12, 1951 L. F. LA PORTE 2,556,697

MEANS FOR EVACUATING REFRIGERATOR EQUIPMENT

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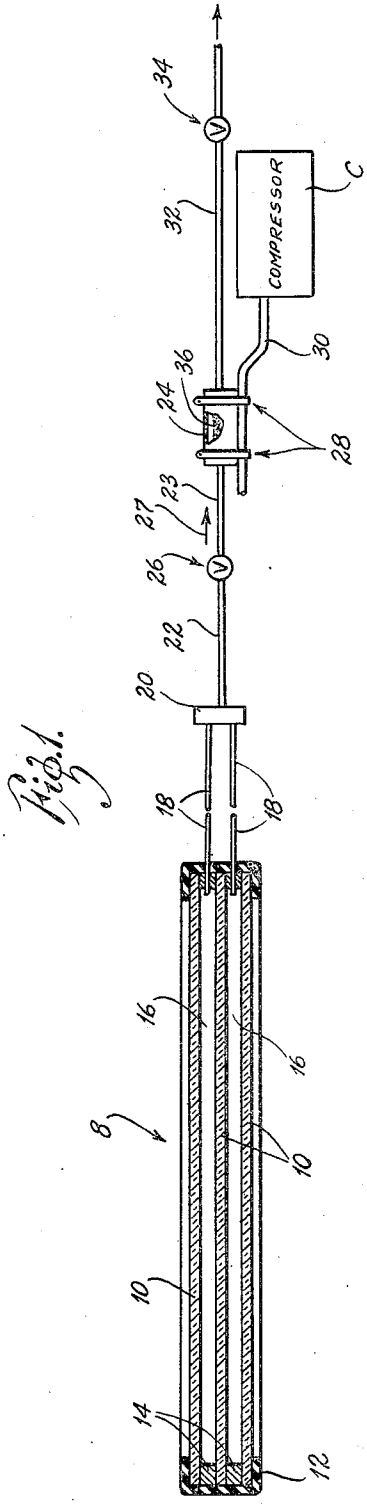


Fig. 1.

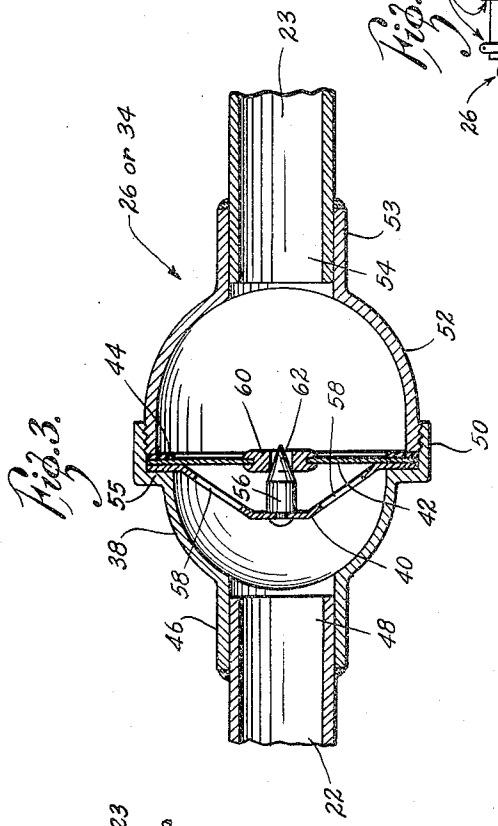


Fig. 3.

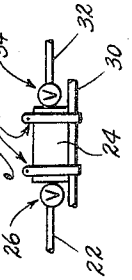


Fig. 4.

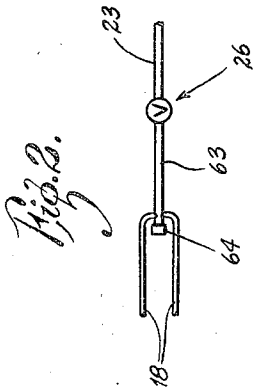


Fig. 2.

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MEANS FOR EVACUATING REFRIGERATOR EQUIPMENT

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17 Claims. (Cl. 62—2)

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The present invention relates generally to refrigeration, and pertains more particularly to a novel means and method for extracting from the spaces obtaining between the panels of refrigerator fronts, doors, and the like, any moisture that may have collected therein.

The invention is directed primarily, though not at all exclusively, to refrigeration equipment of the cabinet type wherein such articles of food as meat, butter, vegetables, and so on, are displayed.

Display cabinets of this character are well known, being found in food markets from coast to coast. As a general rule, the front walls, the swinging doors, and sometimes the side walls of such refrigerator display cabinets comprise a plurality of spaced panes of glass or the like peripherally encased in a frame of wood, rubber, plastic or other impervious material, as is understood.

Obviously, in addition to the insulative qualities of such construction, visibility of the merchandise displayed in the cabinet is of prime importance.

Solution of a problem which the refrigeration industry has not been able to solve satisfactorily heretofore, is the primary object of the present invention. The problem referred to is the prevention of the commonly termed cloudiness or fogginess, which invariably forms on the inner surfaces of the outer transparent panels, and on either surface of the intermediate panel or panels.

Such a condition obviously defeats the primary objective of employing transparent material, such as glass, for the spaced panels, in that as the cloudiness continues to spread, visual inspection of the merchandise becomes increasingly difficult.

Heretofore, attempts to cope with this problem have been unsuccessful. Various desiccant materials have been employed to attract the moisture, but as said material becomes increasingly saturated, its effectiveness continues to diminish.

As will be apparent, the present invention provides means whereby any moisture assimilated by such desiccant when employed, is intermittently extracted, so that said desiccant is, so to speak, repeatedly reactivated.

In the manufacture of, for example, the front wall of a display case, at least two, and normally three or more glass panels are encased in a suitable framework of selected material. Spacer members are employed along the marginal edges of the panels to provide an air space between them, and by means of such agents as putty, mastic, or the like, a hermetically sealed construction is contemplated.

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Without entering into a prolix description of the various known methods of constructing multipane parts of refrigerator cases, it may be said that no method has been devised whereby a hermetically sealed assembly, devoid of air and moisture, has been attainable.

In other words, all known methods of manufacturing such assemblies have not been able to preclude the presence of atmospheric pressure in the spaces between the panels, nor the eventual formation of small leaks in the originally impervious casing, thus establishing fluid communication between the atmosphere and the interior of these assemblies.

Consequently, after a cabinet of this type has been in use for some time, it has been found inevitable that gradually increasing areas of the originally transparent portions thereof become at least cloudy, and subsequently become opaque. This is particularly true in coastal areas where the atmosphere is normally moisture laden.

Intermittent evacuation of the spaces between panels to obviate air and moisture collections is the principal object of the present invention, as previously enunciated.

In its preferred form, and with particular reference to refrigerated display cabinets, the method herein preferably utilizes the heat of the gas passing through the discharge line of the compressor to attain this object. That is to say, each time the compressor operates, hot gas from the discharge side of said compressor automatically causes the temperature within a container to rise. This rise in temperature will effect the opening of a first valve leading to atmosphere, as will appear.

Compressor discharge line temperatures generally average between 125 and 150 degrees Fahrenheit during operation, and cool to room temperature shortly after operation ceases. Thus, in the interval between compressor operations, the temperature of and within said container drops or is lowered, resulting in a decrease in pressure which will effect the opening of a second valve, as will also appear.

In this manner, as will be seen, the present invention provides for the constant maintenance of at least a partial vacuum between the glass panels at all times, so that objectionable cloudiness and fogginess cannot accumulate. At the same time, the insulative qualities of the panel assemblies are thus enhanced.

As hereinbefore pointed out, although the invention is primarily directed to the prevention of cloudy formations in refrigeration equipment,

its use in connection with multi-glass windows and doors of air conditioned buildings, and so on, should be obvious.

Other features and advantages of the invention not hereinbefore set forth, will be apparent or referred to in the description to follow, reference being had also to the accompanying drawing, in which,

Fig. 1 is a schematic, or diagrammatic layout of the invention as applied to a multi-pane assembly of a refrigerator cabinet;

Fig. 2 is a similar fragmentary layout of a slightly modified arrangement;

Fig. 3 is a vertical sectional view of a valve assembly;

Fig. 4 is a diagrammatic portrayal of a modified disposition of the one-way valves.

In Fig. 1 of the drawing, numeral 8 indicates generally a conventional assembly of glass panels 10 encased in a rectangular frame 12 of hard rubber, or the like. The assembly is shown in section, and typifies either a refrigerator front wall, a side wall, or a door and so on, as is understood. Spacer members 14 are provided along the marginal edges of the panels so as to provide dead air spaces, designated 16, between them.

As stated previously, the assembly 8 illustrated represents a conventional construction, and its structural details obviously may be modified. Manifestly also, the assembly may include two or four panels, instead of the three shown.

In carrying out the invention, one end of a small tube 18 is inserted through frame 12 and spacer 14 so that said tube is in fluid communication with the dead space or chamber 16 obtaining between two adjacent panels 10. Manifestly, the number of tubes 18 is predicated upon the number of panels in the assembly 8. Thus, in an assembly of three panels, such as that illustrated, two tubes 18 are employed.

As portrayed in Fig. 1, the tubes 18 lead to a header 20, from which lines 22 and 23 lead to a hermetically sealed container 24. Interposed in said lines between header 20 and said container, is a one-way, or uni-directional valve 26, which may be of the type illustrated in Fig. 3. The valve 26 opens only in the direction indicated by the arrow 27.

The container 24 is rigidly clamped as suggested at 26, or otherwise maintained in intimate contact with the discharge line 30 of a compressor C included in the refrigeration system.

From the container 24, a line 32 leads to atmosphere, there being interposed in said line between the discharge end thereof and container 24, a one-way, or uni-directional valve assembly 34, which likewise may be of the type portrayed in Fig. 3.

It is here noted that although not necessary for successful operation, container 24 is preferably at least partially filled with a quantity of desiccant material 36, which may be silica gel, activated alumina, or one of other dehydrating agents well known in the refrigeration industry.

With reference to Fig. 3, the valve assembly there shown is of the diaphragm type, and for descriptive purposes, it will be assumed that this view portrays the valve 26, of which valve 34 is a counterpart. The valve includes a cap member 38, an annular valve needle supporting member 40 of rigid material, a flexible diaphragm 42, and a gasket 44. The diaphragm 42 is preferably, though not necessarily, of resilient metallic material.

The cap 38 is provided with a laterally projecting integral sleeve portion 46 which receives the outlet end portion 48 of line 22, as shown. Said cap member also includes an internally threaded flange portion 50 adapted for engagement with the externally threaded end portion of a hollow hemispherical valve body 52. The latter is provided with a laterally projecting sleeve portion 53, which receives the inlet end portion 54 of line 23.

With this arrangement, the members 40, 42 and 44 are rigidly mounted in position between the valve body 52 and an annular shoulder 55 provided in said cap member.

As previously stated, the disc member 40, which supports centrally thereof a stationary valve needle 56, is of rigid construction, and as shown in the drawing, is provided with a plurality of openings 58. Mounted centrally of the diaphragm 42, is a valve seat 60 which normally engages the tapered end 62 of the needle valve 56, to close the valve.

In other words, the inherent resiliency of the diaphragm 42 normally maintains the valve seat against the needle. However, the diaphragm is sensitive to even slight pressure changes. Thus if pressure passes through openings 58 against the left face of said diaphragm, valve member 60 will be unseated, thereby opening the valve. Further, if a vacuum be created to the right of said diaphragm, the suction will likewise unseat said valve member, and thereby open the valve.

Obviously, the valves 26 and 34 may be constructed otherwise than illustrated. For example a needle valve wherein a light tension spring normally seats the valve, may be employed. The diaphragm valve illustrated however, is preferred since it is extremely sensitive to even slight pressure changes, and will more readily respond to the action of this system in normal operation.

With reference to Fig. 2, it is noted that the tubes 18 may lead into a header 63 which is merely the line 22 slightly enlarged, and sealed at one end by means of a cap 64. Evidently, in the case of a two glass assembly, which requires only a single tube 18, the header can be eliminated.

It is also noted that heating of container 24 may be effected by an electrical heater of the internal or external type, controlled for intermittent application, as is understood.

As shown diagrammatically in Figure 4, the unidirectional valves 26 and 34 may be incorporated in the container 24.

Operation

It will be assumed that the assembly 8 represents the sloping front wall of a display cabinet wherein is incorporated a conventional refrigeration system including a compressor, and that in the normal operation of the system, said compressor has been turned on.

The hot gases emanating from the discharge side of the compressor, passing through line 30, heat the air in the container 24 causing same to expand. The pressure thereby set up within said container, being greater than the external pressure now causes valve 34 to open, as previously described.

Thus, as long as the compressor operates, a quantity of air under pressure, and containing any moisture which may have collected in said

container, is constantly being expelled to atmosphere via open valve **34**.

Assuming that the compressor operating cycle has ceased, the container **24** gradually cools. As it does, diaphragm **42** automatically closes valve **34** and a partial vacuum is created within said container which opens the valve **26**, also as previously described. Thus any moisture that may have collected in the spaces between the glass panels **10** is drawn by suction into the container **24** via tubes **18**, header **20** or **62**, line **22**, valve **26**, and line **23**, to be expelled as heretofore described, when the compressor again goes into operation.

It is noted that preferably the container **24** is charged with a quantity of desiccant material, so that any moisture sucked into the container is temporarily captured by said material. That is to say, the moisture is automatically extracted from the desiccant material and expelled to atmosphere each time the compressor operates, so that said material is intermittently reactivated. However, it is noted also, that the method can be successfully practised with a non-charged container.

From the foregoing, it should be apparent that the invention provides a method whereby heretofore cloudy, foggy, or obscure multi-paned refrigerator fronts, tops, sides, and doors may be automatically maintained clear.

It should also be apparent that the invention contemplates extraction of moisture from multi-paneled structure which may be non-transparent.

Manifestly, in the case of swinging doors for example, the tubes **18** would be of flexible material. And it is to be understood, that although in the diagrammatic layout of Fig. 1, only one assembly **8** is shown, the invention of course contemplates that all the multi-pane assemblies of a cabinet and so on, may be evacuated simultaneously. That is to say, the invention contemplates a tube **18** for each dead air space **16** obtaining in the cabinet which the compressor serves, each said tube leading to the header **20**.

Manifestly also, electrical or other suitable means may be employed to heat the container at intervals, as is understood.

The present method obviously admits of modification without departing from the spirit of the invention, which is characterized by the intermittent evacuation of dead air spaces in multi-pane assemblies, whereby to extract any moisture that may have found its way thereinto.

Therefore, the scope of the invention is not to be limited to the precise details shown and described.

What I claim is:

1. The method of evacuating a multipanel assembly of a refrigerator display cabinet or the like, which method comprises extracting at intervals any air or moisture which may have found its way into the space obtaining between a pair of adjacent panels included in said assembly, transferring the extracted air and moisture temporarily to a hermetically sealed container, and applying heat externally to said container to build up pressure therein whereby to expel said air and moisture to atmosphere.

2. The method of evacuating a multipanel assembly of a refrigerator display cabinet or the like, which method comprises extracting at intervals any air or moisture which may have found its way into the space obtaining between a pair of adjacent panels included in said assembly, providing means for transferring the extracted air and moisture temporarily to a hermetically sealed container, applying heat externally to said container to build up pressure therein whereby to expel said air and moisture therefrom, and providing means for transferring the expelled air and moisture to atmosphere.

3. The method of evacuating a multipanel assembly of a refrigerator display cabinet or the like, which method comprises extracting at intervals any air or moisture which may have found its way into the spaces obtaining between each pair of adjacent panels included in said assembly, providing means for first transferring the extracted air and moisture to a header, providing means for thereafter transferring same to a hermetically sealed container for temporary retention thereof therein, said means including a first pressure-responsive valve assembly, applying heat externally to said container to build up pressure therein whereby to expel said air and moisture therefrom, and providing means for transferring same to atmosphere, said last-named means including a second pressure-responsive valve assembly.

4. The method of extracting at periodic intervals any moisture that may have collected in the spaces between transparent panels of a refrigerator display cabinet, which method consists in heating a hermetically sealed container to thereby build up therein sufficient pressure to open a valve assembly in a conduit leading from said container to atmosphere, and thereupon allowing said container to cool to thereby create therein at least a sufficient vacuum to open a valve assembly in another conduit leading from said container to a header in fluid communication with said spaces.

5. The method of extracting at periodic intervals, any moisture that may have collected in the spaces between transparent panels of a refrigerator display cabinet or the like, which consists in heating a hermetically sealed container to build up therein sufficient pressure to open a valve assembly in a conduit leading from said container to atmosphere, and thereupon allowing said container to cool thus creating therein at least a sufficient vacuum to open a valve assembly interposed in a conduit between said container and said spaces, said container being heated by the hot gases passing through the discharge line of a compressor included in the refrigeration system serving said cabinet.

6. The method defined in claim 1, wherein the hermetically sealed container is partially filled with a quantity of dehydrating material.

7. That method of preventing the accumulation of air and moisture in the enclosed spaces obtaining between adjacent panels included in multi-panel equipment of a refrigerator cabinet or the like, which is characterized by the intermittent evacuation of said spaces through the application of heat for a period of time externally to a container charged with a quantity of dehydrating material thereby to expand any air or moisture which may have collected in said container, and subsequently permitting the container to cool, said container being in fluid communication with said spaces via a first conduit including a valve assembly responsive to pressure changes, and in fluid communication with atmosphere via a second conduit including a similar valve assembly.

8. Means for extracting at regular intervals during the normal operation of a refrigeration system, any air or moisture that may have infil-

trated the space obtaining between adjacent panels included in a multi-panel display cabinet assembly, said means including a hermetically sealed container in intimate contact with the discharge line of the compressor included in said system, a first conduit leading from one side of the container to said space, a pressure responsive valve assembly interposed in said conduit between said multi-panel assembly and said container, a second conduit leading from the opposite side of said container to atmosphere, and a pressure responsive valve assembly in the second conduit, each of said valve assemblies being of the type which opens only in one direction.

9. Means for extracting at regular intervals during the normal operation of a refrigeration system, any air or moisture that may have infiltrated the space obtaining between adjacent panels included in a multi-panel display cabinet assembly, said means including a hermetically sealed container in intimate contact with the discharge line of the compressor included in said system, a quantity of desiccant material provided in said container, a first conduit leading from one side of the container to said space, a pressure responsive valve assembly interposed in said conduit between said multi-panel assembly and said container, a second conduit leading from the opposite side of said container to atmosphere, and a pressure responsive valve assembly in the second conduit, each of said valve assemblies being of the type which opens only in one direction.

10. Means for extracting at regular intervals during the normal operation of a refrigeration system, any air or moisture that may have infiltrated the spaces obtaining between adjacent panels included in a multi-panel assembly of the character described, said means including a hermetically sealed container mounted in heat transfer relation to the discharge line of the compressor included in said system, a quantity of dehydrating material in said container, a header, a first conduit leading from one side of the container to said header, a uni-directional valve assembly interposed in said conduit between the header and the container aforesaid, a plurality of tubes each in sealed fluid communication at one end with one of said spaces and at the other end with said header, a second conduit leading from another side of said container to atmosphere, and a unidirectional valve assembly in the latter conduit, both of said valve assemblies including a diaphragm sensitive to pressure changes, and both being adapted to operate simultaneously.

11. Means for evacuating a multi-pane assembly of a refrigerator cabinet, said means comprising a first conduit sealed at one end in fluid communication with the encased space obtaining between a pair of adjacent panes of said assembly and at the other end with the interior of a closed container; a first uni-directional type valve interposed in said conduit between said assembly and the container aforesaid; a second conduit sealed at one end in fluid communication with the container the other end thereof leading to atmosphere; a second uni-directional type valve interposed in the latter conduit between said container and the ultimate extremity thereof; and means for heating said container to build up sufficient pressure therein to effect the closing of the first valve and simultaneously to effect the opening of the second valve aforesaid.

12. Means for evacuating a multi-pane assembly of a refrigerator cabinet, said means comprising a first conduit sealed at one end in fluid communication with the encased space obtaining between a pair of adjacent panes of said assembly and at the other end with the interior of a closed container; a first uni-directional type valve interposed in said conduit between said assembly and the container aforesaid; a second conduit sealed at one end in fluid communication with the container the other end thereof leading to atmosphere; a second uni-directional type valve interposed in the latter conduit between said container and the ultimate extremity thereof; and means for heating said container to build up sufficient pressure therein to effect the closing of the first valve and simultaneously to effect the opening of the second valve aforesaid, said means comprising the transfer of heat inherent in the gases passing through the discharge line of a compressor to the container aforesaid.

13. Means for evacuating a multi-pane assembly of a refrigerator cabinet, said means comprising a first conduit sealed at one end in fluid communication with the encased space obtaining between a pair of adjacent panes of said assembly and at the other end with the interior of a closed container; a first uni-directional type valve interposed in said conduit between said assembly and the container aforesaid; a second conduit sealed at one end in fluid communication with the container the other end thereof leading to atmosphere; a second uni-directional type valve interposed in the latter conduit between said container and the ultimate extremity thereof; and means for heating said container to build up sufficient pressure therein to effect the closing of the first valve and simultaneously to effect the opening of the second valve aforesaid, said means comprising the transfer of heat inherent in the gases passing through the discharge line of a compressor to the container aforesaid, the latter being partially filled with a quantity of a selected dehydrating material.

14. The means for evacuating a multi-pane assembly as defined in claim 11, wherein said first uni-directional valve includes a hollow body provided with an externally threaded end portion, a cap member including an internally threaded flange portion, a stationary valve needle and an annular supporting member of rigid material therefor, a plurality of openings in the latter, a flexible diaphragm provided centrally thereof with a valve seat adapted normally to engage the tapered point of said needle, and an annular gasket member, the peripheral portions of said supporting member, said diaphragm, and said gasket being clamped in position between an annular shoulder provided in said cap and the threaded end portion aforesaid of said valve body.

15. The means for evacuating a multi-pane assembly as defined in claim 11, wherein said second uni-directional valve includes a hollow body provided with an externally threaded end portion, a cap member including an internally threaded flange portion, a stationary valve needle and an annular supporting member of rigid material therefor, a plurality of openings in the latter, a flexible diaphragm provided centrally thereof with a valve seat adapted normally to engage the tapered point of said needle, and an annular gasket member, the peripheral portions of said supporting member, said diaphragm, and said gasket being clamped in position between an annular shoulder provided in said cap and the

threaded end portion aforesaid of said valve body.

16. In combination with a refrigerator display cabinet including at least one multi-pane wall assembly and refrigeration apparatus including a compressor, means for utilizing the heat inherent in the discharge line of said compressor to extract from the space obtaining between adjacent panes of said wall any air or moisture which may have infiltrated such space, said means including: a sealed container partially filled with dehydrating material and rigidly attached to said line in heat transfer relationship thereto; a first conduit leading from the container to said space; a first pressure sensitive one-way valve interposed in said conduit between the container and said wall assembly; a second conduit leading from the container to atmosphere; and another pressure sensitive one-way valve interposed in the second conduit between the container and the ultimate end portion of said conduit; the first valve being adapted to close simultaneously with the opening of the second valve when compressor operation builds up pressure within said container.

17. In combination with a refrigerator display cabinet including at least one multi-pane wall assembly and refrigeration apparatus including a compressor, means for utilizing the heat inherent in the discharge line of said compressor to extract from the space obtaining between adjacent panes of said wall any air or moisture which may have infiltrated such space, said means including: a sealed container partially filled with dehydrating material and rigidly attached to said line in heat transfer relationship thereto; a first conduit leading from the container to said space; a first pressure sensitive one-way valve interposed in said conduit between the container and said wall assembly; a second conduit leading from the container to atmosphere; and another pressure sensitive one-way valve interposed in the second conduit between the container and the ultimate end portion of said conduit; the first valve being adapted to open simultaneously with the closing of the second valve subsequent to a compressor operation.

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REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,647,785	Coughlin	Nov. 1, 1927
1,774,374	Horton	Aug. 26, 1930
1,856,008	Warren	Apr. 26, 1932
1,913,703	D'Adrian	June 13, 1933
1,934,133	Lauderback	Nov. 7, 1933
2,062,747	Gelstharp	Dec. 1, 1936
2,266,346	Vincent	Dec. 16, 1941