Oct. 4, 1966 R. M. LELIAERT 3,276,219

REFRIGERATION SYSTEM FOR COLD VAPOR BLAST

Filed April 29, 1964 2 Sheets-Sheet 1

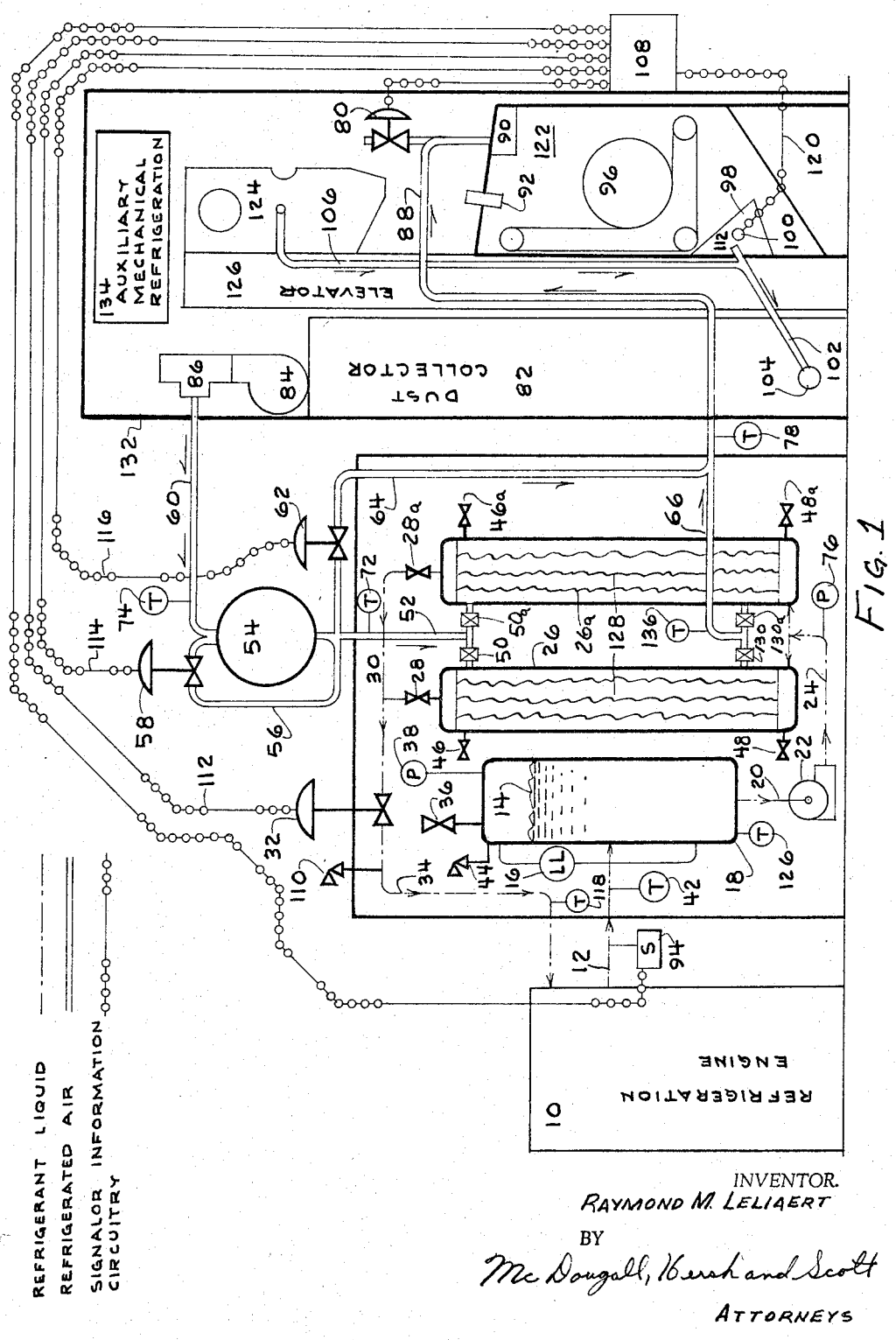


FIG. 1

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REFRIGERATION SYSTEM FOR COLD VAPOR BLAST

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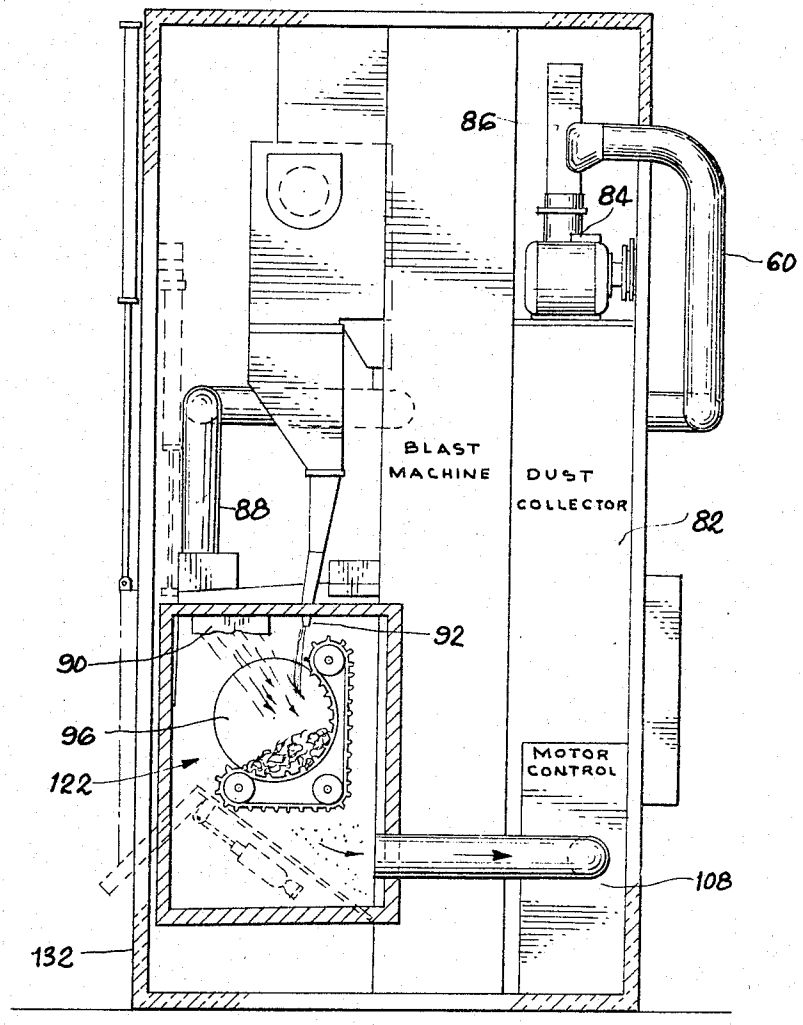


FIG. 2

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United States Patent Office 3,276,219
Patented Oct. 4, 1966

3,276,219

REFRIGERATION SYSTEM FOR COLD VAPOR BLAST

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Filed Apr. 29, 1964, Ser. No. 363,461
15 Claims. (Cl. 62—180)

This invention relates to a system for the refrigeration of parts by means of a stream of cold air or other gas or fluid and it relates more particularly to a system of the type described having a flexibility to meet wide variations in demand for refrigeration, ranging from periods of no demand to periods of demand which greatly exceed the capacity of refrigeration engine, a reliquefier, recondenser or a cascade compressor-coil refrigeration system employed in the system thereby to shave off the peaks and enable more efficient and effective utilization of refrigeration engine, a reliquefier, recondenser, or a cascade compressor-coil refrigeration system of intermediate capacity.

The invention will be described with reference to a system for the removal of flash or fins in the molding of parts of rubber or plastics, as described in U. S. Patent No. 2,996,846, wherein the parts to be deflashed are exposed to a blast of refrigerant such that the thin fins or flashing are reduced in temperature for embrittlement by the cold before the body portion making up the remainder of the parts. Engagement of the parts with a blast of particulate material operates to effect removal of the thin embrittled portions without undesirable effect on the remainder, thereby to produce finished parts from which the flash or fins are removed. The solids including the particles and removed plastic or rubber flash are separated for recovery of the particles for re-use in the blast thrown against the refrigerated parts.

In the system of the aforementioned patent, use is made of a refrigerant liquid, such as liquid carbon dioxide, which is thrown directly onto the molded parts while in the blast machine to chill the parts whereby portions of small cross-section are reduced to embrittling temperature prior to the remainder for enabling removal of the embrittled portions by a centrifugal wheel blast of solid particles. The spent refrigerant gas is not re-usable in its spent state and as more refrigerant gas is added to the system the pressure within the system rises causing the cold gas and air to escape to the atmosphere outside the enclosed system by leakage, pressure relief valve or through doors during loading and unloading operations. This constitutes a material waste of refrigeration in that it exhausts a large amount of cold out into the atmosphere thereby to increase the cost of operation and to introduce other objections to the described system.

The improvement of this invention is addressed to the use of a cold air blast or other blast of chilled gas or fluid for the refrigeration of the parts but wherein the air or gas or other fluid derives its refrigeration by indirect heat exchange with a refrigerant liquid maintained within a closed circuit whereby more efficient use can be made of the refrigeration system and whereby the cold refrigerated air can be recovered for recycle in the refrigeration system thereby to reduce the amount and cost of refrigeration.

One of the principal problems arising in a system of the type described resides in the ability to meet the wide variations in demand from periods where no refrigeration of the parts is required during loading, unloading or non-use of the machine to periods when the demand for refrigeration varies between prefreeze periods and the mechanical abrasive blasting period subsequent to freezing of the flash on the parts and it varies depending upon the volume and nature of the parts being processed; the temperature required for the selective embrittlement of the fins or flashings of the various parts varies depending somewhat upon the character and composition of the materials from which such parts are formed. The materials from which such parts are formed may range from rubbers and plastics capable of becoming embrittled at temperatures within the range of −100° F. to +30° F. and organo silicon materials which are not embrittled until cooled to a temperature below −175° F.

The design of a refrigeration system having a capacity sufficiently to meet the demands for the refrigeration of parts formed of organo silicons can result in a unit having a capacity far in excess of that needed for a great majority of the materials processed through the deflashing machine thereby generally to increase the cost not only from the standpoint of initial investment in equipment and installation, but also from the standpoint of space requirements, efficiency of operation, and cost of operation, thereby to render the process less attractive.

It is an object of this invention to produce a refrigeration system of the type described which is simple in construction and easy in operation; which is effective to shave off the peaks in demand thereby to enable utilization of a refrigeration engine of intermediate capacity but which is capable of meeting the peak demands often required in use thereby to reduce the total cost of refrigeration; which is flexible in operation to meet the current demands for refrigeration from periods of low demand to periods of high demand thereby to adapt the single unit for multiple use in a refrigeration system; in which the refrigerant operates in a closed cycle for savings in cost of refrigerant and refrigeration but in which the refrigeration is transmitted indirectly to a suitable carrier for supply of refrigeration in the desired amounts to the parts to be refrigerated; in which the amount of refrigeration taken up by the carrier can be varied to control the refrigeration conditions existing in the processing of parts for further flexibility in the control of the temperature to which the parts are refrigerated thereby to make most efficient use of refrigeration; and in which refrigeration can be recovered to save on the amount of refrigeration required thereby not only to increase the capacity of the machine but further to increase the savings in cost of refrigeration.

These and other objects and advantages of this invention will hereinafter appear and for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawing, in which:

FIG. 1 is a flow diagram of the refrigeration system embodying the features of this invention; and

FIG. 2 is a schematic elevational view of a deflashing unit with which the refrigeration system of this invention is adapted to be utilized.

Referring now to the drawing, the system can be divided into a refrigerant circuit shown in solid lines and a cold air refrigeration system shown in dotted lines and a signal or information circuitry in broken lines.

The refrigerant circuit includes a refrigeration engine, reliquefier, recondenser or cascade system **10** driven by a suitable power source and controlled by a low temperature safety switch **94** which shuts down the refrigeration engine when the temperature of the refrigerant liquid delivered through line **12** to a receiver **18** reaches a predetermined low point. The refrigeration engine, for example, can be a standard piece of equipment, such as a Model B Cryogenerator, marketed by Cryogenerators Division of North American Philips Co. Inc., of Ashton, Rhode Island. The refrigerant that is used in the system described in dichlorodifluoromethane but other refrigerants, such as nitrogen, ethane, propane and the like, can

be used depending upon the refrigeration temperature required to be developed in the system.

From the refrigeration engine **10**, the cold liquid refrigerant flows through line **12** to the receiver **18** which is fitted with a safety valve **44** and a charging valve **36** through which additional refrigerant liquid may be introduced to make up refrigerant in the system. The receiver **18** is also provided with a level indicator **16** which shows when the right amount of refrigerant liquid has been added to the system or when the refrigerant has fallen below a predetermined operating level through leakage. The receiver is also fitted with a temperature indicator **126** for measurement of the temperature of the cold refrigerant liquid.

The receiver has an outlet at the bottom in communication with line **20** having a pump **22** for movement of the cold refrigerant liquid from the receiver **18** through line **24** to the bottom side of one or a number of heat exchangers **26** and **26a**, each of which is provided with coils **128** through which the refrigerant liquid flows in heat exchange with air or other gases or fluids of the refrigeration cycle. The warmed refrigerant leaves the heat exchangers **26** and **26a** at the top for return through lines **30** and **34** to the refrigeration engine **10**. Line **30** may be provided with a temperature indicator **118** for measurement of the temperature of the warmed refrigerant.

The cold air blast or refrigeration cycle includes a dust collector **82** which draws off spent cold air from the deflashing machine **122** and separates dust therefrom. Line **60** from the dust collector fan **84** and discharge T **86** communicates with a constant volume blower **54** which causes positive displacement of the spent filtered cold air through line **52** to one or more of the heat exchangers **26** and **26a** depending on the open or shut positions of valves **50** and **50a**. The air flows downwardly through the heat exchanger **26** or **26a** or both about the heat exchanger coils **128** for indirect heat exchange with the liquid refrigerant in countercurrent flow upwardly through the coils to effect reduction in air temperature. The cold air issues from the outlet valves **130** and/or **130a** at the bottom of one or both of the heat exchangers into line **66** for flow to line **88** and into the deflasher unit **122** where it flows over and through parts to be processed reducing the temperature of the thin sections of the flash or fins to the embrittlement state.

To provide temperature control of the cold air to the deflasher, a by-pass line **64** is provided between lines **60** and **66** whereby a portion of the air can be by-passed around the heat exchangers for rejoinder with the air cooled during passage through the heat exchangers to enable adjustment of the temperature of the air to be advanced through line **88** to the parts to a level between the temperature of the air recycled from the deflashing machine and the temperature of the refrigerated air issuing from the heat exchangers whereby the temperature of the blend of the air in line **88** will correspond to the proportion of by-passed air to refrigerated air. The proportion by-passed for temperature control can be adjusted in response to the setting of the thermostat sensor **100**.

For example, during the freezing of the flash on the parts, a lower than required temperature of the volume of cold air flowing to the deflashing machine for embrittlement of the flash on the parts is desired for quick freezing. During this part of the cycle it is desirable to pass all of the air through the heat exchanger for maximum refrigeration and lowest temperature. As soon as the flash has been embrittled, it is desirable to reduce the temperature of the volume of air going to the deflashing operation to a temperature more nearly that of the temperature required to maintain the flash in a state of embrittlement during the mechanical abrasive blast part of the cycle for deflashing. This point is signaled when the thermostat sensor **100** shows that colder air is then flowing past the parts and through the deflashing machine. This thermostat sensor then operates the motor control valve **62** opening it partially to by-pass a portion of the total volume of air around the heat exchanger through line **64** to achieve the desired air temperature of air flowing onto the parts.

The blower **54** is preferably of the constant volume type. A by-pass loop **56** equipped with power operated valve **58** may be provided between the inlet and outlet of the blower **54** thereby to enable the blower to operate continuously at capacity while varying the volume of cold air recycled to the heat exchangers. This proportioning of the cold air depends upon the temperature and refrigeration requirements of the parts treated for embrittlement.

For example, during the freezing of the flash on the parts a lower than required embrittlement temperature and maximum rate of refrigeration is preferred. Therefore, valve **58** would be in the closed position with full volume of blower air flowing through the heat exchangers and to the deflashing machine to freeze the flash on the parts. After the flash is frozen, only the required embrittlement temperature needs to be maintained but since a lower rate of refrigeration can be tolerated to maintain the flash in a frozen condition, a lower volume of air can be refrigerated to meet these needs. To accomplish this lower volume of air, valve **58** would be opened sufficiently to give the desired air flow. Valve **58** operates in response to the thremostat sensor **100** and control center **108**.

This by-pass arrangement around the blower is a refinement which gives a greater degree of flexibility to the rate of refrigeration in the system but it is not essential to maintaining the desired temperature of the cold air flowing to the parts to be refrigerated and therefore is not an essential element of the system.

An optional means of temperature control for deflashing rubber, plastic and similar parts having relatively warm embrittlement temperatures can be obtained through the use of by-pass valve **80** which is mounted on cold air line **88** which discharges into the deflashing machine **122**. Such parts, for example, may be certain molded rubber parts of acrylate polymers which may have embrittlement temperatures in the range of 0° F. to −20° F.

When extremely cold air from the heat exchangers **26** and **26a** is not required to embrittle parts, blower **54** can be shut down so that no cold air flows through line **88**. In such case, only cold, but somewhat warmer air is throttled or modulated through valve **80** to achieve a more accurate temperature control within the deflashing machine and at less expense of refrigeration than when operating the refrigeration engine **10** and heat exchangers **26** and **26a**. This air coming from the insulated and enclosed room **132** is normally cooled to the range of 0° F. to −40° F. by an auxiliary refrigeration means **134** such as a mechanical refrigerant compressor coil system.

In this case, temperature of the air flowing into the deflashing machine is controlled by thermostat sensor **100** through the control center **108** which closes blower **54** and actuates motor control valve **80** to control the volume of cold air entering the deflashing machine. Circulation of cold air into and out of the deflashing machine is by suction of the dust collector fan **84**.

Another optional means of temperature control of the cold air refrigeration system may be obtained by the use of a motor type control valve **32** in line **30**, to throttle the flow of liquid refrigerant through coils **128** of heat exchangers **26** and **26a** by signal from the thermostat sensor **100** through the control center **108** which will be described in more detail hereafter. However, this is not a preferred method of temperature control due to its relatively slow response to temperature change demands for the refrigerated air.

Still another optional means of controlling the temperature of the air refrigeration system is through intermittent operation of the refrigeration engine **10**. Although not a preferred means of temperature control due to its relatively slow response to temperature change demands for refrigerated air, it is possible to vary the rate of refrigeration of the air at the heat exchangers **26** and **26a** by controlling the temperature of liquid refrigerant **14** flowing through coils **128** in the heat exchangers by intermittent operation of refrigeration engine **10**.

In such case, during periods of low demand for refrigeration, the refrigeration engine **10** would shut down for certain periods and the liquid refrigerant **14** in receiver **18** would be circulated through the heat exchangers at relatively higher temperatures until such time as the liquid refrigerant became too warm for effective refrigeration of the air. The refrigeration engine **10** would then again start up to reduce the temperature of the liquid refrigerant to levels for effecitve refrigeration of the air.

From time to time it will be necessary to defrost or derime the coils **128** in heat exchangers **26** and **26a**. This can be done on an intermittent operating basis or on a continuous operating basis by one of several means which are well known to those skilled in the art of heat transfer. For example, heat exchangers **26** and **26a** normally would operate with air flowing through both in parallel flow to be refrigerated. For such operation air line valves **50**, **50a**, **130** and **130a** would all be open. Valves **28** and **28a** in the liquid refrigerant lines also would be open. Defrost line valves **46**, **46a**, **48** and **48a** would be closed.

Then if it is desired to defrost heat exchanger **26**, for example, while the other heat exchanger **26a** remains on line on a continuous operating basis to refrigerate air, valves **50**, **130** and **28** would be closed and valves **46** and **48** would be opened. Warm air would then be caused, by means not shown, to flow into heat exchanger **26** through valve **46** and exhaust from the heat exchanger through valve **48** thereby defrosting coils **128** in heat exchanger **26**.

On the other hand, if it were desired to defrost on an intermittent basis, both heat exchangers **26** and **26a** could be defrosted simultaneously. In such case valves **50**, **50a**, **130**, **130a**, **28** and **28a** all would be closed while valves **46**, **48**, **46a** and **48a** all would be opened. Warm air would then be caused to flow through both heat exchangers at the same time by passing in through valves **46** and **46a** out through valves **48** and **48a**.

The control center **108** has been referred to in previous paragraphs describing means of controlling the temperature of the cold air delivered to the deflasher machine **122**. The control center **108** is an integrated unit of timers, which may be of the mechanical, pneumatic or solid state type by way of example; temperature sensor-transmitter arrangements such as the Foxboro pneumatic arrangements which are well known in the industry and which can use gas filled sensor bulbs which compare and amplify signals to operate pneumatic motor valves or electrically operated motor valves; or temperature sensor-transmitter arrangements using thermocouples (copper-constantan) by way of example which give an electrical signal which may be amplified and transmitted to operate pneumatic or electrically operated motor valves.

The control center can control the operations of the deflasher machine on a temperature basis only such as by signal from thermostat sensor **100** to appropriate motor control valves or by timers which can be preset to signal various components of the deflasher equipment as well as components of the refrigeration system or the control center can control the operations by a combination of temperature and time signals to the above mentioned components.

When in operation, the temperature conditions in the deflasher unit are normally met by the refrigeration capacity of the refrigeration engine whereby the temperature of refrigerant liquid withdrawn from the receiver **18** will just about correspond with the temperature of refrigerant liquid made available by the refrigeration engine so that the unit can operate steadily over an extended period of time without interruptions.

On the other hand, when the temperature requirements demanded in the deflasher unit are such as to require less refrigeration than the capacity of the refrigeration engine, temperature of refrigerant liquid will decrease to a point lower than desired for operation of the refrigeration machine and refrigeration system, at which time the safety low temperature switch **94** shuts off the refrigeration engine. Under the extreme situation when the parts to be processed require very cold temperature for embrittlement, such as when processing parts of an organo silicon resinous material or elastomer which requires extremely low temperatures for embrittlement, the normal capacity of the refrigeration engine can be insufficient to maintain the desired low temperature of refrigerant liquid required to meet the demand for refrigeration.

However, in the system described, the refrigeration means to be added to supplement that capable of being made available by normal operation of the refrigeration engine is supplied from the low temperature refrigerant liquid stored up in the receiver **18** whereby a larger amount of low temperature liquid refrigerant can be made available over an extended period of time sufficient to reduce the temperature of the refrigeration gas to a level low enough to process the silicone parts for embrittlement of the flash for removal. Since such high demand is intermittent by reason of the time required for loading and unloading of the parts and because of the possible intervening use of the machine with parts having lesser demand for refrigeration, the temperature of liquid refrigerant can be restored to a low level in the receiver to enable a unit of lower refrigeration capacity to be used in such situations of high demand.

The demand for refrigeration which is placed on that available in the circulating liquid refrigerant is varied in the system described depending upon the temperature of cold air required and/or the volume of cold air to embrittle the flash on parts and to maintain it in an embrittled state. This demand is capable of being balanced in the system described by the proportioning of the recycled cold air advanced through line **52** to the heat exchangers for passage in heat exchange relationship with the refrigerant liquid and by the amount of cold air by-passing the heat exchangers through line **64** whereby the desired temperature conditions can be maintained in the processing cold air while making most efficient utilization of the refrigerant.

For example, where intermediate temperatures on the order of —50° F. cold air, as measured by thermocouple **78** in line **88**, is required for processing parts, such a temperature may be achieved by the recycle of the spent refrigerated cold air discharged from dust collector fan **84** and the insulated enclosure through T **86** and line **60** at a temperature of say about —20° F. to pass one portion of this total volume of air through the heat exchangers for reduction in temperature to about —180° F. as measured by thermocouple **136** while the remainder of the volume of spent cold air is by-passed around the heat exchanges through line **64**, as controlled by valve **62**, for admixture with the —180° F. air coming from the heat exchangers to provide a blend of —50° F. air, as measured at thermocouple **78**, advanced through line **88** to the deflashing machine **122**.

When instead of —50° F. air, the demand is for —110° F. air to be delivered through line **88**, the percentage of air to be by-passed around the heat exchangers through line **64** is decreased and the percentage of total air passing through line **52** and through the heat exchangers is increased.

When instead of —50° F. or —110° F. air, the demand is for —180° F. to be delivered through line **88**, all

of the recycled air can be passed in heat exchange relationship through the heat exchangers with little or no air passing through line **64** due to closing of valve **62**. The refrigeration available in the refrigerant liquid **14** stored in receiver **18** is used to provide for removal of the larger amount of heat from the larger volume of air passing through the heat exchangers.

If still lower air temperatures are required, this can be achieved by increasing the heat removal capacity of the heat exchangers either by putting more heat exchangers into the line or by increasing the volume of refrigerant liquid through coils **128** in heat exchange relationship with the air.

When higher temperature air is desired in line **88**, for example, in the order of about —10° F., then the heat exchanger system along with by-pass line **64** can be shut down completely by stopping blower **54** and air for embrittling parts and maintaining them at the desired temperature can be accomplished by drawing cold air from the insulated enclosure **132** into the deflashing machine **122** through modulating valve **80** instead of refrigerated air from line **88**. In this case, the air cooling is provided entirely by auxiliary mechanical refrigeration means **134** and the more expensive extreme cold producing refrigeration engine need not be operated during this time period. However, the refrigeration engine **10** can be operated during such time period to reduce the temperature of the liquid refrigerant stored in receiver **18** preparing for subsequent time periods when the demand for refrigeration at the heat exchangers may exceed the output of the engine.

Also, as described earlier, optional or auxiliary means for temperature control can be used such as intermittent operation of the refrigeration engine **10**, varying the flow or volume of refrigerant liquid through the heat exchangers or altering the total volume of recycled spent cold air by by-passing a portion of it around blower **54**.

It will be apparent from the foregoing that the system described provides for efficient utilization of a refrigeration engine or other cold producing means in a closed cycle for refrigerating refrigerant liquid whereby the amount of refrigeration made available in heat exchange relationship process to cool a gas may be adjusted to meet various demands of the equipment from demands which are less than the capacity of the refrigeration engine to demands which are greatly in excess of the capacity of the refrigeration engine and wherein the cycle of the refrigerated cold gas passed in heat exchange relationship with the refrigerant liquid can be balanced with the refrigerant liquid to achieve a desired end result in the refrigeration capacity of the refrigerated cold gas thereby to provide great flexibility in the operation of the refrigeration system and to make refrigeration available at relatively low cost.

While the utilization of the refrigeration gas has been described with reference to the variations in demand for embrittlement of thin sections of parts molded of elastomers or plastics to assist in the removal thereof, it will be understood that the described refrigeration system will have application to any other related and unrelated uses wherein variations will occur in the demand for the amount of refrigeration.

It will be further understood that changes may be made in the details of construction, arrangement and operation without departing from the spirit of the invention, especially as defined in the following claims.

I claim:

1. In a refrigeration system for making a large volume of cold fluid available for the chilling of parts and media by direct contact of the parts and media with the refrigerated fluid comprising the combination of a refrigerant liquid cycle and a refrigeration fluid cycle in which the refrigeration is transferred from the liquid refrigerant to the refrigeration fluid indirectly through a heat exchanger, the refrigerant liquid cycle comprising:

(a) a refrigerant machine for making available a refrigerant liquid,

(b) a receiver for the storage of refrigerant liquid delivered from the refrigerant machine,

(c) a heat exchanger having a refrigeration coil extending therethrough from an inlet at one end to an exit at the other end for the flow of refrigerant liquid therethrough,

(d) means communicating the machine with the receiver for the passage of refrigerant liquid from the machine to the receiver,

(e) means communicating the receiver with the inlet end of the heat exchanger coil,

(f) means communicating the outlet end of the heat exchanger coil with the machine,

(g) a pump means for displacement of refrigerant liquid from the receiver to the inlet of the heat exchanger

said refrigeration fluid cycle comprising:

(1) a chamber into which the refrigerated fluid is introduced for passage into direct contact with the parts and media to be chilled,

(2) means communicating one end of the heat exchanger with the chamber for the passage of refrigerated fluid from the heat exchanger to the chamber,

(3) a pump means having an inlet and an outlet for positive displacement of fluid from the inlet to the outlet,

(4) means communicating the pump outlet with the other end of the heat exchanger and means communicating the pump inlet with the chamber for positive displacement of spent refrigeration fluid from the chamber to the heat exchanger and through the heat exchanger in heat exchange relationship with the heat exchange coils in the heat exchanger, and

(5) means interposed between the pump outlet and the heat exchanger communicating with the means communicating the heat exchanger outlet with the chamber for bypassing the heat exchanger with some of the fluid circulated by the pump means.

2. A refrigeration system as claimed in claim **1** which includes means for controlling the rate of flow of refrigerant liquid from the receiver to the heat exchanger coil to control the amount of cold transmitted to the refrigeration fluid.

3. A refrigeration system as claimed in claim **1** which includes means for controlling the ratio between the amount of refrigeration fluid advanced through the heat exchanger and the amount bypassing the heat exchanger to control the temperature of the fluid mixture before introduction into the chamber.

4. A refrigeration system as claimed in claim **1** which includes switch means responsive to the temperature of the refrigerant liquid for controlling the operation of the refrigeration machine.

5. A refrigeration system as claimed in claim **1** which includes a level indicator for the receiver for controlling the operation of the refrigeration machine to shut off the machine responsive to the rise of the liquid to a predetermined level in the receiver and for initiating operation of the machine for the supply of refrigerant liquid responsive to the fall of the liquid in the receiver to a predetermined level.

6. A refrigeration system as claimed in claim **1** which includes a valve means for controlling the amount of refrigerant liquid circulated through the coil of the heat exchanger.

7. A refrigeration system as claimed in claim **1** which includes means for defrosting the coils of the heat exchanger.

8. A refrigeration system as claimed in claim **1** which includes a bypass communicating the pump means outlet with the pump means inlet for recirculating a portion of the fluid displaced by the pump, and means for control-

ling the ratio of fluid bypassed about the pump means to the amount of spent refrigeration fluid circulated to the heat exchanger to permit the pump means to operate at capacity while a fractional amount of the spent refrigeration fluid is advanced towards the heat exchanger.

9. A refrigeration system as claimed in claim **8** in which said means comprises power operated valve means responsive to the temperature requirement of the chamber.

10. A refrigeration system as claimed in claim **1** which includes valve means in the means communicating the heat exchanger with the chamber for controlling the amount of cold refrigeration fluid introduced into the chamber.

11. A deflashing system comprising a deflasher unit in which parts to be deflashed are processed, a chamber enclosing the deflasher unit, and a refrigeration system for making a large volume of cold refrigeration fluid available for introduction into the deflasher unit for chilling the parts by direct contact with the refrigeration fluid in which the refrigeration system comprises the combination of a refrigerant liquid cycle and a refrigeration fluid cycle, in which the refrigeration is transferred from the refrigerant liquid to the refrigeration fluid indirectly through a heat exchanger, the refrigerant liquid cycle comprising:

(a) a refrigerant machine for making available a refrigerant liquid,

(b) a receiver for the storage of refrigerant liquid delivered from the refrigerant machine,

(c) a heat exchanger having a refrigeration coil extending therethrough from an inlet at one end to an exit at the other end for the flow of refrigerant liquid therethrough,

(d) means communicating the machine with the receiver for the passage of refrigerant liquid from the machine to the receiver,

(e) means communicating the receiver with the inlet end of the heat exchanger coil,

(f) means communicating the outlet end of the heat exchanger coil with the machine,

(g) a pump means for displacement of refrigerant liquid from the receiver to the inlet of the heat exchanger coil for the flow of refrigerant liquid thereto;

the refrigeration cycle comprising:

(1) means communicating one end of the heat exchanger with the deflasher unit for the passage of refrigeration fluid from the heat exchanger to the deflasher unit,

(2) a pump means having an inlet and an outlet for positive displacement of fluid from the inlet to the outlet,

(3) means communicating the pump outlet with the other end of the heat exchanger and means communicating the pump inlet with the deflasher unit for positive displacement of spent refrigeration fluid from the deflasher unit to the heat exchanger and through the heat exchanger in heat exchange relationship with the refrigeration coil of the heat exchanger, and

(4) means interposed between the pump outlet and the heat exchanger and communicating with the means communicating the heat exchanger with the deflasher unit for bypassing the heat exchanger with some of the fluid recirculated by the pump means.

12. A deflashing system as claimed in claim **11** which includes means in the means communicating the heat exchanger with the deflasher unit for bleeding off some of the refrigeration fluid into the chamber.

13. A deflashing system as claimed in claim **12** which includes valve means for controlling the amount of refrigeration fluid bled into the chamber whereby fluid withdrawn from the chamber into the deflasher unit during operation thereof has controlled refrigeration.

14. A deflashing system as claimed in claim **11** in which the fluid recirculated between the heat exchanger and the deflashing unit comprises air.

15. A deflashing system as claimed in claim **11** which includes a separator in communication with the deflashing unit for the separation of spent refrigeration fluid from the solid materials entrained therein and in which the pump means communicates with the separator for the recirculation of clean spent refrigeration fluid to the heat exchanger.

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