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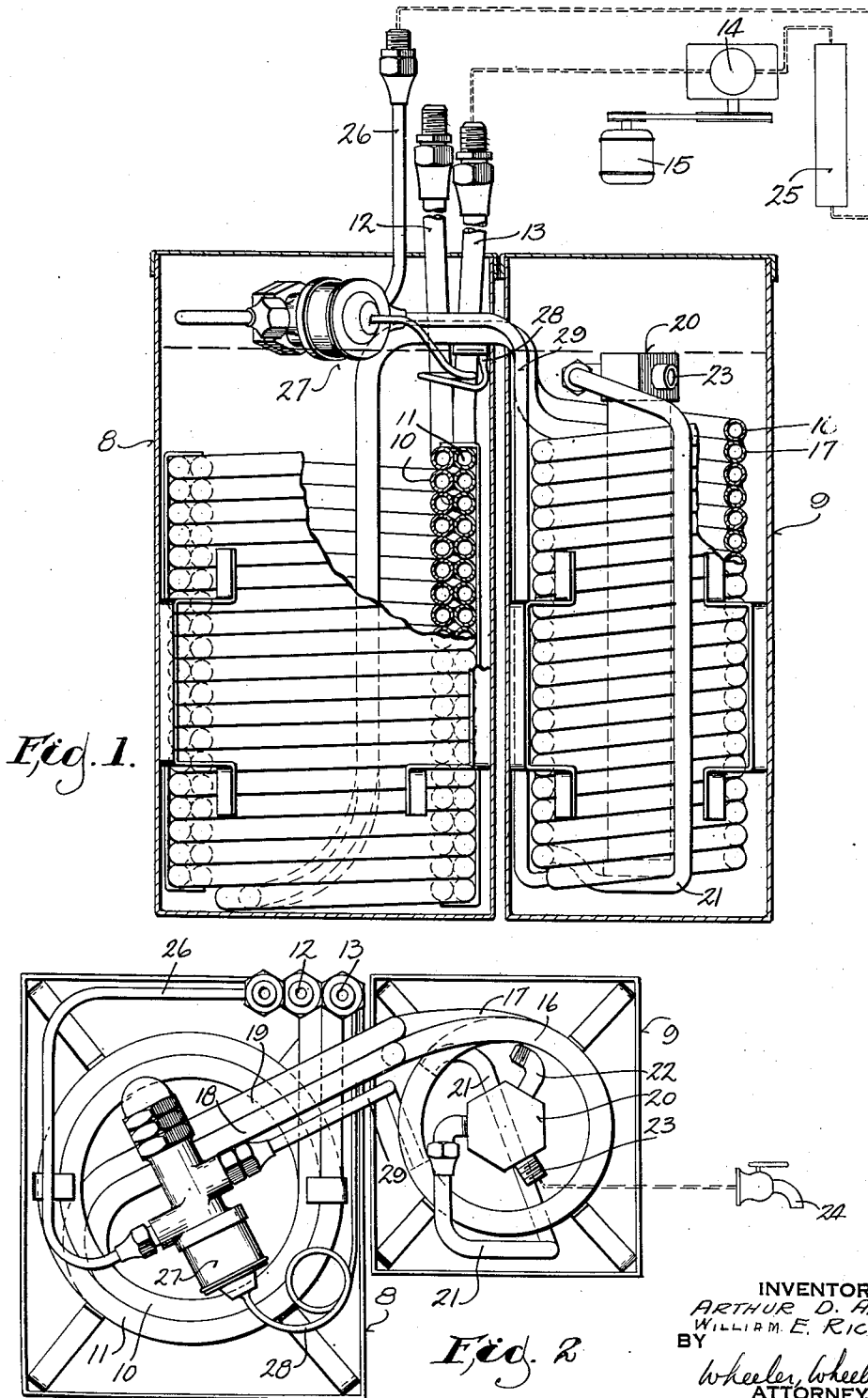
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DISPENSER FOR REFRIGERATED BEVERAGES

Filed Nov. 22, 1939

2 Sheets-Sheet 1



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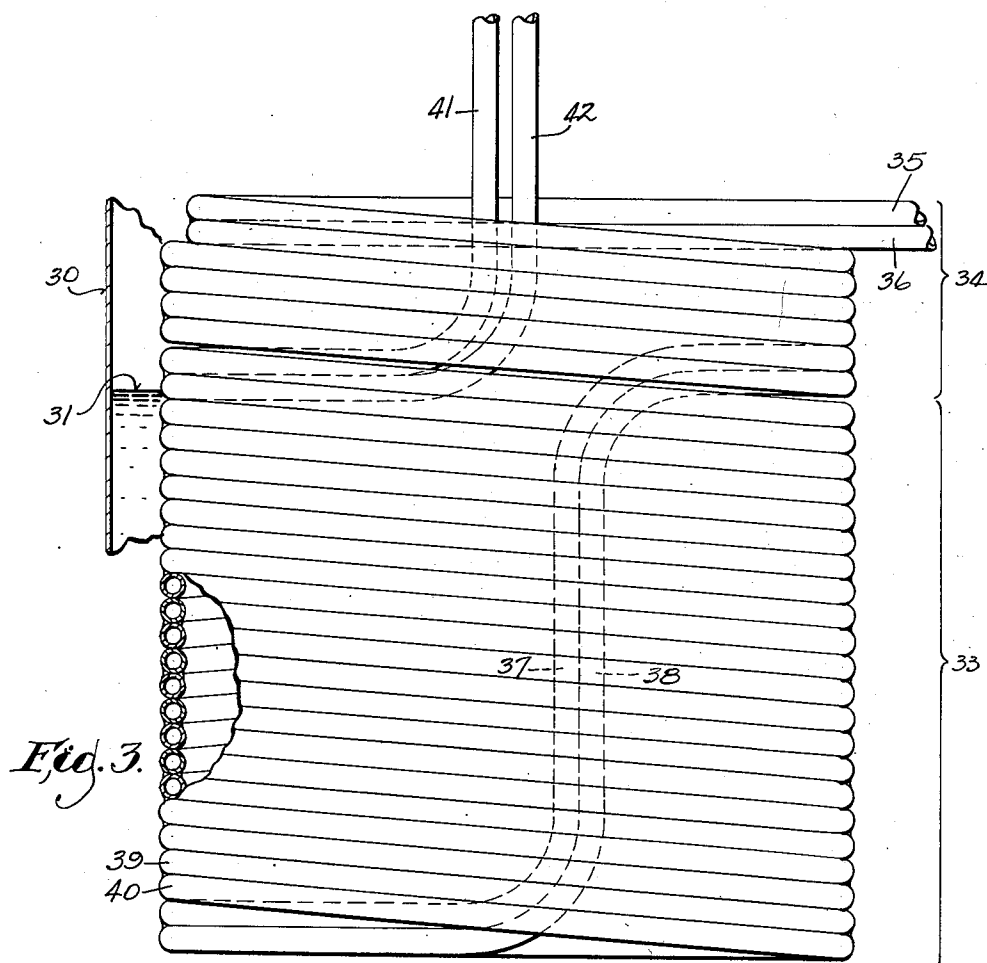
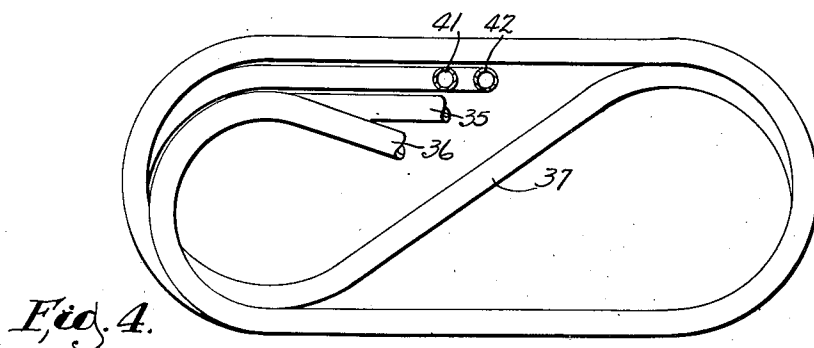
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2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

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DISPENSER FOR REFRIGERATED  
BEVERAGES

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7 Claims. (Cl. 62-141)

This invention relates to improvements in dispensers for refrigerated beverages.

It is the primary object of the invention to provide a beverage refrigerating apparatus, with or without a carbonator, which will enable a moderate source of power to supply beverage at a uniformly low temperature without subjecting the refrigeration compressor to frequent starting load demands despite erratic delivery requirements ranging from long periods of light demand to short periods of exceptionally heavy demand.

The problem is best illustrated by reference to a coin controlled dispenser such as may be located in or near a manufacturing plant subject only to occasional use during working hours but subject to practically continuous heavy use during lunch hours and rest periods. In a given installation of this type where the available power is limited, it may be found that such power is not adequate to lower the temperature of the beverage to the desired point where the demand is continuously heavy for a substantial period. Or, if the power is adequate to effect substantially continuous cooling of the supply, it may be found that the device will be expensive to operate because the refrigerating mechanism will be set in operation every time there is any casual demand on the machine during the period when the load is normally light. We attempted to solve this problem by immersing the heat exchanging coils in a hold-over bath, but discovered that the bath would gradually warm up during the periods of heavy demand with the result that the dispensed beverage would become inadequately cooled during such periods.

Accordingly it is the specific purpose of the present invention to provide a device of this character which will operate economically with relatively light power by dividing the heat exchanger into two sections with a counter-flow arrangement of the coils in which to exert the cooling effect of the refrigerant primarily in a flash cooler effective on the beverage immediately adjacent the point where it is dispensed, and only secondarily effective upon a hold-over bath which functions as a pre-cooler for the beverage, the result being to reduce the number of starts of the refrigerating apparatus during periods of light load and to maintain such apparatus in substantially continuous operation during periods of heavy demand to effect continuous cooling of the dispensed beverage to the desired level over an indefinitely prolonged period of time.

Other objects of the invention will appear more

clearly to those skilled in the art from a study of the following disclosure of the invention.

In the drawings:

Fig. 1 is a view in cross section through a device embodying the invention, the refrigerating system being illustrated diagrammatically.

Fig. 2 is a plan view of a portion of the apparatus shown in Fig. 1.

Fig. 3 is a view in side elevation of a heat exchanging coil arrangement representing a modified embodiment of the invention.

Fig. 4 is a plan view of the apparatus shown in Fig. 3.

Fig. 5 is a fragmentary detail view of a modified coil arrangement.

Like parts are identified by the same reference characters throughout the several views.

The particular form of the device shown in Figs. 1 and 2 is primarily determined by the fact that carbonation of the beverage liquid is required in connection with its refrigeration immediately prior to its dispensation. The construction shown in Fig. 3 and Fig. 4 represents one of many forms of the device which may be employed where carbonation is not involved in the problem.

In the device shown in Figs. 1 and 2 a large receptacle 3 contains a bath housing one section of the heat exchanging coil hereinafter to be described, while a smaller receptacle 9 contains a bath in which there is disposed the flash cooling section of the heat exchanger. The two baths are entirely separate and for dispensing ordinary beverages a sweet water bath may be employed.

Immersed in the bath in tank 8 is a heat exchanger section comprising an inner helical coil 10 and an outer helical coil 11. These coils are preferably intimately wound in direct metal to metal contact, and are preferably also connected by solder or the like to facilitate heat transfer between the beverage, such as water, in the inner coil 10 and the refrigerant in the outer coil 11. The water enters coil 10 through pipe 12 from any convenient source. The refrigerant leaves coil 11 through pipe 13 which is the return line to the compressor 14 driven by motor 15.

The coils 10 and 11 communicate in series with coils 16 and 17 which are dual wound in a single helix and immersed in a bath in the tank 9 of the flash cooling section of the apparatus. The pipe 18 leads from the inner coil 10 of the pre-cooler over the surface of the bath in tank 8 into the top of tank 9 and thence through the top of coil 16. The pipe 19 leads to the bottom of the

external coil 11 in the pre-cooler to carry refrigerant thereto from the coil 17 in the tank 9 of the flash cooling section of the apparatus. As in the pre-cooler, the two coils 16 and 17 in the flash cooling tank 9 are preferably bonded by solder or otherwise, in intimate metallic heat conducting contact with each other. This contact is sufficiently intimate in the flash cooler so that no bath would ordinarily be required in this section of the apparatus but for the necessity of chilling the carbonator.

The carbonator 20 is not shown in internal detail because it is a conventional piece of commercial equipment. From the bottom of coil 16 pipe 21 leads upwardly and into the top of the carbonator to transfer the chilled beverage liquid from the refrigerating coils to the carbonator. The carbonator has an inlet at 22 for carbon dioxide gas and a dispensing outlet at 23 for the carbonated beverage. It will be understood that this outlet leads to whatever dispensing arrangement is provided, the details of which are unimportant to the present invention except that they preferably include a valve 24 as diagrammatically indicated in Fig. 2. The valve is shown merely to indicate the fact that this machine is especially designed to satisfy widely varying demand requirements.

The refrigerant compressed by compressor 14 passes in the usual manner through a condenser 25 and thence in liquid form to pipe 26 which carries the refrigerant to the expansion valve 27 subject to the control of a thermostat at 28, influenced in the usual manner by the temperature of the refrigerant returning through pipe 13 to the compressor. It will be understood that details of the refrigeration system as herein disclosed are merely illustrative.

When the temperature of the returning refrigeration gas reaches a predetermined level, the thermostat acts through duct 28 to open the expansion valve 27 to increase the flow of refrigerant. From the expansion valve the refrigerant flows through pipe 29 to the bottom of the dual coil in the flash cooler where it enters the bottom end of pipe 17. Thus, the coldest refrigerant arriving through the expansion valve 27 first contacts the coldest beverage liquid about to be delivered through coil 16 by means of pipe 21 to the carbonator or other point of dispensation.

If the beverage liquid in the coil 16 of flash cooling tank 9 should tend to be inadequately cooled, the first effect of the newly arrived refrigerant would be to absorb the heat from the liquid in this portion of the apparatus. Only after such liquid is thoroughly chilled to the desired temperature, does anything more than the mere residual refrigerating effect of the refrigerant reach the pre-cooling coil 11 in the pre-cooling tank 8. However, if the withdrawal of beverage has been relatively light and all of the beverage liquid in tank 9 has reached the predetermined degree of chill, then the refrigerant, with very little loss by evaporation, will pass from tank 9 to tank 8 through pipe 19 into the pre-cooler where it will not only chill the beverage arriving through pipe 12 and coil 10, but will also chill the bath in tank 8.

Thus when withdrawals again become heavy, the bath in tank 8 will act as a hold-over to take up heat from the rapidly supplied beverage liquid arriving through pipe 12, thereby pre-cooling such liquid to reduce its temperature to a level such that the flash cooling section of the heat exchanger in tank 9 can continuously handle the

desired reduction in temperature to meet all reasonable demands on the apparatus.

This latter result, of itself, might be achieved without any bath in tank 9 and, therefore, without any tank as such. However, carbonation is most adequately effective when the beverage and the carbonator are chilled. To assure the adequate absorption of heat from the carbonator by the section 17 of the refrigerating coil, it is preferred that a bath be provided in the flash cooling tank 9, and maintained above the level of the carbonator as indicated by the dotted lines in Figure 1. The level of the bath in tank 8 should be above the top of the coil and may be assumed to be indicated by the dotted lines.

In Fig. 3 and Fig. 4 the heat exchanging coils illustrated will be understood to be immersed in a bath in tank 30 to the level indicated at 31. Two continuous pipes are shown bonded together and dual wound into two separate coil sections. The coil section 33 is the pre-cooler and is immersed in the bath. The coil section 34 is the flash cooler and is disposed above the level 31 representing the top of the bath. The refrigerant enters the top of coil section 34 through pipe 36 and the beverage liquid leaves the top of coil 34 through pipe 35 in counter-flow arrangement. The bottom of section 34 of the heat exchanger arrangement is connected to the bottom of the heat exchanging section 33 by means of pipes 38 and 37 which are continuous extensions of pipes 36 and 35 respectively, and are also continued as pipes 40 and 39 of the submerged coil section 33. From the top of this submerged coil section 33 the same two pipes are continued as pipes 42 and 41, pipe 42 being the refrigeration return pipe to the compressor, and pipe 41 being the beverage inlet. Pipes 37 and 38 not only have to extend downwardly from the upper section 34 to the lower section 33 of the heat transfer inlet, but must reverse their direction of curvature in order that the coil may comprise a unit of continuous pitch as illustrated. For this reason it will be noted that pipes 37 and 38 cross the coil diametrically as shown in Fig. 4.

For a liquid requiring no carbonation, the device illustrated in Figs. 3 and 4 will serve the same purposes as those above described, in that the entire refrigerating capacity is primarily exerted in the flash cooling coil section 34 upon the beverage immediately adjacent the point where the beverage is dispensed. When the beverage is adequately chilled the residual refrigerant effect of the refrigerant arriving through pipe 36 is communicated first to the newly arrived beverage in pipe 39, and secondly to the hold-over bath in which the pre-cooling section of the coil is immersed. Over long periods of substantially continuous withdrawal this hold-over bath will serve to pre-cool the arriving beverage to a temperature sufficiently low so that the flash cooling section of the device can complete the drop in beverage temperature to the desired discharge temperature.

Two different heat exchanging relations of the respective coils or conduits have been illustrated. In Fig. 1, in the pre-cooling tank 8 the coils are concentric. In the flash cooler of Fig. 1 and in both sections of the device in Fig. 3, the coils are dual wound in a single helix, both coils having the same radius. Another convenient arrangement is to dispose one coil inside the other as suggested in Fig. 5, in which the refrigeration pipe 44 is inside of the beverage pipe 43 with clearance between the two pipes adequate to handle the de-

sired volume of beverage. Other specific heat exchanging arrangements are available in considerable variety and, except as expressly indicated in the accompanying claims, the invention is not regarded as being limited in these respects.

We claim:

1. In a device of the character described, a multiple heat exchanger comprising a pre-cooling section and a flash-cooling section for liquid to be refrigerated, said sections comprising liquid conduits connected together in series and complementary refrigerant conduits connected together in series, the liquid conduit of the pre-cooling section being provided with a connection for a source of liquid supply and the liquid conduit of the flash-cooling section being provided with a discharge connection; the refrigerant conduit in the flash-cooling section being provided with a connection from a source of refrigerant and the refrigerant conduit in the pre-cooling section being provided with a refrigerant discharge connection; the refrigerant conduit and the liquid conduit in the flash-cooling section being in direct metallic heat conductive relation to each other and the respective liquid and refrigerant conduits in the pre-cooling section being provided with means constituting a relatively large holdover capacity in heat transferring relation to both conduits of said preheating section.
2. The device of claim 1 in which the successively connected refrigerant conduits comprise an evaporator adapted to receive liquid refrigerant in the flash-cooling section of the heat exchanger and to deliver vaporous refrigerant from the pre-cooling section.

3. The device of claim 1 in which the means providing holdover capacity constitutes a bath in which the conduits of the pre-cooling section are immersed, the conduits of the flash-cooling section being immersed in a holdover bath of less thermal capacity than the bath first mentioned.

4. The device of claim 1 in which the pre-cooling and flash-cooling sections each comprise refrigerant and liquid coils intimately associated in metallic heat conductive relation and having connections such as to provide for counterflow of liquid and refrigerant in each section, the flash-cooling section coils being provided with means constituting a holdover of substantially less capacity than that with which the pre-cooling section is provided.

5. The device of claim 1 in which the conduits of the flash-cooling section comprise intimately associated coils provided with a holdover bath of less capacity than the holdover means of the pre-cooling section, said coils and bath being adapted to receive a carbonator to be chilled by said bath.

6. The device of claim 1 in which there is means for controlling refrigerant flow and a thermostat operatively associated with the refrigerant conduit of the pre-cooling section adjacent the discharge connection thereof is operatively connected to actuate such means.

7. The device of claim 1 in which a casing surrounds the conduits of the pre-cooling section, said casing being adapted to retain a bath constituting said holdover means.

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