Nov. 1, 1960 R. S. BRADEN 2,958,208

CONTROL FOR A REFRIGERATION SYSTEM

Filed Jan. 31, 1957 3 Sheets-Sheet 1

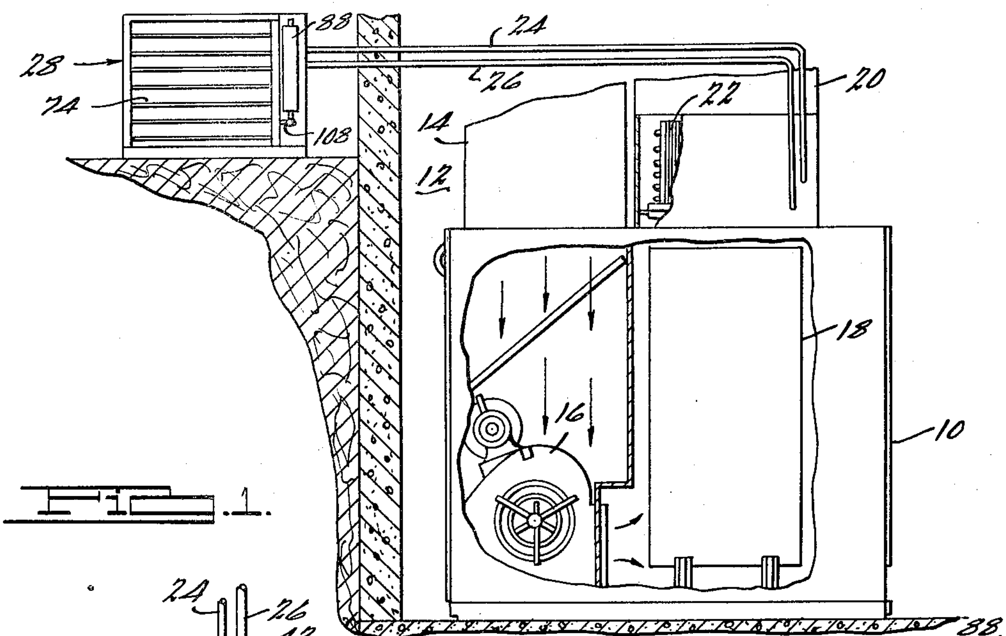

FIG. 1.

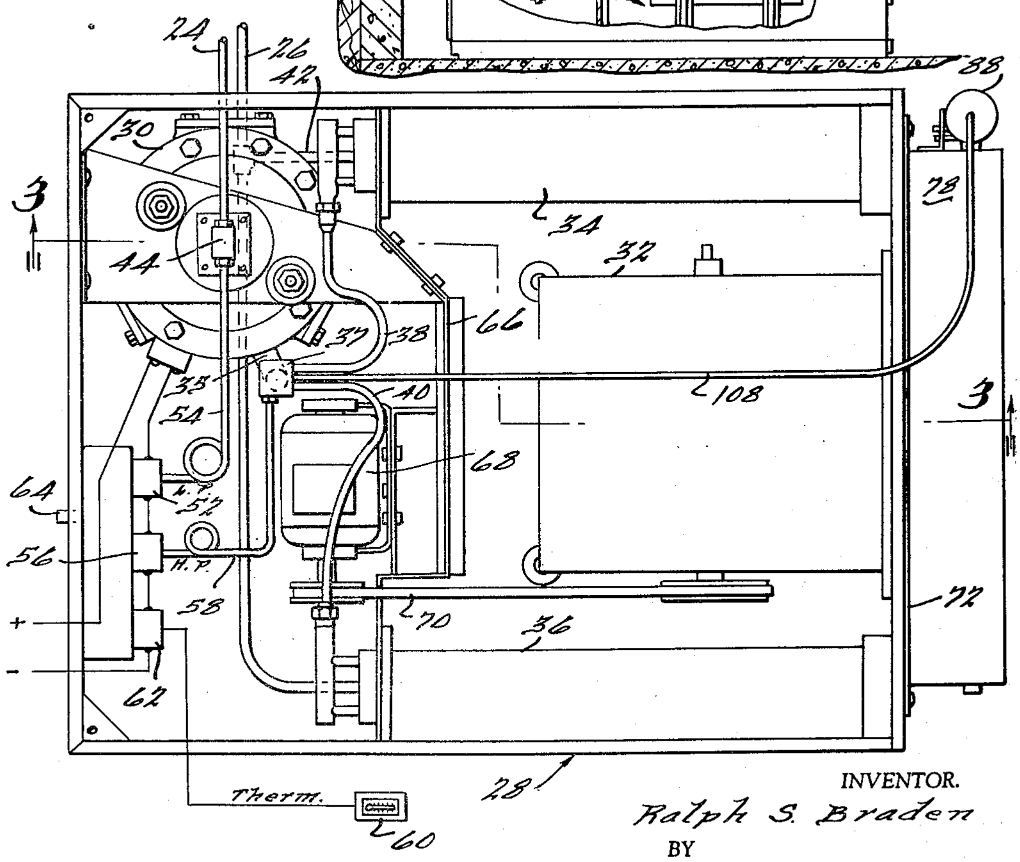

FIG. 2.

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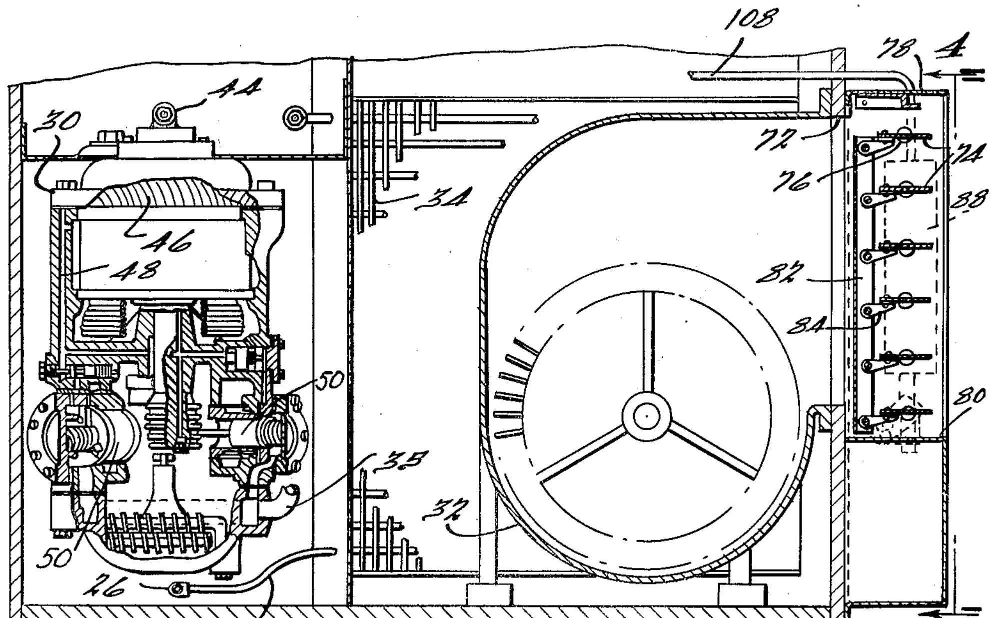

FIG. 3.

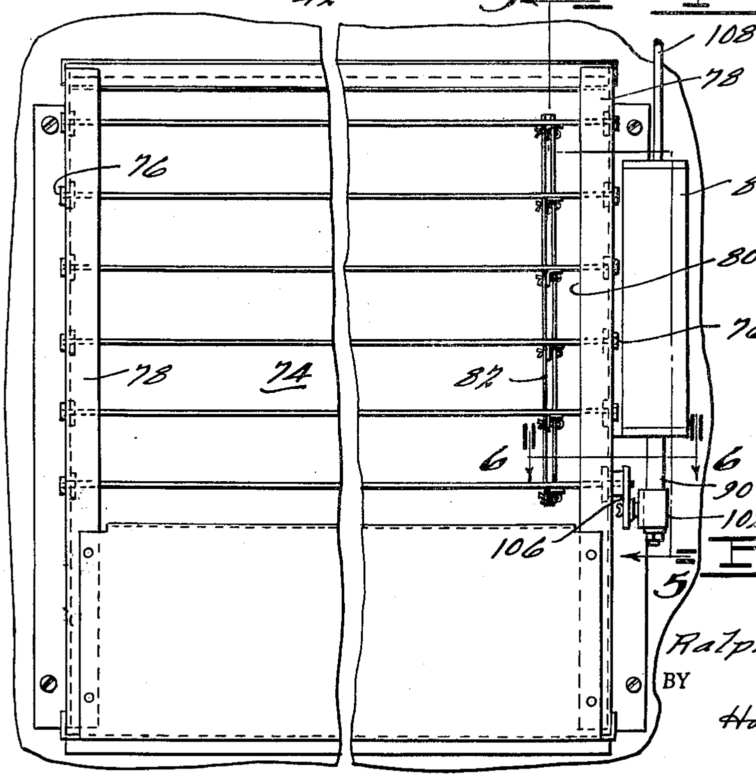

FIG. 4.

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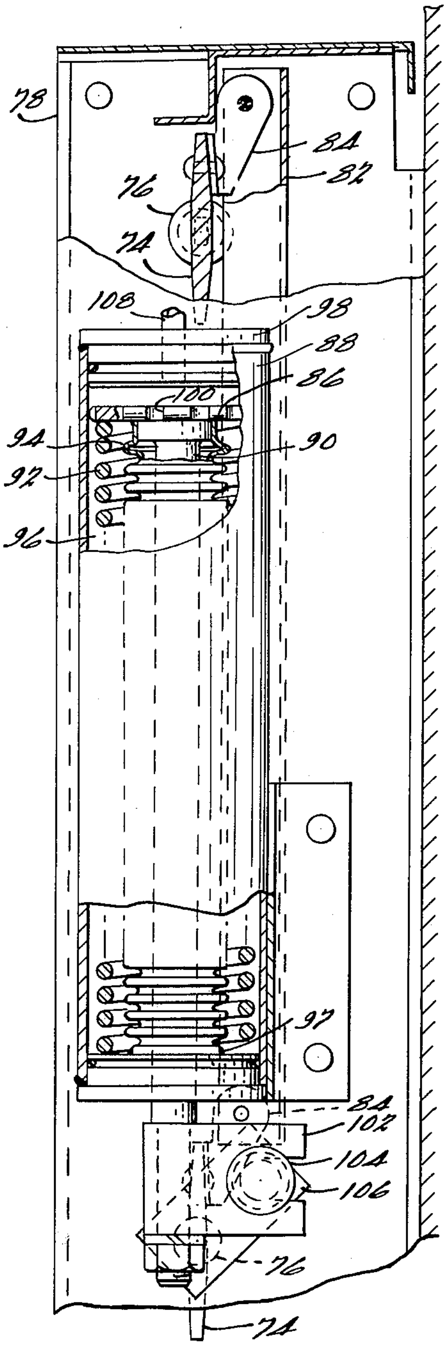

FIG. 5.

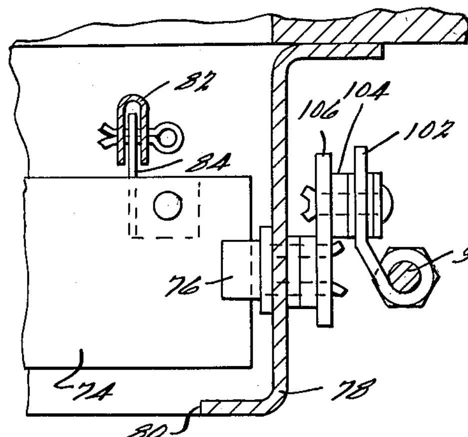

FIG. 6.

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CONTROL FOR A REFRIGERATION SYSTEM

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Filed Jan. 31, 1957, Ser. No. 637,410

1 Claim. (Cl. 62—181)

This invention relates to a control for a refrigeration system and more particularly to apparatus operable to throttle the flow of air over an air cooled condenser in response to variations in the condition of the refrigerant in the system.

Heretofore, some difficulties have been encountered during mild weather with some refrigeration systems employing air cooled condensing apparatus. These difficulties occur when the condensing temperatures become lower than normal due to cool outside air temperatures. This causes the pressure of the refrigerant in the condenser to be of low magnitude and there is then an insufficient pressure differential across the expansion valve to force an adequate amount of refrigerant through the valve into the evaporator. With an insufficient amount of refrigerant in the evaporator the amount of refrigerant which is boiled off in the evaporator is inadequate which results in a low suction pressure of the refrigerant entering the compressor. Some refrigeration systems rely upon the passage of such suction refrigerant over the windings of the electric motor driving the compressor to cool this electric motor and such systems frequently employ a safety control device to stop the compressor motor when the cooling is inadequate. Safety control devices of this type generally require manual operation of a reset switch to restart the compressor. Thus, it is found that when the suction pressure of the refrigerant entering the compressor is low the cooling of the compressor is unsatisfactory and the compressor motor is stopped by the above mentioned safety control device and it is necessary to manually operate the reset switch to restart the compressor. This results in an undesirable number of inconvenient shut downs of the compressor during mild or cool weather and it is an object of this invention to eliminate these shut downs and correct the conditions which cause them by providing damper means to restrict the flow of air over the condenser under conditions which would otherwise provide excessive cooling of the refrigerant in the condenser.

It is also an object of this invention to variably restrict the air flow across the condenser in response to variations in the pressure of the refrigerant on the discharge side of the compressor as the pressure of this refrigerant reflects variations in its temperature and by permitting substantially unobstructed flow of air across the condenser when the refrigerant head pressure is too high and throttling the air flow when the head pressure is too low the refrigerant suction pressure which cools the compressor motor is indirectly controlled and the motor cooling is held within adequate limits.

In the drawings:

Fig. 1 is a diagrammatic view, partly in section, of a typical residential heating and air conditioning unit of the air cooled type showing my invention applied thereto;

Fig. 2 is a plan view of the condensing unit with its top cover removed;

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Fig. 3 is a vertical section taken on the line 3—3 of Fig. 2 through the condensing unit;

Fig. 4 is an end elevation of the condensing unit taken on the line 4—4 of Fig. 3;

Fig. 5 is an end view, partly in section, taken on the line 5—5 of Fig. 4; and

Fig. 6 is a horizontal section taken on the line 6—6 of Fig. 4.

In Fig. 1 a typical residential installation is illustrated as including a furnace **10** installed in a room **12**, such as a basement of a residence, and having a cold air return duct **14**, a blower **16**, a heat exchanger **18** and an air delivery duct **20**. An evaporator coil **22** is mounted in the duct **20** to cool air forced by blower **16** through duct **20** for delivery to remote parts of the residence. According to common practice the furnace **10** is used to heat the residence during some seasons while the evaporator **22** is relied on to cool the residence during other sasons. My invention relates only to a refrigeration system of which the evaporator **22** forms one element and further discussions of the furnace **10** and air ducts **14** and **20** will be unnecessary.

The evaporator **22** is connected by refrigerant lines **24** and **26** with a condensing unit **28** which is preferably located outside of the residence and includes a hermetic compressor **30**, a blower **32** and a pair of spaced condenser coils **34** and **36**. The compressor **30** discharges high pressure refrigerant through a pipe **35** and fitting **37** to tubes **38** and **40** to the condenser coils **34** and **36** and the refrigerant, after passing through the condenser coils travels through tube **26** and a branch **42** thereof, leading from coil **34**, to the evaporator **22** and its associated expansion valve, which is not shown. The refrigerant, after passing through the evaporator coil **22**, returns to the condensing unit **28** through suction tube **24** and enters the top of the compressor through a fitting **44**. The refrigerant then passes down over an electrtic motor **46**, which forms a part of the hermetic compressor **30**, and serves to cool this motor. The refrigerant then passes through a passage **48** and other internal passages to a plurality of cylinders **50** where it is compressed and discharged to the pipe **35**. Suction gas cooling of compressor motors is a common practice and I do not claim to have deviated from general practice in the construction of the compressor, per se.

In accordance with general practice a low pressure control switch **52** is provided to stop the electrtic motor **46** whenever the suction pressure of refrigerant in line **24** falls below a desired level. A tube **54** connects control **52** to fitting **44**. Similarly a high pressure control **56** is provided to stop the electrtic motor **46** whenever the discharge pressure exceeds predetermined limits and this control is connected to fitting **37** by tube **58**. A thermostat **60** is also provided with a control switch **62** to interrupt the operation of the electric motor **46** and a manual reset button **64** is provided to restart the compressor after it has been stopped by switch controls **52** or **56**. These controls follow generally accepted practice and do not, in themselves, constitute a deviation from common commercially available constructions.

The blower **32** and condenser coils **34** and **36** are separated from the compressor **30** by a partition **66** which extends transversely of the condensing unit **28**. An electric motor **68**, by means of a belt **70**, drives the blower **32** to induce a flow of air inwardly through each of the condenser coils **34** and **36**. The air then is forced out an opening **72** provided in the end of the condensing unit **28**.

In order to control the flow of air over the condensing coils I provide a plurality of dampers or vanes **74** in registry with the opening **72**. The dampers **74** each carry a pair of pins **76** which are pivotally mounted on a supporting frame structure **78** having a central opening **80**. The individual dampers **74** are interconnected for operation in unison by a bar **82** having a plurality of pivotally mounted arms **84** respectively connected to individual dampers **74**.

Means are provided to move the dampers to selected positions or stations by moving one damper, such as the lowermost damper, and by means of bar **82** the other dampers follow the one moved damper. A piston **86** is reciprocally mounted in a hollow cylinder **88** and provided with a piston rod **90** which penetrates the bottom end of cylinder **88** and is adapted to move with piston **86**. The piston **86** is urged in an upward direction by a spring **92** which is contained within cylinder **88** and a bellows **94** encompasses the piston rod **90** and has its upper end sealed to the under side of piston **86** and its lower end **97** sealed to the lower end of cylinder **88**. A cavity **96** for the reception of refrigerant under pressure is thus defined within cylinder **88** in the space above piston **86** and below a top **98** provided on cylinder **88** and in the space surrounding bellows **94**. The piston **86** is provided with a plurality of peripheral openings **100** interconnecting the above-mentioned spaces which cooperate to define cavity **96**. The piston rod **90** carries a bifurcated member **102** which straddles a pivot **104** carried by an arm **106** keyed to one of the pins **76** of the lowermost damper **74**. It will be evident that downward movement of piston **86** in Fig. 5 will lower pin **104** and rotate arm **106** and the dampers. The dampers will achieve a more nearly horizontal or open position when piston **86** is moved downwardly.

In order to control the positioning of piston **86** and dampers **74** a refrigerant line **108** extends from the top of cylinder **88** to the fitting **37** which receives high pressure refrigerant from compressor **30**. The line **108** is in fluid flow communication with the cavity **96** in cylinder **88**. Thus the higher the discharge pressure of refrigerant being delivered by compressor **30** to condensers **34** and **36** the greater the pressure forcing piston **86** downwardly in opposition to spring **92** and the more open the position assumed by dampers **74**. The dampers **74** are shown completely open in Fig. 3 and completely closed in Fig. 5.

I claim:

In a refrigeration system the combination of a compressor driven by an electric motor hermetically sealed in a housing with said compressor, an air cooled condenser and blower means for creating a circulation of air thereover to cool it, an evaporator, a discharge line connecting said compressor with said condenser, a suction line connecting said evaporator with said housing and operable to dump refrigerant into the interior of said housing to pass such refrigerant over said electric motor to cool it and to supply such refrigerant to said compressor, control means operable to stop said electric motor when the cooling effect of such refrigerant on said electric motor is inadequate, refrigerant pressure regulating apparatus associated with said air cooled condenser and comprising damper means to restrict the air circulation over said condenser, said damper means being operable to variably restrict such flow of air in response to movement of said damper means to a plurality of selective stations, and refrigerant pressure responsive motor means operably connected to said damper means to position said damper means at said stations, said motor means being solely responsive to refrigerant pressure on the discharge side of said compressor.

References Cited in the file of this patent

UNITED STATES PATENTS

1,838,259	Hull	Dec. 29, 1931
2,210,325	Newton	Aug. 6, 1940
2,214,103	Dickey	Sept. 10, 1940
2,283,025	Wolfert	May 12, 1942