

B. S. McCLELLAN.
CONDENSER.
APPLICATION FILED JAN. 4, 1915.

1,201,208.

Patented Oct. 10, 1916.

Fig. 1.

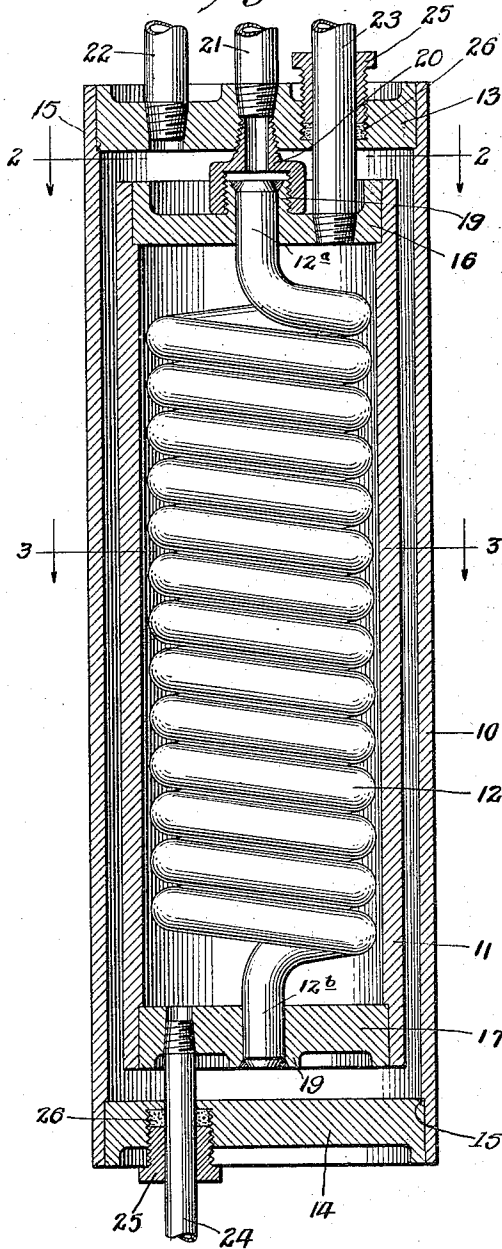


Fig. 2.

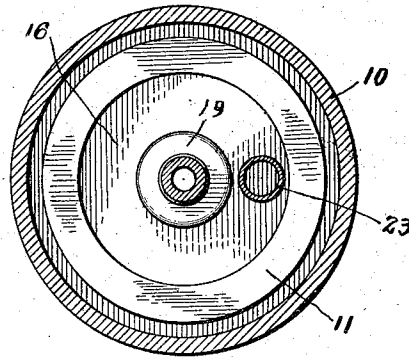
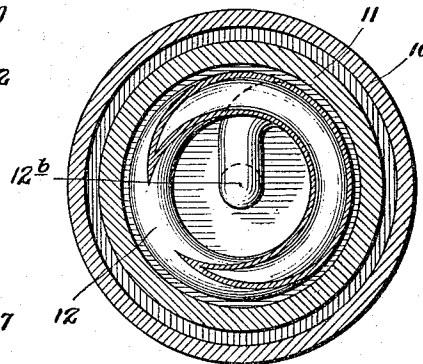


Fig. 3.



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UNITED STATES PATENT OFFICE.

BENJAMIN S. McCLELLAN, OF CHICAGO, ILLINOIS.

CONDENSER.

1,201,208.

Specification of Letters Patent.

Patented Oct. 10, 1916.

Application filed January 4, 1915. Serial No. 350.

To all whom it may concern:

Be it known that I, BENJAMIN S. McCLELLAN, a citizen of the United States, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Condensers; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in condensers or condensing apparatus for refrigerating systems, and more particularly to that class of condensing apparatus applicable for use in refrigerating systems in which ammonia gas as the refrigerant.

The condenser of a refrigerating system is designed to receive the ammonia gas from the compressor of such systems under conditions of high pressure and temperature. In passing through the condenser the gas is subjected to the cooling effect of a continuous flow of water thereby removing a portion of the sensible heat of the gas, sufficient to condense the gas, or, in other words, to transform the compressed ammonia gas from its gaseous to its liquid state.

Among the objects of my invention is to provide a construction for condensers of the character described, in which the maximum cooling effect of the water is obtained by the provision of an exceedingly large cooling area or surface in proportion to the entire surface of the device, and by conducting the water through said device in such manner as to utilize the same to the greatest extent, and to thereby secure increased efficiency in the device in proportion to its size and cost.

A further object of my invention is to produce a condensing device embodying in its construction simplicity and ruggedness, enabling the same to withstand long and effective usage without attention or replacement of parts.

The features above referred to will be more clearly understood as I proceed with the description of the device embodying my invention, in connection with the accompanying drawings, in which—

Figure 1 is a view in vertical section

through the condensing apparatus; Fig. 2 is a view in transverse section taken on line 2—2 of Fig. 1; and Fig. 3 is also a view in transverse section taken on line 3—3 of Fig. 1.

Referring to the drawings, the condenser comprises in general two cylindric shells or casings 10 and 11, one inclosed within the other, the inner casing 11 containing and inclosing a coil of pipe 12.

Referring more in detail to the construction of the parts mentioned and the arrangement of the several inlet and outlet pipes whereby the gaseous and liquid agents are conducted into and discharged from the condenser, the outer cylindric shell or casing 10 comprises a hollow tubular member of metal of desirable thickness and preferably closed at both of its ends by means of head members 13 and 14. The head members are preferably of metal considerably greater in thickness than the casing and slightly greater in diameter than the inner diameter of said casing and adapted to fit tightly within the ends of the casing, there being preferably provided in the inner surface of the cylindric wall at the ends of the casing, annular recesses forming shoulders as at 15, said recesses forming seats adapted to receive said head members. To insure a secure, tight and non-leaking connection between the head members 13, 14 and the casing 10, the outer and adjacent peripheral margins of said head members are welded together, thereby forming a substantially integral cylinder.

The inner casing 11 is constructed in identically the same manner as the outer casing, but is proportionately smaller in all dimensions to permit the same to be inclosed within the outer casing, there being provided a spacer chamber separating the cylindric walls of the casings and the adjacent head members thereof. The head members 16 and 17 of the inner casing, in general, are similar in form and structure to those of the outer casing and are secured in position within the ends of the tubular shaped inner casing in identically the same manner as before described in connection with the outer casing, namely, by the provision of annular shoulders forming recesses in the inner surface of the casing at the ends thereof, adapt-

ed to receive the head members. The head members are welded within the ends of the casing, as before stated in connection with the construction of the outer casing.

5 The pipe coil 12, hereinbefore referred to as inclosed within the inner casing 11, preferably consists of a plurality of conduits in the form of closely spaced coils of tubing or
10 pipe of suitable material supported in concentric relation to the cylindric wall of said casing and extending substantially from one end to the other of said casing, the diameter of said pipe coil being slightly less than the interior diameter of the casing thereby per-
15 mitting a small space to separate the outer circumferential surface of the coils and the adjacent surface of the cylindric wall of the casing. Although a pipe coil is a preferable construction, it is apparent that any ar-
20 rangement of conduits whereby a comparatively small quantity of cooling water may be conducted through the inner casing, in a manner to provide a large and well distributed cooling area, is equally applicable.
25 The upper and lower end portions 12^a and 12^b of the coil are bent at right angles to the coils and in axial alinement with each other and project in opposite direction in concentric relation with the casing. Said end portions of the coil are secured or mounted in
30 the head members 16 and 17 of the inner casing, the same projecting through said head members; the extremities of said end portions terminating flush with the outer surface of the annular flanges 18 and 19
35 formed on the outer surfaces of the upper and lower head members 16 and 17 and surrounding the apertures through which the ends of said coil extend. To provide a non-leaking connection between the end portions
40 of said coils and the head members, the ends of the pipe coils are preferably welded into the apertures of the head members through which they extend. The pipe coil is thus
45 rigidly mounted within the inner casing, and is adapted to conduct a current of water therethrough, as will be now pointed out. Surrounding the upper end portion 12^a of the coil, is a cup-shaped fitting or connect-
50 ing member 20 having an annular portion provided with interior screw threads engaging the screw threads of the flange 19 surrounding the extreme end portion 12^a of said coil, and a stem portion provided with
55 a passage which extends into and has screw-threaded engagement with an aperture in the adjacent head member 13 of the outer casing 10. The connecting member 20 communicates with a water inlet pipe 21 which
60 also has screw-threaded engagement with said aperture in the head member 13, said pipe and connecting member abutting end to end within said aperture. The lower end portion 12^b of the coil extends through the
65 lower head member 14 as before stated, and

communicates with the circulating space or chamber between the outer and inner casings or shells. This space is provided with an outlet at the upper portion of the casing in the form of a pipe 22 mounted in the
70 upper head member 13 adjacent to the water inlet pipe 21.

The ammonia is introduced into the condenser by means of an inlet pipe 23 located at the top of the condenser and is dis-
75 charged through an outlet or discharge pipe 24 at the lower end or bottom of the condenser. These pipes communicate with the interior of the inner casing or shell 11, preferably passing through the upper and lower
80 head members 13 and 14 of said outer casing 10, and having screw-threaded engagement with the head members of the inner casing. To prevent leakage between the
85 pipes 23 and 24 and the apertures in the head members of the outer casing through which said pipes extend, the following construction is employed, namely, a stuffing box, consisting in each instance of a gland
90 25 adapted to have screw-threaded engagement with an annular recess formed in the outer surface of each head member and surrounding the pipes. In the bottom of each
95 of said recesses is contained a quantity of packing 26 of suitable material adapted to be tightly compressed by means of the glands 25, to form non-leakable connection between the pipes 23 and 24 and their respective head members. The inlet pipe is
100 preferably greater than the outlet or discharge pipe, inasmuch as the ammonia upon entering the condenser, is in gaseous form and is discharged from the condenser in liquid form, as will hereinafter appear.

Referring now to the operation of the
105 condenser, the water and ammonia gas enter at the upper end of the condenser and through their respective passages, to wit: the water entering through the inlet pipe 21 and the gas through the pipe 23. The water
110 is conducted from the pipe 21 through the connecting member 20 into the coil 12; and is discharged from the lower end thereof into the space between the outer and inner casings. The discharge or outlet for the
115 water being the pipe 22 located at the upper end of the condenser, as before stated, the cooling water upon being discharged from the coil at the lower end thereof, passes upwardly in the annular circulating space or
120 chamber between the outer and inner casings. As a result, therefore, the inner casing is entirely surrounded by or immersed in a body of water which is constantly circulating through the space and about the
125 inner casing in its passage through the condenser subsequent to being discharged from the coil 12. The ammonia gas, prior to entering the condenser, undergoes compression to a high pressure through the medium of a
130

compressor such as is ordinarily used in refrigerating apparatus. The gas, under high pressure, enters the space within the inner casing through the inlet pipe 23, and comes in contact with the coils and the surface of the cylindric casing wall. The coil being of lower temperature than the ammonia gas, the heat of the gas is removed or absorbed by the water passing through the pipe coil. The reduction of temperature of the ammonia gas under conditions of high pressure, results in the liquefaction of the gas, for reasons well known to those familiar with the art of refrigeration. The ammonia now in its liquid state flows by gravity to the bottom of the inner casing and is removed therefrom through the discharge pipe 24, and thence to a suitable receptacle, as for instance, a liquor receiver.

Among the advantages secured by the use of a condenser constructed in accordance with the features of my invention may be mentioned the application of a coil for conducting the water through the condenser, said coil being mounted within a casing adapted to receive the ammonia gas. By this arrangement, a greater area of cooling surface is obtained, this being represented by the area of the outer surface of the coils and the area of the inner surface of the casing. This advantage is at once apparent when attention is directed to the usual construction for cooling or heating devices, wherein the medium to be heated is ordinarily passed through the coil, the same being surrounded by the cooling or heating agent, in which case the effective surface is but the area of the inner surface of the pipe constituting the coil. Furthermore, the introduction of the gas into a chamber or space larger than the pipe through which it enters said space, permits a greater quantity of the gas to be subjected to the effect of the cooling surface, and as a result, a greater quantity of gas may be liquefied in proportion to the size of the condenser and the quantity of water used. A further novel feature of the invention is the use of two casings, one within the other, there being provided a chamber or space between them which is adapted to contain or conduct a constantly circulating volume of water. The advantages of this construction are manifold. In the first place, it acts to reduce the temperature of the inner casing, thus maintaining the same at a lower temperature than the gas, to the end that the interior surface of the inner casing is utilized as cooling surface and not merely a surrounding wall or container for the ammonia gas. It is apparent, however, that the cooling effect of the casing is not so effective as that of the coil inasmuch as the temperature of the water upon leaving the coil is of somewhat higher temperature, due to the absorption of heat from the ammonia gas during

the passage of the water through said coil. By this arrangement, the maximum cooling effect of the water is secured, as well as the maximum cooling surface obtained, thus increasing materially the efficiency of the condenser by making possible the use of a smaller condenser and a less quantity of water. A further advantage is derived from the construction herein described, whereby a space is provided between the inner and outer casings adapted to be filled with water, is the utilization of the water as an insulating medium, that is, it forms in effect an insulation for the inner casing, whereby changes in the temperature of the air surrounding the condenser do not affect the temperature of the inner casing or the temperature conditions within the same, therefore, assuming the temperature of the cooling water entering the condenser remains constant, a variation in the temperature of the air exterior to the condenser would not result in an increase or decrease of heat through the walls of the casing and a consequent loss of cooling effect of the device, it being obvious that the volume of water surrounding the inner casing would absorb any heat from the surrounding air and conduct it from the condenser before it could be transmitted to the inner casing. In this manner the water serves to maintain constant and uniform conditions of operation, irrespective of external conditions of temperature.

The novel features of construction and advantageous results secured thereby, unite to produce an efficient, inexpensive and economical condenser, applicable for use not only in connection with refrigerating apparatus, but for any purpose in which the transfer of heat from one medium to another is sought to be accomplished.

The details of construction of a condenser embodying the features of my invention may be variously modified without departing from the spirit of my invention, and for that reason I do not wish to be limited to the construction herein described except in so far as specifically pointed out in the appended claims.

I claim as my invention,

1. A condenser, comprising an outer cylindric metal casing consisting of a tube and head members closing the ends of the same, an inner cylindric casing also consisting of a tube and head members closing the opposite ends of the same, said inner and outer casings being separated throughout by a circulating chamber, a pipe-coil within the inner casing communicating at one end with the chamber at one end of the condenser, inlet and outlet pipes for a refrigerating fluid extending through the outer head members and secured in apertures in the inner head members, and inlet and discharge pipes for the cooling water, one connected with the one end of said

pipe, and the other communicating with space between the casings at the same end thereof.

2. A condenser, comprising inner and outer closed cylindric casings, separated by spaces at their sides and ends to form a circulating chamber, a pipe-coil within the inner casing, secured at its opposite ends in the head members of said casing, said pipe-coil communicating at one of its ends with the space between the casings and being provided at its opposite end with a connecting member passing through the space between the casings, said outer casing having at one end, inlet and discharge apertures, with one of which the said connecting member is connected, and the inner casing having inlet and outlet apertures at its opposite ends, and supply and delivery pipes extending through the opposite ends of the outer casing and connected with the inlet and outlet apertures of said inner casing.

3. A condenser, comprising an outer cylindric casing consisting of a tube and head members closing the ends of said casing, an inner casing inclosed within said outer casing and separated throughout by a circulating chamber, a pipe-coil mounted in said inner casing, a water supply pipe extending through one of the head members of the outer casing and communicating with the adjacent end of said pipe-coil, the other end of said coil communicating with the circulating space, a water discharge pipe extending through the head member at the same end of the outer casing and communicating with said circulating chamber, and inlet and discharge pipes for a refrigerating fluid, communicating with said inner casing.

4. A condenser, comprising inner and outer closed cylindric casings, separated by spaces at their sides and ends, to form a circulating space about said inner casing, a pipe within the inner casing, secured at its opposite ends in the head members of said casing, said pipe communicating at one of its ends with the space between the head members of the casings, said outer casing having at one end inlet and discharge apertures, with one of which the opposite end of said pipe is connected, and the inner casing having inlet and outlet apertures at its opposite ends, and pipes extending through the opposite ends of the outer casing and connected with the inlet and outlet apertures of said inner casing.

5. A condenser, comprising an outer casing consisting of a tubular member closed at its ends by means of head members fitting in the ends of said tube, an inner casing consisting also of a tube closed at its ends by means of head members, said inner casing being inclosed within the outer casing and separated within said inner casing, the op-

posite ends thereof extending through and fixed in the head members at opposite ends of said casing, one of said ends of the pipe-coil communicating with said circulating chamber and being provided at its opposite end with a connecting member passing through said chamber between the ends of the casing, the head members of said outer casing being provided with an inlet aperture with which said connecting member communicates, and a water discharge aperture adjacent to said inlet aperture communicating with said circulating chamber, and inlet and discharge pipes for a refrigerating fluid extending through the head members at opposite ends of the outer casing, and communicating with apertures in the adjacent head members of the inner casing.

6. A condenser, comprising inner and outer cylindric casings, consisting of tubes and head members closing the ends of said casings, said casing being inclosed within said outer casing and separated throughout by a circulating space, a pipe mounted in said inner casing, a water supply pipe extending through one of the head members of the outer casing and communicating with the adjacent end of said pipe, the other end of said pipe communicating with the circulating space, a water discharge pipe extending through the head member at the same end of the outer casing and communicating with said circulating space, and inlet and discharge pipes for a refrigerating fluid extending through the head members of the outer casing and communicating with said inner casing, said apertures in the head members being provided with stuffing boxes surrounding said pipes and in screw-threaded engagement with said apertures.

7. A condenser, comprising an outer casing consisting of a tubular member closed at its ends by means of head members welded in the ends of said tube, an inner casing consisting also of a tube closed at its ends by means of head members, said inner casing being inclosed within the outer casing and separated therefrom at its ends and sides by a circulating space, a pipe coil mounted within said inner casing, the opposite ends thereof extending through and fixed in the head members at opposite ends of said casing, one of said ends of the pipe-coil communicating with said circulating space, and the opposite end with a water inlet pipe, a water discharge aperture in said head member of the outer casing adjacent to said inlet pipe and communicating with said circulating space, and inlet and discharge pipes for a refrigerating fluid extending through apertures in the head members at opposite ends of the outer casing, and communicating with apertures in the adjacent head members of the inner casing, said pipes extending

through stuffing boxes mounted on said head members of the outer casing each comprising a gland having screw-threaded engagement with said apertures and surrounding said pipes, and packing in said recess.

In testimony, that I, BENJAMIN S. McCLELLAN, claim the foregoing as my inven-

tion I affix my signature in the presence of two witnesses, this 2nd day of January A. D. 1915.

BENJAMIN S. McCLELLAN.

Witnesses:

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."