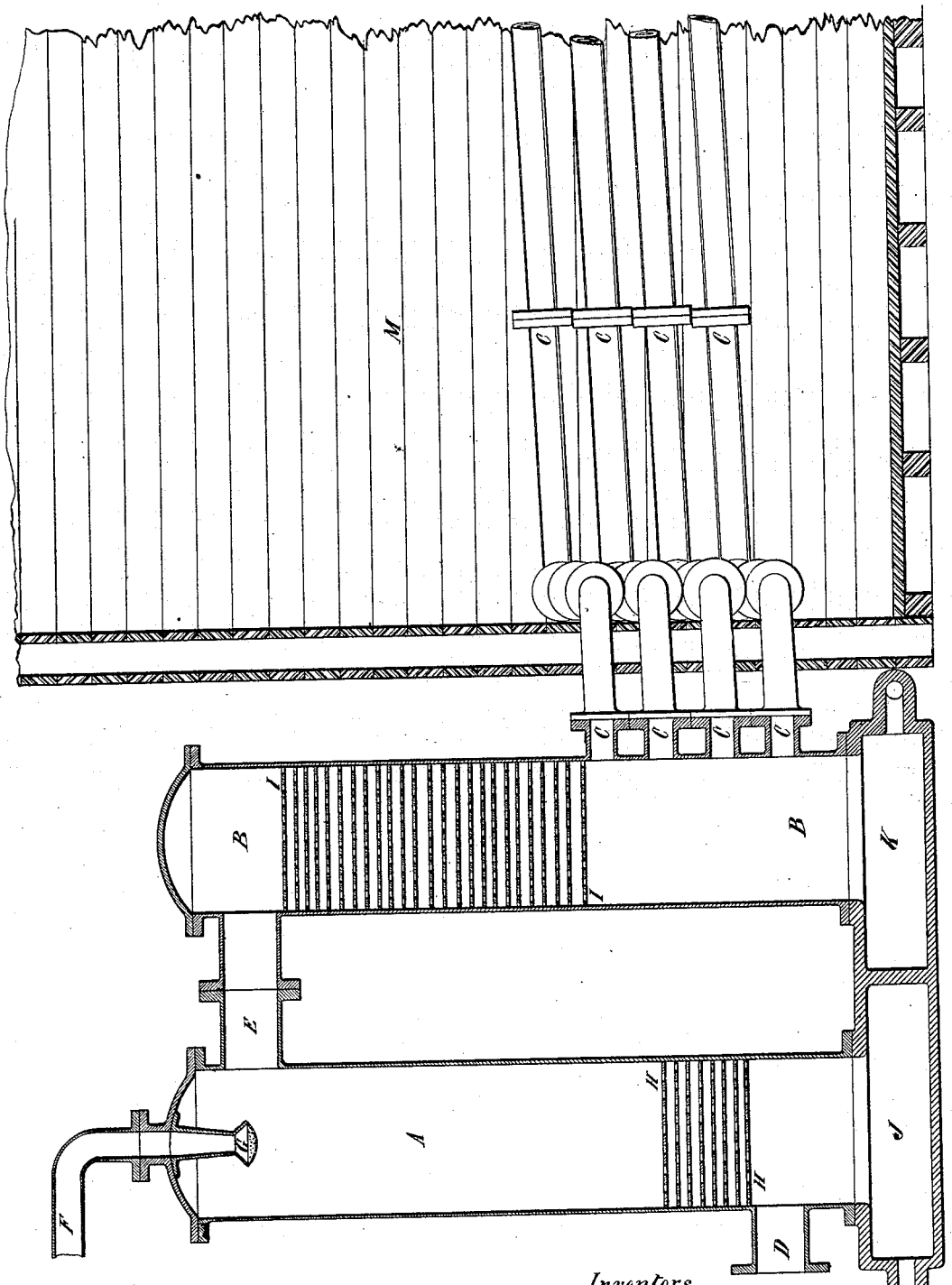
H. & J. BELL & J. J. COLEMAN.

Refrigerating Apparatus.

No. 202,509. Patented April 16, 1878.



Witnesses

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UNITED STATES PATENT OFFICE.

HENRY BELL, JAMES BELL, AND JOSEPH JAMES COLEMAN, OF GLASGOW, SCOTLAND.

IMPROVEMENT IN REFRIGERATING APPARATUS.

Specification forming part of Letters Patent No. **202,509**, dated April 16, 1878; application filed October 1, 1877.

To all whom it may concern:

Be it known that we, HENRY BELL, JAMES BELL, and JOSEPH JAMES COLEMAN, all of Glasgow, in the county of Lanark, Scotland, have invented a new and useful Improvement in Refrigerative Apparatus, of which the following is a specification:

Our invention relates to refrigerative apparatus of the kind in which the refrigerant action is produced by compressing air, abstracting heat from the air when compressed, and subsequently allowing it to expand; and our object is to obtain an improved application of this process for the important purpose of preserving meat or other food or beverages. In attempts hitherto made to practically apply the process referred to difficulties have been met with through the freezing of moisture contained in the air during its expansion, and our improved apparatus is especially designed to avoid such difficulties by means which insure that the proportion of moisture in the air at the time when it expands shall not be sufficient for the formation of ice or frozen particles.

The accompanying drawing is a vertical section of our improved apparatus.

The apparatus is designed for the air to be passed through on its way from the cylinder or cylinders in which it is compressed to the cylinder or cylinders in which it is expanded. The well-known process of cooling the air, while being compressed, by injecting water into the cylinder in which the compression is effected, or by incasing the compressing-cylinder in a water-jacket, or in both ways, is intended to be used in carrying out our invention, and the use of our apparatus, hereinafter described, is to be additional to, and not instead of, such known process.

The apparatus we employ comprises two vertical cylinders, A B, or vessels of any convenient and suitable form, and a set of pipes, C. The first vessel A is formed with an inlet, D, at its lower part for the admission of the compressed air from the compressing-cylinders, the air passing upward through this first vessel A, then across, by a connecting-passage, E, to the top of the second vessel B, in which vessel it descends, and from the lower part of which it passes into the set of pipes C. At the top of the first vessel A there is fitted a pipe, F, for the introduction of water of ordinary temperature, (or colder, when conveniently obtainable,) such water being forced by a pump, so as to overcome the internal pressure of the compressed air. This water-injection pipe F is fitted with a rose-nozzle, G, for the purpose of dividing the entering water and distributing it over the area of the vessel A, it being important that the air and water should intermingle intimately while the air passes upward and the water downward.

To insure complete contact and action between the water and air, so that the water may abstract as much as possible of the heat rendered sensible by the compression of the air, the vessel A is provided with suitable materials, down through which the water may drip while the air passes upward through the interstices. For this purpose we employ a number of perforated metal diaphragms, H, which are fixed across the lower part of the vessel A, but above the air-inlet D, and it is best to arrange these diaphragms with the holes in each opposite the solid metal of the next above and below, in order that the subdivided currents may have their directions continually changed, and be thereby made to impinge upon the wetted surfaces of the diaphragms. Similar diaphragms I are fitted in the second vessel B; or any equivalent arrangement of materials may be substituted for the diaphragms I. The purpose of this second series of diaphragms I in the second vessel B is in a sense the reverse of that of the first series H in the first vessel A. The first series H are for bringing the air and water closely together; the second series I are for separating as completely as possible from the air any moisture it carries over from the vessel A into the vessel B. The jets of air, passing through the perforations in each plate I in succession, impinge on the next plate, and deposit the suspended moisture on the plates. At the bottom of each vessel A B there is a casing, J K, to receive the water, which may be withdrawn therefrom periodically or continuously through any suitable water-trap valves.

Assuming that the water employed and introduced by the pipe F is of the ordinary tem-

perature, it cannot, of course, reduce the heat of the air below that temperature, and at this temperature the air will still retain some moisture, which will be precipitated and possibly congealed on the air being subsequently expanded and becoming of considerably lower temperature. It is the purpose of the set of pipes C to cause the separation and deposition from the air before it reaches the expansion-cylinder of any moisture which would thus tend to congeal, and thereby interfere with the proper working of the apparatus. These pipes C are placed in an atmosphere of a lower than the ordinary temperature, and, being inclined upward from the vessel B, the moisture deposited in them in consequence of the additional cooling of the air in passing through them drains back from them into the vessel B. We place the pipes C in the chamber M, in which the meat or other substances to be preserved by maintaining a low temperature are placed, and thereby obtain the required cooler atmosphere in the most convenient and economical manner. The object of passing this compressed air through pipes in the provision-chamber M is not for the purpose of cooling the air in this chamber; but, on the contrary, the object is to complete the cooling of the air in its compressed state in these pipes by the cold air of the provision-chamber, and this before this compressed air passes into the expansion-cylinder, where its rarefaction produces the required degree of cold.

The pipes C should be of considerable length, the precise length in each case depending on the temperature intended to be maintained in the chamber M and other circumstances.

Where several chambers M are to be kept cool by the same refrigerating apparatus—for example, a number of vans composing a railway-train, or several separate compartments in a ship—the pipes C may be arranged in only one compartment of the series.

We claim as our invention—

1. In a refrigerating structure, cooled by the expansion of compressed air, a series of pipes conveying the compressed air and passing through the refrigerating-chamber, substantially as and for the purpose set forth.

2. In a refrigerating apparatus, the combination of a vessel in which the compressed air is saturated with water with a drying-chamber and pipes C, inclined upward from said drying-chamber and passing through the refrigerating-chamber, all substantially as described.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

HENRY BELL.
JAMES BELL.
JOSEPH JAMES COLEMAN.

Witnesses:
EDMUND HUNT,
LOCK MOORE.