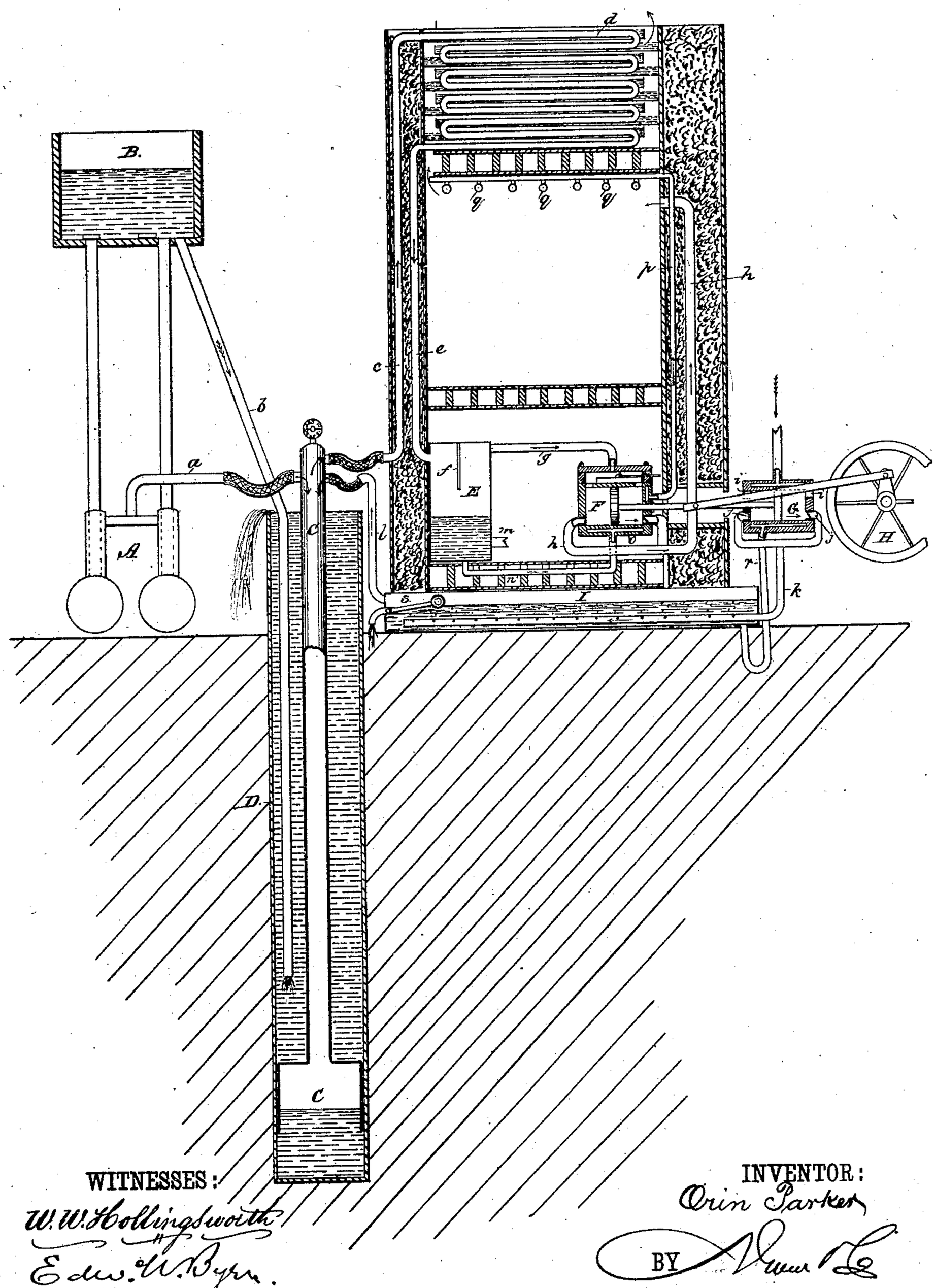
(No Model.)

O. PARKER.

REFRIGERATING APPARATUS.

No. 265,627. Patented Oct. 10, 1882.



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REFRIGERATING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 265,627, dated October 10, 1882.

Application filed January 11, 1882. (No model.)

To all whom it may concern:

Be it known that I, ORIN PARKER, of Washington city, in the District of Columbia, have invented a new and Improved Refrigerating Apparatus; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawing, forming part of this specification, in which the figure is a sectional view of the apparatus.

My invention relates to an improved method and apparatus for making ice and refrigerating in general. It partakes to some extent of the character of two other previous inventions for which I made application for Letters Patent July 31, 1881, and November 21, 1881, which applications were allowed respectively September 14, 1881, and November 29, 1881, and in which the production of cold was effected by the compression of air by a hydraulic air-compressor, which air after being cooled was then allowed to expand in the freezing-room to reduce the temperature of the latter. This invention is really supplementary to the others, and important in utilizing those processes to their full value. In the processes there described the useful effect was due only to and limited by the difference in capacity of air for heat under constant pressure and at a constant volume about .07 of a heat-unit per pound for each degree. By supplementing these processes by the present invention not only is this difference in specific heat utilized, but also a reduction in temperature is attained, and consequently a capacity for abstracting heat-units equivalent to the work done, according to well-known thermo-dynamic laws. In my present invention I interpose in the path of the compressed air as it comes from the compressor or holder an expansion-cylinder with piston and cut-off valves, through which the compressed and cooled air is expanded just before it passes into the freezing-room, so that this compressed air in expanding through this cylinder exerts a power before passing into the refrigerator that is used to drive another volume of compressed air into the holder.

My process, then, in general terms, consists in utilizing during expansion the motive energy of an expansible fluid under compression at low temperature for the purpose of compressing another volume of expansible fluid to be used expansively for the same purpose of producing cold.

My invention also consists in various other improvements in matters of detailed construction, as will be hereinafter fully described, and pointed out in the claims.

In the drawing, A represents my hydraulic air-compressor, which is described in my first said application for patent filed July 31, 1881. This hydraulic compressor takes water from an elevated head, B, and the air is compressed in A by the direct contact and dynamic force of the water. The air from this compressor, more or less heated by compression, passes then through pipe *a* to the holder and cooler C, which is in the nature of a long hollow column closed at the top and open at the bottom, with a larger diameter that fits in the well or tank D, in which it moves up and down. This well is supplied with water through the pipe *b* coming from the head, which water serves to cool the air in the holder, and as fast as this said water becomes warm it is allowed to flow off at the top. Both the inlet-connection for the air to the holder on the side next to the compressor and also the connections on the other side are made by means of flexible sections of pipe, so that the holder may move freely up and down in the well. As the air passes into the holder in intermittent charges from the compressor this movement of the holder compensates for such spasmodic action, and makes the issuance of air from the holder continuous and uniform. As the air leaves the holder C more or less cooled it passes through the pipe *c* to the coils *d* over the freezing-room, which coils are immersed in pans which are kept filled with water, and by the evaporation of which water by the dry cold air leaving the freezing-room the air in this coil is further chilled, and the energy of the waste air from the freezing-room thus conserved, as described more fully in the application for patent filed November 21, 1881, before referred to. The air taken through this coil then passes down pipe *e*, which, like pipe *c*, is embedded in the non-conducting packing of the walls of the freezing-room, and after traversing the pipe enters the tank E. This tank has a baffle-plate, *f*, and acts as a trap to collect the condensed moisture, and has also

another function, as will be hereinafter described. The cooled and compressed air then passes from tank E through pipe *g* to a double-acting expansion-cylinder, F, which is provided with a piston and suitable cut-off valves, which piston is worked by the expansion of the cooled air, which escapes thence through exhaust-pipe *h* into the freezing-room, where the cold is produced by the dissipation of the heat-units contained in said air, due to the expansion taking place in the cylinder. The power exerted upon the piston of cylinder F by the expansion of the air therein I make to run another air-compressor, G, which consists of a smaller cylinder with a piston arranged on the same rod with the piston of cylinder F. A fly-wheel, H, is connected by a crank and pitman with the common piston-rod, so as to render the action of the device smooth and uniform. The air is taken into the dry-air compressor G through inlet-valves *i i*, and is forced out through outlet-valves *j j* into a pipe, *k*, which enters a shallow tank, I, and is perforated, and which perforated end is submerged in the water contained in said tank, so that the air in escaping through the perforations of the pipe *k* is made to rise through the water in fine streams or bubbles, which permits the heat developed by the compression of the air to be eliminated and carried off by the water in said tank. The air from this tank then escapes through pipe *l* and passes through a flexible section into the main compressed-air holder. It will thus be seen, from the operation described, that the compressed air in passing to the freezing-room utilizes, by expansion in a cylinder, a part of its energy to compress other volumes of air and increase the volume of air in the holder, and then escapes and is further expanded into the freezing-room to secure useful effect in refrigerating. As regards this part of my invention, it will be seen that the invention is not necessarily limited to air as a medium, but any expansible fluid, whether a fixed gas—such as air—or a volatile liquid—such as ammonia—might be used with the same advantageous results.

In order to economize temperature and preserve the efficiency of the apparatus, water is forced into the tank E by a force-pump connected at *m*, and the water forced in passes out through pipe *n* to a water-jacket, *o*, around the expansion-cylinder, whence it passes through pipe *p* to the spray-nozzles *q* in the freezing-room, and which water is allowed to fall in spray and freeze into ice in a tank in the bottom part of the freezing-room. The additional function of the tank E will here become apparent, for it will be seen that the water of condensation from the air is carried into the freezing-chamber to be frozen into ice, and the upper portion of tank E acts as an air-cushion to make the water enter the freezing-room under pressure and in a uniform flow. Passing this water also around the expansion-cylinder has a doubly useful effect: first, to utilize the cold produced by the expansion of the air in this cylinder to chill the water that is to be made into ice, and, secondly, to prevent this cylinder from becoming choked with congealed moisture inside. An independent stream of water is also made to circulate around the jacket of the dry-air compressor and escapes through a trap-pipe, *r*, into the shallow tank I, whence it escapes and runs off through a float-valve, *s*. The purpose of this latter circulation of water is simply to remove the developed heat from the air compressed by the dry-air compressor.

Instead of using a hydraulic air-compressor for furnishing the initial power, any other form of air-compressor may be used.

In defining my invention more clearly, I would state that I am aware of the fact that a given body of air circulating in a cycle has been compressed, its heat eliminated, and then expanded in a cylinder for the double purpose of creating cold and performing mechanical work to assist the compression of the same body of air at another part of the cycle, and I do not claim this broadly. In such operations, however, high pressures are used, which involves expensive machinery, and a greater number of heat-abstractors are required. My invention differs from others in that the expansion of a given body of cooled and compressed air is made, not to compress the same air, but to compress another body of air which is delivered back to the air-holder, where it mingles with and increases the bulk and is then cooled and expanded. My invention does not work in cycles upon the same body of air, but only uses the same air once and then allows it to escape. Instead, therefore, of using a limited body of air in endless circulation and high pressure, I use a large body of air and low pressure, with but one passage through the machine, thus enabling me to employ less expensive mechanism and still utilizing perfectly the differential effect of compression, abstraction of heat, and expansion to produce the required cold.

Having thus described my invention, what I claim as new is—

1. The process of refrigeration which consists in utilizing, during cold-expansion, the motive energy of compressed air of low temperature for the purpose of compressing another independent body of air, then conducting this independent body of air to that part of the main body of compressed air and allowing them to become cooled together and expand to produce the same work of compressing more new air and then escape, as described.

2. The combination, with a compressed-air holder and a pipe connecting the same with the freezing-room, of an expansion-engine, substantially as described, placed in the path of the compressed air to the freezing-room for utilizing the motive energy of the compressed air in expanding, and a supplemental air-compressor connected to said expansion-engine

and also to the air-holder, and having inlet-valves for external air, and an outlet-connection to the holder of the main bulk of air for augmenting the bulk of compressed air at the expense of its expansible energy, as and for the purpose described.

3. The trap-tank E, combined with the compressed-air pipe, and the expansion-engine, as and for the purpose described.

4. The combination, with an air-compressor, of the air holder and cooler, consisting of well D and elongated hollow column C, closed at the top and open at the bottom, and provided with flexible connection, as shown and described.

5. The combination of the dry-air compressor, having a water-jacket, the shallow tank I of the perforated exhaust-pipe *k* entering the shallow tank, and the trap-pipe *r*, effecting a water communication between the water-jacket of the air-compressor and the shallow tank, as and for the purpose described.

6. The combination, with the expansion-air engine having a water-jacket, of a set of air-pipes connecting with the air-engine cylinder and communicating with the freezing-chamber, and a set of water-pipes connecting with the water-jacket and communicating with the freezing-chamber, substantially as and for the purpose described.

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Witnesses:
EDWD. W. BYRN,
G. W. HAY.