(No Model.)

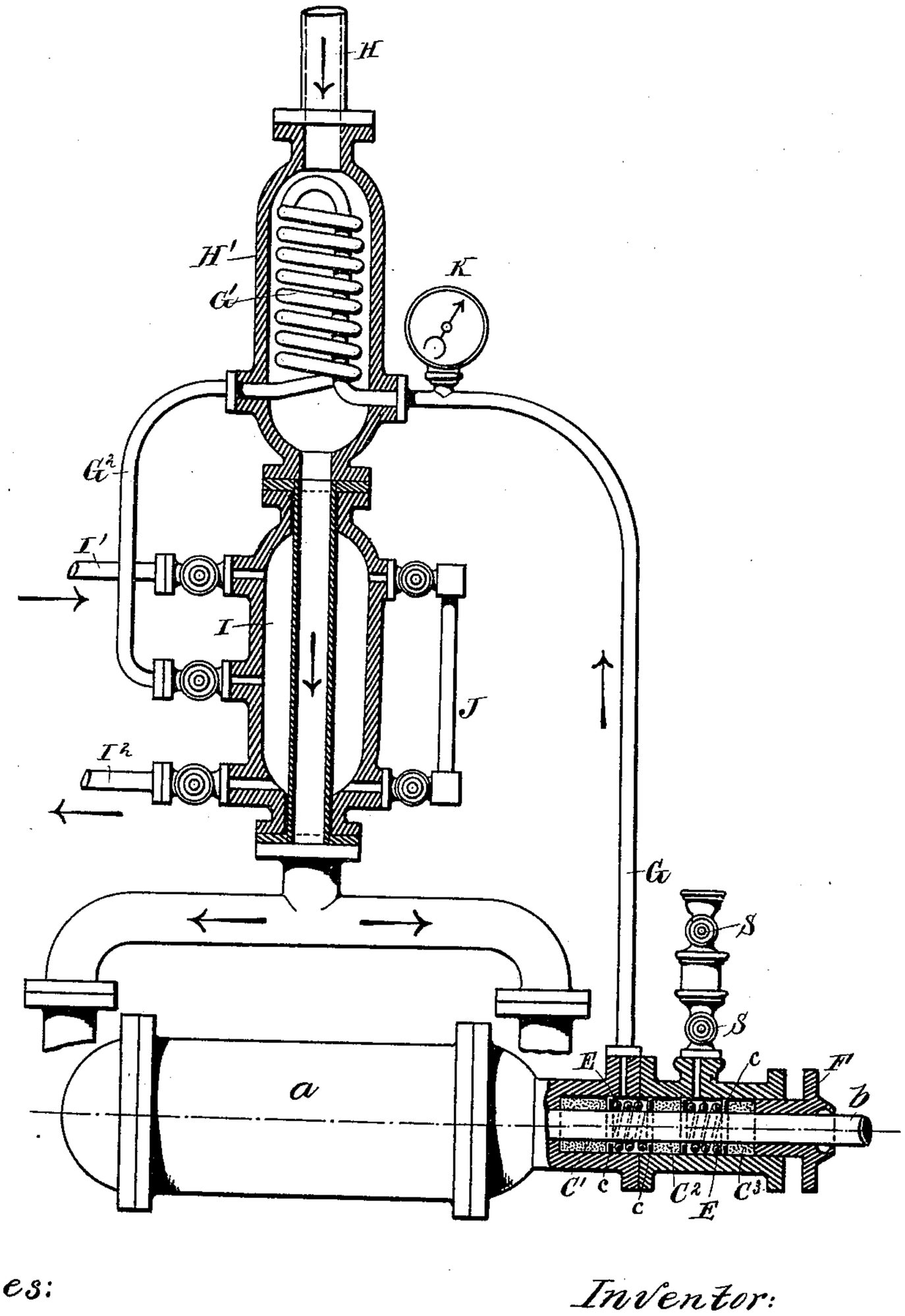
2 Sheets—Sheet 1.

P. EFFERTZ.

GAS COMPRESSOR.

No. 329,726. Patented Nov. 3, 1885.

Fig. 1.



Witnesses:
E. J. Griswold
Charles R. Searle,

Inventor:
Peter Effertz
by his attorney
Thomas Drew Stetson

(No Model.)

2 Sheets—Sheet 2.

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GAS COMPRESSOR.

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Fig: 2.

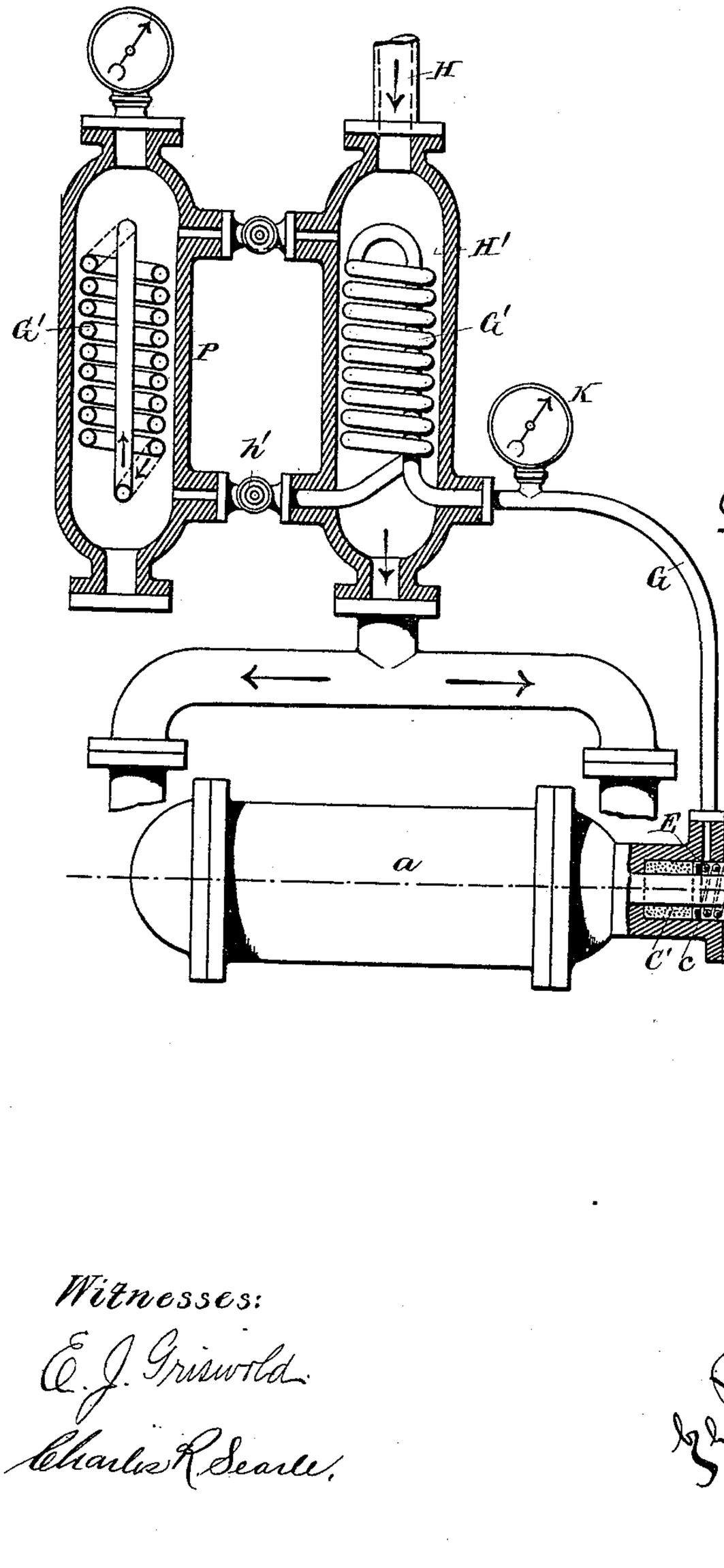
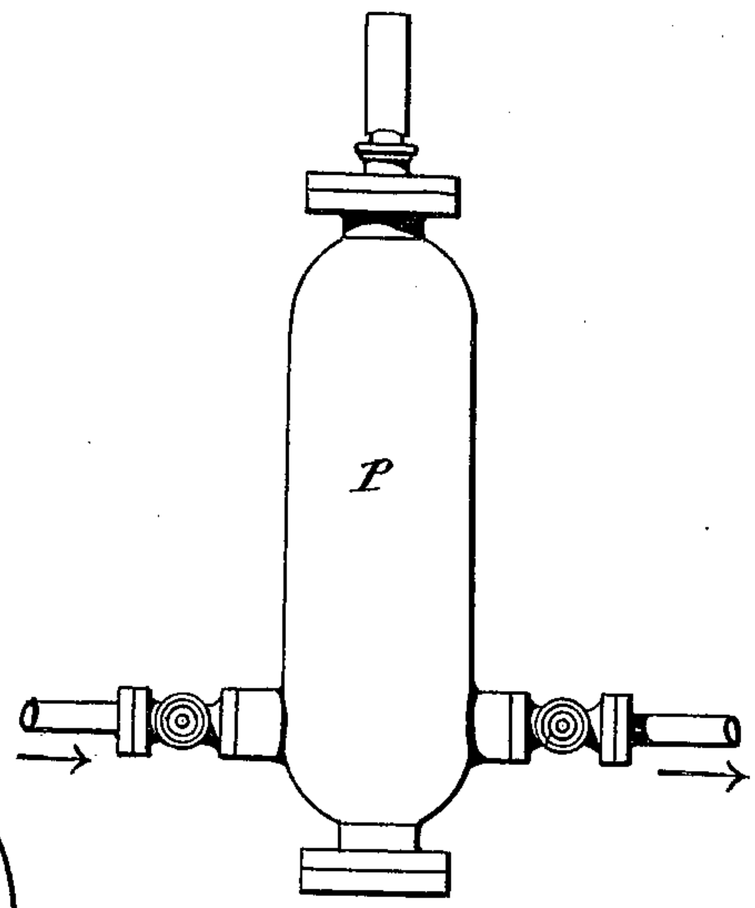


Fig: 3.



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Inventor:

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by his attorney

Thomas Dyer Stetson

UNITED STATES PATENT OFFICE.

PETER EFFERTZ, OF CHEMNITZ, SAXONY, GERMANY.

GAS-COMPRESSOR.

SPECIFICATION forming part of Letters Patent No. 329,726, dated November 3, 1885.

Application filed June 29, 1885. Serial No. 170,067. (No model.)

To all whom it may concern:

Be it known that I, PETER EFFERTZ, of Chemnitz, in the Kingdom of Saxony, in the Empire of Germany, have invented a certain new and useful Improvement Relating to Gas-Compressors, of which the following is a specification.

The improvement is adapted for use with refrigerating apparatus for the manufacture of ice and for other purposes, as also for gas-compressors for any other purpose. The object is to prevent any loss of valuable material without requiring the packing in the stuffing-boxes to be compressed with any unusual tightness, so as to create objectionable friction.

It has been heretofore proposed to employ a loose metallic ring, sometimes designated as a "lantern-brass," in the midst of the packing in a stuffing-box, and to connect a chamber thus formed with what is technically known as the "vacuum side" of the apparatus, by which is meant the portion of the system of pipes and passages in which the gas is at the lowest pressure in the act of being returned to the compressor; but as it is usually the fact that, even in what is termed the "vacuum side," the pressure is considerably above the pressure of the external atmosphere, it follows that there is still considerable pressure in the gas in the chamber thus formed in the stuffing-box. Such pressure tends to force the gas outward past the packing, which is exterior thereto. The gas thus forced outward is lost, and is liable to become a source of annoyance, or even of injury, to the health of those employed about the machines. I avoid the difficulty by leading a pipe from the chamber in the stuffing-box to a point where it is cooled down to the temperature of the returning gas, which is usually much below the freezing-point of water. The great condensation of the gas, due to this cooling, reduces its bulk, and, with some gas, induces a condensation into a liquid form. I provide a chamber for its reception, and maintain the chamber at a very low temperature. As only a small amount of gas will usually be thus delivered for a considerable time, a small chamber may serve. The greatly concentrated or condensed gas is removed from the chamber, either at intervals or constantly, by a pump, or by the employment of absorbents. I provide gages to determine the pressure, and, in case of condensation of the gas, to determine the quantity of condensed gas which accumulates in the chamber.

In what I esteem the most complete form of the invention I provide the stuffing-box with three sets of packing and separate them by two instead of one chamber. The gas from both the chambers may be led to the same or a different condensing and storing apparatus. In what I esteem the most complete operation I use the outer chamber as a means for introducing a lubricant.

Instead of making each chamber by a lantern-brass or any rigid ring, I obtain an equally effective chamber by the employment of two thin rings, with a sufficiently stout spiral spring between. The spiral spring gives a sufficiently free opening, through which the gas can certainly and easily find its way to the connected pipe, and also maintains an elastic pressure, which is of great importance in maintaining the tightness of the packing for considerable periods without requiring the gland to be set up. The three packings may be of uniform thickness; but preferably the inner packing is thickest.

My invention allows the pressure in the chamber in the stuffing-box to be kept down to that of the atmosphere; or by properly pumping or providing absorbents the pressure may be kept a little below that of the atmosphere. In either case there will, for obvious reasons, be no appreciable loss of gas from its forcing itself out past the second and third packings.

The accompanying drawings form a part of this specification, and represent what I consider the best means of carrying out the invention.

Figure 1 is a longitudinal vertical section. Fig. 2 is a corresponding section showing a modification. Fig. 3 is an elevation of a portion showing a further modification.

Similar letters of reference indicate corresponding parts in all the figures where they occur.

In all the figures, *a* is the compressor, and *b* the piston-rod of a suitable piston, (not shown,) but which, it will be understood, operates tightly in the compressor, with the usual

effect of drawing in attenuated gas through suitable valves, (not shown,) compressing it to the high tension required and delivering it through suitable valves (not shown) to be subsequently utilized by allowing it to expand after removing the heat generated by compression, which may be done by liberal application of water to the exterior of pipes or vessels in which the hot compressed gas is contained. The expansion produces the refrigerating effect which is desired, and after the expanded gas has been led through pipes to manufacture ice or otherwise utilize the low temperature produced it is brought back to the compressor. The apparatus involved in my invention is applied in connection with the return-passages for the gas.

The other portions of the apparatus need not be represented.

In all the figures the stuffing-box is marked A′, and is manufactured in sections tightly joined together. The packing is divided into three parts, C′ C² C³, separated by pairs of thin metallic rings *c*. Between each pair of rings is a stout spiral spring, E. The packing is compressed by a gland, F, operated by bolts, (not shown,) as usual.

Referring to Fig. 1, a pipe, G, communicates with the space between the packings C′ and C². The gas during the periods of maximum pressure at the adjacent end of the compressor is liable to leak past the first packing, C′. Any gas thus leaking is received in the chamber between C′ and C², and is led away through the pipe G.

I provide means, which will now be described, for keeping the pressure in the pipe G down to about the pressure of the atmosphere, so that there is no force tending to drive the gas out past the second packing, C².

H is a pipe bringing the return-gas from the ice-making apparatus. (Not shown.)

H′ is a considerable chamber, through which the gas thus received traverses on its way to the compressor. In its interior is a coil, G′, which receives the gas at a low pressure from the stuffing-box and causes it to be cooled to the extreme low temperature of the return gas. This cooling greatly reduces the volume of the gas escaping from the stuffing-box. Under favorable conditions it will condense it into a liquid. I will describe it as being thus condensed. The condensed gas is led from the coil G through a pipe, G², and delivered into a reservoir, I. This reservoir is kept cool by the passage of the return gas through it by means of the concentric pipe H². I provide pipes I′ I² communicating, respectively, with the top and bottom of the reservoir I, and controlled by suitable stop-cocks. The condensed gas at the pressure of the atmosphere may be drawn out from this chamber I at any time by opening both the stop-cocks and allowing similar gas to enter through the uppermost, while the condensed gas flows out of the lowermost.

Instead of drawing out the condensed gas at intervals, still better working may be attained in large apparatus by connecting an efficient exhausting-pump to the lower pipe, I², or by connecting such pipe to a chamber containing suitable chemicals for absorbing the gas, the gas being subsequently recovered therefrom by being driven out by processes that are well known.

J is a glass gage, which indicates the height to which the condensed gas has accumulated at any time in the chamber I.

K is a manometer or pressure-gage, which indicates the pressure in the pipe G and its connections. The attendant should empty the chamber I, or work the pump or absorbing apparatus with more efficiency, whenever the manometer shows the pressure in G to be materially above that of the atmosphere.

I have shown the chamber between the packings C² and C³ as communicating with an apparatus having two cocks and an intermediate chamber suitable for admitting oil. After opening the upper cock, S, the intermediate chamber may be filled with oil poured in the cup at the top. Then by closing the upper cock, S, and opening the lower, either widely or partially, the oil will be allowed to fill the chamber between the second packing, C², and the third packing, C³. Instead of this, any desired pipe may be connected for leading in any suitable fluid, or for leading away any gas which may flow past the packing C² and reach this portion of the apparatus. The elastic action of the springs E is important. The reciprocations of the piston-rod *b* induce a constant wear of the packing, which impairs its tightness. As heretofore worked, the gland F should be set up so as to compress the packing into smaller compass at short intervals. The labor this involves is greatly reduced by the springs E, which, when the gland has been set up so as to compress the packing and the springs to a proper extent, exerts a constant expansive force which maintains the packing under nearly the same pressure for a long period. The gland may be consequently tightened at longer intervals.

Referring to Fig. 2, P is a chamber corresponding to the reservoir I, and arranged to receive the condensed gas produced by the intense cooling in the coil G′. This chamber may in practice be at a much greater distance than is here shown, so that the temperature may be raised or lowered without materially affecting that of the chamber H′.

Q is a coil inclosed in the chamber P and communicating, through terminals, (not represented,) with any suitable provisions for either cooling or heating. I can work this apparatus in the same manner as has been described for working Fig. 1. In such case I send a current of the return gas or other cold medium through the coil Q. If, on the contrary, it is required to work the apparatus by absorption, the chloride of lime or other material which is to absorb the gas is supplied in the chamber P, and at intervals the lower stop-

cock, *h'*, connecting this chamber with the chamber H', being closed and the upper stop-cock being open, steam is introduced in the pipe Q, and the gas previously absorbed by the chemical is driven into the chamber H', where it mingles with the gas in the vacuum side of the apparatus, and is thus recovered. When the most of the gas is thus driven out, the steam being shut off and the chamber P cooled, the lower stop-cock, *h'*, is again opened and the absorption goes on as before.

Fig. 3 shows a corresponding arrangement with a stop-cock on each side of the chamber P. This allows the same arrangement of the chambers to be employed with a driving out or drawing out of the condensed gas from time to time, as in Fig. 1.

Various other modifications may be made in the forms and proportions without departing from the principle or sacrificing the advantages of the invention. I can use a portion only, if desired. I can dispense with the outer packing, C^3, and with the chamber between it and the packing C^2 and its connections.

I claim as my invention—

1. In combination with the pipe G and means, as G' H', for concentrating and condensing the gas, the spring E, in the chamber of the stuffing-box, adapted to maintain the tightness of the packing by its elastic action, as herein specified.

2. A cold-storage reservoir, I, and provisions, as I' I^2, for emptying it at will, in combination with cooling means G' H' H^2, the pipe G, and the stuffing-box A' of a gas-compressor having separate packing C' C^2, as herein specified.

3. The triple packing C' C^2 C^3, in combination with the stuffing-box of a gas-compressor, and means S and connection for supplying oil, and with means G G' H' for leading away the gas from one of the chambers, substantially as herein specified.

In testimony that I claim the foregoing as my invention I have signed my name in presence of two subscribing witnesses.

PETER EFFERTZ.

Witnesses:

JNO. L. PARISH,

F. W. KASTEN.