

(No Model.)

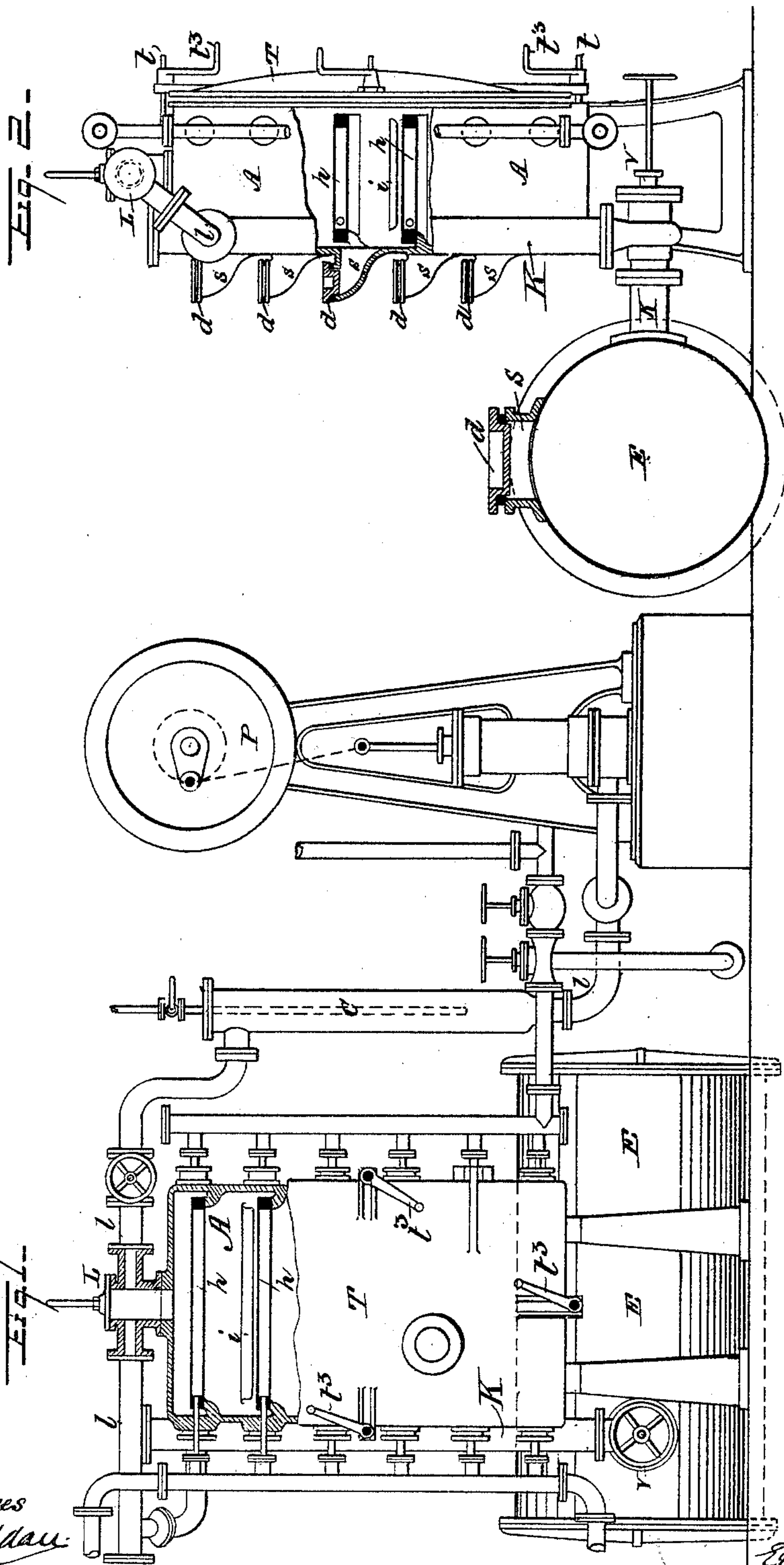
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E. PASSBURG.

VACUUM DRYING APPARATUS FOR EXPLOSIVES.

No. 497,683.

Patented May 16, 1893.



Witnesses
A. J. Hadden
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Inventor
Emil Passburg
by his Attorney
A. J. Hadden

(No Model.)

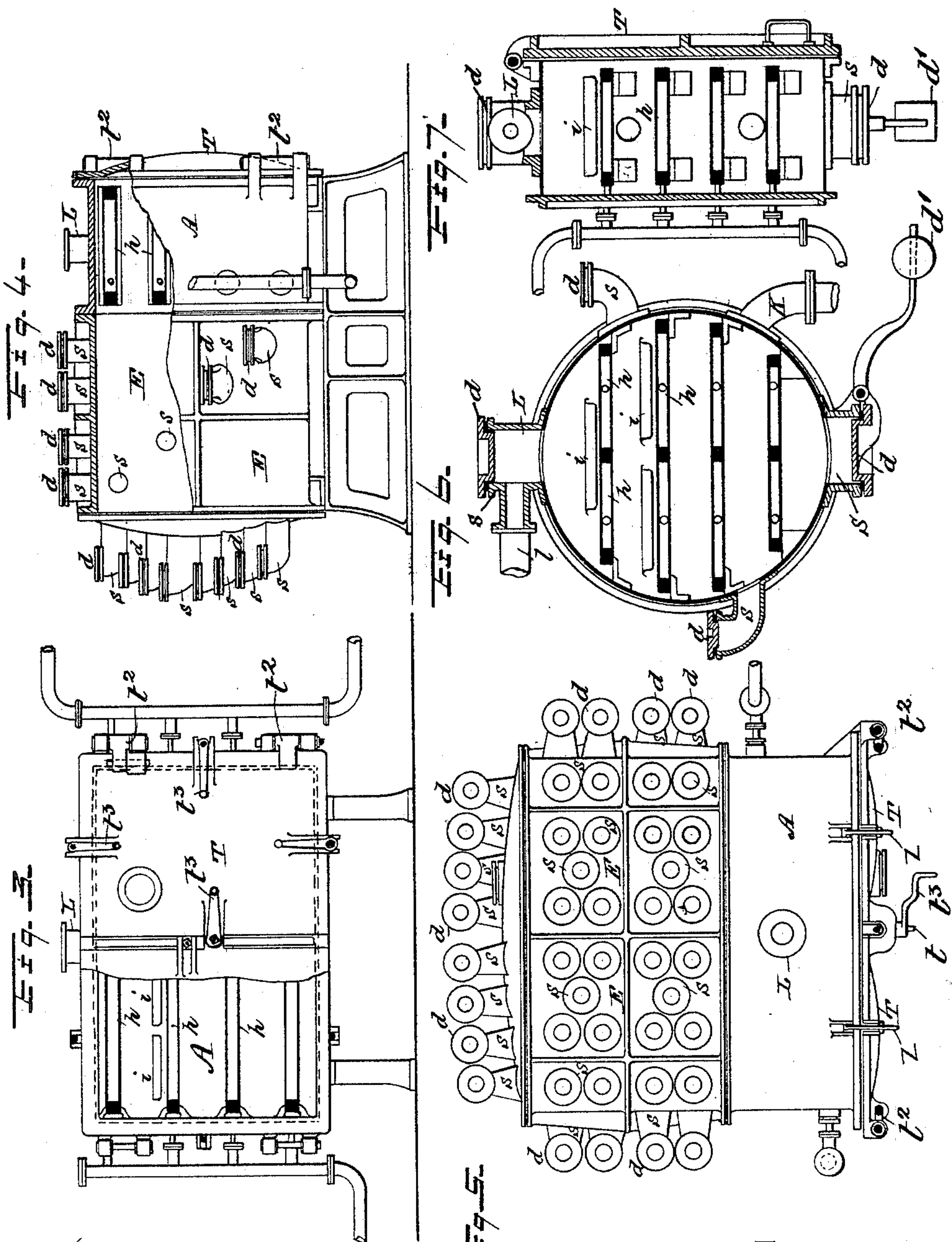
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H. Haddan
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Inventor

Emil Passburg
by his Attorney *H. Haddan*

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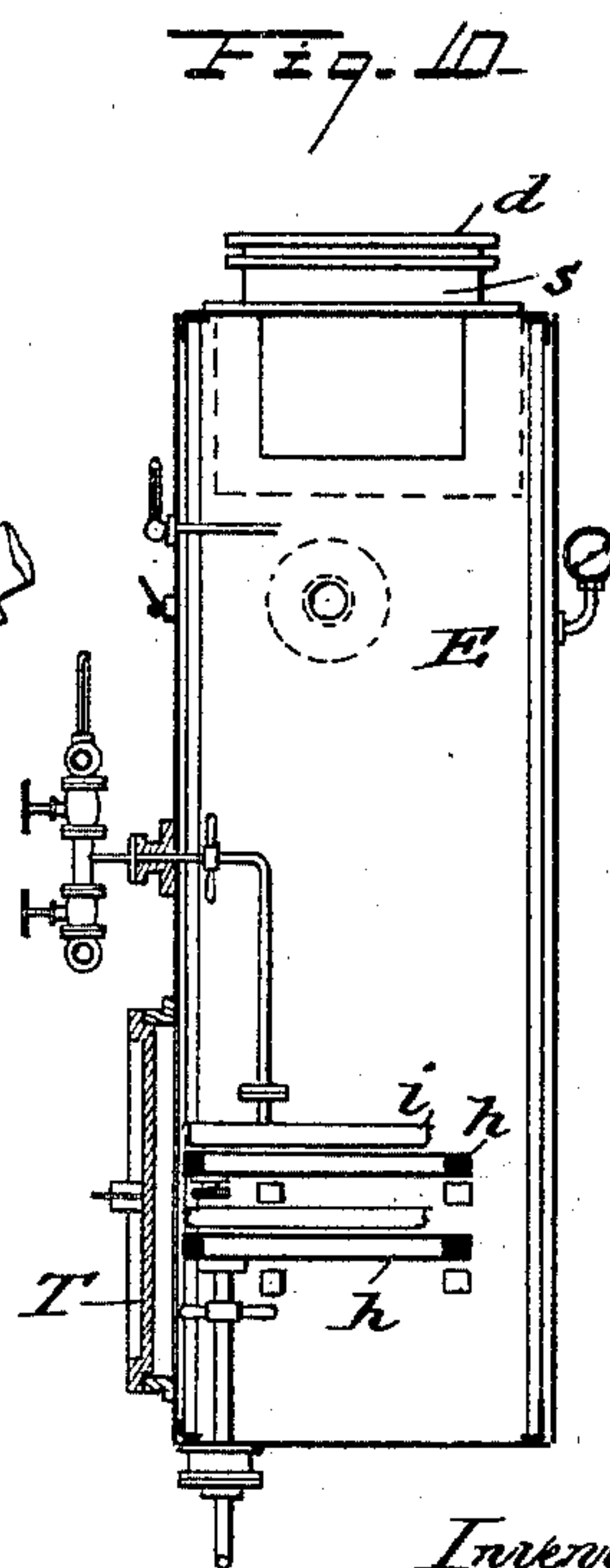
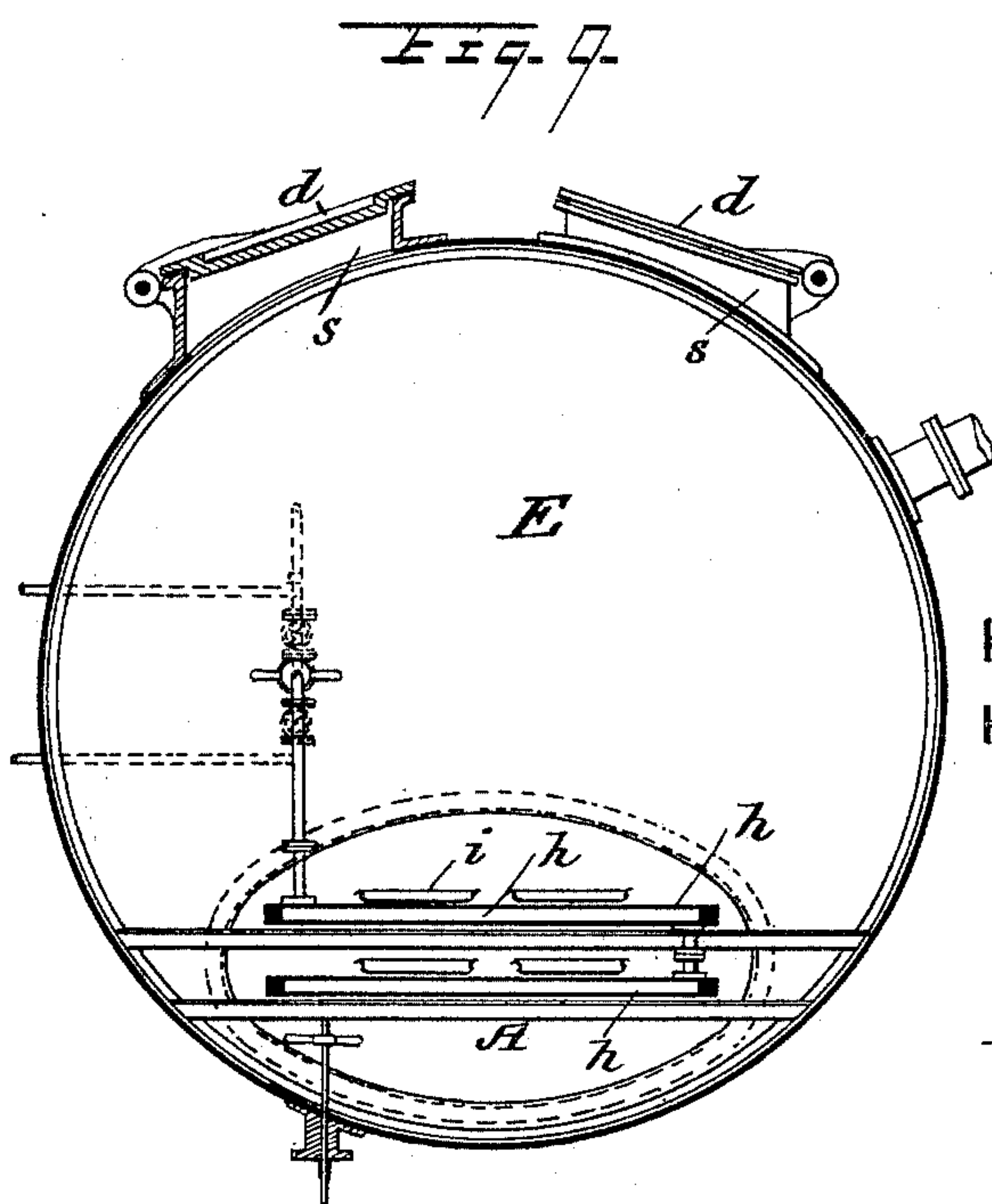
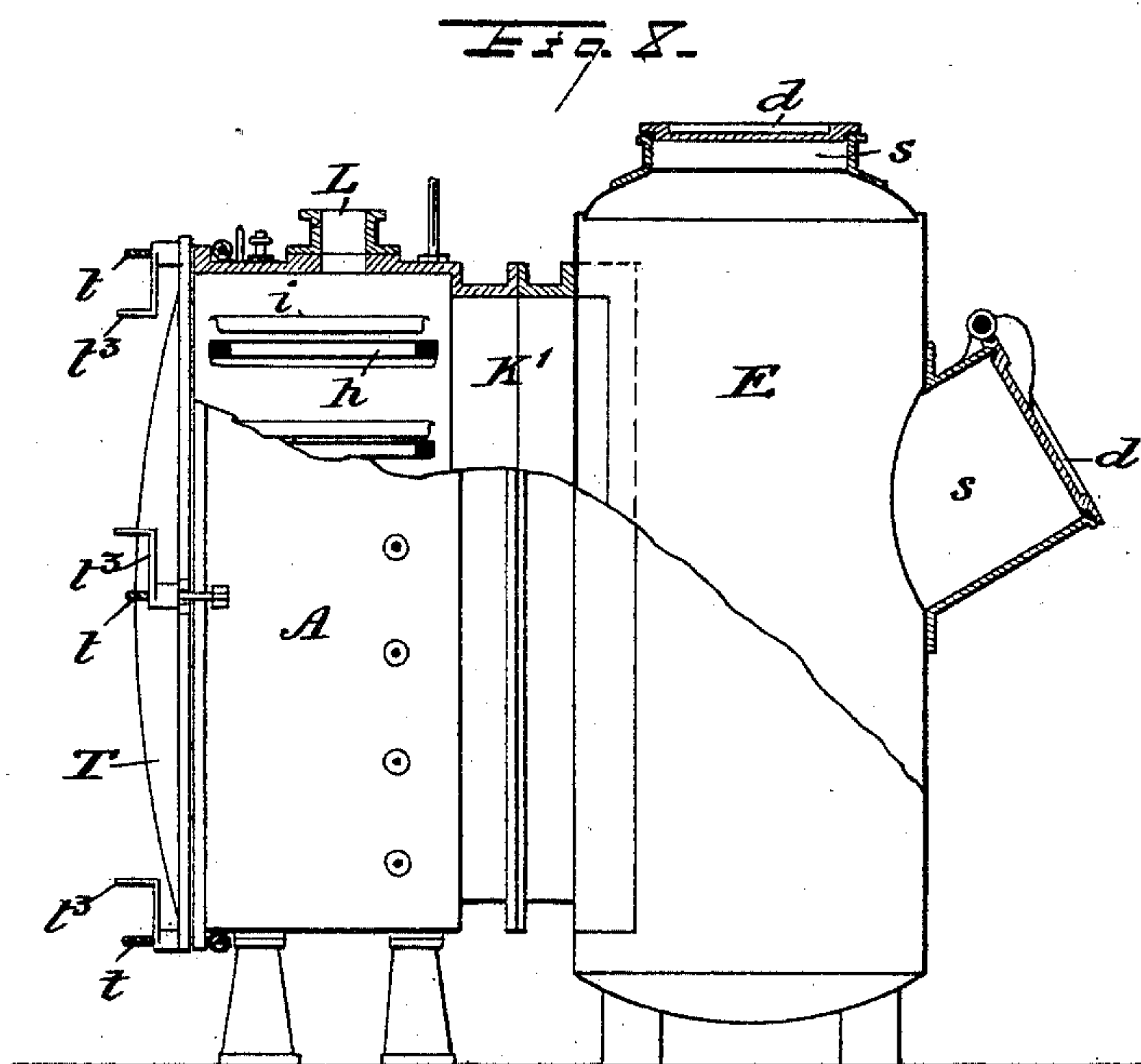
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UNITED STATES PATENT OFFICE.

EMIL PASSBURG, OF BRESLAU, GERMANY.

VACUUM DRYING APPARATUS FOR EXPLOSIVES.

SPECIFICATION forming part of Letters Patent No. 497,683, dated May 16, 1893.

Application filed August 29, 1891. Serial No. 404,050. (No model.) Patented in Germany January 15, 1890, No. 56,330; in France February 4, 1890, No. 203,556, and in England July 26, 1890, No. 11,745.

To all whom it may concern:

Be it known that I, EMIL PASSBURG, a subject of the Emperor of Germany, residing at Breslau, in Germany, have invented a certain
5 new and useful Improvement in Vacuum Drying Apparatus for Explosive Substances, (for which I have obtained Letters Patent in Great Britain, dated July 26, 1890, No. 11,745; in Germany, dated January 15, 1890, No.
10 56,330, and in France, dated February 4, 1890, No. 203,556,) of which the following is a specification.

This invention relates to the drying of explosives and the object of the invention is to
15 provide a method and means whereby the drying may be safely performed.

Heretofore in the drying of explosives such as fulminates, gun cotton, picrates and others of a violent nature, great danger was incurred
20 by reason of the liability of such explosives to spontaneously explode when the drying reached a certain stage, so that it has not yet been found possible to devise any apparatus for effecting the drying, nor in any way to arti-
25 ficially cause a quick drying of such explosives within buildings or in closed spaces, since there is too great a liability of utterly wrecking such apparatus or buildings as the result of an explosion.

The invention consists in a method of putting in practice the principle of drying *in vacuo* (so called) so that explosives may be dried in a vacuum apparatus without any danger of damage thereto, or to the work people or surroundings, should an explosion occur. It is well known that many moist materials may be efficiently and conveniently dried by passing them into or through a chamber from which the air is exhausted, heat being
40 in many instances employed in addition to the absorption effect of the vacuum. The aforesaid liability of the higher explosives to spontaneous explosion however renders it impossible to dry such explosives by application of the ordinary methods of vacuum drying, as
45 any attempts thereto result in the shattering of the apparatus due to the explosion.

The improved method, by means of which I have found that the drying may be per-
50 formed with safety to the apparatus and surroundings, consists in exposing a certain

quantity of the explosive in a chamber from which the air is exhausted, the chamber bearing such relation in point of size and the "vacuum" being such in point of rarity with
55 regard to the amount of explosive dried, that should the latter explode, the gases disengaged will find sufficient space for their expansion within the limits of the chamber in which the exhaustion prevailed, and will, after occupy-
60 ing said space not possess a force of expansion sufficient to burst the walls of the chamber.

The principle of the new method of drying explosives therefore consists in carrying on
65 the same within a chamber in which a vacuum is maintained and exists, the dimensions of the chamber being sufficient to afford unoccupied space for free expansion of any gases resulting from an explosion, to the extent nec-
70 cessary to take from these gases their potency of disruptive force on the walls of the chamber.

It is obvious that the greater the space within the chamber relatively to the amount
75 of explosive dried, the less will be the disruptive effect of pressure on the walls of the chamber for the less will be the pressure produced within the chamber, but at the same time the greater would be the expenses of the
80 process either by reason of the greater amount of work laid on the exhaust pumps or the smaller capacity of the apparatus for drying purposes. To obviate these drawbacks, I employ a drying chamber the walls of which are
85 so made that they give to an overpressure from the interior and allow gases to escape. The explosions which occur are of great suddenness and consequently to provide such chambers with ordinary relief valves would
90 be useless. For relief, the relief valves or openings must be made of far beyond the ordinary relieving capacity to be suitable for the purpose in view. Thus the doors of the apparatus may be so made that they are held
95 closed only by the outer atmospheric pressure; also a number of large orifices may be made covered with plates or covers loosely placed thereon. A few of these orifices should be below, in which case their covers must be
100 provided with counterweights to keep them closed against their own gravity. The sides

of the apparatus should be provided with a plurality of such openings, and it is preferable that they be formed so that they open upward, partly for the convenience of fitting the covers thereon, and partly with a view to the prevention of damage when the covers are blown off. The exact construction employed is not of consequence provided the general function of these openings and covers is fully provided for, they being intended to prevent entrance of air from outside and to instantaneously and effectively provide for the rapid issue of gases from the interior in all directions, and so avoid bursting of the apparatus. The method of drying explosives before mentioned, must be followed so that the greater amount of potency of the gases developed by explosion may be neutralized by their occupying the "vacuum" before they open the apparatus. In such an apparatus an explosion loses its disruptive force, since it occurs primarily in the vacuum, there is thus no air wave set up by the explosion to propagate the shock.

Suitable apparatus for carrying out this method of drying explosives is shown in the annexed drawings in which—

Figure 1 is a side elevation partly in section of a drying chamber with the expansion chamber connected thereto, and shows also the apparatus for exhausting the air in the chamber. Fig. 2 is an end elevation partly in section of the drying and expansion chambers. Fig. 3 is a front elevation and Fig. 4 both partly in section and Fig. 5 a plan view of a modified form of apparatus. Figs. 6 and 7 are cross sections of a modified form of drying chamber. Fig. 8 is a sectional side elevation of another modified construction of combined drying chamber and expansion chamber. Figs. 9 and 10 are cross sections of another modification in which the drying and expansion spaces are combined in one chamber.

The apparatus shown is one in which the substance to be dried is spread out on basins *i* which stand upon boxes *h* and to which the evaporating heat is supplied by conduction from the latter which are heated by means of steam, hot water, hot air, &c. The improvements may however be adapted in a similar way to any vacuum drying apparatus.

Referring to Fig. 1, A is the drying chamber, C is a condenser, L is the pipe branch connected with the drying chamber A and *l* the piping connected with the air pump P by means of which vacuum is formed and maintained in the chamber A.

The arrangement by which the space to receive exploded gases in the apparatus is increased may be provided for by connecting therewith a suitably strong closed vessel E (herein called an expansion chamber). This vessel may in itself be separate from the drying chamber and be connected by means of a pipe K of large diameter with the drying chamber A, a valve or stop cock V being pref-

erably provided in the said pipe so that the communication between the said vessel and drying chamber may be opened or closed as it is needless to destroy the vacuum in the expansion chamber when the drying chamber has to be opened for removal of the dried materials. The air in the expansion chamber may also be exhausted at the same time as that in the drying chamber or either immediately upon or even after the commencement of that stage or period of the process of drying which experience has shown to be liable to the danger of explosion. Or the said expansion chamber E may be made practically in one with the drying chamber A as in Figs. 3 to 5 or connected by a very large tubular part K' as in Fig. 8, or be actually part of the same chamber as in Figs. 9 and 10. This gives the advantage of freer communication between the drying and the expansion chambers but has not the convenience of separation for purposes of exhaustion as before described.

The second purpose of the invention is fulfilled by arranging in the wall of the drying or expansion chamber in either or both of where is convenient, a sufficient number of orifices *s* being substantially short tubes upon the open ends of which are fitted loose closing lids *d* made air tight with suitable rubber or other packing rings. The lids *d* press lightly by force of gravity only on the branches *s* except only during the working of the process, when the vacuum prevails in the chamber or chambers, at which time the excess of outer atmospheric pressure, holds the lids in firm and air tight manner in place. As soon as overpressure prevails in the interior of the chamber or chambers by reason of an explosion of sufficient material, the lids open or are blown off, and allow the gases to escape from the openings. The lids are so arranged that in flying off they do no damage. For this purpose the openings *s* may be arranged so that they are not placed one immediately over the other, or the lids may be connected by hinges (see Fig. 9) or their movements can be regulated in any convenient way. It is preferable to arrange these openings at suitable places all over the fixed walls of the apparatus, there being more or less of them according to the liability of the matter dried to explode and the force of such explosion. The openings are preferably directed either upward or downward. The lids *d* are simply placed to rest on the upwardly directed openings and their own weight holds them in place, but the lids closing the downwardly directed openings require to be held upward against their seats by some means capable of giving way to the outrush of gas on occurrence of explosion. Such lids are preferably hinged and supported by balance weights *d'* as shown in Fig. 6. The said expansion chamber may also be fitted with one or more openings *s* with covers *d* thereon as before described.

The door or doors T of the drying chamber

by which access is had to the interior or by which the matters to be dried are inserted or removed, are held closed lightly either by means of screw bolts Z or by weights or counterpoise; such doors will be held firmly closed as long as the air pressure outside exceeds that inside the drying chamber. When such doors are fixed in place by screw-threaded bolts and hand nuts, the latter may and should be loosened or removed after sufficient diminution of the interior pressure, so that the doors being held closed only by excess of exterior atmospheric pressure, will be opened on occurrence of an explosion of sufficient magnitude.

In Figs. 3 to 5 the double doors T are shown supported by hinges t^2 and made to be fastened by crank nuts t^3 and bolts. The crank nuts are removed after the vacuum is sufficient to hold the door closed. In Fig. 7 the door is hinged above and closes by its own weight.

I am aware that in drying apparatus working under pressure, relief valves have been used which will allow air, or whatever gases may be in the drying chamber to escape after the pressure exceeds a certain desired maximum. Such however differ in no essential from the usual safety valves of other containers under pressure, such as steam boilers, and I do not claim such simple relief valves which would be useless where large volumes of gas are suddenly generated. My apparatus differs in that the stationary fixed part of it forms as it were but a skeleton to support the removable covers.

I am also aware that condensers have been placed in communication with vacuum drying machines but such condensing chambers are not adapted for the purpose for which my

pressure relief or vacuum extending chambers (expansion chambers) are intended.

I therefore claim as my invention—

1. In a vacuum drying apparatus, the combination with a drying chamber adapted to receive a charge of explosive, of an air pump, or exhauster, connected to said chamber, the latter being provided with openings or outlets made to extend in different directions, and air tight covers made to sit loosely on said openings so as to be held closed merely by the vacuum in the chamber, the covers of the downwardly extending openings being provided with balance or counter weights, substantially as described.

2. In a vacuum drying apparatus, the combination with a drying chamber adapted to receive a charge of explosive, of an air pump, or exhauster, connected to said chamber, the walls of the latter being provided with outlets or openings, and air tight covers made to sit loosely on said openings so as to be held closed merely by the vacuum in the chamber, substantially as described.

3. In a vacuum drying apparatus adapted for drying explosives, the combination with the drying chamber, and an exhauster, of an expansion chamber made to communicate with the drying chamber, the latter being provided with openings or outlets, and air tight covers made to sit loosely or unfastened upon the openings so as to be held closed merely by reason of the vacuum in the drying chamber, substantially as described.

In witness whereof I have signed this specification in presence of two witnesses.

EMIL PASSBURG.

Witnesses:

ERNST JAECKEL,
SELMA BAUMGART.