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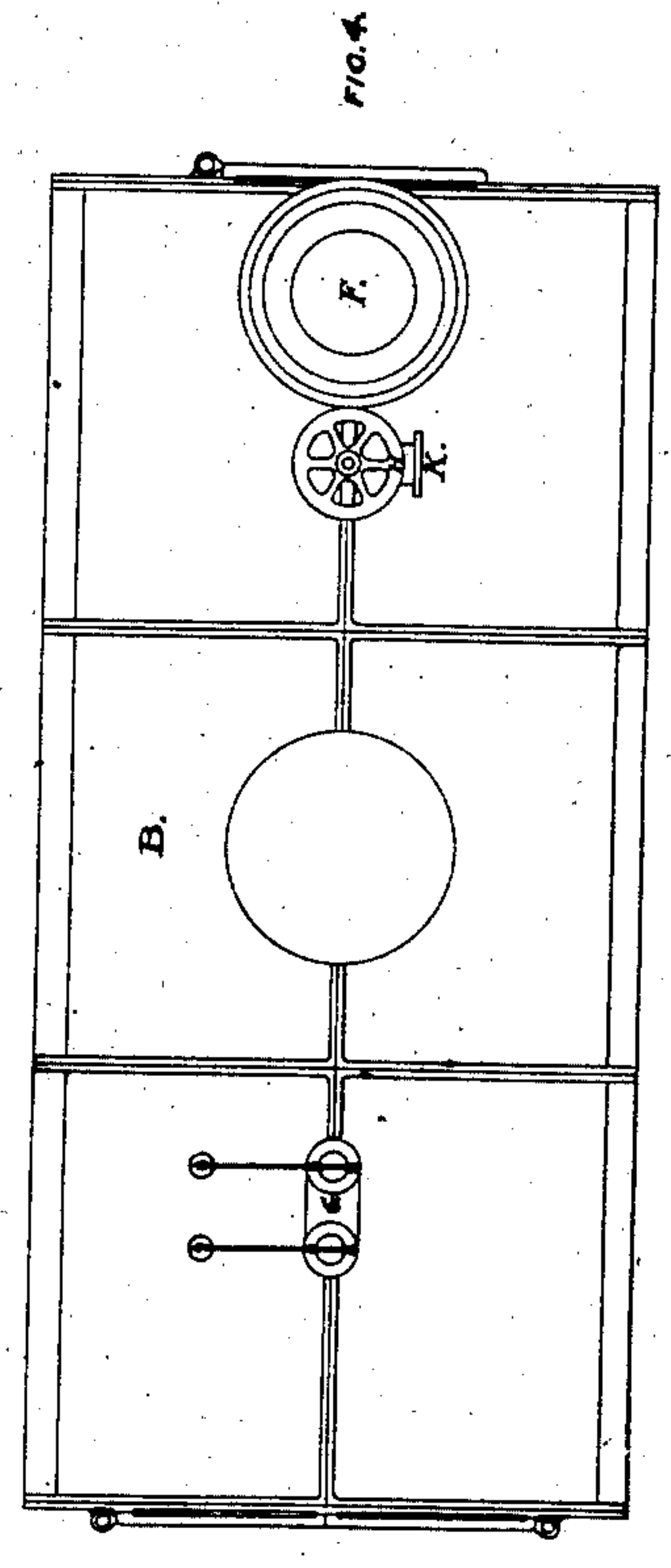
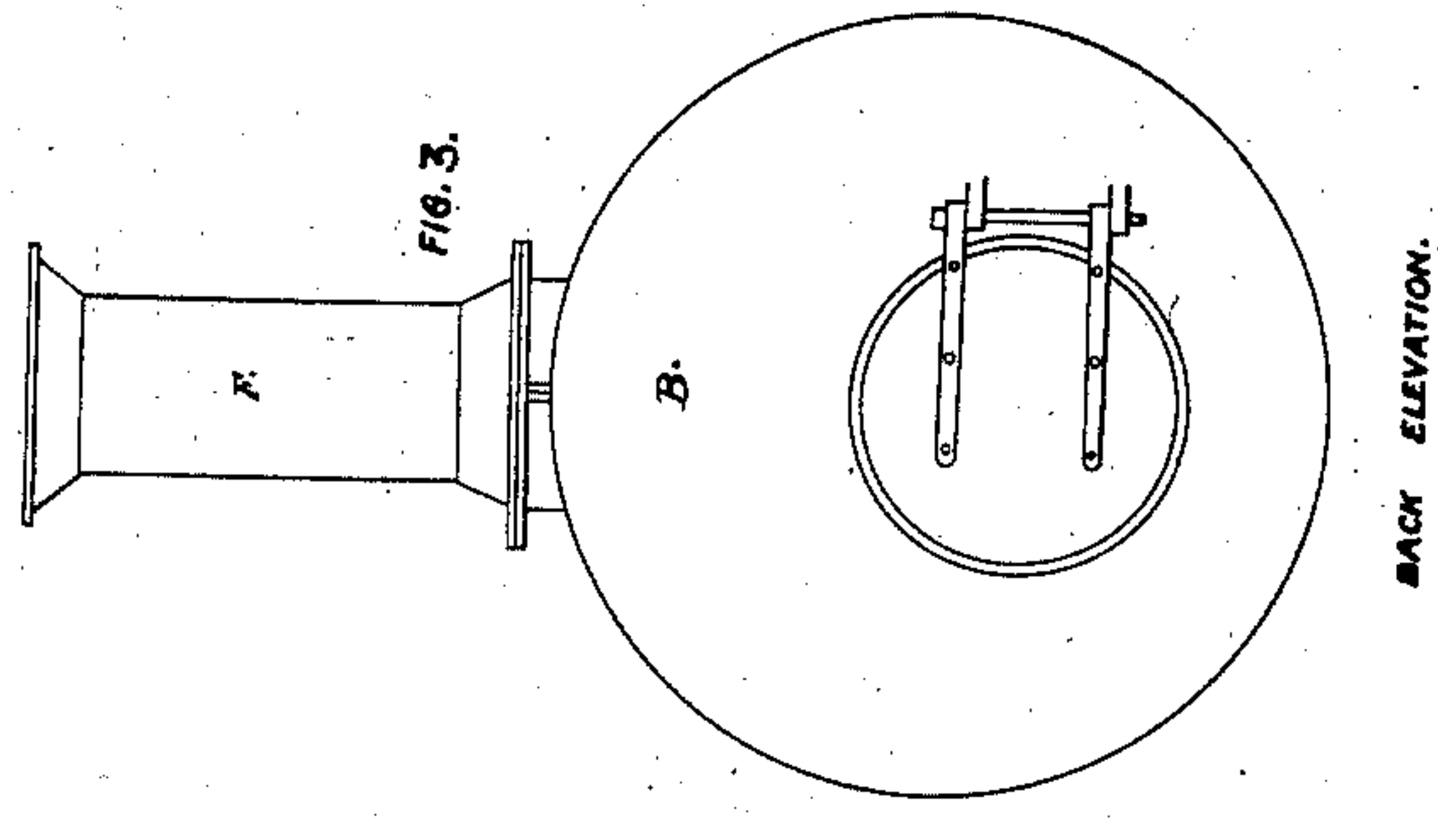
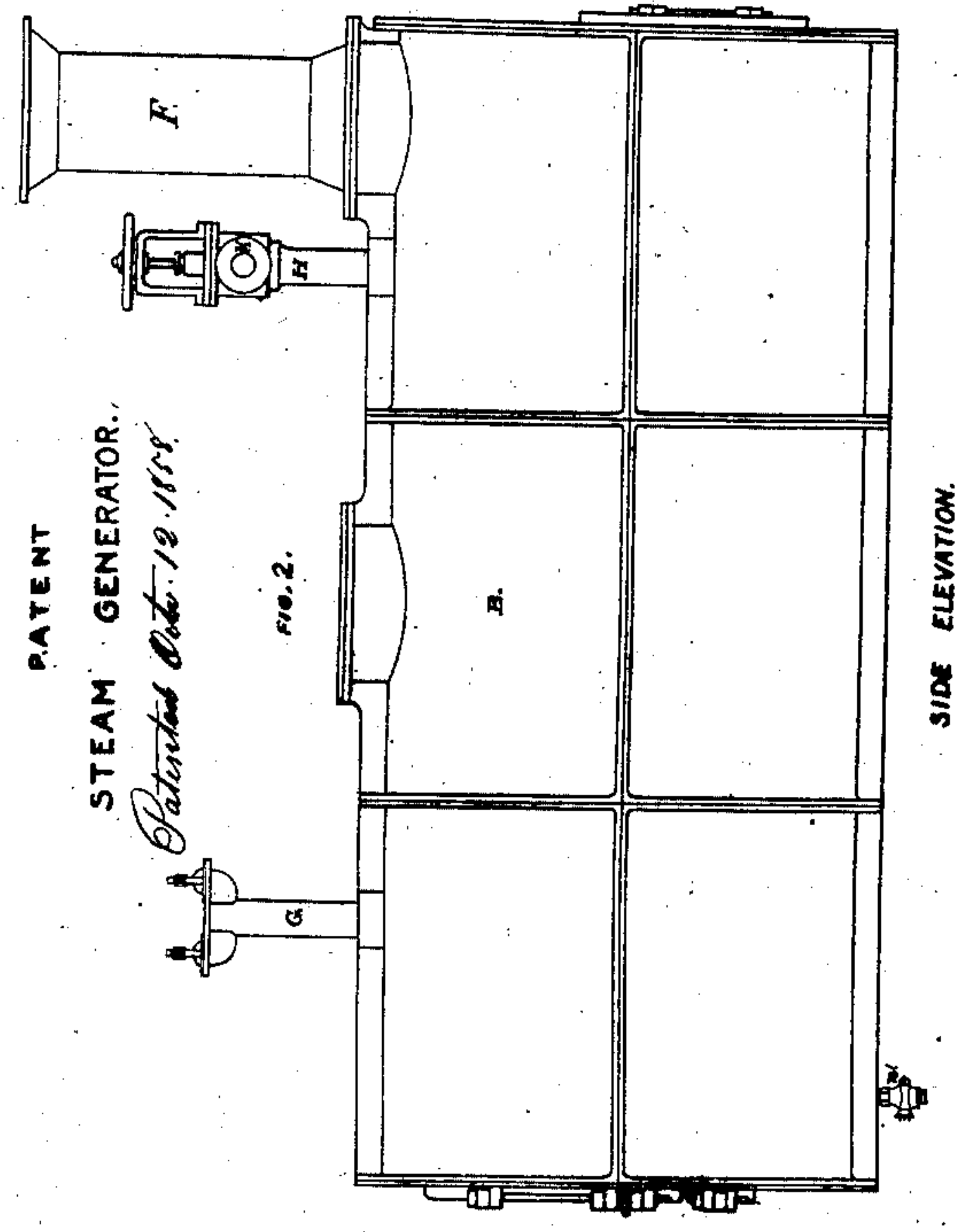
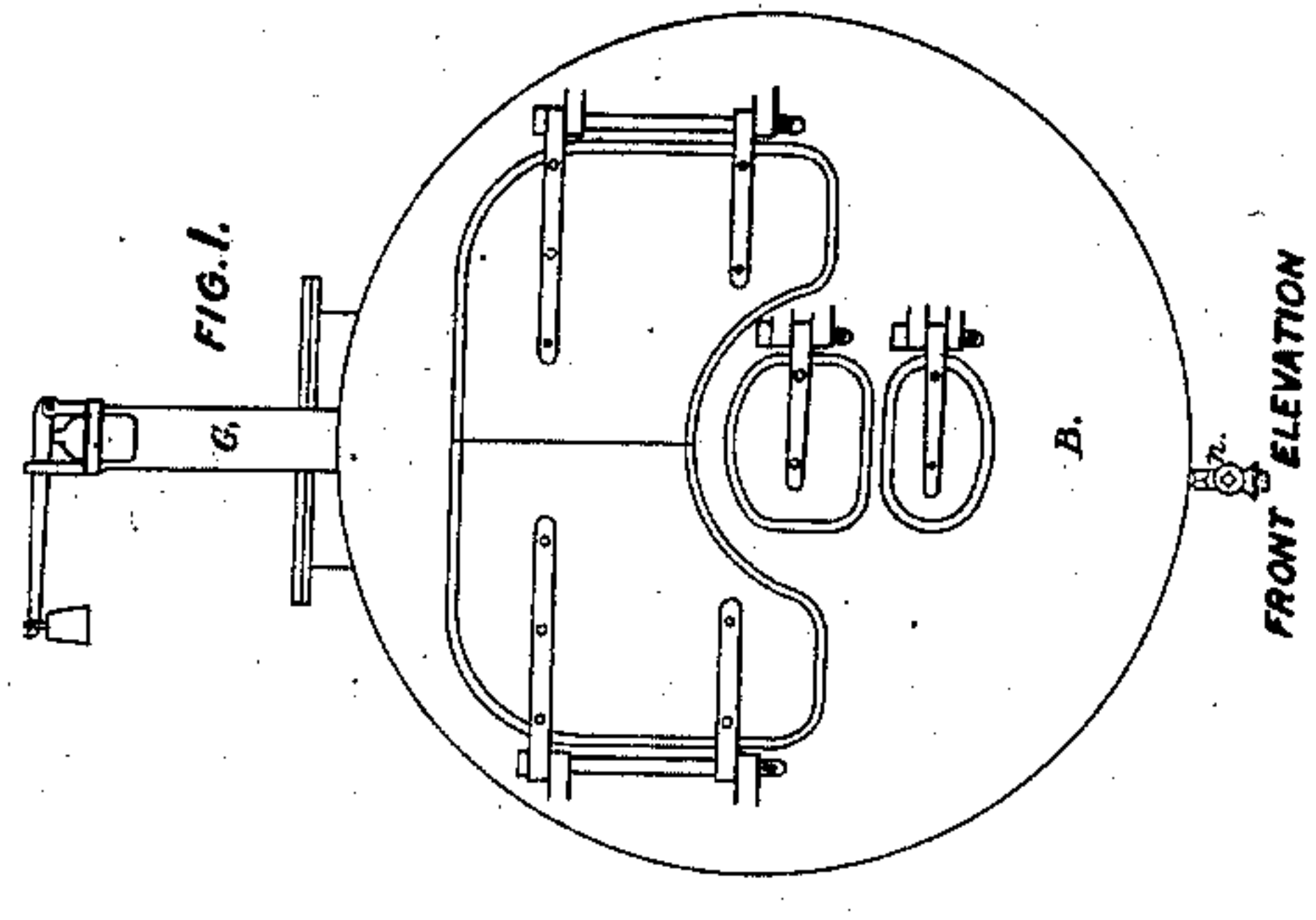
WARLICH'S

PATENT

STEAM GENERATOR.

Patented Oct. 19 1888

No. 21,788.



SCALE - INCH TO A FOOT.

WARLICH'S



TRANSVERSE SECTION AT A. B.



LONGITUDINAL SECTION.



TRANSVERSE SECTION AT C.D.



F16.3.

SCALE .INCH TO A FOOT.

UNITED STATES PATENT OFFICE.

F. C. WARLICH, OF KENTISHTOWN, ENGLAND.

STEAM-GENERATOR.

Specification of Letters Patent No. 21,788, dated October 12, 1858.

To all whom it may concern:

Be it known that I, FERDINAND CHARLES WARLICH, of Hope Cottage, Gloucester Place, Kentishtown, England, a subject of the King of Hanover, have invented or discovered new and useful Improvements in the Generation of Steam; and I, the said FERDINAND CHARLES WARLICH, do hereby declare the nature of the said invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement thereof, that is to say—

This invention has for its object the modification and removal of several of the causes of steam boiler explosions and to obtain a more simple method of producing high pressure steam with great economy.

Description of the drawings.—Figure 1 is an end view; Fig. 2 a longitudinal elevation; Fig. 3 another end view; Fig. 4 a plan; Figs. 5 and 7 two transverse sections; Fig. 6 a longitudinal section, and Fig. 8 a plan in section of apparatus combined according to my invention.

In each of these figures the same letters indicate the same parts.

A is the generator set in a cast iron casing B which it is preferred should be cast in twelve parts and screwed together as shown. The length of the generator shown is 10 feet by 3 feet 9 inches diameter constructed similarly to a Cornish boiler with a flue C running through the same of 1 foot 9 inches diameter. In this flue is fitted the cast iron cylindrical fire box D projecting 6 inches beyond the generator to the outer casing. The fire box is 4 feet long divided into two parts, the lower division set with a fire grate *a* being about two square feet of fire bars. A cast iron cylindrical flue box 6 feet 6 inches long in two divisions E, fitting closely to the end of the fire box D. The upper division contains 12 water heating pipes *b* fastened together by elbows at *c* and set in two frames *d d* each pipe being 6 feet long and one inch bore. Into the top of the bottom portion of the cylinder E is fitted a plate of cast iron *e*.

The bottom portion of the cylinder E, or that beneath the division plate *e*, is closed at its front and open at its rear end—it being made to communicate with the front end flue under the partition B', hereinbefore referred to. Into the said flue space beneath the

plate *e*, the heated volatile products of combustion can circulate and impart heat to the adjacent surface of the generator. Furthermore, the division of the flue space by the plate *e*, and the arrangement of the coil *b*, in the upper division causes the coil to be heated to better advantage than it would be without the said partition *e*. To this coil of pipes *b* is connected at *f* a pipe of the same diameter running from the front between the two cylinders viz, the steam generator and the casing, and being screwed to the mouth piece of the feed pump at *h*. Another pipe is also connected at *i* to these pipes on the other side returning to the front between the generator and the flue casing and continuing by an elbow *k* to the perforated pipes *m* lying within the cylindrical steam generator A. These perforated pipes or pipe have or has one inch bore and 6 feet long the whole length being perforated with fine holes through the upper part having generally about 8 to 9 perforations to the square inch.

The outer or flue cylinder or casing B is half an inch thick made of cast iron in twelve parts and joined together by screws or otherwise. The interior of this flue casing or cylinder should be well lined with a nonconducting substance. Loam and powdered fire brick mixed together with water into a paste like dough which will be found a good lining dried after it is put on and then supplied with one or more good washings of foundry blacking in the usual way. For this object the inside of the flue casing should be as rough as it can be cast.

The heating space of the flue between the steam generator and the cast iron casing or flue cylinder is divided into two flues see Figs. 5, 6, 7, at B'. The lower half again is divided into two parts B² so as to form a seating for the generator.

The space between the steam generator and the outer cast iron case or cylinder is four inches. The other half upper heating space or flue is three inches from whence the hot gases and heated air from the furnace (after having traversed the lower and upper flues) enter the funnel or chimney F. At this latter point may be fixed a thermometer for the indication of the temperature at this stage in order to indicate the degree of the heated gases and vapors entering the funnel or chimney and which should not be less than

300° Fahrenheit. If this temperature be kept steady and regular it will always insure a good draft and consequently a moderate combustion in the furnace. In front of the steam generator there may also be fixed a thermometer communicating with the interior, as also a pressure gage both arranged and placed as known to engineers. And on the top a double safety valve G (Figs. 1, 2, 4, 5, 6) as likewise the stop valve H with a branch steam pipe K leading to the cylinder of the engine. The fire of the furnace ought to be so regulated that no part of the flues may exceed a temperature of about 500° Fahrenheit. This temperature does not of course heat the iron plates to the same degree but it will act sufficiently to so balance the temperature of the steam within the steam generator as to prevent its condensation as well as to oppose the radiation of the heat that the plates of the generator have received from the steam contained within it. Under these conditions the heated mist and vapor forced through the perforated pipes or pipe into the steam generator from the water heating pipes will expand instantaneously in meeting a higher temperature and becomes under the influence of the high pressure also high pressure steam, rendering partly its latent into sensible heat according to the pressure to which it is subjected. The slight condensation of the steam (if any) is modified if not entirely removed by placing a perforated copper plate I (Figs. 6 and 7) a few inches from the bottom of the generator it being about $\frac{1}{4}$ or $\frac{1}{2}$ an inch thick. This plate naturally has the temperature existing in the steam generator. The heavy saturated steam (if any such) in descending comes in contact with this copper plate, expands instantly into a higher state of steam thereby mitigating or removing any ill effects that otherwise might arise within the steam generator.

The steam produced by the above method can thus be raised at will from one to ten and more atmospheres in less than as many minutes with great economy and without the slightest danger provided the steam generator is made strong enough to stand the pressure at its ordinary working standard.

Between the elbow *k* and the perforated pipes *m* are placed two cocks *l l* to shut off the communication with the pipes *m m*. At the bottom of the generator A passing through the casing B is a pipe and cock *n* for drawing off any condensed water. In the flue casing B Figs. 1, 2, 3 are doors for convenience for getting at the pipes, &c.

The setting and arrangements of the steam generator may be varied in this way *videlicet* instead of having the fire box inside the flue it may be placed outside constructed similar to the present fire box of

locomotives however with this difference of being only $\frac{1}{4}$ the size as at present.

For stationary engines the generator may be constructed with two flues instead of one—the one being set with a fire grate in the flue in front and the other in the flue at the back of the generator. The main flue of the steam generator may then be entirely occupied with the coil box. For small engines of from one to five horse power the generator may be placed upright rounded at the bottom in an egg shape fitted in a casing with spaces between for flues containing the heating pipes winding around the steam cylinder in the form of a coil—and the whole may be placed in a cylindrical iron vessel like the common iron stoves fitted with doors for charging it with fire or heating the apparatus by jets of gas instead of a fire if suitably arranged.

The perforated pipes may run the whole length of the generator, and may be placed above the flue instead of on the side. The generator may be constructed with two flues instead of one, the one being set with a fire grate in front the other at the back end of the generator.

Having stated the nature of my invention and the means by which the same is to be carried out I wish it to be understood that I do not claim any of the parts separately nor do I confine myself to the dimensions herein stated neither do I claim the heating of water in tubes or pipes and then allowing such heated water to pass by jets into a highly heated chamber or vessel as I am aware that such is not new as will be seen by reference to George Bennett's English patent dated August 15th 1843. In the said Bennett's invention however, the heating of the water was directly effected by the waste steam from the cylinder of the engine whereas, in my apparatus such is not the case, it being heated in a coil of pipes arranged within a flue space or chamber placed within the steam generator and made to communicate with the fire place or box and with flues disposed against the ends and bottom and top of the generator.

Therefore, what I claim is:

1. The arrangement of the water heating coil of pipes, B, within flues leading from the fireplace and through or about the steam generator as described, when such water heating pipes terminate in foraminous pipes, *m, m*, extending into the steam generator so as to discharge the heated water into it, in fine jets or spray or mist as described.

2. And in combination with the coil containing flue within the generator, and the flues about the ends and cylindrical outer surface of the generator, I claim the flue space directly beneath the coil flue and arranged within the generator as described

such being exhibited in Fig. 6, and particularly in Fig. 7.

3. I also claim the arrangement of the side flues, the two bottom flues and single
5 top flue of the generator in combination with the arrangement of the water heating pipes extending through the same and with

the coil flue and fire place as represented in the drawings.

F. C. WARLICH.

Witnesses:

GEO. PITT,
JOHN R. DARKER.