(No Model.) 2 Sheets—Sheet 1.

# F. J. WEISS.

## CONDENSER.

No. 496,761. Patented May 2, 1893.

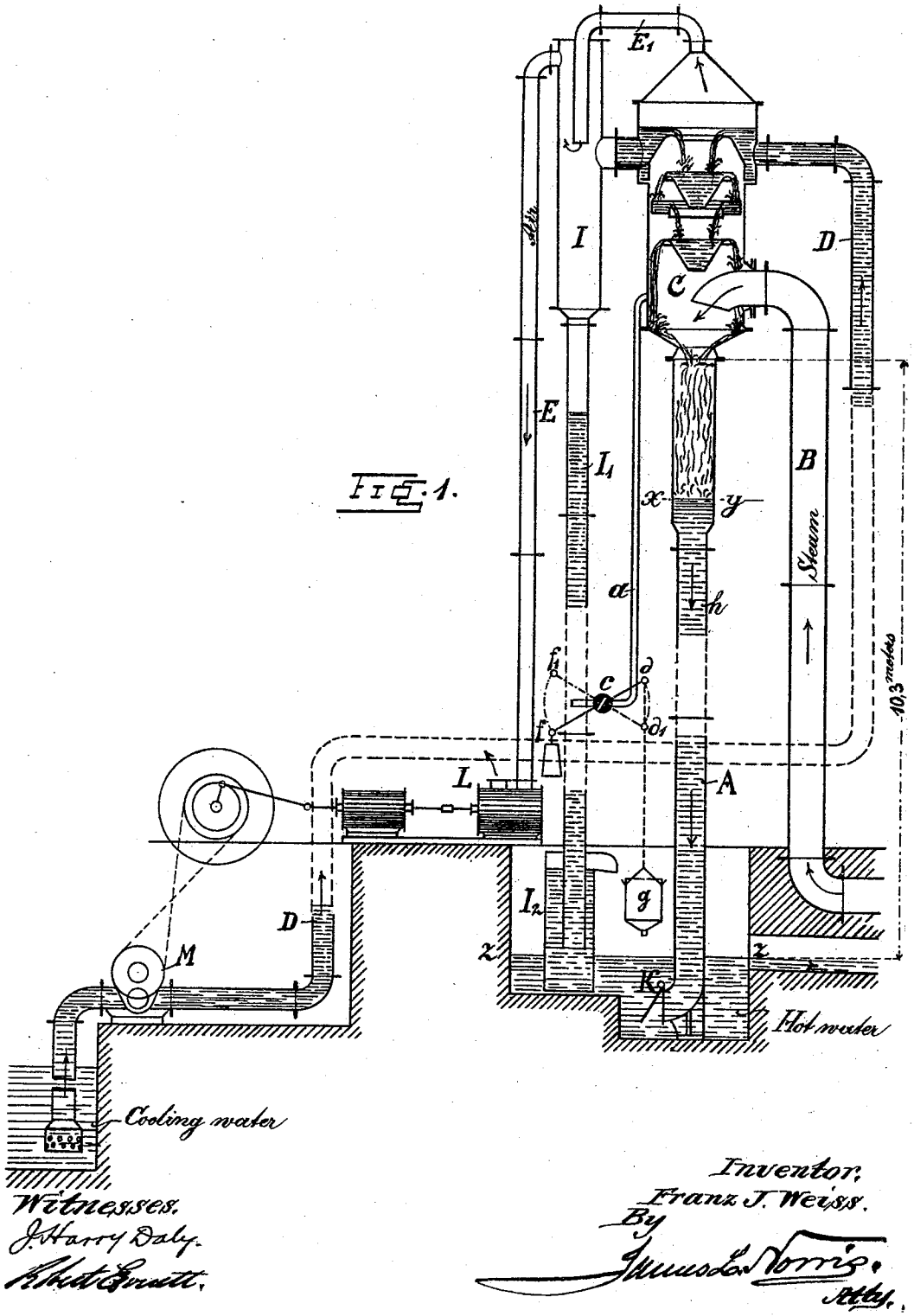


FIG. 1.

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(No Model.) 2 Sheets—Sheet 2.

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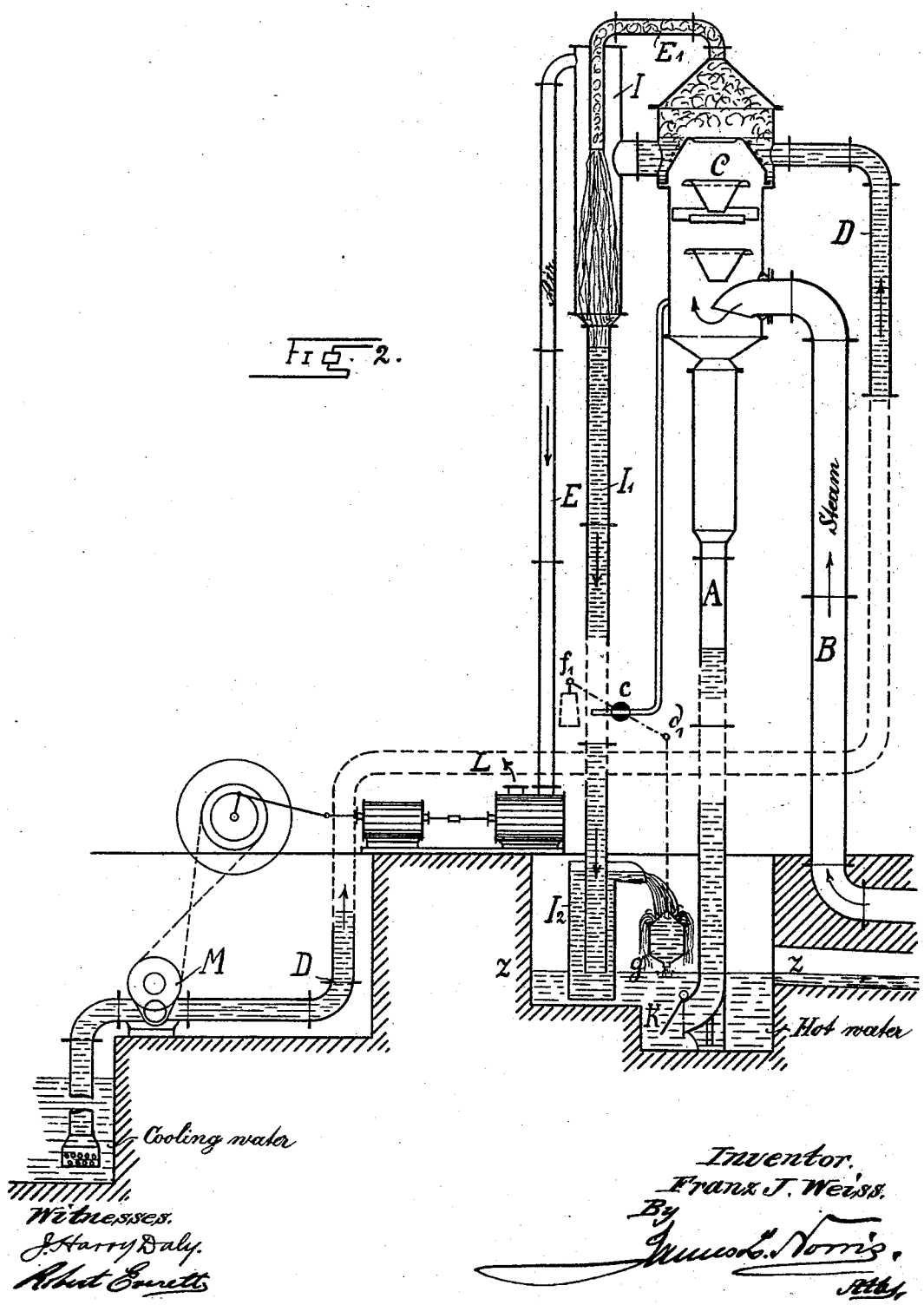
## CONDENSER.

No. 496,761. Patented May 2, 1893.

Fig. 2.

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# UNITED STATES PATENT OFFICE.

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## CONDENSER.

SPECIFICATION forming part of Letters Patent No. 496,761, dated May 2, 1893.

Application filed October 29, 1892. Serial No. 450,368. (No model.)

*To all whom it may concern:*

Be it known that I, FRANZ JOSEPH WEISS, of Basle, in the canton of Basle and Republic of Switzerland, have invented a certain new and useful Improvement in Condensers, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to the condensation of steam and other vapors and to apparatus therefor.

It has for its object to obviate a defect which is associated with the use of counter-current condensers, and occurs whenever they operate with the greatest efficiency and therefore under the most favorable conditions. If in a condenser, a certain weight of steam, coming from a steam engine, an evaporating apparatus or the like, is mixed with a certain weight of water of a certain temperature, the liquid mixture possesses a definite temperature which is always the same whatever may be the system on which the condenser is arranged. In case, however, the apparatus is a counter-current condenser the pressure prevailing therein may be completely lowered by an air pump of suitable size, to the pressure of saturated vapors corresponding to the temperature of the liquid measure (the hot water running off) whereas that is physically impossible in the case of a parallel current condenser, and likewise with any condenser having a "wet" air pump, or could only be attained with an infinitely large air pump. The state in counter-current condensation, in which the vacuum has been completely raised to that which corresponds to the temperature of the hot water running off, and where, therefore, the condensation performs its maximum duty or works with a degree of efficiency of one hundred per cent. is hereinafter called the "ideal point."

Experience has shown that with properly arranged counter-current condensers the said ideal point is easily attainable at any time and is actually attained. But when such is the case the remarkable phenomenon occurs that the water in the condenser rises and enters the air suction pipe terminating at the top of the same. If between the condenser body and the air pump, which with counter-current condensation must always be a "dry" one, no so called water separator is included; the water passes over into the dry air pump in enormous quantities, so that the air cylinder is completely filled thereby, and as this pump in the nature of things is not arranged for the delivery of water, serious disturbances in the working, if not the destruction, of the air pump are the immediate consequences. In case, however, a water separator as shown in the drawings, which must be placed sufficiently high for the water, which passes over into it and is separated from it, to be automatically drawn off by a water barometer pipe, and if this water barometer pipe or waste pipe, is wide enough for carrying off all the water which has passed over, no water will pass into the air pump. It has then been found that as soon as the ideal point is reached, or perhaps even somewhat exceeded, and water, therefore, passes over, the entire quantity of water conducted to the condenser passes over into the water separator, not a drop of water passing through the waste pipe proper. The steam condenses in a pipe, on its way from the counter-current condenser, to the water separator, which it traverses together with the water (or parallel to it) in other words, when reaching the ideal point the (counter-current) condensation shifts from the (counter-current) condenser body proper, to the water separator as shown in Figure 2 of the drawings and thus becomes a parallel current condensation. Accordingly the water pipe from the water separator, (or, more correctly, from the parallel current condenser body) must be made of such width that with the available weight of water, it is capable of carrying off all the condensed water, then the air pump is protected in all cases against access of water.

It has further been found that, if once the passage of water to the separator has commenced and the condensation has changed from a counter-current condensation to a par-

allel current condensation, this state will never cease of itself, but will continue until the condensation is stopped. From this results the following inconvenience, that is to say, as under otherwise similar circumstances (equal quantity of the steam to be condensed, equal quantity of cooling water, equal temperature of the cooling water, equal capacity of the air pump) a lower vacuum is always produced with a parallel current than with a counter-current, the vacuum sinks in the condenser during the state just explained, where the condensation takes place by parallel current.

My invention consists in the combination, with counter-current condensers, of means for bringing the above state, if it has occurred, rapidly to a termination and for shifting the condensation back again to the condenser body proper where it takes place again by counter-current, without any necessity for stopping the condensation, all as hereinafter more fully described with reference to the accompanying drawings.

Figs. 1 and 2 are vertical sectional views of a condenser embodying my invention.

According to my improvement as illustrated more particularly in Fig. 2 of the drawings, I provide means for putting the steam pipe B for a moment in direct communication with the air suction pipe E, which at once as soon as the running of the water through the parallel current body I has begun the condensation is then shifted back in a sure manner into the counter-current body C, while this acts with less certainty if the said state has been allowed to last for some time and this means is not used until later on. In the following manner these means are rendered automatic and immediately operative as soon as the running of water through the current body I begins. The water barometer waste-pipe I′ is arranged so as to terminate in a basin or vessel $I^2$, Fig. 1 which has an outlet a little above the surface *z. z.* of the hot water running off, the exhaust steam pipe B is connected with the air suction pipe E, through a pipe *a b*, having a cock *c* inserted, which is usually kept closed by the counter-weight attached at *f*, to the lever *f′*, *d′* for actuating the cocks. From the other end *d* is suspended a pail *g*, in such manner that water must run into it as soon as the vessel $I^2$, runs over; the pawl *g*, has at its bottom an opening which always remains open. As soon as the ideal point is reached and the condensation shifts from C to I, so that the whole volume of water runs off through I′, the pail *g* becomes filled, (despite of its having an opening below, because the latter is too small for the entire volume of water which passes over to prevent the immediate filling of the pail) the weight of the volume of water filling it overcomes the counter-weights *f*, turns the said lever to the position *f′ d′* and opens the cock *c*, Fig. 2 whereby, owing to equalization of pressure taking place between B and F, the condensation is at once shifted back to C, again and the running of the water through I I′ ceases, the pail *c*, therefore, no longer contains water; it is now emptied at once through the opening below, which always remains open, and the counter-weight *f*, closes the cock *c*, again as shown in Fig. 1. This state lasts until the ideal point is reached the next time, whereupon the same operation re-commences; longer and longer periods during which the condensation takes place by the counter-current which acts under favorable conditions alternate with very short periods during which the condensation takes place by the parallel current which acts under less favorable circumstances. In the arrangements illustrated, the descending pail *g* opens the cock *c*, and allows air to pass into the air suction pipe E, or into the steam pipe B, if the water comes down through pipe I′. By reasons of the vacuum which momentarily sinks a little owing to the admission of air the condensation immediately shifts from the body I back again to the body C, the water discontinuing to pass through I and I′, the pail *g* is emptied and the cock *c* is closed again as hereinbefore described with reference to Figs. 1 and 2.

In lieu of the cock *c*, shown, I may use any other suitable closing device, for instance, a lift valve, slide valve, or the like which is opened by the descending pail, and then closed again by a counter-weight or by an equivalent spring.

Having described my invention, what I claim is—

1. A method of condensing steam and other vapors by counter-currents, alternating with parallel currents, in which the condensation effected at intervals by the parallel currents is brought back to condensation by counter-currents by temporarily admitting air into the space of the condenser in which the air has been rarefied substantially as specified.

2. A method of condensing steam and other vapors by counter-currents alternating with parallel currents, in which the condensation effected at intervals by the parallel currents is brought back to condensation by counter-currents by temporarily admitting air into the spaces or pipes in connection with the condenser, substantially as specified.

3. In a counter-current condenser, the combination with the air suction pipe of the condenser, of a connection between the said pipe, and the outer air, of a pail suspended below the overflow for the water barometer pipe of the condenser, and of means as described for temporarily opening the said connection and adapted to be actuated by the weight of the water flushing into said pail, substantially as specified.

4. In a counter-current condenser, the combination with the pipes connected with the condenser, of a connection between the said

pipes and the outer air, of a pail suspended below the overflow for the water barometer pipe of the condenser, and means as described for temporarily opening the said connection and adapted to be actuated by the weight of the water flushing into said pail, substantially as specified.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRANZ JOSEPH WEISS.

Witnesses:
GEORGE GIFFORD,
ERNST SCHULZE.