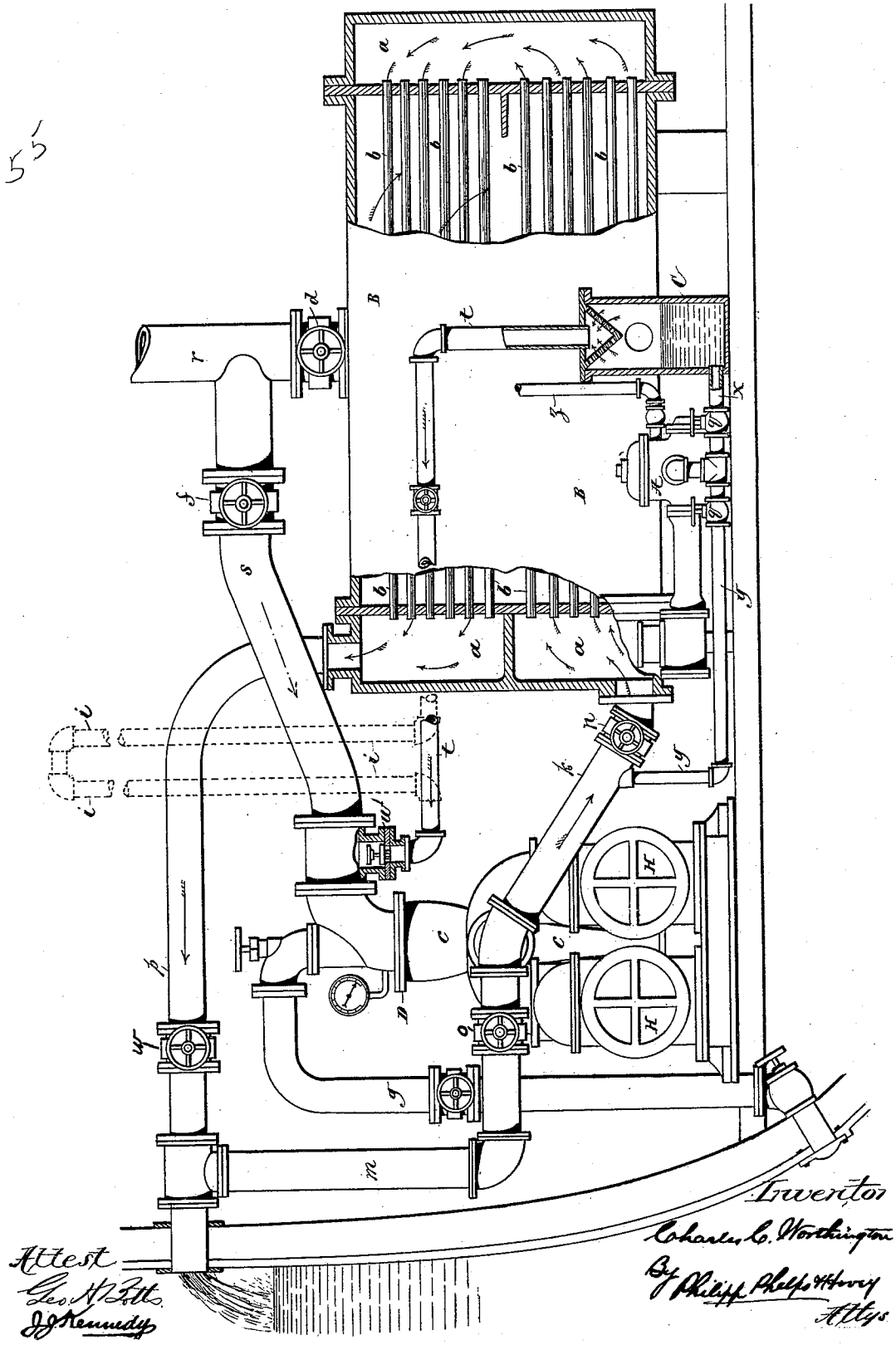
(No Model.)

C. C. WORTHINGTON.

CONDENSING APPARATUS.

No. 405,142. Patented June 11, 1889.



Attest
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UNITED STATES PATENT OFFICE.

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CONDENSING APPARATUS.

SPECIFICATION forming part of Letters Patent No. 405,142, dated June 11, 1889.

Application filed December 10, 1888. Serial No. 293,129. (No model.)

To all whom it may concern:

Be it known that I, CHARLES C. WORTHINGTON, a citizen of the United States, residing at Irvington, county of Westchester, and State of New York, have invented certain new and useful Improvements in Condensing Apparatus, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to a condensing apparatus for use in connection with steam-engines and other steam apparatus, and which embodies both a surface and an injection or jet condenser, the two being so organized that either can be used at pleasure and that the pump of the injector or jet condenser operates both as the circulating and the air pump for the surface condenser when the latter is in use. By this means one of the pumps which are commonly employed in connection with surface condensers is dispensed with, and at the same time an independent condenser is provided, which can be used at such times as it is necessary to suspend the operation of the surface condenser for cleaning or repairs or for any other reason.

As a full understanding of the invention can be best given by an illustration and a detailed description of an organized condensing apparatus embodying the same, all further preliminary description will be omitted and a full description given, reference being had to the accompanying drawing, which shows by a side elevation, partly in section, a condensing apparatus embodying the invention.

Referring to said drawing, it is to be understood that *r* represents the pipe through which the steam passes to the condensing apparatus. This pipe communicates with the upper part of the condensing-chamber of an ordinary surface condenser B, the lower part of which chamber communicates with a closed chamber or hot well C, in which the water and the air and vapor resulting from the condensation of the steam accumulate. The condenser B is provided at its end with chambers *a*, with which the pipes *b* for the circulation of the condensing-water communicate in the usual manner. Although, as shown in the present case, the surface condenser is of that type in which the condensing-water circulates through the pipes while the steam to be condensed circulates among them, this order may be reversed, if preferred, without departing from the invention.

The pipe *r* is provided with a branch *s*, which communicates with the upper end of the condenser-cone *c* of an injection or jet condenser D, which may be of any suitable form, but is preferably of the construction shown in United States Letters Patent No. 227,342, dated May 11, 1880, and No. 318,225, dated May 19, 1885. The pipes *r s* are provided with valves *d f*, by which they are controlled, so as to allow the steam to pass to either of the condensers at pleasure. The condenser D is provided with the usual pipe *g*, through which the condensing-water is supplied in the manner common in this class of condensers. The condenser D is exhausted by means of an ordinary duplex pump H, which is combined with the condenser, as shown in the Letters Patent referred to, and the delivery of which communicates with a waste-pipe *m*, and also by a pipe *k* with the chamber *a* of the surface condenser, which receives the circulating water. The pipes *k m* are provided with suitable valves *n o*, by which they can be controlled. The surface condenser B is provided with a waste-pipe *p*, having a valve *w*, which communicates with the chamber *a*, into which the circulating water passes from the pipes *b*, and through which it is discharged.

The upper part of the chamber or hot well C is provided with a pipe, which connects with the pipe *s* between the valve *f* and the condenser D, and through which the air which enters the surface condenser and the hot well and the vapor which results from the condensation of the steam are withdrawn by the action of the condenser D, so as to maintain the requisite vacuum in the condenser B. The pipe *t* is provided with a check-valve *w'*, which forms a water-check to prevent water from entering the pipe *t* and flooding the hot well and surface condenser if through any failure on the part of the pump H the water should rise in the condenser D so as to enter

the pipe *s;* or an equivalent water-check for this purpose may be formed by causing the pipe *t*, as indicated by dotted lines, to extend to such a height—say thirty feet or more—above the surface of the water-supply that the vacuum formed in the surface condenser will not be sufficient to cause the water to rise to the summit of the pipe *t*, and thus flow to the hot well.

The hot well C communicates by a pipe *x* with a feed-pump A, by which the water resulting from the condensation of the steam is withdrawn from the hot well and returned to the boiler through a pipe *z*. The suction side of the pump A may also communicate by a pipe *y* with the pipe *k* or other source of water-supply from which the boiler can be fed when the supply from the hot well is not sufficient, or when the surface condenser is not in operation, the pipes *x y* being controlled by suitable valves *q*.

The condensing apparatus is herein shown as located in the hull of a vessel, as the apparatus is well adapted for use in connection with marine engines; but it is to be understood that it is not limited to such use, but is of general application.

The operation of the apparatus is as follows: When it is desired to use the surface condenser, the valves *d n w* will be opened and the valves *f o* closed. The pump H being then put in operation, the condensing-water will be drawn into the pump through the pipe *g* and cone *c* and discharged through the pipe *k* into the surface condenser, where, after circulating through the pipes *b*, it will be discharged through the pipe *p*. The steam will enter the condenser through the pipe *r*, and, circulating among the pipes *b*, will be condensed, and the resulting water will flow into the hot well, to be withdrawn and restored to the boiler by the pump A. The water as it is drawn into the cone *c* by the action of the pump H will create a partial vacuum in the pipe *s* and the upper end of the cone *c*, which will act to draw the air and the vapor which accumulate in the hot well C past the valve *w*, and thus maintain the requisite vacuum in the surface condenser. The air and vapor thus exhausted from the hot well and the condenser will be carried downward in the cone *c* by the falling water, and will be thoroughly and evenly commingled with the water, so that the whole can be removed by the pump, as fully set forth in the Letters Patent referred to. The commingled air and water will be forced through the pipes of the surface condenser and finally discharged, as before stated.

In surface condensers as ordinarily organized it is necessary to provide two separate pumps in addition to the boiler feed-pump—one for circulating the water through the condenser and another for exhausting the air and vapor to maintain the vacuum. In the present organization, however, the injection or jet condenser and its pump H operate both as a circulating-pump to circulate the water through the surface condenser and as an air-pump to exhaust the air and vapor and maintain the requisite vacuum in that condenser, thus dispensing with one of the pumps heretofore employed. In addition to this saving of one pump in connection with the surface condenser, the present organization provides an independent condenser which can be used whenever for any reason it is necessary or desirable to suspend the operation of the surface condenser. In such case the valves *d n w* will be closed and the valves *f o* will be opened. The pump H being then set in operation, the condensing-water will be drawn in through the pipe *g*, and, issuing from the nozzle of the condenser, will pass downward in the cone *c* to the pump, and the steam entering through the pipe *s* will be condensed by the water, and the air and vapor, as well as the water resulting from the condensation of the steam, will mingle with the condensing-water and be discharged by the pump through the pipe *m*, the same as described in the Letters Patent referred to.

In conclusion, it is to be remarked that the condensing-water, instead of circulating through the surface condenser after leaving the pump H—that is, being forced through the condenser by the pump—may circulate through the condenser before reaching the pump—that is, be drawn through the condenser by the pump. In such case the condensing-water will enter the surface condenser from the source of supply, and after circulating through the condenser will flow into the injection or jet condenser, and will be withdrawn from the latter and discharged into a waste-pipe.

What I claim is—

1. The combination, with a surface condenser and an injection or jet condenser, of the pipe *r* and branch *s*, having valves *d f*, for delivering the steam to either condenser, and a pump communicating with the jet condenser to withdraw the condensing-water therefrom, and with the surface condenser to circulate the water therein, substantially as described.

2. The combination, with a surface condenser, of an injection or jet condenser communicating with the surface condenser to withdraw the air and vapor therefrom, and a pump communicating with the injection or jet condenser to withdraw the condensing-water therefrom, and with the surface condenser to circulate the water therein, and the pipe *r* and branch *s*, having the valves *d f*, for delivering the steam to either condenser, substantially as described.

3. The combination, with a surface condenser, of an injection or jet condenser, a

pipe connecting the two, by which the air and vapor are exhausted from the former by the latter, and a water-check located in said pipe, by which the condensing-water is prevented from entering the surface condenser, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES C. WORTHINGTON.

Witnesses:
B. W. PIERSON,
LOUIS R. ALBERGER.