

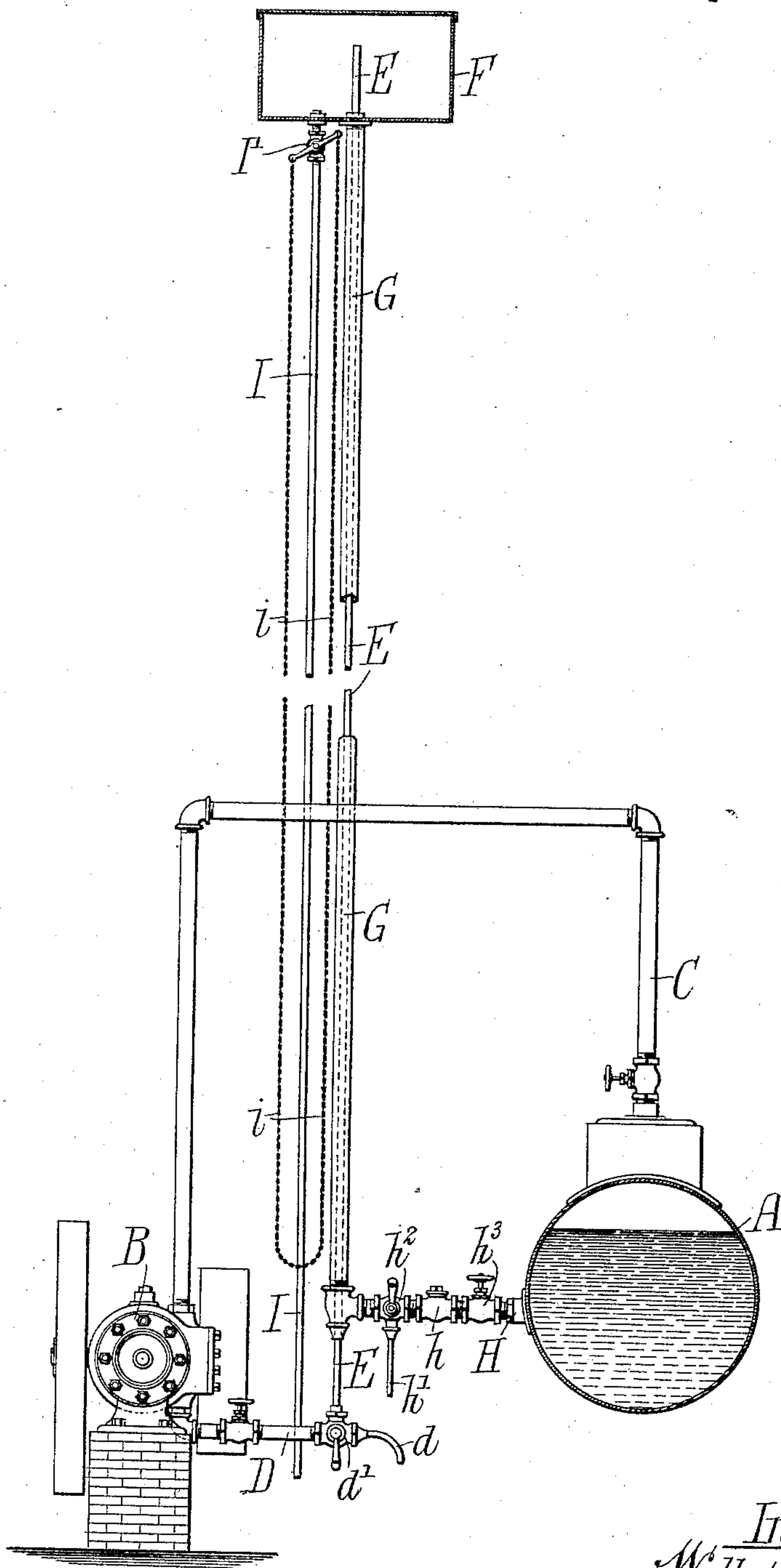
(No Model.)

W. BURNHAM.

STEAM LOOP CONNECTION FOR STEAM ENGINES.

No. 474,437.

Patented May 10, 1892.



Witnesses:-

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UNITED STATES PATENT OFFICE.

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STEAM-LOOP CONNECTION FOR STEAM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 474,437, dated May 10, 1892.

Application filed January 12, 1892. Serial No. 417,884. (No model.)

To all whom it may concern:

Be it known that I, WALTER BURNHAM, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful
5 Improvements in Steam-Loop Connections for Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawing, and to the letters of reference marked thereon, which forms a part of
10 this specification.

This invention relates to the application of what is known as the "steam-loop" to the exhaust of steam-engines; and it has for its object the attainment of greater safety, economy, and efficiency in the operation of such
15 engines.

In Letters Patent of the United States No. 394,859, granted to William Irving, December
20 18, 1888, is illustrated and described what is now known in the art of steam-engineering as the "steam-loop." In that patent, in so far as it relates to steam-engines, the steam-loop is applied to the steam-supply pipe of an engine, or, in other words, to the pipe conveying steam from a generator to the engine. Its
25 object there, as set forth in the patent, is to take the water of condensation and entrainment from the steam-pipe and thus deliver drier and hotter steam to the engine-cylinder. Obviously in that case the presence of the steam-loop in no wise affects the principle of operation of the engine, but only improves
30 its action to the extent that it accomplishes the specific results above pointed out. I have discovered that the steam-loop principle may be applied to the exhaust of a steam-engine, and that by such application not only may all the water of condensation be returned to
40 the boiler with the resulting advantage of economy, but that the mode of operation of the engine may be in a sense modified—that is to say, an engine discharging into the atmosphere must work above atmospheric
45 pressure and may by the application of the steam-loop to its exhaust be made to work successfully below atmospheric pressure.

Describing my invention with reference to

the accompanying drawing, A represents a steam-generator; B, a steam-engine; C, a steam-
50 pipe leading from the generator to the valve-chest of the engine, and D the exhaust-pipe leading from the engine-cylinder. The steam-loop device connecting the exhaust-pipe D with the interior of the generator below the
55 water-level of the latter is composed of the "riser" E, condensing-chamber F, drop-leg G, delivery-pipe H, and valved pipe I, through which the pressure in the condensing-chamber F may be exhausted. The riser E is con-
60 nected with the exhaust-pipe D of the engine and at its top terminates within and above the bottom of the closed condensing-chamber F. The drop-leg G of the loop leads downward from the bottom of the condensing-chamber F, and,
65 as here shown, embraces the riser E, being enough larger than the latter to give a suitable annular space for the accommodation and free movement of the water therein. At its lower
70 end the drop-leg connects with the pipe H, which opens into the generator below the water-line thereof and contains a check-valve *h*. The exhaust-pipe D is provided with an opening *d* into the atmosphere, controlled by a valve
75 *d'*, which may be a three-way valve, also controlling the opening into the riser E. The pipe H is further desirably provided with a drain-pipe *h'*, controlled by a valve *h*², and also with a stop-valve *h*³. The pipe I leads
80 from the bottom of the condensing-chamber F and is provided with a valve I', which, as shown, is located near the top of the pipe I and is operated by a depending chain *i*. The
85 lower end of the pipe I is open. Assuming the condensing-chamber F to be sufficiently elevated to give to the drop-leg G such a height that it may contain a column of water that
90 will balance the pressure in the generator E, the steam-loop will take all the steam and water delivered by the exhaust-pipe D and will transfer it in the form of water to the generator without great loss of heat and with
95 great economy in the consumption of fuel and safety in the operation of the engine. Even though under some circumstances the steam-loop connected with the exhaust may be al-

lowed to impose some degree of back-pressure upon the engine, its employment will be economical and desirable; but the loop may be so constructed, applied, and operated that
 5 it shall impose no back-pressure upon the engine, but, on the other hand, shall afford a more or less complete vacuum in the condensing-chamber F, whereby it shall positively assist the steam-pressure in the operation of the engine, thus enabling the latter to
 10 do its work with less boiler-pressure, while attaining the advantages of great economy in the restoration of water from the exhaust at a high heat to the boiler.

15 In putting the apparatus above described into operation the air is exhausted from and a vacuum created in the condensing-chamber F by any suitable means through the pipe I, in which the valve I' is opened for this purpose and then closed. Steam is then supplied
 20 to the engine as usual. The exhaust may be advantageously delivered into the atmosphere for a few turns of the engine by means of the cock d', which may then be set to give communication between the exhaust-pipe and
 25 the riser E of the loop. The water or water and steam then passing from the engine through the pipe D will rise through the riser E into the condensing-chamber F, where the
 30 steam so raised condenses to water, which falls into the drop-leg G. When a water column of sufficient height to balance the pressure in the boiler A shall have been accumulated in the drop-leg G, further accumulation
 35 therein will force the check-valve h open toward the generator and result in delivering a corresponding quantity of water from the bottom of the drop-leg into the generator. The operation will continue so long as sufficient
 40 heat is supplied to the water in the generator.

In illustration of the manner in which the steam-loop, applied as described to the exhaust of the engine, modifies or may modify
 45 the operation of the latter, I will suppose that the boiler-pressure be fifty pound plus, (or above atmospheric pressure,) and that the pressure in the condensing-chamber F be
 50 fourteen pounds minus, (or below atmospheric pressure.) Then the height of the water-column in the drop-leg G will be about one hundred and forty-eight feet high, and the
 55 pressure on the piston will be in effect sixty-four pounds to the square inch instead of fifty, or, in other words, will be steam-pressure of fifty pounds plus the vacuum of fourteen pounds.

As another form of illustration, suppose that when the engine exhausts into the atmosphere it takes five pounds plus of boiler-pressure (five pounds above atmospheric pressure) to move the engine, and that there
 60 is neither a plus nor a minus pressure in the boiler, but simply steam at atmospheric pressure, and that there is a fourteen-pound

vacuum in the condensing-chamber F. The water column of the drop-leg will then be only about thirty-three feet high and the pressure on the piston will be fourteen pounds to the square inch. Again, suppose that the pressure in the boiler is five pound minus (or below atmospheric pressure) and that the pressure in the condensing-chamber F is fourteen pounds minus (or below atmospheric pressure.) The water column in the drop-leg G will
 75 then be only about twenty-one feet high and the pressure on the piston will be nine pounds.

It is well known that steam at atmospheric or less pressure may be very cheaply produced and that the amount of water required
 80 will be small. It is therefore obvious that great gain must follow the putting of an engine and its generator in the closed circuit described, in which the steam-loop connects the engine-exhaust with the generator, and
 85 in using very low or minus pressure steam. Among these advantages are the absence of danger from explosions and the certainty that the engine will run and its generator be fed with water quite regardless of whether
 90 the boiler-pressure be plus or minus.

In this present application no reference is made to the objection that in many cases the drop-leg must be impracticably high, because
 95 in another patent, No. 394,828, granted to me on the 18th of December, 1838, as an improvement upon and developement in the aforesaid Irving invention, I have described how a series of short loops may be combined with each other to perform the operation of a
 100 single high loop. That invention is applicable to the combination of the steam-loop with the exhaust of an engine herein set forth, and in what manner it may be best employed is set forth in another application
 105 for patent filed by me of even date herewith.

The inclosure of one vertical member of the steam-loop in the other—as, for example, the inclosure of the riser within the drop-leg, as hereshown—is found in practice to be
 110 productive of much advantage in the avoidance of loss of heat. The exhaust-steam from the engine, rising through a pipe embraced within the column of water in the drop-leg, imparts its heat to said water and so far raises its temperature that if the drop-leg
 115 be also incased or jacketed properly the water returns to the boiler at very nearly the temperature of the boiler contents. It is noted and easily explained that the lower part of the column of water in the drop-leg is much hotter than that in the upper part of the column and hotter than the exhaust-steam of the engine.

I claim as my invention—

1. In combination with a steam-engine and a steam-generator supplying said engine, a steam-loop connecting the exhaust of the engine with the generator, the whole forming a

closed circuit embracing the engine and generator.

2. A steam-loop, constructed and operating substantially as shown and described, having one of its vertical members within the other.

3. The combination, with a steam-generator and an engine, of a steam-loop leading from the exhaust of the engine and having an elevated condensing space or chamber connected in the loop, and means whereby the

pressure in said chamber may be reduced below atmospheric pressure.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

WALTER BURNHAM.

Witnesses:

H. H. NEWMAN,

S. F. CHAMBERLAIN.