(No Model.) 2 Sheets—Sheet 1.

W. BURNHAM.

STEAM LOOP SYSTEM.

No. 474,439. Patented May 10, 1892.

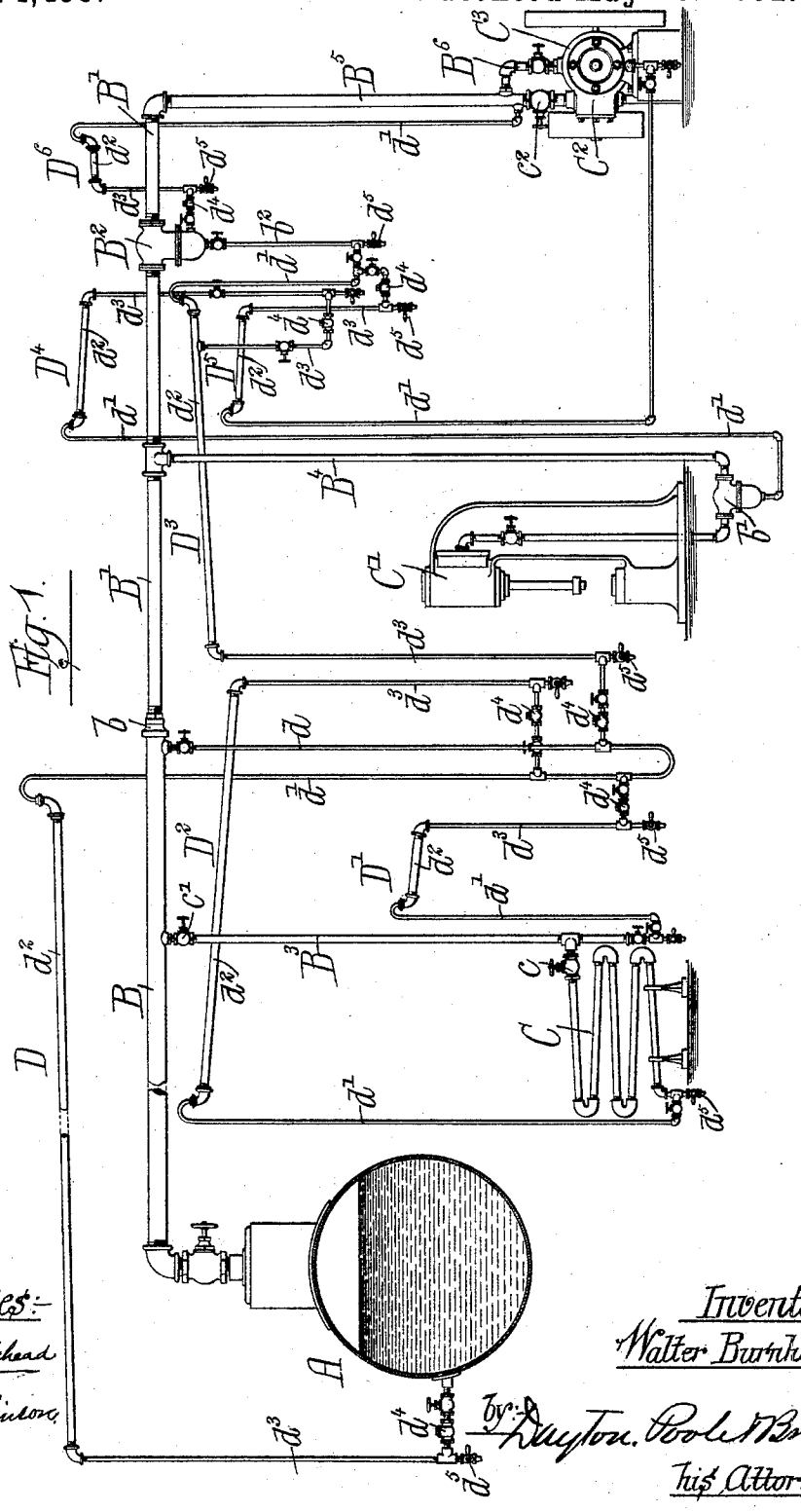

Fig. 1.

Witnesses:-
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C. E. Tomlinson.

Inventor:-
Walter Burnham.
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THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

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Fig. 4.

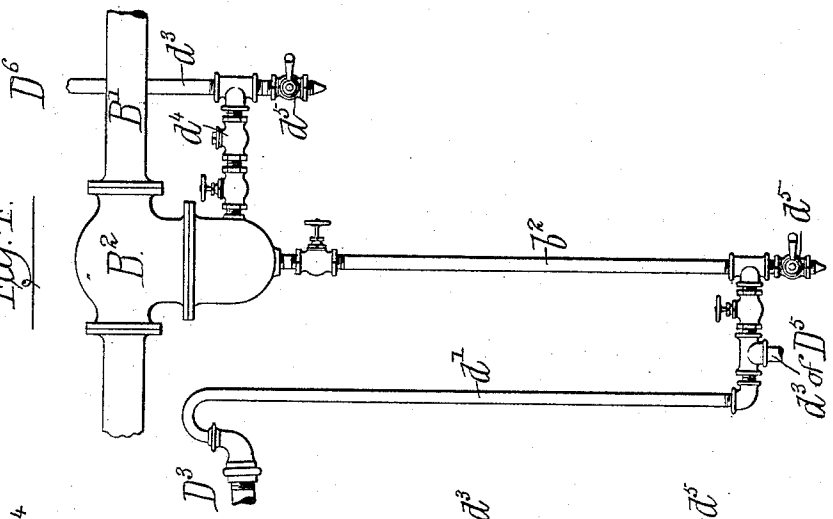


Fig. 3.

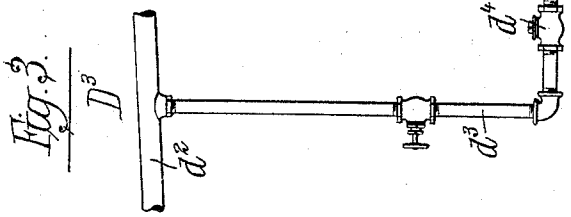
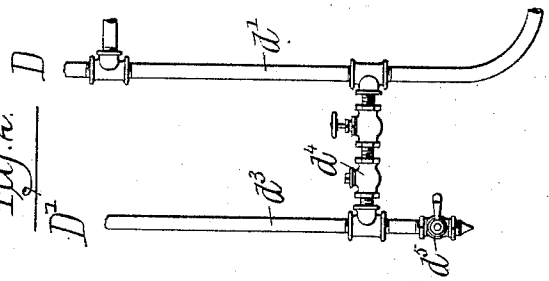


Fig. 2.



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His Attorneys.

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UNITED STATES PATENT OFFICE.

WALTER BURNHAM, OF CHICAGO, ILLINOIS.

STEAM-LOOP SYSTEM.

SPECIFICATION forming part of Letters Patent No. 474,439, dated May 10, 1892.

Application filed January 12, 1892. Serial No. 417,886. (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 Improvements in Systems of Steam-Loops for Steam Plants; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

It is proposed by this invention to provide an improvement in the application of a plurality of "steam-loops" to steam plants having such extent or containing such a number of steam-using devices as to require several loops to return to the generator the condense-water from its various parts or appliances.

The object of the invention is to make practicable the employment of any number of loops that may be desired without the expense, inconvenience, and other disadvantages involved in the extension of each loop into direct connection with the boiler.

The principle of construction and operation in the water-returning devices now known as "steam-loops" are set forth in the patent to William Irving, No. 394,859, granted December 18, 1888. In many steam plants, and particularly in many of great extent or employing a large number of steam-using appliances, it is practically impossible to employ so many loops as are desirable if each is to be connected directly with the boiler, owing to distance, variations in pressure, relative elevations, available vertical space, and other conditions, while in those cases where lateral distance is the only obstacle, the great expense of running all the loops to the boiler is a sufficient obstacle to their adoption. By the present invention all these objections are obviated and the use of as many loops as may be thought advantageous is made practicable.

The invention consists, essentially, in the combination, with a main loop, (which may or may not have direct connection with a steam-using mechanism,) of one or more auxiliary loops, usually operating severally with a steam-using device and discharging into the main loop, whereby the said main loop becomes a receptacle for the contents of the auxiliary loops, and the means of returning the water of condensation from all said auxiliary loops to the generator.

The nature of the invention and the variety of conditions to which it is applicable will be fairly illustrated by the accompanying drawings, which represent an actual and successful construction.

In said drawings, Figure 1 is a diagrammatic view of the entire plant, embracing a heating apparatus, a series of steam-hammers and a steam-engine, the series of coils and the series of hammers being severally represented by a single one. Figs. 2, 3, and 4 are enlarged details of certain of the connections shown in Fig. 1, Fig. 2 illustrating the delivery connection of the loop D′ with the main loop D; Fig. 3 showing the delivery connection of the loop D^4 with the horizontal of the loop D^3, and Fig. 4 showing both the connection of the separator with its drainage-loop D^5 and the delivery connection of loop D^6 with said separator.

A represents a steam generator or boiler.

B B′ are sections of a steam-main, say, about eight hundred feet long, connected with each other by a reducer at *b*, three hundred feet distant from the boiler.

B^2 is a separator connected into the steam-main near its outer end.

C is a heating apparatus supplied through a branch B^3 leading from the steam-main at a distance of about two hundred feet from the boiler.

C′ is a steam-hammer supplied through a branch B^4 leading from the steam-main at a point about five hundred feet from the boiler, and C^2 is a steam-engine taking steam through a branch B^5, connected with the end of the steam-main.

In addition to the steam-using devices above mentioned the cylinder of the engine is provided with a steam-jacket C^3, which is supplied with steam through a pipe B^6 leading from the branch B^5.

Seven steam-loops are necessary to accomplish all the desired objects in this plant. The branch-pipes B^3, B^4, and B^5 are vertical or descend from their connection with the steam-main B B′, so that desirably each of said branches is provided with a steam-loop at a low point therein. Another steam-loop is desired to take the discharge from the heat-

ing apparatus C; still another is required to take the water from the separator B^2, and another is employed to take the water from the steam-jacket of the engine-cylinder. This makes six. If all the six loops were separately connected with the boiler, the expense of running their lateral members the long distance necessary to reach the boiler would involve great expense. Moreover, the amount of the lowest pressure at certain points of steam use is very greatly below the boiler-pressure, and a loop from such low-pressure point of steam use connected directly with the boiler would need to be given relatively great height in order to afford the necessary water column to balance this difference in pressure. I therefore employ an additional loop, called the "main" loop, into which some of the six loops referred to directly deliver and into which all the six loops ultimately deliver their contents. This main loop is shown at D. It connects with the steam-pipe B near the reducer *b* by a descending pipe *d*, which for the purpose of affording proper connection with and operation of some of the auxiliary loops, as will hereinafter more fully appear, descends a considerable distance before connecting with the "riser" *d'* of the loop proper. The "horizontal" of the main loop D is shown at d^2 and its "drop-leg" at d^3. The drop-leg connects with the boiler below the water-line through the medium of a check-valve d^4, which opens toward the boiler, and the loop is provided with a blow-off d^5. The riser, the horizontal, the drop-leg, the check-valve, and the blow-off are present in each loop of the system and, where marked at all, are designated, respectively, by the same letters—to wit, *d'*, d^2, d^3, d^4, and d^5—the loops themselves being distinguished from each other by the general designating-letter applied to them as entireties. The boiler-pressure is, say, one hundred pounds, and at the point in the steam-main with which the pipe *d* connects the pressure is ninety-nine pounds, or one pound less than boiler-pressure. The main loop D is therefore a low one, which in the actual case here illustrated happens to be a necessity of the situation. It is this fact of lack of available space in which to erect a higher loop that practically determines the connection of the main loop D with the steam-main at or near the point *b*, instead of at the main separator B^2, at which latter point the pressure is ninety-four pounds. A main loop connected with the said separator B^2 and going to the boiler would obviously require to be of greater height than that of the main loop here shown and than the situation would allow.

D' is a loop for taking care of the drainage in the pipe B^3, which supplies the system of coils represented by C. The coil-cock *c* being closed and the cock *c'* being left open, the connection of the loop D' with the lower end of the pipe B^3 maintains a circulation in the latter and affords drainage for its water of condensation. The pressure in B^3 is only slightly less than in the steam-main B, and said loop D' may therefore deliver into the riser *d'* of the main loop D through the medium of only a short drop-leg d^3.

When the coil C is in use, the pressure at its drainage end is only, say, ninety-eight pounds. The available vertical space for the loop prevents the drainage from the coil being returned to the boiler by one loop, wherefore the auxiliary loop D^2 is employed, the drop leg d^3 of which delivers into the riser of the main loop D.

The pressure in the separator B^2 is, as stated, only ninety-four pounds. With this separator is connected the auxiliary loop D^3. Owing to the relatively low pressure in the separator the drop-leg of the loop D^3 requires to be of considerable height, and it is therefore connected with the main loop D by junction with a low point in the pipe *d*, which, as will now appear, is extended downward so far as indicated mainly for the purpose of giving a suitable height of drop-leg in said loop D^3.

The pressure in the branch steam-pipe B^4 and its separator *b'* is about ninety-five pounds, while that in the loop D^3 is about ninety-four pounds. Economy and convenience in construction demand that the auxiliary loop D^4, which drains the separator *b'*, should if possible deliver its water into the horizontal of said loop D^3, in which the pressure may be slightly less than in loop D^4. Other conditions are that the steam-hammer may be disused at times while the engine C^2 is in use, and vice versa, with the effect of relative fluctuations in pressure in the separator B^2 and its loop D^3 on the one hand and the separator *b'* and its loop D^4 on the other. To provide for such fluctuations, the riser *d'* of the loop D^4 is carried a considerable distance above the horizontal of the loop D^3, instead of delivering directly into it, and the drop-leg d^3 of said loop D^4 is carried first below the horizontal of the loop D^3 and then up into communication with said horizontal. If the steam-hammer C' be in use and the engine C^2 out of use, then the pressure in the loop D^3 may raise the water in the drop-leg of the loop D^4 higher than the horizontal of the loop D^3; but if the steam-hammer C' be not in use and the engine C^2 be running, then the greater pressure in the loop D^4 will force the water down and out of the descending portion of its drop-leg and hold it up in the ascending portion of said drop-leg.

The pressure in the cylinder-jacket C^3 is, say, only ninety-three pounds. Convenience and economy require that all of the engine connections should be near the engine. The loop D^5, which drains the cylinder-jacket, is therefore shown as being led away up and back to where its drop-leg enters the lower level of the riser of the loop D^3. As there is less pressure in the jacket C^3 than in the separator B^2, the pipe b^2, leading from the separator B^2 to the riser D^3, is carried downward, as shown, for the purpose of giving a suitable

drop-leg in the loop D^5, which is connected therewith and because the situation and conditions do not allow the extension of the loop D^5 above the relative height at which it is shown. Moreover, because there is considerable water of condensation from the jacket C^3 in the loop D^5 the drop-leg of said loop D^5 is extended downward into the lower level of the riser of loop D^3 in order that in this pipe the water delivered by the loop D^5 may be heated up by the steam before it enters the riser of loop D^3.

When the engine C^2 is not in use and its steam-cock c^2 is closed, it is desirable to keep the branch-pipe B^5 both hot and dry. In other words, it is desirable to maintain a steam circulation through the branch B^5 and to keep said branch clear of condense-water. Accordingly the loop D^6 is provided, having its riser d' connected into the branch B^5 close to the cock c^2. As the pressures in B^5 and B^2 are very nearly equal, the loop D^6 is led above the steam-main and the drop-leg of said loop is connected to deliver into the separator. Except that circumstances of situation require that the horizontal and drop-leg of loop D^6 be elevated out of the way it might be extended less high and connected into the pipe b^2, which leads from the separator B^2 or into the riser d' of loop D^3.

It will be observed that loops D', D^2, and D^3 deliver directly into the main loop D and that loops D^4, D^5, and D^6 deliver into the loop D^3. The main loop D is therefore the means for ultimately delivering water of condensation from all the points in the system at which it is accumulated and that by the combination of auxiliary with main loops in the manner illustrated drainage may be sent from any number of points in a steam plant, varying widely in pressure without the expense and inconvenience of long horizontal connections and without the necessity of giving the elevation to the loops leading from points of lower pressure, which would be required if such points were directly looped back to the generator.

It is obvious that the exact arrangement of auxiliary and main loops will vary in different plants; but the principles of construction and arrangement will be essentially the same as here indicated. It is also obvious that under some circumstances a plurality of main loops or loops directly connected with the boiler and each having auxiliaries may be advantageously employed, while of course in connection with a system of main and auxiliary loops one or more independent loops may in some situations be advisable.

I claim as my invention—

1. The combination, with a steam-generator and a pipe or pipes supplied from the generator, of a main steam-loop delivering water of condensation into the generator and one or more auxiliary loops delivering directly into the main loop.

2. The combination, with a steam-generator and a pipe or pipes supplied with steam from the generator, of a main steam-loop delivering water of condensation into the generator, and one or more auxiliary loops delivering into the main loop, and one or more other auxiliary loops delivering into a loop which delivers into the main loop, each of said auxiliary loops having direct delivery into the loop into which it discharges.

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.