(No Model.)

W. BURNHAM.

STEAM SEPARATOR.

No. 414,373. Patented Nov. 5, 1889.

Fig. 1.

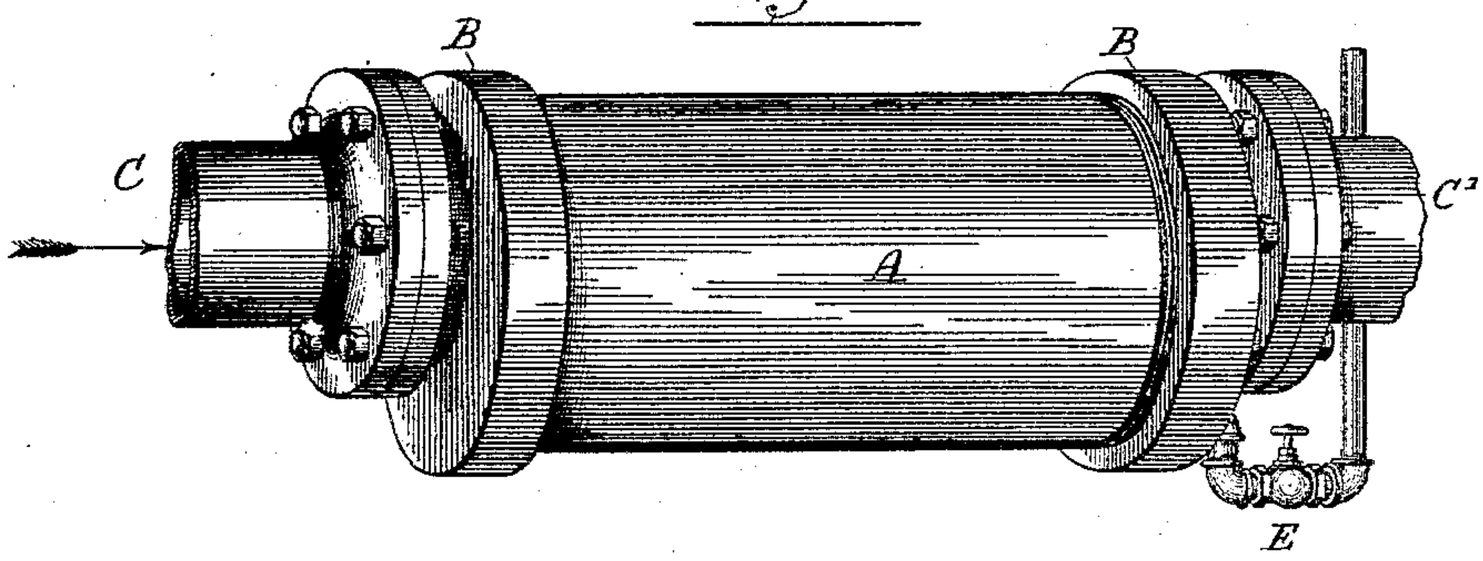


Fig. 2.

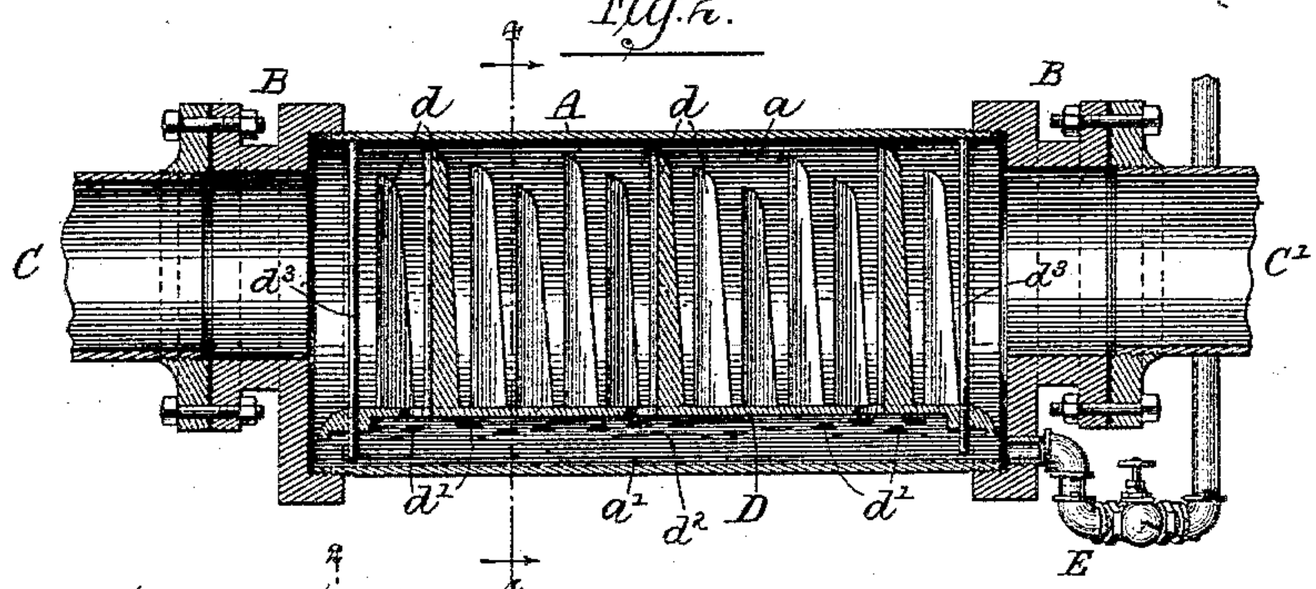


Fig. 3.

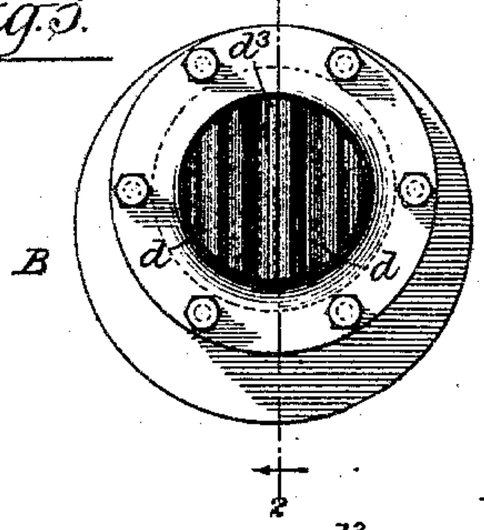


Fig. 4.

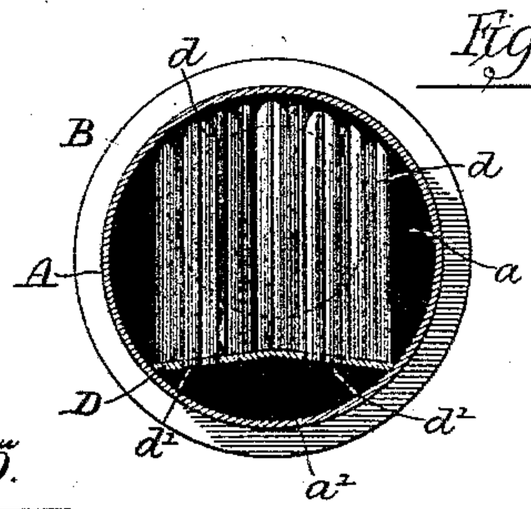
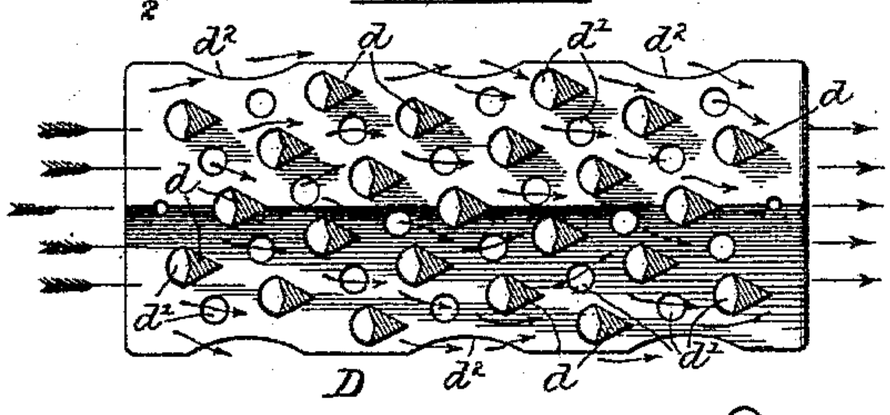


Fig. 5.



Witnesses:-

Louis M. T. Whitehead.

Wm. F. Fleming.

Inventor:-

Walter Burnham

by:- Dayton, Poole & Brown

Attorneys.-

UNITED STATES PATENT OFFICE.

WALTER BURNHAM, OF HYDE PARK, ILLINOIS.

STEAM-SEPARATOR.

SPECIFICATION forming part of Letters Patent No. 414,373, dated November 5, 1889.

Application filed February 21, 1889. Serial No. 300,741. (No model.)

To all whom it may concern:

Be it known that I, WALTER BURNHAM, of Hyde Park, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Steam-Separators; 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.

This invention relates to steam separators or devices for separating water from steam of that class which are connected in steam-supply pipes leading to engines and other steam-using apparatus.

It has among its objects, first, to provide a construction wherein the shell is of wrought metal, and therefore much stronger and less liable to deterioration from changes of temperature and consequent bursting than when made of cast-iron, as heretofore.

The invention has for another object to provide a more effective construction for accomplishing the purpose of breaking up the steam-current and arresting the particles of water therein.

The nature of the invention will appear from the following description of the accompanying drawings, in which—

Figure 1 is a perspective of the separator and its immediate connections. Fig. 2 is a central longitudinal vertical section. Fig. 3 is an end elevation. Fig. 4 is a transverse vertical section. Fig. 5 is a top view of the interior diaphragm and horizontal section of the studs which rise therefrom.

A represents a wrought-metal cylinder, which will usually be of iron or steel, and which, when of the diameter of merchantable tubing, may be cut from such tubing to the required length.

B B are the heads of the cylinder, which, when applied to sections of tubing, may be screwed to the latter, as indicated in the drawings. When the diameter of the cylinder A is to be greater than that of merchantable tubing, the cylinder may be made of sheets of wrought-metal plate riveted together like the plates of a steam-boiler, and the heads may be of the same material, riveted thereto in like manner.

C C′ are the sections of the steam-supply pipe, which connect with the separator at opposite ends thereof, the form of the connection with the heads of the separator being suitable to the dimensions of the apparatus.

D is a perforated diaphragm, which divides the chamber embraced by the cylinder A into upper and lower compartments *a* and *a′*. As shown, it is made of cast-iron and narrower than the cylinder at the bottom of the steam-inlet pipe C, so that when inserted in the cylinder A it may rest against the sides of the latter below the lower margin of the steam-pipe. This diaphragm is provided with upright studs or projections *d d*, extending to near the top of the cylinder, as shown in Figs. 2 and 4. As an especial improvement said studs *d* are made sectionally triangular in form, with one of their wide faces in the direction of the incoming steam. Preferably this front face of the studs is concave from side to side, as shown in Fig. 5, in order to better arrest the water contained in the steam impinging against said studs and to direct the same downward. Of the numerous apertures *d′* in the diaphragm D one is desirably located immediately in front of each of the studs *d*, in order to immediately and more certainly conduct the water arrested by the stud into the lower compartments *a′*. This result will be more perfectly attained by such location of some of the holes *d′*, because the steam arrested by the studs will in part sweep downward along their surface, and thus forcibly carry the water through the holes so placed. The diaphragm is also shown provided at its edges with notches d^2 to facilitate the passage into the lower compartment of water which may run down the sides of the cylinder or off the diaphragm. To enable the water to promptly drain from the upper to the lower compartment, the diaphragm D is preferably made to decline from its longitudinal median line to each side, as clearly shown in Fig. 4. It is also desirably shorter than the cylinder A or than the distance between the heads B B, so as to provide spaces, or at least a space, at the front end of the separator, by which water swept into the separator along the bottom of the induction-pipe C may speedily pass out of

the steam-current and down into the lower compartment *a'*.

While I do not wish to be restricted to any particular arrangement of the water-gathering obstructions within the separator, I have very carefully studied the effect of different arrangements of such obstructions and found that shown to be most advantageous. It will be seen from the drawings (particularly from the view given in Figs. 3 and 5) that steam which passes one of the studs will strike another, and that thereby all parts of the steam-current will be made to impinge upon one or more of said studs in its passage through the separator, and thereby enabled to deposit the water carried in suspension by it. I have also with equal care studied the arrangement of the holes *d'* to insure speedy transfer of water collected in the upper chamber *a* to the lower compartment *a'* of the separator; but other forms or arrangements of passages for this purpose may be adopted without departure from my invention.

It is desirable that the diaphragm D shall be located below the lower margin of the steam-induction pipe C or below the direct or more forcible current of the steam, in order that the water falling or accumulated thereon may not be again taken up and swept along by the steam-current, but may, on the other hand, be more free to run to the points of escape into the lower compartment *a'*. I also do not wish to be limited to the upright arrangement of the studs or obstructions *d*, since obviously they may be otherwise formed. Such vertical arrangement is, however, I believe, preferable to any other that may be given them.

The diaphragm D may be secured in its position so as to maintain its position against displacement in handling or putting up the separator by any suitable means. The devices shown for this purpose in Fig. 2 are vertical rods d^3, which are threaded through the diaphragm and bear at their upper ends against the top of the cylinder. By shortening these rods—*i. e.*, running them into the threaded holes in the diaphragm—the latter may be easily inserted, and afterward by running out the rods into forcible bearing against the top of the cylinder they serve to firmly press the diaphragm against the walls of the cylinder, and thus to retain it in place.

The steam-pipes may be connected concentrically to the cylinder-heads or eccentrically, as shown. In the smaller sizes the latter construction will usually be adopted in order to obtain as much depth of space as possible below the steam-pipe for the accommodation of the diaphragm and a considerable space beneath it. In other cases the same construction may be adopted to allow a steam-pipe to be placed near a ceiling.

The proportions which I prefer to give the separator are as follows: The cylinder is in diameter twice the diameter of the steam-pipe and in length four times the diameter of the steam-pipe, or twice its own diameter. These proportions may be, and often will need to be, varied, and it is one of the advantages of the construction indicated that such variation to meet particular situations may be made with the utmost convenience—as, for example, if space will not allow a cylinder of a particular length a shorter one may be substituted, or one that is both shorter and of greater diameter. As another example, these frequent cases may also be mentioned in which an excessive amount of water is entrained by the steam. In these cases the separator will need to be of unusual length or diameter. The diaphragm will commonly be made in short sections, and as many of these will be inserted as there is room for in the cylinder. Cast-iron separators made of fixed sizes cannot be thus varied.

Another important advantage of the improved construction described over the cast-iron separators hitherto used is their greater safety and durability. I have found by experience that cast-iron separators, though originally tested to stand a strain of two hundred pounds pressure to the square inch, and though standing for some time a pressure of, say, one hundred pounds per inch in use, finally burst at a much lower pressure—as, for example, at twenty-five to fifty pounds to the square inch. This is manifestly due to the disintegration of the metal by frequent and sudden expansion and contraction. No such difficulty is encountered in the improved construction herein set forth. The wrought-metal cylinder has the same enduring qualities as the steam-pipe itself, and its safety may be relied upon as certainly as that of said steam-pipe.

It will be observed that the studs or obstructions *d d*, having spaces between them, do not operate to any considerable extent to downwardly deflect the course of the more forcible steam-current, and that the extension of the studs below the steam-inlet pipe serves to carry the water thereon beyond or below such more forcible current and to drip it into a part of the separator whence it may escape by the eduction-pipe. In this respect they differ from the continuous depending "baffle-plates" of separators heretofore employed, which, while they gather and drain the water, finally drip it into the forcible current, by which much of it may be again taken up.

The discharge-pipe E shown in the drawings leads from the lower compartment *a'* of the separator, and, as indicated, has the upward direction peculiar to the so-called "Irving system" of returning water from a steam-pipe to a steam-boiler. This, however, is not material, as the separator may be used to discharge in other directions and through any sort of devices.

I claim as my invention—

1. The combination, with a wrought-metal cylinder and heads removably secured thereto, having openings for connection with the

steam-pipe, of a detached plate provided with studs inserted within the cylinder and affording a bottom water-space within the cylinder communicating with the space above it.

2. The separator described, comprising a horizontal shell having removable heads which are provided with eccentric openings for connection with the steam-pipe, a separate inserted diaphragm resting on the sides of the shell and constructed to afford passage from the space above to the space below it, and upright studs connected with said plate standing across the line of passage between the openings in the heads and an opening for the discharge of water from the space below the diaphragm.

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

WALTER BURNHAM.

Witnesses:
M. E. DAYTON,
P. H. T. MASON.