No. 751,717. PATENTED FEB. 9, 1904.

S. M. COCKBURN.

# DEVICE FOR COLLECTING AND REMOVING STEAM.

APPLICATION FILED OCT. 17, 1902.

NO MODEL. 3 SHEETS—SHEET 1.

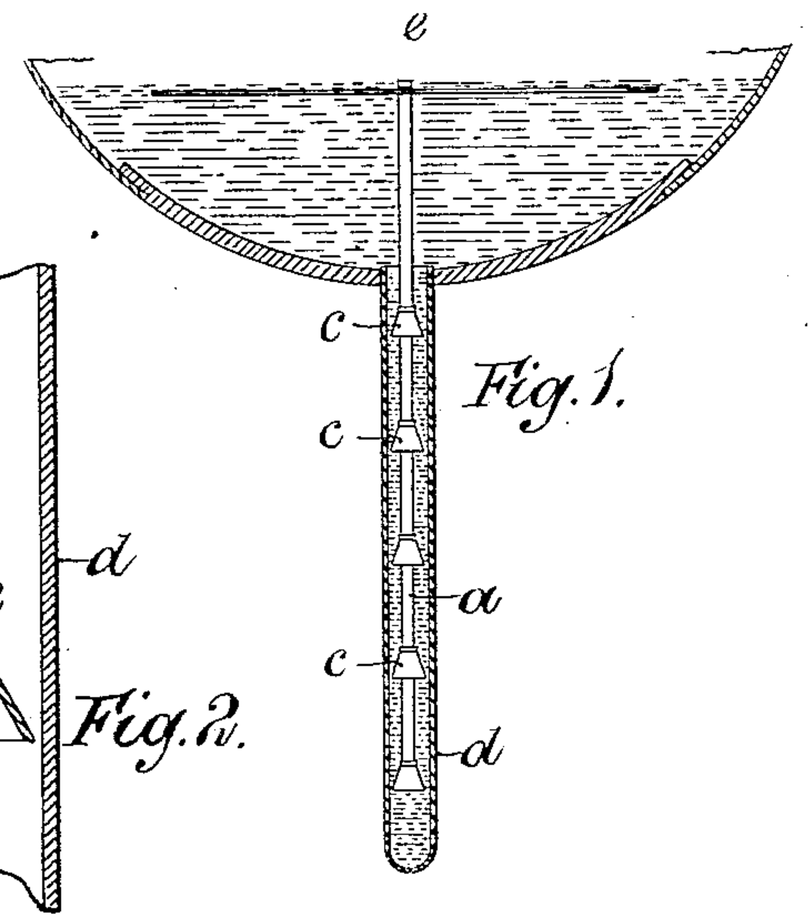


Fig. 1.

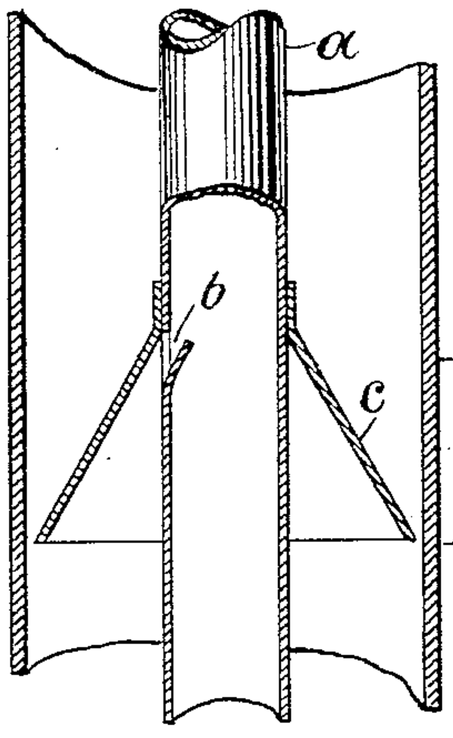


Fig. 2.

WITNESSES

J. M. Kuehne

J. M. Dowling

INVENTOR

Sidney Mauthorpe Cockburn

By Richards & Co

ATTORNEYS

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NO MODEL. 3 SHEETS—SHEET 2.

Fig. 4.

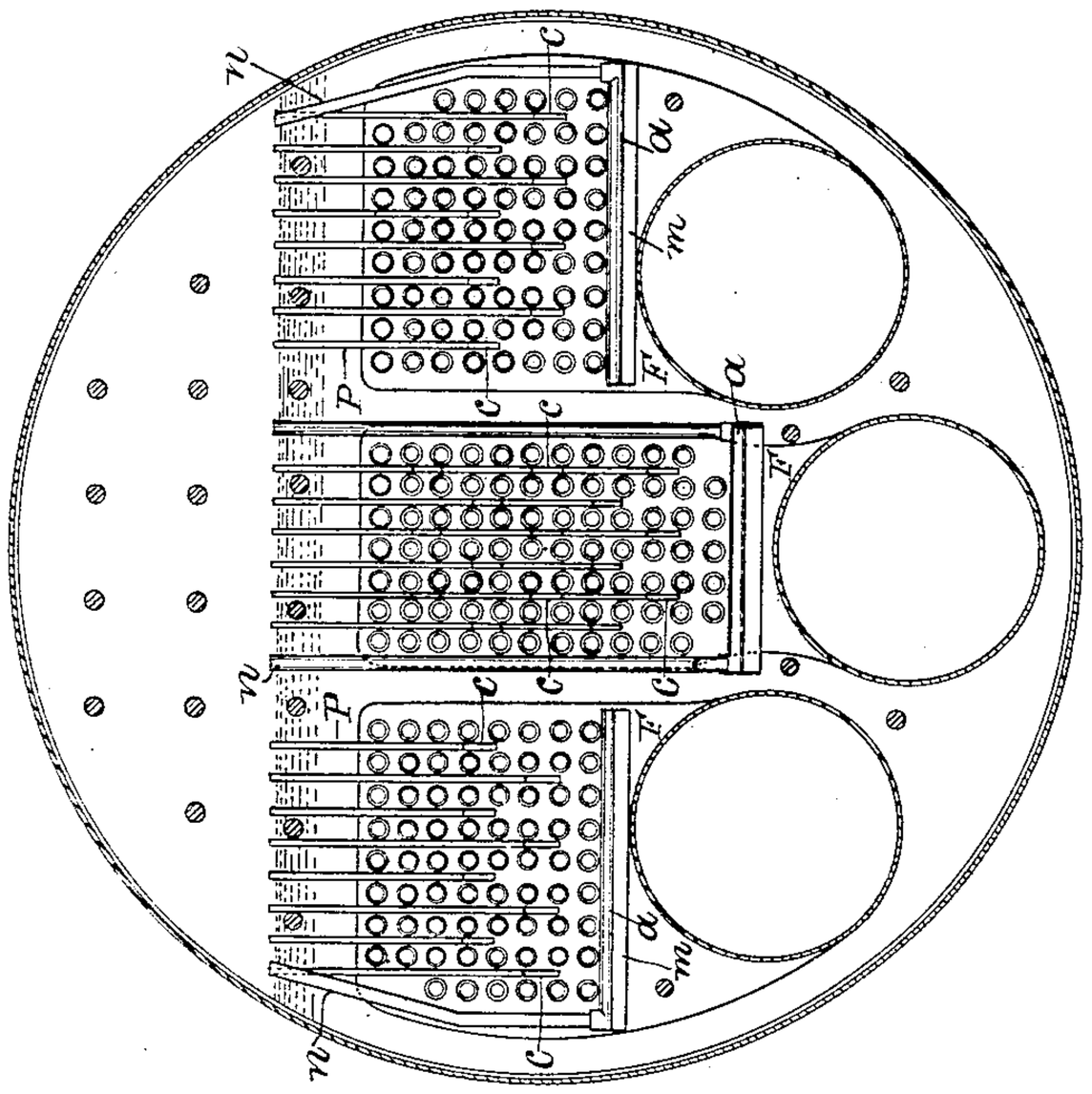
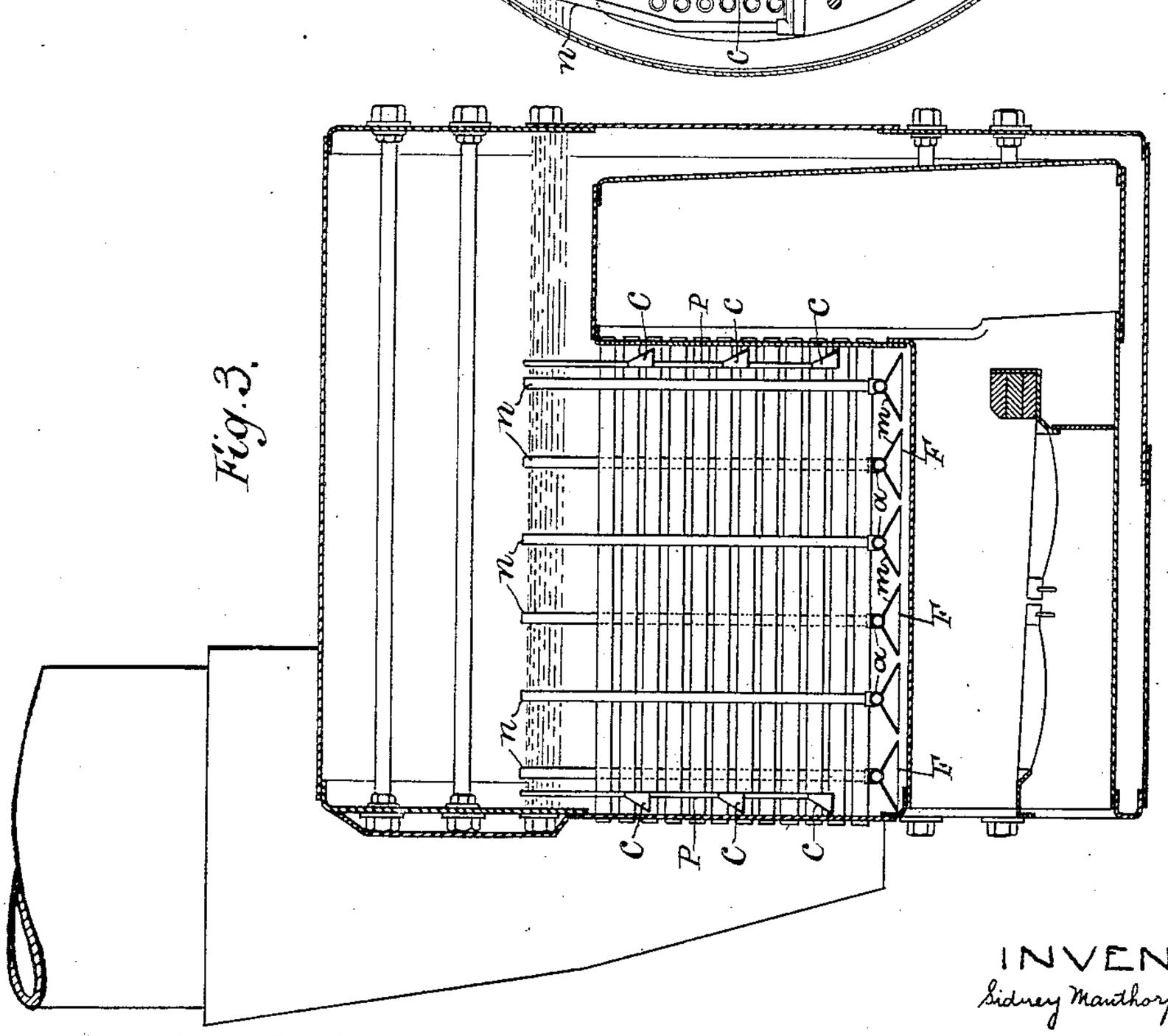



Fig. 3.




WITNESSES

J. M. Kuehne

J. M. Dowling

INVENTOR

Sidney Manthorp Cockburn

By Howson & Howson

ATTORNEYS

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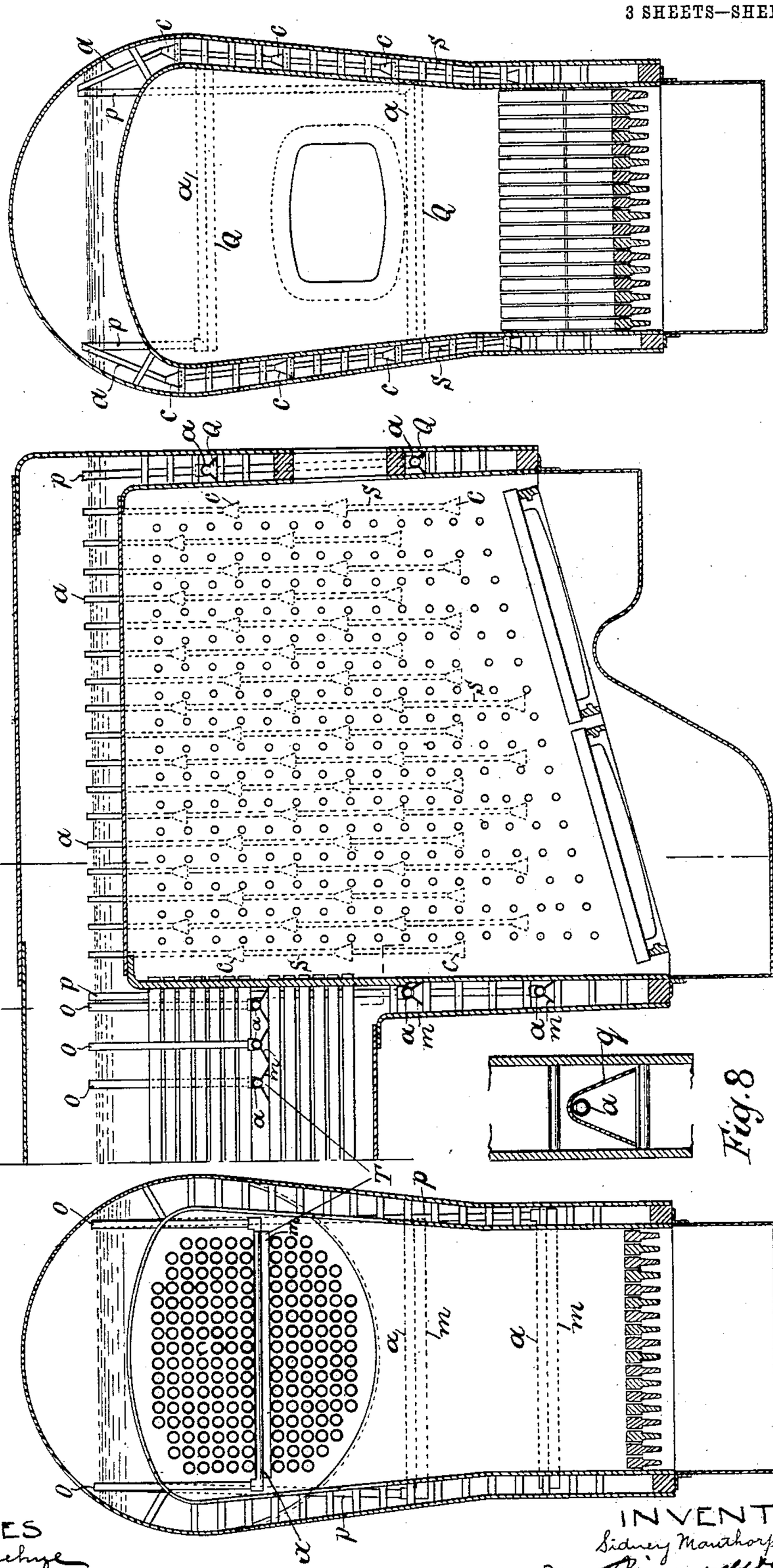
NO MODEL. 3 SHEETS—SHEET 3.

Fig. 1.




WITNESSES
J. M. Kuehye
J. W. Dowling

INVENTOR
Sidney Marthorp Cockburn
By Pierce & Co
ATTORNEYS

No. 751,717. Patented February 9, 1904.

# UNITED STATES PATENT OFFICE.

SIDNEY MANTHORP COCKBURN, OF LONDON, ENGLAND.

## DEVICE FOR COLLECTING AND REMOVING STEAM.

SPECIFICATION forming part of Letters Patent No. 751,717, dated February 9, 1904.

Application filed October 17, 1902. Serial No. 127,667. (No model.)

*To all whom it may concern:*

Be it known that I, SIDNEY MANTHORP COCKBURN, of No. 18 Southampton Row, London, W. C., England, have invented a certain new and useful Improved Device for Removing Steam from the Heating-Surfaces of Steam-Generators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a contrivance which is adapted to remove bubbles of steam from the heating-surfaces of steam-generators almost immediately on their formation and provide a means whereby they may be conducted to a steam drum or dome with comparatively small disturbance of the water in the boiler.

The object is to enable steam which has received from the heating-surface all the heat it requires to readily give place to water for which heat is wanted to convert it into steam with the twofold purpose, first, that of causing the heating-surface to transmit heat with greater rapidity, and thus increase the power of a boiler, and, second, to avoid the injury which so frequently arises from the undue heating of the surface by a lengthened contact with steam on the one and heated products of combustion on the other side.

The device may be applied under a variety of circumstances, as illustrated in the accompanying drawings.

The advantages due to the use of my device are derived from the fact that while bubbles of steam progress very sluggishly if they have to make their way by successive displacements of a mass of water which surrounds them, the steam itself will be able to flow with exceeding rapidity along a continuous channel devoid of water. Thus if a pipe be provided into which the steam can freely enter immediately on generation on the heating-surface such pipe will most efficiently serve the purpose of transmitting the steam by the adoption of a section quite small relatively to the section which would be occupied by the steam if it had to thread its way through the mass of water unconducted. Moreover, this small section, which in my device is provided for the transit of the steam, is isolated from the heating-surface by intervening water, and thus the heating-surface is rendered permanently effective for heat transmission and free from danger of overheating.

Figure 1 shows the most simple application of my device, and may be understood by regarding it as a Field tube with reversed flow. Fig. 2 is a section, on an enlarged scale, of a portion of this tube. Figs. 3 and 4 show how my invention is applied to a marine boiler of the cylindrical tubular type. Figs. 5, 6, and 7 represent similar contrivances applied to a locomotive-boiler; and Fig. 8 shows, on an enlarged scale, a modification of a detail of one form of my extractor.

In all the figures there is a tube *a*, which leads from the close proximity of a portion of the steam-generating surface of the boiler to the steam-space. In the surface of this tube a number of perforations *b b* are provided for the inflow of the steam which is generated in the neighborhood. In all the figures the tube *a* stands at a little distance from the heating-surface and at intervals along its length funnels *c c* are attached, the edges of which extend sufficiently far to be quite or nearly in contact with the heating-surface for the purpose of gathering ascending bubbles of steam and conducting them through the perforations *b* into the tube *a*, and thus remove them from contact with the heating-surface. In several of the figures the perforated tube *a* is also shown horizontally placed, in which case the function of the funnels is performed by wing-plates *m m*.

Fig. 1 shows the most simple application of my invention, in which the action is somewhat like that of the well-known Field tube, but with the direction of flow reversed. In this the tube *d* is supposed to dip into a furnace or be surrounded by heated products of combustion which cause the generation of steam on the internal surface of the tube. The bubbles of steam thus formed will on rising be intercepted by the edges of the cone-shaped funnels *c c*, which project from the tube *a*. Near the apex of each of the cones an aperture *b* is made in the tube. This allows the steam which has collected in the cone to pass into

the tube *a* and be transmitted directly to the steam-space *e*. The most efficient proportions will be those which are just capable of admitting and transmitting the steam alone without any water. The situation of the orifice is such that steam will have precedence, but if the rate of generation is not sufficient to provide all the steam which under a difference of pressure due to the head of water outside the tube *a* can pass through the orifice *b* then water will follow or accompany the entering steam and by occupying a portion of the tube *a* will lessen the head. In this way an automatic adjustment will take place. On account of the very small resistance to the flow of steam as compared with that of water a very small tube free from water and a very small perforation in it will be sufficient to conduct away a large volume of steam. The almost immediate removal of the steam from the heating-surface of the tube *d* will, by enabling that surface to be permanently in contact with water, largely augment the quantity of steam generated on its surface, and thus increase the boiler-power.

Fig. 2 shows on a larger scale a portion of the tube shown in full in Fig. 1. The same contrivance can be advantageously fitted into a tube which is not closed at the lower end and which is somewhat inclined to the vertical, as in the Yarrow type of boiler.

In Figs. 3 and 4, which are respectively a longitudinal and a transverse central section of a cylindrical marine boiler, two forms of my device are exhibited. One arrangement, F, serves to extract the large quantity of steam which is generated on the surface of the cylindrical furnace and convey it direct to the steam-space without having to pass between the tubes which are situated above the furnace. In this arrangement the perforated pipe *a* is horizontal and is provided with wing-plates *m m*, the perforations being in the bottom of the pipe *a*. To one end of *a* a vertical pipe *n* is connected, the upper end of which is above the water-surface. The other arrangement, P, serves to extract the steam which is generated on the tube-plates. On account of the narrow space between the tubes the funnels *c c* are very flattened. The lower edges of the funnels are situated to stand on a level with the narrowest width between the tubes, and thus the surfaces of the tubes themselves partly perform the function of the funnel. Figs. 5, 6, 7, and 8 represent similar contrivances applied to a locomotive-boiler. Fig. 5 is a vertical longitudinal section. Fig. 6 is a transverse section along the line 11 11 of Fig. 5, and Fig. 7 is a transverse section along the line 12 12 as seen when looking toward the furnace-door. In this case the tubes are closer together than in a marine boiler, so that very narrow funnels and a tube of especially small diameter or flattened section would be requisite if the contrivance P of Figs. 8 and 9 were adopted. Although even in this case such an arrangement would be satisfactory, an alternative method T is shown. For this purpose a row of tubes is omitted from about the center of the nest, and a number of tubes *a*, perforated along the bottom and provided with wings, are inserted in the vacated space, each horizontal tube *a* being connected with a vertical member *o*. Of that nearest the fire-box the edge of the wing is caused to be in contact with the tube-plate, and thus all the steam generated on the lower half of the tube-plate and on the first short length of the tubes secured to that half is intercepted and conducted to the steam-space without being permitted to grope its way between the overlying tubes and interfere with the free access of water to them. The other elements, T, serve a similar purpose, but with less and less effect the farther they are from the fire-box. Hence it will probably be undesirable to insert more than a limited number. In these drawings there is also shown an arrangement Q, which is like that lettered T, and of which the horizontal member *a*, with its wings, is inserted through a suitably-situated hand-hole provided in the exterior shell of the fire-box. This extracts the steam which is formed on the furface of the fire-box immediately below it and by means of a vertical pipe *p* conducts it directly to the steam-space. This arrangement Q is fitted to abstract the steam and provide water more free from bubbles on the front and back surfaces of the fire-box. From the sides of the fire-box the steam is abstracted by a number of elements S, each of which consists of a vertical perforated tube *a*, carrying a number of funnels *c c*, such as has been previously described, the inverted mouth of the funnels being rectangular and placed with one edge in contact with the fire-box surface.

Fig. 8 shows an alternative method of constructing the contrivance named F in Figs. 8 and 9 and T and Q in Figs. 5, 6, and 7. In this the tube *a*, perforated in its upper surface, is threaded through the end plates of a hood *q* at the upper portion thereof. In this way *q* forms the funnel for collecting the bubbles and *a* provides the channel for conducting the steam away.

My invention can be carried into effect in any one of these various ways. Each is adapted to the special circumstances of the case, but all depend for their efficiency on the principle of providing a perforated channel leading to the steam-space, the perforations being disposed in such a way that steam in the neighborhood shall have precedence of entry before water.

Instead of requiring a brisk circulation of the water in order that the steam formed may be as speedily as possible removed from contact with the heating-surface by entraining the bubbles of steam in the stream of water which has hitherto always been aimed at in the boiler

design I am able to attain the desired result in a much more perfect manner by the simple devices which have been described.

I claim—

1. In steam-generators having heating-surfaces so situated that the steam generated thereon tends to pass in contact with them in rising to the steam-space, a device for collecting the steam by simple gravity action consisting of pipes, not exposed to the source of heat, leading to the steam-space from the neighborhood of the heating-surfaces, orifices in said pipes, and protruding deflecting-plates leading to said orifices thus directing the steam to the orifices.

2. In steam-generators having heating-surfaces so situated that the steam generated thereon tends to pass in contact with them in rising to the steam-space, a device for collecting the steam by simple gravity action consisting of pipes, not exposed to the source of heat, leading to the steam-space from the neighborhood of the heating-surfaces such pipes having orifices situated underneath inverted-funnel-shaped surfaces the edges of which are placed near heating-surfaces which are situated in a nearly-vertical position.

3. A device for collecting steam, and removing it from passing upward in contact with higher situated portions of the heating-surfaces of a boiler, consisting of an inverted trough in the upper portion of which is placed a perforation-pipe leading by an ascension-pipe to the steam-space.

In testimony that I claim the foregoing as my invention I have signed my name in the presence of two subscribing witnesses.

SIDNEY MANTHORP COCKBURN.

Witnesses:
T. A. HEARSON,
WALTER J. SKERTEN.