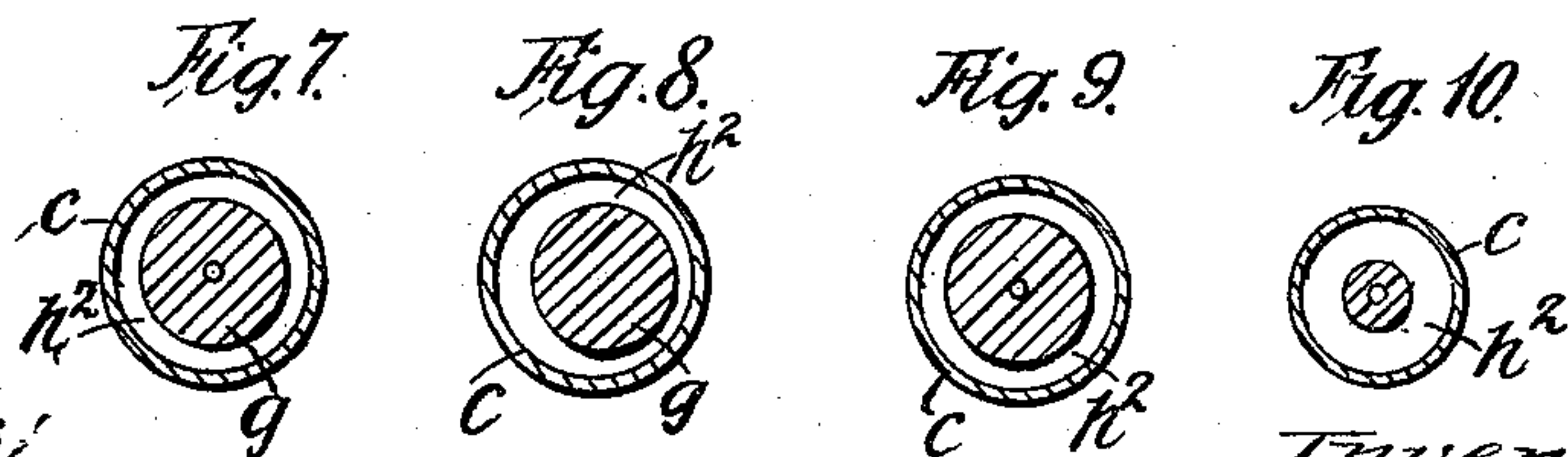
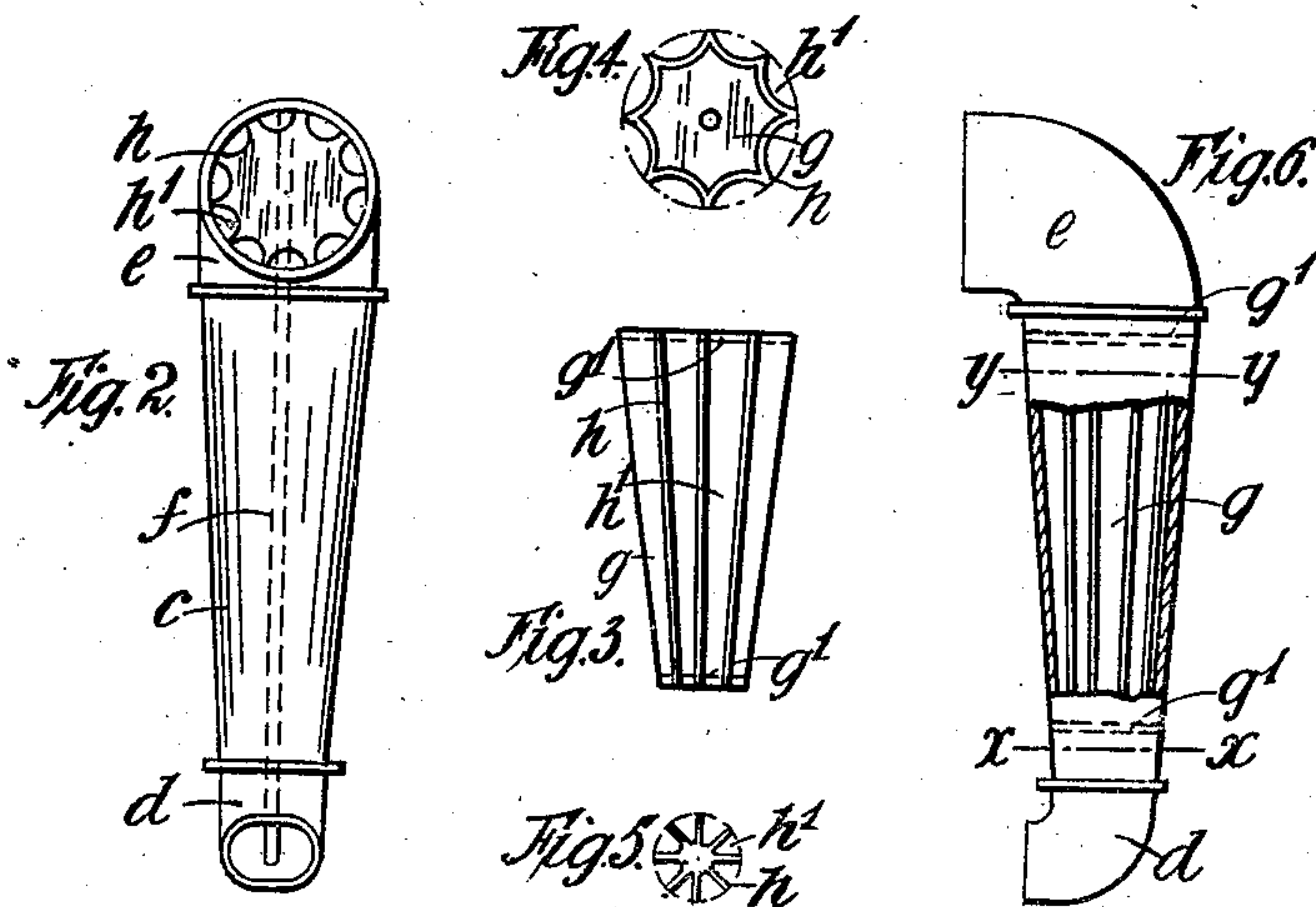
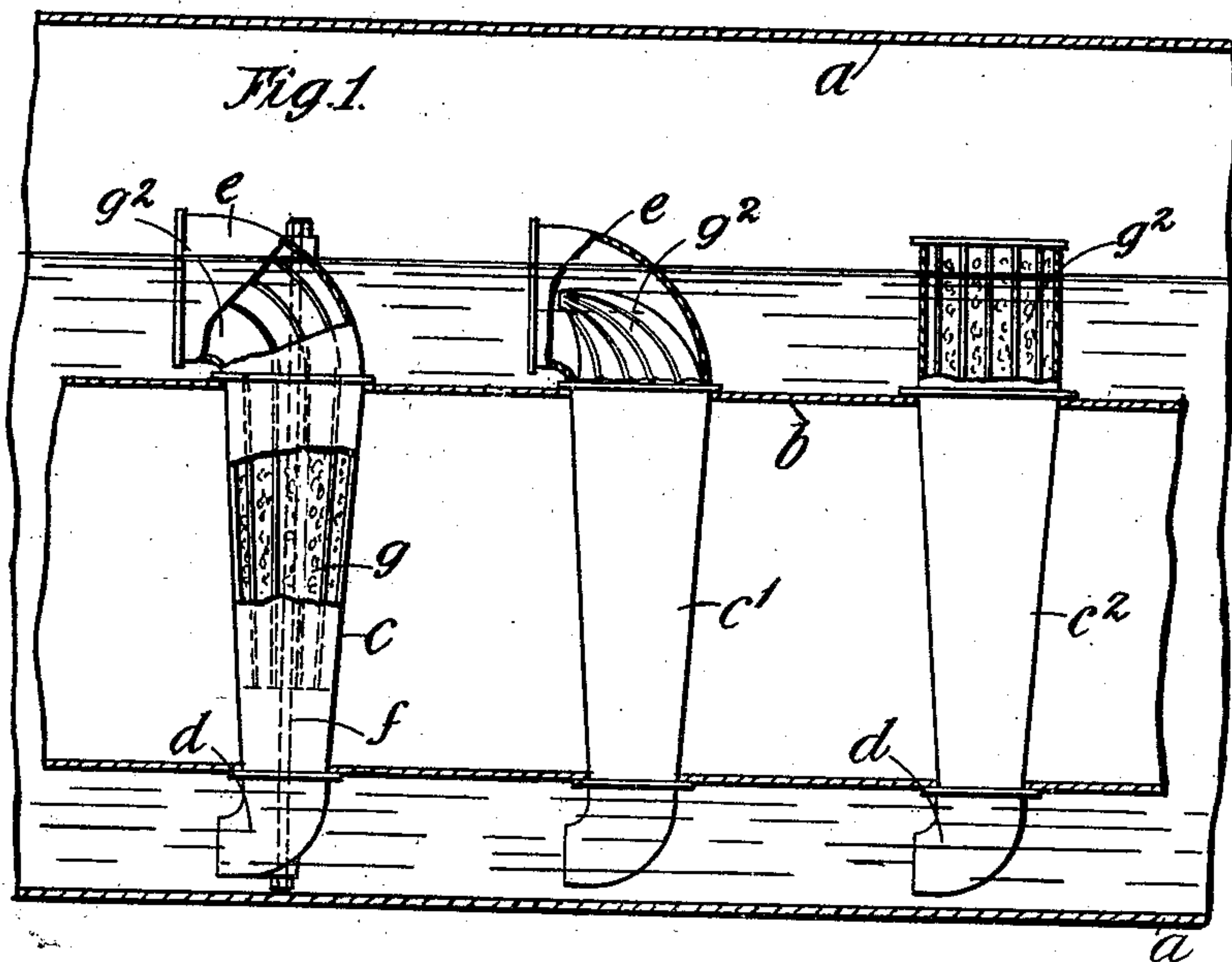


No. 842,024.

PATENTED JAN. 22, 1907.

H. SCHOFIELD.
STEAM BOILER.

APPLICATION FILED DEC. 15, 1905.



Witnesses:
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UNITED STATES PATENT OFFICE.

HARRY SCHOFIELD, OF LONDON, ENGLAND, ASSIGNOR OF ONE-THIRD TO
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STEAM-BOILER.

No. 842,024.

Specification of Letters Patent.

Patented Jan. 22, 1907.

Application filed December 15, 1905. Serial No. 291,884.

To all whom it may concern:

Be it known that I, HARRY SCHOFIELD, en-
gineer, a subject of the King of Great Brit-
ain, residing at 1^a Bryantwood road, Dray-
ton Park, London, N., England, have invent-
ed certain new and useful Improvements in
or Relating to Steam-Boilers, of which the
following is a specification.

This invention has reference to steam-boil-
ers, especially to those having internal fur-
naces or flues, such as Lancashire and Cor-
nish boilers, and relates more particularly to
boilers in which cross-tubes are fitted in the
said internal furnaces or flues.

In cross-tubes or water-circulation tubes
as usually arranged the water in the center
thereof is liable to remain idle and compara-
tively cold and dead, thus retarding the pro-
duction of steam, since only the water near
the circumference or side wall of the tube can
come under the action of the flames and heat-
ed gases.

In order to obviate this disadvantage, ac-
cording to the present invention the center
part of the cross-tube or circulation-tube is
occupied by a core, filling-piece, or plug, pro-
vided, preferably, with vertical inclined or
spiral grooves, flutings, or corrugations,
which serves to displace the idle or dead
water of the cross-tube, leaving around it a
relatively narrow or restricted water space or
channel containing a thin body or jacket of
water, which, being near the circumference
of the tube, and therefore subject to the full
heating effect, becomes rapidly raised to
boiling-point and is thrown into active cir-
culation. Hence a very quick generation of
steam is secured. The boiler becomes equiva-
lent, in effect, to a small tube-boiler, while
preserving the advantages of the cylindrical
or shell type of boiler.

As the cross-tubes or water-tubes usually
become wider at the top, the core or plug,
which may for distinction be termed a
"steaming-core," is made to correspond; but
it may be of any desired shape in cross-sec-
tion or arranged in any convenient way in
order to vary the thickness of liquid between
it and the wall of the tube at different points,
as may be found desirable. For instance, it
may be ribbed, fluted, or corrugated, if de-
sired, vertically or otherwise.

The invention will be more readily under-
stood by reference to the accompanying
drawings, in which—

Figure 1 is a longitudinal section of part of
an internal-flue boiler, showing by way of
illustration three different modes in which
the steaming-cores and cross-tubes may be
arranged, though only one type would usu-
ally be employed in one and the same boiler.
Fig. 2 is a separate front elevation of the first
cross-tube—that is to say, the one toward
the left, Fig. 1. Fig. 3 shows the filling-
piece or steaming-core separately in eleva-
tion, the same being in this instance provided
with ribs, corrugations, or flutings. Figs. 4
and 5 are respectively upper and lower end
views of the said core. Fig. 6 is a side view
of the cross-tube with part of the wall thereof
broken away to show the core in position.
Figs. 7 to 10 are detail cross-sectional views,
hereinafter referred to.

Referring first more particularly to Fig. 1, *a*
represents the shell of the boiler, which may be
of the well-known Lancashire or Cornish type.
b is an internal flue or furnace of the usual
kind, and *c c' c''* are cross-tubes or circulation-
tubes. In the example shown these cross-
tubes are formed with a taper, so that they
are wider at the top than at the bottom.
They are provided with inlet-nozzles, hoods,
or elbows *d* at their lower or narrower ends
and outlet-nozzles or hoods *e* at their upper
or wider ends for promoting and directing
the circulation of water, these hoods being
securely clamped in position, for example, by
nuts *f'*, working on tie-rods *f*, passed centrally
down the cross-tubes *c*. These nozzles *d* and
e may, as in Fig. 1, be both directed toward
the front of the boiler in order to set up a lon-
gitudinal circulation therein—that is to say,
to cause the water to flow along the top of
the flue toward the boiler-front and then
back under the bottom of the flue. The filling-
piece or steaming-core, to which the present
invention more particularly applies, is shown
at *g* and may be of plain, circular, or other con-
venient shape in cross-section and has a ta-
per corresponding to that of the cross-tube,
practically so. In the example illustrated,
however, it is provided with straight or ver-
tical ribs or ridges *h*, which divide the cir-
cumference into vertical channels, corruga-

tions; or flutings h' all around it. The said ribs or ridges h fit close against the inner walls of the cross-tubes, so that the channels or flutings form, as it were, separate tubes of small cross-sectional area, and hence the water within them becomes highly heated and is rapidly thrown into energetic circulation, as occurs in what are known as "small-tube" or "express" boilers.

The ribs and flutings instead of being straight may obviously be made more or less inclined or spiral, if desired.

The steaming-core may either be solid, or it may have a suitable filling in its interior. It may, moreover, be hollow and simply have a closure, say, at the bottom, its interior being left full of water, which being allowed to remain idle will soon acquire a high temperature and will therefore not interfere materially with the rapid production of steam. Thus in the example illustrated in Fig. 4 in connection with the first cross-tube or circulation-tube—that is to say, the cross-tube c —the filling-piece is provided at each end with end plates or covers g' to prevent the free circulation of water through the center of the core. The tie-rod f is passed centrally through these covers. Thus the arrangement is practically equivalent to a solid core without the inconvenience due to the weight of the solid metal in the latter.

The steaming-core or filling-piece may either terminate near the top of the furnace b , as in the arrangement shown in the cross-tube c , or it may be continued upward into the hood or nozzle e , as shown in connection with the second cross-tube c' . In the latter case the said hood may have a filling-piece g^2 of its own adapted to fit onto and form a continuation of the main filling-piece, or the latter may be formed or provided with a bent-over extremity or elbow corresponding to the piece g^2 . This extremity g^2 may be contracted or tapered to a point in the center of the mouth of the hood or nozzle e , as shown in the example illustrated. According to another modification, as shown in connection with the third cross-tube c^2 , the upper elbow or hood e may be dispensed with, or rather it may be replaced by a short upright cylinder or nozzle e' , through which the filling-piece or core g may extend upward, as shown at g^3 , this extension g^3 being either integral with the core or being a separate piece or block fitted thereon.

It is to be understood that although three cross-tubes are shown this is only for purposes of illustration and to show different modifications already, since the invention can be carried out with either kind separately.

Although in the arrangements above described the filling-piece or core is referred to as being fluted or corrugated, yet in some cases the said core may simply be of plain

circular form in cross-section, as represented in Fig. 7, which is a detail cross-sectional view through the cross-tube on the line $x x$ of Fig. 6, but indicating a filling-piece without any flutings or corrugations. In this case the circumferential water-space in the tube becomes a plain annular channel or passage h^2 , corresponding, however, to the flutings or channels h' and analogous to them in action. Moreover, the arrangement of the tube and core may, if desired, be such, for instance, that there is more liquid at the front of the tube where the fuel-gases impinge than at the rear, and with this object the core may be disposed toward one side eccentrically or otherwise, as shown in Fig. 8, which is a corresponding section to Fig. 7. It may also be desirable to make the area of the water-space around the core approximately equal at its upper and lower ends, and this may be done either by making the flutings h' deeper toward their lower ends (compare Figs. 4 and 5) or by reducing the diameter of the lower end (see Fig. 10) of the core to a greater extent than would otherwise be the case. By the latter arrangement the width of the space h^2 between the tube and the core becomes greater at the lower part, Fig. 10, than at the upper part, Fig. 9, these in Figs. 9 and 10 being, respectively, cross-sections on the lines $x x$ and $y y$, Fig. 6, thus compensating for the reduction in size or radius at the lower part and keeping the actual area h of the free water space or passage practically uniform throughout the length of the tube c .

The core or filling-piece may be of cast-iron, gun-metal, stamped sheet metal, or other suitable material and, as stated, may be solid or hollow, and its surface may be smooth or glazed, or even be enameled, to obviate the adherence of scale thereto.

In some cases the core or filling-piece may rest inside the tubes on radially-projecting points or rests, of which there may be, say, three at the top and three at the bottom, adapted to fit the taper of the tube.

Obviously the invention may be modified in a variety of ways without departing from the essential features thereof.

What I claim, and desire to secure by Letters Patent of the United States, is—

1. In a steam-boiler, the combination of a longitudinal flue, cross-tubes for water arranged transversely of the said flue and open at top and bottom, and filling means extending approximately from the top to near the bottom of the cross-tube for confining the water to the circumference of such cross-tubes, so as to form a thin annular body of circulating water inside said cross-tubes, substantially as described.

2. In a steam-boiler, the combination of a flue, a cross-tube containing water, and means extending approximately from the top to near the bottom of the cross-tube for forming

an obstructed annular space inside said cross-tube through which the water can flow directly upward from the space below the flue to the space above it.

5 3. In a steam-boiler, a water-tube, means inside said tube extending approximately from the top down to near the bottom of the latter for forming an annulus of circulating water, and a hood at the top of said tube for
10 directing the outflow of water therefrom, substantially as described.

4. In a steam-boiler, the combination of a cross-tube, means extending from the top
15 down to near the bottom of the tube for forming an annular water-passage in same, and means for discharging the water from said tube into the water in the boiler, in a horizontal direction, substantially as described.

5. In a steam-boiler, the combination of a
20 cross-tube, a core inside same extending from the top thereof down to near the bottom of said tube through which water cannot pass, such core having an annular space between itself and the cross-tube, and means for direct-
25 ing the water which flows out of the top of the tube and causing it to flow away in a horizontal direction, substantially as described.

6. In a steam-boiler, the combination of a
30 cross-tube, a core inside same extending from the top down to near the bottom of the tube through which water cannot pass, such core

having an annular space between itself and the cross-tube, and an elbow-shaped hood at each end of said cross-tube, substantially as described.

7. In a boiler, the combination of a longitudinal flue, a circulation-tube extending
35 across said flue, a filling-core within said tube, forwardly-directed nozzles extending within the boiler and carried by opposite ends of the
40 tube, and a tie-rod extending through the interior of the said core and exterior of the nozzles for retaining the latter in position on the tube.

8. In a steam-boiler, the combination of a
45 longitudinal flue, a circulation-tube fitted across the ends of said flue, a filling-core within said tube, forwardly-directed nozzles at the upper and lower ends of said tube, and
50 adapted to extend within the boiler for directing the flow of water, and a tie-rod passing through the core and nozzles for maintaining the same in position with respect to the flue.

In testimony whereof I have hereunto set
55 my hand, in presence of two subscribing witnesses, this 24th day of August, 1905.

HARRY SCHOFIELD.

Witnesses:

C. BARNARD BURDON,
ALFRED NUTTING.