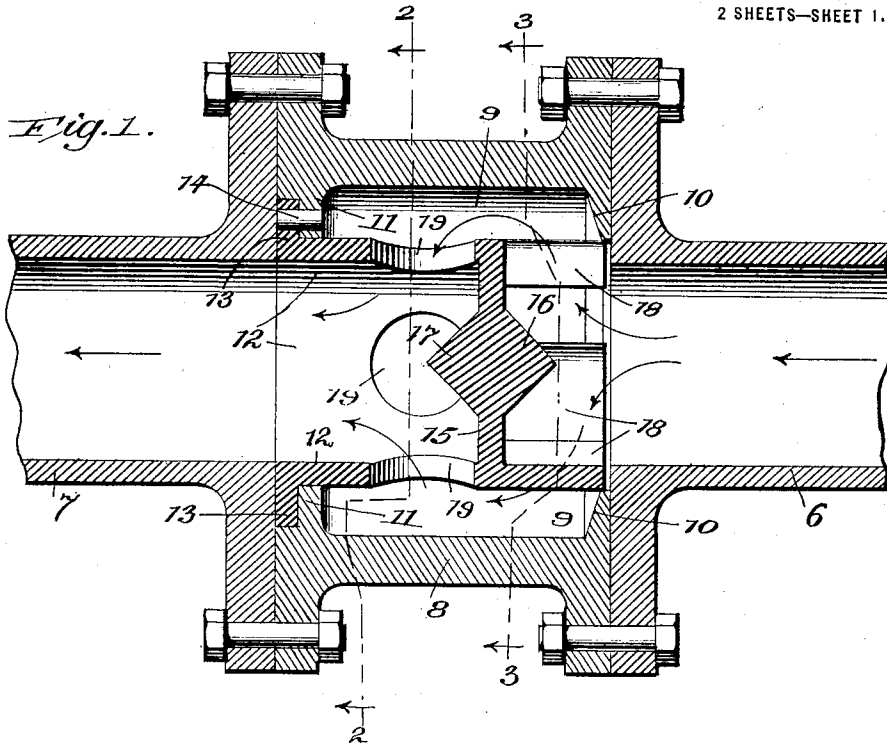
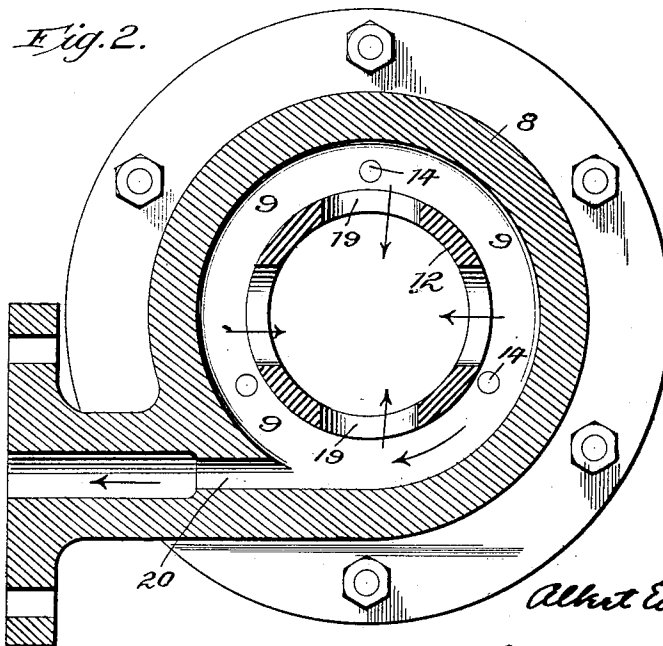


A. E. TOMPKINS.
STEAM DRIER.
APPLICATION FILED MAR. 23, 1921.

1,386,211.

Patented Aug. 2, 1921.

2 SHEETS—SHEET 1.



Inventor

Albert Edward Tompkins

By

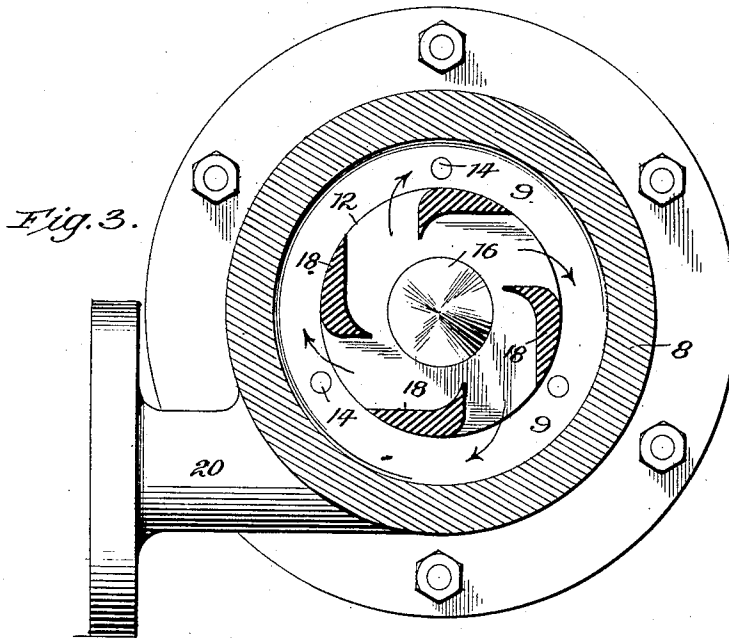
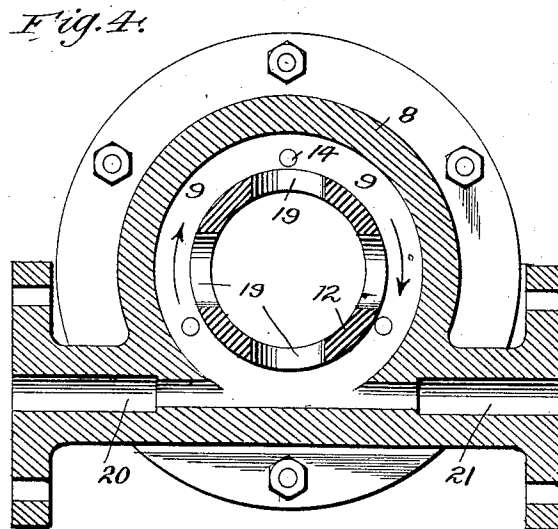
Dodge & Sons

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Attorney

UNITED STATES PATENT OFFICE.

ALBERT E. TOMPKINS, OF HANTS, ENGLAND.

STEAM-DRIER.

1,386,211.

Specification of Letters Patent.

Patented Aug. 2, 1921.

Application filed March 23, 1921. Serial No. 454,889.

To all whom it may concern:

Be it known that I, ALBERT EDWARD TOMPKINS, a subject of the King of Great Britain, and resident of Little Brookley, Brockenhurst, Hants, England, have invented certain new and useful Improvements in Steam-Driers, of which the following is a specification.

This invention relates to steam driers and particularly to steam driers of the vortex type. The invention is also applicable to separation of liquids from gases and the like. I shall however describe it as applied to a steam drier since this simplifies the explanation those skilled in the art will appreciate its applicability to analogous uses. Such uses are contemplated by me.

The object of the invention is to produce a simple device, having no moving parts, which may be inserted in a steam pipe line at any desired point including points within the boiler and which will operate to separate substantially all the water from the steam and expel it positively from the pipe. The expelled water may be discharged back into the boiler or to some other point, and such discharge may be through a trap if desired. This device is however capable of operating without a trap if the parts are properly proportioned to the service.

The device is intended to be interposed in a steam pipe line and is housed in a shell or casing formed with an annular vortex chamber. The guide structure is mounted within this shell or casing and is provided with a partition formed with deflecting guides and spiral vanes which direct the flowing steam into the vortex chamber in tangential directions so as to produce high velocity rotary flow in the vortex chamber. This flow expels the water by centrifugal force. The steam passes on through the guide structure by means of ports which are spaced from the discharge end of the vortex chamber and which therefore leave an annular groove toward which the separated water is impelled and in which it circulates rapidly. This circulating water is discharged through a tangential port located in the periphery of the shell or casing in alinement with this annular water groove. The result is that the steam leaving the vortex chamber does not entrain any of the separated water.

Practical embodiments of the invention

are illustrated in the accompanying drawings in which,—

Figure 1 is a longitudinal axial section of the preferred form of the device.

Fig. 2 is a section on the line 2—2 of Fig. 1 looking in the direction of the arrows.

Fig. 3 is a section on the line 3—3 of Fig. 1 looking in the direction of the arrows, and

Fig. 4 is a view similar to Fig. 2 showing a modification.

6 and 7 are pipe sections forming part of a steam main or line. Mounted between these pipe sections, and coaxial with them is casing 8 of the drier. The pipes 6 and 7 and the casing 8 are shown as connected by bolts passing through abutting flanges, but any equivalent construction might be used.

Where the device is installed on a steam pipe within a boiler it is not subjected to severe differential pressure and may therefore be constructed more lightly than the device shown in the drawing.

The vortex chamber in the casing 8 is indicated at 9 and lies between a beveled flange 10 and an opposed flange 11. The bevel of the flange 10 is preferably about 120° to the axis of the pipe 6. The guide structure consists of a tubular thimble or sleeve 12 formed with a flange 13 which enters a channel formed in the end of the casing 8 to receive it. In other words, the flanges 11 and 13 are in contact. The member 12 is held against rotation by dowel pins 14 passing through these two flanges. The guide member 12 is divided transversely by a partition 15 which is provided on the steam entrance side with a deflecting cone 16, and on the steam exit side with a similar deflecting cone 17. Steam entering through the pipe 6 strikes the cone 16 and is deflected radially outward through the spirally arranged vanes 18. These discharge the steam in paths approximately tangential to the periphery of the guide member 12 and set up rapid rotary motion of the steam in the vortex chamber 9.

The steam is discharged from the vortex chamber through the openings or ports 19 and flows away through the discharge pipe 7. The guide cone 17 assists in causing the steam entering through the ports 19 to flow down the discharge pipe 7. The discharge port for the separated water is shown at 20 and is tangential to the periphery of the vortex chamber 9. It is located at the ex-

treme left hand of the vortex chamber 9 (with reference to Fig. 1), and hence is beyond the ports or openings 19.

The relation between the ports 19 and 20 is an important feature of the present invention. The ports 19 are spaced an appreciable distance from the left hand end of vortex chamber 9 so that the casing 8 and the guide member 12 combine to form an annular trough or groove toward which the separated water is impelled by the steam flow and in which it is caused to circulate rapidly. The only exit offered to water flowing in this groove is the port 20, and the port 20 is so proportioned as to be adequate to discharge the entire water content of the steam. Moreover there is no tendency for steam entering through the ports 19 to entrain any of the separated water.

The effect of this arrangement is initially to separate the water from the steam by centrifugal force and simultaneously to sweep the separated water beyond the zone of steam flow and into an annular water passage in which it is free to circulate at high speed. The water acquires a high circular velocity from the steam flow and is discharged from the casing by its own kinetic energy and centrifugal effect.

I suggest the following relative dimensions as suited to give satisfactory operation.

The total area of the passages between the vanes 18 should be slightly greater than the transverse area to the pipe 6 and substantially equal to the total area through the ports 19. The diameter of the tangential drain port 20 should be approximately one-eighth the diameter of the pipe 6 and the radial depth of the vortex chamber 9, *i. e.*, the radial distance between the interior of the shell 8 and the exterior of guide member 12 should be approximately one-quarter of the diameter of the pipe 6. The form of the guide members 16 and 17 is subject to some variation, but I prefer to use cones whose base diameter is practically one-half the diameter of the pipe 6 so that the lines of flow between the vanes 18 will lie in planes normal to the axis of the vortex chamber 9 or approximately so. The purpose is to produce a violent rotary flow without accentuating the axial flow in the chamber 9.

In certain cases it is desirable to provide a tangential port alined with the discharge port 20. This construction is used when the device is installed within a boiler and is found to promote better circulation. It may also be used where the separator is inserted on external piping in connection with a steam trap. A device of this character is shown in Fig. 4 in which the direction of rotation of the steam is indicated by the arrows. The water discharge connection is illustrated at 20 and the other parts are numbered similarly to Figs. 1 to 3 inclusive.

The auxiliary steam connection is shown at 21 and is axially alined with the discharge port 20. Where the device is used with a steam trap the port 21 serves as the second connection characteristic of such installations. The port 20 is as before described a water discharge port.

The operation of both forms of the device will be obvious from the above description. It will function properly without any steam trap provided the discharge port 20 is properly proportioned. I prefer to use the device in the forms shown in Figs. 1, 2 and 3 without any trap, the port 20 being connected, for example, to an exhaust system or a heater system.

The device will operate in any position but I prefer to mount it with the discharge port 20 at the lowest point in the device so that water will drain away by gravity when steam is shut off.

That part of shell 12 between discharge pipe 7 and ports 19 is in effect an annular baffle extending beyond the water discharge port 20 and serving to shield the same from the disturbing action of outflowing steam, and I use this term in certain of the claims to define this element.

What is claimed is:—

1. In a steam drier, the combination with a casing structure including a steam inlet passage, a steam discharge passage, said passages being opposed to each other, an annular separating chamber of larger diameter than said steam passages interposed between them, and a tangential water discharge port leading from the periphery of said separating chamber adjacent said discharge passage, of a deflector obstructing direct flow between said steam passages; fixed spiral vanes arranged in annular series and extending between said deflector and the periphery of said inlet passage; and an annular baffle surrounding said steam discharge passage and extending toward said deflector and beyond said water discharge port.

2. In a steam drier, the combination with a casing structure including a steam inlet passage, a steam discharge passage, said passages being opposed to each other, an annular separating chamber of larger diameter than said steam passages interposed between them, and a tangential water discharge port leading from the periphery of said separating chamber adjacent said discharge passage, of a deflector obstructing direct flow between said steam passages, and provided with guiding surfaces of substantially conical form presented toward the steam inlet and discharge ports; fixed spiral vanes arranged in annular series and extending between said deflector and the periphery of said inlet passage; and an annular baffle surrounding said steam discharge passage

and extending toward said deflector and beyond said water discharge port.

3. In a steam drier, the combination with a casing structure including a steam inlet passage, a steam discharge passage, said passages being opposed to each other, an annular separating chamber of larger diameter than said steam passages interposed between them, and a tangential water discharge port leading from the periphery of said separating chamber adjacent said discharge passage, a deflector obstructing direct flow between said steam passages, fixed spiral vanes arranged in annular series and extending between said deflector and the periphery of said inlet passage, the total area between said vanes being slightly greater than the area of the steam inlet passage; and an annular baffle surrounding said steam discharge passage and extending toward said deflector and beyond said water discharge port.

4. In a steam drier, the combination with a casing structure including a steam inlet passage, a steam discharge passage, said passages being opposed to each other, an annular separating chamber of larger diameter than said steam passages interposed between them, and a tangential water discharge port

leading from the periphery of said separating chamber adjacent said discharge passage, of a unitary deflecting and guiding element removably mounted in said casing structure and comprising a deflector obstructing direct flow between said steam passages; fixed spiral vanes arranged in annular series and extending between said deflector and the periphery of said inlet passage, and an annular baffle surrounding said steam discharge passage and extending toward said deflector and beyond said water discharge port.

5. In a steam drier, the combination with a casing structure including a steam inlet passage, a steam discharge passage, an annular separating chamber of larger diameter than said steam passages interposed between them, and a tangential water discharge port leading from the periphery of said separating chamber adjacent said discharge passage, of a deflector obstructing direct flow between said steam passages; and an annular baffle surrounding said steam discharge passage and extending toward said deflector and beyond said water discharge port.

In testimony whereof I have signed my name to this specification.

A. E. TOMPKINS.