

PATENT SPECIFICATION

1,034,918

DRAWINGS ATTACHED.

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1,034,918

COMPLETE SPECIFICATION.

Improvements in or relating to Steam Traps.

We, SPIRAX-SARCO LIMITED, a British Company, of 130/132, St. George's Road, Cheltenham, Gloucestershire, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to steam traps.

According to the present invention there is provided a steam trap having a chamber and a valve for permitting escape of fluid from the chamber, the valve being under the control of a pile of bimetallic elements arranged in pairs such that the elements of each pair become concave towards each other upon heating thereof by fluid in the chamber, wherein adjacent elements in the pile are shaped to maintain substantially the whole of the facing surfaces of said adjacent elements spaced from each other and accessible to fluid in the chamber in all conditions of the trap.

For a better understanding of the invention and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawing, in which:—

Figure 1 is a sectional elevation of part of a steam trap,

Figure 2 is, to an enlarged scale, a plan view of a pile of bimetallic elements used in the trap of Figure 1, and

Figure 3 is a section on III—III of Figure 2.

The steam trap shown in the drawing is an improved form of the steam trap described in the Complete Specification of Application No. 30831/63 (Specification No. 987,344) with reference to Figures 1 and 3 of the drawings accompanying that Specification. The improved steam trap of Figure 1 has a casing 1 only the bottom part of which is shown in

Figure 1. The casing 1 encloses a chamber 2 which is connected to a steam system (not shown). A cylindrical member 3 is secured by screw-threading in a hole 4 through the bottom wall of the casing 1. The cylindrical member 3 has a vertical bore 5 therethrough, the bore being of reduced diameter near the top of the cylindrical member 3 and a shoulder 6 being formed where the change in diameter takes place. A hexagonal flange 7 is formed on the outside of the cylindrical member. A port 6A extends from the bore 5 at a location just below the shoulder 6 to the exterior of the cylindrical member 3 at a position above the flange 7. A valve stem 8 is disposed in the bore 5, the stem being a sliding fit in the reduced diameter portion of the bore 5. The lower end of the stem 8 carries a frusto-conical valve head 9 which co-operates with a seat 10 formed at the lower end of the bore 5. The upper end of the stem 8 projects upwardly from the top of the cylindrical member 3 and has thereon a pile of bimetallic elements 11 and nuts 12 for holding the assembly together. The bimetallic elements 11 are of the same size and shape. Each bimetallic element is formed from sheet material and in effect has three crossed beams, viz. a long beam that includes arms 12 and 13, an intermediate length beam that has arms 14 and 15, and a short beam that has arms 16 and 17. The central portion 18 where the three beams merge has a hole 19 formed at the common centre of the three beams. The valve stem 8 passes through the holes 19 of the bimetallic elements employed in the trap. A raised ring 20 concentric with the hole 19 is formed on the central portion 18 by a pressing operation. The end portions of the arms 12 to 17 are tapered and the tips of all the arms of each element are bent over in the same

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direction as illustrated at 21 in Figure 3. The bent-over tips project on the side of each element opposite to that on which the raised ring 20 is formed.

5 In the pile of bimetallic elements 11, the elements are arranged in pairs, the two elements of each pair being mirror images of each other having regard to the materials of construction. In Figure 3 the central bimetallic element 11 and the right-hand one are two elements of a pair. It will be noted that the tips of the arms 12 touch and the tips of the arms 13 touch. Guides (not shown) are provided for maintaining all the arms 12 in alignment. In the cold condition which is the condition illustrated in Figure 3, the tips of the arms 14 to 17 of each element touch the tips of the corresponding arms of the other element of the pair. On heating of the pile of bimetallic elements the central portions 18 of the two elements of each pair move further apart. The ring 20 of each element touches the ring 20 of one of the bimetallic elements of an adjacent pair in the pile of elements.

10 It will be understood that as the elements 11 are within the chamber 2, they are in communication with the steam system to which the casing 1 is connected. With the chamber 2 in a cold condition, the elements 11 are in their undeflected state as indicated in Figures 1 and 3. The lowest element 11 rests on top of the cylindrical member 3 and the lower nut 12 rests on the top element 11, the valve head 9 being spaced from its co-operating seat 10. Thus the chamber 2 communicates via the port 6A, the space 22 that is between the stem 8 and the wall of the bore 5, and the seat 10 with atmosphere. Upon the chamber 2 becoming hot, the elements 11 deflect, becoming alternately concave and convex uppermost, the lowermost element 11 becoming concave upwardly and the uppermost element convex upwardly. The free ends of the arms 12 and 13 of each element 11 remain in contact with the free ends of the arms 12 and 13 of the other element 11 of the same pair but the free ends of the arms 14 to 17 of each element become spaced from the free ends of the arms 14 to 17 of the other element of the pair. This occurs because the beam that includes the arms 12 and 13 is longer than the beams that have the arms 14 to 17 so that the free ends of the arms 12 and 13 deflect to a greater extent than the free ends of the arms 14 to 17. It will be understood that the deflection of the elements 11 causes the nuts 12 and the stem 8 to rise whereby the head 9 eventually closes the valve seat 10 and communication between the chamber 2 and atmosphere is prevented. The pressure of fluid within the chamber 2 acts on the frusto-conical valve head 9 and tends to urge the stem downwardly against the action of the arms 12 and 13 of the ele-

ments 11. With continuing increase of temperature the upward force on the stem 8 arising from the beams that have the arms 12 and 13 increases to oppose the downward force on the stem 8 arising from the fluid pressure acting on the valve head 9. Eventually with increasing temperature the free ends of the arms 14 and 15 of each element 11 encounter the free ends of the arms 14 and 15 of the other element 11 of the same pair. Subsequently with still further increase of temperature, the free ends of the arms 16 and 17 of each element 11 encounter the free ends of the arms 16 and 17 of the other element 11 of the pair. The parameters of the bimetallic elements 11 in relation to the effective area of the valve head 9 against which the fluid in the chamber 2 operates are chosen such that the valve will be open when the temperature in the chamber 2 is lower than a predetermined amount below that corresponding to the temperature of saturated steam at the pressure prevailing in the chamber. When the temperature in the chamber 2 is higher than the predetermined amount below that corresponding to the temperature of saturated steam at the pressure prevailing in the chamber the valve is shut. The successive coming into operation of the arms of the bimetallic elements enables the curve through the points corresponding to the various temperatures and pressures at which the valve opens to be adapted to the curve of temperature against saturation pressure of steam.

The effect of the raised rings 20 and the bent-over tips of the arms of the bimetallic elements is to maintain, in all conditions of the trap, substantially the whole of both surfaces of each bimetallic element free to be washed by fluid in the trap, thereby to obtain good sensitivity of the trap in its response to changes of temperature.

WHAT WE CLAIM IS:—

1. A steam trap having a chamber and a valve for permitting escape of fluid from the chamber, the valve being under the control of a pile of bimetallic elements arranged in pairs such that the elements of each pair become concave towards each other upon heating thereof by fluid in the chamber, wherein adjacent elements in the pile are shaped to maintain substantially the whole of the facing surfaces of said adjacent elements spaced from each other and accessible to fluid in the chamber in all conditions of the trap.

2. A steam trap as claimed in claim 1, wherein contacting peripheral portions of the elements of each pair are shaped to maintain substantially the whole of the facing surfaces of said adjacent elements of each pair spaced from each other and accessible to fluid in the chamber in all conditions of the trap.

3. A trap as claimed in claim 1 or 2, wherein projections are formed on the ele-

direction as illustrated at 21 in Figure 3. The bent-over tips project on the side of each element opposite to that on which the raised ring 20 is formed.

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ments 11. With continuing increase of temperature the upward force on the stem 8 arising from the beams that have the arms 12 and 13 increases to oppose the downward force on the stem 8 arising from the fluid pressure acting on the valve head 9. Eventually with increasing temperature the free ends of the arms 14 and 15 of each element 11 encounter the free ends of the arms 14 and 15 of the other element 11 of the same pair. Subsequently with still further increase of temperature, the free ends of the arms 16 and 17 of each element 11 encounter the free ends of the arms 16 and 17 of the other element 11 of the pair. The parameters of the bimetallic elements 11 in relation to the effective area of the valve head 9 against which the fluid in the chamber 2 operates are chosen such that the valve will be open when the temperature in the chamber 2 is lower than a predetermined amount below that corresponding to the temperature of saturated steam at the pressure prevailing in the chamber. When the temperature in the chamber 2 is higher than the predetermined amount below that corresponding to the temperature of saturated steam at the pressure prevailing in the chamber the valve is shut. The successive coming into operation of the arms of the bimetallic elements enables the curve through the points corresponding to the various temperatures and pressures at which the valve opens to be adapted to the curve of temperature against saturation pressure of steam.

The effect of the raised rings 20 and the bent-over tips of the arms of the bimetallic elements is to maintain, in all conditions of the trap, substantially the whole of both surfaces of each bimetallic element free to be washed by fluid in the trap, thereby to obtain good sensitivity of the trap in its response to changes of temperature.

WHAT WE CLAIM IS:—

1. A steam trap having a chamber and a valve for permitting escape of fluid from the chamber, the valve being under the control of a pile of bimetallic elements arranged in pairs such that the elements of each pair become concave towards each other upon heating thereof by fluid in the chamber, wherein adjacent elements in the pile are shaped to maintain substantially the whole of the facing surfaces of said adjacent elements spaced from each other and accessible to fluid in the chamber in all conditions of the trap.
2. A steam trap as claimed in claim 1, wherein contacting peripheral portions of the elements of each pair are shaped to maintain substantially the whole of the facing surfaces of said adjacent elements of each pair spaced from each other and accessible to fluid in the chamber in all conditions of the trap.
3. A trap as claimed in claim 1 or 2, wherein projections are formed on the ele-



- ments for maintaining the outwardly facing surfaces of the elements of each pair spaced from the corresponding surfaces of the adjacent elements of adjacent pairs so that
- 5 these surfaces are accessible to fluid in the chamber in all conditions of the trap.
4. A trap according to claim 1, 2 or 3, wherein each bimetallic element is in the form of a plurality of crossed beams, the beams
- 10 being of different lengths one from another and the elements being of the same size and shape and orientated so that in the pile beams of the same length are in alignment.
5. A steam trap according to claim 4, wherein each element has the tips of the arms thereof that constitute the beams bent over in the same direction. 15
6. A trap as claimed in claim 5, wherein the free ends of the arms are tapered.
7. A steam trap substantially as herein- 20 before described with reference to the accompanying drawing.

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