Dec. 9, 1924. 1,518,586

P. W. KNAUF

TRIP VALVE

Filed Aug. 17, 1922

Fig. 1

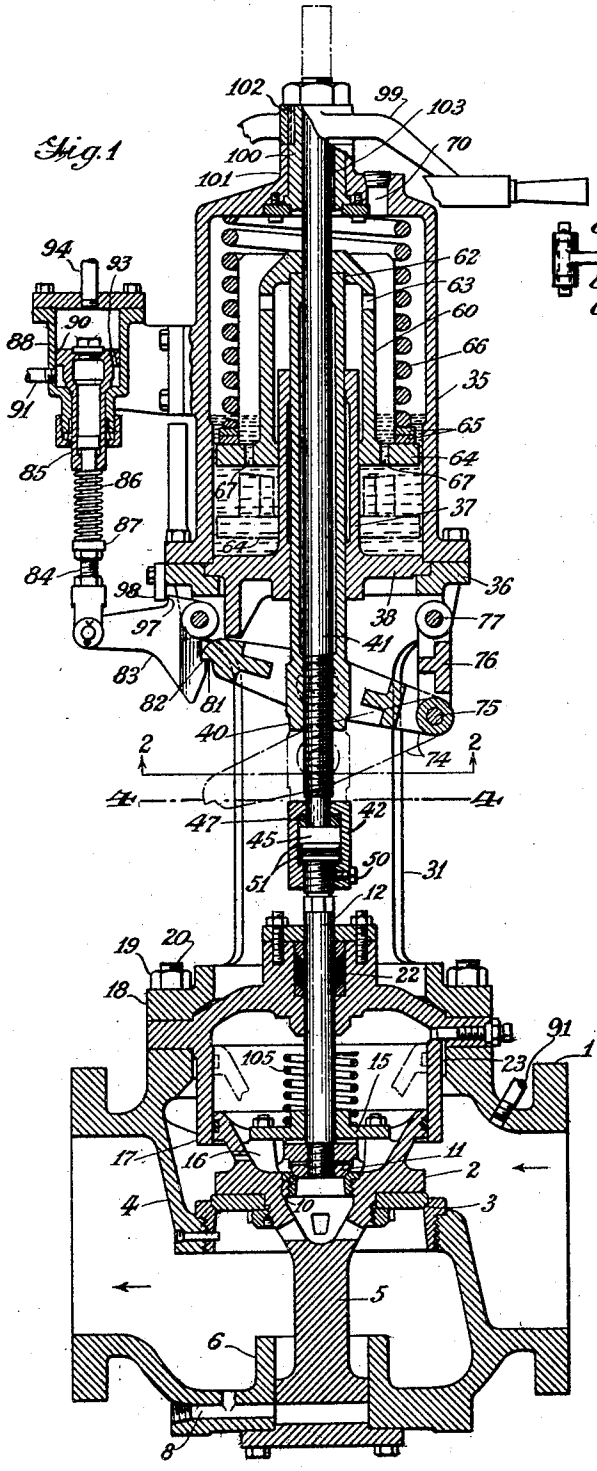


Fig. 2.

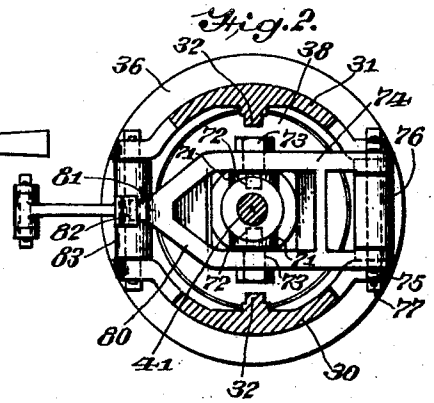


Fig. 3.

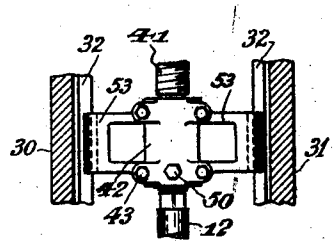
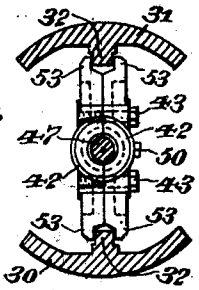


Fig. 4.



INVENTOR

Paul W. Knauf

By

Cyrus N. Anderson

ATTORNEY

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UNITED STATES PATENT OFFICE.

PAUL W. KNAUF, OF CYNWYD, PENNSYLVANIA, ASSIGNOR TO SCHUTTE AND KOERTING COMPANY, OF PHILADELPHIA, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA.

TRIP VALVE.

Application filed August 17, 1922. Serial No. 582,394.

To all whom it may concern:

Be it known that I, PAUL W. KNAUF, a citizen of the United States, and a resident of Cynwyd, in the county of Montgomery and State of Pennsylvania, have invented an Improvement in Trip Valves, of which the following is a specification.

My invention relates broadly to trip valves of a character to be employed in connection with turbine or other engines and which are adapted to be tripped under certain conditions, as in case of overspeed, to close the steam supply line leading to the engine, but more particularly to constructions of a character in which the valve, when tripped, is adapted to be closed by the action of a strong spring.

The general object of the invention is to provide an improved and novel construction of means for facilitating the operation of the said valve either to open or close the same.

A more specific object of the invention is to provide a novel construction of means whereby the portion of the valve rod which enters the valve casing and which is connected with the valve need not be rotated during the time when the said spring is being compressed or when the valve is being opened. By thus avoiding the rotation of the portion of the valve rod within the valve casing in the presence of steam at a high degree of temperature the wearing and cutting of the valve rod and of portions with which the latter contacts are to a large extent, if not entirely, avoided.

Another object of the invention is to provide a novel construction of means whereby an oil dash pot for controlling the speed of the closing movement of the valve may be situated remotely with respect to the valve casing whereby the oil within the chamber of the said dash pot is unaffected by the heat from the said valve casing.

Other objects and advantages of the invention will be pointed out in the detailed description thereof which follows or will be apparent from such description.

In order that the invention may be readily understood and its practical advantages fully appreciated, reference may be had to the accompanying drawing in which one form of mechanical embodiment thereof is shown. However, it is to be understood that the invention is susceptible of embodiment in other forms of construction than that shown, and that changes in the details of construction may be made within the scope of the claims without departing from the said invention.

In the drawing:

Fig. 1 is a view in vertical longitudinal section of a trip valve construction embodying my invention;

Fig. 2 is a transverse sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a vertical sectional view taken at right angles to the plane in which Fig. 1 is taken and showing a detail of construction; and

Fig. 4 is a transverse sectional view taken on the line 4—4 of Fig. 1.

Referring to the drawing: 1 designates a valve casing the opposite ends of which are flanged, whereby said casing is adapted for attachment to the flanged ends of sections of pipe (not shown) constituting the steam supply line for supplying steam to a turbine or other engine.

2 designates a valve structure which is adapted to co-operate with a seat 3 surrounding an opening through an angular partition plate 4 extending across the valve casing 1. The valve 2 is provided with a stem 5 the lower headed end of which is guided within a cylindrical projection 6 extending upwardly from the lower side of the valve casing. The space within the cylindrical projection 6 underneath the lower end of the stem 5 is adapted to be drained through an opening 8 adapted to have connection with a pipe, which is not shown.

The upper end portion of the valve 2 is of inverted substantially cone-shape, as shown, and is provided with a seat 10 with which a pilot valve 11 co-operates. The pilot valve is secured to the lower end of the part 12 of a two-part valve actuating rod which will be referred to more in detail later on. The movement of the pilot valve 11 relatively to the valve 2 is limited by the plate 15 which is secured to lugs or projections 16 upon the inner side of the inverted cone-shaped portion of the valve. The upper end portion of the valve 2 projects upwardly into the open lower end of a cylinder 17 which cylinder, and the ring 18 overlying a lateral flange upon the same, are held in position upon the valve casing 1 by nuts 19 upon screw threaded bolts 20 as shown. The part 12 of the

valve actuating rod passes upwardly through an opening in the closed end of the cylinder 17. The said part 12 is surrounded by a suitable packing, as indicated at 22.

When the valve is in closed position, as indicated in the drawing, the space above the same and within the cylinder 17 becomes filled with steam which leaks past the valve and also enters through controllable openings 23, one or more of which may be provided.

The valve construction as above described is not novel with me but it has been deemed necessary to show the same in order to explain fully and properly my invention and the manner of its use and operation.

Extending upwardly from the valve casing are the oppositely disposed substantially parallel supporting members 30 and 31 each provided with a guide 32 upon its inner side. The tripping and other mechanism constituting my invention are supported upon these members 30 and 31. 35 designates a hollow casing, the lower end of which is secured to and supported upon an annular head-like portion 36 upon the upper ends of the members 30 and 31. A guiding tubular member 37 is situated concentrically of the casing 35 and projects upwardly thereinto. The lower end of the said tubular member is provided with a flange 38 the outer edge portion of which extends into a groove between the lower end of the casing 35 and the upper inner edge portion of the head-like member 36. The said flange is clamped between these parts and thereby held in position. A relatively long sleeve-like member 40 extends upwardly through the guiding tubular member 37, fitting the upper and lower end portions thereof somewhat closely as indicated, but being spaced from the intermediate portions thereof. The lower end of the sleeve-like member 40 is internally screw threaded and is in engagement with the screw threaded lower end portion of the part 41 of the valve actuating rod, the remaining part of said rod being designated by the reference number 12. These two parts, 12 and 41, are connected together by means of the two-part connecting member 42 which parts are secured together by means of screw threaded bolts 43. The part 41 is rotatable with respect to the part 12. The connecting member 42 is hollow and incloses a head 45 preferably integrally connected with the lower end of the part 41. Interposed between the head 45 and the upper end of the chamber within the member 42 within which said head is situated is a two-part metallic bearing ring or washer 47, preferably of bronze. The upper end of the part 12 of the valve actuating rod has screw threaded engagement with a tapped opening in the lower end of the two-part member 42 and in order to secure the said member 42 to the member 12 so as to prevent relative rotation between the two when once connected a binding screw 50 is provided, as shown in Fig. 1. Metal thrust washers 51 are provided within the chamber of the member 42 intermediate the adjacent opposing ends of the parts 12 and 41. The opposing contacting surfaces of these washers are convex as shown. Both of the parts of the connecting member 42 are provided with outwardly extending flat projections or arms 53 the outer ends of which are in engagement with the guides 32 previously referred to. The fact that the part 41 may be rotated relatively to the part 12 is important because it enables actuation and operation of the valve to open and close the same without the necessity of turning the part 12 of the valve actuating rod which extends into the valve casing 1. If it were necessary to turn the part 12 of the valve rod within the valve casing in the presence of steam at a high temperature the contacting relatively rotating parts would be cut and thereby injured because these parts cannot be lubricated.

The tubular guiding member 37 projects upwardly into an inverted hollow member 60 which is adapted to slide up and down thereon. The relatively long sleeve-like member 40 extends upwardly through the tubular guiding member 37 and its upper end is situated in a depression or seat 62 in the inner side of the top of the member 60. The member 60 is provided with openings 63 so that the interior thereof is in communication with the interior of the casing 35. A coiled compression spring 66 is situated within the casing 35 and its lower end rests upon ring washers 65 which in turn rest upon a flange 64 which extends outwardly from the lower end of the member 60. By increasing or diminishing the number of the washers 65 the tension of the spring 66 may be increased or diminished. The upper end of the said spring contacts with the lower side of the top of the casing 35. The flange 64 is provided with relatively small openings 67 through which a retarding and cushioning liquid, such as oil, is adapted to pass from one side to the other of the said flange. The liquid below the member 60 acts as a cushion to prevent too rapid descent of the valve after it has been tripped in the manner to be hereinafter described. The speed of descent depends upon the size of the said openings and the strength of the spring 66. The said retarding liquid is adapted to be inserted into the casing 35 through an opening 70.

The relatively long sleeve-like member 40 is provided adjacent its lower end with lateral projections 71 having holes therein which extend in directions transversely of the length of the said sleeve-like member 40

into which extend the reduced end portions 72 of short screw threaded bolts 73 having screw threaded engagement with the opposite sides of a two-armed lever 74. The outer or right hand end of said lever is pivotally connected by means of a pin or bolt 75 to the lower end of a swinging link 76 pivotally connected at its upper end by means of a pin 77 to rearwardly extending enlargements or bracket-like portions upon the upper ends of the parts 30 and 31. The inner ends of the opposite sides of the said lever converge and are joined together as indicated at 80 in Fig. 2 of the drawing to form a narrow portion as shown which is shouldered to form an engaging portion 81 which is adapted to be engaged by a shoulder 82 upon the depending arm of a bell crank lever 83, the other arm of which extends outwardly and has connection with the lower end of a rod 84 the opposite end of which is headed and projects into the lower end of a hollow piston 85. A coiled spring 86 surrounds the rod 84 and one end thereof is seated against a nut 87 upon the said rod 84, while the opposite end thereof is seated against the outer lower end of the hollow piston 85. The said piston extends into a chamber 88 and is provided with a flange 90 which fits closely but movably within the said chamber 88. A pipe 91 communicates at one end with the lower end portion of the chamber 88 and at its opposite end with the intake side of the valve casing, as indicated. The steam passes from the valve casing through the pipe 91 to the lower end of the chamber 88 and there is usually sufficient leakage to permit the steam to pass around the upper end of the trip piston 90 into the upper portion of the chamber 88, but in order to facilitate the passage of the steam to the upper side of the said piston a bleed hole 93 is provided, as shown. It will be seen that normally the steam occupies the chamber 88 on both sides of the flange 90 of the trip piston. A pipe 94 leads from the chamber 88 above the trip piston 90 and means (not shown) is provided for closing said pipe which is adapted to be opened in case of emergency, such as overspeed of a turbine, to permit escape of steam through the pipe 94 from said chamber. Upon release of steam pressure in the upper side of the chamber 88 above the piston 90 the steam pressure upon the under side of said piston causes quick upward movement thereof and upon the contact of its lower end with the head upon the upper end of the rod 84 the latter is moved quickly upwardly to effect pivotal movement of the bell crank lever 83 to disengage the shoulder 82 from the contact portion 81 upon the lever 74. Pivotal movement of the lever 83 toward the left is limited by the engagement of the shoulder 97 thereon with the stationary stop 98 while movement in the opposite direction is limited by the engagement of the upper side of the outwardly arm of the said lever with the lower end of the said stop.

It may be noted here that the piston trip structure per se just described is not new with me and constitutes no part of my present invention.

As illustrated in the drawing, the valve is in closed position and the lever 74 is in its uppermost position in interlocked relation with respect to the bell crank lever 83. In order to open the valve the part 41 of the valve actuating rod is turned toward the left; that is, in counterclockwise direction, by means of the wheel 99 which is secured to a rotatable sleeve 100 secured within a bearing 101 at the upper end of the casing 35. The said wheel is connected to the sleeve 100 by means of a key 102 and the sleeve is in turn connected to the part 41 of the valve actuating rod by means of a spline or feather 103. Such connection permits sliding movement of the part 41 with respect to the sleeve 100 simultaneously with its rotation.

Upon rotation of the part 41 toward the left as already stated, the first action is to open the pilot valve 11 so as to permit steam to pass to the under or opposite side of the valve. This having been done it will be understood that further opening movement of the valve is effected against the weight of the valve plus a certain amount of steam pressure, the amount of such steam pressure being about one-fifteenth (1/15th) of the working pressure of the same. The valve is fully opened when the two-part coupling 42 is in contact with the lower end of the sleeve-like member 40. As the valve approaches its open position the upper end of a spring 105, coiled around the part 12, contacts with the under side of the top of the cylinder 17 and is compressed between the same and the plate 15 previously referred to. The presence of such spring causes the pilot valve 11 to engage and remain in contact with the under side of the plate 15 during the time or period that the valve is in open position. By thus holding the pilot valve in contact with the plate 15 "chattering" is prevented. Without the presence of such spring there would be relative vibratory movement between the pilot valve and the main valve, when the latter is in open position, which would be objectionable.

Assuming that the valve is in open position and that the lever 83 has been tripped to release the lever 74, the valve is quickly closed under the influence of its own weight and of the spring 66. When thus moved into closed position the lever 74 will pass to the position indicated by the dash and dot

lines in Fig. 1. The first thing to be done in the operation of opening the valve is to turn the part 41, which turns independently of the part 12, toward the right so as to return the lever 74 into the position in which it is shown in full lines in Fig. 1. Such operation does not affect either the pilot or the main valve. During such operation it is only necessary to overcome the pressure exerted by the coiled spring 66. The valve is thereafter opened by turning the part 41 in the opposite direction as before described. It will be seen, therefore, that the provision of a two-part valve actuating rod is of importance because it avoids the necessity of compressing the spring 66 and at the same time lifting the valve, and such structure also avoids the necessity of rotating the part 12 against the pressure exerted thereon and upon any parts connected to and moving therewith by the steam within the valve casing.

It will thus be seen that by my invention I have provided a construction by means of which the operation of the valve is greatly facilitated.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In a trip valve structure, the combination of a valve casing, a valve therein, a two-part valve actuating rod which parts are connected together, one of which is non-rotatable and extends into the said valve casing and is connected to the said valve and the other of which parts is rotatable, a casing situated a distance from said valve casing and through which the rotatable part of said valve actuating rod extends, tripping means situated exteriorly of and between the said valve casing and the second named casing which is adapted to hold the said valve and valve actuating rod in open position, means for releasing said tripping means, and means situated intermediate said second named casing and the said valve actuating rod for effective movement thereof to close the said valve upon release of the said tripping means.

2. In a trip valve structure, the combination of a valve casing, a valve therein, a two-part valve actuating rod one of which parts is non-rotatable and extends into the said casing and is connected to said valve and the other of which parts is rotatable, a casing situated a distance from the said valve casing and through which the rotatable part of said rod extends, tripping means situated intermediate the said valve casing and the second named casing which means comprises a lever having pivotal and adjustable connection intermediate its ends with the rotatable part of said valve actuating rod, a link depending from the said second named casing to the swinging end of which one end of the said lever is connected, and a pivot catch which is adapted to engage the other end of said lever, the said tripping means being adapted to hold the said valve and valve actuating rod in open position and the said catch being adapted to disengage from the said lever to release the said tripping means, and a spring intermediate the said second named casing and the said valve actuating rod for causing movement of the latter to close the said valve upon release of said tripping means.

3. In a trip valve structure, the combination of a valve casing, a valve therein, a two-part valve actuating rod one of which parts is non-rotatable and extends into the said casing and is connected to said valve and the other of which parts is rotatable, a casing situated a distance from the said valve casing and through which the rotatable part of said rod extends, tripping means situated intermediate the said valve casing and the second named casing which means comprises a lever having pivotal and adjustable connection intermediate its ends with the rotatable part of said valve actuating rod, a link depending from the said second named casing to the swinging end of which one end of the said lever is connected and a pivot catch which is adapted to engage the other end of said lever, the said tripping means being adapted to hold the said valve and valve actuating rod in open position and the said catch being adapted to disengage from the said lever to release the said tripping means, a spring situated intermediate the said second named casing and the said valve actuating rod for effecting movement of the latter to close the said valve upon release of the said tripping means, and means for retarding the closing movement of said valve actuating rod.

4. In a trip valve structure, the combination of a valve, a two-part actuating rod having connection with said valve, which parts are connected together and are relatively rotatable, a tripping device comprising a lever having adjustable connection with one of the parts of the said rod, means operating to close the said valve when the said tripping device is released, means for adjusting the said lever with respect to the said part for resetting the tripping device and for simultaneously placing the said first mentioned means in condition for effecting closure of said valve upon release of said tripping device and for thereafter opening said valve.

5. In a trip valve structure, the combination of a valve, a two-part rod having connection with said valve for actuating the same, one of said parts being rotatable relatively to the other, a tubular member having adjustable connection with the rotatable part of said actuating rod, a tripping device

comprising a catch and a lever having pivotal connection with the said tubular member, a casing into which the said tubular member projects and through which one of the parts of the said actuating rod extends, a hollow member within the said casing having a closed end through which the said part of the actuating rod extends and against the closed end of which the said tubular member contacts, a coiled spring surrounding the said hollow member and bearing at one end against a portion integral with said hollow member and at its other end against the upper end of said casing, the said tubular member being adapted to be moved inwardly of said casing upon rotation of the said part of the actuating rod in one direction to engage the said lever with the catch of the said tripping device and to compress the said spring, and the said rod upon rotation in the opposite direction being moved longitudinally to effect opening movement of the said valve.

6. In a trip valve structure, the combination of a valve having a two-part actuating rod connected therewith, one of which parts is rotatable with respect to the other, a tubular part having screw threaded engagement with one of said parts, a tripping device comprising a movable catch and a lever, one end of which is adapted to engage said catch and the opposite end of which is pivotally supported upon a swinging pivot, and which lever is pivotally connected intermediate its ends with the said tubular member, a casing into which the said tubular member projects and through which the said actuating rod extends, a hollow member within said casing having a closed end against which the said tubular member is in contact, and the said hollow member having a flange at its lower edge, a spring situated within said casing and coiled around said hollow member and seated at its lower end upon the said flange and upon its upper end against the top of said casing, and means for rotating the rotatable part of the said valve actuating rod in either direction, rotation of the same in one direction effecting upward movement of the said tubular member to engage the said lever with the said catch and to compress the said spring, and rotation in the opposite direction effecting longitudinal movement of the valve actuating rod to open the said valve.

In testimony that I claim the foregoing as my invention, I have hereunto signed my name this 14th day of August, A. D. 1922.

PAUL W. KNAUF.