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PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to Butterfly Valves

I, KAZUO KITAZAWA, a citizen of Japan, of No. 21—13, 2-Chome, Ohara, Setagaya-Ku, Tokyo, Japan, 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 butterfly valves and more particularly to a braking device for the manual operation handle of a butterfly valve to be installed in a piping system adapted to transport hydraulic fluid under high pressure which can perfectly brake the handle in any desired position so that the component parts of the butterfly valve may be firmly and properly held in position regardless of the hydraulic pressure acting on them.

Various types of butterfly valves have been proposed and employed in a piping system which is adapted to transport hydraulic fluid under high pressure in order to control the flow of such fluid passing through the pipes which are connected to each other by the valves in the piping system and most of these butterfly valves are provided with manually operable handles by the manipulation of which the valves may be full or partially opened or perfectly closed as desired so that the fluid is allowed to pass through the piping system without restriction or at varying controlled rates or such flow of the fluid can be completely obstructed. However, none of the conventional butterfly valves provided with such manually operable handles are perfectly satisfactory because the conventional butterfly valve handles can not firmly hold the component parts of the valves in their respectively intended positions and accordingly, when the components parts of such valves are subjected to the high pressure of the hydraulic fluid which acts on them as the fluid passes through the piping system wherein the butterfly valves are installed, the parts are inevitably caused to be more or less displaced resulting in an undesired relation between the parts. As

a result, the conventional butterfly valves can not be expected to satisfactorily perform their intended functions.

Therefore, one object of the present invention is to provide a braking device for the manually operable handle of a butterfly valve which can perfectly brake the handle in any desired position so that when the handle is gripped and turned in either direction to fully or partially open or perfectly close the valve and then the handle is released, the handle will be instantly and positively held in that position.

Another object of the present invention is to provide a braking device for the manually operable handle of a butterfly valve which can be easily and simply operated.

Another object of the present invention is to provide a braking device for the manually operable handle of a butterfly valve which comprises a relatively small number of component parts having relatively simple construction and arrangement, and accordingly, can be easily constructed at low cost.

A further object of the present invention is to provide an efficient and reliable braking device for the manually operable handle of a butterfly valve which can positively hold the handle in any desired position and accordingly, can hold the component parts of the valve in their respectively intended positions depending upon the position of the handle by which the same are positively held.

According to the present invention, there is provided a butterfly valve comprising a hollow cylindrical flanged body to be connected at the opposite ends to pipes in a piping system adapted to transport hydraulic fluid under high pressure; a disc member rotationally disposed within said body and extending across the interior of the body at right angles to the longitudinal axis of the latter for rotational movement between valve open and closed positions; an annular packing disposed around the outer periphery of said disc member and adapted

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to provide a fluid-tight sealing between the inner periphery of said body and the outer periphery of said disc member; a rotary shaft extending across the body at right angles to the longitudinal axis of the body and passing through said packing and disc member with the upper end protruding through an upper portion of the body and the lower end rotatably seating in a diametrically opposite lower portion of the body; and an elongated manual operating handle operatively connected to said protruding upper end of the rotary shaft for rotating the shaft and hence the valve disc and extending horizontally at right angles to the vertical axis of the shaft; characterised by the provision of a braking device for said operating handle comprising a spring-loaded wedge actuating means pivoted to said handle within a partially box shaped intermediate portion thereof, which portion is formed between the opposite ends of the handle; wedge means carried by said wedge actuating means at one end of the latter for movement in the longitudinal direction of said handle; and a stationary brake disc held in position between said top of the body and said handle at one end of the latter surrounding said protruding upper end of the shaft and adapted to frictionally hold said wedge means between itself and said intermediate portion of the handle.

The above and other objects and advantages of the present invention will be more readily apparent to those skilled in the art from the following description of a butterfly valve which incorporates therein a preferred form of braking device embodying the present invention when read in conjunction with the accompanying drawings in which:—

Fig. 1 is a fragmentary vertically sectional view of an upper portion of a butterfly valve which incorporates a preferred form of braking device therein and which also shows the manual hollow operating handle of said valve in longitudinal section and said braking device for the handle in partial side elevation and in partial section;

Fig. 2 is a fragmentary top plan view of a portion of said butterfly valve, said handle and said braking device with the top wall of the handle partially broken away;

Fig. 3 is a fragmentary perspective view of an intermediate portion of said operation handle in partial section especially showing the arrangement of a pair of brake plate receiving notches formed at the fore end of said intermediate handle portion and the configuration of the inner surface formed in the bottom wall of the intermediate handle portion along which a frusto-conical wedge member of said braking device is adapted to slidably move in the longitudinal direction and slidably rotate in the lateral direction thereof;

Fig. 4 is a fragmentary perspective view of a portion of a spring-loaded lever of said braking device;

Fig. 5 is a fragmentary perspective view of said frusto-conical wedge member;

Fig. 6 is a fragmentary longitudinally sectional view of said intermediate handle portion especially showing the manner in which said wedge member slidably moves in the longitudinal direction along the inner bottom surface of said intermediate handle portion as said lever is pivoted about its pivot support; and

Fig. 7 is a cross-sectional view taken substantially along the line VII—VII of Fig. 6 as seen in the direction of the arrow and showing the manner in which said wedge member slidably and laterally rotates along the inner bottom surface of said intermediate handle portion.

The present invention will be now described referring to the accompanying drawings in which a portion of a butterfly valve to be installed in a piping system adapted to transport hydraulic fluid under high pressure and incorporating therein a preferred form of braking device embodying the present invention is illustrated. Although the invention will be described in connection with controlling the operating handle for the illustrated butterfly valve, it will be understood that the invention can be equally applied for controlling the operation handle of any other similar valve and the following description is for illustration only, but not for limiting the application of the braking device only to such a butterfly valve. Since the butterfly valve itself is conventional, description of the butterfly valve will be made on only parts which are directly related to the operation of the handle braking device hereinafter. The butterfly valve generally comprises as its principal component parts a hollow cylindrical body 1 provided at the opposite ends with flanges 2 and 2 (only one flange is shown in Fig. 1) to be connected to adjacent pipes (not shown) in a piping system adapted to transport hydraulic fluid under high pressure and the body is also provided in diametrically opposite points of the outer periphery between the opposite end flanges 2 with top and bottom bosses 3 having centre bores 4. A disc member 5 is rotationally disposed within the body 1 vertically extending across the interior of the body at right angles to the longitudinal axis of the latter in substantial alignment with the top and bottom bosses 3 for rotational movement between valve open and closed positions and the disc member is provided with a centre bore (not shown) extending cross the diameter of the disc in alignment with the centre bores 4 in the top and bottom bosses 3. The centre bore in the disc member 5 is formed by a pair of vertically extending elongated raised portions 6 which project outwardly from the opposite sides of the disc member 5. An annular packing 7 is disposed around the outer periphery of the disc member 5 and the packing is also provided with a pair of diametrically opposite bores (not shown) in alignment

with the bores 4 in the body bosses 3 and with the centre bore in the disc member 5. The annular packing 7 provides a fluid-tight sealing between the inner periphery of the body 1 and the outer periphery of the disc member 5. A rotary shaft 8 vertically extends through the bores 4 in the bosses 3, the bores in the annular packing 7 and the centre bore in the disc member 5. The upper end portion of the shaft 8 projects above the top boss 3 in the body 1 and the extreme upper end of the projecting upper shaft portion is threaded for receiving a hexagonal nut 9 thereon and the lower end of the shaft 8 is loosely received in the bottom wall of the body 1 so that the shaft may be rotated relative to the body 1. The above mentioned shaft is provided immediately below the threaded extreme end with a polygonal section handle receiving portion (not shown). The diameter of the centre bore in the disc member 5 and that of the shaft 8 are so selected that the centre bore in the disc member 5 snugly receives the shaft 8 whereby when the shaft is rotated in either direction the disc member carrying the packing 7 thereon can rotate together with the shaft. An operating handle 10 is received at the fore end portion 11 having a polygonal opening (not shown) mating with the polygonal portion at the upper end of the shaft 8 and extends horizontally or at right angles to the vertical axis of the body 1. The operating handle 10 consists of the fore end portion 11 in a multi-plate shape, an integral box shape intermediate portion 12 and an integral rear portion or hand grip portion 13. The above-mentioned nut 9 holds the handle 10 on the shaft 8 and the handle can be manually and horizontally turned in either direction so as to rotate the shaft 8 which in turn rotates the disc member 5 resulting in opening or closing the valve. The above-mentioned constructions, arrangements and functions of the component parts of the butterfly valve are conventional and well known in the art and further detailed descriptions of these parts will not be necessary.

According to the present invention, a braking device for controlling or braking the operating handle 10 of the butterfly valve referred to above is incorporated in the valve. The braking device generally comprises a L-shape lever 20 having a shorter arm 21 downwardly extending within the intermediate handle portion 12 and an integral longer arm 22 extending rearwardly and downwardly through the open bottom of the rear handle portion 13 out of the latter. The shorter arm 21 and the longer arm 22 are connected to each other at a point shown with reference numeral 23 where a transverse bore is formed and a transverse pivot pin 24 loosely extends through the transverse bore with the opposite ends projecting through and supported in a pair of aligned bores 25 in the side walls of the intermediate

handle portion 12 (only one bore is shown in Fig. 3) whereby the lever 20 may be pivoted about the pivot pin 24. The shorter arm 21 is formed in the centre of the lower or free end with a notch 26 having a substantially semi-circular shape for the purpose to be described in detail hereinbelow. The longer arm 22 is normally urged downwardly by means of a leaf spring 27 which has one end abutting the inner surface of the top wall of the rear handle portion 113 and the other end of the spring is secured by means of a rivet 28, for example, to the upper surface of the longer arm 22. A frusto-conical wedge member 29 having an intermediate constricted or reduced diameter neck portion 30 between the opposite ends is rotatably received in the intermediate handle portion 112 with the neck portion 30 loosely received in the semi-circular notch 26 in the shorter lever arm 21. A brake disc 31, having a bore which is in alignment with the bores in the top body boss 3 and in the fore handle portion 111, is held in position between the top body boss 3 and the fore handle portion 111 surrounding the shaft 8. A portion of the peripheral edge of the brake disc 31 (the right side edge portion as seen in Fig. 1) extends into the intermediate handle portion 12 and abuts against the frusto-conical wedge member 29 within the intermediate handle portion 112. The box-shape intermediate handle portion 112 has a pair of aligned side notches 32 and 32 extending rearwardly from the fore end into the opposite walls of the handle portion 112 by a short distance for receiving the rear end portion of the brake disc 31 therein. The inner surface of the bottom wall of the box-shape intermediate handle portion 12 forms a frictional guide way 33 for the wedge member 29 in the manner as will be described hereinafter. The wedge member guiding way 33 is formed by the bottom wall of the intermediate handle portion 112 and has a tapered surface which is sloped rearwardly and downwardly in the longitudinal direction and outwardly and upwardly from the opposite sides of the lowest centre in the transverse direction. The frusto-conical wedge member 29 has a diameter which increases from one end toward the other end in conformity with the taper of the guiding way 33 in the longitudinal direction and the periphery of the wedge member is adapted to at all times to make rolling contact with the transverse sloped surface of the guiding way in the transverse direction. As mentioned above, the reduced diameter neck portion 30 of the wedge member 29 is loosely or rollably received in the notch 26 in the shorter lever arm 21 whereby the wedge member 29 can be slidably moved in the longitudinal direction of the intermediate handle portion 112 together with the lever 20 and slidably rolled in the transverse direction of the intermediate handle portion relative to the lever 20.

After the lever 20 and the wedge member 29 have reached the dotted line positions of Fig. 6, if the handle 10 is turned in either direction while maintaining the lever and the wedge member in the above-mentioned dotted line positions, the wedge member 29 will slidably roll in the transverse direction of the intermediate handle portion 12 relative to the lever 20 and the shaft 8 and the disc member 5 will rotate in the same direction as the handle 20 by an angular distance corresponding to the rotational movement of the handle. Then, if the handle 10 and the lever 20 are quickly released from the gripping force acting on them, the leaf spring 27 immediately springs out to urge the lever 20 downwardly whereupon the lever 20, the wedge member 29, the shaft 8 and the disc member 5 are firmly held in their respective positions which these parts assume when the gripping force on the handle 10 and the lever 20 are removed therefrom whereby the butterfly valve may be firmly held in its partially opened position regardless of the pressure of the flowing high pressure hydraulic fluid acting thereon.

In operation, when the operator grips the handle 10 together with the lever 20 at the grip or rear handle portion 13 in his one hand and then increases his gripping on these parts so as to cause the lever 20 to pivot about the pivot pin 24 in the counter-clock direction against the force of the leaf spring 27 to the dotted line position of Fig. 6, for example, the frust-conical wedge member 29 carried by the shorter lever arm 21 is caused to slidably and rearwardly move in the longitudinal direction of the intermediate handle portion 12 on the guiding way 33 together with the lever 10 against the holding down force of the brake disc 31. Then, when the operator turns the operation handle 10 in either direction while maintaining his gripping on the lever 20 in the dotted line position of Fig. 6, the wedge member may be allowed to frictionally roll sidewise along the triangular cross-section transverse surface of the guiding way 33 and the shaft 8 and the disc member 5 firmly connected to the shaft for rotation therewith may be caused to smoothly rotate in the same direction as the handle 10 by an angular distance corresponding to the angular displacement of the handle. After the parts of the valve have moved in the manner as mentioned just above, the operator quickly releases his gripping on the handle 10 and the lever 20 whereupon the leaf spring 27 springs out to cause the lever 20 to pivot about the pivot pin 24 in the clockwise direction as seen in Figs. 1 and 6 so as to urge the longer lever arm 22 downwardly whereby the frust-conical wedge member 29 is urged forwards in frictional contact with the underside of the brake disc 31 and with the sloped guide way 33 of the intermediate handle portion 12 to the position

in which the wedge member 29 had assumed prior to the above-mentioned operation. With the wedge member 29 held in the position as mentioned above, the handle 10, the lever 20, the shaft 8 and the disc member 5 can be firmly held in their respective positions in which they assume when the operator releases his gripping on the handle 10 and the lever 20 whereby the butterfly valve may be positively maintained in any desired position.

Thus, it will be understood that in the butterfly valve which incorporates therein the handle braking device of the present invention, even when the component parts of the butterfly valve which are firmly held in position in the manner mentioned hereinabove may be accidentally subjected to any force which tends to displace them from their proper positions or relationship to the extent that the parts will come loose resulting in accidental rotation of the shaft and the disc member or even when the handle may accidentally subjected to any force which tends to rotate the handle, since the frust-conical wedge member 29 held in position is designed to hold the other various parts of the valve against any accidental displacement in response to any force which otherwise tends to accidentally displace them, the valve parts or the handle can be positively held in position against the force urging the same to displace and the valve can perform its function satisfactorily.

In the foregoing, the invention has been described particularly in connection with controlling or braking of the operating handle of a butterfly valve, but it will be understood that the braking device can be equally applied to other types of valves the handles of which are to be controlled or braked without departing from the spirit of the invention and within the scope of the invention as defined in the appended claims.

WHAT I CLAIM IS:—

1. A butterfly valve comprising a hollow cylindrical flanged body to be connected at its opposite ends to pipes in a piping system adapted to transport hydraulic fluid under high pressure; a disc member rotationally disposed within said body and extending across the interior of the body at right angles to the longitudinal axis of the latter for rotational movement between valve open and closed positions; an annular packing disposed around the outer periphery of said disc member and adapted to provide a fluid-tight sealing between the inner periphery of said body and the outer periphery of said disc member; a rotary shaft extending across the body at right angles to the longitudinal axis of the body and passing through said packing and disc member with the upper end protruding through an upper portion of the body and the lower end rotatably seating in a diametrically opposite lower portion of the body; and an elongated manual

After the lever 20 and the wedge member 29 have reached the dotted line positions of Fig. 6, if the handle 10 is turned in either direction while maintaining the lever and the wedge member in the above-mentioned dotted line positions, the wedge member 29 will slidably roll in the transverse direction of the intermediate handle portion 12 relative to the lever 20 and the shaft 8 and the disc member 5 will rotate in the same direction as the handle 20 by an angular distance corresponding to the rotational movement of the handle. Then, if the handle 10 and the lever 20 are quickly released from the gripping force acting on them, the leaf spring 27 immediately springs out to urge the lever 20 downwardly whereupon the lever 20, the wedge member 29, the shaft 8 and the disc member 5 are firmly held in their respective positions which these parts assume when the gripping force on the handle 10 and the lever 20 are removed therefrom whereby the butterfly valve may be firmly held in its partially opened position regardless of the pressure of the flowing high pressure hydraulic fluid acting thereon.

In operation, when the operator grips the handle 10 together with the lever 20 at the grip or rear handle portion 13 in his one hand and then increases his gripping on these parts so as to cause the lever 20 to pivot about the pivot pin 24 in the counter-clock direction against the force of the leaf spring 27 to the dotted line position of Fig. 6, for example, the frust-conical wedge member 29 carried by the shorter lever arm 21 is caused to slidably and rearwardly move in the longitudinal direction of the intermediate handle portion 12 on the guiding way 33 together with the lever 10 against the holding down force of the brake disc 31. Then, when the operator turns the operation handle 10 in either direction while maintaining his gripping on the lever 20 in the dotted line position of Fig. 6, the wedge member may be allowed to frictionally roll sidewise along the triangular cross-section transverse surface of the guiding way 33 and the shaft 8 and the disc member 5 firmly connected to the shaft for rotation therewith may be caused to smoothly rotate in the same direction as the handle 10 by an angular distance corresponding to the angular displacement of the handle. After the parts of the valve have moved in the manner as mentioned just above, the operator quickly releases his gripping on the handle 10 and the lever 20 whereupon the leaf spring 27 springs out to cause the lever 20 to pivot about the pivot pin 24 in the clockwise direction as seen in Figs. 1 and 6 so as to urge the longer lever arm 22 downwardly whereby the frust-conical wedge member 29 is urged forwards in frictional contact with the underside of the brake disc 31 and with the sloped guide way 33 of the intermediate handle portion 12 to the position

in which the wedge member 29 had assumed prior to the above-mentioned operation. With the wedge member 29 held in the position as mentioned above, the handle 10, the lever 20, the shaft 8 and the disc member 5 can be firmly held in their respective positions in which they assume when the operator releases his gripping on the handle 10 and the lever 20 whereby the butterfly valve may be positively maintained in any desired position.

Thus, it will be understood that in the butterfly valve which incorporates therein the handle braking device of the present invention, even when the component parts of the butterfly valve which are firmly held in position in the manner mentioned hereinabove may be accidentally subjected to any force which tends to displace them from their proper positions or relationship to the extent that the parts will come loose resulting in accidental rotation of the shaft and the disc member or even when the handle may accidentally subjected to any force which tends to rotate the handle, since the frust-conical wedge member 29 held in position is designed to hold the other various parts of the valve against any accidental displacement in response to any force which otherwise tends to accidentally displace them, the valve parts or the handle can be positively held in position against the force urging the same to displace and the valve can perform its function satisfactorily.

In the foregoing, the invention has been described particularly in connection with controlling or braking of the operating handle of a butterfly valve, but it will be understood that the braking device can be equally applied to other types of valves the handles of which are to be controlled or braked without departing from the spirit of the invention and within the scope of the invention as defined in the appended claims.

WHAT I CLAIM IS:—

1. A butterfly valve comprising a hollow cylindrical flanged body to be connected at its opposite ends to pipes in a piping system adapted to transport hydraulic fluid under high pressure; a disc member rotationally disposed within said body and extending across the interior of the body at right angles to the longitudinal axis of the latter for rotational movement between valve open and closed positions; an annular packing disposed around the outer periphery of said disc member and adapted to provide a fluid-tight sealing between the inner periphery of said body and the outer periphery of said disc member; a rotary shaft extending across the body at right angles to the longitudinal axis of the body and passing through said packing and disc member with the upper end protruding through an upper portion of the body and the lower end rotatably seating in a diametrically opposite lower portion of the body; and an elongated manual



operating handle operatively connected to said protruding upper end of the rotary shaft for rotating the shaft and hence the valve disc and extending horizontally at right angles to the vertical axis of the shaft; characterised by the provision of a braking device for said operating handle comprising a spring-loaded wedge actuating means pivoted to said handle within a partially box shaped intermediate portion thereof, which portion is formed between the opposite ends of the handle; wedge means carried by said wedge actuating means at one end of the latter for movement in the longitudinal direction of said handle and a stationary brake disc held in position between said top of the body and said handle at the end of the latter surrounding said protruding upper end of the shaft and serving to frictionally hold said wedge means between itself and said intermediate portion of the handle.

2. A butterfly valve as set forth in Claim 1, in which said operating handle consists of an end plate portion secured to said protruding upper end of the rotary shaft, an integral intermediate box-shape portion having a cross-section area which increases from one open end to the other, and an integral opposite end portion having a reversed U-shape cross-section, said intermediate portion having a substantially triangular cross-section wedge guiding way formed by the bottom wall thereof and sloped downwardly in the longitudinal direction and outwardly and upwardly from the opposite sides of the lowest centre in the transverse direction.

3. A butterfly valve as set forth in Claim 1, or Claim 2, in which said spring-loaded wedge actuating means comprises a lever including a shorter arm formed at one end with a substantially semi-circular notch and an integral longer arm connected to the other end

of said shorter arm and having one end of a leaf spring secured thereto and the other end of which spring abuts the inner surface of the top wall of said rear handle portion, said lever being pivoted in the junction between said shorter and longer arms at a transverse pin extending between and anchored to the side walls of said intermediate handle portion.

4. A butterfly valve as set forth in Claims 2 and 3, in which said wedge means comprises a frust-conical member the diameter of which increases from one end toward the other end in conformity with the sloping configuration of said guiding way in the longitudinal direction and the periphery of which is adapted at all times to frictionally roll in contact with said stationary brake disc and the sloped guide way in the transverse direction of the guide way, said frusto-conical member being provided at a point between the opposite ends thereof with a constricted or reduced diameter neck portion adapted to be loosely received by said lever short arm whereby the frust-conical member may be frictionally moved along said guide way in the longitudinal direction thereof together with said lever as the lever is moved upwardly and downwardly and frictionally rolled on the guide way in the transverse direction thereof as the lever is moved horizontally and laterally.

5. A butterfly valve, constructed, arranged and adapted to operate substantially as hereinbefore described with reference to the accompanying drawings.

GEE & CO.,
Chartered Patent Agents,
51-52 Chancery Lane,
London, W.C.2,
and
22 Whitefriargate, Hull.
Agents for the Applicant.

