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2,925,733

TORQUE TUBE LEVEL CONTROL

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Fig. 1,

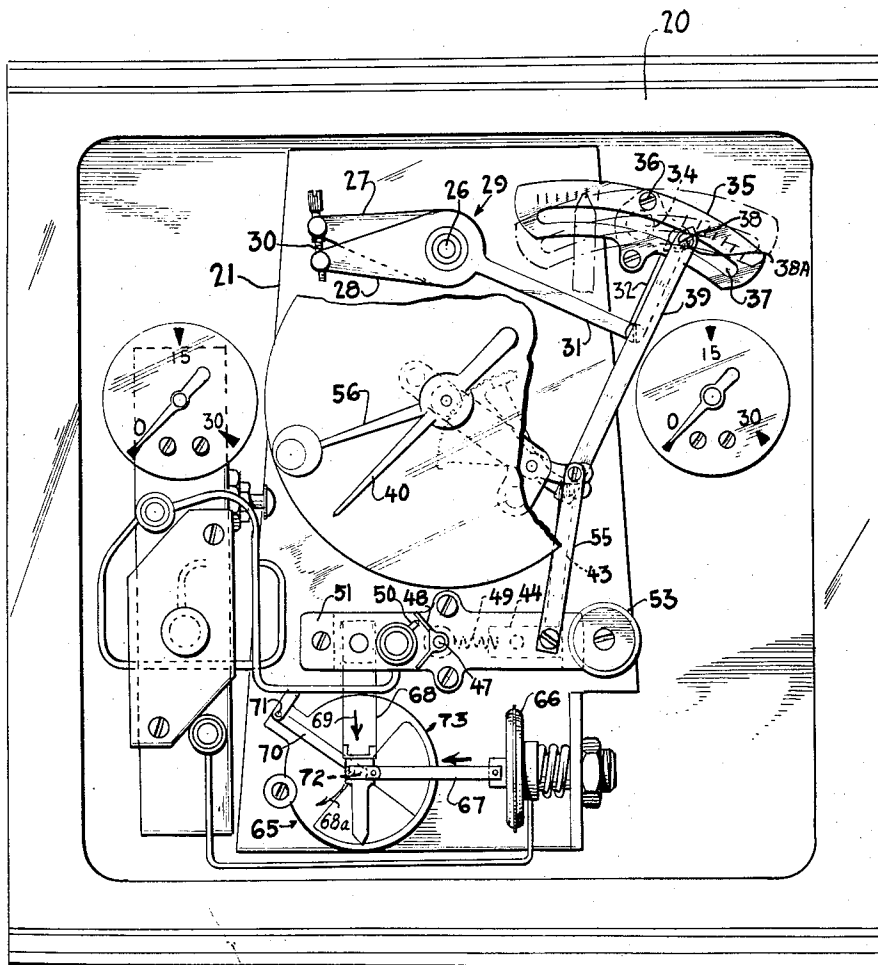
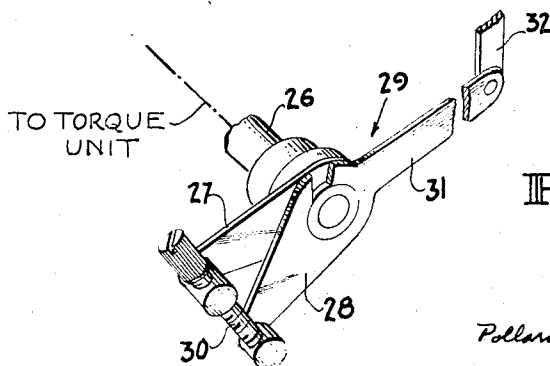


Fig. 3

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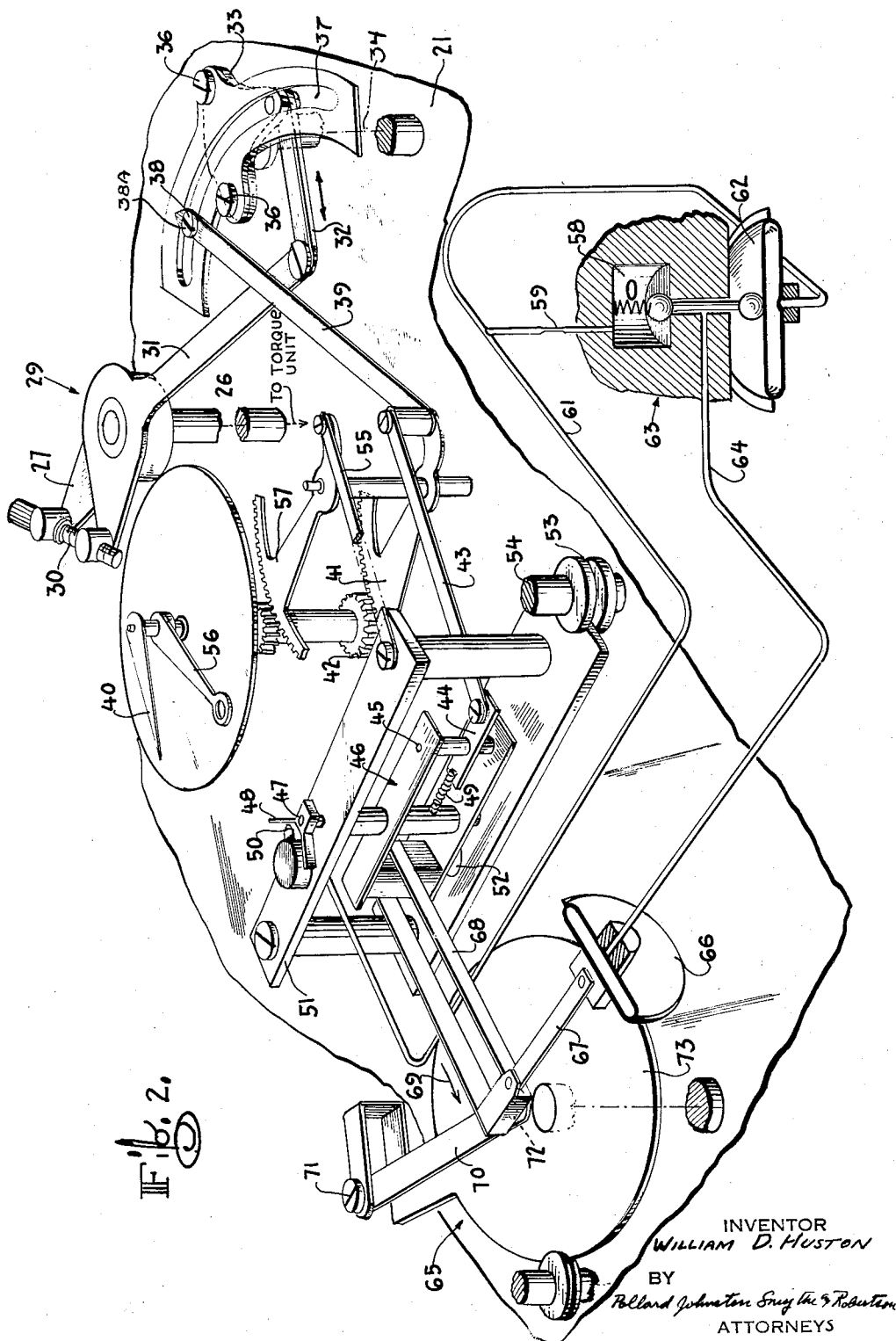
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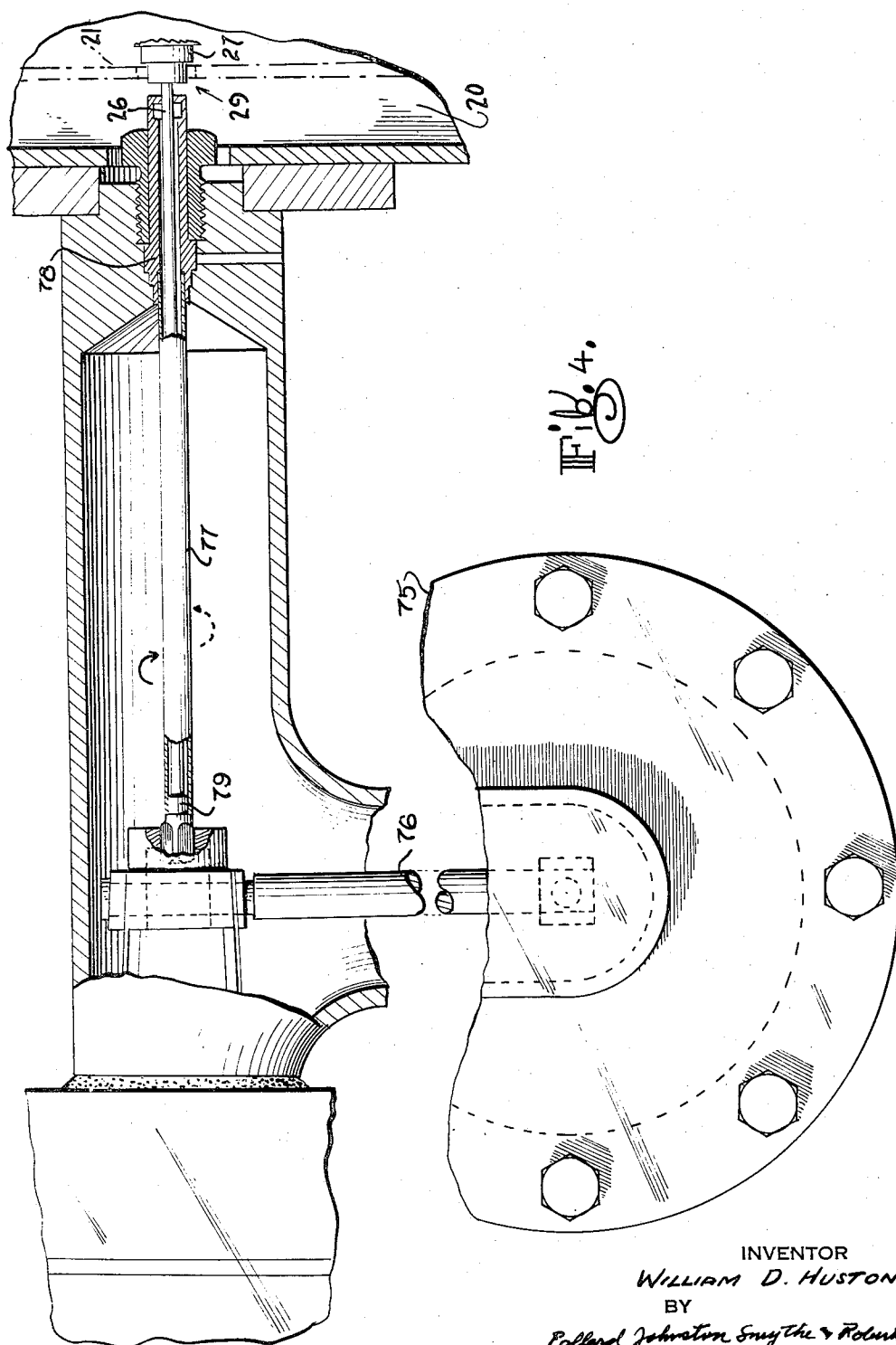
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TORQUE TUBE LEVEL CONTROL

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1 Claim. (Cl. 73—309)

This invention relates to pneumatically operated instruments and particularly to an instrument responsive to level for producing a pneumatic control pressure.

In level control instruments, it is necessary in many cases to provide an instrument readily adjustable for liquids having different specific gravities and which can be used regardless of the direction in which the level control signal is applied to the instrument. Also, in order to have a universal instrument, it is frequently necessary to provide for a varying band feedback mechanism which will function in a forward direction or in a reverse direction.

One of the objects of the invention is to provide a controller which can be used for various liquids and which can be used regardless of the direction in which the signal is applied or the direction in which the valve or mechanism controlled thereby is operated.

Another object of the invention is to provide an improved linkage arrangement for connecting a level responsive means with a pneumatic control instrument.

In one aspect of the instrument, a level responsive means is connected to a torque tube assembly such as the one shown in copending application Serial No. 519,690, filed July 5, 1955, now Patent No. 2,821,860. The rotatable rod of the torque tube is rotated in response to liquid level changes and is connected to a pivoted movement transfer rock arm, said rock arm being oscillatable thereby. The rock arm is connected by link mechanism to a lever mounted on a differential carriage, the lever being pivoted about an axis spaced from the pivoted axis of said differential carriage. A flapper is mounted on the axis of the differential carriage, said flapper being movable by the aforementioned lever. A rotatably mounted carrier is provided having a nozzle mounted on it which cooperates with the flapper to produce a nozzle pressure. The nozzle is connected to a source of air through a restriction, movement of the flapper and nozzle relative to each other in response to a change of level causing a change in pressure in the nozzle. The nozzle pressure is connected to a pressure responsive relay which furnishes an output pressure for operating the valve or element to be controlled. Movement of the valve or element to be controlled is fed back through a feed back arrangement to the differential carriage so as to tend to reposition the nozzle and flapper relative to each other after a change in their relationship.

In a preferred form, the aforementioned rock arm may be a segment having an arcuate slot or guide means, the rock arm being pivotally mounted between its ends and adjacent the center thereof. The torque tube rotatable rod is connected to said segment so that said segment will be oscillated about the axis of its pivot upon rotation of said torque tube rod. A link is adjustably or slidably mounted in the arcuate slot of said segment, the other end of the link being connected to an operating mechanism for the flapper and nozzle of a pneumatic control instrument. The end of the link

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in the arcuate slot can be adjustably moved so as to be on either side of the pivot axis of the segment so as to change the direction of operation of the device. Further, the distance from the pivot axis can be adjusted as needed so as to change sensitivity or response. A feed back mechanism can be connected to the differential carriage through a supporting means which can be arranged to permit adjustment of the operating band of the pneumatic control and direction thereof.

These and other objects, advantages and features of the invention will become apparent from the following description and drawings which are merely exemplary.

In the drawings:

Fig. 1 is a front view of the instrument with portions thereof broken away;

Fig. 2 is an enlarged fragmentary perspective schematic view of operating parts of Fig. 1;

Fig. 3 is an enlarged fragmentary broken view of the connection between the torque tube rod and operating link; and

Fig. 4 is a fragmentary view of one form of level responsive torque tube arrangement.

A general description of the instrument first will be given, reference being made to Fig. 1 wherein casing 20 may carry thereon a mounting plate 21 upon which the various parts of the indicating and pneumatic control elements are fastened, the plate being mounted on the inside back part of casing 20. A door or cover (not shown) can be pivotally mounted on the front of the casing.

The torque tube assembly actuating or rotatable rod 26 has mounted thereon an arm 27 which is connected to arm 28 of lever or bell crank 29 through an adjustable screw arrangement 30. The rod 26 rotates responsive to a level responsive means such as seen in Fig. 4. Arm 31 is connected to link 32 which in turn is connected to pivoted plate or crank lever 33, said pivoted plate being pivotally mounted on axis 34 on the frame of the instrument. Segment or element 35 can be fastened to plate 33 by means of screws 36 and is rotatable therewith. Segment 35 may have an arcuate or suitably shaped slot or guide 37 for receiving the end 38 of operating mechanism link 39. End 38 of the link 39 may have a screw 38A with an associated clamp or means for adjustably fastening the pivot point of the link in arcuate slot 37. The amount of movement given to link 39 by rotation of rod 26 by the liquid level will vary in accordance with the position of 38 relative to axis 34 and will change in direction in accordance with the side of axis 34 upon which link 38 is located. The torque tube assembly may include a casing 75 in which is mounted a float or displacement means (not shown), said means being movable in a plane perpendicular to the sheet of drawing. Arm 76 is fastened to one end of tube 77, the other end being held at 78. Rotatable rod 26 is fastened at 79 to the tube 77. Thus, adjustment of the link 38 in slot 37 can be made in accordance with the specific gravity of the liquid involved. Operating movement link 39 is connected to indicating pointer 40 through gear and pinion arrangement 41, 42 (Fig. 2) in the usual manner. Link 39 also is connected through link 43 with the pneumatic control, link 43 being connected to the flapper operating lever 44, lever 44 being mounted at 45 on differential carriage 46. Flapper 48 and carriage 46 are rotatable about axis 47, the flapper being rotatable upon movement of operating lever 44 through the stiff spring 49 or other suitable connection. The flapper has two extensions, either of which can be employed in accordance with the position of nozzle 50.

In the form shown, nozzle 50 is mounted on adjustable carrier 51, carrier 51 being pivoted on mounting plate 21 by screw or shaft 52. The edge of the carrier can be frictionally engaged by the set point adjusting arrange-

ment 53, turning of shaft 54 serving to move the nozzle relative to flapper 48 and thus change the set point. In order to indicate the set point, carrier 51 can be connected to the set point indicator hand 56 through the usual pinion and gear arrangement 57.

Describing operation, a change in the level of liquid will move link 39 in accordance with the location of pivot point 38 on segment 35 and thus will result in a change of the relation of flapper 48 to nozzle 50. A change in pressure in nozzle 50 will result in a change of output pressure, air being supplied to the nozzle through restriction 59 from an air supply also connected to chamber 58 of the air relay 63. Nozzle pressure in pipe 61 also is connected to diaphragm 62 with the relay mechanism 63 so as to control air pressure in the output line 64.

In the form illustrated, a follow-up or feedback mechanism 65 can be used, change of pressure in feedback diaphragm 66 causing movement of link 67 and of link assembly 68 so as to reset differential carriage 46. Link assembly 68 moves in the direction of the arrow 69 in an arc 68a determined by the position of pivot point 71, link 67 and 68 being pivotally connected at pivot point 72 which is supported by arm 70. Rotation of disc 73 will change the relative position of 71 to 72 and thus permit change of the proportioning band and direction of the feed back.

It is to be understood that details of construction can be varied without departing from the spirit of the invention except as defined in the appended claim.

What is claimed is:

An instrument comprising a level responsive means, a torque tube rotatable in response to the level responsive means, a nozzle device, a flapper device, a differential

carriage upon which one of said devices is mounted, said carriage being oscillatable about an axis and said one of said devices being rotatable about said axis of said carriage, an adjustable carrier pivotally mounted on an axis, the other of said devices being mounted on said carrier so that said devices can be moved relative to each other, and a connecting mechanism for moving said one of said means in response to the rotation of the torque tube, said connecting mechanism including a rod connected to the torque tube and rotatable thereby, a pivoted transfer rock arm, means connecting said rod to said rock arm for oscillating said arm in response to the movement of said rod, a pivoted plate to which said rock arm is connected, a segment attached to said pivoted plate for pivotal movement therewith about a pivot adjacent its center, said segment having an arcuate slot therein which extends to both sides of the center thereof, link means connected to the differential carriage for movement of said one of said devices, and means adjustably mounting said link means in said slot so that it can be moved to either side of the axis of rotation of the segment by merely moving said mounting means in said slot, so that the direction of operation of the instrument can be changed and also so that the distance from the axis of rotation of the segment can be changed in order to change the sensitivity of the instrument.

References Cited in the file of this patent

UNITED STATES PATENTS

2,248,322	Annin	July 8, 1941
2,445,255	Younkin	July 13, 1948
2,616,440	Mason	Nov. 5, 1952