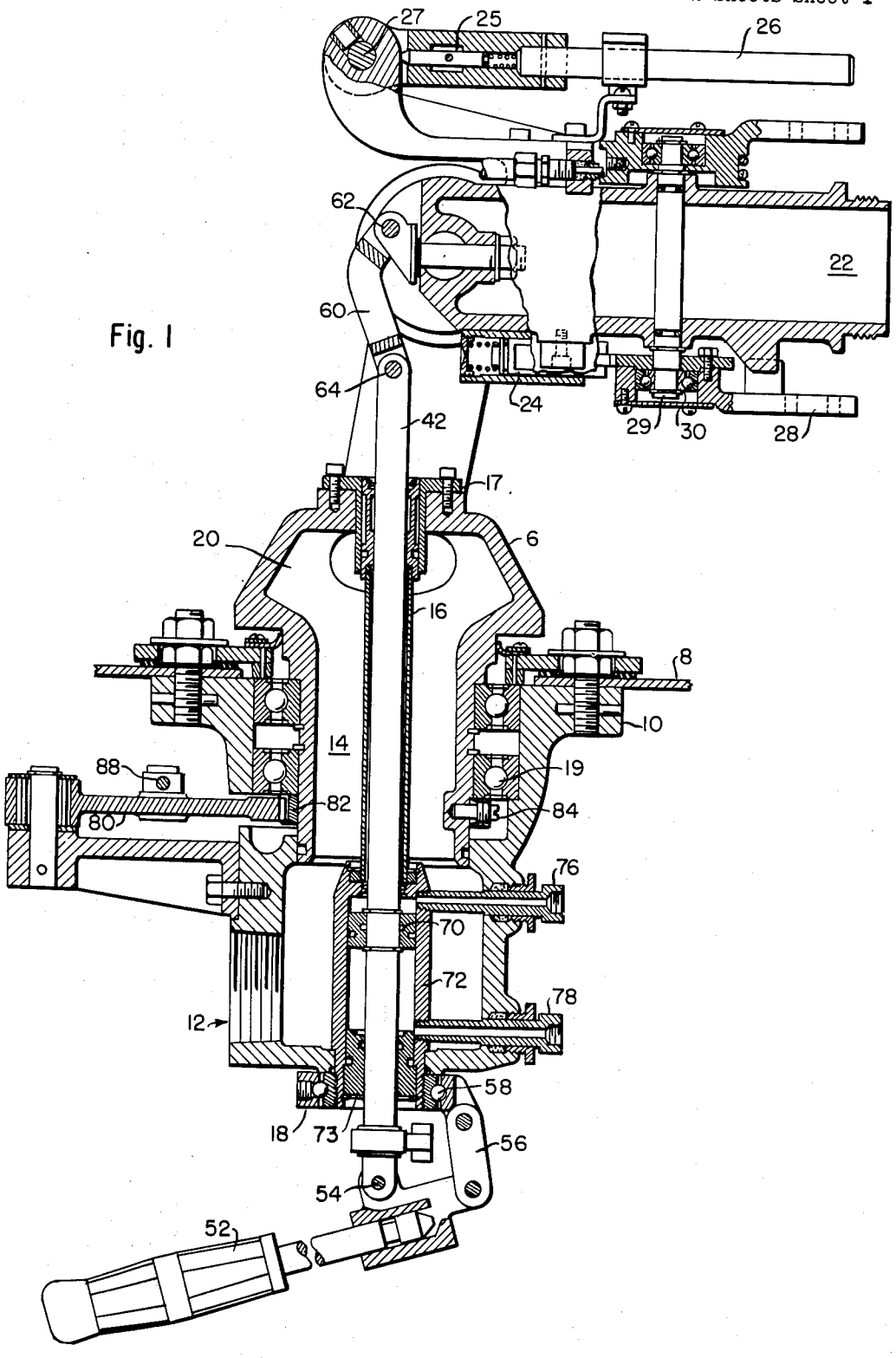
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HYDRAULIC TURRET CONTROL

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Fig. 1

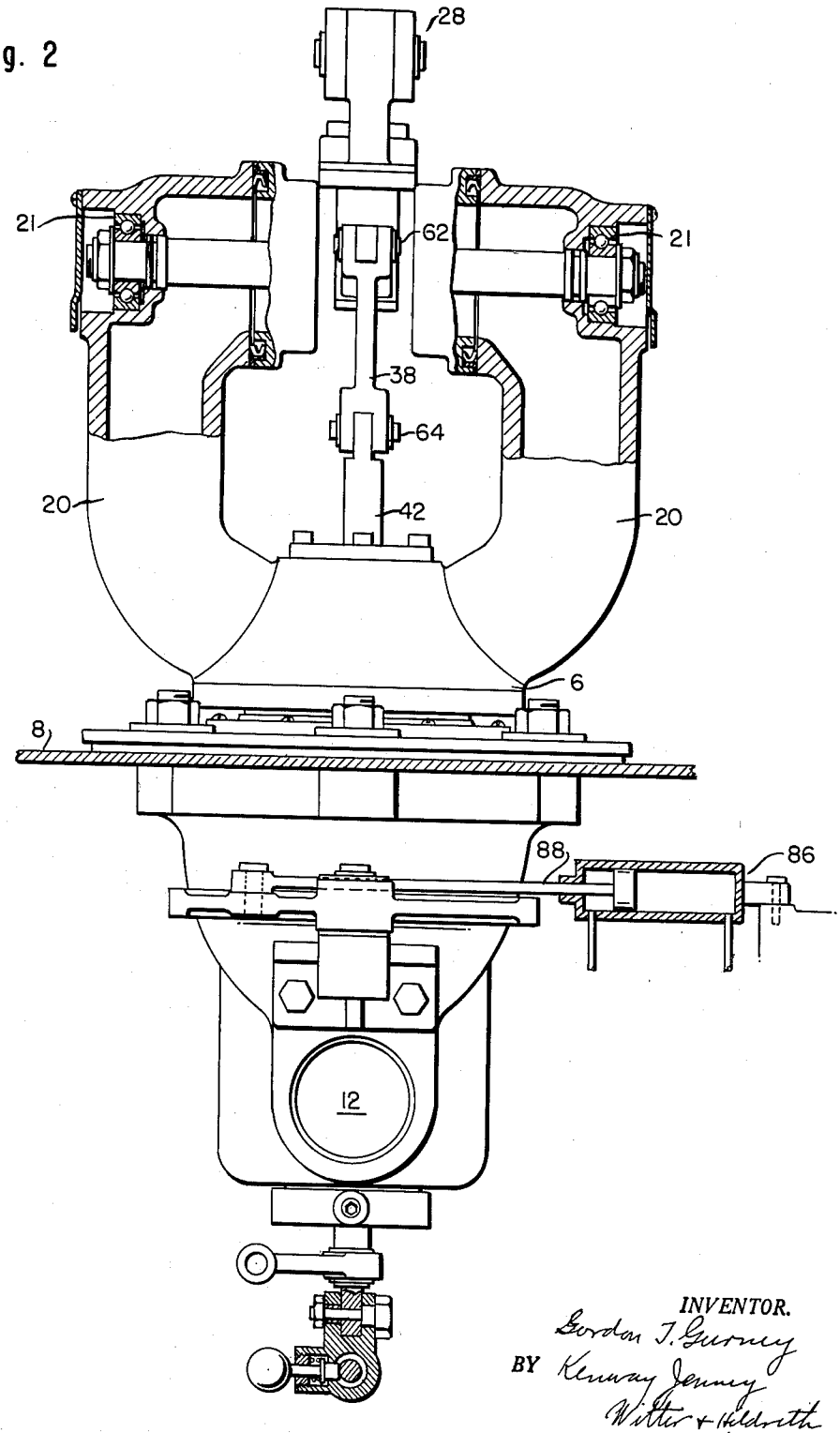


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Fig. 2



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HYDRAULIC TURRET CONTROL

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Application September 24, 1954, Serial No. 458,146

5 Claims. (Cl. 169—25)

The present invention relates to control apparatus for fire fighting turrets and in particular to a combined hydraulic and manual turret control system.

In the application of Howard G. Freeman Serial No. 262,958, filed December 22, 1951, now Patent No. 2,698,665 dated January 4, 1955, for a control apparatus for fire fighting turrets, there is described a simple and easily operated turret control system in which the controls are essentially manual and mechanical. In that application there is described a fire fighting turret for handling either water or fire fighting foam. In such devices it is necessary that the control system move the turret in order to precisely locate the direction and elevation of the nozzle, and in addition, means are usually provided for changing the pattern control devices which fit in front of the nozzle.

In the above-mentioned application the elevation and azimuth of the turret nozzle are directed through the use of a single handle. Vertical movement of the handle controls the nozzle elevation and angular motion about its axis of rotation controls the nozzle azimuth. In order to achieve these results the handle transmits rotary forces tending to change the azimuth of the nozzle through a tube and vertical forces through a link passing through the middle of the tube. In addition, a convenient double cable assembly is shown by which the proper shaping device may be placed in front of the nozzle. Selection is achieved by tension on one or the other of the two cables. It is desirable that the simplicity and accuracy of the form of manual control described in said application be retained and that there be combined with it hydraulic actuating means. Hydraulic control means permit the direction of the turret and nozzle to be controlled remotely, and if properly designed, the hydraulic actuating means can be used as a supplement to manual control in order to reduce the amount of force required to operate the turret manually.

Accordingly, it is the object of this invention to provide a simple and effective combined mechanical and hydraulic control system for fire fighting turrets. It is a further object of this invention to provide a combined hydraulic and mechanical control system in which the hydraulic system will operate independently of the manual system or may be used to reenforce the manual operation.

With these objects in view, the present invention contemplates an arrangement whereby a single handle transmitting force only to a single control rod together with an appropriate linkage operates to manually position the nozzle. This rod carries an enlarged flange which rides in a cylinder and operates as a hydraulic piston to effect control of nozzle elevation. The angular position of the turret is controlled by a large gear sector, a relatively small angular rotation of which will rotate the turret a full 360°. It is a feature of this construction that it is light and compact but at the same time is suitable for heavy as well as light turrets and through the use of conventional feedback techniques, makes it possible to apply hydraulically boosted manual direction to the heavy

turrets which previously required power operation. A further feature of this construction is the fact that it does not restrict the use of either mechanical or other pattern control means to vary the shape of the flow pattern being ejected from the nozzle.

In the accompanying drawings which will be used to describe this invention,

Fig. 1 represents a side elevation partially in section showing the internal arrangement of the operating parts, and

Fig. 2 is an external rear elevation a small portion of which is cut away.

As described in the above-mentioned application the illustrated embodiment of the invention as shown in both Figs. 1 and 2 comprises a turret body **6** adapted to be rotated about a vertical axis for training of the turret in azimuth. The body protrudes up through a supporting partition **8** which may be the cab roof of a crash fire truck, and a frame **10** extends down below the partition and serves as a support for the body. The frame has a liquid inlet **12** connecting with the central passage **14** extending through the body. A control rod **42** passes at its upper end through the body **6** and extends downwardly along the azimuth axis of the body through the water passage **14** in the body and the liquid inlet member **12**, in the frame and out through the bottom of the frame. The body is journalled in ball bearings **19** in the frame and twisting of the control rod turns the body in azimuth, while vertical motion of the control rod controls the nozzle elevation in a manner to be described.

The body of the turret is provided with the usual flaring arms **20**, having water passages branching from the passage **14**. The bearing member **21** at the upper end of each arm supports the nozzle member **22** through which the water or foam is ejected. The nozzle member is journalled for rotation about the horizontal axis of the bearings in order that it may be positioned in elevation. Suitably sealed water passages connect the nozzle with the passages of the arms **20**. The nozzle member **22** terminates in a suitable discharge device which may be changed as desired, as described in the application of Freeman Serial No. 262,958. The flow shaping devices which are positioned in front of the nozzle are not shown, but the bracket to which they are attached is indicated by a reference figure **28**. The bracket pivots about the sealed axle **29** upon ball bearing supports **30**. The spring loaded plunger **24** is adapted to catch in one of a plurality of notches in the mounting bracket to center one of the shaping devices in front of the nozzle. The auxiliary handle **26** is provided on top of the nozzle and may be pivoted into operating position about the pinned hinge **27**. The spring loaded catch **25** fixes the handle in operating position.

The controls for this apparatus and their operation may be described as follows. The principal operating member transmitting the forces required for manual control of both elevation and azimuth is the rod **42** which extends through the sealing tube **16** and connects the control handle **52** with the nozzle **22**. The rod is pinned to the handle by the pin **54** and the handle is free to rotate about this joint. The end of the handle is connected through a link **56** to the ring **18** which is journalled to turn on the ball bearing raceway **58** about the axis of the rod **42** at the lower end of the fixed frame **10**. The link **56** is pinned at both ends and is free to rotate about these pinned joints as the rod **42** moves vertically along its axis. The upper end of the control rod **42** is joined by the bent link **60** to the nozzle **22**. The link is also pinned at one end by the pin **62** which joins it to the nozzle and at the other end by the pin **64** securing it to the control rod. Both of these pin joints also permit free rotation about a horizontal axis as the rod moves vertically. The pin **62**

attaching the link to the nozzle is above the center line of the nozzle and this fact together with the bend in the link itself assures a moment arm by which the elevation of the nozzle can be changed by a vertical force on the control rod regardless of the vertical direction of the nozzle at any given moment.

The apparatus may also be operated hydraulically. To that end the lower end of the control rod **42** carries flange section **70** which operates as a hydraulic piston inside the hydraulic cylinder **72**. The cylinder is firmly secured at its lower end by threaded joints to the frame **10**. The control rod passes through a sealed opening in the top of the cylinder **72**, through the cylinder itself, and through a plug **73** sealing the bottom end of the cylinder. Both ends of the hydraulic cylinder are so formed and the rod itself is packed in a manner which prevents escape of the hydraulic fluid. The tube **16** which encloses the control rod is used to seal the control rod from the fire fighting liquid in the passages, and thereby reduce the amount of packing around the rod itself in order to minimize friction on the control rod. This tube is sealed in a flanged sleeve **17** bolted to the body and is also scaled in the upper end of the hydraulic cylinder **72** which is attached to the frame. The control rod passes through an O ring sealed opening in the upper end of the hydraulic cylinder, through the tube, and through another O ring seal at the upper end of the tube as it passes out through the body. The control rod is therefore restrained to move along the azimuth axis defined by the axis of the hydraulic cylinder and the opening in the turret body.

Two tubular connections **76** and **78** are threaded to the side of the cylinder **72** and also through sealed joints in the side of the frame **10**. These connections serve to connect the hydraulic system to the hydraulic piston carried inside the frame and carry the hydraulic fluid to one side or the other of the piston **70**. It will be apparent from a brief inspection of this arrangement that the injection of hydraulic fluid under pressure through the inlet **76** will serve to drive the rod **42** downward and thereby raise the angle of elevation of the nozzle. Similarly the nozzle may be depressed by injecting high pressure hydraulic fluid in through the duct **78** and thereby raising the rod **42**. In the same way the vertical elevation of the nozzle may be controlled by raising and lowering the handle **52** which also serves to raise and lower the control rod **42**. The handle **52** pivots about the pin joining it to the link **56** and the link **56** itself gives sufficient freedom of motion to enable the rod to travel a precisely vertical path which is necessary in this case since it carries the piston which must travel axially in the cylinder **72**. At the upper end of the shaft the link **60** is also necessary to permit the shaft to move vertically.

Manual control of azimuth may also be effected by motion of the handle **52**. In this case the handle is moved about the axis of the control rod **42**. The ring **18** rotates about the raceway **58** permitting the handle to move in azimuth thereby twisting the control rod. The torque about the axis of the control rod is transmitted to the body through the link **60** at the other end of the rod and the body rotates on the ball bearings **19** in the frame.

Remote control of the azimuth position of the nozzle is achieved by the operation of the gear sector **80** having a relatively large radius arm and operating upon a portion of the circumference of the body **6** which carries a series of gear teeth **82**. The gear teeth on the body are at a smaller radius from the center of rotation of the body (i. e. the axis of the control rod) than the radius arm of the gear sector **80** and it is therefore possible to obtain complete rotation of the turret body with approximately a 90 degree movement of the gear sector. The stop **84** in the body of the turret prevents the gear sector from traveling a distance which would bring it out of engagement with the gear teeth on the body itself. Motion of the gear sector is obtained through the motion of the hydraulic piston **86** which is attached to the gear sector by means of the linkage **88**. Alternatively this rotary motion may be obtained by use of a rotary hydraulic motor.

While this invention has been described with reference to a single embodiment it is apparent that it may be constructed in a variety of forms as encompassed within the following claims.

I claim:

1. A fire fighting turret comprising a frame, a body member, means for mounting the body member for rotation in azimuth, a nozzle member journalled about an axis in the body for rotation in elevation, communicating liquid passages in the body member and nozzle member, a control rod extending along the azimuth axis, a link connecting the control rod to the nozzle at a point displaced from the elevation axis of the nozzle, a handle connected with the control rod and the frame for independently turning the body in azimuth and the nozzle member in elevation by means of the control rod, hydraulic means to effect control of the elevation of the nozzle by vertical displacement of the control rod, and hydrauiic means for rotating the body in azimuth.

2. A fire fighting turret comprising a fixed frame, a body member mounted on the frame for rotation in azimuth, a nozzle member journalled on the body member for rotation and elevation, communicating liquid passages in the frame body and nozzle members, a control rod extending through sealed openings in the frame and body members and extending along the azimuth axis, a link connecting the upper end of the control rod with the nozzle member, a ring at the lower end of the frame free to rotate about the azimuth axis, a handle pivotally connected to the control rod, link connecting the handle with the ring, whereby motion of the handle will independently turn the body in azimuth and move the nozzle member in elevation, a hydraulic piston having its axis parallel to the axis of the control rod to effect changes of elevation of the nozzle by motion of the control rod along the azimuth axis, and hydraulic means to effect rotation of the nozzle in azimuth.

3. A fire fighting turret comprising a fixed frame, a body member mounted on said frame for rotation in azimuth, a nozzle member journalled on the body for rotation in elevation, communicating liquid passages from the frame to the body to the nozzle, a control rod passing along the azimuth axis through sealed openings in the frame and body members, a handle, attached to the lower end of the control rod, a ring on the frame free to rotate about the axis of the control rod, a link connecting the control rod to the ring, a link connecting the upper end of the control rod to a point on the nozzle displaced from the elevation axis for any position of the nozzle, whereby the nozzle will follow the angular positions of the control handle, hydraulic means for rotating the body in azimuth, and hydraulic means operating upon the control rod for changing the nozzle in elevation.

4. A fire fighting turret comprising a body member, means for mounting the body member for rotation in azimuth, a nozzle member journalled on the body for rotation in elevation, communicating liquid passages in the body and nozzle members, a frame member on which the body is mounted, a control rod extending along the azimuth axis its lower portion passing through a sealed opening in the frame and its upper portion passing through a sealed opening in the body, a link connecting the upper end of the control rod to a point on the nozzle which is displaced from the elevation axis for any position of the nozzle, a ring on the exterior of the frame which is free to rotate about the azimuth axis, a handle, the midportion of which is attached to the lower end of the control rod, a link connecting the end of the handle to the ring, a hydraulic cylinder attached to the frame, an enlarged portion on the control rod where it passes through the hydraulic cylinder, said enlarged portion acting as a piston, hydraulic connections leading to both ends of the hydraulic cylinder whereby actuation of the hydraulic

cylinder will raise and lower the control rod thereby changing the nozzle elevation, and hydraulic means for rotating the turret body in azimuth.

5. A fire fighting turret comprising a stationary frame, a body member mounted on said frame for rotation in azimuth, a nozzle member journalled on the body for rotation and elevation, communicating liquid passages leading from the frame through the body to the nozzle, a control rod extending along the azimuth axis of the body, a link pivotally connected to the control rod and to the nozzle at a point displaced from the elevation axis for any position of the nozzle, said link effecting vertical displacement of the nozzle coincident with vertical displacement of the control rod and transmitting to the body member any torque forces tending to rotate the control

rod, a bracket connected to a cylindrical raceway on the frame free to rotate about the azimuth axis, a handle connected to the lower end of the control rod, a link pinned to both the end of the control rod and the cylindrical ring whereby vertical motion of the handle will affect change in nozzle elevation and force tending to change in the azimuth angle of the handle will transmit a torque to the turret body thereby changing the azimuth angle of the nozzle, hydraulic means acting upon the control rod to move it in either direction along the azimuth axis, and hydraulic means acting upon the turret body to rotate it about the azimuth axis.

No references cited.