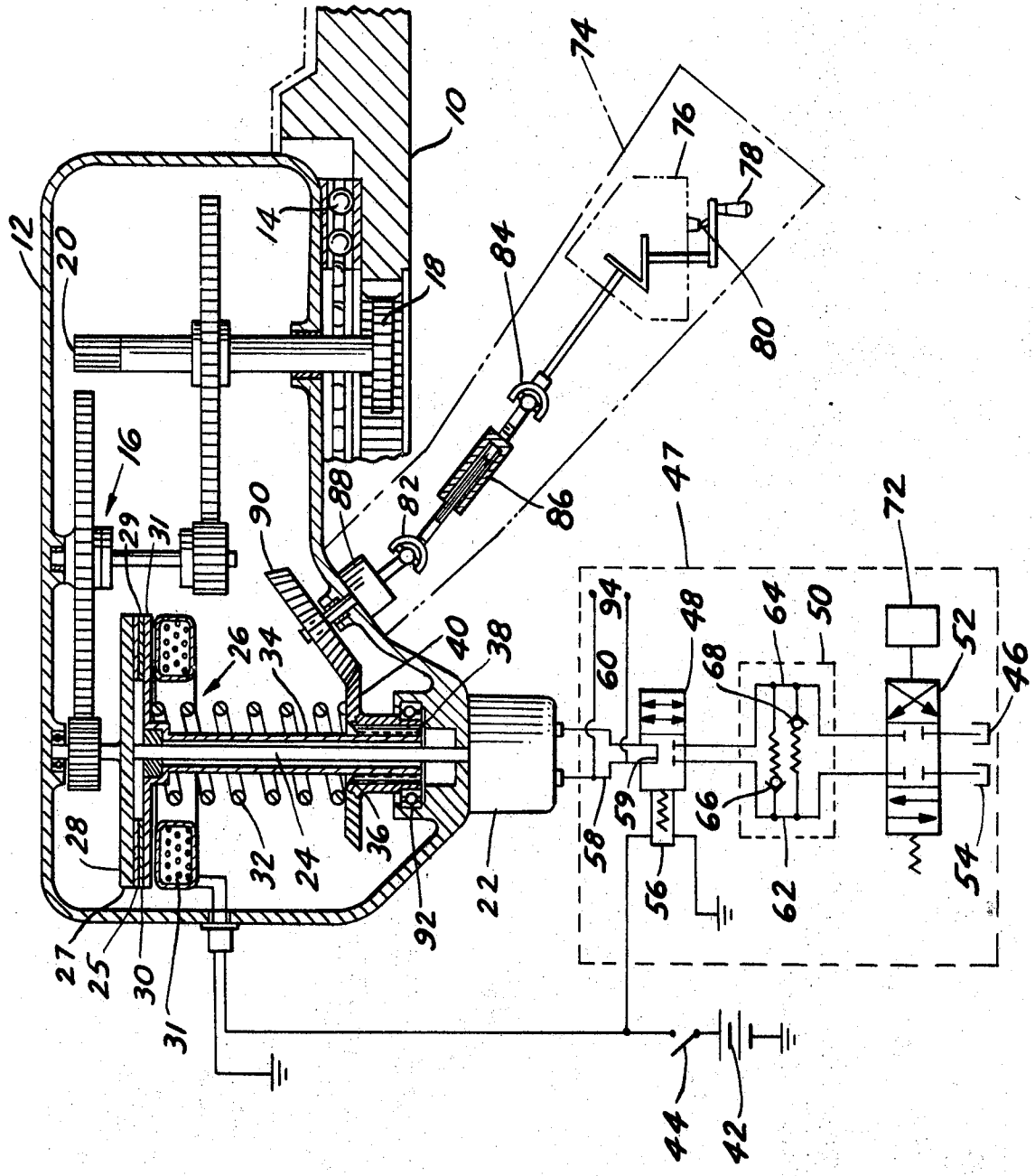
Sept. 15, 1970 A. MANIKER ET AL 3,528,320

TURRET TRAVERSE MECHANISM

Filed Aug. 28, 1968



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United States Patent Office 3,528,320 Patented Sept. 15, 1970

3,528,320

TURRET TRAVERSE MECHANISM

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Filed Aug. 28, 1968, Ser. No. 756,015
Int. Cl. F16h 5/48
U.S. Cl. 74—625 3 Claims

ABSTRACT OF THE DISCLOSURE

A turret traverse mechanism for rotating the turret about the traverse axis of a support hull. Motor and manual power means alternately and selectively drive the turret housing depending upon the positon of a clutch mechanism which is connected with each of the power means and also the position of a motor control means.

This invention relates to a turret and more particularly to means for rotating a turret about a traverse axis.

It is conventional in military operations to mount a rotatable turret on the hull of a tank and to provide a driving means therefore. This driving means is necessary to enable rotation of the turret to any traverse position regardless of the direction in which the tank is moving. It has been found that if the power for the driving means is lost, the tank crew becomes extremely vulnerable to enemy attack due to its inability to direct the armament which is mounted on the turret at the enemy. Accordingly, there exists a great need for a flexible system which will permit the tank crew to rotate the turret about the traverse axis after normal power has been lost. In addition, it is often desirable to selectively rotate the tank turrent manually so as not to divulge the tank's position. The prior art method of accomplishing this was with a differential. To expedite manual operation, however, it is further desirable that the means for manually rotating the turret be automatically connected with the turret output drive means when electrical and hydraulic power is removed or unavailable and yet be disconnected from the turret output drive means when power is available.

According to the present invention, there is provided a turret traverse mechanism for rotating a turret about a traverse axis on a support hull. A motor power source and a manually operated power source selectively provide power for rotating the turret. A power transfer means is provided for normally coupling the manual means with the output gear means which transmits the rotative power between the support housing and the support hull. Decoupling means are provided for decoupling the manual power means from the output gear means and simultaneously providing power to the motor means which is also connected to the power transfer means for providing rotational power to said output gear means whereby the turret may be rotated about the traverse axis. The power transfer means comprises a clutch type brake which holds the turret housing locked in azimuth by means of a no-back unit. The brake is normally engaged by compression springs against a piston which holds a geared brake plate assembly against a flange on the input shaft. When the gunner squeezes his palm switches, a solenoid constituting the decoupling means is energized thereby attracting the brake plate away from the input shaft flange, releasing the brake. The brake plate is geared to the manual traversing handle through a no-back unit which prevents the turret from traversing when the brake is applied. In the event that power is not available, the turret can be traversed by use of the manual traverse handle. The brake then becomes a clutch and is driven by the manual traverse handle through a no-back unit.

Other advantages of the present invention will become apparent to those of ordinary skill in the art by the following description when considered in relation to the accompanying drawing of which:

The turret traverse mechanism according to the present invention, is shown, partly in section, in the single figure.

Referring now to the drawing, the outline of a tank support hull is shown at **10**. The turret housing **12** is rotatably mounted on the support housing by means of bearings **14**. An output drive means is shown schematically at **16** having a plurality of gears and an output pinion **18** connected with said support hull for transmitting rotative power between a support housing **12** and the hull. A guide means for the output drive means is shown schematically at **20**.

Selectively energizable motor means **22** is connected with the output gear means by input shaft **24**. Hydraulic power for the motor **22** is controlled by the tank gun in a manner which will be described hereinafter. When power is delivered to motor **22** however, rotative force necessary to rotate the turret about the traverse axis is transmitted through input shaft **24**, drive means **16**, pinion **18** and then to hull **10**.

Hydraulic motor **22** is connected with a power transfer means shown generally at **26** by means of input shaft **24**. Power transfer means **26** comprises normally engaged clutch means including driven member **28**, driving member **30**, biasing means **32**, and means for disengaging the clutch means. Driving member **30** comprises a clutch plate **29** mounted on disc **31** which is secured to shaft **34**. Shaft **34** is coaxial with input shaft **24** and is axially movable. Outward splines **36** formed on the bottom of shaft **34** slidably engage inward splines **38** mounted on hand traverse drive gear **40**. The driving member **30** normally engages driven member **28** which comprises the clutch plate **25** bonded to disc **27** which is mounted on shaft **24**. Biasing means **32** comprises a clutch spring connected between driving member **30** and hand traverse drive gear **40** for yieldably biasing driving member **30** against driven member **28**. The means for disengaging the clutch means **31** comprises electromagnetic means for disengaging driving member **31** and driven member **28**. Through switch **44** a power source indicated at **42** is connected with the clutch coil formed within electromagnetic means **31** and provides a magnetic coupling between the electromagnetic means **31** and driving means **30**. The coil is formed from a sufficient number of turns to create an electromagnetic field which is sufficiently strong to attract driving member **30**, made of any suitable magnetic material. Although the means for disengaging the clutch means has been represented in the drawing by only a clutch coil, suitable magnetic material could be provided in and around the clutch coil to strengthen the magnetic field as necessary.

The means for energizing the hydraulic motor **22** is shown generally in dotted area **47**. The power source for providing hydraulic fluid for motor **22** is shown at **46**. Fluid for motor **22** flows from source **46** through directional control valve **52**, cross-over relief valve **50**, bypass valve **48**, motor **22**, and then back to reservoir **54**. When switch **44** is closed to provide energy to coil **31**, current flows to solenoid **56** of bypass valve **48** which connects lines **58** and **60** with lines **62** and **64** respectively. Relief valves **66** and **68** will permit fluid to flow therethrough when the pressure on line **64** and **62** respectively exceed a predetermined value. Directional control valve **52** is controlled by the gunner's control handle **72** and directs

the fluid from source 46 through either line 62 or line 64 depending on the direction in which the turret is to be turned. Moreover, if desired, the gunner may disconnect the source of fluid and reservoir from the lines 62 and 64 so that the pressure in lines 62 and 64 operates as a buffer for motor 22, thereby restricting its movement. When switch 44 is opened, coil 31 is not energized, solenoid operated bypass valve means 48 is deenergized whereby fluid lines 58 and 60 are short circuited as shown in the drawing at 59, hence permitting fluid to flow freely therebetween. Although motor 22 remains connected with shaft 24, clutch driven member 28, and output gear means 16, this creates very little drag on the system.

The manual control means which may be utilized to rotate turret 12 about hull 10 is shown generally in dotted area 74. Manual control means 74 comprises manual traverse gear box 76 having a handle 78 connected thereto with detent 80 positioning handle 78 in a desired position, universals 82 and 84 with a telescoping spline 86 connected therebetween, and a no-back unit 88. Manual traverse gear box may suitably involve a plurality of gears arranged in a suitable ratio to permit relatively easy turning of the turret by handle 78. Telescoping spline 86 provides for movement of the manual traverse gear box 76 relative to the turret housing 12. The universals 82 and 84 shaft with telescoping splines permits misalignment of the components due to the manufacturing tolerances without affecting the operation or performance of the manual system. The no-back unit 88 is commercially available and prevents movement of turret housing 12 from being reflected into the manual traverse gear box. Force transmitted by attempted movement of the turret housing 12 will cause no rotation of manual traverse handle 78, due to the presence of the no-back unit. In addition, the handle detent 80 keeps the handle in an optimum stowed position when the handle is not used and prevents further possible injury to the operator if the no-back unit fails.

The output of the no-back unit 88 is connected to an output pinion 90 which is meshed with hand traverse drive gear 40. Hand traverse drive gear is mounted on bearings 92 which is fixed to turret housing 12. An antibacklash mechanism is normally incorporated with output pinion 90 to eliminate mechanical play.

If desired, the system could further be operated by eliminating both the aforementioned hydraulic supply means and the manual control means for rotating the turret and provide pressurized fluid for the motor 22 by a turret traverse servomechanism. This is conventionally known as the stabilized mode in which the clutch coil 31 and bypass valve 48 are energized and the clutch is disengaged so that power for the hydraulic motor is controlled by a servomechanism. The stabilized mode operation is not peculiar to this invention however, and will not be described in detail. If however, it were desirable to utilize such an additional mode, the power or the hydraulic motor would be supplied at 94.

The operation of the circuit will be first described with reference to the turret traverse mechanism receiving no electrical power as shown in the drawing. When the system is thus turned "off," biasing spring 32 will urge driving member 30 into engagement with driven member 28, thus breaking the driven member 28 against rotation. When electrical power is not available, hydraulic power will not be available to the motor 22 because solenoid bypass valve 48 will not be energized and will assume the bypass position as shown in the drawing. After disengaging handle detent 80, the turret may now be moved by rotating handle 74. Power will be transmitted to the universal splined shaft, through shaft 24, driving member 30, driven member 28, output drive means 16, and finally to hull 10. The turret is "locked" into place by means of the no-back unit 88 which prevents rotation of manual traverse handle 78 by precluding the transfer of energy from gear 90 to the manual control means 74.

When power is available and it is desired to operate the turret traverse mechanism in the power load, the gunner squeezes his palm switch 44 when he desires to rotate the turret housing about the transverse axis. When switch 44 is closed, the clutch coil 13 is energized thereby attracting the clutch plate 30 and spline shaft 34 to the coil, thereby compressing biasing spring 32. With the breaking action caused by the engagement of driven and driving members 28 and 30 removed, the input shaft is thereby free to rotate. When the gunner squeezes his palm switch 44, solenoid 56 is also energized which allows hydraulic fluid to pressurize the motor. The operation of the turret is controlled by the gunner in the normal power mode fashion by gunner's control handle 72. By selective control of handle 72, the fluid from hydraulic source 46 is directed through line 62 or 64 depending on direction in which the turret housing is to be removed. Assuming for instance, that the gunner connects the input pressure source 46 with line 64, fluid will flow through line 64, solenoid operated bypass valve 48, line 62, directional control valve 52, and then to the reservoir 54. Power will then be transmitted from motor 22 through shaft 24, with driven member 28 acting as a flywheel, output drive means 16, and then to the tank hull 10. In the power mode, the turret is "locked" by the pressure developed in lines 58, 60, 62, and 64. When the directional control valve does not connect the source in reservoir with lines 62 and 64, the fluid in these lines acts as a buffer and precludes the motor from rotating freely. Cross-over relief valve 50 will, however, permit the flow of fluid therethrough to preclude damage of any of the equipment in the power train system in the event an excessive force is applied to the main turret housing 12. It can be seen therefore that the holding torque of the motor and the holding torque of the clutch will not be additive, hence, the gear train 16 need only be designed to withstand the highest of these two torques. This improved design results in a substantial cost savings.

Release of the gunner's palm switch 44 breaks the circuit to the clutch coil 31 and the bypass valve solenoid 56, thereby returning the clutch to the engaged position and the bypass valve to the bypass position as shown in the drawing. The turret can now be traversed by the use of the manual traverse handle and the cycle can be repeated.

It can thus been from the above description that the manual control means is always available to the operator unless the power mode has been selected. No manual shift operation or mechanisms are required to engage the manual system. The introduction of the manual system in combination with the power system has not increased the inertia of the rotating members in any manner whatsoever for stabilized or power operation. The device is fail safe and the loss of electric or hydraulic power will mechanically engage the clutch, permitting manual traverse.

Since it is obvious that many changes and modifications can be made in the above described details without departing from the nature and spirit of the invention, it is to be understood that the invention is not limited to said details except as set forth in the appended claims.

We claim:

1. A turret traverse mechanism comprising:

a turret housing rotatably mounted on a support hull about a traverse axis,

output gear means connected between said hull and said turret housing for transmitting rotative power therebetween,

a hydraulic motor mounted on said support housing for selectively rotating said turret housing about said traverse axis,

manual control means removably connected with said output gear means for selectively rotating said turret housing about said traverse axis.

electromagnetic clutch means including:
- a driven member connected with said output gear means and said hydraulic motor,
- a driving member removably engaging said driven member and connected with said manual control means,
- a spring biasing means connected with said driving member for yieldably biasing said driving member against said driven member, and
- electromagnetic means mounted on said housing and magnetically coupled with said driving means to disengage said driving and driven members when said electromagnetic means is connected with a source of electrical power,

hydraulic source means removably connected with said hydraulic motor, and solenoid operated valve means connected with said motor and operable to connect and disconnect said hydraulic source means and said motor when said driving and driven members are disengaged and are engaged respectively whereby said turret may be selectively rotated about said traverse axis by either said motor or said manual control means.

2. A turret traverse mechanism comprising:

a turret housing rotatably mounted on a support hull,

outut drive means connected between said turret and said hull for transmitting rotative power therebetween,

selectively energizeable motor means connected with said output drive means selectively providing rotative power for selectively rotating said turret housing about a traverse axis,

manual control means removably coupled with said output drive means for selectively providing rotative power for selectively rotating said turret housing about said axis,

power transfer means for selectively connecting said manual control means with said output drive means when said motor means is deenergized comprising:
- a driven member connected with said output drive means;
- a driving member connected with said manual control means;
- a housing means for biasing said driven and driving members into engagement, and
- means for disengaging said driving and driven members comprising an electromagnetic means mounted on said support housing and adapted to be connected with a source of electrical power, said electromagnetic means being magnetically coupled with said driving member and operable to selectively disengage said driving and driven members when power from said source is applied to said electromagnetic means, whereby said manual control means is disconnected from said output drive means, and said turret may be selectively rotated about said traverse axis by either said motor means or said manual control means.

3. A turret traverse mechanism comprising:

a turret housing rotatably mounted on a support hull,

output drive means connected between said turret and said hull for transmitting rotative power therebetween,

selectively energizeable motor means connected with said output drive means selectively providing rotative power for selectively rotating said turret housing about a traverse axis,

manual control means removably coupled with said output drive means for selectively providing rotative power for selectively rotating said turret housing about said axis,

power transfer means for selectively connecting said manual control means with said output drive means when said motor means is deenergized comprising:
- a driven member connected with said output drive means,
- a driving member connected with said manual control means,
- a biasing means for biasing said driven and driving members into engagement, and
- means for disengaging said driving and driven members whereby said manual control means is disconnected from said output drive means, and said turret may be selectively rotated about said traverse axis by either said motor means or said manual control means.

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