United States Patent [19]

Luft et al.

[11] **3,793,908**

[45] **Feb. 26, 1974**

[54] **ELECTRIC PNEUMATIC SHIFT CONTROL**

[75] Inventors: **Robert G. Luft**, Wildwood; **LeRoy G. Halvorson**, Ingleside, both of Ill.

[73] Assignee: **International Harvester Company**, Chicago, Ill.

[22] Filed: **Apr. 13, 1972**

[21] Appl. No.: **243,722**

[52] **U.S. Cl.** **74/870**

[51] **Int. Cl.** **B60k 21/00**

[58] **Field of Search** ..... 74/870; 180/77 S

[56] **References Cited**

UNITED STATES PATENTS

3,679,018	7/1972	Luft	180/77 S
3,550,478	12/1970	Bechman et al.	74/847
3,386,316	6/1968	Armantrout	74/870
3,487,725	1/1970	Brunot	74/870 X
3,512,277	5/1970	Stuller	180/77 R X

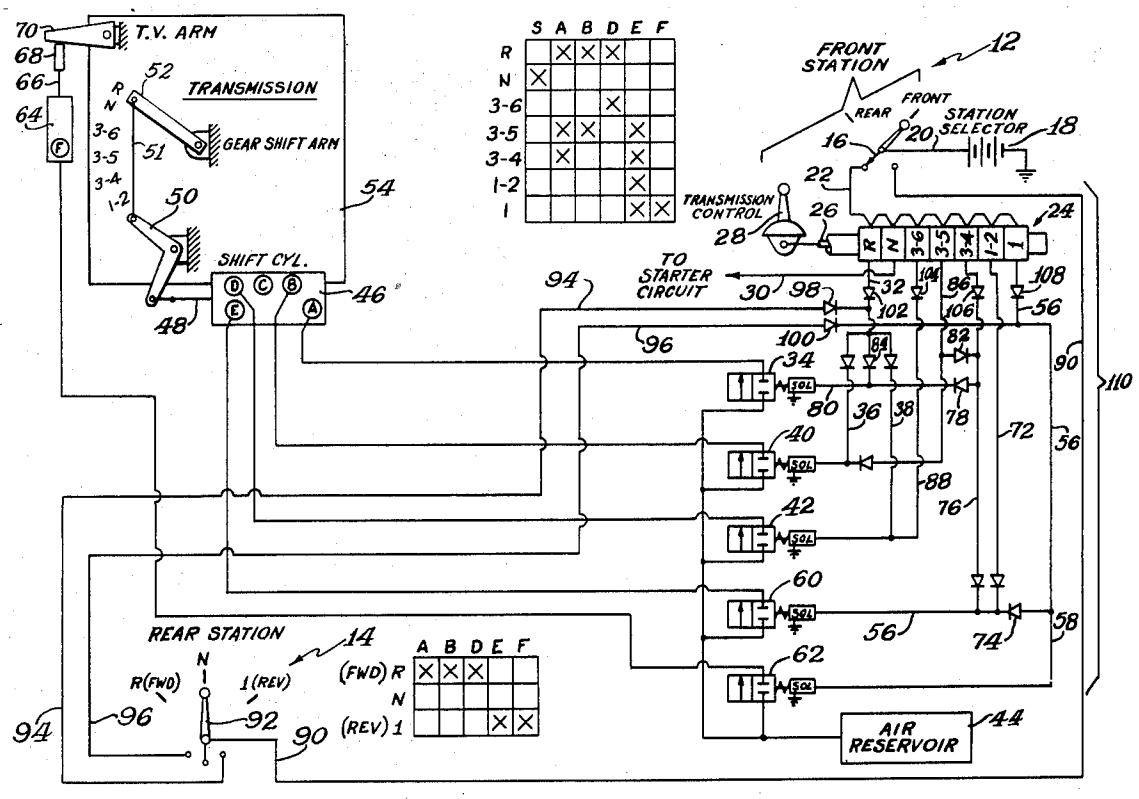
Primary Examiner—Arthur I. McKeon

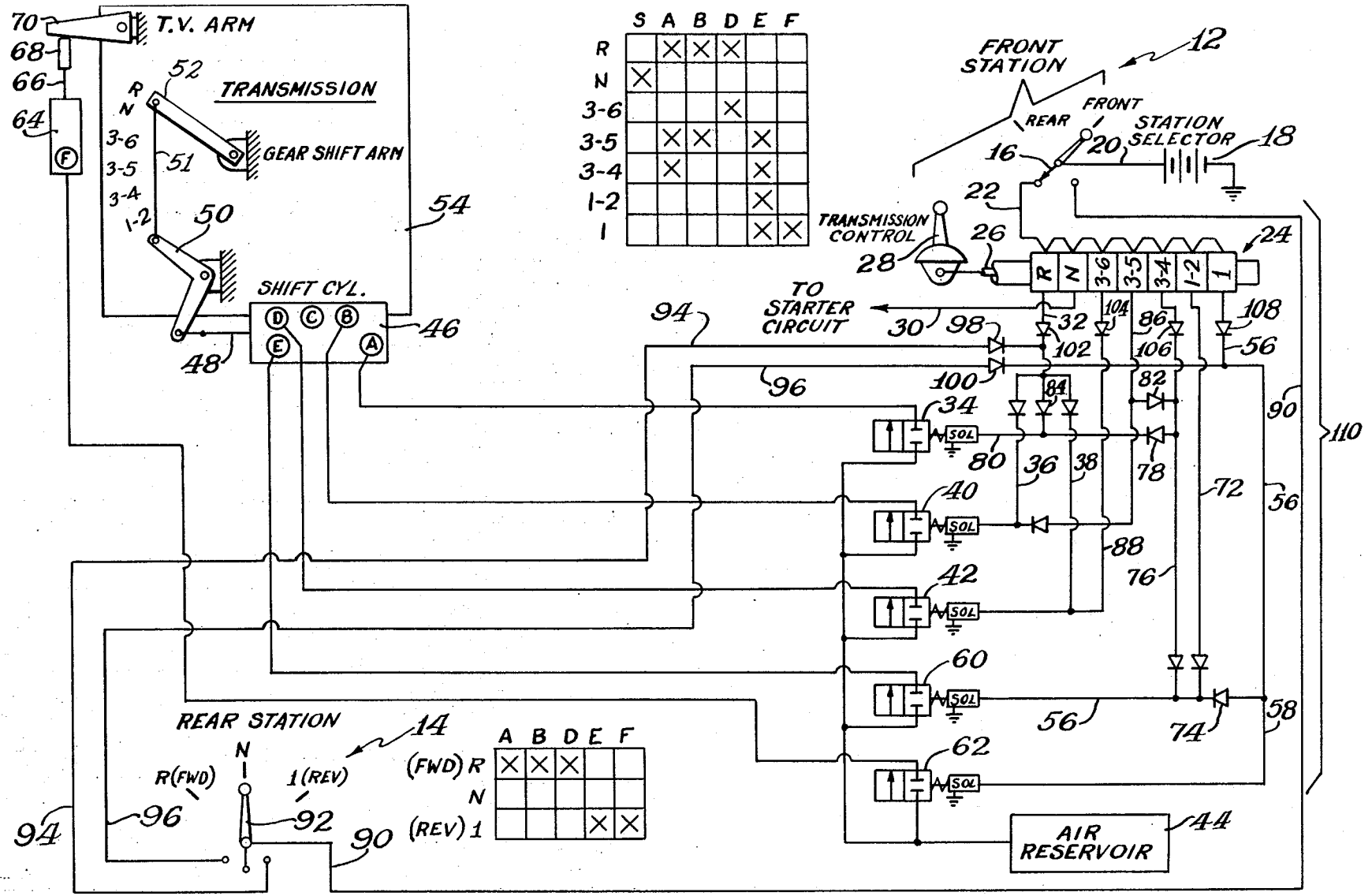
Attorney, Agent, or Firm—Ronald C. Kamp; Floyd B. Harman

[57] **ABSTRACT**

A means for controlling a transmission from either one of a pair of operator stations. A multi-position cylinder conditions the transmission for a given direction of travel and speed range. Air pressure is directed to various chambers within the cylinder to achieve the desired position by a plurality of solenoid-operated valves. The valves are selectively energized by a circuit means, including a switch means located in each of the operator stations. A selector switch in one station selectively connects one of the switch means with a source of electrical energy.

7 Claims, 1 Drawing Figure




T.V. ARM
TRANSMISSION
GEAR SHIFT ARM
SHIFT CYL.
FRONT STATION
REAR STATION
TRANSMISSION CONTROL
STATION SELECTOR
TO STARTER CIRCUIT
AIR RESERVOIR
SOL
R
N
3-6
3-5
3-4
1-2
1
S A B D E F
(FWD) R
(REV) 1
R(FWD)
1(REV)
70
68
66
64
52
51
50
54
48
46
12
16
18
20
22
24
26
28
30
32
34
36
38
40
42
44
56
58
60
62
72
74
76
78
80
82
84
86
88
90
92
94
96
98
100
102
104
106
108
110
14

ELECTRIC PNEUMATIC SHIFT CONTROL

CROSS REFERENCE TO RELATED APPLICATION

This application is related to that disclosed and claimed in the application of Robert G. Luft entitled DUAL STATION TRANSMISSION CONTROL, Ser. No. 52,938 now U.S. Pat. No. 3,679,018 filed July 7, 1970.

BACKGROUND AND SUMMARY OF THE INVENTION

The aforementioned patent fully describes some of the reasons for and necessity of an arrangement for controlling a transmission from two different operator stations. It is an object of this invention to provide a dual station control for a transmission which is simple, inexpensive and reliable, and in which the number and length of fluid conduits are minimized, the use of a plurality of common standard components is maximized, and the need for specially constructed cams and the like is eliminated. It is also an object of this invention to provide a control means having the aforementioned attributes for control of a transmission, and especially a transmission of the automatic type, from a single station.

These and other objects and many of the attendant advantages of the present invention will become more readily apparent upon a perusal of the following description and the accompanying drawing, wherein the sole figure is a schematic diagram of a transmission control incorporating the invention.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring now to the drawing, there is shown a front station or operator compartment **12** and a rear station **14.** A selector switch **16** is provided in the front station **12** and is connected with a source of electrical energy, such as a battery **18,** by means of conductor **20.** The switch **16** is of the two-position type and in its FRONT position, is illustrated in the drawing, connects the battery **18** with a conductor **22.** The conductor **22** communicates with a transmission control switch means **24** which comprises seven single pole single throw switches. These switches are closed by a cable control means **26** which is actuated by a manual handle **28** located in the front station **12.**

Considering now the individual switches, the N switch is closed when the handle **28** is positioned in its neutral position and directs electrical energy to the starter circuit through the conductor **30.** When the R switch is closed by moving the handle **28** to its reverse position, electric energy is directed through conductors **32** and **80** to actuate the solenoids of valve **34** and through conductors **36** and **38** to actuate the solenoids of valves **40** and **42** respectively. These valves **34, 40** and **42** are spring biased to the position shown in the drawing and are shifted by their solenoids to direct air pressure from the reservoir **44** to the respective ports A, B and D of the shift cylinder **46.** The shift cylinder is of the multiposition type having a plurality of chambers to which air pressure may be selectively directed to control the degree of extension of the rod **48** in the cylinder, and may, for example be of the type sold by

Westinghouse Air Brake Co. and identified as their 2X3M4-N-2B Cylinder Assembly.

The rod **48** of the cylinder is linked to a bellcrank **50,** which in turn is connected to gear shift arm **52** of the transmission **54** by means of link **51.** The gear shift arm **52** is connected to a conventional type of transmission conditioning mechanism, such as a valve spool for directing hydraulic pressure to the proper clutch packs within the transmission for achieving the designated direction and speed range gear changes. For reverse gear the pressuring of ports A, B and D will extend the rod **48** of the cylinder **46** the proper amount to move the gear shift arm **52** to condition the transmission for low speed in a reverse direction.

When the handle **28** is moved to its **1** position for low gear in a forward direction the switch identified as **1** will be closed. Electrical energy will be transmitted through the conductors **56** and **58** to actuate the solenoids of valves **60** and **62** respectively. Energizing the solenoids causes the valves **60** and **62** to shift against the bias of their springs directing air pressure from the reservoir **44** to the port E of the shift cylinder **46** and to the port F of the slave cylinder **64.** The rod **66** of the slave cylinder **64** includes a plunger **68** which is capable, in its extended position, of moving the throttle valve arm **70** associated with the transmission **54,** which is of the automatic type in that it will automatically shift to higher gears as engine speed increases and the load encountered permits, and will shift down as the engine throttle control is moved to accelerate the engine or when load encountered lugs the engine down. The rod **66** and its plunger **68** is normally biased to a retracted position, but when air pressure is introduced through port F the rod **66** is extended causing the throttle valve arm **70** to be moved whereby the transmission **54** receives the same signal or indication it would if the operator were attempting to rapidly increase engine speed. Hence, the transmission **54** will be prevented from shifting up, i.e., shifting from first gear to a higher gear. The air pressure directed to port E of the shift cylinder **46** will have shifted the rod **48** to position the arm **52** at the position indicated **1-2** so that the transmission is conditioned for first gear in a forward direction, with the capability of shifting to second gear but for the fact that the throttle valve arm **70** has been moved to prevent the automatic shift to second gear.

When the handle **28** is moved to a position to close the switch indicated **1–2,** electrical energy will be directed through conductor **72** causing the solenoid of valve **60** to be actuated. Valve **60** will be shifted directing air pressure from the reservoir **44** to the port E. The transmission gear shift arm **52** will be positioned as previously described at the **1–2** position. Now, however, the diode **74** will prevent actuation of the solenoid of valve **62** and the plunger **68** will be retracted by the spring biased slave cylinder **64** and the throttle valve arm **70** can perform its normal function, permitting the transmission **54** to shift to second gear when conditions permit.

When the handle **28** is positioned to close the switch indicated as **3–4,** the conductor **76** is energized causing the solenoid of valve **60** to be actuated. Simultaneously, the diode **78** permits the conductor **80** to be energized and the solenoid of valve **34** actuated. Air pressure is thereby directed to the ports A and E of the shaft cylinder **46.** The rod **48** will be extended on a point to position the arm **52** at the **3–4** position. The

transmission 54 will therefore be conditioned to operate in either third or fourth gear in a forward direction depending upon conditions. The diodes 74, 82 and 84 prevent any of the other solenoids being actuated.

Closing the switch indicated as 3–5 by moving the handle 28 energizes the conductor 86 and actuates the solenoid of valve 40. The diode 82 also permits the solenoid of valve 60 to be actuated and diode 78, permits the solenoid of valve 34 to be actuated. Air pressure is, therefore, directed to ports A, B and E of shift cylinder 46 and its rod 48 moved to position the arm 52 as indicated at 3–5. The transmission 54 will thereby be conditioned to automatically shift to any one of third, fourth or fifth gears on a forward direction depending upon conditions.

Similarly, movement of handle 28 to its 3–6 position will close the switch indicated as 3–6, causing the conductor 88 to be energized and the solenoid of valve 42 to be actuated. Air pressure is directed to port D of the shift cylinder 46. The rod 48 will be extended to position the arm 52 at 3–6. The transmission 54 will be conditioned to automatically shift to any one of third, fourth, fifth and sixth gears, conditions permitting, in a forward direction.

The station selector switch 16, when moved to its rear position, isolates the switch 24 from the battery 18 and connects the conductor 20 with the conductor 90 leading to the wiper of a switch 92 in the rear station 14. The front station 16 is rendered inactive and the rear station 16 now has control over the transmission 54. In order to drive the vehicle in a "forward" direction from the rear station 14 the switch 92 is moved to its R position. The conductor 90 is thereby connected with a conductor 94 which connects with the conductor 32. Energizing conductor 32 functions to actuate the solenoids of valves 34, 40 and 42 which conditions the transmission 54 for reverse drive as described previously. Movement of the switch 92 to its 1 position will cause the vehicle to move in a "reverse" direction with respect to the rear station. The conductor 90 is connected with a conductor 96 which connects with the conductor 56. Energizing the conductor 56 will cause the solenoids of valves 60 and 62 to be actuated which conditions the transmission 54 for forward drive as described previously.

The diodes 98 and 100 serve to insure isolation of the switch 92 from the battery 18 whenever the selector switch 16 is in its FRONT position. Similarly, the diodes 102, 104, 106 and 108 insure that the switch 24 can exercise no control over the transmission 54 whenever the selector switch 16 is in its REAR position. The remaining diodes within the circuit means, indicated generally at 110, are for the purpose of insuring that only the desired ones of the solenoids, as previously described, are actuated. These diodes are conventional and consideration need be given only the power transmission requirements of each to fulfill optimum cost-performance design criterion.

While a preferred embodiment of the present invention has been illustrated and described herein, it is to be understood that various changes and modifications may be made without depending from the spirit of the invention as defined by the scope of the appended claims.

What is claimed is:

1. A control means for a transmission having a shift arm capable of being moved between a plurality of positions, each of said positions conditioning the transmission for a given direction and speed range, comprising:

a multiposition shift cylinder operatively connected to the shift arm for moving said arm to its said positions;

said cylinder having a plurality of ports which, when selectively pressurized, cause said cylinder to move to each of its multipositions;

a solenoid-actuated valve communicating with each of said ports and capable, when energized, of directing fluid pressure thereto;

circuit means including a first manually actuated switch means for selectively energizing certain ones of said valves to extend said cylinder to a desired one of its multipositions.

2. A control for a transmission according to claim 1 and further comprising;

a second manually actuated switch means for selectively energizing at least a portion of said circuit means; and

a selector switch for selectively energizing one of said first and second switch means.

3. A control means according to claim 2, wherein the transmission is capable of automatically shifting from a high gear to a lower gear under conditions of acceleration, and further comprising:

a throttle valve arm connected with said transmission to condition said transmission for said lower gear under conditions of acceleration;

a fluid cylinder engageable with said arm and movable under the influence of fluid pressure to move and maintain the throttle valve arm in the position it would assume under said acceleration conditions; and

means for selectively directing fluid pressure to said fluid cylinder.

4. A control for an automatic transmission capable of automatically shifting from a low gear to a higher gear comprising:

a multiposition shift cylinder operatively connected to and capable of initially conditioning the transmission for said low gear;

a plurality of solenoid-operated valves for directing fluid pressure to said cylinder;

circuit means, including a first manually actuated switch means, for selectively energizing the desired ones of said valves to orient said cylinder to initially condition the transmission for said low gear; and

means operable upon energization of a certain one of said valves to prevent said transmission from shifting to a higher gear.

5. A control according to claim 4 wherein said last mentioned means comprises;

a throttle valve arm connected with said transmission to insure the transmission is conditioned for said low gear under conditions of acceleration;

a fluid cylinder engageable with said arm and movable under the influence of fluid pressure received from said certain valve to move and maintain the throttle valve arm in the position it would assume under said acceleration conditions.

6. A control according to claim 5, and further comprising:

a second manually actuated switch means for selectively energizing at least a portion of said circuit means; and

a selector switch for selectively energizing one of said first and second switch means.

7. A control for an automatic transmission driven by an engine, which transmission is capable of shifting from a high gear to a lower gear under conditions of acceleration of the engine, comprising:

a throttle valve arm connected with said transmission to condition said transmission for said lower gear under conditions of acceleration;

a fluid cylinder engageable with said arm and movable under the influence of fluid pressure to move and maintain the throttle valve arm in the position it would assume under said acceleration conditions; and

means for selectively directing fluid pressure to said cylinder.

* * * * *