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 [21] Appl. No. **863,262**  
 [22] Filed **Oct. 2, 1969**  
 [45] Patented **Aug. 17, 1971**  
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[54] **AUTOMATIC PNEUMATIC COUPLING SYSTEM**  
 14 Claims, 2 Drawing Figs.

[52] U.S. CL..... 213/76,  
 213/212  
 [51] Int. Cl..... B61g 5/08  
 [50] Field of Search.....213/1.3, 76,  
 110, 212; 173/332; 285/64

[56] **References Cited**

**UNITED STATES PATENTS**

1,932,091	10/1933	Stevens .....	213/76
3,245,553	4/1966	Cope .....	213/212

**ABSTRACT:** An improvement in an automatic coupling system for a railway car which is equipped with a mechanical knuckle-type coupler, a main air line adapted to be connected to a corresponding air line of another railway car, a main valve interposed in the main air line, and means for actuating the main valve responsive to intentional uncoupling of the railway car. The improvement, in its preferred form, takes the form of an extensible pneumatic piston and cylinder assembly, one part of which is attached to the main body of mechanical coupler and the other part of which is operably connected to the operating mechanism of the coupler for opening of the knuckle of the coupler. The piston and cylinder assembly is operatively associated with the means for actuating the main valve so that upon actuation of the main valve during intentional uncoupling of the railway car, air will be admitted to the piston and cylinder assembly. Upon separation of the railway cars, air is bled from the system allowing piston and cylinder assembly to retract leaving the coupler open and ready for coupling. The bleeding of the cylinder and piston assembly is preferably effected through a pneumatic time delay circuit to assure that the assembly has been fully extended upon uncoupling of the railway car before operating pressure is lost in the cylinder and ram assembly.

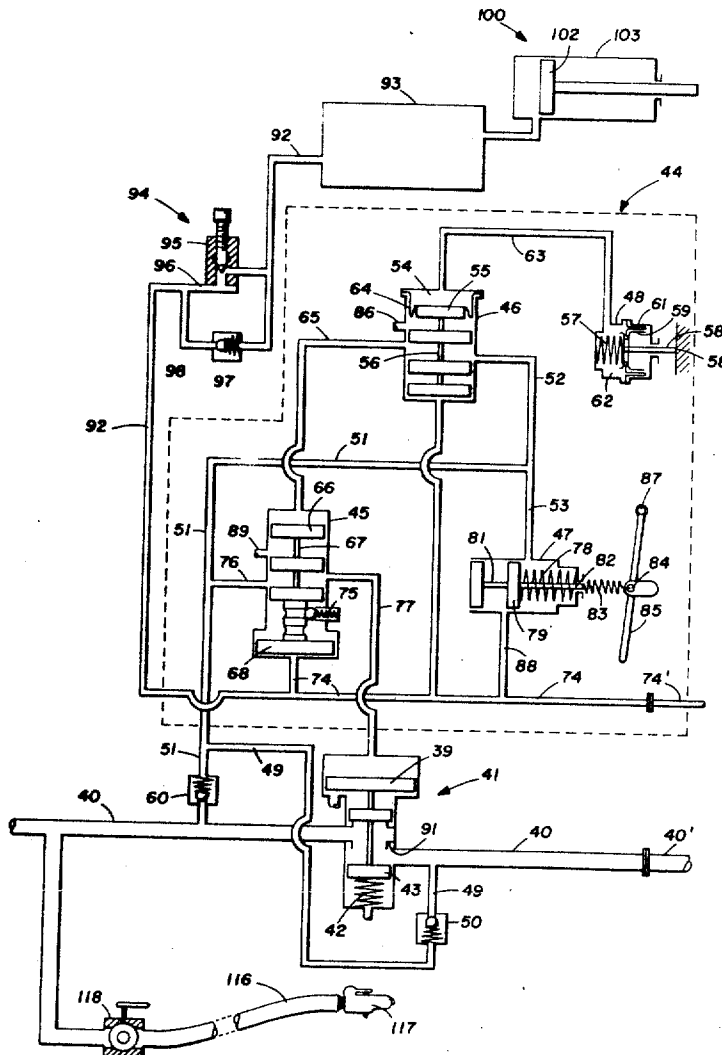
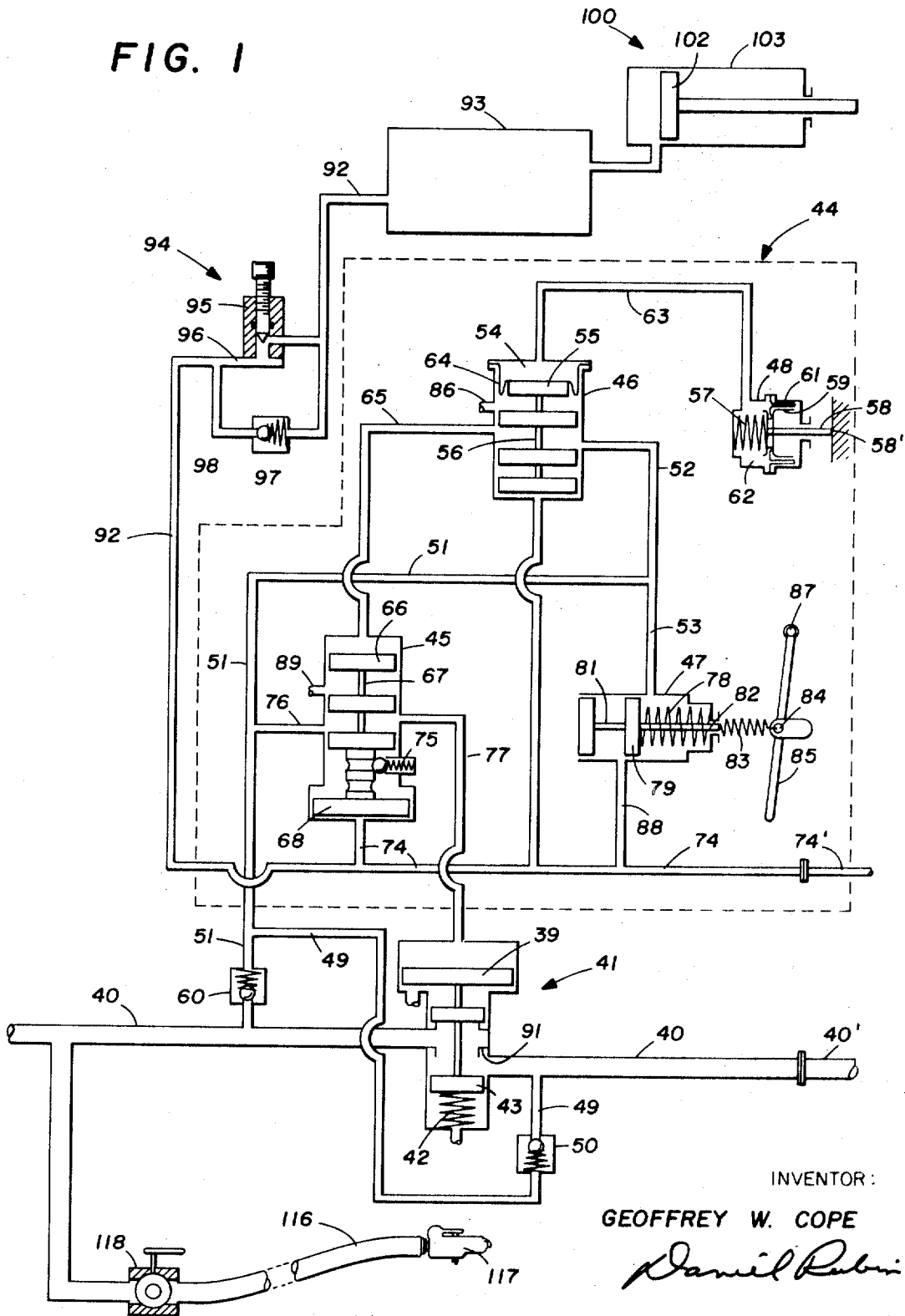


FIG. 1



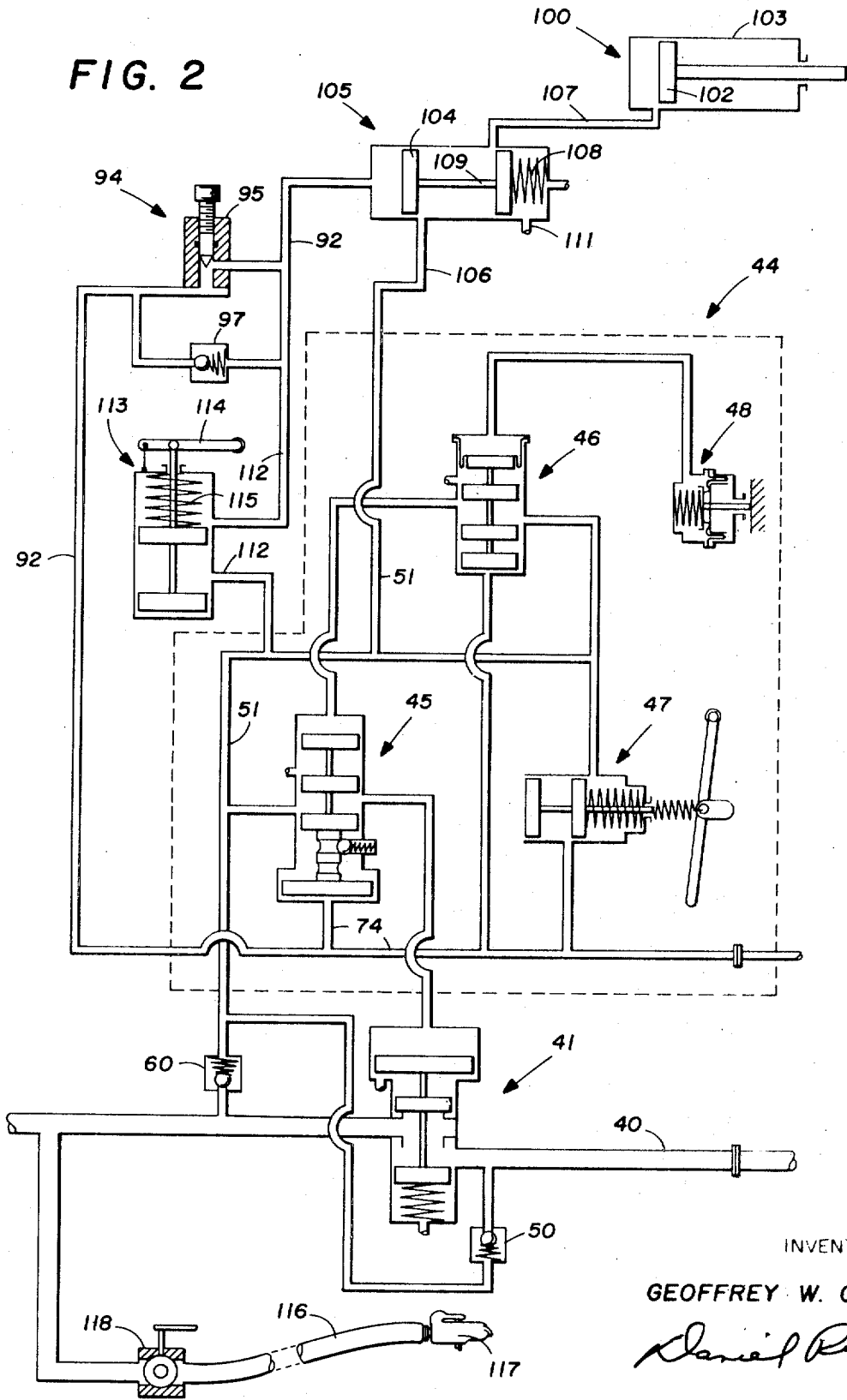
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FIG. 2



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## AUTOMATIC PNEUMATIC COUPLING SYSTEM

## RELATED APPLICATIONS

Application for U.S. Letters Pat. Ser. No. 741,116.

## BACKGROUND OF THE INVENTION

## 1. Field of the Invention

This invention relates to coupling systems for railway cars, and more particularly, but not by way of limitation, to automatic systems for opening of the knuckles of mechanical knuckle-type couplers in response to intentional uncoupling of the car.

## 2. Description of Prior Art

In order to comply with regulations of the A.A.R. and Interstate Commerce Commission, railway cars are interconnected, when coupled, by an air line which serves to operate airbrakes with which each of the cars is equipped. The airbrakes are designed to be applied when the air line is vented and be released when the air line is pressurized, thus providing for automatic application of the brakes of the car in the event of an accidental or unintentional separation of the railway cars resulting in a break in the air line. Thus, when railway cars are to be intentionally separated, the air line at both ends of the car must be closed to enable the brakes of the cars remaining coupled to the locomotive to be controlled and the uncoupled cars to retain their mobility for humping or other purposes.

Some cars, such as rapid transit cars, are equipped with combined mechanical, air and electric couplers having electric control circuits for automatically opening and closing the brake line on intentional coupling and uncoupling and for opening the brake line upon accidental uncoupling. However, the vast majority of railway cars in use are freight cars having no electric power, and the few freight cars that are provided with electric power do not have control circuits for controlling valving of the air line.

Recently, as disclosed in application for U.S. Letters Pat. Ser. No. 741,116, there has been invented an automatic pneumatic coupling system for railway cars which may be used in connection with standard A.A.R. knuckle-type couplers for automatically controlling the valving of the air line of a railway car. The automatic pneumatic coupling system of the referenced application differentiates between intentional and accidental uncoupling. Upon intentional uncoupling, the pneumatic system closes the air line preserving pressure in the brake system so that the railway car may retain its mobility. Upon accidental uncoupling, the air line remains open, thus bleeding the brake system of air pressure and effecting application of the brakes.

While the automatic pneumatic coupling system of the application referred to above is a significant advance in the art and obviates the necessity for workmen to go between railway cars to manually couple and uncouple the gladhands at the adjoining ends of the air lines and operate the angle cock valve controlling flow through these lines, it does not provide a means for insuring that the knuckles of the mechanical couplers are opened during the uncoupling operation.

More particularly, in the use of standard knuckle-type couplers, railway cars may be separated by the opening of one knuckle only. It is quite apparent that if, during the switching of cars, two cars which have not had their knuckles open are brought together the result will be a closed knuckle impact and a failure to couple. Further, the gathering range of a knuckle-type coupler is maximum when both knuckles are open so that for maximum coupling efficiency the open knuckle position is the most desired condition. The present invention is directed to an improvement in automatic pneumatic coupling systems, which improvement serves to open the knuckle of the mechanical knuckle-type couplers of both cars upon intentional uncoupling of the railway car from an adjoining car.

## SUMMARY OF THE INVENTION

The invention may be generally described as an improvement in an automatic coupling system for a railway car which includes a mechanical knuckle-type coupler, a main air line, a main valve interposed in the main air line, and means for actuating the main valve responsive to intentional uncoupling of the railway car, which improvement comprises means operatively associated with the main valve-actuating means for opening the knuckle of the coupler upon the intentional uncoupling of the railway car.

For a detailed description of the preferred embodiments of the invention, reference is made to the drawings.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of a preferred embodiment of the pneumatic circuit of the present invention; and

FIG. 2 is a schematic view of an alternative embodiment of the present invention.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

For a description of pneumatic circuitry suitable for operation of the cylinder and ram assembly illustrated in FIGS. 1 and 2, reference is first made to FIG. 1.

In FIG. 1, the main air line 40, which is adapted to receive air from its own reservoir or an adjoining railway car for supplying air to a brake system, has interposed therein a main air valve 41. Valve 41 is a two-way valve, which normally is maintained in a closed position by spring 42 acting against head 43, may be opened by air pressure exerted against head 39 from control line 77.

In order to open valve 41 when the railway car equipped with the pneumatic circuit of FIG. 1 is coupled or becomes unintentionally uncoupled and to permit closing of valve 41 upon intentional uncoupling of the railway car, main-valve-actuating means are provided. The main-valve-actuating means, generally contained within the dashed line and indicated by the reference numeral 44, includes valves 45-47 and cylinder 48 connected by pneumatic control lines to be hereafter described. Valves 45, 46 and 47 serve to direct air derived from the main air line 40 through control lines 49 and 51. Lines 49 and 51 are provided with spring-biased check valves 50 and 60, respectively. As illustrated, check valves 50 and 60 permit flow from main air line 40 into control lines 49 and 51, but prevent flow in the reverse direction. Upon the coupling of a railway car equipped with pneumatic circuit of FIG. 1 with a similarly equipped car, and assuming one or both cars are changed, air will be available in main air line 40 and flow through control line 49, and check valve 50 into control line 51. Control line 51 is provided with two branches 52 and 53, the flow through which is controlled by valves 46 and 47, respectively. Valve 46, which controls the flow through line 52, as above mentioned, is a two-way sliding spool valve which upon coupling is moved to the position shown in FIG. 1 by pressure in chamber 54 acting on head 55 of the sliding spool 56. Pressure in chamber 54 is derived from valve 48 which is a spring biased plunger-type valve. Cylinder 48, often referred to as a puffer cylinder has a spring 57 which normally urges a plunger 58 to an extended position, plunger 58 which passes through cup 59 also serves to support the inner periphery of a rolling diaphragm 61. Diaphragm 61 forms a chamber 62 which communicates with the chamber 54 of valve 46 through a control line 63. Upon coupling of the railway car equipped with the system of FIG. 1, plunger 58 is depressed by engagement with a suitable surface extending from the adjoining car thereby compressing air in chamber 62. Pressure in chamber 62 will be transmitted through control line 63 to chamber 54, which like chamber 62 is provided with a rolling diaphragm 64. The pressure generated in chamber 54, as explained before, moves the spool 56 of valve 46 to the position illustrated in FIG. 1 permitting air introduced through branch 52 of control line 51 to pass through valve 46 and control line 65 at

tached thereto. The air admitted to control line 65 will act against head 66 of two-way sliding spool valve 45 causing spool 67 to move to the position shown in FIG. 1, as the opposite control head 68 of spool 67 will have little pressure exerted thereon. Spool 67 will be maintained in the position shown in FIG. 1 while pressure is maintained on head 66 by ball and spring detent 75. On movement of spool 67 to the position shown in FIG. 1, air in control line 51 passes through line 76 and valve 45. The air passing through valve 45 will also pass through line 77 which communicates the air with head 39 of valve 41 moving head 39 to the position shown in FIG. 1 thus opening valve 41 and permitting air in main air line 40, which is derived from its own reservoir or from corresponding air line 40' of an adjoining railway car to pass through valve 41 into the brake train line of the railway car, in either direction, depending upon which of the cars was initially charged.

In the coupling procedure described above, during which procedure the main air line valve 41 is open to permit communication between main air line 40 and corresponding main air line 40' of an adjoining car, the valve 47, which is a spring-biased sliding spool valve, is maintained in position shown in FIG. 1 by spring 78 which acts against head 79 of spool 81. In the embodiment shown in FIG. 1, the stem portion 82 of spool 81 is connected through a spring 83 and a pin and slot connection 84 to an operating lever 85 of a conventional coupler operating rod. As is well known to those skilled in the art, by operation of lever 85, the lock-lift assembly of a conventional knuckle-type coupler may be lifted to permit opening of the knuckles when uncoupling the railway car.

Should the railway car become unintentionally uncoupled, due to a broken knuckle or knuckle pin, the plunger 58 of puffer cylinder 48 would extend decreasing the pressure on head 55 of spool 56 thus permitting spool 56 to move upwardly, as viewed in FIG. 1. In its upward position valve 56 would block flow through line 52 and permit air pressure on head 66 of valve 45 to be vented through control line 65 and exhaust port 86 of valve 46. However, the detent means 75 will prevent the shifting of spool 67 thus maintaining pressure on head 39 of valve 41. Valve 41 would then remain in the open position permitting venting of the main air line 40. As main air line 40 will be separated from the corresponding air line 40' of an adjoining car upon an unintentional uncoupling, main air line 40 will vent and the airbrakes will be applied. The same action will occur in the adjoining car. The air pressure established in the control lines 49 and 51 will be maintained upon unintentional uncoupling as check valves 50 and 60 will seat upon venting of main air line 40 preventing loss of pressure in the control lines 49 and 51 downstream from the check valves 50 and 60.

However, upon intentional uncoupling, which is effected by normal operation of the uncoupling lever 85 about its pivot point 87, the spool 81 of valve 47 will be shifted to the right, as viewed in FIG. 1 permitting air in control line 51 to flow through branch 53 thereof and valve 47 into line 88 which communicates with control line 74. Air pressure created in control line 74 through valve 47 will shift valve 45 by exerting force on head 68 of spool 67. As head 68 is larger in dimension than head 66, both of which will be in communication with the air pressure in control line 51, head 68 will shift spool 67 against the force exerted on head 66 and the force exerted by the detent means 75 moving spool 67 upwardly as viewed in FIG. 1. Upon shifting of spool 67, air flow from control line 51 through valve 45 will be blocked and the air creating pressure on head 39 of valve 41 will be vented by flow through line 77, valve 45 and exhaust port 89 of valve 45. Upon venting of the air from valve 41, spring 42 will effect closing of valve 41 by urging head 43 against seat 91.

Upon separation with railway cars during intentional uncoupling, the mobility of the railway car equipped with the system of FIG. 1 will be maintained as air pressure in the brake system will be maintained by the closing of valve 41. After the operator has released lever 85, which is normally before the cars are separated, valve 47 again returns to the position

shown in FIG. 1 thus preventing significant loss of air pressure in the brake system through valve 47. With valve 47 returning to its initial position by spring 78, the system is again ready for opening of valve 41 upon coupling of railway cars equipped with the system of FIG. 1.

All of the above described pneumatic circuitry which comprises main valve actuating means 44 is disclosed in U.S. Pat. application Ser. No. 741,116, assigned to the assignee hereof.

The present invention is an improvement upon the above system and in a preferred embodiment comprises a first conduit 92 which communicates the control line 74 with an air reservoir 93 through a pneumatic time delay means 94. The time delay means 94 takes the form of a manually adjustable needle valve 95 in leg 96 of conduit 92 and a check valve 97 in parallel leg 98 of conduit 92, the function of which will be hereafter explained. Air entering reservoir 93 through conduit 92 by way of needle valve 95 and check valve 97 is discharged from reservoir 93 through conduit 101 against a coupler actuator piston 102 which is reciprocally mounted within a cylinder 103 for extension relative thereto.

Thus, upon intentional uncoupling of a railway car by movement of lever 85, in the manner described above, the air communicated through valve 47 will pass through line 88, control line 74, and conduit 92. Due to the resistance created by needle valve 95, a major portion of the air flowing through conduit 92 will pass through conduit 98 and check valve 97 into reservoir 93. From reservoir 93 the air passes through conduit 101 to the piston and cylinder assembly, generally indicated by the reference numeral 100. The air upon being admitted to piston and cylinder assembly 100 will create a pressure against piston 102 which, upon separation of the cars would cause the piston 102 to extend and open the knuckle of the coupler to which actuator piston 102 is attached. As the control line 74 will be vented upon separation of the railway cars, due to its separation from corresponding control line 74' of the adjoining car, the knuckle opening means described above are designed to maintain pressure against piston 102 for a short period after separation of the cars in order to insure that the knuckle is open. Pressure is maintained against piston 102 as, upon venting of control line 74, the pressure in reservoir 93 will slowly diminish as air is exhausted through needle valve 95, check valve 97 having closed upon venting of control line 74. By adjustment of needle valve 95, the time required for reservoir 93 and thus the pressure in cylinder and piston of the actuator assembly 100 to diminish can be controlled to produce whatever period of time delay may be desired, a period of 10 to 15 seconds being preferred. After pressure in assembly 100 has been diminished to atmospheric pressure, by venting through needle valve 95 and control line 74, the piston 102 will be retracted leaving the knuckle of the coupler open and ready for subsequent coupling of the railway car. As the pressure admitted to control line 74 by actuation of valve 47 is also communicated to the corresponding control line 74' of an adjoining car, the cylinder and piston of the actuator assembly of the corresponding car (not shown) will be pressurized thus assuring opening of the knuckles of both couplers, without the necessity of actuating the operating lever (not shown) of the adjoining car. The advantages of a system which opens the knuckles of both cars responsive to operation of either one of the levers 85 of the railway cars are manifold. Operator safety is of course increased as an operator can open both of a mated pair of knuckles from one side of a track rather than crossing the track after opening one knuckle to open the remaining knuckle (freight cars having the operating lever exposed only on one side of the railway car).

As both knuckles are automatically opened, the dangers of experiencing closed knuckle impacts between railway cars is obviated. Further, the gathering range of the couplers is maximized as both the cars to be coupled will have open knuckles.

An alternative embodiment of the invention is illustrated in FIG. 2 which, as in FIG. 1, is provided with a main air line 40, the flow through which is controlled by a main air valve 41 the operation of which is in turn controlled by the valve actuating

means 44 generally contained within the dashed line of FIG. 2. The valve actuating means 44 of FIG. 2 operates in exactly the same manner as the valve actuating means 44 described in FIG. 1.

The means for opening the knuckle of the coupler, however, take a different form in FIG. 2. More particularly, air admitted to conduit 92 upon intentional uncoupling of the railway car by manipulation of lever 85 rather than being discharged into reservoir 93, as in FIG. 1, it is discharged against head 014 of a two-way, spring biased, sliding spool valve 105 to move the valve position shown in FIG. 2. When the valve 105 is so positioned air may pass through the valve from conduit 106, which communicates with control line 51 to conduit 107 from which it will be discharged into piston and cylinder of the actuator assembly 100 thus creating a pressure against piston 102. Upon separation of the railway cars, and the concomitant venting of control line 74 and thus conduit 92, pressure acting on head 104 of valve 105 will gradually diminish as check valve 97 will close requiring that air admitted to valve 105 pass through needle valve 95, thus causing a time delay in the venting of valve 105. As the pressure against head 104 of valve 105 decreases to the point where the force of spring 108 becomes the greater of the two forces, spring 108 will move the spool 109 of valve 105 to the left permitting the venting of cylinder and ram assembly 100 through conduit 107 and discharge port 111 of valve 105. As pressure on head 104 of valve 105 will be relatively slow in venting, pressure will be maintained on piston 102 for sufficient period of time to assure opening of the knuckle of the coupler after separation of the railway cars.

The embodiment of FIG. 2 also provides means for opening the knuckle of the coupler should it become closed while the car is uncoupled or after uncoupling from a nonequipped car. More particularly, interposed between control line 51 and conduit 92 is a conduit 112 the flow through which is controlled by a two-way spring biased, manually operated sliding spool valve 113. By lifting handle 114 of valve 113 to compress spring 115, air from line 51 is permitted to flow through conduit 112 and valve 113 into valve 105 where it will exert a pressure against head 104 shifting the spool 109 thereof to the position shown in FIG. 2. In this position, as described above, air from control line 51 is admitted to the cylinder and ram of the actuator assembly 100 thereby opening the knuckle of the coupler. The air introduced into valve 105 through conduit 112 and 92 will gradually vent through needle valve 95 and control line 74 to the atmosphere permitting return of spool 109 to the left, as viewed in FIG. 2, under the influence of spring 108 to permit venting of cylinder and ram assembly 100 to prepare the mechanical coupler for coupling.

Provision is made in both embodiments of the invention to permit railway cars equipped with the invention to be connected to nonequipped cars without requiring any special procedure or transition equipment.

More particularly, with reference to FIGS. 1 and 2, a secondary air line 116, one end of which is equipped with a conventional gladhand connection 117, communicates with main air line 40 downstream from valve 41. The secondary line 116 is equipped with a conventional manually operated two-way valve 118. As valve 118 is normally closed when a railway car is uncoupled, a railway car equipped with the pneumatic control system of FIG. 1 may be automatically connected to a similarly equipped car. If a railway car equipped with the control system of FIG. 1 is connected to a nonequipped car, then gladhand 117 is connected to the corresponding gladhand conventionally provided on freight cars and valve 118 is opened. Valve 41 will prevent venting of air in line 40 therethrough when pressure is admitted to line 116. Specifically, puffer valve 58 will not be actuated upon connection of an equipped car to a nonequipped car. Thus, control valve 45, which upon a prior uncoupling of the equipped car has been moved to a position which vents the pressure against head 39 of valve 41, will remain in this position permitting spring 42 to seat head 43 and prevent the air in line 116.

The actuator assembly 100 may take various forms to accomplish opening of the knuckles of mechanical couplers. It could, for example, form part of coupler actuator 5 illustrated in U.S. Pat. No. 3,245,553. Cylinder 103, in this instance, would correspond to housing or casing 13 which is affixed to the side of the coupler. Piston 102 would correspond to plunger 14 reciprocally mounted within casing 13 and air admitted to actuator 100 would open the knuckle in the manner described in that patent.

Alternatively, and again with reference to U.S. Pat. No. 3,245,553, the actuator assembly of the present invention could be used to operate the four-way air valve 45 rather than the solenoid 46, as illustrated. In this event, the valve 45 of that patent or the piston 102 of the present invention would have to be spring biased to return the valve 45 to the position shown in FIG. 2 of that patent after opening of a knuckle. In this alternative embodiment of the actuator 5 which serves to open the knuckle would be operated hydraulically.

Whatever form the actuator 100 takes, it can be appreciated that reservoir 93 of FIG. 1 may be eliminated, though such is not preferred since the use of a reservoir permits the pressure developed in the assembly to be maintained for a longer period of time.

I claim:

1. In an automatic coupling system for a railway car which includes (a) mechanical knuckle-type coupler, (b) a main air line adapted to be connected to a corresponding air line of another railway car for communicating air between the cars, (c) a main valve interposed in the main air line for controlling the flow of air therethrough, and main valve actuating means responsive to intentional uncoupling of the railway car for controlling the flow of air through the main valve, the improvement which comprises:

means operatively associated with said main-valve-actuating means for automatically opening the knuckle of said coupler upon the intentional uncoupling of the railway car and the knuckle of the coupler on an adjacent railway car similarly equipped.

2. The coupling system of claim 1, wherein said main valve actuating means include a control line and means for placing said control line in communication with said main air line upon intentional uncoupling of said railway car, and said means for opening said knuckle comprises:

a pneumatically actuatable assembly operably connected to said mechanical coupler for operation of said mechanical coupler to open the knuckles thereof; and

conduit means connecting the pneumatically actuatable assembly with the control line for actuation of said assembly when said control line is placed in communication with the main air line upon intentional uncoupling of the railway car.

3. The coupling system of claim 2, wherein said control line is vented to the atmosphere upon separation of said railway car from another car thereby permitting venting of said conduit means.

4. The coupling system of claim 3, including:

an air reservoir interposed in said conduit means between said control line and said pneumatically actuatable assembly.

5. The coupling system of claim 4, including:

time delay means interposed in said conduit means between said control line and said reservoir which exhibits relatively little impedance to airflow from said control air line to said reservoir, but which impedes airflow in the reverse direction.

6. The coupling assembly of claim 3, including time delay means interposed between said control line and said pneumatically actuatable assembly which exhibits relatively little impedance to airflow from said control line to said reservoir, but which impedes airflow in the reverse direction.

7. The coupling assembly of claim 6, in which said pneumatically actuatable assembly comprises:

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an extensible cylinder and piston assembly one part of said assembly being fixed to the body of said mechanical coupler and the other part operably connected to the operating mechanism of said coupler so that the knuckle of said coupler will be opened upon extension of said assembly. 5

8. The coupling system of claim 1, wherein said main-valve-actuating means includes a first control line which is adapted to communicate with said main air line when said railway car is coupled or intentionally uncoupled and a second control line which is placed in communication with said main air line upon intentional uncoupling of said railway car, and said means for opening said knuckle comprises: 10

a pneumatically actuatable assembly operably connected to said mechanical coupler for operation of said mechanical coupler to open the knuckles thereof; 15

a first conduit communicating said assembly with said first control line;

an operating valve interposed in said first conduit, the operating valve being biased to first position to restrict airflow from said first control line to said assembly and vent said assembly and movable to a second position to permit airflow between said assembly and said first control line; and 20

a second conduit communicating said second control line with said control valve for actuating said valve to said second position upon intentional uncoupling of the railway car to permit airflow between said assembly and said first control line for actuating the assembly upon intentional uncoupling of the railway car. 25

9. The coupling system of claim 8, wherein said second control line is vented to the atmosphere upon separation of the railway car from another car permitting return of said control valve to said first position. 30

10. The coupling system of claim 9, including: 35

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time delay means interposed in said second conduit which exhibits relatively little impedance to airflow from said second control line to said control valve, but which impedes airflow in the reverse direction.

11. The coupling system of claim 10 including: a third conduit connecting said first control line and said second conduit;

a second control valve interposed in said third conduit, said valve being biased to a closed position and actuatable to an open position to permit actuation of said assembly.

12. The coupling system of claim 11 in which said pneumatically actuatable assembly comprises:

an extensible cylinder and piston assembly, one part of said assembly being fixed to the body of said mechanical coupler and the other part operably connected to the operating mechanism of said coupler so that the knuckle of said coupler will be opened upon extension of said assembly.

13. The coupling system of claim 12, which includes: a secondary air line communicating with said main air line downstream from said main valve;

valve means interposed in said secondary air line for controlling flow therethrough; and

means interposed in said main air line for preventing venting of air in said secondary air line through said main valve.

14. The coupling system of claim 1, including: a secondary air line communicating with said main air line downstream from said main valve;

valve means interposed in said secondary air line for controlling flow therethrough; and

means interposed in said main air line for preventing venting of air in said secondary air line through said main valve.