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(71) Applicant: **BENDIX COMMERCIAL VEHICLE
SYSTEMS LLC** [US/US]; 901 Cleveland Street, Elyria,
Ohio 44035 (US).

(72) Inventors: **KASPER, Phillip J.**; 901 Cleveland Street,
Elyria, Ohio 44035 (US). **TANEYHILL, David J.**; 901
Cleveland Street, Elyria, Ohio 44035 (US). **NIGLAS, Paul
C.**; 901 Cleveland Street, Elyria, Ohio 44035 (US). **WIED-
ER, Gerhard**; 901 Cleveland Street, Elyria, Ohio 44035
(US).

(74) Agent: **GREENLY, Cheryl L.** et al.; 901 Cleveland Street,
Elyria, Ohio 44035 (US).

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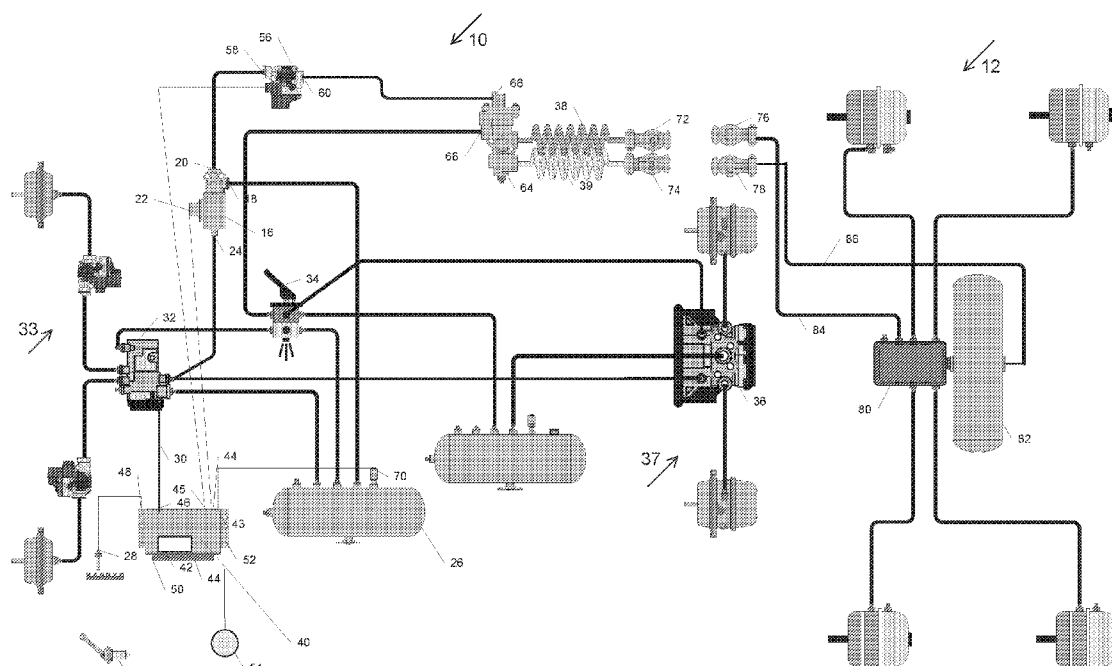


Figure 1

(57) Abstract: A system on a tractor for controlling trailer service brakes comprises a manually operated trailer brake switch, a first electropneumatic valve in communication with a pressure source and a controller. The controller has an input communicating with the trailer brake switch, an output communicating with the electropneumatic valve and control logic. The control logic receives an input from the trailer brake switch indicating a driver's request to apply the trailer service brakes of the combination vehicle, determines if a predetermined condition exists and transmits a signal to the output to the electropneumatic valve. The electropneumatic valve transmits pressure to a trailer service control line to actuate the trailer service brakes in response to the trailer brake switch and existence of the predetermined condition.



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- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
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APPARATUS AND METHOD FOR TRAILER SERVICE BRAKE CONTROL

Background

[0001] The present invention relates to examples of a control device for trailer service brakes and method of controlling trailer service brakes. Today's air brake systems on commercial vehicles include multiple pneumatic valves used to provide air to the service brakes of both the tractor and the trailer. One example valve to actuate the trailer service brakes is a trailer control valve, such as the TCS-9000™ control brake valve available from Bendix Commercial Vehicle Systems LLC, Elyria Ohio. The trailer control valve is located in the cab of a tractor and includes a handle. The driver of the commercial vehicle activates this valve when he wants to operate the trailer service brakes independently of the tractor service brakes. The air control lines must be routed through the dash of the cab in order for the driver to actuate the trailer service brakes by hand. In some safety situations, drivers should not be permitted to activate only the trailer service brakes. There is a need to eliminate air running through the dash of commercial vehicles while still maintaining driver features, such as independent control of the trailer service brakes, in limited situations.

Summary

[0002] Various examples of a system on a tractor for controlling trailer service brakes comprises a manually operated trailer brake switch, a first electropneumatic valve in communication with a pressure source and a controller. The controller has an input communicating with the trailer brake switch, an output communicating with the first electropneumatic valve and control logic. The control logic receives an input from the trailer brake switch indicating a driver's request to apply the trailer service brakes of the combination vehicle, determines if a predetermined condition exists and transmits a signal to the output to the first electropneumatic valve, wherein the first electropneumatic valve

transmits pressure to a trailer service control line to actuate the trailer service brakes in response to the trailer brake switch and existence of the predetermined condition.

[0003] Various examples of a system on a tractor for controlling trailer service brakes comprise a manually operated trailer brake switch and a controller. The control logic of the controller receives an input from the trailer brake switch indicating a driver's request to apply the trailer service brakes of the combination vehicle, determines if a predetermined condition exists and transmits pressure to a trailer service control line to actuate the trailer service brakes in response to the trailer brake switch and existence of the predetermined condition.

[0004] Various examples of a method for controlling trailer service brakes comprises receiving an input from a trailer brake switch indicating a request to apply trailer service brakes, determining whether the vehicle meets a predetermined condition and transmitting a signal to the output to an electropneumatic valve to actuate the trailer service brakes in response to the activation of the trailer brake switch and the speed being less than a predetermined speed.

Brief Description of the Drawings

[0005] In the accompanying drawings which are incorporated in and constitute a part of the specification, embodiments of the invention are illustrated, which, together with a general description of the invention given above, and the detailed description given below, serve to exemplify the embodiments of this invention.

[0006] **FIGURE 1** illustrates a schematic representation of an example tractor service braking system and a trailer service braking system on a commercial vehicle.

[0007] **FIGURE 2** illustrates a schematic representation of a tractor service braking system and a trailer service braking system on a commercial vehicle according to another example.

[0008] **FIGURE 3** illustrates a method of operating the trailer service brakes according to an example of the present invention.

Detailed Description

[0009] With reference to **FIGURE 1**, a tractor service braking system **10** and trailer service braking system **12** of an air braked commercial vehicle is illustrated.

[0010] The tractor system **10** includes a service brake foot valve **34** for receiving a driver's request to stop or slow the entire vehicle. The foot valve **34** receives supply air pressure from a reservoir **26** and delivers the driver requested delivery pressure to a front axle valve **32**, a rear axle valve **36** and a first input **68** of a tractor protection valve **64**. The front axle valve **32** will deliver the pressure to the front service brakes **33**, the rear axle valve **36** will deliver the pressure to the rear axle service brakes **37** and the tractor protection valve **64** will deliver the pressure to the trailer service braking system **12**.

[0011] The tractor service braking system **10** communicates with the trailer service braking system **12** through the tractor protection valve **64**. The tractor protection valve **64** has the first input **68** and a second input **66**. The tractor protection valve **64** communicates the control pressure of the highest value of either the first input **68** or the second input **66** to the trailer system **12** while protecting the air in the tractor system **10** in case of separation of the connection between the tractor system **10** and trailer system **12**. The tractor protection valve **64** communicates with a trailer control pressure line **38**. The trailer control pressure line **38** communicates via gladhand **72** to gladhand **76** of the trailer system **12**. Gladhand **76** communicates with the trailer control pressure line **84** of the trailer system **12**. The tractor protection valve **64** communicates with a trailer supply pressure line **39**. The trailer supply pressure line **39** communicates with gladhand **74** to gladhand **78** of the trailer system **12**. Gladhand **78** communicates with the trailer supply pressure line **86**.

[0012] In the trailer system **12**, the trailer supply pressure line **86** communicates with a trailer reservoir **82**. The trailer control pressure line **84** communicates with a trailer control valve device **80** mounted on the trailer. The control valve device **80** performs service

braking functions. The service brakes on the trailer are actuated in response to the pressure received on the trailer control pressure line **84** as long as sufficient pressure is available in the trailer reservoir **82**.

[0013] The tractor system **10** includes a trailer control switch **14**. The trailer control switch **14** is manually operated by a driver from inside a cab of the tractor. The trailer control switch **14** is electronic and may be a two state switch or alternatively a three state switch with on – hold – off states. The trailer control switch **14** may be installed in a dashboard panel or may be attached to the steering column. The trailer control switch **14** is used by the driver when he only wants to apply the trailer service brakes and not the tractor service brakes.

[0014] The tractor system **10** includes a first electropneumatic valve **16**. The first electropneumatic valve may be a 3/2 solenoid operated valve. The first electropneumatic valve **16** receives supply air pressure from the reservoir **26** at a supply input **18**. The first electropneumatic valve **16** communicates pneumatically with the front axle valve **32** at input **24** and transmits control pressure at output **20** to the second input **66** of the tractor protection valve **64**.

[0015] The tractor system **10** may include a second electropneumatic valve **56**. The second electropneumatic valve **56** may be an anti-lock brake system pressure modulator valve. An input **58** of the second electropneumatic valve **56** would communicate pneumatically with the output **20** of the first electropneumatic valve **16**. An output **60** would communicate with the second input **66** of the tractor protection valve **64**.

[0016] The tractor system **10** includes a controller **40**. The controller **40** includes a processor with control logic **42** for receiving and transmitting messages. The control logic **42** may also receive sensor signals and transmit control signals to control the tractor service brake system **10** of the vehicle. The control logic **42** may include volatile, non-volatile memory, solid state memory, flash memory, random-access memory (RAM), read-only memory (ROM), electronic erasable programmable read-only memory (EEPROM), variants of the foregoing memory types, combinations thereof, and/or any other type(s) of memory suitable for providing the described functionality and/or storing computer-executable

instructions for execution by the control logic 42. The controller 40 may perform anti-lock brake functions, stability control functions and automated driver assist functions. In one example, the controller 40 may be integrated with another vehicle controller on the tractor.

[0017] The controller 40 receives signals at input 50 from the trailer control switch 14. The input indicates a driver's desire to actuate the service brakes of the trailer system 12 independent of the tractor service brakes. Alternatively, the controller 40 receives the request via a serial vehicle communications bus 30 or from a source other than the driver.

[0018] The controller 40 receives signals at input 48 from a wheel speed sensing device, illustrated as wheel speed sensor 28. It is understood that more than one wheel speed sensor may be installed as part of the tractor system 10 in order to determine vehicle speed. Each wheel speed sensor is connected to the controller 40. The control logic 42 determines vehicle speed in response to the wheel speed sensor signals. Alternatively, the controller 40 includes a communications port 46 and communicates on the vehicle communications bus 30 to receive the vehicle speed from another source, such as the engine.

[0019] The controller 40 receives signals at input 43 from a pressure sensing device, illustrated as pressure sensor 70. The pressure sensor 70 is in pneumatic communication with the reservoir 26. The control logic 42 determines available supply pressure in response to the pressure signal. It is understood that more than one pressure sensor may be installed as part of the tractor system 10 in order to determine available supply pressure. Each pressure sensor is connected to the controller 40. Alternatively, the controller 40 communicates on the vehicle communications bus 30 to receive the pressure information from another source, such as a vehicle electronic air control system.

[0020] The controller 40 electrically communicates with the front axle valve 32 and the rear axle valve 36 to autonomously actuate the tractor service brakes in certain stability control situations. The controller 40 may communicate control signals via the vehicle communications bus 30 or via dedicated outputs to each valve.

[0021] The controller 40 electrically communicates with the first electropneumatic valve 16 at the output 44 to actuate the trailer service brakes in situations where the driver may request a trailer service brake actuation but not a tractor service brake application. No

input is required from the foot valve **34**. The controller **40** receives a signal at input **50** from the trailer brake switch **14** in response to the driver's request to only actuate the trailer service brakes. These situations may occur when a tractor driver is positioning the tractor to be mechanically connected to the trailer or when the driver desires to perform a pre-trip inspection of the trailer service braking system.

[0022] The controller **40** transmits a control signal at output **44** in response to the request to actuate only the trailer service brakes. The first electropneumatic valve **16** opens a path from the reservoir **26** to output **20** to provide supply pressure, thereby delivering control pressure to the tractor protection valve **64**. The tractor protection valve **64** will transmit the control pressure to tractor control line **38** and onto the trailer service brake system **12** as long as a trailer is connected to the tractor. The controller **40** will also discontinue the signal to the first electropneumatic valve **16** when actuation of the trailer service brakes is no longer desired by the driver based on the input from the trailer brake switch **14** or when certain predetermined conditions are not met.

[0023] In instances where fine pressure control or less than full supply pressure is desired at the trailer service brakes, the controller **40** electrically communicates at output **45** with the second electropneumatic valve **56**. Full pressure may be desired if the vehicle is on an incline, but may not be necessary if the vehicle is on a flat surface. Reducing the pressure to the brake system will preserve the life of the brake components. The second electropneumatic valve **56** will receive the control pressure from the first electropneumatic valve **16** and cycle the solenoids to provide varying amounts of air to the second input **66** of the tractor protection valve **64**. The tractor protection valve **64** will transmit the control pressure to the tractor control line **38** and into the trailer service brake system **12** as long as a trailer is connected to the tractor. Alternatively, a pneumatic only pressure reduction valve could be used in place of the second electropneumatic valve **56**.

[0024] The controller **40** may also communicate with an indicator **54**. The indicator **54** may be a lamp in the dash of the vehicle or a dashboard display. The indicator **54** shows the driver the operating state of the trailer service brake system.

[0025] Therefore, a system on a tractor for controlling trailer service brakes comprises a manually operated trailer brake switch, a first electropneumatic valve in communication with a pressure source and a controller. The controller has an input communicating with the trailer brake switch, an output communicating with the first electropneumatic valve and control logic. The control logic receives an input from the trailer brake switch indicating a driver's request to apply the trailer service brakes of the combination vehicle; determines if a predetermined condition exists, and transmits a signal to the output to the first electropneumatic valve, wherein the first electropneumatic valve transmits pressure to a trailer service control line to actuate the trailer service brakes in response to the trailer brake switch and existence of the predetermined condition.

[0026] With reference to **FIGURE 2**, a tractor service braking system **10'** and a trailer service braking system **12'** of an air braked commercial vehicle showing another example embodiment of the invention is illustrated. Elements that are the same as in Figure 1 have the same numbers.

[0027] The tractor system **10'** includes the service brake foot valve **34** for receiving a driver's request to stop or slow the vehicle. The foot valve **34** receives supply air pressure from the reservoir **26** and delivers the driver requested delivery pressure to the front axle valve **32**, the rear axle valve **36** and the first input **68** of the tractor protection valve **64**. The front axle valve **32** will deliver the pressure to the front service brakes **33** as well as to the second input of the tractor protection valve **64**. The rear axle valve **36** will deliver the pressure to the rear axle service brakes **37** and the tractor protection valve **64** will deliver the pressure to the trailer service braking system **12'**.

[0028] The tractor service braking system **10'** communicates with the trailer service braking system **12'** through the tractor protection valve **64**. The tractor protection valve **64** communicates the control pressure at either the first input **68** or the second input **66** having the highest pressure value to the trailer system **12'** while protecting the tractor system **10'** in case of separation of the connection between the tractor system **10'** and trailer system **12'**. The tractor protection valve **64** communicates with the trailer control pressure line **38**. The trailer control pressure line **38** communicates via gladhand **72** to gladhand **76** of the trailer

system 12'. Gladhand 76 communicates with the trailer control pressure line 84. The tractor protection valve 64 communicates with a trailer supply pressure line 39. The trailer supply pressure line 39 communicates with gladhand 74 to gladhand 78 of the trailer. Gladhand 78 communicates with the trailer supply pressure line 86.

[0029] The trailer supply pressure line 86 communicates with a trailer reservoir 82. The trailer control pressure line 84 communicates with a control valve device 80 mounted on the trailer. The control valve device 80 performs service braking functions. The service brakes on the trailer are actuated in response to the pressure received on the trailer control pressure line 84 or automatically in response to a signal from the tractor system 10', as will be disclosed.

[0030] The tractor system 10' includes the trailer control switch 14. The trailer control switch 14 is manually operated by a driver from inside a cab of the tractor. The trailer control switch 14 is electronic and may be a two state switch or alternatively a three state switch with on – hold – off states. The trailer control switch 14 may be installed in a dashboard panel or may be attached to the steering column. The trailer control switch 14 is used by the driver when he only wants to apply the trailer service brakes and not the tractor service brakes.

[0031] The tractor system 10' includes the controller 40. The controller 40 includes a processor with control logic 42 for receiving and transmitting messages. The control logic 42 may also receive sensor signals and transmit control signals to control the tractor service brake system 10' and the trailer service brake system 12' of the vehicle. The control logic 42 may include volatile, non-volatile memory, solid state memory, flash memory, random-access memory (RAM), read-only memory (ROM), electronic erasable programmable read-only memory (EEPROM), variants of the foregoing memory types, combinations thereof, and/or any other type(s) of memory suitable for providing the described functionality and/or storing computer-executable instructions for execution by the control logic 42. The controller 40 may perform anti-lock brake functions, stability control functions and automated driver assist functions.

[0032] The controller **40** receives signals at input **48** from the wheel speed sensing device, illustrated as wheel speed sensor **28**. It is understood that more than one wheel speed sensor may be installed as part of the tractor system **10** in order to determine vehicle speed. Each wheel speed sensor is connected to the controller **40**. The control logic **42** determines vehicle speed in response to the wheel speed sensor signals. Alternatively, the controller **40** includes a communications port **46** and communicates on a vehicle communications bus **30** to receive the vehicle speed from another source, such as the engine.

[0033] The controller **40** receives signals at input **43** from the pressure sensing device, illustrated as pressure sensor **70**. The pressure sensor **70** is in pneumatic communication with the reservoir **26**. The control logic **42** determines available supply pressure in response to the pressure signal. It is understood that more than one pressure sensor may be installed as part of the tractor system **10'** in order to determine available supply pressure. Each pressure sensor is connected to the controller **40**. Alternatively, the controller **40** communicates on the vehicle communications bus **30** to receive the pressure information from another source, such as a vehicle electronic air control system.

[0034] The controller **40** electrically communicates with the front axle valve **32** and the rear axle valve **36** to autonomously actuate the tractor service brakes in certain stability control situations. The controller **40** may communicate control signals via the communications bus **30** or via a dedicated output.

[0035] The tractor system **10'** includes a communication line **92**. The communication line may be a controller area network line or a power line carrier bus that will transmit control signals on the communication line **92** of the tractor system **10'** through an electrical connector **95** to the communication line **94** of the trailer system **12'**. The controller **40** electrically communicates with the trailer control valve **80** via the communication line **92**. Alternatively, the controller **40** may communicate wirelessly with the trailer control valve **80**. The controller **40** will transmit a signal or message such that the trailer control valve **80** will respond by actuating the trailer service brakes. No pneumatic signal is transmitted between the tractor system **10'** and the trailer system **12'**. Fine pressure

control of the trailer system **12'** can be achieved by changing the transmitted signal or the messages.

[0036] The controller **40** may also communicate with the indicator **54**. The indicator **54** may be a lamp in the dash of the vehicle or a dashboard display. The indicator **54** shows the driver the operating state of the trailer service brake system **12'**.

[0037] **FIGURE 3** illustrates a flowchart for implementing a method **100** of controlling the trailer service brakes using the systems of Figure 1. The method **100** begins at step **102**. In step **104**, the driver activates the trailer brake switch **14**, indicating his desire to apply only the trailer service brakes.

[0038] In step **106**, the control logic **42** determines if a predetermined condition is met. In one example, the predetermined condition is whether the speed of the tractor is less than a predetermined speed. The predetermined speed may be about five miles per hour. This low speed ensures that the tractor is fully stopped or nearly stopped. In another example, the predetermined condition is a pressure value from the pressure sensor being greater than a predetermined pressure. The predetermined pressure may be about sixty psi. Other examples of predetermined conditions include the presence of a trailer, the trailer parking brake status, such that if the trailer is parked, there is no need to activate trailer service brakes, and whether the transmission is in neutral or low gear. In addition, a geofence may be implemented to prevent the service brake activation outside the geofence.

[0039] In another example, the control logic **42** may consider a time out as a predetermined condition. The control logic **42** would not allow the trailer service brakes to be activated for longer than a predetermined period of time after the trailer brake switch **14** is activated. Each of the initial predetermined conditions must still be met to allow the service brakes to be applied. The predetermined period of time may be between one and three minutes. Other implementations of predetermined conditions are also possible.

[0040] In one example, if none of the predetermined conditions are met and there is no additional driver intervention, the trailer service brakes are released and the trailer parking brakes would be automatically applied to ensure that the trailer remains stationary.

[0041] If the predetermined condition is not met, the driver receives an indication in step 108. The indication may be via the indicator 54. The indicator 54 may be lit only when the trailer service braking system 12 is actuated and may blink if a request for service brakes was made via the trailer brake switch 14 but the predetermined condition was not met. Other methods of indicating the status of the trailer service braking system to the driver, such as LCD displays and audible means are contemplated. The method 100 then returns to the start step 102.

[0042] If the predetermined condition is met, the method 100 continues to step 110. In another example, one or more of the predetermined conditions must be met. The control logic 42 transmits a control signal to activate the trailer service brakes. The control signal includes transmitting a signal at output 44 to activate the first electropneumatic valve 16 so that air pressure will flow to the second input 66 of the tractor protection valve 64, through the tractor control line 38 and into the trailer control line 84.

[0043] If the second electropneumatic valve 60 is present in the system, then the control logic 42 will transmit a signal to both the first electropneumatic valve 16 and the second electropneumatic valve 56. The signal to the second electropneumatic valve 56 is adjusted, such as pulse width modulated, to provide less than the full available delivery pressure to the trailer service braking system 12. The control logic 42 will maintain the trailer service brakes as actuated as long as the trailer brake switch 14 is in the active state, a predetermined condition is no longer met or until the trailer brake switch 14 is moved to the off position if the trailer brake switch 14 returns to neutral after actuation. Alternatively, the function of the second electropneumatic valve to deliver a tunable pressure value can be combined into the first electropneumatic valve 16 such that only one valve is used.

[0044] The control logic 42 continuously monitors the vehicle conditions, such as speed and supply pressure. If the vehicle condition changes such that the predetermined condition is no longer met as in step 112, the trailer service brakes are released in step 114 where the control logic no longer transmits a signal to the first electropneumatic valve 16 or the second electropneumatic valve 56, which will discontinue the control pressure supplied to the trailer service braking system 12. In one example, if none of the predetermined

conditions are met and there is no additional driver intervention, the trailer parking brakes would be automatically applied to ensure that the trailer remains stationary.

[0045] With this method of operating the trailer service brakes, the driver cannot abuse the trailer service braking system by using the trailer service brakes during on the road driving situations since the operation is limited to low speed operation. The trailer service brakes will not be activated if the available pressure is not at a predetermined minimum. Neither will the driver be able to leave the trailer service brakes activated indefinitely using the system of the present invention.

[0046] Therefore a method of controlling trailer service brakes comprises receiving an input from a trailer brake switch indicating a request to apply trailer service brakes; determining whether the vehicle meets a predetermined condition; transmitting a signal to the output to an electropneumatic valve to actuate the trailer service brakes in response to the activation of the trailer brake switch and the speed being less than a predetermined speed.

[0047] While the present invention has been illustrated by the description of embodiments thereof, and while the embodiments have been described in considerable detail, it is not the intention of the applicants to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art. Therefore, the invention, in its broader aspects, is not limited to the specific details, the representative apparatus, and illustrative examples shown and described. Accordingly, departures may be made from such details without departing from the spirit or scope of the applicant's general inventive concept.

We claim:

1. A system on a tractor for controlling trailer service brakes comprising:
a manually operated trailer brake switch;
a first electropneumatic valve in communication with a pressure source on the tractor; and
a controller, the controller having:
an input communicating with the trailer brake switch;
an output communicating with the first electropneumatic valve; and
control logic, the control logic:
receiving an input from the trailer brake switch indicating a driver's request to
apply the trailer service brakes of the combination vehicle;
determining if a predetermined condition exists; and
transmitting a signal to the output to the first electropneumatic valve, wherein
the first electropneumatic valve transmits pressure to a trailer service control line to actuate
the trailer service brakes in response to the trailer brake switch and existence of the
predetermined condition.
2. The system as in claim 1, wherein the predetermined condition is one or more of a
speed of the tractor being less than a predetermined speed and a pressure at the pressure
source being greater than a predetermined pressure.
3. The system as in claim 2, wherein the predetermined speed is about five miles per
hour.
4. The system as in claim 2, wherein the predetermined pressure is about sixty psi.
5. The system as in claim 1, the controller further having a communications port for
receiving signals regarding the predetermined condition.
6. The system as in claim 1, the control logic further transmitting a signal to the output
to the electropneumatic valve to release the trailer service brakes in response to the
predetermined condition not being met.
7. The system as in claim 1, further comprising an indicator, wherein the control logic
transmits a signal to the indicator to indicate the status of the trailer service brakes.

8. The system as in claim 1, the control logic further transmitting a signal to the output to the first electropneumatic valve to maintain the trailer service brakes as actuated in response to the trailer brake switch being maintained in the active position and a speed of the combination vehicle being less than a predetermined speed.
9. The system as in claim 8, wherein the first electropneumatic valve deactuates the trailer service brakes after a predetermined time period from actuation.
10. The system as in claim 1, wherein the controller is integrated with another vehicle controller.
11. The system as in claim 1, further comprising a second valve, wherein the second valve communicates pneumatically with the first electropneumatic valve and the trailer service control line to reduce the pressure delivered to the trailer service brakes.
12. The system as in claim 11, wherein the second valve is a second electropneumatic valve, wherein the control logic transmits a signal to the second electropneumatic valve to variably control the amount of pressure delivered to the trailer service brakes.
13. The system as in claim 11, wherein the second valve is a pneumatic reduction valve.
14. A method for controlling trailer service brakes comprising:
 - receiving an input from a trailer brake switch indicating a request to apply trailer service brakes;
 - determining whether the vehicle meets a predetermined condition;
 - transmitting a signal to actuate the trailer service brakes in response to the activation of the trailer brake switch and the existence of the predetermined condition.
15. The method as in claim 14, wherein the predetermined condition is one or more of a speed of the tractor being less than a predetermined speed, a time period from actuation being less than a predetermined time period and a supply pressure being greater than a predetermined pressure.
16. The method as in claim 15, wherein the predetermined speed is about five miles per hour.
17. The method as in claim 15, wherein the predetermined pressure is about sixty psi.

18. The method as in claim 15, wherein the predetermined time period is about three minutes.
19. The method as in claim 14, further comprising indicating the status of the trailer service brakes to the driver.
20. The method as in claim 14, wherein transmitting a signal to actuate the trailer service brakes comprises actuating a first electropneumatic valve and a second valve.
21. The method as in claim 14, wherein transmitting a signal comprises transmitting a wireless signal to actuate the trailer service brakes.
22. A system on a tractor for controlling trailer service brakes comprising:
 - means for receiving a request to activate the trailer service brakes;
 - means for determining a predetermined condition of a vehicle; and
 - means for transmitting pressure to a trailer service braking system to actuate the trailer service brakes independent of the tractor service brakes in response to the request to activate the trailer service brakes and the predetermined condition being at least one of the speed of the vehicle being less than a predetermined speed, the supply pressure of the tractor being greater than a predetermined pressure and a time period from actuation of the trailer service brakes being less than a predetermined time period.

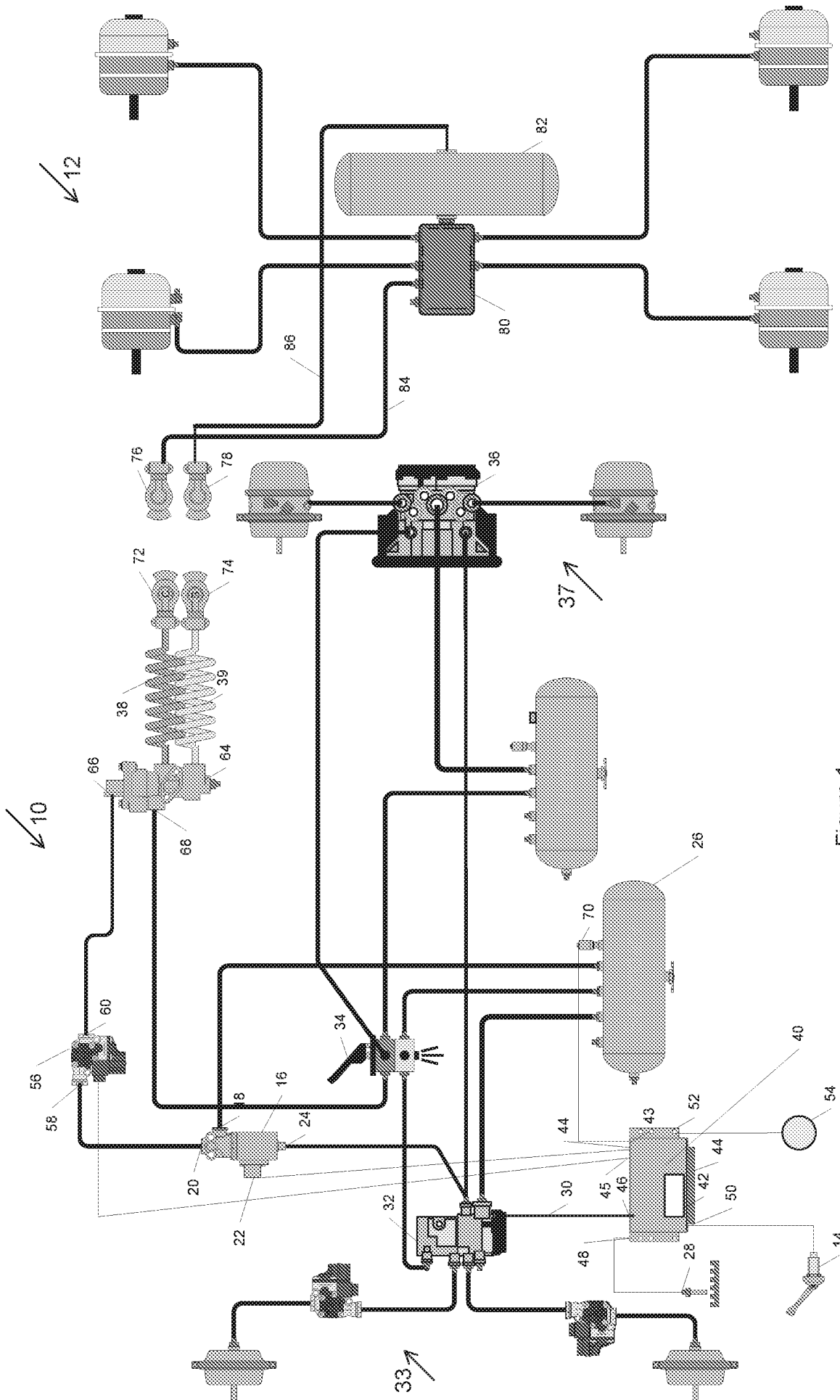


Figure 1

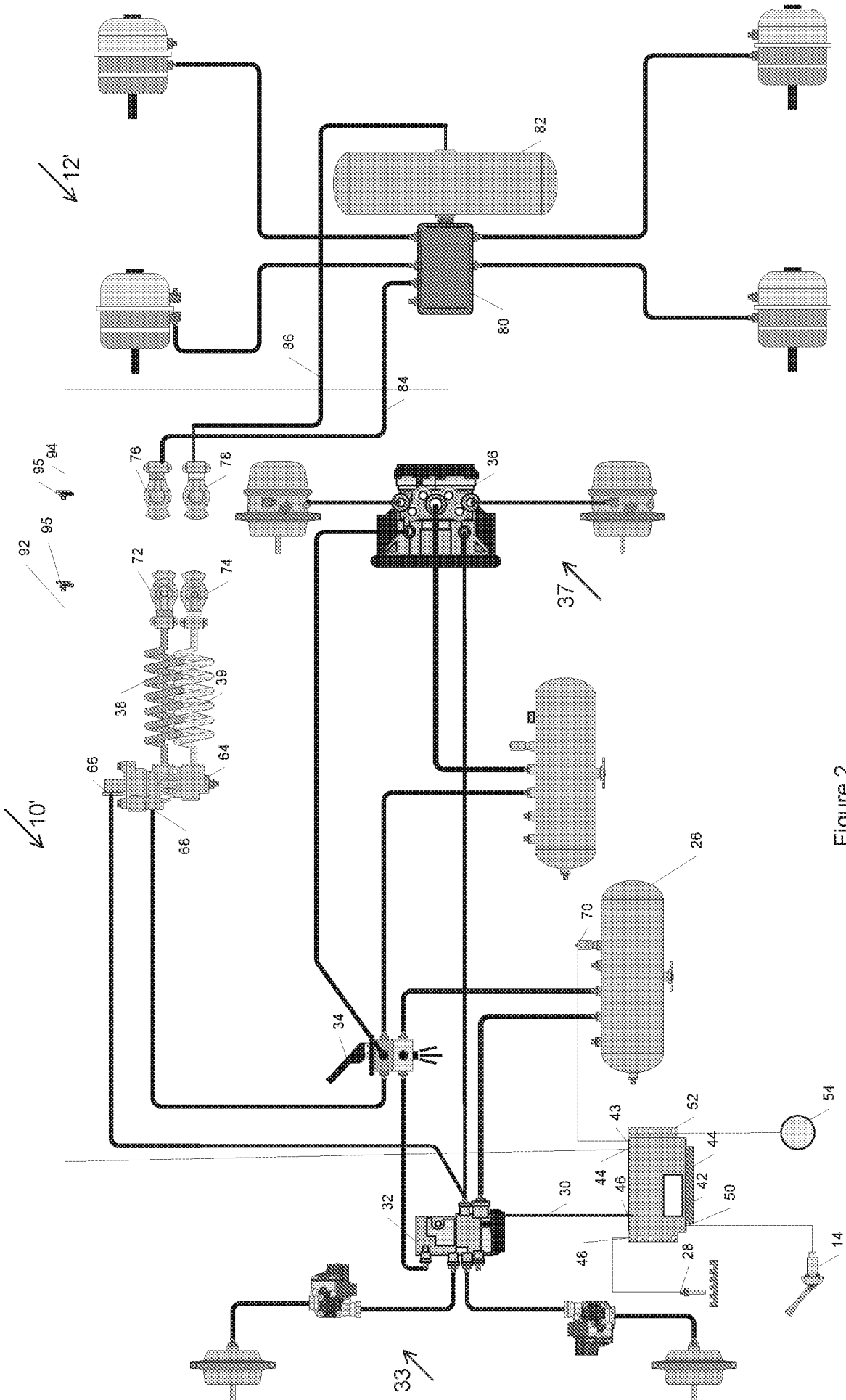


Figure 2

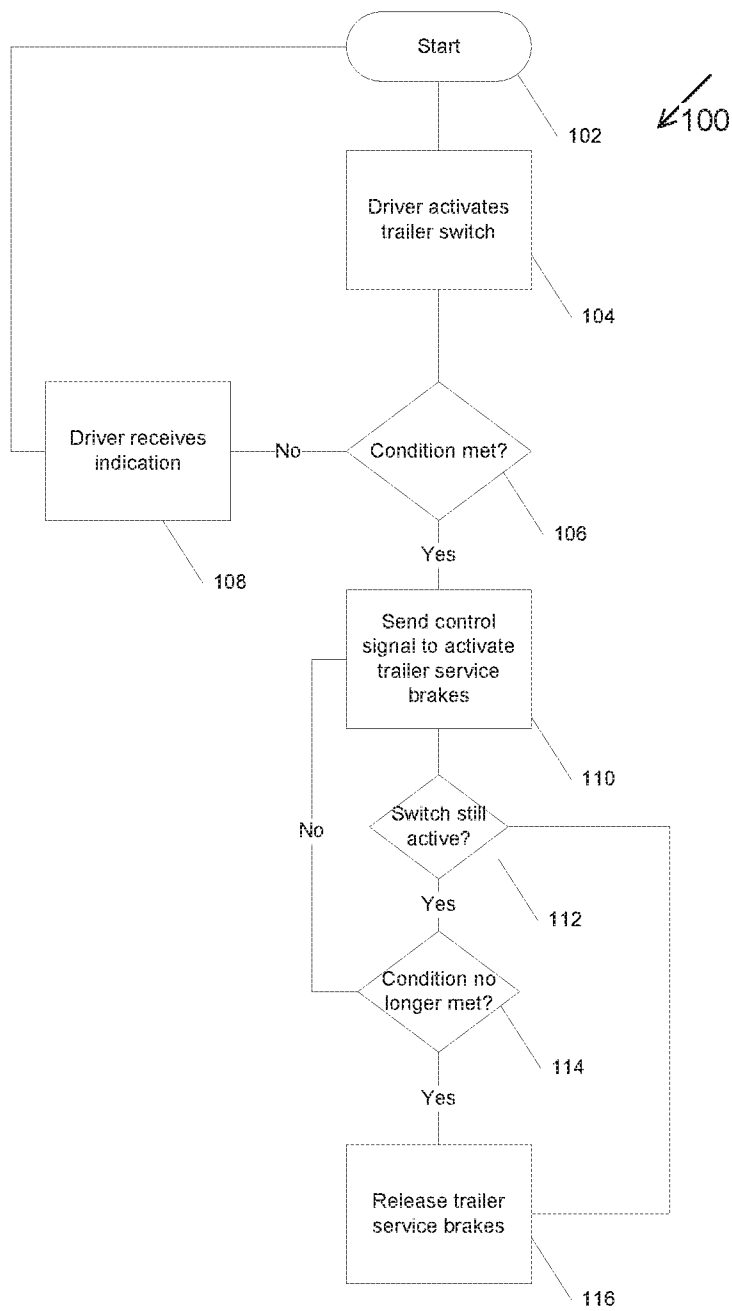


Figure 3

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2019/026721

A. CLASSIFICATION OF SUBJECT MATTER		
INV.	B60T7/20	B60T13/66
		B60T13/68
		B60T8/17
		B60T8/32
ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
B60T		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	AU 2012 201 087 B2 (BENDIX COMMERCIAL VEHICLE SYS) 9 January 2014 (2014-01-09)	1-7,10,
A	paragraphs [0023] - [0029], [0053] - [0058]; figures 2, 3	11,13-22
	-----	8,9,12
X	US 5 061 015 A (CRAMER KENNETH L [US] ET AL) 29 October 1991 (1991-10-29)	1-7,11,
A	column 1, line 39 - column 3, line 62; figure 1	13-22
	-----	8-10,12
X	US 8 152 243 B2 (BENSCH UWE [DE]; FOERSTER HENNING [DE] ET AL.)	1-4,6,
	10 April 2012 (2012-04-10)	11,12,
A	column 7, line 3 - column 11, line 52; figures 2, 3, 5, 6	14-22
	-----	5,7-10,
	-/--	13
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
27 June 2019		09/07/2019
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Lopez, Marco

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2019/026721

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 9 278 673 B2 (NISSAN NORTH AMERICA INC [US]) 8 March 2016 (2016-03-08) column 5, line 40 - column 9, line 42; figures 9-15 -----	14,19, 21,22 1-13, 15-18,20

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
AU 2012201087	B2	09-01-2014	NONE
US 5061015	A	29-10-1991	AU 5943190 A 11-11-1991 US 5061015 A 29-10-1991 WO 9116223 A1 31-10-1991
US 8152243	B2	10-04-2012	CN 101117115 A 06-02-2008 DE 102006036748 A1 07-02-2008 JP 2008037420 A 21-02-2008 US 2008030068 A1 07-02-2008 US 2012173112 A1 05-07-2012
US 9278673	B2	08-03-2016	NONE