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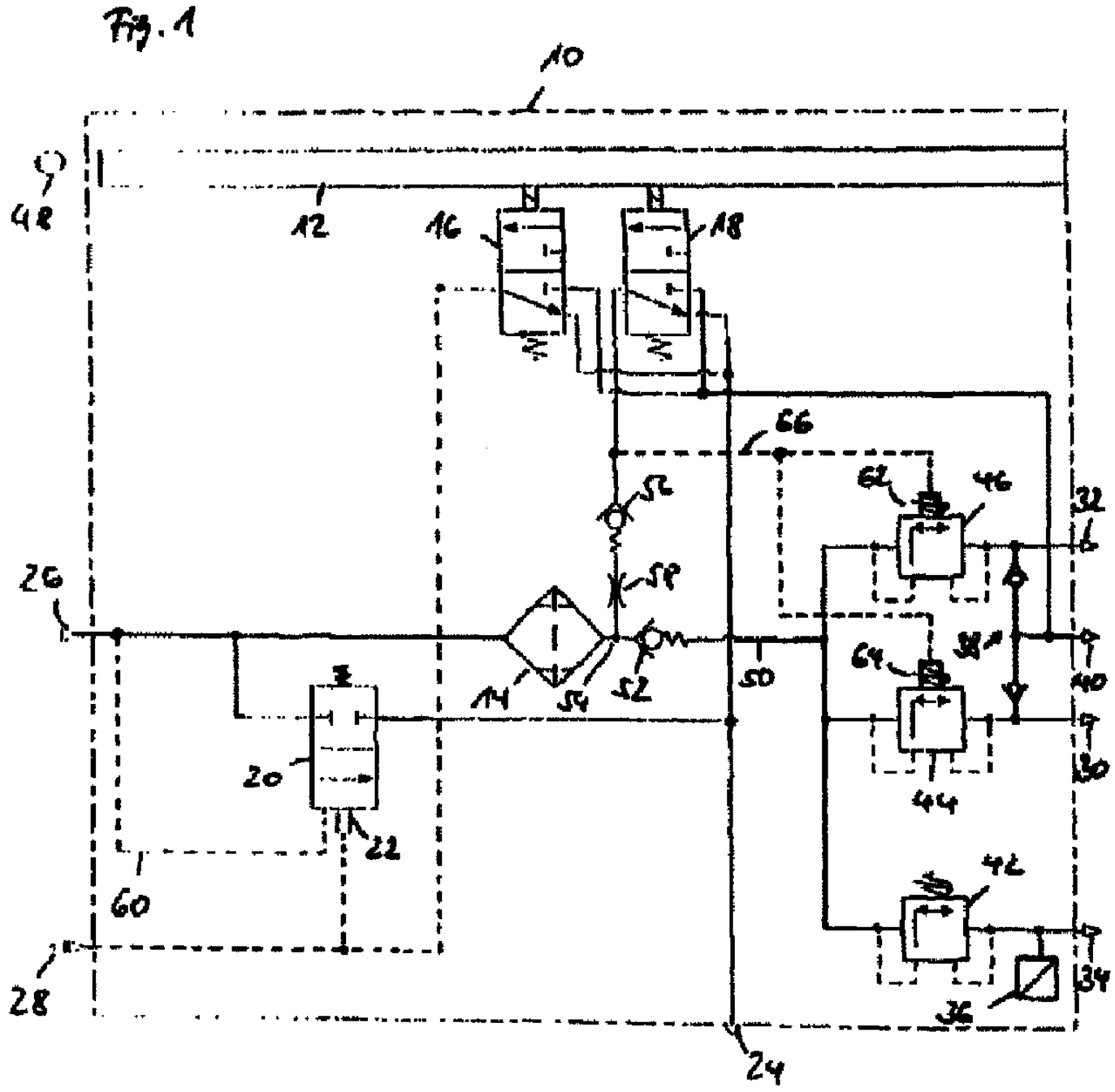
(54) Titre : DISPOSITIF D'ALIMENTATION EN AIR COMPRIME CONCU POUR UN VEHICULE UTILITAIRE ET PROCEDE POUR FAIRE FONCTIONNER CE DISPOSITIF D'ALIMENTATION EN AIR COMPRIME

(54) Title: COMPRESSED AIR SUPPLY SYSTEM FOR A UTILITY VEHICLE AND METHOD FOR OPERATING SAID COMPRESSED AIR SUPPLY SYSTEM

Fig. 1



(57) Abrégé/Abstract:
The invention relates to a compressed air supply system (10) for a utility vehicle, said system comprising a compressed air inlet (26) that can be coupled to a compressor (14), a filter unit (14) that can be coupled to the compressed air inlet (26) via a supply line, a

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(57) Abrégé(suite)/Abstract(continued):
discharge valve element (20) that is coupled to a discharge outlet (24) and the supply line, a first valve element (16) and a second valve element (18), a control inlet (22) of the discharge valve element (20) being controllable by the first valve element (16) and the second valve element (18) being arranged in a regeneration air path for regenerating the filter unit (14), and at least one pneumatically lockable overflow valve via which a consumer circuit coupled to the compressed air supply system is supplied with compressed air. The invention is characterized in that the at least one pneumatically lockable overflow valve can be controlled by the second valve element. The invention also relates to a method for operating a compressed air supply system.

ABSTRACT

The invention relates to a compressed air supply system for a utility vehicle, said system comprising a compressed air inlet that can be coupled to a compressor, a filter unit that can be coupled to the compressed air inlet via a supply line, a discharge valve element that is coupled to a discharge outlet and the supply line, a first valve element and a second valve element, a control inlet of the discharge valve element being controllable by the first valve element and the second valve element being arranged in a regeneration air path for regenerating the filter unit, and at least one pneumatically lockable overflow valve via which a consumer circuit coupled to the compressed air supply system is supplied with compressed air. The invention is characterized in that the at least one pneumatically lockable overflow valve can be controlled by the second valve element. The invention also relates to a method for operating a compressed air supply system.

COMPRESSED AIR SUPPLY SYSTEM FOR A UTILITY VEHICLE AND METHOD FOR OPERATING SAID COMPRESSED AIR SUPPLY SYSTEM

The invention relates to a compressed air supply unit for a commercial vehicle having a compressed air inlet that can be coupled to a compressor, a filter module coupled to the compressed air inlet via a delivery line, a discharge valve unit coupled to a discharge outlet and the delivery line, a first valve unit and a second valve unit, the first valve unit serving to control a control inlet of the discharge valve unit and the second valve unit being arranged in a regeneration air path for the regeneration of the filter module, and at least one pneumatically closable overflow valve, which serves to supply a consumer circuit coupled to the compressed air supply unit with compressed air.

The invention further relates to a method for operating a compressed air supply unit having a compressed air inlet that can be coupled to a compressor, a filter module coupled to the compressed air inlet via a delivery line, a discharge valve unit coupled to a discharge outlet and the delivery line, a first valve unit and a second valve unit, which is arranged in a regeneration air path for the regeneration of the filter module, in which method at least one pneumatically closable overflow valve serves to supply a consumer circuit coupled to the compressed air supply unit with compressed air and the first valve unit serves to control a control inlet of the discharge valve unit.

Such compressed air supply units fulfill numerous functions in commercial vehicles. These include, in particular, the supply of dry, purified compressed air to the braking system and other compressed air consumers, the exercise of a multi-circuit safety valve function to reciprocally safeguard various consumer

circuits and to ensure a specific filling order, and the provision of a pressure regulator function. The compressed air used by the compressed air consumers is provided primarily by a compressor, which is generally driven by the internal combustion engine of the commercial vehicle. In many systems the compressor can be brought into an energy-saving state, either by separating a clutch, which serves to couple the compressor to the internal combustion engine, or by pneumatic actuation of a compressor control inlet, in order to bring the compressor into an idling state.

Besides the delivery operating state of the compressed air supply unit, an important further operating state to achieve is the regeneration operating state for the filter unit. For this purpose dry, compressed air is fed from the compressed air reservoirs connected to the compressed air supply units through the filter module in a direction opposed to the delivery direction. The air flowing through the filter module at least partially absorbs the moisture in the filter module before flowing out into the open via the discharge valve of the compressed air supply unit.

WO 96/34785 A1 discloses a compressed air supply unit, the consumer circuits of which are supplied by pneumatically closable overflow valves. In this way it is possible, irrespective of the closing or opening pressure of the overflow valves, purposely to intervene in the supply or safeguarding of the consumer circuits and the regeneration process by purposely closing one or more overflow valves. According to WO 96/34785 A1 the regeneration of the compressed air supply unit is accomplished by the opening of a discharge valve and the selective extraction of compressed air from one or more of the consumer circuits. In order to allow this selective extraction, it is necessary to assign to each of the overflow valves a solenoid valve, which is specifically intended for the purpose of closing the

overflow valve as required, resulting in a comparatively high overall equipment cost.

The object of the invention is to provide a compressed air supply unit and a method of operation, which will allow influencing of the filling order at the lowest possible equipment cost.

This object is achieved by the features of the independent claims.

Advantageous embodiments of the invention are specified in the dependent claims.

The invention is based on the compressed air supply unit of generic type in that at least one pneumatically closable overflow valve is capable of actuation by the second valve unit. The second valve unit therefore has a dual function. On the one hand it serves to close or open the regeneration air path, the second valve unit itself being an integral part of the regeneration air path. On the other hand the second valve unit serves for the selective closing of overflow valves, so that a plurality of largely independent functions are advantageously integrated into one component of the compressed air supply unit.

At least one pneumatically closable overflow valve is here usefully assigned to a consumer circuit, which failing pneumatic closure of the overflow valve can be filled with a higher priority than at least one further parallel consumer circuit, so that on closing of the overflow valve at least one further consumer circuit can be filled before the consumer circuit coupled to at least one pneumatically closable overflow valve. Closing of the overflow valves therefore serves to temporarily defer the filling of specific consumer circuits of intrinsically high filling priority, such

as the service brake circuits, for example, and instead to fill a circuit of normally low filling priority.

In this context the further consumer circuit is usefully assigned to the pneumatic suspension of the commercial vehicle.

The provision of an electronic control module is furthermore particularly advantageous. This may, in particular, be integrated into the compressed air supply unit.

It is then advantageous if the valve units are solenoid valves.

It is furthermore preferable to assign a pressure sensor, which is integrated into the compressed air supply unit and is connected to the electronic control module, to the further consumer circuit.

It is also feasible, however, for the electronic control module to have an interface, via which signals characteristic of the pressure in the further consumer circuit can be transmitted.

The invention is based on the method of generic type in that at least one pneumatically closable overflow valve is actuated by the second valve unit. In this way the advantages and particular features of the compressed air supply unit according to the invention are also embodied as a method. This also applies to the especially preferred embodiments of the method according to the invention specified below.

In a useful development of the method at least one pneumatically closable overflow valve is assigned to a consumer circuit, which failing pneumatic closure of the overflow valve can be filled with a higher priority than at least one further parallel consumer circuit, so

that on closing of the overflow valve at least one further consumer circuit can be filled before the consumer circuit coupled to at least one pneumatically closable overflow valve.

The further consumer circuit is furthermore assigned to the pneumatic suspension of the commercial vehicle.

The method is furthermore advantageous in that it is controlled by an electronic control module.

The pressure in the further consumer circuit is furthermore usefully determined within the compressed air supply unit and in the form of a corresponding signal is transmitted directly to the electronic control module.

Alternatively or in addition the pressure in the further consumer circuit is determined and in the form of a corresponding signal is relayed to the electronic control module via an interface coupled to a data bus.

The invention will now be explained by way of example on the basis of especially preferred embodiments, with reference to the accompanying drawings, in which:

Fig. 1. shows a schematic, partial representation of a first embodiment of a compressed air supply unit according to the invention and

Fig. 2. shows a schematic, partial representation of a second embodiment of a compressed air supply unit according to the invention.

The compressed air supply unit 10 comprises an electronic control module 12. The control module 12 is equipped with an electrical interface 48 for the purpose of energy supply and signal exchange with other vehicle components. Two 3/2-way solenoid valves 16, 18

is capable of actuation by the electronic control module 12. Other components, such as a heating system, a plurality of pressure sensors and further solenoid valves, for example, which may be provided in connection with the electronic control module 12, are not represented. The compressed air supply unit has a compressed air inlet 26, which can be coupled to a compressor, and a discharge outlet 24. A discharge valve 20 is arranged between the compressed air inlet 26 and the discharge outlet 24. Also connected to the compressed air inlet 26 is a filter module 14. The compressed air delivered to the compressed air inlet 26 is fed to the consumer circuits via this filter module 14, a non-return valve 52, which prevents compressed air flowing back from the consumer circuits, also being provided on this path. The consumer circuits are generally supplied from the supply line 50, coupled to the non-return valve 52, via a multi-circuit safety valve unit, here exemplified by three overflow valves 42, 44, 46, incorporated into the compressed air supply unit. The overflow valves 44, 46, for example, directly supply the service brake circuits 30, 32 of the commercial vehicle. The overflow valve 42, for example, supplies the pneumatic suspension circuit 34 of the commercial vehicle. The pressure in the pneumatic suspension circuit 34 is registered by a pressure sensor 36, which is electrically connected to the electronic control module 12. The pressures of the other consumer circuits may also be monitored by pressure sensors, the latter not being shown here. The service brake circuits 30, 32 are connected to one another via a shuttle valve 38. Attached to this shuttle valve 38 is a supply line 40, which serves, in particular to supply further consumer circuits, the supply line 40 being connected to overflow valves, which are assigned to these consumer circuits. The subordinate consumer circuits are therefore supplied in series via the supply line 40, whilst the pneumatic suspension circuit 34 is supplied with compressed air

in parallel with the service brake circuits 30, 32. It is also possible, instead of supplying the consumer circuits in series via the supply line 40, to supply the remaining consumer circuits in parallel, that is to say directly from the supply line 50 without passing via the overflow valves 44, 46. The overflow valves 44, 46 each have a control inlet 62, 64, the pressurization of which acts in the same direction as the closing force of the overflow valves 44, 46. A control line 66, which actuates these control inlets 62, 64, is connected to a solenoid valve 18. This is embodied as a 3/2-way valve, the remaining connections of the solenoid valve 18 being connected to the supply line 40 and the discharge outlet 24 of the compressed air supply unit 10 respectively. The connection of the solenoid valve 18 connected to the control line 66 is further connected by way of a non-return valve 56 and a restrictor 58 to a line section 54 between the filter module 14 and the non-return valve 52. In this respect the solenoid valve 18 is an integral part of a regeneration air path, which connects the supply line 40 to the discharge outlet 24 via the solenoid valve 18, the non-return valve 56, the restrictor 58, the filter module 14 and the discharge valve 20. A further solenoid valve 16 is likewise connected to the supply line 40 and the discharge outlet 24. The remaining connection of the 3/2-way solenoid valve 16 serves for actuation of a control inlet 22 of the discharge valve 20 and an energy-saving control outlet 28, which serves for the connection of a control inlet of a compressor. Ventilation of the energy-saving control outlet 28 brings the compressor into an energy-saving state, that is to say a so-called idling state. It is also feasible, via the energy-saving control outlet 28, to activate a controllable clutch, which depending on the control state of the clutch serves to couple the compressor to the internal combustion engine of the commercial vehicle or to separate it therefrom. It is also possible to dispense entirely with the energy-

saving control outlet 28 and to use an electrical control signal for energy management of the compressor. A further control line 60 is provided, so that the discharge valve 20 can also function as a pressure-relief valve. It is likewise feasible to provide a separate pressure-relief valve for this purpose.

With regard to the regeneration of the filter module 14, the compressed air supply unit 10 functions as follows. In a first operating state both solenoid valves 16, 18 are unenergized. Consequently the regeneration air path is closed, and the energy-saving control outlet 28 is evacuated, so that the compressor connected thereto delivers and the discharge valve 20 is closed due to the evacuated control inlet 22. If both solenoid valves 16, 18 are energized, the regeneration air path is open, and the energy-saving control outlet 28 is ventilated, so that the compressor idles and the discharge valve 20 is opened.

The solenoid valve 18 fulfils a further function with regard to the filling of the consumer circuits 30, 32, 34 and the ventilation of the supply line 40. If the valve is unenergized, filling is performed in the conventional filling order, which is defined by the opening pressures of the overflow valves 42, 44, 46. Normally therefore, the service brakes circuits 30, 32 have filling priority. If the solenoid valve 18 is energized, however, and the control inlets 62, 64 of the overflow valves 44, 46 are thereby ventilated, this closes the overflow valves 44, 46. Consequently the pneumatic suspension circuit 34 is first filled via the overflow valve 42 connected in parallel. The pressure sensor 36 here ensures pressure control of the compressed air supply unit 10. If no pressure sensor is incorporated into the compressed air supply unit 10 for this purpose, the pressure of the pneumatic suspension circuit can also be determined elsewhere, and a corresponding signal transmitted to the electronic

control module 12 of the compressed air supply unit, in particular via the electrical interface 48. Instead of the pressure sensor 36 or in addition to the pressure sensor 36, a pressure relief valve may also be provided (see also Fig. 2).

Fig. 2 shows a schematic, partial representation of a second embodiment of a compressed air supply unit according to the invention. As has already been mentioned in connection with Fig. 1, a pressure relief valve 74, as shown here, may be connected to the pneumatic suspension circuit 34. On the other hand the embodiment according to Fig. 2 may also be equipped with a pressure sensor in the pneumatic suspension circuit 34. Otherwise the embodiment in Fig. 2 largely corresponds to that according to Fig. 1, a delivery line shut-off valve 68 being additionally provided here, however. This has a first control inlet 72, which is coupled to the solenoid valve 16. A second control inlet 72 is connected directly to the compressed air inlet 26. If the regeneration of the filter module 14 is therefore initiated by switching of the two solenoid valves 16, 18, the delivery line shut-off valve 68 can thereby be brought into its closed state due to the ventilation of the first control inlet 70. Consequently the volume of compressed air between the compressor and the delivery line shut-off valve 68 is not lost during the regeneration. If operation of the compressor is resumed, the evacuation of the control inlet 70 and the ventilation of the control inlet 72 ensures switching of the delivery line shut-off valve 68.

It has been described in connection with Figs. 1 and 2 that the solenoid valves 16, 18 are supplied with compressed air supply from a point downstream of the overflow valves 44, 46. It is also possible, however, to supply the compressed air from the supply line 50, that is to say from a point downstream of the non-

return valve 52, but upstream of the multi-circuit safety valve unit.

The present invention is furthermore not limited to the circuit connections described for the solenoid valves 16, 18. The control functions of the compressed air supply unit can also be divided in some other way between these solenoid valves 16, 18 or even exercised by other control elements

The features of the invention disclosed in the preceding description, in the drawings and in the claims may be essential, both individually and also in any combination, for the realization of the invention.

List of reference numerals

10 compressed air supply unit
12 electronic control module
14 filter module
16 valve unit
18 valve unit
20 discharge valve
22 control inlet
24 discharge outlet
26 compressed air inlet
28 energy-saving control outlet
30 service brake circuit
32 service brake circuit
34 pneumatic suspension circuit
36 pressure sensor
38 shuttle valve
40 supply line
42 overflow valve
44 overflow valve
46 overflow valve
48 interface
50 supply line
52 non-return valve
54 line section
56 non-return valve
58 restrictor
60 control line
62 control input
64 control input
66 control line
68 delivery line shut-off valve
70 control input
72 control input
74 pressure-relief valve

Patent claims

1. A compressed air supply unit (10) for a commercial vehicle having

- a compressed air inlet (26) that can be coupled to a compressor,

- a filter module (14) coupled to the compressed air inlet (26) via a delivery line,

- a discharge valve unit (20) coupled to a discharge outlet (24) and the delivery line,

- a first valve unit (16) and a second valve unit (18), the first valve unit (16) serving to control a control inlet (22) of the discharge valve unit (20) and the second valve unit (18) being arranged in a regeneration air path for the regeneration of the filter module (14), and

- at least one pneumatically closable overflow valve, which serves to supply a consumer circuit coupled to the compressed air supply unit with compressed air.

characterized in that at least one pneumatically closable overflow valve is capable of actuation by the compressed air supply unit.

2. The compressed air supply unit (10) as claimed in claim 1, **characterized in that** at least one pneumatically closable overflow valve is assigned to a consumer circuit, which failing pneumatic closure of the overflow valve can be filled with a higher priority than at least one further parallel consumer circuit, so that on closing of the overflow valve at least one further consumer circuit can be filled before the

consumer circuit coupled to at least one pneumatically closable overflow valve.

3. The compressed air supply unit (10) as claimed in claim 2, **characterized in that** the further consumer circuit is assigned to the pneumatic suspension of the commercial vehicle.

4. The compressed air supply unit (10) as claimed in one of the preceding claims, characterized in that an electronic control module (12) is provided.

5. The compressed air supply unit (10) as claimed in claim 4, **characterized in that** the valve units (16, 18) are solenoid valves.

6. The compressed air supply unit (10) as claimed in claim 4 or 5, **characterized in that** a pressure sensor, which is integrated into the compressed air supply unit and is connected to the electronic control module, is assigned to the further consumer circuit.

7. The compressed air supply unit (10) as claimed in one of claims 3 to 5, **characterized in that** the electronic control module has an interface, via which signals characteristic of the pressure in the further consumer circuit can be transmitted.

8. A method for operating a compressed air supply unit (10) having a compressed air inlet (26) that can be coupled to a compressor, a filter module (14) coupled to the compressed air inlet (26) via a delivery line, a discharge valve unit (20) coupled to a discharge outlet (24) and the delivery line, a first valve unit (16) and a second valve unit (18), which is arranged in a regeneration air path for the regeneration of the filter module (14), in which method at least one pneumatically closable overflow valve serves to supply a consumer circuit coupled to the

compressed air supply unit with compressed air and the first valve unit (16) serves to control a control inlet (22) of the discharge valve unit (20), **characterized in that** at least one pneumatically closable overflow valve is actuated by the second valve unit.

9. The method as claimed in claim 8, **characterized in that** at least one pneumatically closable overflow valve is assigned to a consumer circuit, which failing pneumatic closure of the overflow valve can be filled with a higher priority than at least one further parallel consumer circuit, so that on closing of the overflow valve at least one further consumer circuit can be filled before the consumer circuit coupled to at least one pneumatically closable overflow valve.

10. The method as claimed in claim 9, **characterized in that** the further consumer circuit is assigned to the pneumatic suspension of the commercial vehicle.

11. The method as claimed in one of claims 8 to 10, **characterized in that** it is controlled by an electronic control module (12).

12. The method as claimed in claim 11, **characterized in that** the pressure in the further consumer circuit is determined within the compressed air supply unit and in the form of a corresponding signal is transmitted directly to the electronic control module.

13. The method as claimed in claims 11 or 12, **characterized in that** the pressure in the further consumer circuit is determined and in the form of a corresponding signal is relayed to the electronic control module via an interface coupled to a data bus.

Fig. 1

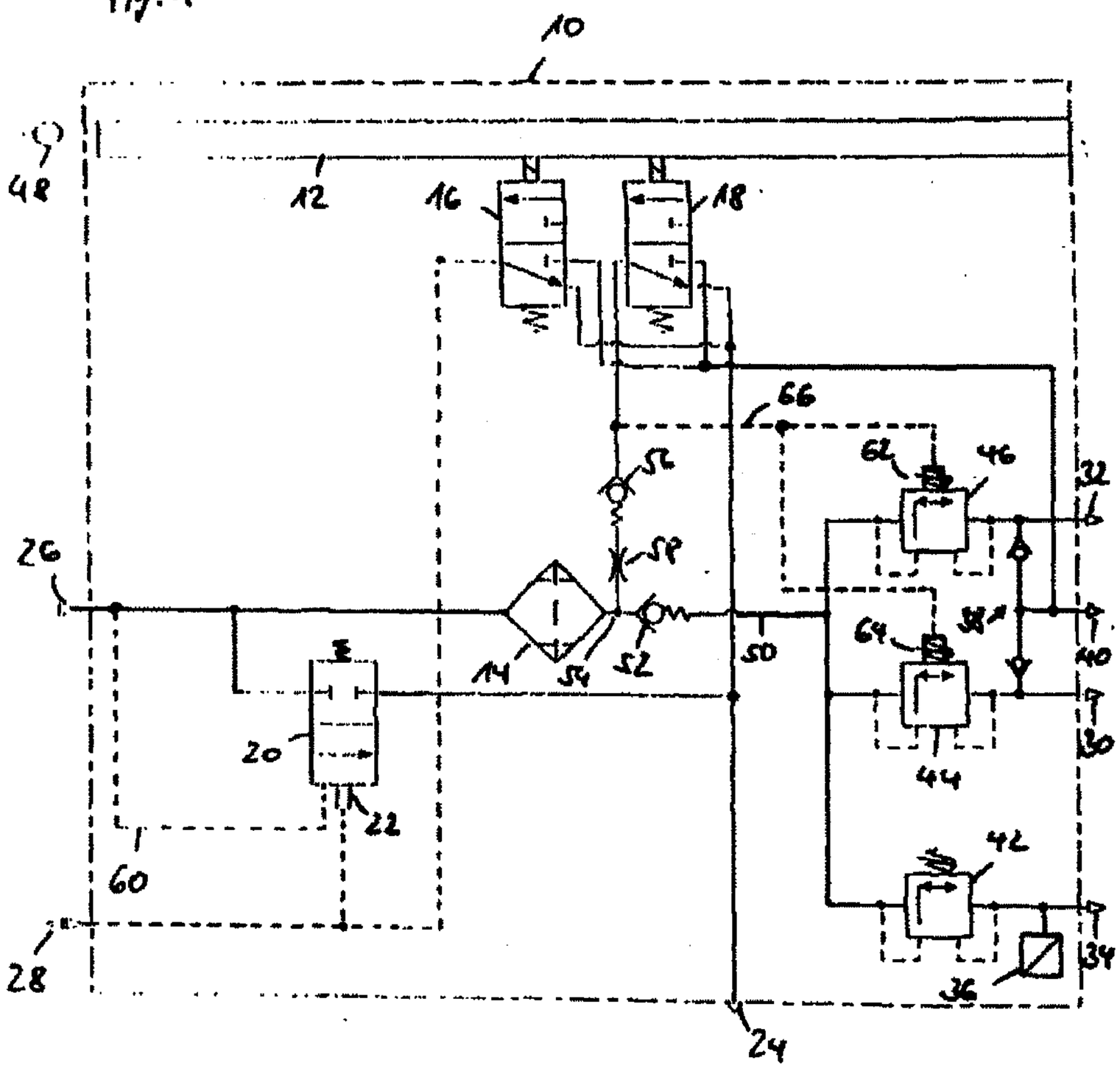

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Fig. 2

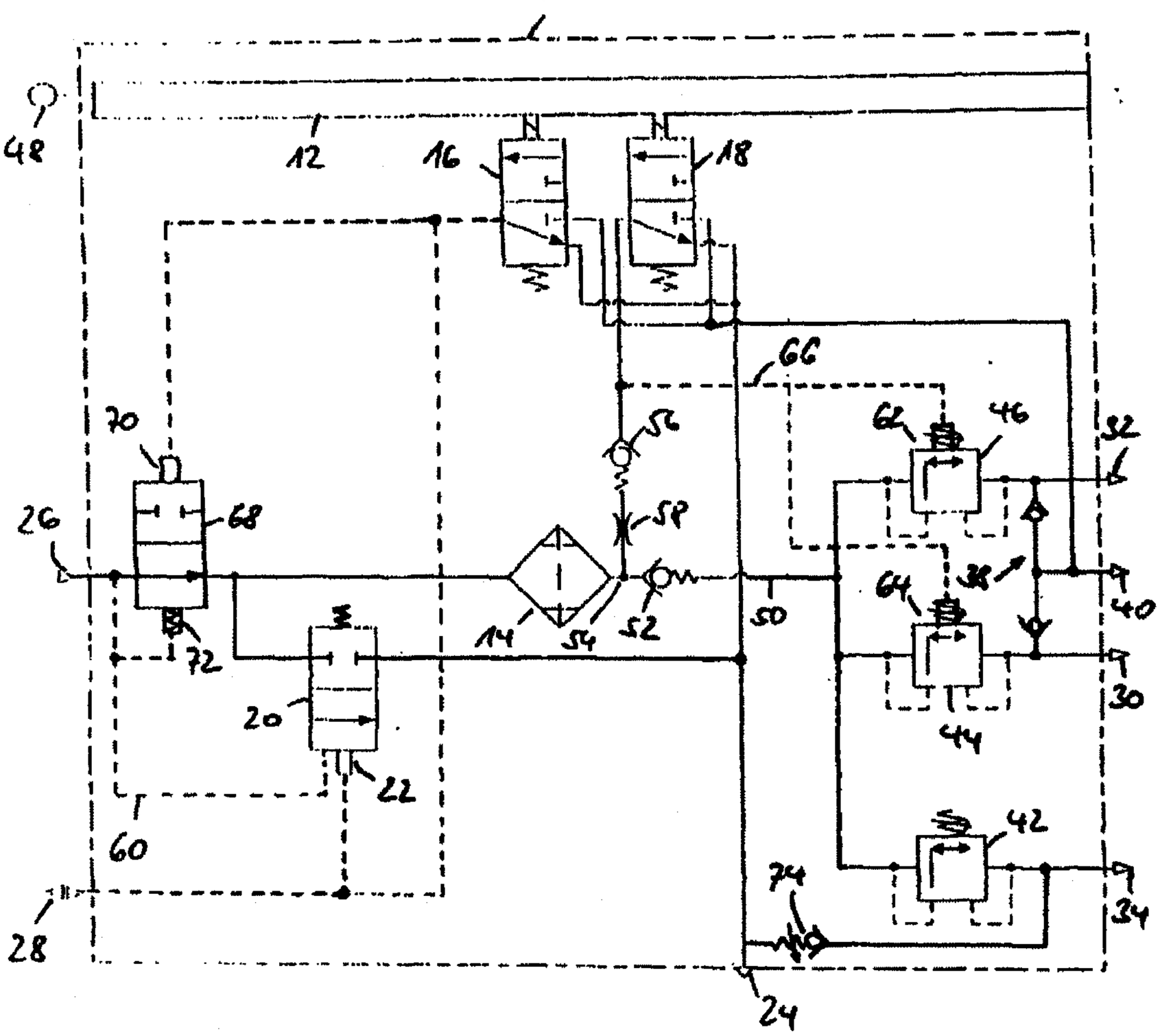

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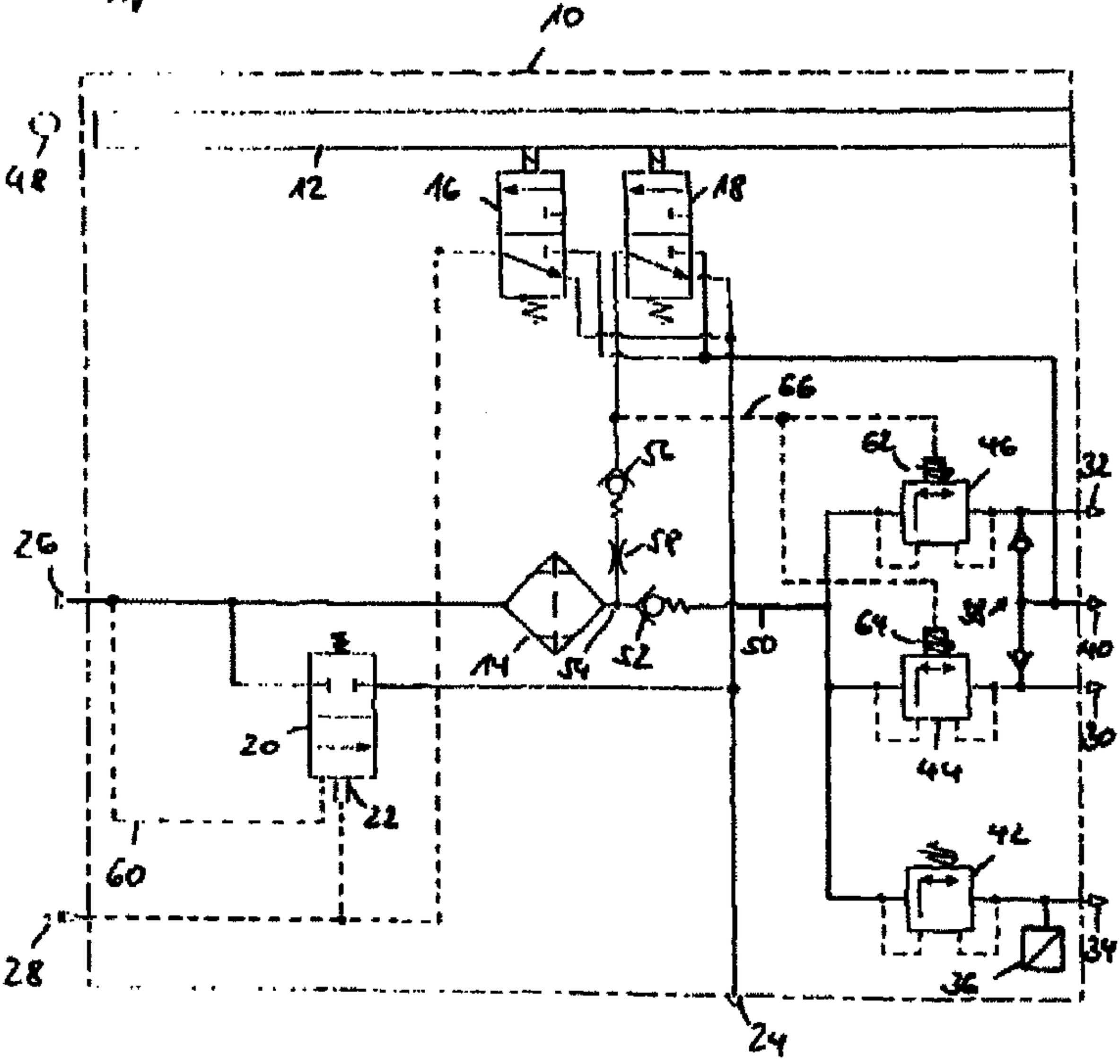
Fig. 1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