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(54) **Ram cylinder control system for wheel type excavator**

Steuersystem eines Stempels eines Radladers

Système de commande pour vérins des chargeurs à roues

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates to a system for controlling a ram cylinder interposed between an axle and an upper frame in a wheel type hydraulic excavator, and in particular to a ram cylinder control system for a wheel type excavator for automatically locking or releasing a ram cylinder depending on the operating mode of an excavator.

Background Art

[0002] As is generally known, (see US 5919243) a wheel type hydraulic excavator comprises a ram cylinder provided between an axle and an upper frame so as to damp impact caused by the rocking of the upper frame having a large weight while the excavator is traveling, and a control system for locking or releasing the ram cylinder according to an operating mode of the excavator. The ram cylinder control system is designed to release the ram cylinder while the excavator is traveling, so that an upper swivel body is prevented from being rocked when the excavator encounters irregularity on a road surface while traveling, and the ram cylinder control system is adapted to lock the ram cylinder while the excavator is working, so that the upper swivel body is prevented from being excessively tilted to a side by working loads.

[0003] Now, the construction and operation of such a conventional ram cylinder control system is described with reference to Fig. 1. In a wheel type excavator, hydraulic oil from a main hydraulic pump 101 is controlled by a control valve 102 in such a way that the hydraulic oil is supplied to and controls a travel motor 103 and a plurality of actuators.

[0004] And, the hydraulic oil from a pilot hydraulic pump 105 is controlled by a pilot control valve 107 by way of a pilot feed line 106, and the controlled hydraulic oil acts as pilot pressure (P1a-P2a) for controlling the control valve 102.

[0005] Meanwhile, the hydraulic oil from the pilot hydraulic pump 105 flows along a ram cylinder hydraulic line 108, wherein the hydraulic oil flowing in this manner is controlled by a ram cylinder control valve 109 provided in the ram cylinder hydraulic line 108 and acts as pilot pressure for locking or releasing a pair of ram cylinders 111 mounted on the opposite side of an axle 110.

[0006] The ram cylinders 111 are connected with each other via a connection line 111a that has a pair of check valves 111b to block off the discharge of the hydraulic oil from each of the ram cylinders 111. The check valves 111b are normally-closed, pilot-opened check valves, which are configured to be operated by the pilot pressure of the pilot hydraulic pump 105 supplied through the ram cylinder hydraulic line 108, thereby allowing the hydraulic

oil to be discharged from each of the ram cylinders 111. As the check valves 111b allow the hydraulic oil to be discharged from each of the ram cylinders 111 in this manner, the hydraulic oil in the ram cylinders 111 is capable of flowing freely, thereby permitting the extension and retraction movement of the ram cylinders 111. If the pilot pressure ceases to exist, the check valves 111b will block off the discharge of the hydraulic oil from each of the ram cylinders 111. Consequently, the working fluid in both of the ram cylinders 111 cannot flow in any direction, thereby locking the ram cylinders 111.

[0007] A brake control valve controls the hydraulic oil supplied to a brake from an auxiliary pump 112, and the controlled hydraulic oil is supplied to the brakes 115, thereby causing the vehicle to stop.

[0008] In addition, a forward control valve 117a and a backward control valve 117b are used to control the hydraulic oil of the pilot hydraulic pump 102 in response to travel condition signals indicating a forward position, a neutral position and a backward position. That is, a travel condition signal is applied to the forward control valve 117a if a joystick 118 is positioned at the forward position, a travel condition signal is applied to the backward control valve 117b if the joystick 118 is positioned at the backward position, and no travel condition signal is applied to the travel control valves if the joystick 118 is positioned at the neutral position.

[0009] The control system for locking or releasing the ram cylinders 111 is provided with a ram cylinder hydraulic line 108 for supplying hydraulic oil from the pilot hydraulic pump to the pressure receiving parts of the check valves 111b, a solenoid ram cylinder control valve 109 for controlling the flow of hydraulic oil through the ram cylinder hydraulic line 109, and a ram cylinder locking switch 116 for feeding or cutting off the solenoid operating power to the ram cylinder control valve 109.

[0010] Such a conventional ram cylinder control system feeds the check valves 111b with hydraulic oil flowing along the ram cylinder line 108 to supply pilot pressure if the locking switch is turned on and thus the power is applied to the control valve in order to release the ram cylinders during traveling. In addition, if the pilot pressure is supplied to the check valves 111b, the check valves 111b allow the discharge of hydraulic oil from the ram cylinders 111, thereby permitting the extension and retraction movement of the ram cylinders 111, so that the ram cylinders 111 can absorb and damp the vibration of the upper frame during traveling.

[0011] If the locking switch 116 is turned off in order for the excavator to start its works, the pilot pressure supplied to the check valves 111b is released as the ram cylinder control valve returns to its home position. In addition, if the pilot pressure is released from the check valves 111b, the check valves 111b will block off the discharge of hydraulic oil from the ram cylinders 111, thereby prohibiting the extension and retraction movement of the ram cylinders 111, so that the ram cylinders 111 are locked against any rocking phenomenon of the upper

frame during the course of performing works.

[0012] However, such a conventional ram cylinder control system has a drawback in that it is highly cumbersome and inconvenient for an operator to manually operate the ram cylinder locking switch, depending on a working or traveling condition of the excavator, so as to lock or release the ram cylinders at the operator's desire.

DISCLOSURE OF THE INVENTION

[0013] Accordingly, the present invention has been conceived to solve the above-mentioned and other problems inherent in the prior art system, and an object of the present invention is to provide a ram cylinder control system for automatically locking or releasing ram cylinders according to operation modes of an excavator, thereby assuring easy and convenient manipulation of a hydraulic excavator.

[0014] Another object of the present invention is to provide a ram cylinder control system for automatically locking or releasing ram without resort to the operator's manual operation, thereby preventing any safety accident that may otherwise be caused due to non-locking or non-releasing of the ram cylinders

[0015] In order to achieve the above-mentioned objects, according to the present invention, there is provided a ram cylinder control system for a wheel type excavator having brakes, a joy stick and ram cylinders for supporting an upper frame of a vehicle body, comprising: a pilot hydraulic pump; pilot-opened check valves for normally prohibiting discharge of working fluid from the ram cylinders to lock the ram cylinders; a ram cylinder control valve adapted to shift from a home position to an operating position in response to a valve control signal for allowing the hydraulic oil from the pilot hydraulic pump to open the check valves so that the hydraulic oil can be discharged from the ram cylinders; brake pressure sensing means for detecting hydraulic oil pressure supplied to the brakes; joystick position detector means for detecting position of the joystick to generate one of a forward position signal, a backward position signal and a neutral signal; and a controller for applying the valve control signal to the ram cylinder control valve if the forward position signal or the backward position signal is generated from the joystick position detector means and if the brake pressure detected by the brake pressure sensing means is no greater than a set pressure, and for cutting off the valve control signal applied to the ram cylinder control valve if the neutral signal is generated from the joystick position detector means and if the brake pressure exceeds the set pressure.

[0016] According to the present invention, the ram cylinders can be automatically locked or released according to operation modes of the excavator.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The above and other objects, features and ad-

vantages of the present invention will be more apparent from the following detailed description taken in conjunction with the accompanying drawings, in which:

5 FIG. 1 is a hydraulic circuit diagram of a ram cylinder control system for a conventional wheel type excavator;

10 FIG. 2 is a hydraulic circuit diagram of a ram cylinder control system for a wheel type excavator according to the present invention;

FIG. 3 is a block diagram illustrating control operations of a controller of the inventive ram cylinder control system; and

15 FIG. 4 is a block diagram illustrating a modified embodiment of the controller employed in the inventive ram cylinder control system.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

20 [0018] Preferred embodiments of the present invention will now be described with reference to the accompanying drawings.

[0019] Referring first to Fig. 2, there is shown is a hydraulic circuit diagram of a ram cylinder control system for a wheel type excavator according to the present invention. As shown, the ram cylinder control system for a wheel type excavator comprises a main hydraulic pump for supplying hydraulic oil to various hydraulic actuators such as a travel motor 1, a pilot hydraulic pump 20 for supplying pilot pressure to control valves, and an auxiliary pump 30 for supplying hydraulic pressure to brakes 5 provided on vehicle axles 4.

[0020] The hydraulic oil from the main hydraulic pump 10 is supplied to the travel motor 1 controlled by a plurality of control spools 12b, 12c including a traveling control spool 12a, and a plurality of hydraulic actuators. In addition, the travel motor 1 is connected to a driving shaft 3 for driving the vehicle axle 4 through a transmission 2.

35 [0021] The hydraulic oil from the auxiliary pump 30 is supplied to the brakes 5 through a pair of brake lines after passing through a brake feeding valve 14 and is properly controlled by a control valve 15, thereby operating the brakes 5 in a predetermined manner. Reference numeral 40 15a in Fig. 2 indicates a brake pedal operated by the foot of the operator.

[0022] A brake pressure sensor 17 is provided between brake lines 16a, 16b for feeding the brakes 5 with the hydraulic oil from the auxiliary pump 30. The brake pressure sensor 17 is adapted to detect a brake pressure in the brake lines 16a, 16b, whichever is higher, and then input a corresponding signal into a controller 19 described later.

45 [0023] Meanwhile, a pilot control valve 23 is designed to reduce the pressure of the hydraulic oil from the pilot hydraulic pump 20 and produce a plurality of pilot signal pressures P1a, P1b; P2a, P2b; and PTF, PTR for controlling the traveling control spool and other control

spools 12b, 12c of the control valve 12. Reference numeral 22 indicates a pilot cut-off valve for feeding or blocking off the hydraulic pump fed to the pilot control valve 23 along the pilot feeding line 21 from the pilot hydraulic pump 20.

[0024] The joystick 26 is configured in such a way that it is moved to one of the forward position, neutral position and backward position and outputs a forward position signal, a neutral position and a backward position signal depending the positions thereof. The joystick 26 comprises joystick position detection means for detecting the forward position, neutral position and backward position. The detection means is provided with a forward joystick position switch 26a, a backward joystick position switch 26b and a neutral joystick position switch 26c.

[0025] If this joystick 26 is positioned at the forward position or the backward position and thus the forward position signal or the backward position signal is generated, the signal is supplied to the forward control valve 25a or the backward control valve 25b through the controller 19 described later, thereby shifting the corresponding one of the traveling control valves 25a, 25b. At this time, if the forward control valve 25a or the backward control valve 25b is shifted, the hydraulic oil from the pilot hydraulic pump 20 acts as the forward pilot pressure or the backward pilot pressure through the traveling control pilot line 27a or 27b. If the joystick 26 is positioned at the neutral position 26c, no traveling signal is fed to the traveling control valves 25a, 25b.

[0026] Meanwhile, the vehicle axle 4 is provided with a pair of ram cylinders 24, which are connected with each other through a connection line 24a. The connection lines 24a has a pair of check valves 24b that normally block off the discharge of hydraulic oil from each of the ram cylinders 24.

[0027] The check valves 24b are pilot-opened check valves that can be operated by the pilot pressure from the pilot hydraulic pump 20 fed through the ram cylinder hydraulic line 18, thus permitting discharge of hydraulic oil from the ram cylinder. This assures free flow of the hydraulic oil between the two ram cylinders 24, thereby permitting the extension and retraction movement of the ram cylinders 24. Of course, if the ram cylinder line 18 is blocked off and thus the pilot pressure is extinguished, the check valves 24b prohibits any discharge of the hydraulic oil from the ram cylinders 24, so that flow of the hydraulic oil between the two ram cylinders 24 is prevented, thereby locking the ram cylinders 24.

[0028] The ram cylinder hydraulic line 18 is provided with a ram cylinder control valve 29 for locking or releasing the ram cylinders 24. The ram cylinder control valve 29 is capable of being shifted between an operating position at which the pilot hydraulic pump 20 is in communication with the pilot pressure receiving parts of the check valves 24b to allow the extension and retraction movement of the ram cylinders 24, and a home position at which the extension and retraction movement of the ram cylinders 24 is avoided by cutting off the fluid com-

munication between the pilot hydraulic pump 20 and the pilot pressure receiving parts of the check valves 24b. At the home position, the pilot pressure, which has acted on the check valves 24b, is drained to an oil tank T.

[0029] The ram cylinder control valve 29 is always resiliently biased to the home position 29b by a return spring 29c provided at one side of the control valve 29. In addition, if a signal is applied to a solenoid part 29d, the ram cylinder control valve 29 is shifted toward the operating position 29a. The solenoid part 29d is activated if a ram cylinder-locking signal is applied from the controller 19.

[0030] With this arrangement of ram cylinder control valve 29, if a ram cylinder releasing signal is applied to the solenoid part 29d from the controller 19, the ram cylinder control valve 29 is shifted to the operating position 29 and thus releases the ram cylinders 24, but if no ram cylinder releasing signal is applied to the solenoid part 29d from the controller, the ram cylinder control valve 29 returns to its home position 29b and thus causes the ram cylinders 24 to be locked.

[0031] As shown in Figs. 2 and 3, the controller 19 is connected to the respective output signal lines of the joystick 26 to receive the forward position signal or the backward position signal from the joystick 26 (S101), and at that time, if the brake pressure detected by the brake sensor 17 does not exceed a set pressure (S103), it is determined that the vehicle is now traveling and the ram cylinder releasing signal is fed to the ram cylinder control valve 29 (S105). Thus, the ram cylinder control valve 29 is shifted to the operating position 29a and allows fluid communication between the pilot hydraulic pump 20 and the check valves 24b, so that the ram cylinders 24 is can be released (S107). Therefore, the vibration of the upper frame of the vehicle body can be absorbed and damped during the traveling movement of the excavator.

[0032] If the neutral position signal is generated from the joystick 26 (S101-1) or if the brake pressure detected by the brake pressure sensor 17 exceeds the set pressure (S103-1) under the condition that the forward position signal or the backward position signal is generated from the joystick 26 (S101), it is determined that the vehicle is now performing works or urgently braked during travel. At this time, the releasing signal applied to the solenoid part 29c of the ram cylinder control valve 29 is blocked off (S109). Thus, the ram cylinder control valve 29 returns to its home position to cut off the fluid communication between the pilot hydraulic pump 20 and the check valves 24b, so that the ram cylinders 24 can be locked (S111). Accordingly, it becomes possible to minimize or prevent the rocking phenomenon of the vehicle body that may be otherwise caused in the process of working or urgent braking of the excavator.

[0033] On the other hand, the controller 19 is operable in a fixed releasing mode for directly supplying a releasing signal to the ram cylinder control valve 29 regardless of signals inputted from the joy stick 26 and the brake pressure sensor 17 (S115) and in a fixed locking mode for

supplying a locking signal to the ram cylinder control valve 29 (S117), in addition to the automatic mode (S 113) described above. A selection switch 33 is provided outside of the controller 19 so that one of the automatic mode (S113), the fixed releasing mode (S115), and the fixed locking mode (S117) can be freely selected by an operator.

[0034] Fig. 4 shows a modified embodiment of a controller 19. The controller 19 of this embodiment has a fixed locking mode (S117) and a releasing mode (S 119) unlike the embodiment described above. The releasing mode (S 119) is identical to the automatic mode S113 of the preceding embodiment described above. Of course, the fixed locking mode (S117) is configured to directly supply the locking signal to the ram cylinder control valve 29.

[0035] In addition, the controller 19 of the this embodiment is provided with a selection switch so that one of the fixed locking mode (S 117) and the releasing mode (S 119) can be freely selected by the operator.

[0036] The controller 19 minimizes the number of modes selectable by an operator, thereby preventing the operator from confusedly using the respective modes. In particular, because the operator's confusion for the respective modes can be prevented, the vehicle can be conveniently driven.

[0037] While the invention has been shown and described with reference to certain preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details can be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

Claims

1. A ram cylinder control system for a wheel type excavator having brakes (5), a joystick (26) and ram cylinders (24) for supporting an upper frame of a vehicle body comprising:

a pilot hydraulic pump (20);
 pilot-opened check valves (24b) for normally prohibiting discharge of working fluid from the ram cylinders (24) to lock the ram cylinders (24);
 a ram cylinder control valve (29) adapted to shift from a home position to an operating position (29a) in response to a valve control signal for allowing the hydraulic oil from the pilot hydraulic pump (20) to open the check valves so that the hydraulic oil can be discharged from the ram cylinders (24);
 joystick position detector means for detecting position of the joystick to generate one of a forward position signal, a backward position signal and a neutral signal; and **characterised in that** it further comprises brake pressure sensing means for detecting hydraulic oil pressure sup-

plied to the brakes;

a controller (19) for applying the valve control signal to the ram cylinder control valve (29) if the forward position signal or the backward position signal is generated from the joystick position detector means and if the brake pressure detected by the brake pressure sensing means is no greater than a set pressure, and for cutting off the valve control signal applied to the ram cylinder control valve (29) if the neutral signal is generated from the joystick position detector means and if the brake pressure exceeds the set pressure.

2. The system of claim 1, wherein the controller (19) is adapted to cut off the valve control signal applied to the ram cylinder control valve (29) even when the forward position signal or the backward position signal is generated from the joystick position detector means, as far as the brake pressure exceeds the set pressure.
3. The system of claim 1 or 2, wherein the controller (19) has an automatic mode for applying or cutting off the valve control signal to the ram cylinder control valve (29) depending on the signals from the brake pressure sensing means and the joystick position detector means, a fixed releasing mode for applying the valve control signal to the ram cylinder control valve (29) regardless of the signals from the brake pressure sensing means and the joystick control signal applied to the ram cylinder control valve (29) regardless of the signals from the brake pressure sensing means and the joystick position detector means.
4. The system of claim 3, further comprising a mode selection switch (33) for enabling an operator to select one of the automatic mode, the fixed releasing mode and the fixed locking mode.
5. The system of any one of the claims 1 to 4, wherein the controller (19) has a releasing mode for applying or cutting off the valve control signal to the ram cylinder control valve (29) depending on the signals from the brake pressure sensing means and the joystick position detector means and a fixed locking mode for cutting off the valve control signal applied to the ram cylinder control valve (29) regardless of the signals from the brake pressure sensing means and the joystick position detector means.
6. The system of claim 5, further comprising a mode selection switch (33) for enabling an operator to select one of the releasing mode and the fixed locking mode.

Patentansprüche

1. Arbeitszylinder-Steuersystem für einen Radbagger, der Bremsen (5), einen Joystick (26) und Arbeitszylinder (24) zum Unterstützen eines oberen Rahmens einer Fahrzeugkarosserie besitzt, mit:

einer Vorsteuer-Hydraulikpumpe (20);
 durch Vorsteuerung zu öffnenden Rückschlagventilen (24b), um den Ausstoß von Arbeitsfluid von dem Arbeitszylinder (24) normalerweise zu verhindern, um die Arbeitszylinder (24) zu verriegeln;
 einem Arbeitszylinder-Steuerventil (29), das ausgelegt ist, um sich in Reaktion auf ein Ventilsteuersignal aus einer Ruheposition in eine Arbeitsposition (29a) zu verschieben, um zuzulassen, dass das Hydrauliköl von der Vorsteuer-Hydraulikpumpe (20) die Rückschlagventile öffnet, damit Hydrauliköl von den Arbeitszylindern (24) ausgestoßen werden kann; und
 Joystickpositions-Detektormitteln zum Erfassen der Position des Joysticks, um entweder ein Vorwärtspositionssignal, ein Rückwärtspositionssignal oder ein Neutralsignal zu erzeugen;
dadurch gekennzeichnet, dass es ferner umfasst:

Bremsdruck-Erfassungsmittel zum Erfassen von Hydrauliköldruck, der an die Bremsen angelegt wird;
 eine Steuereinheit (19) zum Eingeben des Ventilsteuersignals in das Arbeitszylinder-Steuerventil (29), falls das Vorwärtspositionssignal oder das Rückwärtspositionssignal von den Joystickpositions-Detektormitteln erzeugt wird und falls der durch die Bremsdruck-Erfassungsmittel erfasste Bremsdruck nicht größer als ein Solldruck ist, und zum Unterbrechen des Ventilsteuersignals, das in das Arbeitszylinder-Steuerventil (29) eingegeben wird, falls das Neutralsignal von den Joystickpositions-Detektormitteln erzeugt wird und falls der Bremsdruck den Solldruck übersteigt.

2. System nach Anspruch 1, wobei die Steuereinheit (19) ausgelegt ist, um das Ventilsteuersignal, das in das Arbeitszylinder-Steuerventil (29) eingegeben wird, selbst dann zu unterbrechen, wenn das Vorwärtspositionssignal oder das Rückwärtspositionssignal von den Joystickpositions-Detektormitteln erzeugt wird, sofern der Bremsdruck den Solldruck übersteigt.
3. System nach Anspruch 1 oder 2, wobei die Steuereinheit (19) eine automatische Betriebsart besitzt, um das Ventilsteuersignal in das Arbeitszylinder-

Steuerventil (29) in Abhängigkeit von den Signalen von den Bremsdruck-Erfassungsmitteln und von den Joystickpositions-Detektormitteln einzugeben oder zu unterbrechen, eine feste Freigabebetriebsart hat, um das Ventilsteuersignal unabhängig von den Signalen von den Bremsdruck-Erfassungsmitteln und dem Joystick-Steuersignal, das in das Arbeitszylinder-Steuerventil (29) unabhängig von den Signalen von den Bremsdruck-Erfassungsmitteln und den Joystickpositions-Detektormitteln eingegeben wird, in das Arbeitszylinder-Steuerventil (29) einzugeben.

4. System nach Anspruch 3, das ferner einen Betriebsartauswahlschalter (33) umfasst, um einer Bedienungsperson zu ermöglichen, entweder die automatische Betriebsart oder die feste Freigabebetriebsart oder die feste Verriegelungsbetriebsart auszuwählen.
5. System nach einem der Ansprüche 1 bis 4, wobei die Steuereinheit (19) eine Freigabebetriebsart hat, um das Ventilsteuersignal in das Arbeitszylinder-Steuerventil (29) in Abhängigkeit von den Signalen von den Bremsdruck-Erfassungsmitteln und den Joystickpositions-Detektormitteln einzugeben oder zu unterbrechen, und eine feste Verriegelungsbetriebsart hat, um das Ventilsteuersignal, das in das Arbeitszylinder-Steuerventil (29) eingegeben wird, unabhängig von den Signalen von den Bremsdruck-Erfassungsmitteln und von den Joystickpositions-Detektormitteln zu unterbrechen.
6. System nach Anspruch 5, das ferner einen Betriebsartauswahlschalter (33) umfasst, um einer Bedienungsperson zu ermöglichen, entweder die Freigabebetriebsart oder die feste Verriegelungsbetriebsart zu wählen.

Revendications

1. Système de commande d'un vérin de travail pour une pelle sur pneus comportant des freins (5), un manche de commande (26) et des vérins de travail (24) pour supporter un bâti supérieur d'un corps de véhicule, comprenant une pompe hydraulique pilote (20), des soupapes de contrôle (24b) ouvertes par le pilote pour empêcher en temps normal le déchargement de fluide de travail depuis les vérins de travail (24) pour verrouiller les vérins de travail (24), une soupape de commande (29) du vérin de travail adaptée pour passer d'une position de repos à une position de marche (29a) en réponse à un signal de commande de soupape pour permettre à l'huile hydraulique de la pompe hydraulique pilote (20) d'ouvrir les soupapes de contrôle de sorte que l'huile hydraulique puisse être déchargée des vérins de travail (24), des moyens de détection de la position du manche

- de commande pour détecter la position du manche de commande afin de produire un signal parmi le signal de position avant, le signal de position arrière et le signal neutre, **caractérisé en ce qu'il** comprend en outre des moyens de détection de la pression de freinage pour détecter la pression d'huile hydraulique appliquée aux freins, un circuit de commande (19) pour appliquer le signal de commande de soupape à la soupape de commande (29) du vérin de travail si le signal de position avant ou le signal de position arrière est généré à partir des moyens de détection de la position du manche de commande et si la pression de freinage détectée par les moyens de détection de la pression des freinage n'est pas supérieure à une pression déterminée, et pour couper le signal de commande de soupape appliqué à la soupape de commande (29) du vérin de travail si le signal neutre est produit par les moyens de détection de la position du manche de commande et si la pression de freinage excède la pression déterminée.
2. Système selon la revendication 1, **caractérisé en ce que** le circuit de commande (19) est adapté pour couper le signal de commande de soupape appliqué à la soupape de commande (29) du vérin de travail même lorsque le signal de position avant ou le signal de position arrière est produit par les moyens de détection de la position du manche de commande, dans la mesure où la pression de freinage excède la pression déterminée.
3. Système selon l'une des revendications 1 ou 2, **caractérisé en ce que** le circuit de commande (19) comporte un mode automatique pour appliquer ou déconnecter le signal de commande de soupape de la soupape de commande (29) du vérin de travail en fonction des signaux provenant des moyens de détection de la pression de freinage et des moyens de détection de la position du manche de commande, un mode de libération fixe pour appliquer le signal de commande de soupape à la soupape de commande (29) du vérin de travail indépendamment des signaux provenant des moyens de détection de la pression de freinage et du signal de commande du manche de commande appliqués à la soupape de commande (29) du vérin de travail, indépendamment des signaux provenant des moyens de détection de la pression de freinage et des moyens de détection de la position du manche de commande.
4. Système selon la revendication 3, **caractérisé en ce qu'il** comprend en outre un interrupteur de sélection de mode (33) pour permettre à un opérateur de sélectionner un mode parmi le mode automatique, le mode de libération fixe et le mode de verrouillage fixe.
5. Système selon l'une quelconque des revendications 1 à 4, **caractérisé en ce que** le circuit de commande (19) comporte un mode de libération pour appliquer ou déconnecter le signal de commande de soupape de la soupape de commande (29) du vérin de travail en fonction des signaux provenant des moyens de détection de la pression de freinage et des moyens de détection de la position du manche de commande et un mode de verrouillage fixe pour déconnecter le signal de commande de soupape appliqué sur la soupape de commande (29) du vérin de travail indépendamment des signaux provenant des moyens de détection de la pression de freinage et des moyens de détection de la position du manche de commande.
6. Système selon la revendication 5, **caractérisé en ce qu'il** comprend en outre un interrupteur (33) de sélection de mode pour permettre à un opérateur de sélectionner un mode parmi le mode de libération et le mode de verrouillage fixe.

FIG. 1
(PRIOR ART)

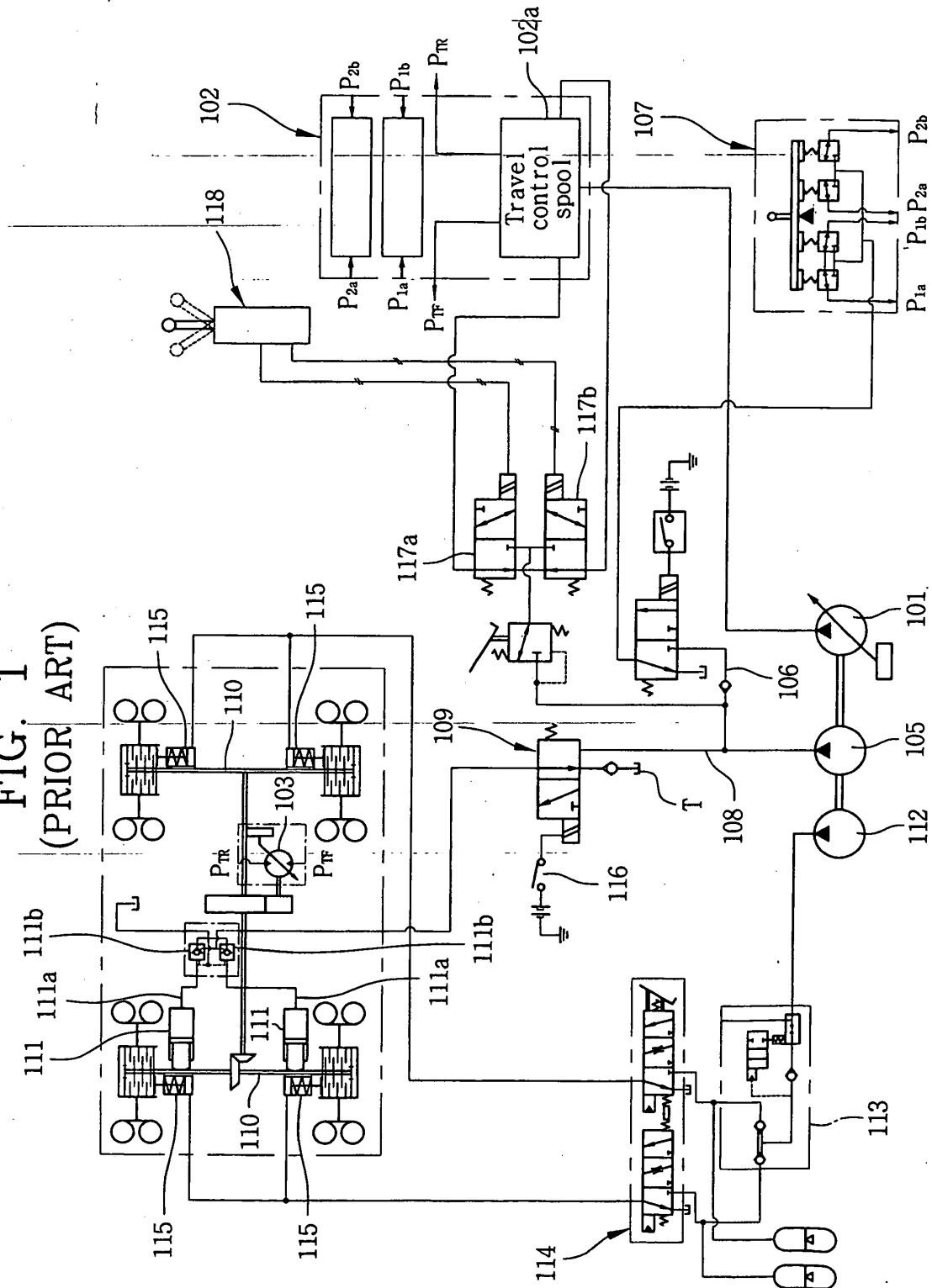


FIG. 2

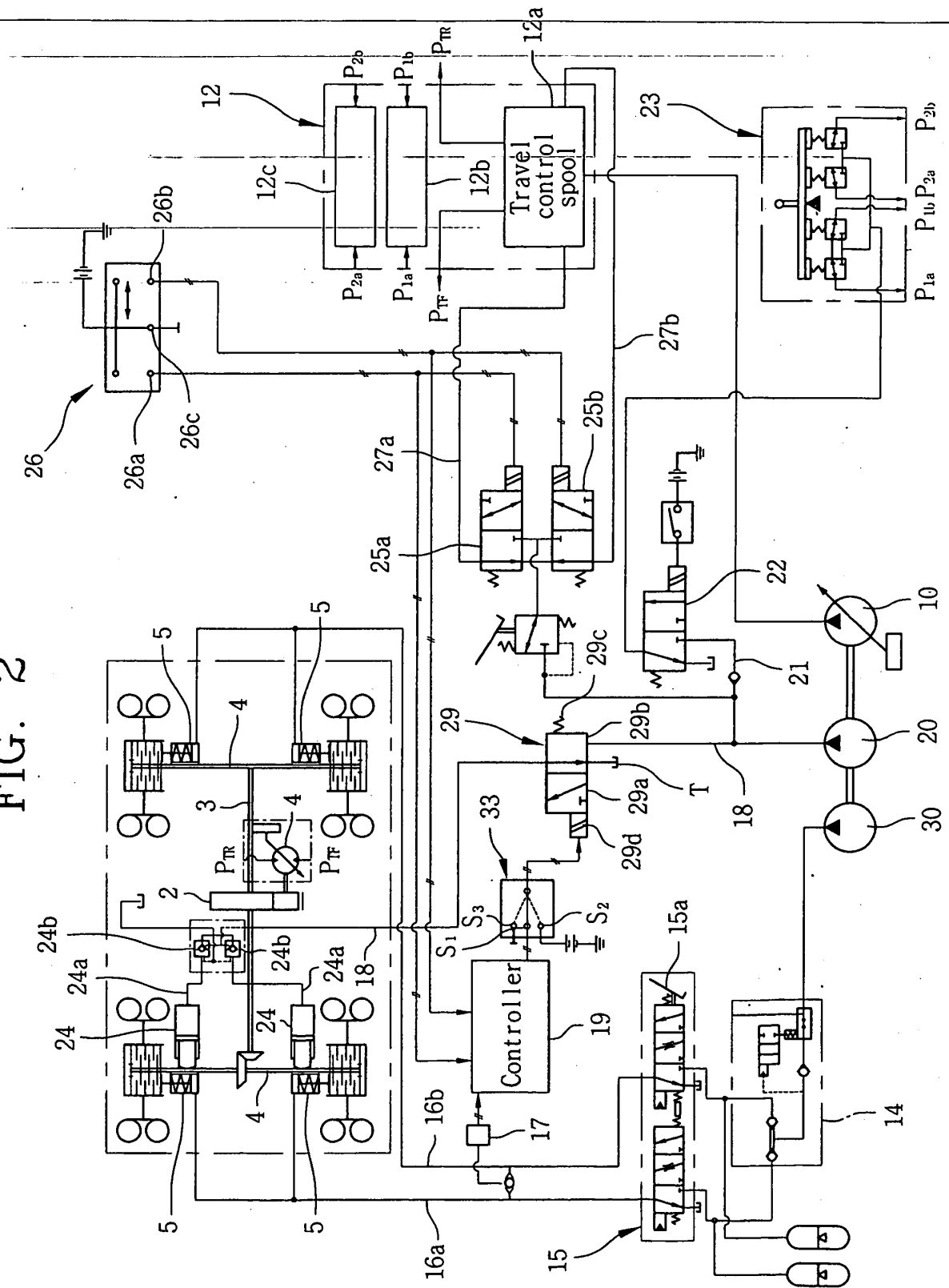


FIG. 3

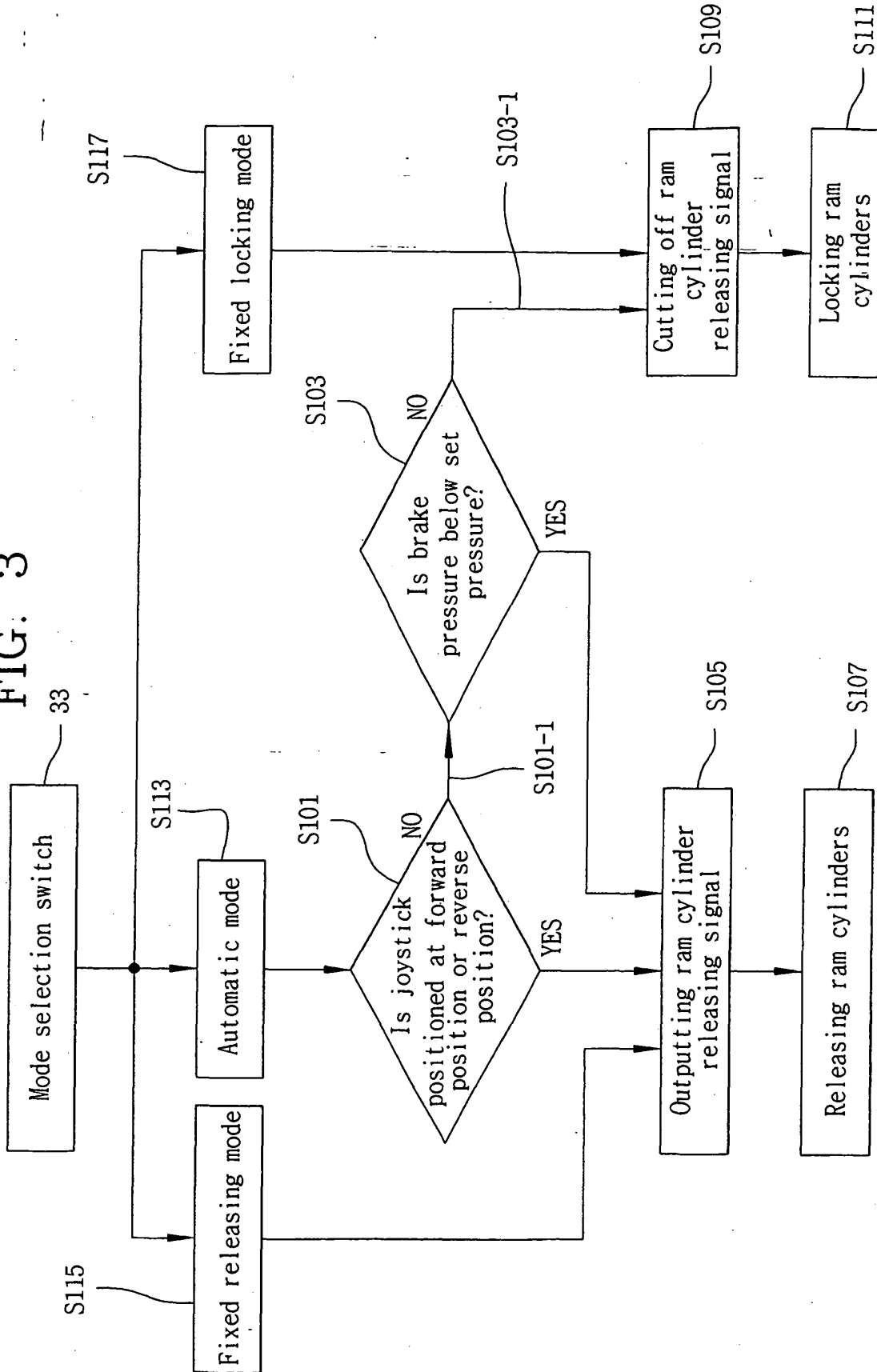
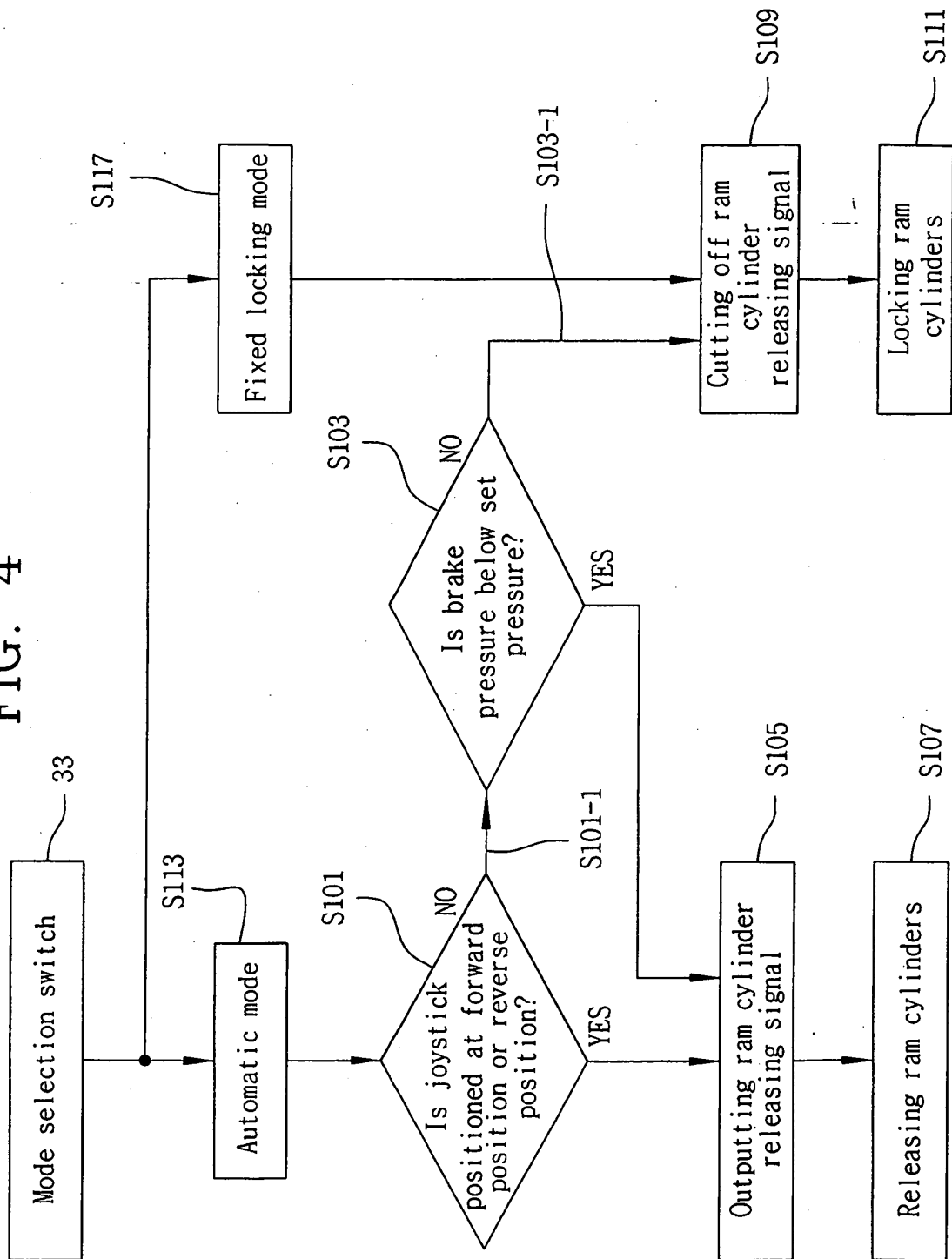


FIG. 4



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 5919243 A [0002]