

March 30, 1937.

C. V. CLARKE

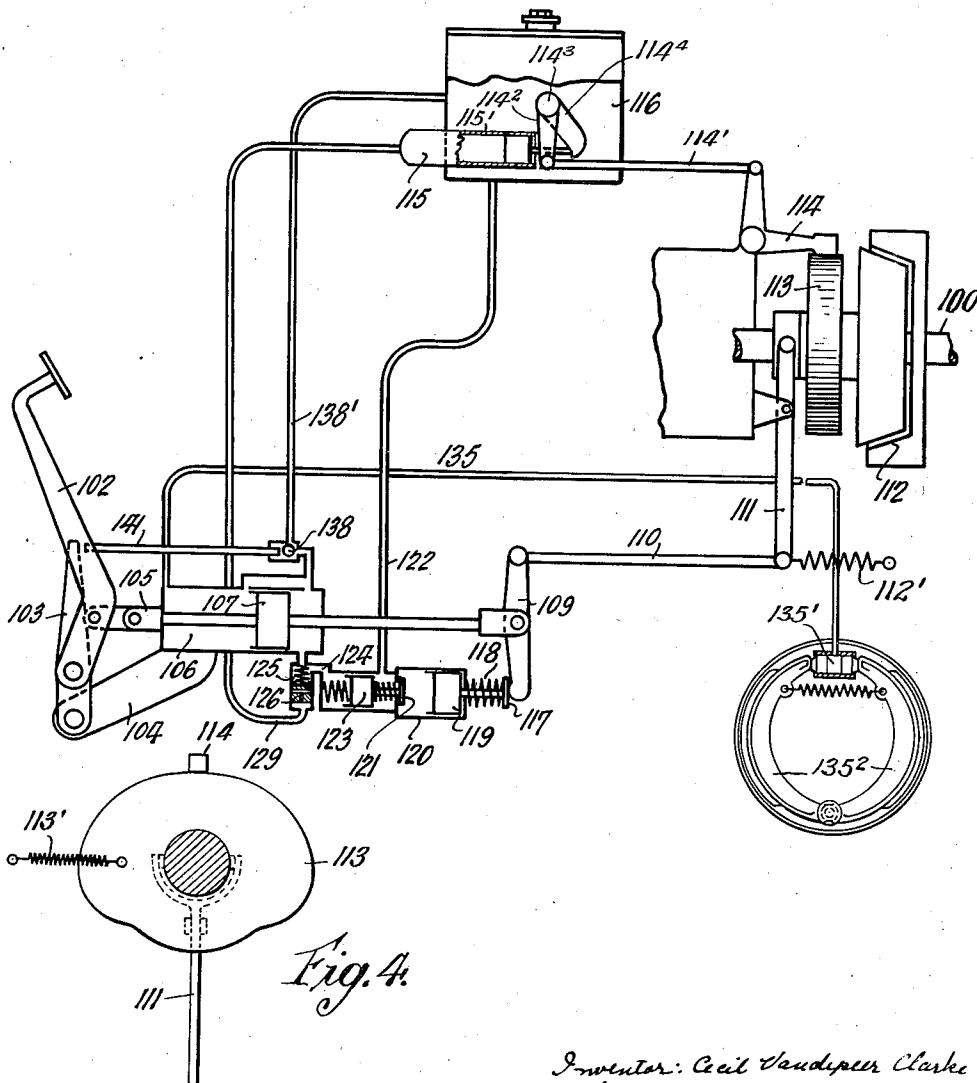
2,075,176

BRAKING MECHANISM

Filed Dec. 20, 1934

3 Sheets-Sheet 1

Fig. 1.



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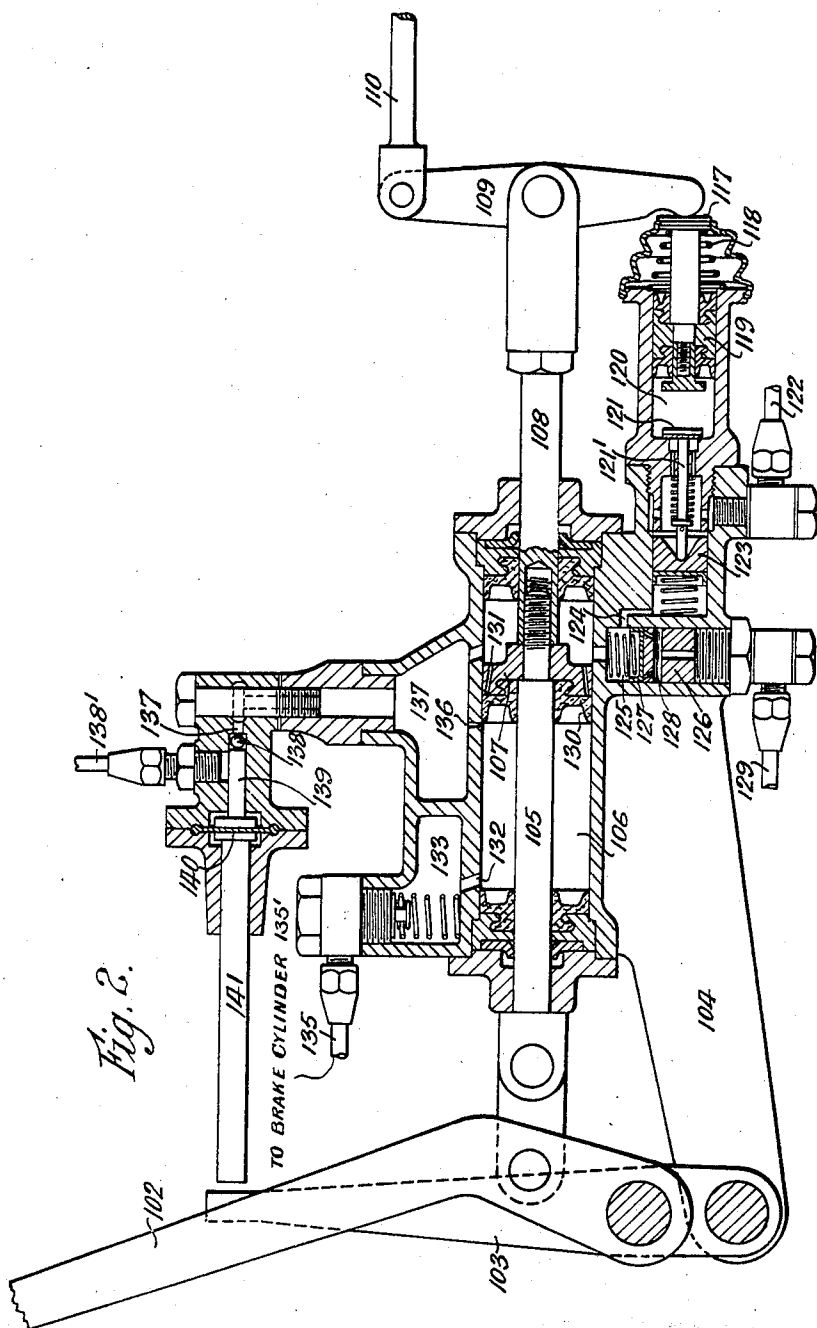
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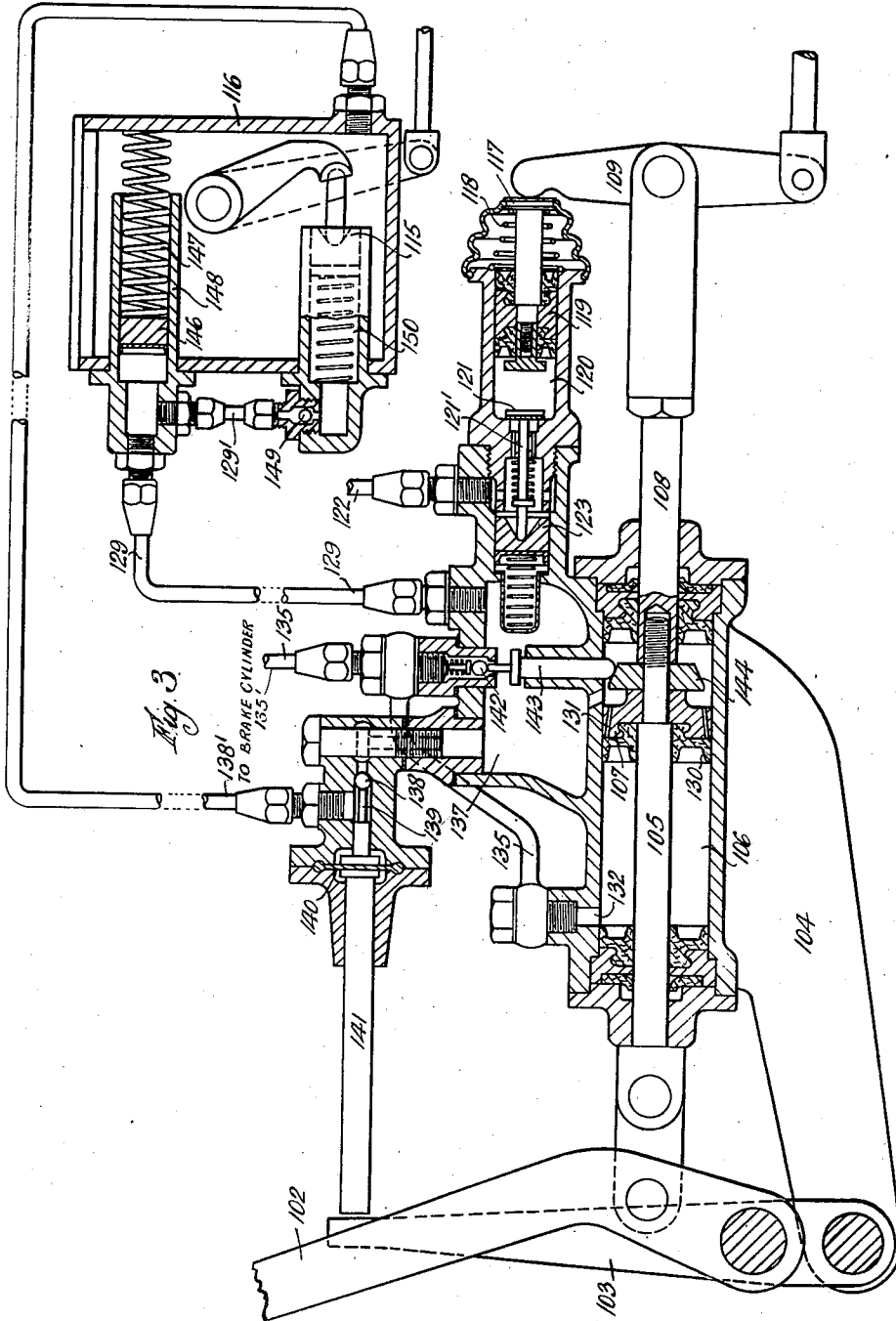
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3 Sheets-Sheet 3



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BRAKING MECHANISM

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11 Claims. (Cl. 188—152)

This invention relates to a hydraulic braking system for use on self-propelled vehicles.

The main object of the present invention is to provide a braking system in which liquid is fed to the system by a servo operation and in which the effort exerted by the servo shall be dependent upon the effort exerted by the manual effort of the operator.

According to the present invention, a braking mechanism for a self-propelled vehicle comprises braking members arranged for actuation through a hydraulic transmission system, a device for feeding liquid to the system, a servo device for actuation of the feeding device, a manually operable device for applying pressure to liquid in the system and adapted upon its initial movement to render the servo device operative, and means which are responsive to the manual effort applied to the manually operable device and also to the effort exerted by the servo device and operating to render the servo device inoperative when the two efforts reach a predetermined relative value.

It is here to be observed that the term "manually operable device" is used in its broadest aspect and is intended to include a device whether hand or foot operated and controlled by an operator.

The invention is illustrated in the accompanying drawings in which:

Figure 1 is a diagrammatic view;

Figure 2 is a section partly in elevation of one form of construction;

Figure 3 is a section partly in elevation of a modified arrangement; and

Figure 4 is a detail view of a cam and associated parts.

Referring to Figures 1 and 2, a foot pedal 102 is pivotally mounted on a lever 103 which is itself mounted to rock on a fixed bracket 104. The pedal 102 is pivotally connected to a rod 105 which extends into a cylinder 106 having therein a ram 107 and this rod is also connected to a rod 108 pivotally connected to a floating lever 109. One end of this lever is connected by a link 110 to a lever 111 the rocking of which results in operating against a draw-off spring 112', a clutch 112 for transmitting drive from a shaft 100 forming part of the power transmission of the vehicle to a cam 113 adapted when driven against a return spring 113' to rock a lever 114, the cam being rocked (when clutched to the shaft 100) in one direction or the other (depending upon the direction of rotation of the shaft 100) through a part of a rotation: this lever is connected by a link 114' to a lever 114² outside a liquid supply

tank 116, the lever 114² being fast with a spindle 114³ which extends through the wall of the tank and has on its inner end a lever 114⁴ operating a ram 115 moving in a cylinder 115' contained in the liquid supply tank 116. Thus, the clutch 112 constitutes a device for bringing into action a servo effect derived from the shaft 100, this servo action being utilized to drive the ram of the arrangement 115.

The other end of the lever 109 abuts against a head 117 which is biased by a spring 118 and is connected to a plunger 119 in a cylinder 120. This cylinder has a port controlled by a spring loaded valve 121 which, when opened, places the cylinder 120 into communication with a vent or exhaust pipe 122 which returns to the tank 116. The rod 121' of this valve abuts against a plunger 123 which is placed through a passage 124 into communication with a chamber 125 having in it a spring loaded plunger 126: this plunger 126 is provided with a cup 127 and with ports 128 the arrangement providing in effect a non-return valve which allows liquid to pass from a pipe 129 and through the plunger 126 and prevents the reverse flow. This pipe 129 extends to the delivery side of the ram and cylinder arrangement 115 while the upper end of the chamber 125 (i. e. that end into which the passage 124 opens) is open to one end of the cylinder 106, the ram 107 in which is provided with a cup 130 and with ports 131 so that liquid can flow from the right hand end of the cylinder 106 and through the ports 131 and past the cup 130 into the left hand end of the cylinder. The left hand end of the cylinder 106 is provided with a port 132 opening into a chamber 133 which communicates with a pipe 135 extending to a ram and cylinder arrangement 135' for operating the brake shoes 135², it being understood that only one set of brake shoes is shown and that a set would be provided for each wheel which is to be braked. The cylinder 106 is also provided with a port 136 which when the ram 107 is moved to the right into the position shown, places the left hand end of the cylinder 106 into communication with a chamber 137 having an outlet valve 138: this valve when opened places the chamber 137 into communication with an exhaust pipe 138' and the valve is adapted to be held closed by a rod 139 connected through a diaphragm sealing device 140 to a rod 141 adapted to be engaged by the upper end of the lever 103.

In operation, when the parts are in the brake released position the valve 121 is closed and liquid is trapped in the cylinder 120. When the

pedal 102 is depressed, the first movement is effected about the pivotal connection to the rod 105 which is held by the reaction applied to the rod 105 through the lever 109 from the spring 112' and from the plunger 119 which is held by the liquid trapped in the cylinder 120. This operation rocks the lever 103 and the upper end thereof presses on the rod 141 and moves the valve 138 to its closed position. Continued movement of the pedal is now effected about its pivotal connection to the lever 103. This results in motion being transmitted through the rod 105 to the lever 109 and as the valve 121 is closed, the head 117 forms a stationary abutment for the lever 109 which thus rocks in an anti-clockwise direction about the head 117. The motion of the lever 109 is transmitted through the link 110 to the lever 111 which engages the clutch and this in turn results in bringing the servo action into effect resulting in the cam 113 operating the lever 114 which in turn operates the ram and cylinder 115. Liquid is thus displaced through the pipe 129 and through the non-return plunger 126 to the chamber 125 and thence through the ram 107 to the pipe 135 the operation resulting in causing sufficient liquid to be displaced to cause the brake shoes to be applied to their brake drums. The pressure of the liquid in the chamber 125 is transmitted through the passage 124 to the plunger 123 and when this pressure reaches a certain value with respect to the force exerted on the pedal 102 and transmitted to the head 117 the valve 121 is caused to open to place the cylinder 120 open to exhaust. The reaction point constituted by the head 117 now moves to the left and thus allows the lever 109 to move about the rod 108 in a clockwise direction so that the lever 111 is operated to move the clutch and to interrupt the servo action.

It will be seen that the initial movement of the pedal has resulted in causing, through a mechanical servo action, the filling of the system with liquid and that when the pressure generated by the servo action and the pressure exerted by the operator on the pedal reach a predetermined ratio (these opposing pressures acting on the valve 121) the servo action is automatically interrupted.

If, by reason of increased effort being applied to the pedal 102 the ram 107 is caused to move further down the cylinder 106, the liquid pressure applied to the plunger 123 is reduced or destroyed and the valve 121 closes and enables the liquid in the cylinder 120 again to provide a reaction point for the lever 109 so that the servo mechanism is again brought into operation until the pressure applied to the plunger 123 by the servo mechanism reaches the predetermined ratio with respect to the increased force exerted on the pedal 102, whereupon the servo mechanism will be rendered inoperative as has been described.

When the pedal is released the parts and pressures return to their original condition, the pressure return being effected by the release of the outlet valve 138.

Figure 3 illustrates an arrangement which is in many respects similar to the arrangement described with reference to Figures 1 and 2 and similar parts are indicated by similar numerals.

Firstly, in place of connecting the pipe 135 to the tank 116 by a port 136 arranged to be uncovered by the ram 107, the pipe 135 is branched to a non-return valve 142 arranged to be opened against the pressure of the liquid in the pipe

135 by a push rod 143 operated by a cam 144 on the rod 105, this cam operating to open the valve when the ram 107 is at or near the end of its stroke (i. e. at a time corresponding to the time at which the port 136 is uncovered by the ram 107 of Figures 1 and 2). It will be seen that when the valve is opened, the pipe 135 is opened to the chamber 137 controlled by the valve 138 which itself controls communications between this chamber and the tank, communication being effected through the pipe 138'.

The valve operating arrangement shown in Figure 3 (i. e., the cams and push rods) avoids the necessity for the formation of ports in the cylinder of a ram having a rubber (or like) cup or other packing and hence avoids difficulties due to the tendency of such ports to score or tear the rubber cup, especially when the cup side of the ram is employed to generate pressure on the liquid. It is to be understood that the operation of a valve by a cam and push rod could be applied to the arrangement shown in Figure 1.

Secondly the non-return valve 127, 128 of Figure 2 is placed on the supply tank side of a device providing an artificial resiliency to the liquid contained in the chamber 137: the device comprises a ram 146 which is loaded by a spring 147 the ram moving in a cylinder 148 open to the pipe 129, this pipe being in unrestricted communication with the chamber 137: the cylinder 148 is also connected through a pipe 129' to a non-return valve 149 which performs the functions of the valves 127, 128 insofar as it prevents reversal of flow from the chamber 137 to the tank 116, the valve 149 opening direct to the cylinder 150 of the ram and cylinder arrangement 115 operated by the lever 114. As is shown, it is preferred to house the cylinder 148 within the tank 116. It will be seen that when the ram and cylinder arrangement 115 is operated by the lever 114, liquid is displaced from the tank 116 past the non-return valve 149 to the pipes 129', 129, the chamber 137 and thence through the ram 107 to the pipe 135: liquid is also displaced into the cylinder 148 and the ram 146 therein is moved against the reaction of the spring 147, the reaction being of course equal to the pressure of the liquid. Now when, after the servo action, the lever 114 has filled the system with liquid and further braking effort is transmitted through the liquid by the direct operation of the ram 107 by the pedal 102, the ram 107 will move very slightly in applying the increased pressure and without the provision of the ram 146 and spring 147 this slight movement would result in increasing the capacity of the system between the tank 116 and the right hand face of the ram 107 and thus would result in causing a pressure drop in this part of the system: the provision of the ram 146 and spring 147 in this part of the system, however, provides an artificial elasticity which enables the total capacity to be automatically varied to maintain a sensibly constant pressure, i. e. if the pressure should tend to drop, the spring 147 would move the ram 146 to maintain the pressure by decreasing the capacity of the system.

It will be seen that the invention provides for a minimum extent of movement of the brake pedal due to the fact that initial application of the brakes is effected by servo action which is merely controlled by the pedal. The quantity of liquid displaced by the servo action can be comparatively great and hence the arrangement

would be of particular advantage for use on heavy vehicles and particularly public service vehicles such as trolley busses, inasmuch as it reduces the manual effort to a minimum.

5 What I claim is:—

1. In braking mechanism for a self-propelled vehicle, the combination of braking members, a hydraulic transmission system, a device operating to feed liquid to the system a servo device
10 operating to actuate the device, a manually operable device operating in its initial movement to render the servo device operative and also operating to apply pressure to liquid fed to the system, and means responsive to the effort applied to the
15 manually operable device and also to the effort exerted by the servo device, the said means operating to render the servo device inoperative when the said two efforts reach a predetermined relative value.

20 2. In braking mechanism for a self-propelled vehicle, the combination of braking members, a hydraulic transmission system, a device operating to feed liquid to the system, a servo device operating to actuate the device, a manually operable device operating in its initial movement to
25 render the servo device operative and also operating to apply pressure to liquid fed to the system, and means responsive to the pressure applied by an operator to the manually operable device, and also to the pressure of liquid fed to the system by the feeding device, the said means rendering the servo device inoperative when the two pressures reach a predetermined relative value.

35 3. In braking mechanism for a self-propelled vehicle, the combination of braking members, a hydraulic transmission system, a device operating to feed liquid to the system, a servo device operating to actuate the device, a manually operable device operating to apply pressure to the
40 system, a floating member operatively associated with the manually operable device and with the servo device, and means responsive to the difference between the pressure exerted by the operator on the manually operated device and the pressure of liquid fed to the system by the feeding device, the said means providing, when the difference is at a maximum, a first reaction point for the floating member so that actuation
50 of the manually operable member is transmitted to effect actuation of the servo device and when the difference falls to a predetermined value the responsive device moves to allow the floating member to render the servo device inoperative.

55 4. An arrangement as claimed in claim 3 and in which the responsive means comprises a valve which is subjected on one side to the pressure of liquid which is trapped in a cylinder and reacts against a member against which the floating member reacts and on the other side to a pressure dependent on the pressure of liquid fed by the servo device to the system, the valve opening to allow the escape of liquid from the cylinder and hence allowing the member to
60 move when the pressure on the said other side overcomes the reaction pressure of liquid within the cylinder.

5. In braking mechanism for a self-propelled vehicle, the combination of braking members, a hydraulic transmission system, a first ram and cylinder device operating to feed liquid to the system, a servo device operating to actuate the device, a second ram and cylinder device operating to apply pressure to the system and in
70 its initial movement to render the servo device

operative, and means responsive to the effort transmitted to the second ram and cylinder device and also to the pressure of liquid fed by the first ram and cylinder device, the said means operating to render the servo device inoperative
5 when the effort and pressure reach a predetermined relative value.

6. In braking mechanism for a self-propelled vehicle, the combination of braking members, a hydraulic transmission system, a first ram and cylinder device operating to feed liquid to the system, a servo device operating to actuate the device, a second ram and cylinder device operating to apply pressure to the system, a chamber containing liquid, a valve controlling the discharge of liquid from the chamber, a reaction member reacting against liquid in the chamber, a floating member reacting against the said reaction member, means connecting the floating member to the second ram and cylinder device
20 and to the servo device, and means applying to the valve and externally of the chamber a pressure dependent upon that developed by the first ram and cylinder arrangement, whereby reaction for the floating member is first supplied
25 by liquid in the chamber, this reaction enabling the second ram and cylinder device to operate through the floating member to render the servo device operative and when the pressure developed by the first ram and cylinder device reaches a
30 predetermined value relative to the reaction pressure in the chamber, the valve is caused to open and the floating member thereby allowed to move to render the servo device inoperative.

7. In braking mechanism for a self-propelled vehicle, the combination of braking members, a hydraulic transmission system, a first ram and cylinder device operating to feed liquid to the system, a servo device operating to actuate the device, a second ram and cylinder device operating to apply pressure to the system, the second ram having passages through which liquid is fed by the first ram and cylinder arrangement, non-return valves in the passages and operating to prevent liquid from
45 returning from the system through the said passages, and in its initial movement to render the servo device operative, and means responsive to the effort transmitted to the second ram and cylinder device and also to the pressure of liquid fed by the first ram and cylinder device, the said means operating to render the servo device inoperative when the effort and pressure reach a predetermined relative value.

8. In braking mechanism for a self-propelled vehicle, the combination of braking members, a hydraulic transmission system, a first ram and cylinder device operating to feed liquid to the system, a servo device operating to actuate the device, a second ram and cylinder device operating to apply pressure to the system, the second ram having passages through which liquid is fed by the first ram and cylinder arrangement, non-return valves in the passages and operating to prevent liquid from returning from the system
65 through the said passages, a chamber containing liquid, a valve controlling the discharge of liquid from the chamber, a reaction member reacting against liquid in the chamber, a floating member reacting against the said reaction member, means connecting the floating member to the second ram and cylinder device and to the servo device, and means applying to the valve and externally to the chamber a pressure dependent upon that developed by the first ram and cylinder arrange-
75

ment, whereby reaction for the floating member is first supplied by liquid in the chamber, this reaction enabling the second ram and cylinder device to operate through the floating member to render the servo device operative and when the pressure developed by the first ram and cylinder device reaches a predetermined value relative to the reaction pressure in the chamber, the valve is caused to open and the floating member thereby allowed to move to render the servo device inoperative.

9. In braking mechanism for a self-propelled vehicle and having a power transmission member, the combination of braking members, a hydraulic transmission system, a device operating to feed liquid to the system, a clutch device arranged to transmit power from the transmission member to the feeding device, a manually operable device operating in its initial movement to render the clutch device operative and also operating to apply pressure to liquid fed to the system, and means responsive to the effort applied to the manually operable device and also to the effort transmitted through the clutch, the said means operating to render the clutch device inoperative when the said two efforts reach a predetermined relative value.

10. In braking mechanism for a self-propelled vehicle and having a power transmission member, the combination of braking members, a hydraulic transmission system, a first ram and cylinder device operating to feed liquid to the system, a clutch device arranged to transmit power from the transmission member to the feeding device, a second ram and cylinder device operating to apply pressure to the system and in its initial movement to render the clutch device op-

erative, and means responsive to the effort transmitted to the second ram and cylinder device and also to the pressure of liquid fed by the first ram and cylinder device, the said means operating to render the clutch device inoperative when the effort and pressure reach a predetermined relative value.

11. In braking mechanism for a self-propelled vehicle and having a power transmission member, the combination of braking members, a hydraulic transmission system, a first ram and cylinder device operating to feed liquid to the system, a clutch device arranged to transmit power from the transmission member to the feeding device, a second ram and cylinder device operating to apply pressure to the system, a chamber containing liquid, a valve controlling the discharge of liquid from the chamber, a reaction member reacting against liquid in the chamber, a floating member reacting against the said reaction member, means connecting the floating member to the second ram and cylinder device and to the clutch device, and means applying to the valve and externally of the chamber a pressure dependent upon that developed by the first ram and cylinder arrangement, whereby reaction for the floating member is first supplied by liquid in the chamber, this reaction enabling the second ram and cylinder device to operate through the floating member to render the clutch device operative and when the pressure developed by the first ram and cylinder device reaches a predetermined value relative to the reaction pressure in the chamber, the valve is caused to open and the floating member thereby allowed to move to render the clutch device inoperative.

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