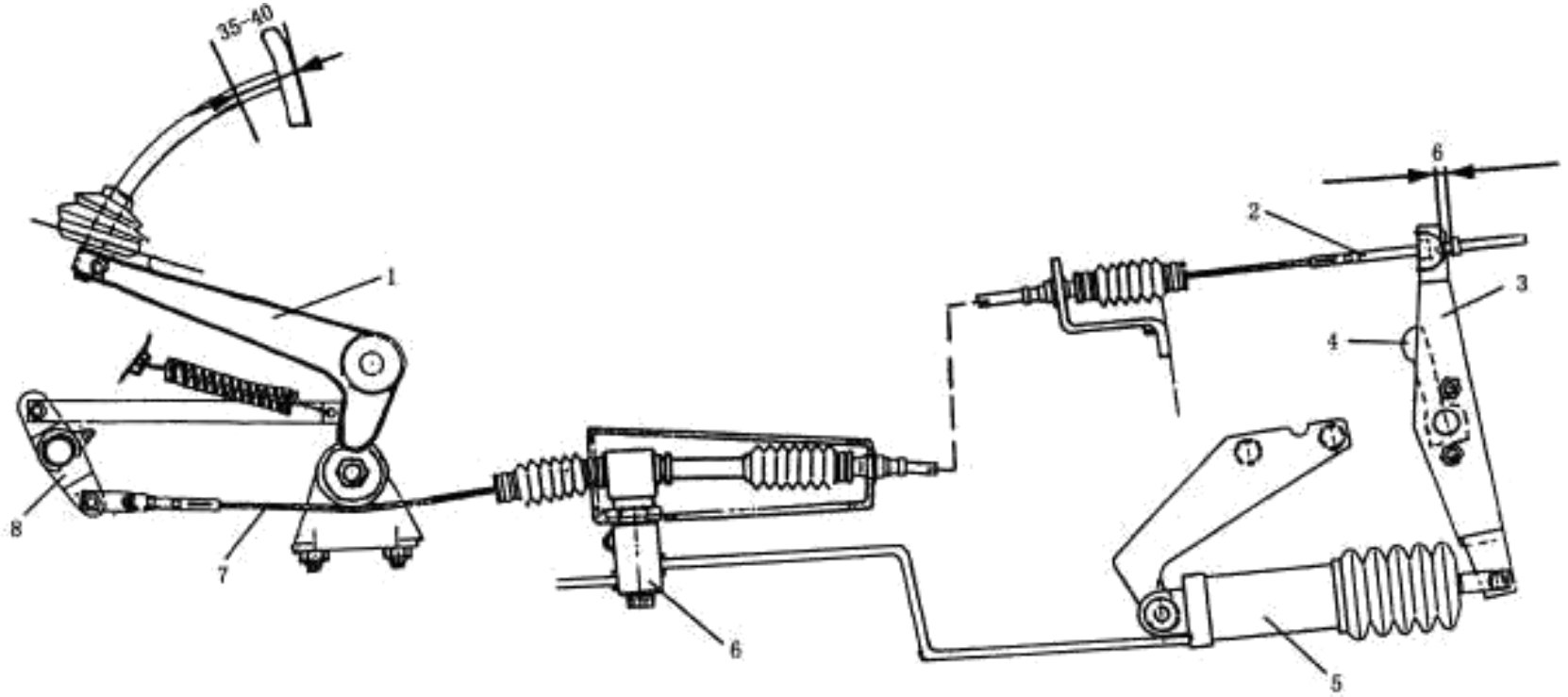
SECTION 3 AIR-ASSISTED AND MECHANICALLY OPERATED CONTROL MECHANISM

- **Ⅰ、 The control mechanism is composed of a mechanically operated system and a boosting system. as shown in Fig. 3-9.**
- The mechanically operated system mainly consists of pedal, pedal arm, steel cable, driving lever, driving swing arm, return spring, etc.
- The air-assisted system mainly consists of control valve (booster push button valve), boost cylinder, etc. The control valve is mainly used to operate the boost cylinder of the clutch during the process of clutch disengagement, so as to reduce the stepping force of the pedal.
- Its structure is shown in Fig. 3-10.

- In operation, the valve stem is pressed down by the pressure cap. The lower end of the valve stem drives the air inlet valve open, and the compressed air enters the boost cylinder through the valve. In non-operating state, the valve stem moves up under the action of the return spring, the air inlet valve is closed under the action of the return spring and the air pressure, and the air inside the boost cylinder goes out from the discharge port through a center air passage in the valve stem.
- The boost cylinder functions to assist the clutch control system by means of a push rod pushing the driving swing arm after the compressed air from the control valve entering the cylinder.
- The structure of the boost cylinder is shown in Fig. 3-7.
- The boost cylinder is composed of piston, push rod, O-ring and return spring. During the operation, the air from the control valve enters the cylinder through inlet port, and pushes the piston and the push rod to move backward. The push rod pushes the lower end of the driving swing arm to move backward, realizing the function of power assistance.

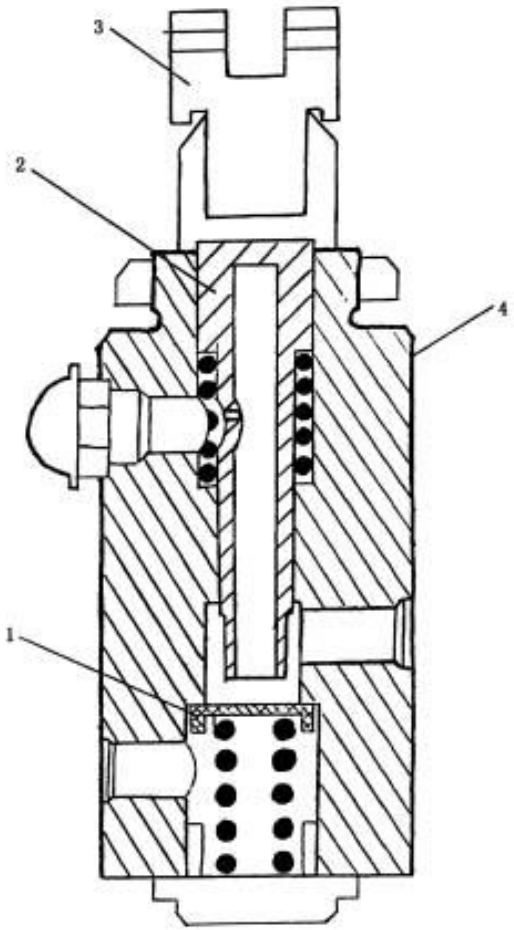
- **Ⅱ、 The operating principle of the clutch control mechanism**
- **1) Engaging state**
- When the clutch is in the state of engagement, the pressure plate spring presses tight the pressure plate, the driven disk and the flywheel. Engine power will be transmitted by means of friction action among the mating surfaces of the three parts.

- **2) Disengaging process**
- When the clutch pedal is stepped, the steel cable is pulled by the driving lever. The end of the driving lever drives the upper end of the driving swing arm to move forward through a pull rod, making the shaft of the release fork to turn. The release fork drives the release sleeve, the release ring and the release lever, causing the pressure plate to move backward. The pressure plate spring is compressed. The clamping load among the various friction surfaces of the pressure plate, the driven disk and the flywheel is released, the friction action disappears and the transmission of the power is cutoff.
- In the above process, when the steel cable is pulled tight, the pressing cap of the control valve is actuated, and inlet valve is pressed open by the rising valve stem. The compressed air enters the boost cylinder, the push rod of the cylinder pushes the swing arm to move, playing the action of power assisting in the process of disengagement.



1. Pedal arm 2. Pull rod 3. Rocker arm 4. Release fork 5. Boost cylinder 6. Boost control valve (pushbutton valve) 7. Steel cable 8. Driving lever

Fig. 3-6 The clutch control mechanism



1. Air inlet valve
2. Valve stem
3. Pressing cap
4. Valve body

Fig. 3-7 The structure of the clutch boost control valve (pushbutton valve)

3) Engaging process

As the clutch pedal is gradually released, the release sleeve gradually moves backward under the action of the pressure plate spring and the control mechanism. The pressure plate spring gradually resumes its pressure upon the pressure plate, the driven disk and the flywheel. The friction torque between the driving and the driven parts increases accordingly as the clamping load increases. And at the same time, the steel cable of the control mechanism gradually reduces its pressure on the control valve. The inlet valve closes, and the valve stem moves up further. The discharge port opens and the compressed air in the boost cylinder is released. During this process, as the driving and the driven parts are different in rotating speed, there exists a sliding friction between the two. As the clamping load and the friction torque increase further, the driving and the driven parts will gradually become the same in rotating speed until the sliding friction is terminated. Up to this point, the driving and the driven parts will work as an integral part to fully transmit the power of the engine to the drive line.

- When the pedal is stepped to a certain point, the boosting system will make the driving swing arm rotate in counter-clockwise direction. And at the same time, the upper end of the swing arm releases the tension force on the steel cable. The pressing cap of the control valve moves upward under the action of the return spring. The control valve is now in a stable state in which its inlet valve is closed and the exhaust valve is not opened. As the pedal is stepped further to a certain position, the system will repeat the above process of movement. This is the so called the "follow-up" feature of the clutch boosting system. It ensures that the air pressure in the boost cylinder increased or decreased simultaneously with the change of the travel of the clutch pedal, i.e. the boost effect varies with the pedal travel.

- ## Ⅲ、 The adjustment of the control system
- The clutch pedal free travel is determined by the clearance between the release bearing and the release ring. If the clearance is too big, the operating travel of the clutch is short and the disengagement of the clutch will be incomplete; and if there is no clearance, the clutch would be slipping or the release bearing burnt. Therefore, in regular maintenance or after reassembly, this clearance must be carefully checked and properly adjusted.
- The adjustment can be made as follows:
- The clearance between the release bearing and the release ring should be 3~4mm. In practice, it is difficult to measure this distance. It is usually judged by adjusting the axial play at the location of the pull rod. When the free axial travel of the pull rod is 6mm, it can be considered that the clearance between the release bearing and the release ring is normal. If the clearance is too big, turn the nut at the rear end of the adjustable pull rod, and vice versa. After this point is well adjusted, proceed to check the free travel of the clutch pedal which should be 35~40mm. Upon the completion of the adjustment of the free travel, tighten the adjusting nuts at both sides of the pull rod, and check again to see if the clutch can work normally. Besides, be sure that you never attempt to adjust the free travel in case the driver's cab is turned up.