

## HYDRAULIC LIFTING AND HITCH EQUIPMENT

The ZETOMATIC hydraulic system is used to control agricultural machines and implements. This equipment has two circuits and is controlled with help of a separate lever for the inner circuit and a separate lever for the outer circuit. The functions of these circuits are labelled.

a) **Inner circuit** — It is intended to lift and lower agricultural machines and implements attached. This circuit is controlled by the main inner circuit lever and by two auxiliary levers.

1. The inner circuit lever (Fig. 50/1) controls the following functions:

- lifting and lowering of agricultural implements into transport or working position;
- height adjustment of the hitch with attached implements by position control;
- adjustment of tractive force when used in draft or mixed regulation;
- adjustment of floating position when using implement with its own supporting wheel

2. Selection lever of hydraulic system (Fig. 50/3) is used when selecting the respective regulation. It has three positions labelled as P, M, D.

„P” — Position (fixed) control. The attached implement is automatically held in an approximately constant vertical position in relation to the tractor.

Fig. 50

„M“ — Mixed control, a combination of the „P“ and „D“ types of control. The layout of the hydraulic equipment enables operation with the implement having its own supporting wheel in the so called free (floating) position, as well.

„D“ — Draft control; The height of the attached implement is automatically adjusted according to the changing soil resistance.

3. Lever for response control (Fig. 50/4). This lever controls the cock for the response rate which is used for the reduction of the quantity of oil flowing into the inner circuit in connection with the necessary speed of reaction of the hydraulic system according to the art of tractor tasks.

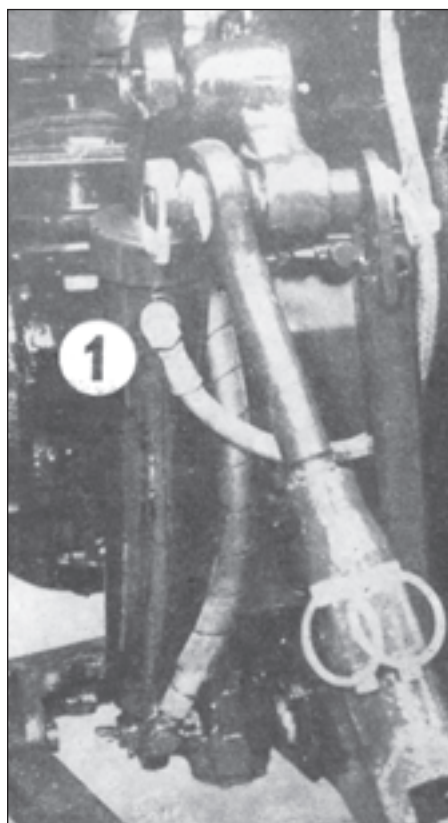


Fig. 51

Throttling the oil quantity supplied from the oil pump to the inner circuit serves for reduction of the response rate, by which responds the hitch control system e.g. to changed resistance of ploughed soil, and by means of the response rate reduction vibration can be eliminated which might occur when ploughing in some types of soil.

The inner circuit consists of the hydraulic oil pump (it supplies oil to the outer circuit as well), the hydraulic distributor box and hydraulic lifting gear. The lifting gear has an internal cylinder, lift arm shaft and lift arms of hydraulics which control the hitch equipment. Tractors with four-cylinder engines are equipped with an additional auxiliary hydraulic cylinder (Fig. 51/1) which is located on the left side of the transmission box and controls directly the left lift arm. This arrangement enables increased lifting performance of the hydraulic equipment.

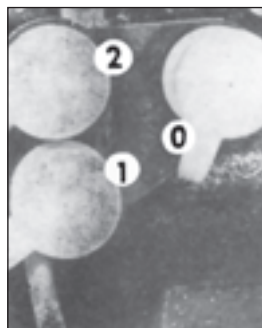


Fig. 52

**b) Outer circuit** — This circuit is controlled with a lever (Fig. 50/2). It supplies pressurized oil to machines and implements which have their own single-acting or double-acting cylinders, or rotating hydraulic motors and/or an additional distributor if needed.

This circuit is equipped with three outlets, each having a quick-coupling device (Fig. 52). The third quick coupling (labelled „0”) is directly linked with the inside room of the transmission box and has to be connected to the outlet of the hydraulic motor or of the distributor box attached to the machine.

The ratio of oil supplied to the inner and to the outer circuits is controlled by the response control lever (Fig. 53). When moving this lever in the direction of the arrow, the oil flow coming into the inner circuit is being reduced and the oil flow coming into the outer circuit is being increased, and vice versa. If only the outer circuit is in operation (the slide valve of the inner circuit is not in the lifting position), then the complete quantity of oil will be supplied to the outer circuit, regardless of the position of the response control lever.

The outer circuit lever controls the oil supply to the two quick couplings labelled as „1” and „2” (Fig. 52).

Fig. 53



Maximum  
oil supply

Minimum  
oil supply



Art of connection of the outer hydraulic equipment:

**The single-acting cylinder** will be connected to the quick coupling „1“.

1. Lifting — The control lever is in its uppermost position. (The lever has to be held in position with the hand.)
2. Neutral position — The control lever is in the middle position where it is held by a spring.
3. Lowering — The control lever is in the position between the neutral and the lowest position and it is automatically locked (the so-called „floating“ position).

**The double-acting cylinder** will be connected in such a way that the oil from the quick coupling „1“ is used for lifting the load and the oil from the quick couplin „2“ for lowering the load.

1. Lifting — The control lever is in its uppermost position. (The lever has to be held in position with the hand.)
2. Neutral position — The control lever is in the middle position where it is held by a spring.
3. Lowering — The control lever is in its lowest position.
4. Free (floating) position — The control lever is in the middle between the neutral and the lowest end position and it is automatically locked; both the quick couplings are linked with the outlet for used oil, and it is possible to use such a machine which has its parts freely movable, e.g. when copying an uneven ground.

### **Rotating hydraulic motor or additional distributor**

The oil supply to these appliances (indicated by P) will be connected to the quick coupling „1“, the oil outlet (indicated by T) to the quick coupling „0“. In case that the reversed hydraulic motor is used, it will be connected to the quick couplings „1“ and „2“. The control lever has to be moved to the uppermost position in which it can be secured by an adjustable trip dog (Fig. 50'5).

The gear box and the main transmission box have a shared oil filling and the oil is used for the hydraulic system of the tractor as well. The standard quantity of oil is 25 litres. When using the tractor on a hilly ground or when the machine is attached to the outer hydraulic circuit, it is suitable to increase the oil level in the gear box to 32 litres. A minimum quantity of 15 litres of oil must be left for a correct function of the gear box.

**ATTENTION:** No further oil must be taken from this quantity for the outer hydraulic circuit. The oil quantity have to be increased by two more litres in case of tractors equipped with the front driven axle.

**NOTE:** A maximum of 10 litres of oil may be taken from the gear box and the main transmission box for the outer circuit of hydraulics.

A maximum ploughing depth when the „D“ and „M“ control has been selected.

#### DESIGNATION LABEL OF THE INNER CIRCUIT

Fig. 54

Free position and a maximum lowered position when the „P“ control has been selected.

Vertical adjustment of the three-point hitch.

#### SELECTION LEVER LABELS OF THE HYDRAULIC CONTROL SYSTEM

Fig. 55



Draft control

Mixed control

Position control

Maximum lift



Motion in one direction — lowering for the double-acting cylinder — the control lever is not locked and returns automatically to the neutral position. The lever has to be held with the hand.



Pressurised oil filling in the quick-acting coupling „2“ (Fig. 52)



Free position — floating for double-acting cylinder.

Lowering — for the single-acting cylinder. In this position the lever is locked and it is not necessary to hold it.



Neutral position — locked. The lever is locked in this position.



## DESIGNATION LABEL OF THE OUTER CIRCUIT

Fig. 56



In this position the pressurised oil is in the quick-acting coupling „1“ (Fig. 52).



Motion in the opposite direction — lifting.

The control lever is not locked, it returns automatically to the neutral position. The lever has to be held with the hand.



Fig. 57



Fig. 58

## Hydraulic pump

The oil for the inner and the outer circuits of the hydraulics is supplied from a gear pump which is mounted on the bottom cover of the transmission box together with the inlet filter, pump drive bracket and safety valve. The hydraulic pump has a delivery rate 32-51 litres of oil per minute at 540/1 000 r.p.m. of the P.T.O.-shaft, the oil pressure of 12.0 MPa and oil temperature  $65 \pm 5^\circ\text{C}$  and a nominal speed of tractor engine 2 200 r.p.m. The safety valve of the pump opens at a pressure  $14 \pm 0.5$  MPa. The maximum pressure is limited by a safety valve to  $16 \pm 2$  MPa.

### Important

It is necessary to bear in mind that the P.T.O.-shaft speed of 1 000 r.p.m. should be engaged during tractor operation only for the time which is needed for the attached equipment requiring this speed. Engine power loss caused by use of unnecessary quantities of oil from the hydraulic pump will thus be avoided and consequently it will have favourable influence on total fuel consumption and besides, the oil in the gear box will not be overheated purposelessly.

## Hydraulic oil filtration

The oil is sucked to the hydraulic pump through the suction filter which consists of a filter screen, magnetic element and a filter closing valve. The filter is mounted together with the hydraulic pump on the bottom cover of the transmission box (Fig. 57). The specified maintenance (see TM 2) of the filter can be carried out without draining the oil from the gear box. Only the oil in the filter body will be lost.

**Attention:** Special attention should be paid to regular maintenance. The interval of 200 engine hours, as mentioned in the Technical Maintenance No. 2 (TM 2), is meant for general agricultural operation with intermittent use of the hydraulic equipment. When the tractor will use e.g. a front loader or forest adapters, it will be necessary to provide maintenance more frequently and always when the performance of the hydraulics drops, or when the hydraulic pump will run noisily.



The oil coming from the distributor of regulating hydraulics flows to the fine filter with a paper cartridge having a filtering capacity of 12 to 15 microns. The fine filter is connected by a pipe to the cover of the hydraulics and is situated on the right side of the engine in front of the fuel tank (Fig. 58).

## IMPLEMENT HITCH

### Three-point hitch (Fig. 59)

The hitch is determined for implements of the I. and II. category. These categories differ in the axis length of the implement which is the centre-distance between the balls on the lower hitch points. The axis length of the I. category implement is 720 mm, the II. category implement 870 mm. The lifting power at the end of lower links is 17.5 kN for tractors Z 5211 and Z 5245, and 24 kN for tractors Z 6211 to Z 7745.

The three-point hitch consists of lower links, an upper link and turnbuckles of lower links.

Extended lower link brackets (Fig. 60) are mounted on tractors Z 7711 and Z 7745 to enable easy fixing of lower links, and their adjusters as well. (Extended lower links for tractors Z 5211 to Z 7245 Horal can be fitted on special order of the customer.)

Fig. 59

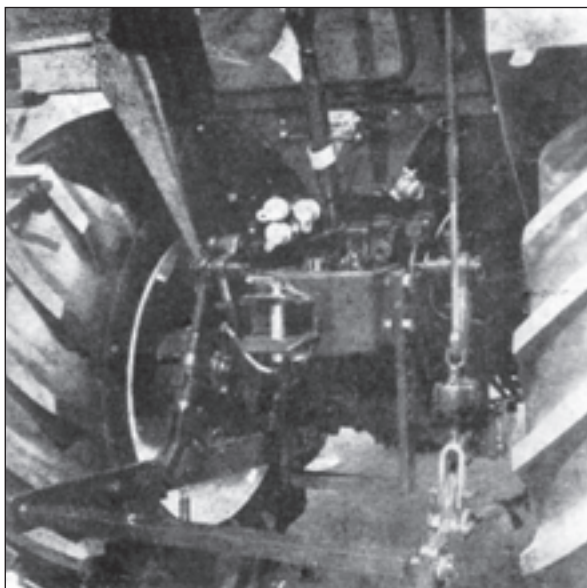
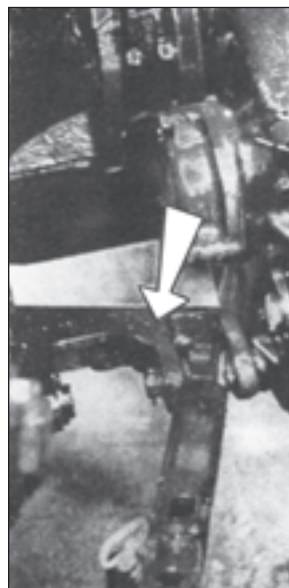


Fig. 60





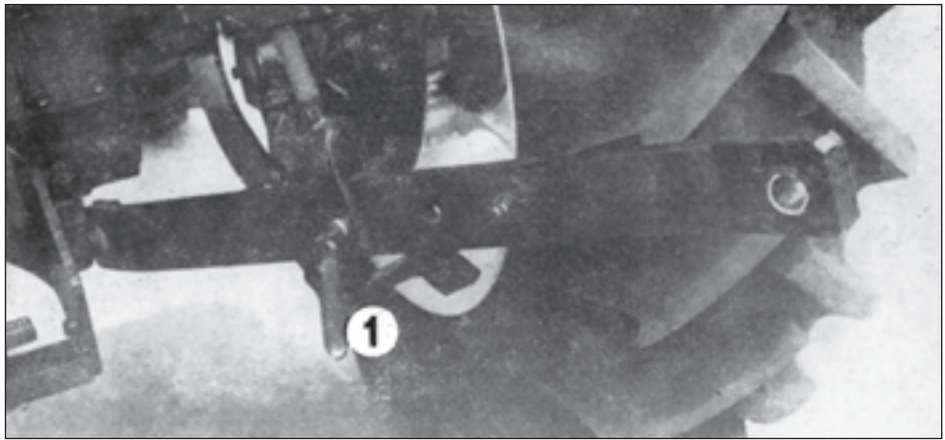


Fig. 61

The lower links are connected with lift rods to hydraulic lifting equipment. Both lift rods have stepless longitudinal adjustment, the right one with a wrench. The design of the left lift rod enables a floating position of the implement by displacement of the pin (Fig. 62) into the groove in the lift rod.



Fig. 62

The top link is attached to the tractor in one of the four holes in the bracket (Fig. 63/1) in dependence on the height of the implement top link hitch point (460 mm to 600 mm), i.e. the vertical distance between the top hitch point and the lower hitch points of the implement or machine. The position to be chosen has to take into account the required sensitivity of the selected draft control or mixed control as well. The greatest sensitivity is on the highest point of the bracket. The top link is continually adjustable.

The stretchers of the lower links are used to eliminate the side swing of the links in the full range of the stroke of the three-point hitch. By lengthening the stretchers it is possible to obtain up to 125 mm side swing of the lower links at the lower hitch points (e.g. for ploughing).

**Attention:** When driving the tractor without any attached implement, the lower links have to be connected together by springs (Fig. 61/1) and the top link has to be secured by a flexible holder (Fig. 63). When transporting implements, the stretchers on the lower links should be shortened in order to eliminate any unwanted side swing. The adjustment of the linkage axis to 720 mm or 870 mm depends on the rear wheel track. The lower links must not hit the tyres when the implement is being lifted and when it comes to its laterally swinging. For this reason the track of the rear wheels has to be adjusted from 1 425 mm to 1 500 for tyres 16.9—30 and 16.9—34 and for the hitch axis length of 870 mm.

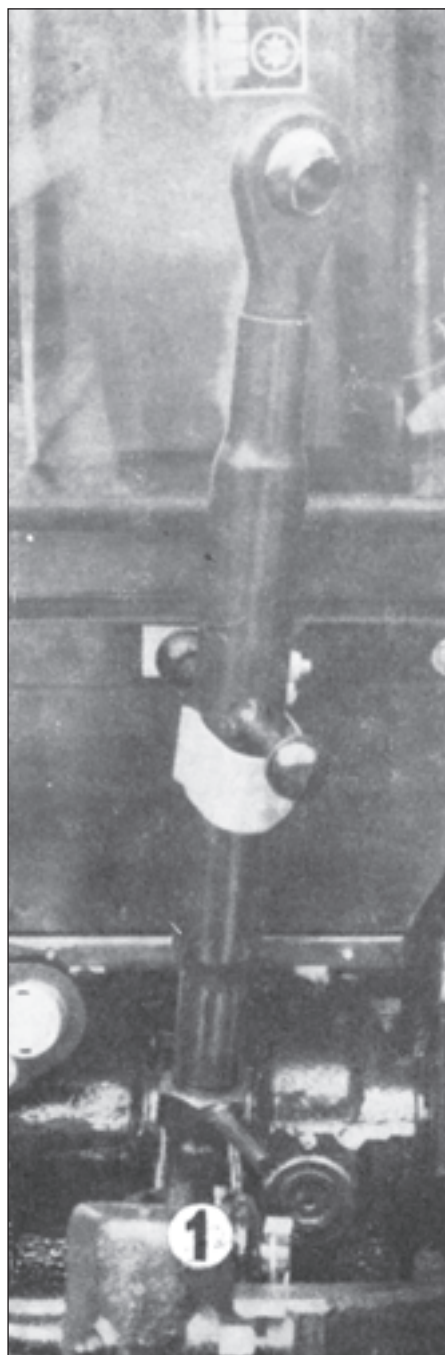
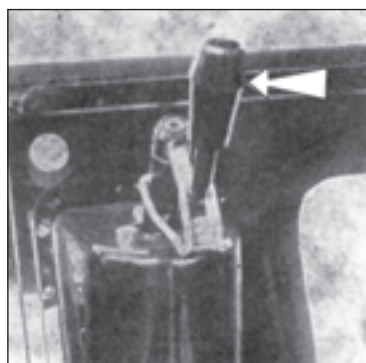


Fig. 63



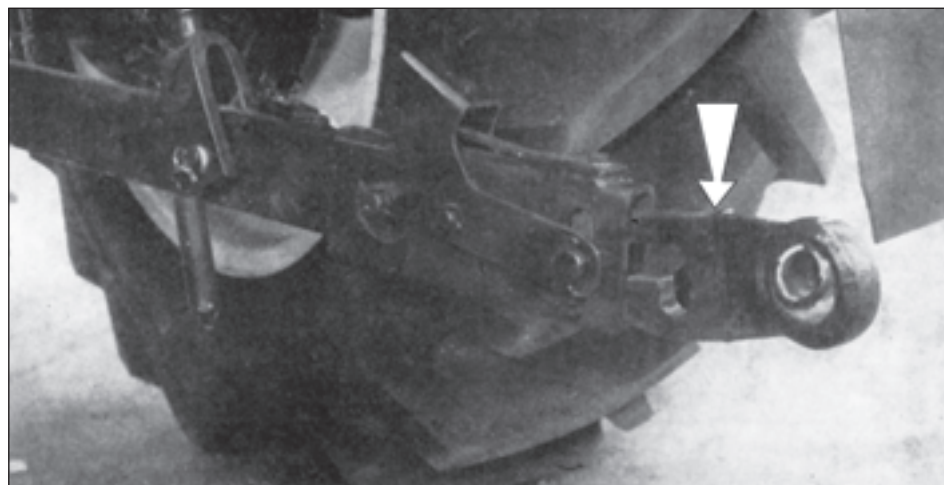
**Lift rod control from the safety cabin  
(Fig. 64)**

**Fig. 64**

This control enables vertical adjustment of the right lower three-point hitch link from the driver's seat. The main part of the control equipment is a lift rod which can be adjusted longitudinally by use of crank situated in the cabin (Fig. 64).

**Lower links with telescopic ends (Fig. 65)**

**Fig. 65**



Telescopic ends enable easy attachment of implement to the three-point hitch by means of freely movable link joints. They replace the lower links fitted with removable cover plates in case of a three-point hitch.

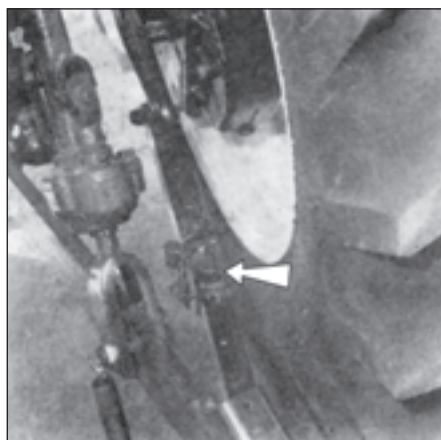


Fig. 66

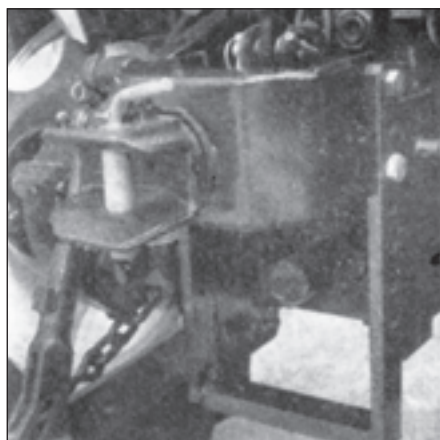


Fig. 67

### Limitation bars (Fig. 66)

These bars allow an approximate 125 mm side swing of the lower links to both sides at the lower link joints when working with implements of I. range and 90 mm to both sides when operating with range II implements. Adjustment of limitation bars is done automatically when agricultural implements are attached.

**Attention:** Both limitation bars must always be attached to the tractor. The side-swing restriction of lower links in the whole lifting range of the three-point hitch will be achieved by locking the limitation bars with use of a setting pin. The hole near the groove should be used for implements of the I. range, the next hole for implements of the II. range.

It is recommended to lock both limitation bars during the transport, especially when transporting agricultural implements. Setting pins must be secured with locking rings.

### Multistage trailer hitch (Fig. 67)

This hitch is used for attachment of two-axle and light single-axle trailers. The height of the hitch can be adjusted in five positions, in 50 mm steps. The height of the individual mouth positions above the ground depends on the tyres fitted. The permissible vertical statical load must not exceed 10 kN. The hitch is able to withstand a maximum tractive force of the tractor.

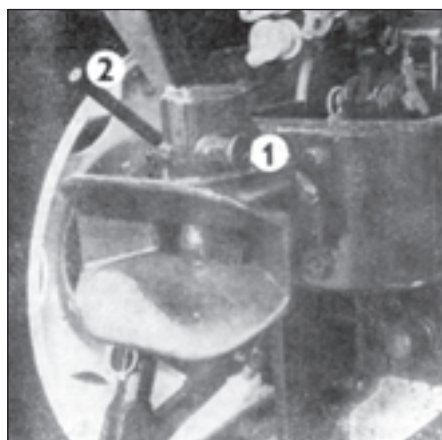


Fig. 68

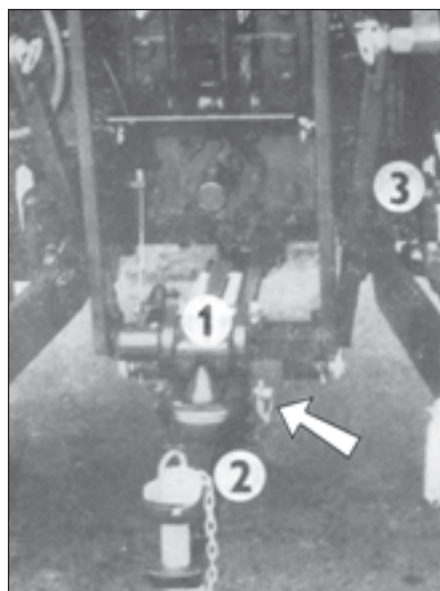


Fig. 69

#### **Automatic tow mouth (Fig. 68)**

The automatic tow mouth is mounted in place of the multistage hitch fixed mouth and is fitted to the bracket of the multistage hitch. It enables the driver to couple up the trailer by himself (without the help of an assistant).

Preparing the automatic tow mouth to attach a trailer:

- pull out the locking device (Fig. 68/1)
- using the lever (Fig. 68/2), lift the main pin until it remains in the upper position.

Both these actions have to be carried out simultaneously.

After the trailer has been attached to the automatic tow mouth, check whether the securing element of the closing-up pin has been snapped.

The permissible static load on the hitch must not exceed 10 kN. The automatic tow mouth in connection with the multistage hitch is able to withstand the maximum tractive force of the tractor.

#### **Automatic pick-up hitch (Fig. 69)**

This equipment is used for attaching single-axle trailers. The hook of this pick-up hitch is lifted and lowered by means of adjustable telescopic rods used in remote control of tractor hydraulics. These rods are connected with lifting arms of hydraulics.

The permissible vertical static load should not exceed 15 kN.

The hitch is able to withstand a maximum tractive force of the tractor.

The hitch is controlled by the inner circuit lever of the hydraulics (Fig. 50/1) for the chosen position control and by the disengageable lever (Fig. 49/3) on the left side of the driver's seat. Before lowering the hook of the pick-up pin, the safety pin of the carrying hooks has to be removed and hooks thus unlocked. The lowered hook with the eyebolt of the trailer is raised by tractor hydraulics and snapped-in hooks must be secured by sliding-in the pin which must be provided with a safety pin. (The arrow, fig. 69).

The lifting arms must then be lowered so that the pick-up hitch rests on the carrying hooks. The pick-up hitch has to be raised slightly when disengaging the trailer to allow the carrying hooks to be unlocked by the disengaging lever.

**Attention:** Carrying hooks must always be secured by a safety pin if a trailer is attached.

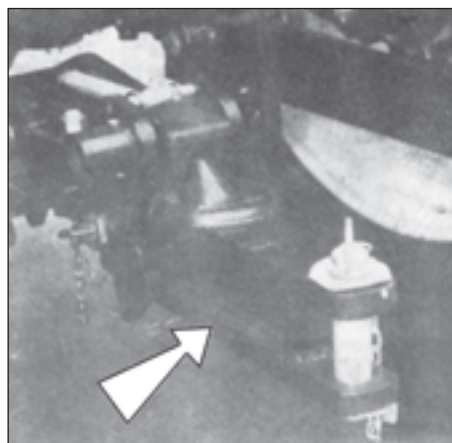


Fig. 70

#### Pick-up hitch extension (Fig. 70)

This extension is fitted together with a hitch for a single-axle trailer and is used for attaching agricultural machines driven by a propeller shaft having non-rotating cover. The extension is hooked by its eyebolt to the hook of the hitch for a single-axle trailer and besides it is fastened with a pin of carrying hooks and this pin is provided with a securing pin. The permissible vertical static load should not exceed 6 kN. The hitch is able to withstand the maximum tractive force of the tractor.



## **Adjustment of the automatic pick-up hitch for a single trailer**

Engage the position control „P“ by means of the system selection lever of the hydraulics (Fig. 50/3). Raise the hydraulic lift arms to their uppermost position (the pin centres of the lift arms have to be  $219 \pm 7$  mm from the upper surface of the main transmission box). Adjust telescopic lift rods (Fig. 69/3) so that they will be connected with the lower eye to the hitch. Shorten the lift rod by one or two turns clockwise and check after each shortening whether the carrying hooks (Fig. 69) and the draw-hook pin have latched in. After the carrying hooks have latched, the upper part of the telescopic lift rods have to be shortened by half a turn again. The upper eyes have then to be put on the pins, washers fitted and secured with pins and rings.

After this adjustment and with the arms of the hydraulics fully fitted, a play of at least 2 mm have to be between the carrying hooks and the pins of each hook (the draw hook can be elevated by hand if the play has been adjusted correctly). This play ensures that the carrying hook will latch, but that the draw hook does not knock against its carrier and so causes an unnecessary overloading of the hydraulic pump. The position of arms of the hydraulics can differ. Therefore the length of the telescopic lift rods has to be adjusted accordingly so that the draw hook is not one-sidedly lifted.

## **The front three-point hitch (fitted on special order of the customer)**

The front three-point hitch (Fig. 71) is used for a frontmounted agricultural machines and implements and for trailed implements as well. Its dimensions are in compliance with the Comecon and ISO recommendations for range II, i.e. the hitch axis 870 mm. The three-point hitch consists of lower fixed links, hydraulically operated lifting cylinders and of an adjustable upper link.

The hitch is lifted by means of two hydraulic cylinders with a diameter 50 mm and a stroke 250 mm which are connected to the outer hydraulic circuit of the tractor as single-acting cylinders. The lifting force at the end of the lower links is 11 kN in the whole lifting range, at hydraulic pressure 16 MPa in the hydraulic circuit of the tractor. The range of stroke of the lower links of the three-point hitch is 145 mm to 931 mm.

The lower links of the hitch are fitted with special eyes on their front ends (Fig. 72) which allow transversal swinging of the connected agricultural machine in the range of  $\pm 8^\circ$ . To secure the transversal movement of the machine during its operation, the securing pins in both eyes of lower links have to be located in the top position (Fig. 73). On the other hand, the lock pins have to be fixed in the low position (Fig. 72) when transporting the machine on slopes or roads. The pins are secured against spontaneous sliding-out by a bayonet lock provided with a spring. If the pin handles are in the vertical position (Fig. 74), then pins are locked, by turning them by  $90^\circ$  to their horizontal position the pins will be unlocked and it is possible to take them out (Fig. 73).