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农村发展卓越中心

UNION - DISCIPLINE - TRAVAIL

Technical Guidance on Rice Post-harvest Management China-Africa Rice Value Chain Development Initiative

(Excerpt from online workshop 14-17 Feb 2022)

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Compiled by WFP China COE

Reviewed by CERFAM

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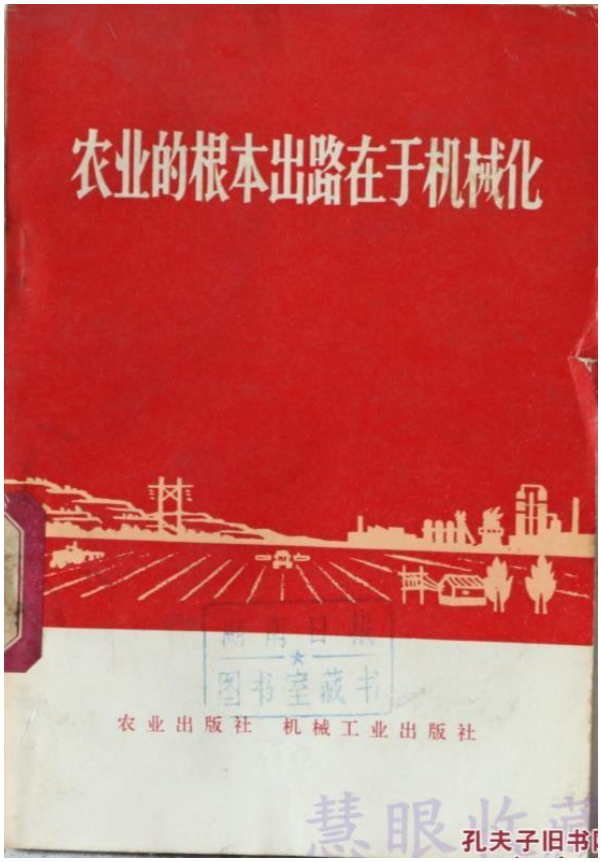
Use of Tractor

Background

"The fundamental way out for agriculture lies in mechanization"



Liang Jun—First female tractor driver in China

Modern large agricultural machinery

Classification of tractor types

According to method of securing traction and self–propulsion:

- **Wheel tractors**
    - Three wheels
    - Four wheels
- **Track–type tractors**

According to utility:

- General–purpose or utility
- All–purpose or row–crop type

Single cylinder diesel engine

Motor tricycles

Walking tractor

Multi-cylinders Diesel Engine

- Four-cylinders Diesel Engine
- Four-wheel tractor

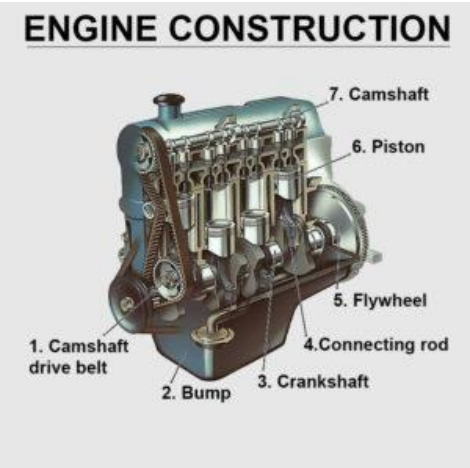
Harvester, Transplanter, Seeder

What does an engine consist of?

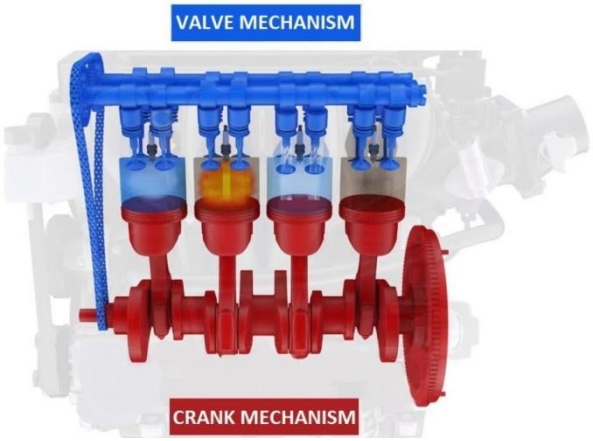
Two main mechanisms:

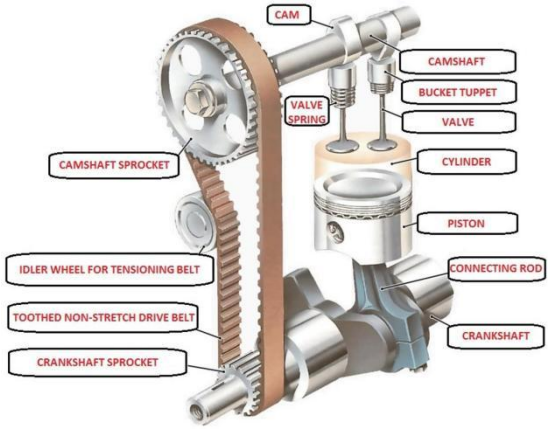
1. Crank mechanism
2. Valve mechanism

Five engine systems:



1. Cooling system
2. Lubrication system
3. Fuel system
4. Starting system
5. Ignition system (gasoline engine)



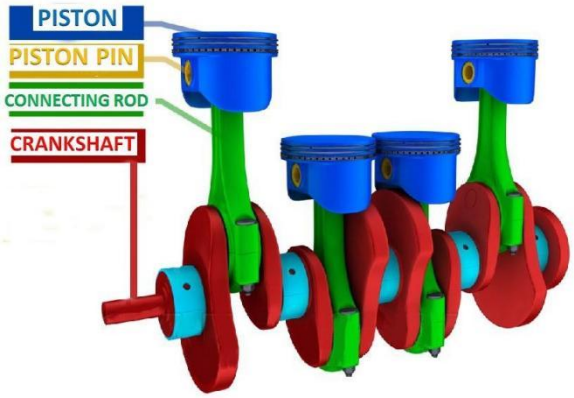


- **Valve mechanism construction**: opening and closing the intake and exhaust valve in time.

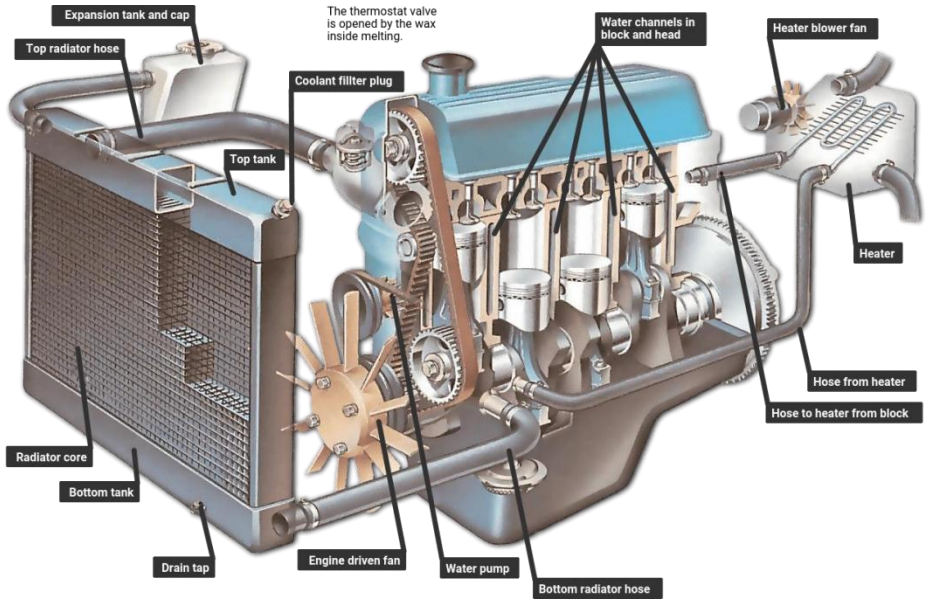
- **Crank mechanism:** transforms back–and–forth motion of the pistons to the crankshaft rotation.

Crank mechanism construction

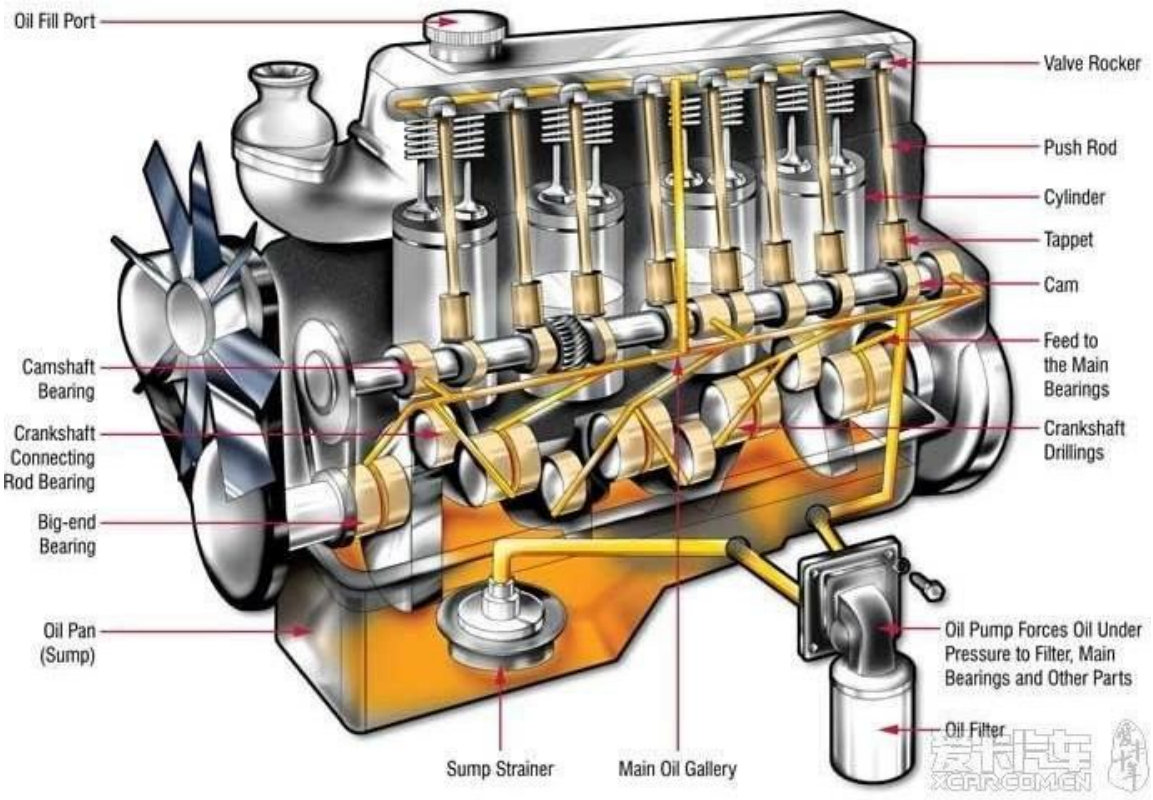
Moving components of crank mechanism: pistons, piston rings, piston pins, connecting rods, crankshaft, flywheel



Cooling System

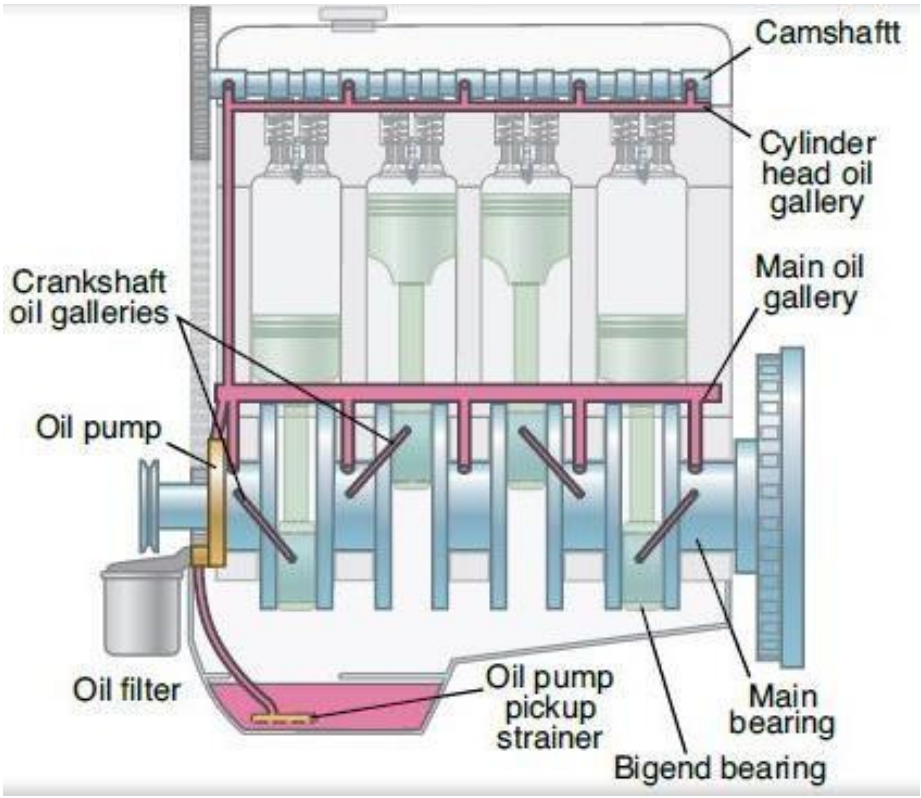


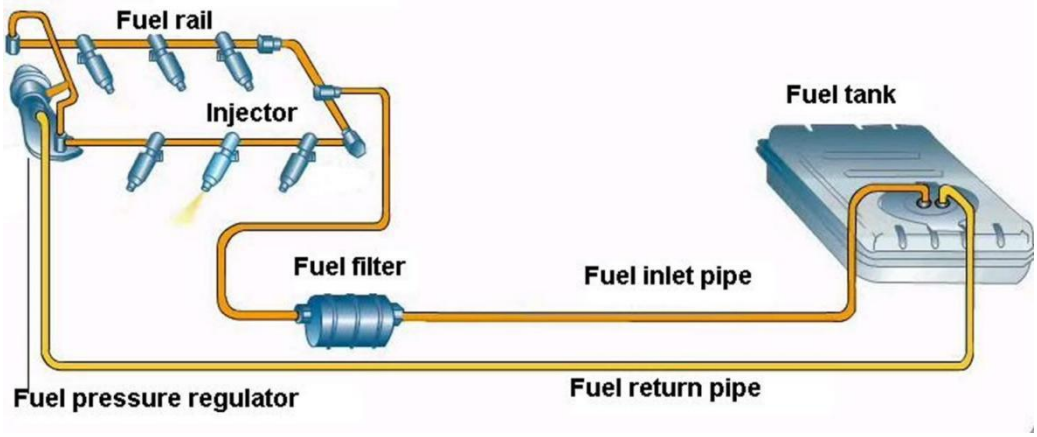
Lubrication (oil) System: Engine oil system – is reducing friction between surfaces by



distribute oil to the moving parts which rub against each other.

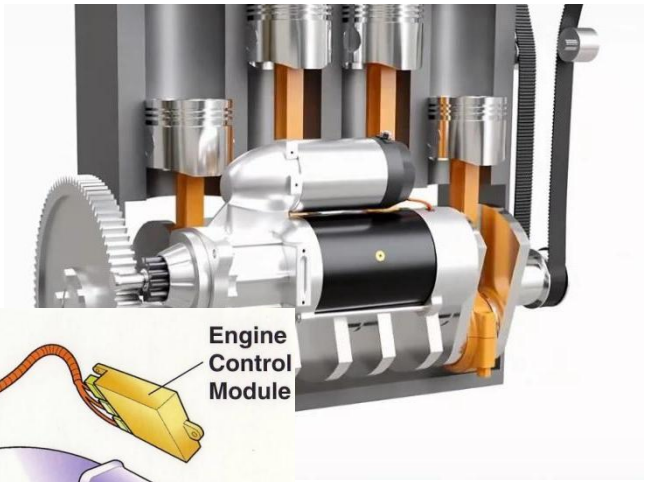
The main components for typical lubrication system



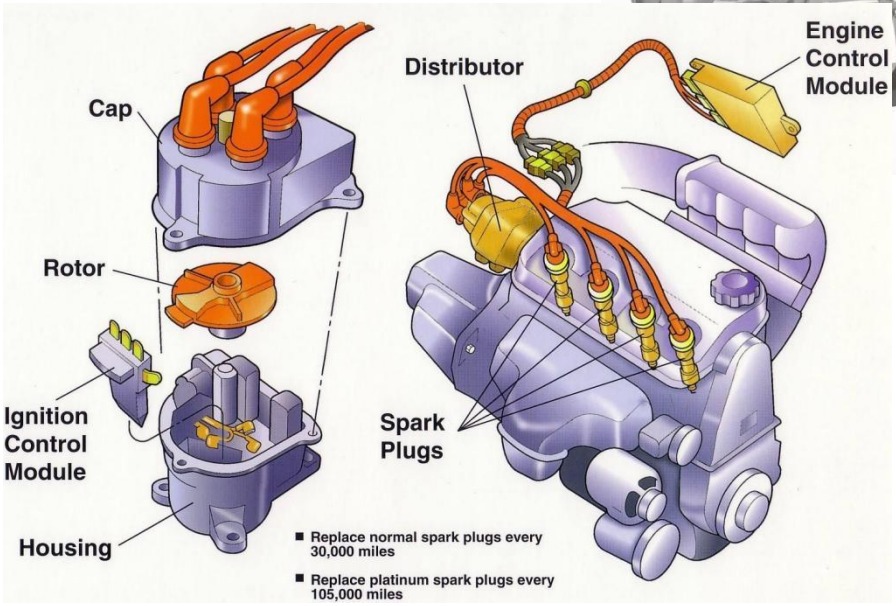


Fuel System

Starting System



Ignition System– gasoline engine



Walking tractor application

Walking Tractor is featured by its simple and compact construction, reliability, long service life, easy operation, simple output, light weight and suitable in paddy field, small dry field, orchards, vegetable gardens, can be used with plough, rotary cultivator, harrow in paddy field, harvester, transportation etc.

Walking tractor consists of

Walking tractor operating procedures — Preparation before work:

1. The engine is inspected and prepared according to the general operating procedures.
2. Check all exposed connectors, fasteners, and tighten if necessary.
3. Check whether the tires are in good condition and their air pressure meets the specified requirements.
4. Check the integrity of all parts, especially carefully check whether the steering wheel and brake are flexible and reliable.
5. Load the goods according to the specified tonnage, and do not overload. The bulky foamed goods must be placed stably and tied firmly. When loading super-long, super-wide and super-high objects, hang up obvious signs and drive at a slow speed according to the prescribed route.
6. There should be a wire rope insurance at the connection between the tractor and carriage for prevent decoupling and an accident.

Walking tractor operating procedures — Requirements for operation and driving:

1. When driving on the road, the driver should abide by the traffic rules, traffic order, and the command of the traffic police.
2. In the event of a traffic accident while driving on the road, you must firstly rescue the wounded and protect the scene, report the actual situation of the accident to the relevant departments, and obey the handling of the traffic supervision department.
3. It is strictly forbidden to mix the goods, and when picking up and sending person to the construction site, the person must sit in the carriage, and overloading is strictly prohibited.
4. After shipment of harmful, toxic substances or chemical preparations, the tractor carriage should be carefully rinsed with water gun. In order to prevent pollution and poisoning, before shipment of grain, vegetables and other edible products, the carriage should also be carefully rinsed.

Walking tractor operating procedures: driving

1. When the reverse bucket tractor is unloading on the construction site, check whether there have wires, obstacles or pedestrians above and beside the tractor.
2. When unloading to the pit, it is necessary to maintain an appropriate
3. Safety distance prevent collapse and rollover.
4. You must start after the carriage is in its place. It is not allowed to drive when the carriage stays in the dumping state. When repairing the dump, use a strut against the carriage.
5. It is strictly forbidden to unload horizontally on the ramp to prevent overturning, due to the deviation of the gravity centre after the tractor is jacked up.
6. When the tractor works at night, there should be enough lighting equipment and lamps in the work area and on the tractor.
7. When the tractor works below 0℃ in winter, it should use negative diesel fuel. When heating with a blowtorch, the tank cover should be opened, and it is not allowed to bake on the local fuel road for a long time.

Walking tractor operating procedures — Requirements after parking:

- After the work is completed, choose a flat and solid place to park orderly.
- When the temperature is lower than 0℃ in winter, after the daily work is completed, the tractor without antifreeze must drain the cooling water when the water tank cover should be opened.
- Carry out routine maintenance

according to regulations.

Maintenance of walking tractor — Maintenance per shift

- Removing dirt, dust and oil from the outer surface of the tractor.
- Check the engine oil seal for oil leaks, check the engine water tank for water leaks, and check the engine intake pipe for air leaks.
- Check the tightening condition of bolts and nuts of all parts.
- Check whether the diesel fuel is sufficient.
- Check whether the cooling water of the diesel engine is sufficient.
- Check the transmission oil level.
- Check that connection point of all joystick hinges is firm.
- Check clutch disengagement and engagement.
- Check the tightness of the V-belt.
- Check steering reliability and flexibility.
- Check that the transmission shift position is correct and smooth.
- Check the reliability of the brakes.
- Check the diesel engine chassis for abnormal noise

Maintenance of walking tractor — Periodical Maintenance

- After every 100 hours of operation or 200 kg of fuel consumption
- Clean the air filter.
- Clean the diesel fuel filter.
- Change the oil.
- Check that the crankcase ventilation pipe is unobstructed.
- Adjust clutch release clearance.
- Adjust the free travel of the clutch brake handle.
- Adjust the brakes.
- Adjust the steering rod length.

- Adjust the tractor deviation.
- Adjust the tension of the V-belt.

Maintenance of Cultivator

1. Remove the soil and tangled grass on the working parts in time and check whether they are in good condition.
2. The lubricating parts should be filled with butter in time.
3. After each shift, comprehensively check whether the bolts of each part are loose.
4. After the fertilization is completed, remove the fertilizer adhering to each part.

5. Before working, check whether the transmission chain is flexible.
6. After each shift, the parts should be checked for deformation, cracks, etc., and repaired or replaced in time.
7. After the work is completed, keep it properly.

Common faults and resolution of rice transplanter

Number	Common faults	Reasons	Troubleshooting
1	Poorly standing seedlings or floating seedlings	too much or too little water in the seedbed; improper adjustment of the depth of transplanting;too hard or too soft topsoil of paddy field; worn claws	the transplanting peed can be slowed down, and the handle of the non-riding rice transplanter can also be pressed down.
2	Seedlings scattered after planting	The pushing stroke of the seedling pusher is small;the seedbed is too dry or the water is too much; the joints between the seedlings and the seedlingsare not tightly fitted; the topsoil of the paddy fieldis too	the transplanting speed can be slowed down, the claws can be replaced, and theseedling guide grooves can be cleaned orreplaced.

Number	Common faults	Reasons	Troubleshooting
		hard or too soft	
3	Leakage exceeding the standard	uneven seeding in the seedling field; the seedlingsare arched, or the seedlings are stuck in the seedling door; there are messes at the seedling mouth; the excessive width of the seedling tray makes it difficult to send the seedlings vertically.	Reload the seedlings or cut the seedlings to a standard width; remove the seedlingsmesses; replace the seedlings with unevendensity
4	Uneven rows of seedlings	The water content of the seedbed soil is inconsistent; the adjustment of the seedling needles in each row is inconsistent; the tension oflongitudinal seedling feeding is inconsistent	for some rice transplanters, the seedling feeding wheels can be adjusted one by one, so that each vertical seedling feeding stroke is 11–12mm.
5	Seedlings at the gate	The claws are worn, and the seedlings cannot be fully taken; the two tips of the claws are uneven and the spacing between the claws is too narrow or wide; the seedling bed soil is too thick, and the standard thickness of the seedbed soil is 2.5–3cm	The new claws should be replaced in time or the distance between the claws should be corrected.
6	The amount of seedlings taken fluctuates	The adjusting bolt for the number of seedlings is loose; the lower hole of the swing rod and the connecting rod shaft are worn	re–adjust the number of seedlings taken and tighten the adjustment bolts; replace the pendulum rod and connecting rod shaft
7	clip seedlings	The tip of the separation needle is worn; the separation needle is upturned; the groove of the pressing plate is deep; the pusher is worn; the guide sleeve is worn; the pusher spring is broken; the fork and the cam are worn	Replace worn parts
8	Inconsistency between the lines	The forks, fork shafts, and seedling cams of each planting arm are not uniformly worn; each chain box is not on the same level	firstly correct each chain box on the same level, and then replace the worn parts
9	Insertion depth adjustment failure	The lifting rod or lifting nut produces a thread stripping; the fixed pin hole is worn out; the fixed pin seat of the rectangular tube is broken	replace the lift rod, nut or pin; welding fixed pin seat

Maintenance of rice harvester

1. Machine cleaning
2. Transmission maintenance
3. Check wear parts
4. Machine lubrication.
5. Check threshing drum and fastener.
6. Check transmission system
7. Machine storage

Maintenance during operation

1. When the diesel engine is used as the power, the exhaust pipe and fire extinguishing cover should be cleaned every day to avoid serious carbon deposition, which will affect the exhaust and fire extinguishing efficiency; When po wered by an electric motor, the straw should be used to cover the electric motor at the hot noon and prevent being exposed to heat.
2. Always pay attention to whether the speed, sound and temperature of the machine are normal. Every time a kind of threshing is finished, or the work is completed for one day, the machine should be stopped to check whether the bearings are overheated, fastening screws and key pins are loose, and any abnormality should be removed in time.
3. When working in the rainy season, always clean up the dust, cuttings, on the cover, and sticky dirt on the rollers and skateboards, etc., to prevent rusting after the ponded water.

Maintenance during storage

1. Clean up dust, dirt, straw, glumes and other debris inside and outside the machine.

2. Coat the surface of unpainted metal parts such as drive pulley and thresher drum with anti-rust oil. Repaint on the racks, covers, etc. where the paint has been removed.
3. For long-distance transportation, the thresher should be installed on the vehicle; for short-distance transportation, the transport wheel should be oiled. The transport speed must not exceed 5 km/h.
4. Place the machine in a dry warehouse or factory shed. If possible, it is best to use sleepers to cushion it and cover it with oil cloth to prevent the machine from being damp, exposed to the sun and rain.
5. Before use in the coming year, a comprehensive cleaning and maintenance of the thresher should be carried out, all bearing housing covers should be opened, oil stains and sundries should be removed, sufficient lubricating oil should be reapplied, and the deformed and worn parts should be replaced

The overall trend of future agricultural machinery

- **Model creation:** build a whole-process mechanized production model for bulk crops and integrate supporting system solutions;
- **Equipment:** promote high-end agricultural equipment, such as large tractors, compound work equipment, large and efficient combine harvesters;
- **Technology:** Promote precise fertilization and application, water-saving irrigation, subsoiling land preparation, straw treatment, no-tillage seeding, precise and small-scale seeding, residual film recovery, agricultural waste utilization and resource utilization mechanization techniques

Development direction of agricultural machinery

- Large-scale, multi-functional combined machinery;
- Intelligence agricultural machinery;
- Precision agricultural machinery;
- Agricultural aviation operating field;
- Specialization of suitable machinery for hills and mountains, fruit industry machinery, facility horticultural machinery, grass and animal husbandry