R E P O R T R E S U M E S

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GASOLINE TRACTOR ENGINE SYSTEMS. AGRICULTURAL MACHINERY--SERVICE OCCUPATIONS, MODULE NUMBER 14.
OHIO STATE UNIV., COLUMBUS, CENTER FOR VOC. EDUC.
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ONE OF A SERIES DESIGNED TO HELP TEACHERS PREPARE POSTSECONDARY STUDENTS FOR AGRICULTURAL MACHINERY SERVICE OCCUPATIONS AS PARTS MEN, MECHANICS, MECHANIC'S HELPERS, AND SERVICE SUPERVISORS, THIS GUIDE AIMS TO DEVELOP STUDENT UNDERSTANDING OF THE OPERATION, COMPONENTS, AND FUNCTIONS OF VARIOUS GASOLINE TRACTOR ENGINE SYSTEMS. IT WAS DEVELOPED BY A NATIONAL TASK FORCE ON THE BASIS OF RESEARCH FROM STATE STUDIES. SUGGESTIONS FOR INTRODUCING THE MODULE ARE GIVEN. SUBJECT-AREA UNITS COVER--(1) OPERATION PRINCIPLES, (2) CONSTRUCTION COMPONENTS, (3) STATIONARY AND MOVING PARTS, AND (4) ELECTRICAL, FUEL, AIR, EXHAUST, AND COOLING SYSTEMS. EACH UNIT INCLUDES SUGGESTED SUBJECT-AREA CONTENT, TEACHING-LEARNING ACTIVITIES, SUGGESTED MATERIALS, AND REFERENCES. CRITERIA FOR THE EVALUATION OF EDUCATIONAL OUTCOMES ARE LISTED. SUGGESTED TIME ALLOTMENT IS 18 HOURS OF CLASS INSTRUCTION AND 24 HOURS OF LABORATORY EXPERIENCE. TEACHERS SHOULD HAVE EXPERIENCE WITH FARM MACHINERY. STUDENTS SHOULD HAVE MECHANICAL APTITUDE AND AN OCCUPATIONAL GOAL IN FARM MACHINERY. THIS DOCUMENT IS ALSO AVAILABLE FOR A LIMITED PERIOD AS PART OF A SET (VT 000 488 THROUGH VT 000 504) FROM THE CENTER FOR VOCATIONAL AND TECHNICAL EDUCATION, THE OHIO STATE UNIVERSITY, 980 KINNEAR ROAD, COLUMBUS, OHIO 43212, FOR $7.50 PER SET. (JM)

GASOLINE TRACTOR ENGINE SYSTEMS

One of Sixteen Modules in the Course Preparing for Entry in
AGRICULTURAL MACHINERY - SERVICE OCCUPATIONS

Module No. 14.

The Center for Research and Leadership Development
in Vocational and Technical Education

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GASOLINE TRACTOR ENGINE SYSTEMS

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GASOLINE TRACTOR ENGINE SYSTEMS

Major Teaching Objectives

To understand the principles of operation and the components and their functions of the various systems of a gasoline tractor engine

Suggested Time Allotments

At school		
Class instruction	18 hours	
Laboratory experience	24 hours	
Total at school		42 hours
Occupational experience		0 hours
Total for module		42 hours

Suggestions for Introducing the Module

It is highly important for those preparing for employment in an agricultural machinery service occupation to understand the construction and principles of operation of tractor gasoline engines.

Competition is keen in many areas of agricultural machinery service because buyers and users of agricultural machinery are demanding first-class service. Employers, therefore, are interested only in efficient employees.

The following techniques should be used to create interest in the module:

1. Bring a small tractor before the class. Remove the rotor button and ask a student why the engine will not run. Replace the rotor button and close the air intake (air cleaner) and ask another student to explain the reason the engine will not run. Involve students in a discussion of the principles of internal engine combustion. Also review the history of the development of internal combustion engines.

2. Place various parts of the gasoline engine system around the classroom and have students attempt to identify them. As the instruction in this module progresses, refer to the parts placed before the class for identification.

Competencies to be Developed

I. To understand the principles of operation of gasoline engines

Teacher Preparation

Subject Matter Content

The basic principles of internal combustion engines were first put forth by a Frenchman named DeRochas in 1862. Experimentation was carried out as early as 1678 by Hautefeuille, of France, to devise a heat engine that would utilize heat to produce continuous power. This particular engine used gun powder but did not prove practical. In 1680, a Dutchman named Huygens exhibited in Paris an engine with a cylinder and piston. This engine also operated on explosive powder.

Experiments on internal combustion engines continued, but it was 1876 before the first successful internal combustion engine on the four-stroke-cycle principle was patented by Dr. N. A. Otto, a German. In 1878, Dugald Clerk, an Englishman, patented a two-stroke-cycle engine.

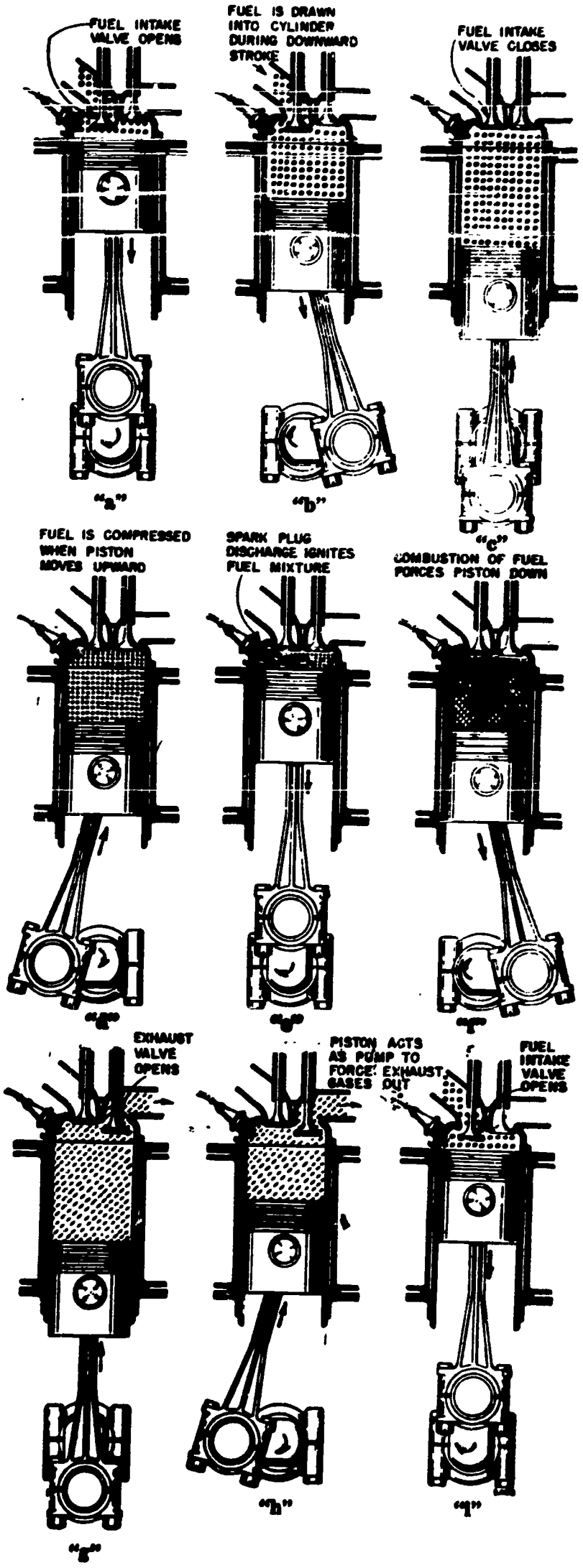
Internal combustion engines generate power by utilizing force created by the combustion of fuel and air. Combustion is the chemical action of oxidation. When this occurs in the internal combustion engine, the process is very rapid and produces great quantities of heat, expanding the gases which produce great pressures. It is the pressure of expansion that the engine converts to mechanical energy at the crankshaft.

Internal combustion engines may be four-stroke-cycle engines or two-stroke-cycle engines. The four-stroke-cycle engine is the most common type found in farm tractors. A stroke is the movement of the piston from Top Dead Center (TDC) or Head Dead Center (HDC) to Crank Dead Center (CDC). A stroke may also be defined as one half a revolution, or 180 degrees crankshaft travel, or the movement of the piston from its highest position in the cylinder to its lowest position in the cylinder.

The action which takes place in a complete cycle involves

1. Intake
2. Compression
3. Power
4. Exhaust

In a four-stroke-cycle engine, four up-and-down movements of the piston are required to complete the necessary actions. In a two-stroke-cycle engine only two up-and-down movements are needed to complete the necessary actions of intake, compression, power, and exhaust.



Sequence of Operations--
Four Cycle Spark-Ignition
Engine

Suggested Teaching Learning Activities

1. Use cutaway engines to demonstrate movement of pistons, valves, etc., in a four-stroke-cycle engine and a two-stroke-cycle engine.

2. Use transparencies and motion pictures to illustrate principles of internal combustion engines.

3. Have students make sketches illustrating the different strokes of the four- and two-stroke-cycle engines.

Suggested Instructional Materials and References

Instructional materials

1. Cutaway engines, four-stroke-cycle small engines and two-stroke-cycle small engines

2. Charts depicting the principles of internal combustion engines

3. Motion pictures and transparencies depicting principles of internal combustion engines

References

S*1. Tractors and Crawlers, pp. 140-144.

S 2. Modern Farm Power, pp. 9-19.

S 3. The ABC of Internal Combustion.

*The symbol T (teacher) or S (student) denotes those references designed especially for the teacher or for the student.

II. To understand the construction and major components of a tractor gasoline engine

Teacher Preparation

Subject Matter Content

Gasoline engines are composed of many small parts. Each part serves a specific function or, in some cases, several functions. The efficient tractor mechanic must have a thorough understanding

of the many parts of a gasoline engine and the functions they perform.

Because of the peculiar function of each part, each falls into a natural group, referred to as an assembly or a system.

Gasoline engine parts may be grouped into the following systems:

1. Stationary parts
    a. Cylinder block
    b. Cylinder head
    c. Crankcase
    d. Oil pan
    e. Cover
2. Moving parts
    a. Pistons and rings
    b. Connecting rods and wrist pins
    c. Crankshaft
    d. Main bearings
    e. Flywheel
    f. Camshaft and camshaft gear
    g. Valves
    h. Rocker arm assembly
    i. Oil pump and accessories
3. Electrical system
    a. Battery
    b. Generator and charging circuit
    c. Ignition circuit (distributor, coil, spark plugs, breaker points, condensor, and magneto)
    d. Cranking motor

4. Fuel, air, and exhaust systems

   a. Air cleaner

   b. Fuel tank

   c. Fuel line, cut-off valve, strainer, and filter

   d. Fuel pump (only in tractors that do not have the fuel tank located above the engine)

   e. Carburetor

   f. Manifold, muffler, and exhaust pipe

   g. Governors

5. Cooling system

   a. Radiator, hose, and pressure cap

   b. Water pump

   c. Thermostat

   i. Fan

Suggested Teaching-Learning Activities

1. Have students make reports on gasoline engines, naming assemblies and systems, the components of each, and the function of each component.

2. Disassemble a gasoline engine so that the components listed in the content may be seen and studied by the students. Reassemble the components, explain the function of each, and give the relationships of all components in a system.

Suggested Instructional Materials and References

Instructional materials

1. Overhead transparencies and charts of cross section veiws of gasoline engines

2. Overhead transparencies and diagrams of exploded view of each gasoline engine system

3. Tractor engines

References

1. Tractors and Crawlers, pp. 1[illegible]0-176.

2. Modern Farm Power, pp. 20-30.

III. To understand the stationary parts of a tractor gasoline engine

Teacher Preparation

Subject Matter Content

The stationary parts are those major parts of the engine which do not move.

The cylinder block is the basic frame of the engine. It supports all the components in relation to one another and maintains them in alignment. The most important requirement of the cylinder block is rigidity. In most cases, tractor engines are made of cast iron alloy.

Cylinder blocks may vary in design. They may be of the integral bore type; this is, the cylinder bore is machined directly into the material of the block. It may have separate and removable cylinder sleeves. The removable sleeve may be of the wet type (the coolant comes in direct contact with the outer surface of the sleeve), or it may be of the dry type (the sleeve or liner is inserted in the bore and is not in direct contact with the coolant).

Valve-in-block engines have the valve seats, ports, and guides in the block casting with their respective water jackets; whereas, the I-head engine block has only the cylinder bore water jackets.

If the block skirt extends only to the center line of the crankshaft main bearing, it is known as a "short skirt." If it extends below the center line of the crankshaft main bearing, it is known as a "deep skirt."

Many engine blocks may have oil galleries cored in. Others may have steel tubes inserted to act as galleries; whereas, others may have oil lines and fittings to carry oil to the various parts.

As a rule, the cylinder head is made of the same material as the cylinder block. It serves as a cap and is attached to the top of the engine block and covers the upper cylinder openings, thereby forming a combustion chamber.

The crankcase is the lower part of the cylinder block; it confines the lubricating oil near the engine's moving parts in the four-cycle engine. It also supports the crankshaft and camshaft bearings.

The oil pan serves as a reservoir to hold the crankcase lubricant and seals the lower part of the engine in the four-cycle engine.

Various types of covers are used on the timing train, the valve train, and sometimes on other components or inspection-holes. They are usually made of stamped steel.

Suggested Teaching-Learning Activities

1. Have students disassemble and examine several gasoline engines and the stationary parts to observe the various designs.

2. Have students label drawings of stationary engine parts.

3. Have students prepare and present written reports on function, designs, construction materials, etc., of stationary parts.

Suggested Instructional Materials and References

Instructional materials

1. Tractor engines

2. Overhead transparencies and diagrams of stationary engine parts

References

1. Modern Farm Power, pp. 21-22.

S 2. Ford Tractor Shop Manual.

J" To understand the moving parts of a tractor gasoline engine

Teacher Preparation

Subject Matter Content

The moving parts of the engine that receive the gaseous energy produced in the combustion chamber and deliver it to the output end of the engine in the form of useful power are referred to in this module as the moving parts.

1. Pistons and rings

   Cylinders are sealed and the gaseous pressure transmitted to the connecting rod by the piston and its rings.

   The top section of the piston is the crown, and the lower section is the skirt.

   The upper set of rings, compression or power rings, are carried by the crown of the piston. The lower set of rings, oil control rings, are carried by the skirt of the piston.

2. Connecting rods and wrist pins

   A connecting rod is a bar or strut with a bearing at each end. The purpose of the connecting rod is to transmit the piston thrust to the crankshaft.

   The connecting link between the connecting rod and the piston is the wrist pin.

   There may be three arrangements of wrist pins.

   a. The wrist pin is secured in the piston, and the bearing is held in the connecting rod end.

   b. The wrist pin is fastened to the connecting rod, and the bearing is part of the piston.

   c. The wrist pin is free and bears against bearings in both the piston and the connecting rod.

3. Crankshafts

   Crankshafts deliver force to the transmission and power train as a result of the thrust from the connecting rod.

Some crankshafts are designed with counterweights opposite the crank pins. These relieve the load on the main bearing by offsetting the inertia forces.

4. Bearings

The purpose of bearings is to support rotating shafts and other moving parts that transmit power from one engine part to another.

Bearings reduce the friction between the moving surfaces by separating them with a film of lubricant and carry away the heat produced by unavoidable friction.

5. Flywheels

The flywheel is a heavy wheel or disk attached to the crankshaft. Through rotation, the flywheel acquires kinetic energy. It stores additional kinetic energy when it speeds up and gives back that energy when it slows down.

The main purpose of the flywheel is to reduce the speed fluctuations of the crankshaft, caused by the difference in the amount of energy exerted on the piston during the power stroke and during the compression stroke.

Single-cylinder engines require larger flywheels than multi-cylinder engines, because energy variations during a complete cycle are greater in single-cylinder engines.

6. Camshaft and gear

The camshaft is a lobed shaft which provides accentric action for opening the valves. It is driven from the crankshaft by a timing gear or through a timing chain.

7. Valves

The purpose of valves is to open and close ports in the combustion chamber. Since there are two ports for each cylinder, there must be two valves. The intake valve allows the fuel-air mixture to enter the chamber when the valve is open. Exhaust valves open to allow burned gases to escape from the combustion chamber into the exhaust system. Both valves are closed on the compression and power strokes.

8. Rocker arm assembly

   The purpose of the rocker arm assembly is to actuate the valves at the proper time. The rocker arm assembly is actuated by the camshaft and consists of valve lifters, push rods, rocker arms, rocker arm shaft brackets, rocker arm shaft and accessory parts.

9. Oil pump and accessories

   The oil pump is located in the oil pan. Its function is to provide engine lubrication. Pumps are of three types: vane, piston, and gear. Because of their long life and trouble-free operation, gear pumps are used in most engines.

   In many engines, oil filters are located between the oil pump and the engine parts to remove abrasive particles.

Suggested Teaching-Learning Activities

1. Demonstrate the action of the running gear through the use of engine cutaways.

2. Have students disassemble an engine and study each part of the running gear and its function.

3. Have students label diagrams of running parts of an engine, giving the function of each part and its relationship to other parts.

Suggested Instructional Materials and References

Instructional materials

1. Tractor engines

2. Overhead transparencies and diagrams of running gear parts

3. Engine cutaway of running gear

References

1. Tractors and Crawlers, pp. 140-144.

2. Modern Farm Power, pp. 23-27.

V. To understand the electrical system

Teacher Preparation

Subject Matter Content

The electrical system of a gasoline tractor provides ignition, which is one of the three essentials for combustion. The electrical system also provides power for easy starting and for accessories, such as lights. Knowledge of the electrical system is essential in trouble shooting and in proper tune-up of the tractor engine.

The generator is the source of power in battery-type tractor electrical systems. Usually belt-driven, it is located at the front of the tractor.

The main components of the generator include pole shoes, armature, commutator, brushes, and housing.

Some tractor manufacturers are installing alternators in place of generators on their tractors. The generator develops direct current, which is suitable for direct use by the battery and electrical equipment on the tractor; and the alternator develops alternating current, which must be "rectified" (changed to direct current) before it can be used.

Generators may vary in design, according to electrical requirements. Types include

1. Third brush generator
2. Shunt generator
3. Interpole generator
4. Bucking field generator
5. Split field generator

All DC generator systems include a cut-out relay (automatic switch) to disconnect the generator output circuit when the voltage of the generator is lower than the voltage of the battery.

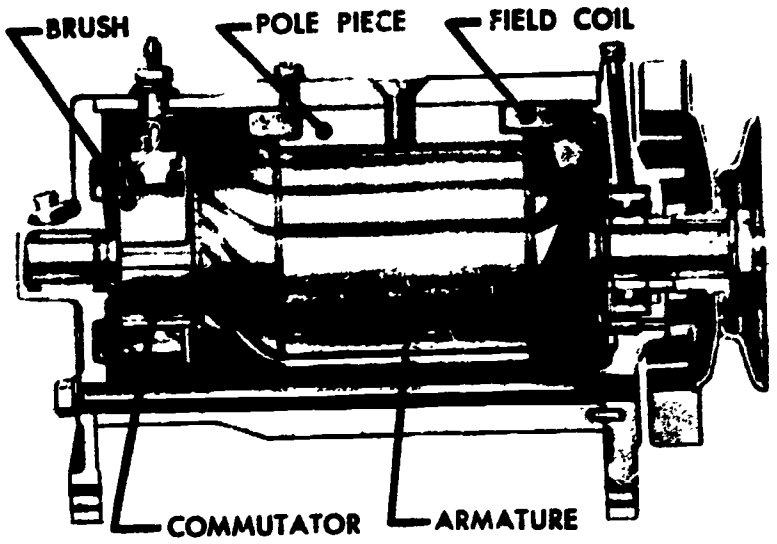
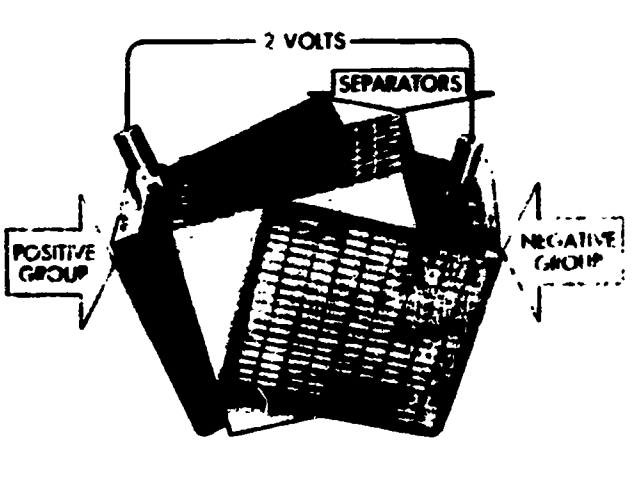
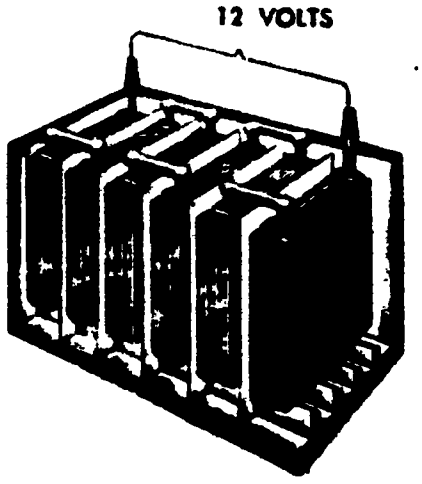


Diagram of Cross Section of a Generator

The purpose of the battery is to convert chemical energy into electrical energy. It stores electrical power when the engine is running, and provides power to start the engine and operate accessories.

A storage battery consists of positive plates, negative plates, an electrolyte, separators, and a container.





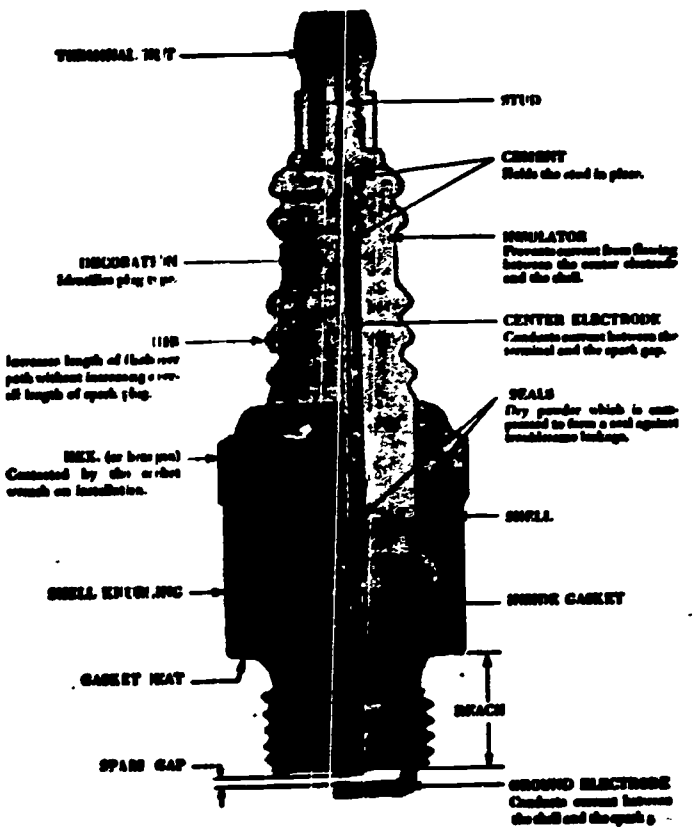
Drawing of a Cross Section View of a Typical Storage Battery

An ignition circuit provides the spark in the combustion chamber to ignite the fuel at the proper time. The major components on farm tractor engines include spark plugs, an ignition coil, and a distributor or a magneto.

1. Spark plugs

   The spark plugs are installed in the engine combustion chambers. The spark which "jumps" between the terminal of the spark plug ignites the air-fuel mixture.

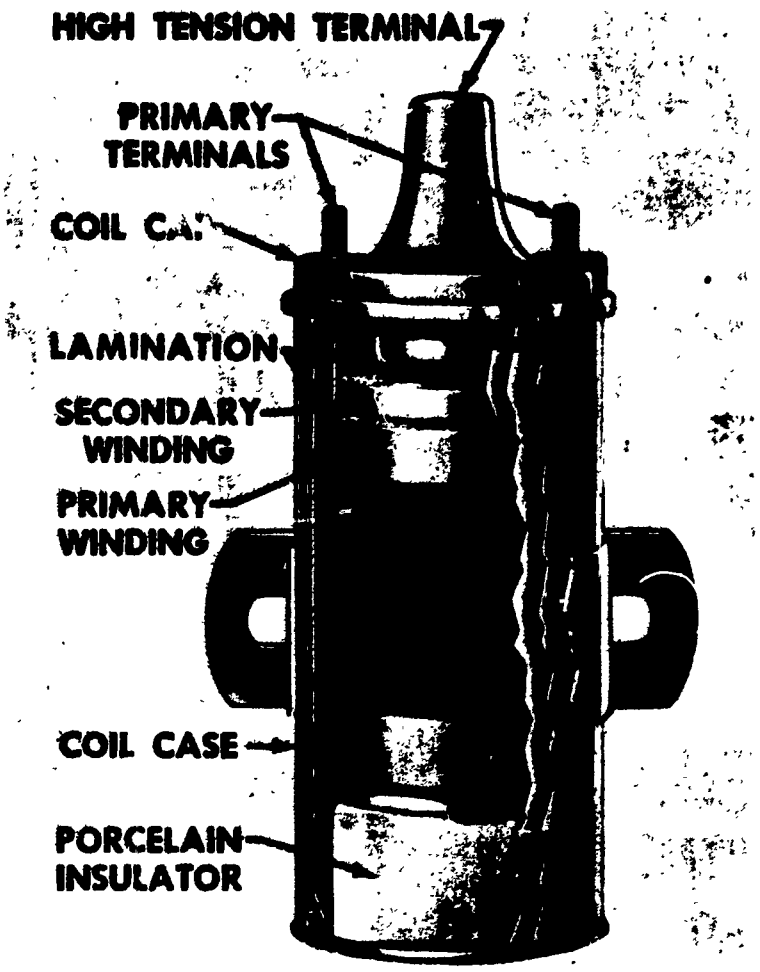
   Spark plugs are usually classed as hot, cold, or standard.



Cutaway View of a Spark Plug

2. Ignition coil

   Coils are used in ignition systems to increase the voltage of the electrical current needed to provide the spark in the combustion chamber. Coils increase the current from 6 to 12 volts to as much as 25,000 volts.



Cutaway View of a Typical Ignition Coil

3. Distributor

A distributor has parts of two separate electrical circuits, a low-voltage circuit and a high-voltage circuit. The low-voltage, or primary system, consists of the source of current, a switch, a set of breaker points, a breaker cam, a condenser, a primary coil, and the wiring to make the circuit complete. The high-voltage, or secondary system, consists of the secondary, the spark distributor, the spark plugs, and the wiring to make the circuit complete. Also, most systems include a mechanism for advancing the timing of the spark.

Cutaway View of a Distributor

Cutaway View of a Distributor

4. Magneto

   Magnetos are self-contained assemblies which are driven by the engine and supply high voltage current to the spark plugs.

   Magnetos contain a coil, a condenser, points, a distributor cap, and a rotor. Magnetos with a spring-loaded drive turn quickly when a cylinder is to fire, thus generating more voltage and resulting in a better spark while starting the engine.

5. Starting motor

   The starting motor, or starter, which is found on most tractors, is a series-wound 6-, 12-, or 24-volt direct-current motor mounted near the flywheel of the tractor.

Suggested Teaching-Learning Activities

1. Have students disassemble and study an electrical system.

2. Have students diagram an engine electrical system, showing each major assembly and component.

3. Using electrical circuit parts, have students put together an ignition system typical of that used on a tractor engine. Have students measure the amount of voltage of the battery, and then of one of the plugs. Emphasize that the increase is due to the function of the coil.

Suggested Instructional Materials and References

Instructional materials

1. The electrical system of an engine mounted on a display board

2. Electrical systems for students to use

3. Overhead transparencies, charts, and diagrams showing exploded views of the components of an electrical system

References

1. Tractors and Crawlers, pp. 158-172.

2. Modern Farm Power, pp. 102-130.

S 3. Electrical Systems.

VI. To understand the fuel, air, and exhaust systems

Teacher Preparation

Subject Matter Content

The purpose of tractor fuel systems is to supply fuel to the engine. The fuel system on most tractors with a spark-ignited engine consists of fuel tank, fuel line, cut-off valve, strainers and filters, fuel pump (unless the fuel tank is located above the engine), carburetor, and intake manifold.

1. Fuel tank

The fuel tank serves as a reservoir for the storage of fuel. On most tractors the fuel tank is located above the engine, and the fuel flows to the carburetor by the force of gravity. Some tanks have built-in filters and strainers to prevent dirt from entering the tank with the fuel.

2. Cut-off valve, strainers, and filters

The cut-off valve closes the fuel line when repairs are made on the fuel system. The strainers remove the small particles of foreign matter before they pass into the carburetor. The sediment bowl collects the large particles of dirt and water.

3. Fuel pump

A fuel pump is necessary on tractors that do not have the fuel tanks located above the engine or that do not have gravity pressure sufficient to supply the engine requirements.

4. Carburetor

The purpose of a carburetor is to mix air and fuel in certain definite proportions so as to form an efficient combustible mixture.

There are three basic types of carburetors used at present.

a. Suction type

b. Float type

c. Diaphragm type

5. Intake manifold

The purpose of the intake manifold is to distribute the air-fuel mixture to the cylinders. It consists of passages from the carburetor to pairs of cylinders or, in some cases, to each cylinder.

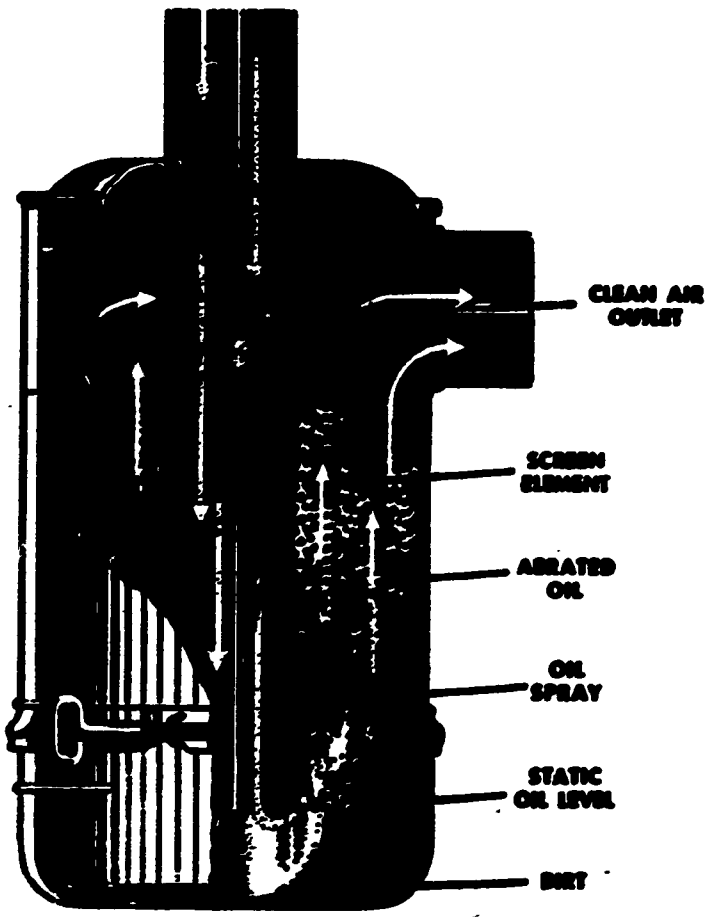
6. Air cleaners

The carburetor air-intake system is part of the fuel system. It consists of a pre-cleaner, a cleaner, and a passage or duct to the carburetor.

The two common types of air cleaners used on tractors are

a. Dry type

b. Oil bath type



Cutaway View of an Oil Bath Type Cleaner

7. Exhaust system

Exhaust systems pipe the exhaust gases away from the engine. Most systems consist of an exhaust manifold to receive the gases from the cylinders, a muffler to reduce the engine noises, and an exhaust pipe to conduct the exhaust gases out of the way of the cylinder.

8. Governors

The purpose of a governor on an engine is to regulate the throttle automatically so as to maintain a uniform rate of engine speed regardless of the load. The flytall or flyweight type of governor is the most common type found on tractors.

Suggested Teaching-Learning Activity

Have students thoroughly disassemble and examine a complete fuel, air, and exhaust system. In the process, they should learn each of the assemblies and the components of each assembly.

Suggested Instructional Materials and References

Instructional materials

1. Tractors for students to use in learning the fuel, air, and exhaust systems

2. Charts and diagrams of air, fuel, and exhaust systems

3. Overhead transparencies, preferably overlays of air, fuel, and exhaust systems

References

1. Tractors and Crawlers, pp. 144-158, 174-176.

2. Modern Farm Power, pp. 51-66, 83-91, 92-101.

S 3. Fuel Systems and Fuel Storage.

VII. To understand the cooling system

Teacher Preparation

Subject Matter Content

Only about one-third of the heat energy of fuel is converted into mechanical energy and leaves the engine in the form of brake horsepower. Thus, about two-thirds of the heat energy of fuel shows up in hot exhaust gases, friction heat, and heating of the walls of the combustion chamber.

The purpose of the cooling system is to remove the unwanted heat from the engine.

Almost all tractor engines are provided with a liquid cooling system. The two types used on tractors are

1. Forced-circulation system

2. Thermo-siphon system

   a. Forced-circulation system

      This system incorporates a pump to assist the circulation and a thermostat to control the temperature of the coolant by controlling the flow of the coolant.

b. Thermo-siphon system

This system differs from the forced-circulation system because a pump is not used to force the circulation of the coolant; but rather the circulation is caused by the difference in the temperature of the coolant in the radiator and in the engine.

Both systems consist of radiator and fan. The purpose of the radiator is to expose the coolant to the air in such a way that an effective heat exchange may take place. The fan increases the flow of air through the radiator so that the heat is removed more rapidly than would be the case if there were no fan.

Pressure caps are used to allow pressure in the radiator to equalize with outside pressure upon cooling and consequent contraction of the coolant. This eliminates the danger of the radiator tank collapsing.

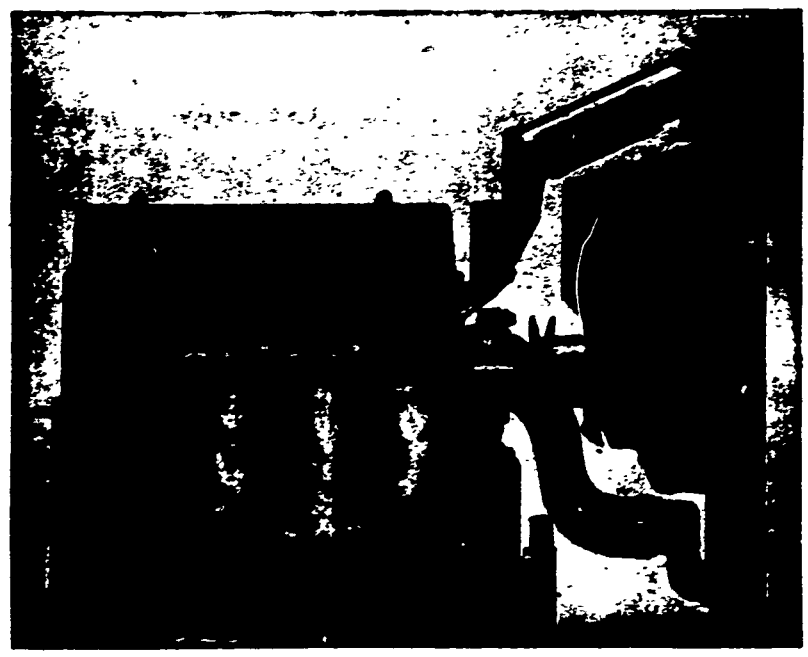


Diagram of Cross Section of a Forced-Circulation Cooling System

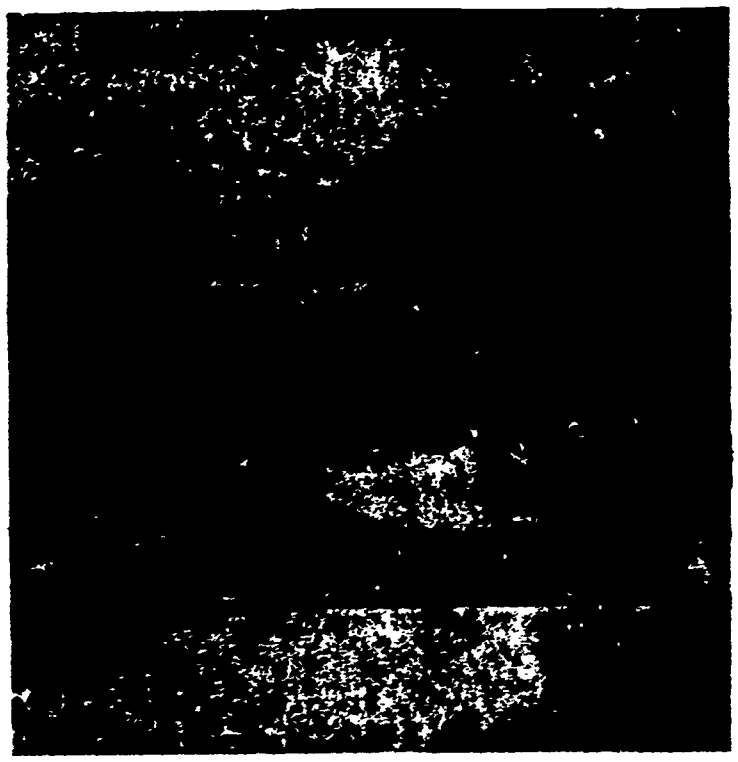


Diagram of Cross Section of a Thermo-Siphon Cooling System

Suggested Teaching-Learning Activities

1. Have students disassemble and examine a cooling system.
2. Have students learn the components of cooling systems.
3. Have students list advantages and disadvantages of the two types of liquid cooling systems.

Suggested Instructional Materials and References

Instructional materials

1. Tractor and other cooling systems for student use
2. Charts, diagrams, and overhead transparencies on cooling systems.

References

1. Tractors and Crawlers, pp. 172-174.
2. Modern Farm Power, pp. 131-142.

S 3. Cooling Systems.

Suggestions for Evaluating Educational Outcomes of the Module

The educational outcome of the module should be evaluated according to knowledge gained by each student and by attitudinal changes.

The following criteria should be used:

1. Student interest in the material covered in the module
2. Student participation in class and laboratory activities
3. Quality of reports presented by students
4. Student performance at the end of the module, compared with performance at the beginning

Sources of Suggested Instructional Materials and References

Instructional materials

"Farm Tractor Maintenance" filmstrip set. Lincoln, Nebraska: University of Nebraska, Agricultural Education Department, College of Agriculture. This filmstrip set includes the following filmstrips.

"Electrical Systems"
"Fuel Systems and Fuel Storage"
"The Engine Cooling System"
"Cooling Systems"

References

1. Ford Tractor Shop Manuel. Tractor and Implement Division, Dearborn, Michigan, Ford Motor Company, 1955-1960.
2. Frazee, Irving and Bedell, Earl L. Tractors and Crawlers. Chicago: American Technical Society, 1963.
3. Promersberger, William J. and Bishop, Frank E. Modern Farm Power. Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1962. Price: $6.28.
4. "The ABC of Internal Combustion," 16 mm. movie, General Motors Corporation.

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INSTRUCTOR NOTE: As soon as you have completed teaching each module, please record your reaction on this form and return to the above address.

1. Instructor's Name_____

2. Name of school_____State_____

3. Course outline used: _____Agriculture Supply--Sales and Service Occupations
   _____Ornamental Horticulture--Service Occupations
   _____Agricultural Machinery--Service Occupations

4. Name of module evaluated in this report_____

5. To what group (age and/or class description) was this material presented?____
   _____

6. How many students:
   a) Were enrolled in class (total) _____
   b) Participated in studying this module _____
   c) Participated in a related occupational work experience program while you taught this module _____

7. Actual time spent teaching module:

		Recommended time if you were to teach the module again:
_____hours	Classroom Instruction	_____hours
_____hours	Laboratory Experience	_____hours
_____hours	Occupational Experience (Average time for each student participating)	_____hours
_____hours	Total time	_____hours

(RESPOND TO THE FOLLOWING STATEMENTS WITH A CHECK (✓) ALONG THE LINE TO INDICATE YOUR BEST ESTIMATE.)

	VERY APPROPRIATE	NOT APPROPRIATE
8. The suggested time allotments given with this module were:		
9. The suggestions for introducing this module were:		
10. The suggested competencies to be developed were:		
11. For your particular class situation, the level of subject matter content was:		
12. The Suggested Teaching-Learning Activities were:		
13. The Suggested Instructional Materials and References were:		
14. The Suggested Occupational Experiences were:		

(OVER)

15. Was the subject matter content sufficiently detailed to enable you to develop the desired degree of competency in the student? Yes_____No_____
Comments:

16. Was the subject matter content directly related to the type of occupational experience the student received? Yes_____No_____
Comments:

17. List any subject matter items which should be added or deleted:

18. List any additional instructional materials and references which you used or think appropriate:

19. List any additional Teaching-Learning Activities which you feel were particularly successful:

20. List any additional Occupational Work Experiences you used or feel appropriate:

21. What do you see as the major strength of this module?

22. What do you see as the major weakness of this module?

23. Other comments concerning this module:

(Date)

(Instructor's Signature)

(School Address)