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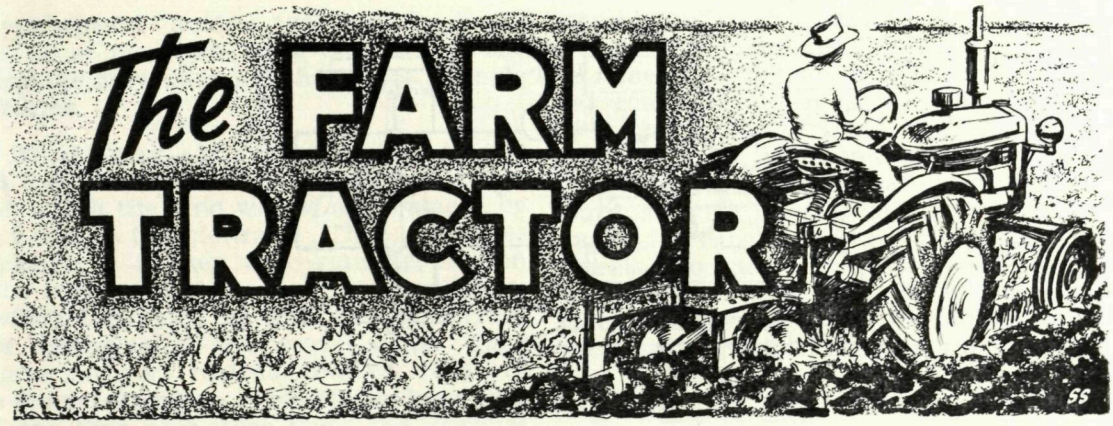
The farm tractor—part.1—tractor types, and some hints on using them



Part 2.—Tractor Types, and Some Hints on Using Them

THE most common type of tractor in this country is the medium-sized four-wheeled general purpose machine, which may have either pneumatic-tyred or all-steel wheels.

The power which a tractor is capable of giving at the drawbar must be transmitted through the rear wheels. No matter how good its engine may be, a tractor will be useless for farm work unless the rear wheels can grip on agricultural land, which is often loose or wet. The steel driving wheels of a tractor are therefore fitted with lugs or strakes, which bite into the soil as the wheels revolve. For the same reason, if the driving wheels are fitted with pneumatic tyres these have a deep tread and are worked at a very low pressure (12 lb. per square inch). The front wheels of a steel-wheeled tractor are provided with flanges which cut into the soil and assist steering. Pneumatic-tyred front wheels generally have treads consisting of one or more ribs running right round the the tyre, but these are less effective than the metal flange, and pneumatic-tyred tractors are sometimes awkward to steer on wet surfaces.

Rowcrop.—Rowcrop tractors are specially intended for use with potatoes, sugar beet and other root crops, which are planted in rows and need to be hoed or cultivated for some time after they have grown above ground. The details in which rowcrop tractors differ from general purpose ones are as follows:—

1. The wheels (either steel or pneumatic-tyred) are narrow enough to go between the rows without damaging the plants.

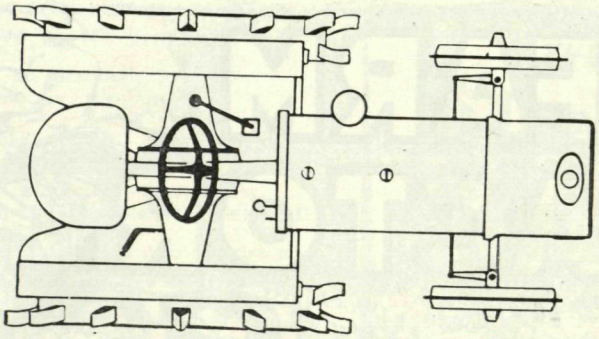
2. The wheels are adjustable on their axles for track width so that they can be made to fit rows of different widths (rows of potatoes, for example, are much wider apart than rows of sugar-beet).

3. The tractor as a whole is high enough off the ground to pass over crops, such as brussels sprouts, in a fairly advanced stage of growth.

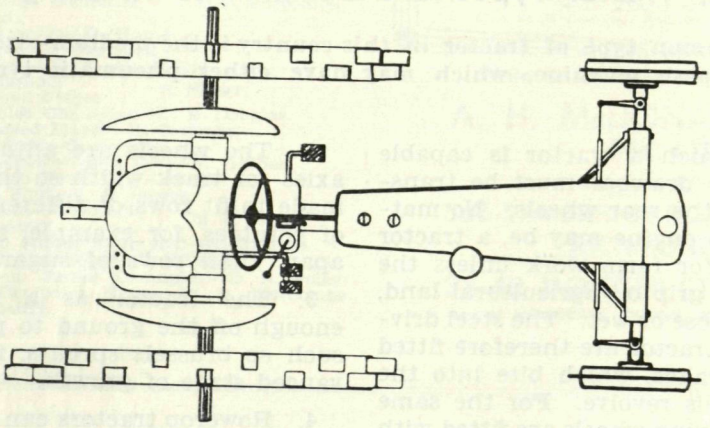
4. Rowcrop tractors can generally make sharper turns than an ordinary tractor so that headlands in the field can be narrower. This is often achieved by fitting independent brakes on the rear wheels. By braking the inside rear wheel, the tractor can be made to turn short on that wheel.

These differences do not, of course, prevent rowcrop tractors from doing ploughing and cultivating. Some rowcrop tractors have only a single wheel at the front, or two wheels so close together as to behave practically as a single wheel. This feature makes it still easier for the tractor to turn sharply, and avoids the extra complication of adjusting the spacing of the front wheels to fit different row widths. Three-wheeled tractors are, however, less convenient for general farm work.

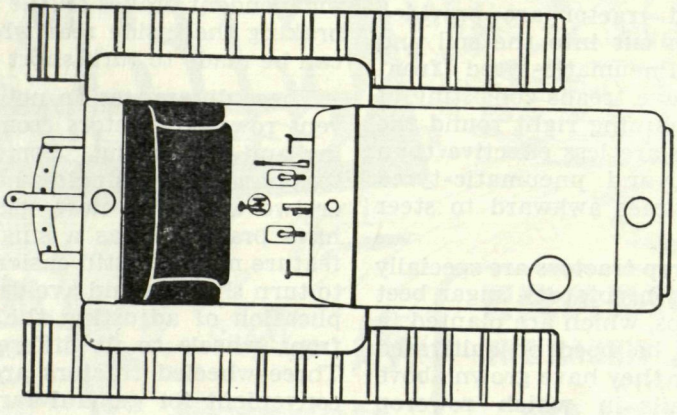
There is a tendency in later tractor models to combine some of the rowcrop and general purpose characteristics in the same tractor. This gives a general purpose tractor with fairly high clearance, adjustable wheels and independent brakes on the



GENERAL PURPOSE



ROW CROP



TRACKLAYING

FIG. 14 TRACTOR TYPES

rear wheels. Such a type may be found to be of more use on a farm where the acreage only warrants the use of a single tractor.

Tracklaying.—The third type of tractor is the "tracklaying" or "crawler" machine on which the land wheels are replaced by an endless flexible track. These machines behave as if they were running, not on the surface of the soil, but on steel rails which they pick up and re-lay in front of themselves as they travel along. They have two very real advantages: they get a much better grip, especially on loose surfaces, than any other type; and, because of the very large area of contact between the tracks and the ground, they do not compress the soil to the same extent as a wheeled tractor of similar weight. They are not very common, however, because they are relatively expensive both to buy and to maintain, although from an engineering point of view they are more efficient than wheeled tractors. Most of the tracklayers used are relatively powerful machines—in fact, a really powerful tractor is almost bound to be fitted with tracks because there is a limit to the pull which a pair of wheels of ordinary size can transmit.

STEEL AND PNEUMATIC-TYRED WHEELS

In designing driving wheels to transmit the heavy pulls required from an agricultural tractor, engineers are facing two difficulties. If, as in the case of steel wheels, the rim is fitted with deep lugs or strakes, the grip is efficient but an appreciable proportion of the total power output of the engine is liable to be wasted in pushing the lugs into the soil. This loss of power is generally called rolling resistance, and is roughly proportional to the speed at which the tractor is travelling. A steel-wheeled tractor cannot be geared to work at a very high speed because it would use up all the power of the engine in getting itself along and have none to spare for pulling an implement.

If, on the other hand, the wheel has a relatively smooth surface, as is the case with pneumatic tyres, the rolling resistance loss is smaller but power is liable to be lost in wheel slip. Everyone knows what wheel "spin" is—for example, when the rear wheels of a motor car spin round on mud or some other slippery surface so that the car comes to a standstill. Wheel "slip" is the same sort of thing in a less acute form: the car or tractor does not come to a complete standstill, but it travels forward a much shorter distance than it ought for each revolution of its driving wheels. In such a case the wheels may be turning five times in order to move the tractor 50 feet along the ground, when if there were no wheel slip four times would do. This leads to:—

1. Waste of fuel.
2. Loss of power at the drawbar.
3. Excessive wear on rubber tyres.

Steel wheels are more suitable for slow, heavy work like ploughing and cultivating, while pneumatics are better for light work like harrowing, manure distributing, or haymaking, which can generally be done at higher speeds. Alternatively, when the same tractor can be fitted with either steel or pneumatic-tyred wheels, it should be worked mainly in the lower gears when fitted with the former and in the higher gears when fitted with the latter. Pneumatic tyres are especially suitable for haulage, and they are almost essential if the tractor is to be used for this work on public roads. Steel-wheeled tractors cannot travel on the roads at all, until they have been fitted with road bands or some similar device for preventing damage to the road surface, and the road bands must be removed again before the tractor can work efficiently in the field. In addition, the grip of road bands is not good enough to allow the tractor to pull any appreciable load on road surfaces.

While on this subject it is worth noting that although tracklaying tractors are highly efficient as regards both rolling resistance and wheel slip, they should always be worked in the lowest possible gear. This is because of track wear which increases more or less in proportion to the speed of travel. Track wear is the most expensive item among maintenance costs, and on sandy or "cutting" soils it may be so great that it is not economic to use a crawler tractor at all. Large implements are necessary to use the full power of a crawler in a low gear.

TRACTOR POWER OR CAPACITY

In some of the preceding paragraphs, such terms as "medium-powered," "relatively low-powered," and so on have been used without explanation. The engineer's measure of a tractor's capacity is its drawbar horsepower. But this "horse-power" bears no relation to the work a horse can do on a farm, i.e., one cannot assume that a ten-horsepower tractor will do the work of ten horses. And so, although a farmer will recognise that a tractor of 15 h.p. is fifty per cent. more powerful than one of 10 h.p. he will probably not know how much to expect from either of them in a day's work when pulling, say, a plough or a cultivator. For this reason another kind of measure is commonly adopted for use on the farm. Instead of specifying the horsepower we sometimes specify how many furrows the tractor should plough at once. This measure is inexact, because the pull required by a given plough will vary with soil, working conditions and the speed of work. Some standards have to be fixed; these are:

1. Speed.—Most ploughing is done at about 3 m.p.h., so this figure is taken.

2. Land.—This is given as "average land." That is land which needs two good or three moderate horses on a single furrow plough at normal width and depth of furrow.

Under these conditions each furrow ploughed needs about 5 h.p. so that—

A 5 h.p. tractor should pull one furrow on average land.

A 10 h.p. tractor should pull two furrows on average land, and one medium-sized tractor of about 15 h.p. should pull three furrows on average land.

When the number of furrows that a tractor should pull is known, the correct widths of other implements can be estimated.

For each 10-inch furrow, a tractor should pull:

Three times the furrow width of cultivator or disc harrow, i.e., 2 ft. 6 in.

Six times the furrow width of heavy harrow, i.e., 5ft.

Five times the furrow width of drill or binder, etc., i.e., about 4 ft.

Thus a 3-plough tractor will handle a 7 ft. 6 in. cultivator or disc harrow, 15 ft. of heavy harrow, 12 ft. of drill or two 6 ft. binders, etc. This gives only an indication; the tractor may pull a bigger implement in easier conditions, and may need a smaller implement in more difficult conditions.

TRACTOR LOADING

In the interests of economy it is important that tractors should be fully loaded. But they should not be overloaded, so that the engine speed is greatly reduced.

There are three ways of adjusting the load to give economical working:—

1. The setting of the implement. Ploughs may be set for wider furrows or have another furrow added, if the load is insufficient. A cultivator may have the two outside tines removed if the tractor is overloaded.

2. Hitching implements together. Seed harrows may be coupled behind a drill—a roller behind disc harrows, etc.

3. Using a higher gear. Light harrows or a drill may be a load in second gear and not in first. It is more economical for a tractor, with the same implement, to work throttled down in second gear than at full throttle in bottom gear.

TRACTOR OPERATION

As a first step in driving a tractor, the operator should familiarise himself with the controls. These are:—

Engine Controls

(a) **Throttle or Governor Lever.**—As has been explained, the control of the throttle is effected through a governor and not, as in the case of a motor car, directly by the operator. The governor control lever is always hand-operated. It does not require continual adjustment during work since the governor automatically controls the engine's response to varying loads.

(b) **Ignition Control.**—There may be an advance-retard lever and an ignition switch. In some makes of tractor these are combined. Some tractors are not fitted with any advance-retard control, but there is always some way of switching off the ignition.

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As the first rains for 1954 are beginning to fall, the farmers of Western Australia are once again ready to commence seeding operations. With these all important activities also come the anxieties associated with them. Farmers' minds will recall events of the past, seasons such as last year for instance, when record rains washed away many hopes for sowing "bumper" crops and in their wake left heavy financial losses. They will also recall the innumerable instances where Caterpillar Track Type Tractor owners, despite swamp like conditions, seeded on schedule because tracks went where wheels couldn't and they reaped a harvest which may have well been lost.

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(c) **Choke.**—There will be some method of choking the engine for starting. Very often this is only a piece of wire attached to the choke, and it may be found by the steering wheel or at the front of the tractor near the starting handle.

Transmission Controls

(a) **Clutch.**—The clutch may be foot or hand-operated: sometimes both types are fitted to the same tractor. On most track-laying machines there are, in addition to the transmission clutch, separate clutches in the final drive to each track. These are hand-operated.

(b) **Gear-box.**—A tractor is not started like a car, by working through the gear-box from bottom to top gear, but is driven off in the gear to be used. Similarly, if the gear is to be changed, the tractor must be brought to rest before making the change. It is very dangerous to try to start the engine without making sure that the tractor is not in gear. The operator should be certain that he knows from the feel of the gear lever when it is in the neutral position and see that it is there before attempting to start the engine.

(c) **Brakes.**—There are various arrangements made for braking different tractors. Some tractors are fitted with independent brakes on the two driving wheels to assist in turning quickly. Tracklaying machines have independent, foot-operated brakes for the two tracks, and these also are used for turning.

STARTING THE ENGINE

First see that the gear lever is disengaged and in the neutral position.

The engine must be started on petrol: see that the vapourising oil tap is closed, and the petrol tap open, or if the tractor is fitted with a two-way fuel tap, see that it is in the petrol position. Make sure that there is some petrol in the petrol tank. See that the radiator blind is pulled up as far as it will go to cover most of the radiator.

Now switch off the ignition, and retard the spark. Many tractors have a combined switch and spark control lever: set this in the "off" position.

Pull the governor control lever one-third out.

On models not fitted with self-starters, pull the choke right out and give four sharp upward pulls to the starting handle. This primes the engine ready for starting. The starting handle should always be pulled up. To avoid possible injury from back-firing get into the habit of cranking with the thumb on the same side of the handle as the fingers.

After priming the engine, open the choke a little, and switch on the ignition, leaving the spark fully retarded. A sharp pull on the starting handle should now start the engine. The engine may take two or three pulls before it fires. Do not re-prime it by pulling out the choke again, unless it is certain that it was not primed properly the first time, since an overchoked engine must be turned over several times to pump out the excess fuel before it will fire. After starting, if the engine is very cold it may need choking slightly until the vapouriser is warmed. Push the choke in as soon as the engine begins to "take hold."

MOVING OFF

Depress the clutch pedal right down and move the gear lever from neutral into the gear which is to be used. In some tractors it may be difficult to get the gear to go in at the first attempt. If this is so, re-engage the clutch, then depress the pedal and try again. Should this also fail, keep the clutch pedal down, hold the gear lever firmly in the direction you wish it to go to engage the selected gear, and very gradually release the clutch. If this is done very slowly the gear will slip in easily. When in gear, advance the ignition to the working position, and open the governor lever until the engine is running at working speed. Now ease in the clutch, allowing the engine to take the load gradually. When the clutch is fully engaged remove your foot from the pedal entirely as "clutch riding" wears out the clutch thrust mechanism.

If the clutch is let in suddenly, there is a big shock on the transmission, a danger of stopping the engine, and where the load is heavy, a danger of causing the tractor to rear up, raising the front wheels off the ground. Should this occur, "throw" the clutch at once and the front will return to the ground. This is most likely to occur with a very heavy load, when the rear of

the tractor is in a hollow or furrow, or when the tractor is facing up a hill, and great care should be exercised in moving off from such positions.

Once the tractor moves off, the governor will control the engine, maintaining an even speed although the load may fluctuate.

STEERING

Steering a wheeled tractor calls for no comment, since it is exactly the same as steering a car or lorry. A tracklaying tractor, however, cannot be steered in the same way as one with wheels; one of the tracks must be declutched or braked so that the other one pushes the tractor round. Instead of a steering column and wheel it will have a lever and a pedal on each side, so that when the left hand lever is pulled, and the pedal depressed, the tractor will turn to the left, and vice versa. It follows that a tracklaying tractor can turn in its own length by spinning round on one track. This is to be avoided as a general practice, and used only in an emergency, owing to the unnecessary strain thus imposed upon the tracks. In turning a tracklayer in ordinary work, the inside track should be kept moving.

SUBSEQUENT OPERATION

Radiator Temperature

If there is a radiator thermometer or temperature indicator, watch it during the first five minutes after starting. When it indicates about 190°F., or the pointer is in the green section of the scale, change over to vapourising oil by first closing the petrol tap, and then opening the vapourising oil tap, or by changing the tap over if the tractor is fitted with a two-way tap. The radiator blind must be partially lowered, covering only so much of the radiator as will serve to prevent the temperature from falling below 190°F. or the indicator from pointing to the "cold" section of the scale. If the tractor has no temperature indicator or thermometer, plough the first bout on petrol, or run the engine for at least five minutes on petrol before changing to vapourising oil. When first on vapourising oil leave the blind fully up until the engine just boils. This will be indicated by a wisp of steam coming from the radiator.

The blind should now be lowered a few inches. If steam appears again repeat the lowering of the blind until a point is found where steam ceases to show at the bottom of the radiator. Then the water temperature will be maintained just below boiling, and should be kept as near this temperature as possible during all work. No great harm is done if the water boils, so long as the radiator does not boil dry, but considerable damage can be done by keeping the engine too cool. This allows unvapourised fuel to reach the cylinders and so go past the pistons to the sump where it dilutes the oil and destroys in great part its lubricating qualities. Should the engine inadvertently be allowed to boil dry, do not add fresh water until the back of the hand can be comfortably applied to the cylinder head, otherwise there is a danger of cracking the cylinder block by sudden cooling.

If the engine is stopped for any reason during work and stands for longer than a minute or two, it must be restarted on petrol, as the vapouriser soon becomes too cool to vapourise the heavier fuel. If the weather has been cold, try, during the last hour of each day's work, to bring the radiator water almost to the boil by raising the blind. This will evaporate unwanted fuel from the lubricating oil and preserve its quality.

Jet Setting

Where a variable jet is fitted to the carburettor on a tractor engine it is of the utmost importance to see that it is correctly set. With an incorrectly set jet a tractor may use nearly double the normal quantity of fuel in a day without doing any more work. Therefore the jet should be set as follows:—

1. Put the tractor in work, e.g., ploughing.

2. As the tractor is working screw the needle down gradually until the engine begins to falter and lose power.

3. Open the jet $\frac{1}{8}$ to $\frac{1}{4}$ of a turn.

This setting should be checked on a number of jobs to ensure the maximum fuel economy for varying loads.

Stopping the Tractor

Throttle the engine down to about half speed and retard the spark. Put the clutch out, move the gear lever to the neutral

position, and let the clutch back. If the tractor is on pneumatics and rolls forward, apply the brake, or anchor the clutch pedal down.

Turn on to petrol for a minute or two before stopping the engine. Finally switch off the ignition and put the tap in the closed position.

On no account must the engine be allowed to stop with vapourising oil in the vapouriser, as it will prove very difficult to start after it has cooled off. Should this be allowed to happen, the float chamber must be drained through the drain cock at the bottom, before the petrol is turned on.

Note that if the vapourising oil tap is opened while the petrol tap is open, some vapourising oil will find its way into the petrol tank and mix with the petrol, rendering starting difficult, so be careful to see that both taps are never open together.

Coupling the Tractor to an Implement

The tractor must be reversed back to the implement until the jaws of the implement hitch fit over the drawbar plate, and the clevis pin pushed into place, locking the two together. The operation of backing the tractor on to an implement calls for a considerable degree of care. This operation has been the cause of many accidents. Halt the tractor 18 inches or so from the implement and throttle the engine right down so that it is just ticking over. Now ease the clutch in very carefully so that the tractor moves back on the implement very slowly. On no account take the foot off the clutch pedal, and be ready at all times to "throw" the clutch at once

When coupling to an implement with a rigid drawbar a helper is generally needed. He should hold the drawbar so that as the tractor backs, the tractor hitch-plate enters the jaws of the drawbar clamp. The helper should stand in such a position that he can readily get out of the way if something goes wrong. He must certainly not get on his hands and knees, for example, to see better what is happening. If the clevis pin is held in position on the top of the drawbar clamp, it can be pushed down as soon as the holes come into line and thus secure the tractor. It is often difficult to hold the tractor in exactly the right position because when the clutch is "thrown" the tractor rolls forward an inch or so. With a plough the drawbar can often be brought into alignment by moving the hitch control lever, or by pushing on the land wheel of the plough to move it forward slightly.

When coupling to an implement with a flexible chain hitch there is no trouble: just put the tractor near enough to the implement to come within the range of the hitch and pin the clamp to the drawbar plate.

(To be Continued)