

# HOWARD ROTAVATOR

## 200

## Instruction Book

THE WORLD'S LEADING MANUFACTURER OF ROTARY TILLAGE EQUIPMENT

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# HOWARD ROTAVATOR

BUILD YOUR OWN

THE HOWARD ROTAVATOR 200 RIDGING

The Howard Rotavator 200 is a machine built to give years of trouble-free service. It has power to the wheels as well as the rotor and is designed to take a full range of ancillary equipment. It is simple and robust and at the same time light and easy to handle.

All machines, however, will give far better service if they are regularly maintained. This handbook, as well as the engine instruction book, should be studied before the 200 is put to use.



## Section 1 SPECIFICATION

Engine—Villiers 12/1 H.S. 4-stroke petrol engine developing 1.95 b.h.p. at 3,400 r.p.m., equipped with recoil starter, 55 m.m. bore x 50 m.m. stroke, 120 c.c. capacity.

**Fuel Tank Capacity:**  
½ gallon. (2½ litres).

**Clutch:**  
Tilting platform over-centre clutch.

**Transmission:**  
Two-speed V-belt drive to worm shaft.  
Speeds .75 m.p.h. and 1.5 m.p.h. at 3,400 r.p.m. engine speed. Rotor speeds 173 and 330 r.p.m. Worm gear drive to land wheels, incorporating free-wheel, one-wheel or two-wheel drive.

**Controls:**  
Throttle (Governor) control by Bowden Cable.  
Clutch control by push rod.  
Wheel lock control.

**Handlebars:**  
Adjustable for height.

**Rotavator:**  
Worm gear driven, centre drive Rotavator. Standard width 10 in. (25 cm.) fitted with three left-hand and three right-hand blades. Extendable to 15 in. (38 cms.) (four left-hand, four right-hand blades). Optional side shields available.

**Dimensions:**  
Length 53 in. (135 cms.).  
Width (over handlebars) 23½ in. (59 cms.).

**Weight:**  
164 lbs. (75 kgs.).

**Extra Equipment:**  
Side Shields, Furrower, Waterproof canvas cover, Tool bar.

**Approved Equipment:**  
Hedge Trimmer and flexible drive equipment, Circular Saw.

**Serial Number:**  
The serial number of the machine is stamped between the two implement coupling clamps on the rear end of the main drive housing and also on a brass plate attached to the rotor shield.

**NOTE:** All directions are given left and right from the normal driving position at the rear of the machine.

**P.T.O. Speed:**  
1,785 and 3,400 r.p.m.

**Pulley Diameters:**  
Engine Pulley 3 in. and 4½ in. Driven pulley 5½ in. x 4½ in.

## Section 2 THE NEW MACHINE

On receipt of your Howard Rotavator '200' check for damage in transit, tighten any loose nuts and bolts, make sure that you understand the details of lubrication and maintenance (given in Section 7) and study both this book and the engine handbook. Check that the machine is fully lubricated.

The machine should be 'run in' for the first ten hours during which care should be taken not to give the engine continuous spells of heavy lugging work.

After the first ten hours work drain and refill both the main drive housing and the rotor drive housing.

## Section 3 CONTROLS

The controls of the '200' are simple and easy to master.

1. The Throttle Lever (engine governor control) is on the right handlebar. Inward movement increases the engine speed.

2. The Engine Clutch is controlled by the push-pull lever below the handlebar cross piece. Pulling the lever tensions the V-belt and engages the drive.
3. Drive to the wheels is engaged by the 'L' shaped lever above the handlebars cross piece. When turned anti-clockwise the drive to the wheels is disengaged. Turning the lever a quarter-turn clockwise engages the left-hand wheel only. Turning it a half-turn engages both wheels (the normal operating position). Wheel-drive must be disengaged if it is required to trundle the machine.
4. Handlebar height is adjusted by loosening the hand nut on the main clamp bolt so that the handlebars may move in the slot provided.
5. Depth of work on the Rotavator is controlled by positioning the depth control lever in the required hole of the depth control quadrant. If the lower of the two holes in the skid is used, greater depth can be obtained if required.

## Section 4 OPERATING THE MACHINE

1. Choose the pulley ratio required for slow (digging) speeds or faster (hoeing) work. The front pulleys give the faster speed, the rear pulleys the slower. Push the clutch rod forward to slacken the V-belt and guide it into the pulley grooves required. *Do not change pulley ratios with the engine running.*
2. Start the engine according to the engine handbook.
3. The machine may be wheeled at high speed to the plot if path surfaces are smooth. When wheel drive is required, turn the wheel lock lever fully clockwise, swivelling the machine slightly on its wheels to ensure engagement of the wheel lock pins. Then increase engine speed on the throttle lever and pull out the clutch rod to engage the drive. If driving along paths etc., lower the depth control skid to ensure that the blades are clear of the ground.
4. To start work, set the depth control lever to the depth required, open the throttle and pull out the clutch. Do not attempt to go too deep on the first pass. Increase the depth gradually in previously uncultivated ground. If depth is set too great on hard ground the machine may jump forward due to the thrust of the blades.

## Section 5 IMPLEMENT COUPLING

The Rotavator unit may be removed by slackening the clamp bolt (Illustration No. 51) and opening the two clamps. This will free the attachment which is then withdrawn from the rear. Make sure that the clamp bolt is properly tightened on replacement.

## Section 6 LUBRICATION AND MAINTENANCE

Although your Howard Rotavator '200' is sturdily built and designed to give years of trouble-free life, regular attention to maintenance, especially to the engine air cleaner and to keeping all nuts and bolts tight will make all the difference in ensuring satisfactory service.

### RECOMMENDED LUBRICANT

Engine (see Engine Handbook). Below 90°F SAE.30. Above 90°F SAE.40.

Air Cleaner Oilbath—use engine oil.

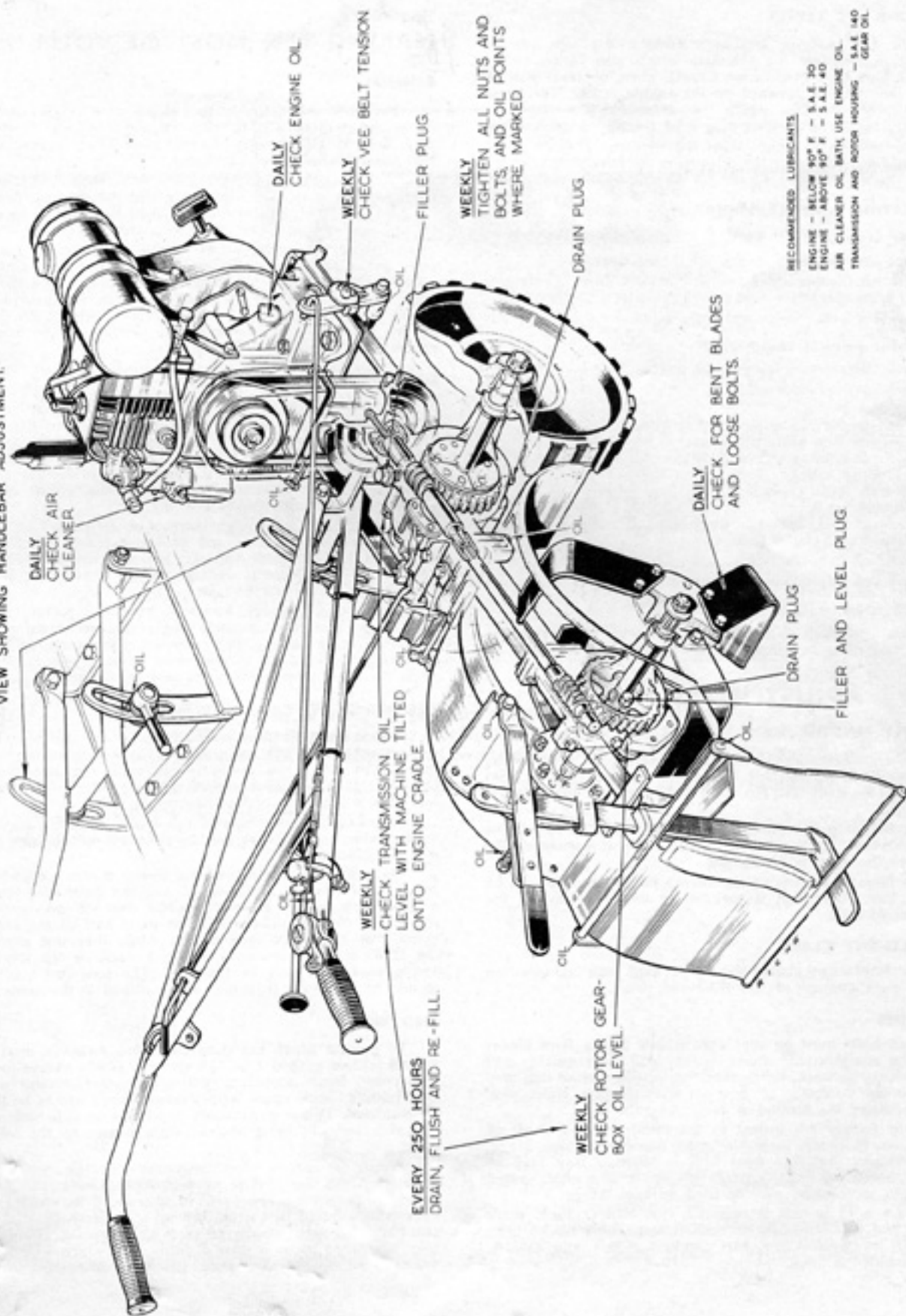
Transmission & Rotor Housings. SAE.140. Gear oil.

Capacity. Transmission Housing ½ pint (.3 litres). Rotor Housing ½ pint (.2 litres).



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VIEW SHOWING HANDLEBAR ADJUSTMENT.



## RECOMMENDED LUBRICANTS

ENGINE - BELOW 80° F. - S.A.E. 30  
ENGINE - ABOVE 80° F. - S.A.E. 40  
AIR CLEANER OIL BATH, USE ENGINE OIL  
TRANSMISSION AND ROTOR HOUSING - S.A.E. 140 GEAR OIL

## LUBRICATION AND MAINTENANCE CHART

## CHECKING OIL LEVELS

1. **Main Transmission Housing.** Remove the top forward setscrew securing the sideplate which also forms an oil level plug (See Lubrication Chart). Then, on level ground, tip the machine forward on the engine cradle. This gives the correct level at which the oil should just seep over the threads. The oil filler plug is on the top of the housing.
2. **Rotor Worm Housing.** With the machine horizontal, oil should just seep over the threads of the filler plug hole. To top up, the machine should be tilted on one side.

## LUBRICATION AND MAINTENANCE SCHEDULE

### Daily (or every 8 hours' work)

1. Check engine oil, and top up if necessary.
2. Check Air Cleaner, clean and change oil if dirty. (This may need doing more than once a day in very dirty conditions.)
3. Check for bent blades and loose bolts.

### Weekly (or every 50 hours' work)

1. Check transmission housing oil level.
2. Check rotor gearbox oil level.
3. **Oil.**
  - (a) Implement clamp bolt and hinges.
  - (b) Engine base plate pivot bolt.
  - (c) Clutch lever spindle and rollers.
  - (d) Throttle lever.
  - (e) Depth lever pivot and clip.
  - (f) Shield hinge.
  - (g) Wheel Lock Trunnion and bush.
  - (h) Handlebar clamp bolt.
4. Tighten all nuts and bolts.
5. Check and adjust Vee-belt tension.

### Every 250 hours' work

Drain and flush (with thin oil, not with paraffin) transmission and rotor housings. Refill with fresh oil SAE.140.

## Section 7 ADJUSTMENTS

### 1. V-BELT TENSION

The drive belt must be kept tight, but should not be over-tightened. To adjust the belt, loosen the wing nut (Ill. No. 134) and rotate the cam (Ill. No. 135) until the necessary tension is obtained.

The belt stop (Ill. No. 122) should be adjusted to suit the engine position. Its purpose is to check the movement of the belt when the drive is disengaged.

The faces of the engine and driven pulleys must always be kept in line. Alignment is secured by the Gib Key on the engine crankshaft.

### 2. IMPLEMENT CLAMP

The Implement clamp should be kept well tightened to prevent misalignment of the Rotavator Unit.

### 3. BLADES

Blade bolts must be kept tight (check daily). Bent blades should be straightened, otherwise they will wear quickly and lose efficiency at work. When replacing blades, ensure that they are mounted correctly to give an even cutting effect with blades entering the ground at even intervals.

Rotor flanges are drilled to accommodate two, three or four blades. Normally three blades are mounted to each flange, facing inwards, but if a finer tilth is required four may be fitted. If a coarser finish is required, two blades only, spaced at 180° to each other, may be used on each flange.

Where a 15 in. cut is required, two blades should point inwards and two outwards on each flange. These blades must be the 10 in. Bantam type, part numbers 20565L and 20565R, if side shields are fitted.

## Section 8

## MAKING THE MOST OF YOUR '200'

### GENERAL

The '200' will cultivate to a depth of 8 in. (20 cms.), but two passes will usually be required. An average first pass of 4 in. to 5 in. (10 cms. to 13 cms.) should be obtained in soil that has previously been cultivated.

If the surface of the ground is very hard or baked, the depth control should be adjusted so that the machine just bites the surface. Further passes should then be made at increased depths, until the required depth is reached.

Generally speaking, when hoeing in cultivated land the front pulley (high ratio) can be used. But the rear pulley (low ratio) should always be used for working virgin land or heavy soil. Never overload the engine by using high ratio where the load is too heavy to be carried easily. On lumpy ground do not try to counteract the jumping of the machine; just hold the handlebars lightly.

### HINTS ON CROPPING LAYOUTS

For the grower at home, mechanical cultivation requires a wider spacing than hand work. Experience shows that 36 in. (90 cms.) is the most suitable spacing. Tall crops e.g. peas and beans, should be sown to 6 ft. (180 cms.) centres and the intermediate crops should be at 3 ft. spacing and of the low variety. This enables the maximum amount of mechanical cleaning to be done while the crop is growing.

At first sight, this might suggest more ground has to be cleared, and so more time and labour involved. But the '200' will make the two passes necessary between each row so quickly and easily—and without damage to the growing crop—that much time and toil will be saved.

Commercial growers, however, may well prefer to plant their crops at normal spacings to give the maximum possible quantity for the acreage. Most growers, commercial and home, appreciate the need for a rotation of crops. It is a mistake to plant the same crop in the same row season after season.

### PREPARING THE LAND FOR WINTER

When heavy land is to be laid up for the winter, the surface should be left rough. By using the furrowing attachment during this late autumn cultivation, the operator can leave the land in ridges. These will promote better drainage and expose a greater surface area to the weather.

If heavy land is rotavated too finely and left bare to the winter rains, the soil may run together and spring cultivations will be difficult.

On light land two courses are open: it may either be left rough, or it may be cultivated to medium depth and sown to a green crop e.g. rye grass. The green crop will prevent leaching out of the soil nitrogen. In the early part of the year the green crop should be rotavated in. More than one pass with the '200' may be necessary. After a week or ten days, the spring seed beds may be prepared. The seed bed rotavation should be shallower than that which turned in the green crop.

### SEED BEDS

In ground which has been cultivated properly, seed beds should seldom exceed 2 in. (5.1 cms.) in depth, except for certain crops. Seeds require a well-aerated shallow soil with a firm bottom. Some small seeds require a seed bed to be lightly consolidated. This is particularly important on light soil, where consolidation will bring the moisture nearer to the seedling plant.

Weeds are at their most dangerous when the crop is in the seedling stage. To obtain weed-free seed beds, the ground should be prepared a few weeks in advance of the sowing dates. Cultivation should be carried out up to a depth of 4 in. (10.8 cms.) and this causes any weed seeds to germinate. These weeds may be turned in by a second cultivation which will prepare the seed bed at the same time. It is most important that this



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second cultivation is more shallow. Remember that the ground is now more open and the machine will consequently tend to dig more deeply. When the seed bed has been prepared, it should ideally be allowed to settle for 24 hours before sowing.

## WEED CONTROL

Rotavation produces a well aerated, warm seed bed in which germination takes place readily. Inevitably, these conditions also favour weed seeds.

Weeds are eliminated by preventing them from flowering or from feeding the deep tap roots or rhizomes. They are killed most easily and inexpensively by rotavating them directly they show green. Annuals will be killed off outright and perennials will be reduced until they too die out. This is true even of such persistent weeds as couch and twitch.

If a particularly tall dense infestation of weeds is to be tackled as much weed as possible should be cut away and burned before rotavation begins. If conditions still seem severe, it may be necessary to take only half widths of cut at a time with the '200'. If the dense weed shows a tendency to twine itself thickly round the rotor, the machine should be stopped, the rotor disengaged and turned manually in a backwards direction so that the tangled weed unwinds itself. It may sometimes be necessary to cut away thickly entwined weed with a knife. As a safety precaution the engine should be stopped before the above procedure is carried out.

## ROW CROP WORK

Work will be easier if rows are made as long as possible. A yard should be allowed at either end for turning.

Weeds between rows may be controlled by rotavating in high ratio, under almost all conditions, while the weeds are small. This will not prevent weeds from growing in the rows themselves. Such weeds must be controlled by hand-hoeing when small. If the land is infested with weeds which have seeded, the following crop should be a cleaning crop e.g. roots or potatoes, which will give a period of several weeks in the early part of the year when the weed seeds will shoot and can be killed by subsequent rotavation.

In planning your crops so that the best use may be made of the '200' two or three inches (about 6 cms.) over the overall width of the machine should be allowed on either side.

## GREEN MANURING

Land not immediately required may be sown down to such crops as mustard or rye grass during the spring and summer, or rye during the winter. These crops should be allowed to mature if they are to be used as green manures; they will then have the best effect on the soil. A winter cover crop will preserve plant foods which would otherwise be leached away, and need not be allowed to mature.

The '200' will be found most useful for intimately mixing lime into acid soils and for working in gypsum, as a soil conditioner, and the whole range of artificial manures.

## Section 9 ATTACHMENTS

### 1. FURROWER

The Furrower is used for opening drills and furrows and splitting ridges for potato planting etc.

The Furrower is fitted on to the depth lever skid. Release and turn the clip to allow the control lever to be pulled sideways until the pin engaging the skid is withdrawn; then pull out the depth control skid from under the rotor shield.

Assemble the furrowing attachment on to the depth control skid, leaving the bottom of the attachment about  $\frac{1}{4}$  in. above the foot of the skid, or as required for the crop to be planted, and tighten locking nut. Refit the assembly to the machine and re-connect the depth control lever.

### Using the Furrowing Attachment

The furrowing attachment is used with the rotor engaged so that the combined operations of cultivating and furrowing are carried out. The depth of the furrow is controlled in the same way as the depth of cultivation. For deep work the skid is raised so that the furrowing attachment is as close to the underside of the shield as possible. After a little experience it will be found easy to maintain the planting width required by judging the distance between the wheel and the thrown-up soil.

When 'splitting the ridges' for earthing up potato handling is easier if alternate ridges are split first, so that each wheel is resting equally, either on the slopes of the ridge which is being straddled or partially supported on soil thrown up each side by the adjacent half earthed-up furrows. In this way the machine will always be level.

### 2. TOOLBAR

The '200' can be used successfully for hoeing or cultivating between narrow spaced crops. Left and right handed hilling ploughs can be used to lightly earth up plant rows and a small single plough can be fitted which may be useful for planting bulbs etc.

#### Fitting

N.B. The Toolbar can be mounted on the front or the rear of the tractor. It is normally despatched assembled for the rear mounted position.

1. Remove the Rotor unit or other attachment from the machine.
2. Place the assembled toolbar flat on the ground.
3. Pull the machine into the centre of the square formed by the framework, insert the rear mounting frame and tighten the clamps.
4. Align the holes of the front cross member with the corresponding holes in the engine cradle and fasten with the two bolts and nuts provided.
5. Attach the appropriate tools in the slots of the frame and space them according to the crop.

#### To use the Toolbar in front of the machine

1. Leaving the rear clamp and front bracket attached to the machine, undo the three bolts on each of the side members and remove the toolbar frame.
2. Reverse the frame and place it in front of the machine with the wheel leading.
3. Reconnect the side members, this time with the single hole at the rear connected to the forward of the two holes on the rear mounting bracket and the front connected to the two corresponding holes in the toolbar frame and, at the same time, to the front bracket.
4. Reverse the direction of the tools on the toolbar frame and space them according to requirements of the crop.

#### Working Instructions and Adjustments

1. The gear ratio should be used according to conditions but normally high ratio (front pulley) is required.
2. The Depth Control Wheel is altered for height by loosening the clamping bolt and raising or lowering the wheel in the block. In certain conditions it may be preferable to remove the wheel entirely.
3. The toolbar frame must be levelled to obtain even penetration on both lines of tools by slackening both bolts on each side, the one in the centre riding in a slotted hole. The tool frame can then be levelled by pivoting about the other bolt and then re-clamp.

#### Lubrication and Maintenance

1. The Depth Wheel and pedestal should be lightly oiled with engine oil.
2. The bright surfaces of all tools should be well greased when not in use.
3. All nuts and bolts should be kept tight.