Howard Rotavator
Bantam
Owner’s Handbook - Manual - Instructions

CONTENTS

The Howard Rotavator 'Bantam'

GENERAL

ROTAVATION is a new method of cultivation successfully followed by farmers and commercial growers in more than ninety countries.

The distinctive feature of any Rotavator is its powered rotating shaft, on which are mounted a number of soil-working blades. As the Rotavator moves along, each blade shears off a small volume of soil, lifting and aerating it, and then returning it loosened in the form of a perfect tilth.

At the same time, the sharp leading edge of each Rotavator blade chops up the vegetation above and below ground, and intimately mixes the chopped up trash evenly through the tillage depth where it will rapidly decompose into soil building humus.

Your 'Bantam' is really a large Rotavator in miniature, a machine that has been designed especially for the small-scale operator. Used wisely and with understanding, it will bring you easier, better and more profitable cultivation.

This book tells you how to use and care for your 'Bantam.' It does not include, however, detailed instructions for the larger maintenance operations—for example, those which become necessary after long service. These should be handled by your Rotavator Dealer.

Instructions for the operation and maintenance of the engine on your 'Bantam' will be found in the special Engine Handbook issued with each machine. Special instruction sheets are issued for 'Bantam' attachments.

BRIEF SPECIFICATION

ENGINE See Engine Handbook.

TRANSMISSION AND GEARBOX. The primary drive from the engine is by V-belt to high and low ratio pulleys. The front belt pulley gives high ratio, i.e. the faster speed; the rear belt pulley gives low ratio, i.e. the slower speed. The drive is then by a worm shaft to a 2-speed gearbox.

Four travel speeds are thus provided. Speeds vary according to the type of engine fitted but the following table gives a fair average:

	TRAVEL	ROTOR
	Low Ratio	
Fast	1.25 m.p.h.	171 r.p.m.
Slow	.63 m.p.h.	171 r.p.m.
	High Ratio	
Fast	2.00 m.p.h.	268 r.p.m.
Slow	1.00 m.p.h.	268 r.p.m.

ROTOR AND BLADES. The 'Bantam' has a 10 in. (25.4 cm.) or a 14 in. (35.6 cm.) rotor, with flanges carrying eight hoe blades. Four of these are right-handed, and four left-handed blades. The drive to the rotor is by worm gear. Depth of cultivation is adjustable to a maximum of 8 in. (20.3 cm.), but the practical depth of cultivation will be determined by soil conditions and the type of work to be done (see page 3).

P.T.O. PULLEY. The pulley (Ill. No. 129) has the following speeds:
High Ratio: 1,964 ft./min.
Low Ratio: 3,070 ft./min.

DIMENSIONS AND WEIGHT. Length overall: 5 ft. 2 in. (157.5 cm.). Width overall: 1 ft. 3 in. (38.1 cm.). Average weight (with rotor unit): 200 lbs. (90.72 kgs.).

CONTROLS

(all directions left and right are given from the rear of the 'Bantam' looking forward).

THROTTLE. The throttle lever is fitted to the right-hand handle-bar and serves as a variable speed governor.

CLUTCH. The clutch control rod is mounted between the handlebars. Pulling out the rod tightens the vee-belt and engages the drive, and vice versa.

GEAR AND ROTOR CONTROLS. The upper gear control rod operates the travel speed gearbox. Neutral position is in the centre of the gear control gate. To select top gear turn the control rod to the right, so lifting the selector pin, then push the rod forward to engage the pin in the lower slot in the gate. To select low gear operate the rod in the same way, but pull it backwards to engage the pin in the upper slot in the gate.

The lower control rod engages and disengages the rotor in the same manner.

DEPTH CONTROL LEVER. This is situated above the rotor shield. To lower the rotor for deeper work, raise the lever. To decrease the depth of cultivation, push the lever down. N.B.—The lever must be moved slightly to the side before movement up or down can take place.

SWINGING THE HANDLEBARS. Toggle links are provided (Ill. Nos. 4, 6 and 7) so that the handlebars may be swung to either side of the machine without releasing grip. All that is necessary is to pull the handlebars to the desired side, at the same time keeping the machine steady. Be careful to keep the hands clear of the toggle links.

HANDLEBAR HEIGHT ADJUSTMENT. A handlebar clamping lever is provided centrally on the right-hand side of the machine. By slackening the lever, the handlebars are freed and may be moved to the desired position. Tighten the lever again after adjusting.

LUBRICATION (See Diagram 1, Pages 12 and 13)

(Instructions for the engine, are given in the Engine Handbook).

RECOMMENDED LUBRICANT: Use S.A.E. 140 throughout.

GEARBOX. The main gearbox contains two level plugs and fillers. The Worm Drive gearbox (level plug 'B' filler plug 'A') has a capacity of ¼ pint (.14 L); it should be inspected, topped if necessary, up to the level plug after every 24 hrs. work, and drained and refilled after every 200 hrs. work. The Change Speed gearbox (level plug 'D' filler plug 'C') has a capacity of 3/5 pint (.34 L); it should be inspected and, if necessary, topped up to the level plug after every 24 hrs. work, and drained and refilled after every 200 hrs. work.

ROTOR WORM GEARBOX. The gearbox has a capacity of ¼ pint (.14 L). A filler plug is provided at 'F' and a level plug at 'G'. The gearbox should be inspected and, if necessary, be topped up after every 24 hrs. work, and drained and refilled after every 200 hrs. work.

ROTOR AXLE CAP ('H'). Remove the screw plug and oil after every 24 hrs. work.

ENGINE MOUNTING OIL CUPS ('I'). The four engine mounting oil cups should be oiled after every 24 hrs. work.

DEPTH CONTROL. Oil moving parts occasionally.

HANDLEBARS AND LINKAGE. All moving parts should be lightly lubricated with engine oil every 24 working hours to prevent rust.

Operating Instructions

STARTING

Ensure that both gear levers are in the neutral position and the clutch lever is in the forward position. Start the engine as explained in the separate Engine Handbook.

Having set the rotor to give the depth required, select the appropriate travel speed. Then engage the rotor gear and engage the clutch by pulling the control rod upwards.

STOPPING

Disengage the clutch by pushing the control rod downwards; return the rotor drive control rod, and then the travel speed control rod, to neutral; then stop the engine as explained in the Engine Handbook.

GENERAL

During the first 24 hours of work, the 'Bantam' should be used for light cultivation only, so that the engine may be properly run in on a light load. Read the section "Making the Most of Your 'Bantam'" before you put your machine to work.

At first, the following method will be found best for turning the 'Bantam' at row ends etc.: disengage the clutch and put the rotor drive control rod into neutral. Then re-engage the clutch and proceed with a turning motion in the desired direction. Experienced owners, however, will find it quite easy to raise the handlebars of the 'Bantam' and swivel the machine round, with the rotor still running—but great care should be taken to keep one's feet clear of the rotor.

It is easier to cultivate in strips planned so that one does not have to turn the 'Bantam' in its own length.

Making the Most of Your 'Bantam'

GENERAL

The 'Bantam' will cultivate to a depth of 8 in. (20.3 cm.), but two passes will usually be required. An average first pass of about 5 in. (12.7 cm.) 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. A picktine rotor may be used for exceptionally heavy land or for land that is badly compacted.

Generally speaking, when operating on 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 very 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 handwork. Experience shows that 36 in. (91.4 cm.) is the most suitable spacing. Tall crops, e.g. peas and beans, should be sown to 6 ft. (182.9 cm.) 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 that more ground has to be cleared, and so more time and labour involved. But the 'Bantam' 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. The operator will be able to tell from the quality of the work whether high ratio or low ratio should be used. 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 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 'Bantam' may be necessary and if the crop is mature, it may have to be cut first. 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. Rotavation should be carried up to a depth of 4 inches (10.1 cms.) and this causes any weed seeds to germinate. These weeds may be turned in by a second rotavation, which will prepare the seed bed at the same time. It is most important that this second rotavation 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 hrs. 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 reaching flower 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 should be cut away and burned before rotavation begins. If conditions still seem severe, it may be necessary to take only a half width of cut at a time with the 'Bantam'. If, during rotavation, 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, fast travel speed, under almost all conditions, while the weeds are small. But this will not prevent weeds from growing in the rows themselves. Such weeds must be controlled by hand-hoeing when small. Should the land become filthy because these weeds have been allowed to seed, 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 Rotavation.

The overall width of the 'Bantam' is 15 in. (38.1 cm). Actual width of cultivation is 10 in. (25.4 cm.) or 14 in. (35.6 cm.) according to the rotor fitted. In planning your crops so that the best use may be made of the 'Bantam', two or three inches (about 6 cm.) over the overall width of the machine should be allowed on either side. This means that the minimum planting or sowing distance is about 19 in. (48.3 cm.). Such a sowing would require one Rotavation for hoeing with a 14 in. rotor fitted; two overlapping Rotavations with a 10 in. rotor. These Rotavations should be done in high ratio, fast travel speed.

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.

To turn in the green manure crop: ratio and travel speed will be determined by the state of maturity of the crop. A satisfactory result should come from low ratio, slow travel speed.

The 'Bantam' 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.

OPERATING HINTS

1. Regular and correct lubrication is essential.
2. The throttle must always be shut to idling position when engaging or disengaging the travel speed control rod.
3. The engine must not be allowed to idle at slow speeds for long periods.
4. Never run the 'Bantam' with the engine labouring. By selecting the right ratio and correct depth of work and travel speed, a reserve of engine power will always be kept in hand.

Adjustments

IMPORTANT. STOP THE ENGINE AND PUT ALL GEARS INTO NEUTRAL BEFORE MAKING ANY ADJUSTMENT.

ENGINE BELT DRIVE. A simple wing nut is fitted to enable the tension of the engine belt drive to be adjusted. This is located on the right-hand side of the engine. Tension is applied by turning the wing-nut in a clockwise direction.

PULLEY BRAKE. To counteract the tendency of the pulley to creep when the engine is idling, a fibre block maintains a slight pressure against the side of the driving wheel pulley. After gradual wear has taken place the block should be moved nearer to the pulley and elongated bolt holes have been provided to permit this. Clamp up securely after adjustment.

TRAVEL SPEED CONTROL ROD. To adjust: remove split pin (Illus. No. 51), screw the eyebolt (Illus. No. 50) on the rod nearer to the forked end and replace the split pin.

ROTOR CONTROL ROD. To adjust: tighten the two locknuts (Illus. No. 61).

REMOVING THE ROTOR UNIT. When the 'Bantam' is to be used with attachments, it will often be necessary to remove the rotor unit. This may be quickly detached by slackening the two nuts on the swivel bolts (Illus. No. 77) on the drive shaft housing at the rear of the gearbox on the left-hand side of the machine, and also the two nuts and swivel bolts (Illus. No. 28) on the main frame on the right-hand side of the machine. See that these swivel bolts are clear of their gates and then pull the rotor unit clear. It is worthwhile placing a block of wood under the engine mounting before detaching the rotor unit. This prevents the front of the machine from dropping violently when the rotor is removed.

Care should be taken after removing the rotor unit, to prevent oil escaping from the dog clutch chamber. This can be done by tilting the 'Bantam' upwards so that the engine mounting rests on the ground.

Maintenance

GENERAL

Keep all nuts and bolts tight. Remember to lubricate your 'Bantam' regularly and correctly.

BLADE FITTING

The 'Bantam' is normally delivered with the blades already fitted. If it is necessary to fit your own blades, this is the way it should be done:

1. Identify left-hand and right-hand blades.
2. The left-hand flange carries two right-handed blades; the right-hand flange, two left-handed blades; the centre flange, two of each.
3. Blades on the left-hand and centre flanges should be fitted to the left-hand sides of the flanges; blades on the right-hand flange should be fitted to the right-hand side. In all cases the heads of the bolts should be in contact with the blade, and the spring washer fitted under the nut.

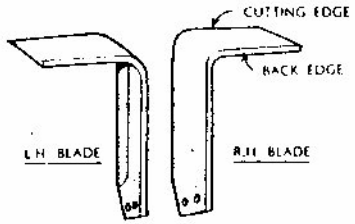

DIAGRAM 2—How to identify right and left hand blades

BLADE MAINTENANCE (See Diagram 3)

This is most important. Examine the blades daily to see that they are correct (Fig. 1). Any bent blades (Fig 2) should be straightened with the blade setting bar (Fig. 3). (The illustration is of a larger machine, but the principle applies).

If the edges of the blades have become turned (Fig. 4), they should be corrected thus: remove the blade, put the end of the blade setting bar behind the blade and beat the cutting edge back into its correct position with a hammer (Fig. 5). The blades will then cut cleanly with the cutting edges only touching the ground and the backs having clearance.

IMPORTANT. BEFORE CLEANING HOE BLADES OR THE UNDERSIDE OF THE SHIELD, RETURN THE ROTOR GEAR CONTROL ROD TO NEUTRAL AND STOP THE ENGINE.

It sometimes happens that a stone is trapped between the blades and the shield. When this occurs, the rotor will automatically stop. The operator should then put the rotor and engine clutch out of gear, lift the 'Bantam' by its handlebars and turn the rotor in reverse by pushing sharply on one of the blades with the foot.

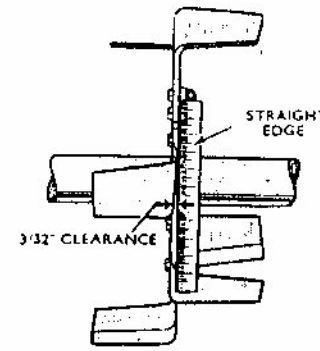

Fig. 1
Checking blade alignment with straight edge (or setting bar).

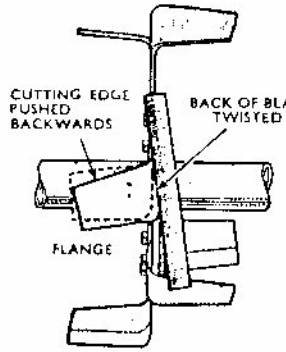

Fig. 2
Showing bent blade.

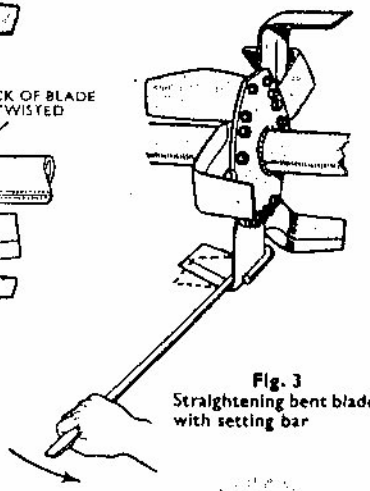

Fig. 3
Straightening bent blade with setting bar

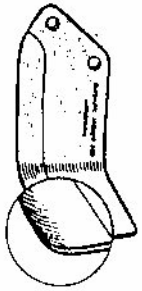

Fig. 4
Enlarged view of blade with cutting edge turned inwards.

Fig. 5
Normal blade.

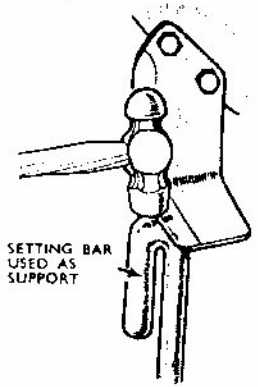

Fig. 6
Restoring turned up edge.

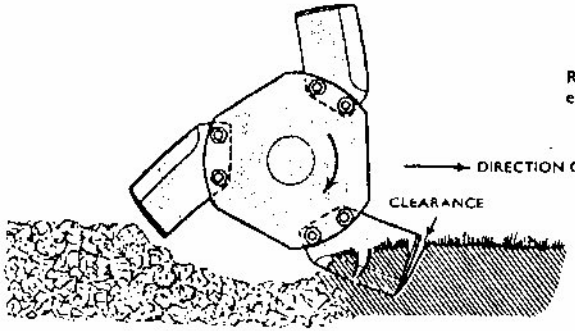

Fig. 7. Correct blade setting showing clearance at back of blade.

DIAGRAM 3—**BLADE MAINTENANCE**

LIST OF PARTS

for the

HOWARD ROTAVATOR BANTAM

When ordering parts always quote the number of the machine and the part number (NOT the illustration number). The number of the machine is to be found at the base of the left-hand handlebar support.

We cannot guarantee that correct replacements will be supplied unless this number and the correct part number are quoted.

In the following list all directions are given left or right looking forward from the back of the 'Bantam'.

Illust. No.	Part No.	Description	No. off.
		HANDLEBARS	
1	20578	Handlebar R.H.	1
	21080	Handlebar R.H. (American)	1
2	20539	Handlebar L.H.	1
3	20557	Grip	2
4	20525	Upper Toggle Link	2
5	20528	Spacer	1
6	20526	Centre Toggle Link	1
7	20527	Lower Toggle Link	1
8		Bolt, $\frac{5}{16}$" B.S.F. × 2" long, Hx. Hd.	2
9		Bolt, $\frac{5}{16}$" B.S.F. × 1$\frac{1}{2}$" long, Hx. Hd.	1
10		Nut, $\frac{5}{16}$" B.S.F., Hx. Pln.	3
11		Throttle Lever Attachment screws, No. 10 dia. A.N.F. Rd. Hd. $\frac{3}{8}$" long. American models only	2
13	20422	Spring	1
14		Bolt, $\frac{5}{16}$" B.S.F. × 4$\frac{3}{4}$" long, Hx. Hd.	2
15		Nut, $\frac{5}{16}$" B.S.F., Hx. Pln.	2
16	20492	Handlebar Adjuster	2
17	20490	Spacer	1
18	20517	Clamping Lever	1
19	20493	Clamping Bolt	1
20		Setscrew, $\frac{7}{16}$" B.S.F. × 1" long, Hx. Hd.	2
21		Locknut, $\frac{7}{16}$" B.S.F., Hx.	2
22	20548	Rotor and Travel Quadrant	1
		FRAME AND ENGINE CRADLE	
25	20489	Side Frame (Front), Home Market	1
	21078	Side Frame (Front), American	1
	20489/6	Pin	1
26		Setscrew, $\frac{5}{16}$" B.S.F. × $\frac{7}{8}$", Hx. Hd.	2
27		Spring Washer, $\frac{5}{16}$" dia.	2
28	20513	Captive Bolt	2
29		Mills Pin (Short), $\frac{1}{4}$" dia. × $\frac{7}{8}$" long	2
30		Nut, $\frac{5}{16}$" B.S.F., Hx.	2

No. Illust.	No. Part	Description	off. No.
31		Washer, $\frac{5}{16}$" dia.	2
32	20502	Handlebar Support	1
33		Setscrew, $\frac{5}{16}$" B.S.F. × $\frac{1}{4}$" long, Hx. Hd.	4
34		Spring Washer, $\frac{5}{16}$" dia.	4
35	20480	Engine Cradle	1
36	20624	Engine Pivot Bolts	2
37		Locknut, $\frac{5}{16}$" B.S.F.	2
38		Setscrew (Cradle, L.H. side), $\frac{5}{16}$" B.S.F. × $\frac{3}{4}$" long—Villiers	2
		Setscrew (Cradle, L.H. side and Anti-Vibration Stay), $\frac{5}{16}$" B.S.F. × 1" Lg.—A.C.	2
39		Spring Washer, $\frac{5}{16}$" dia.	2
		CLUTCH, GEAR AND ROTOR CONTROLS	
40	20572	Knob	1
41	20573	Clutch Rod (Upper)	1
42	20564	Clutch Rod (Lower)	1
43		Splitpin, $\frac{1}{16}$" dia. × $\frac{1}{2}$" long	1
44	20543	Gear Control Rod (Upper)	1
45		Splitpin, $\frac{3}{32}$" dia. × $\frac{1}{2}$" long	2
46	20545	Trunnion Block	1
47	20546	Selector Rod	1
48	20552	Spring	1
49		Splitpin, $\frac{3}{32}$" dia. × $\frac{1}{2}$" long	1
50	20587	Trunnion	1
51		Splitpin, $\frac{3}{32}$" dia. × $\frac{1}{2}$" long	1
52	20555	Travel Selector Lever	1
53		Gear Lever Pin, $\frac{1}{4}$" × Size 0 Taper Pin	1
55	20544	Rotor Control Rod	1
56		Splitpin, $\frac{3}{32}$" dia. × $\frac{1}{2}$" long	2
57	20545	Trunnion Block	1
58	20547	Selector Rod	1
59	20552	Spring	1
60		Splitpin, $\frac{3}{32}$" dia. × $\frac{1}{2}$" long	1
61		Locknut, $\frac{1}{4}$" B.S.F.	2
62	20549	Rotor Selector Eye Bolt	1
63		Splitpin, $\frac{3}{32}$" dia. × $\frac{1}{2}$" long	1
64	20457	Rotor Selector Lever	1
65		Pin, $\frac{1}{4}$" × Size 0 Taper Pin	1
66		Washer, Plain Brt. $\frac{3}{8}$" dia.	1
67	20465	Rotor Dog Selector	1
		FRONT WORM DRIVE HOUSING	
71	20439	Worm Drive Gearbox	1
72		Oil Filler Screws, $\frac{1}{8}$" B.S.W. × $\frac{1}{8}$" Lg. Rd. Hd.	2
73		Fibre Washers, $\frac{3}{8}$" O.D. × $\frac{1}{8}$" I.D. × $\frac{1}{16}$" W.	2
74		Oil Lever Screws, 2 B.A. × $\frac{1}{8}$" Lg. Rd. Hd.	2

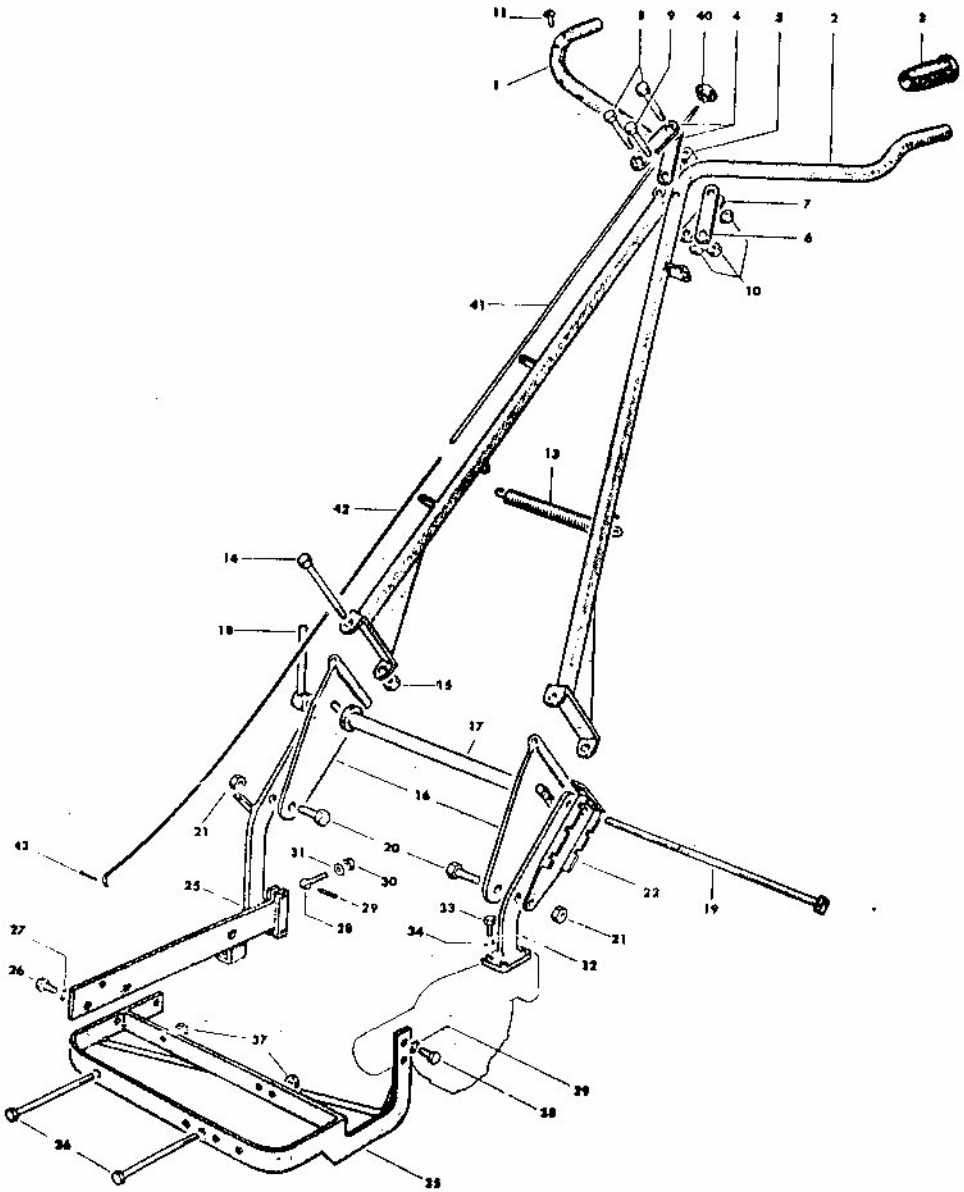

DIAGRAM 4

Illust. No.	Part No.	Description	No. off.
75		Fibre Washers, $\frac{1}{8}$" O.D. × $\frac{3}{16}$" I.D. × $\frac{1}{32}$" W.	2
76		Drain Plug, Type 1385A	1
		Drain Plug Washer, Type 1386A	1
77	20513	Captive Bolt	2
78		Mills Pin, $\frac{1}{4}$" dia. × $1\frac{1}{4}$" long No. G.11	2
79		Washers, Flat Brt. $\frac{5}{16}$" dia.	2
80		Nut, Hex. $\frac{5}{16}$" B.S.F.	2
81	20494	Spare End Cover. (See Tool Kit)	1
82	20462	Gasket (Worm Drive Housing)	1
83	20512	Cover (Worm Drive Gearbox)	1
84	20461	Gasket (Cover)	1
85		Setscrews, 2 B.A. × $\frac{3}{8}$" long, Rd. Hd.	5
86		Spring Washers, 2 B.A. or $\frac{5}{16}$" dia.	5
		Shim, 1" O.D. × $\frac{5}{8}$" I.D. × ·005", ·010" or ·015" as reqd.	

GEARBOX

87	20424	Gearbox	1
88	20423	Bearing (Roadwheel)	1
89	20370	Oilseal (262:131:25:P.10)	1
90		Rivets, $\frac{1}{8}$" dia. × $\frac{1}{2}$" L. Flat Head	6
91	20464	Gasket (Gearbox)	1
92		Setscrew, Gearbox $\frac{1}{4}$" B.S.F. × $\frac{3}{4}$" Lg. Cheese Hd.	9
	20828	Setscrew, Gearbox $\frac{1}{4}$" B.S.F. × $\frac{1}{2}$" Lg. Hex. Hd.	1
93		Spring Washers, $\frac{1}{4}$" dia.	10
94	20485	Travel Gear Selector	1
95	20487	Travel Gear Roller	1
	20499	Selector Pin	1
96	20425	Cluster Gear	1
97	20433	Bush	1
98	20441	Cluster Gear Shaft	1
99		Nut, Hex. $\frac{1}{4}$" B.S.F.	1
100	20445	Road Wheel Axle	1
101	20446	Wheel Axle Bush	1
102		Nut, Hex. $\frac{1}{2}$" B.S.F.	2
103	20560	Bullwheel	2
104	20473	Clamping Nut	1

WHEELS AND TYRES

	20635	Wheel complete, comprising:—	1
110	20686	Wheel Centre	1
111	20635/4	Loose Rim	1
112	20615	Rim	1
113		Setscrews, Hex. Hd. $\frac{5}{16}$" B.S.W. × $\frac{3}{8}$" long	12
114		Spring Washers, $\frac{5}{16}$" dia.	6
115		Nuts, Hex. $\frac{5}{16}$" B.S.W.	6
116	20635/6	Tyre	2

MAINTENANCE AND LUBRICATION GUIDE

DAILY MAINTENANCE (or every 8 working hours)

1. Check oil level in Air Cleaner and top up if required. (Engine lubrication is dealt with in the relevant Engine Handbook).
2. Check tightness of Bolts.
3. Check tightness of Blades.
4. Check for bent Blades and straighten if required.

EVERY THREE DAYS (or 24 working hours)

1. Check oil levels in Main gearbox (both worm drive and Change Speed).
2. Check oil level in Rotor Worm Gearbox.
3. Oil Clutch, Gear and Rotor Control Joints, Depth Control Lever Pivot and Shield Joints.
4. Oil Rotor Axle Cap.
5. Fill Engine Mounting Oil Cups.
6. Oil Handlebar Pivots and Toggle Links.

FORTNIGHTLY (or every 100 working hours)

Wash out Filter in petrol. Renew oil.

MONTHLY (or every 200 working hours)

1. Drain and refill Worm Drive gearbox.
2. Drain and refill Change Speed gearbox.
3. Drain and refill Rotor Worm gearbox.

IMPORTANT.—Keep a sharp look out at all t
Blades and for wire or any obstruction roun
the Rotor.

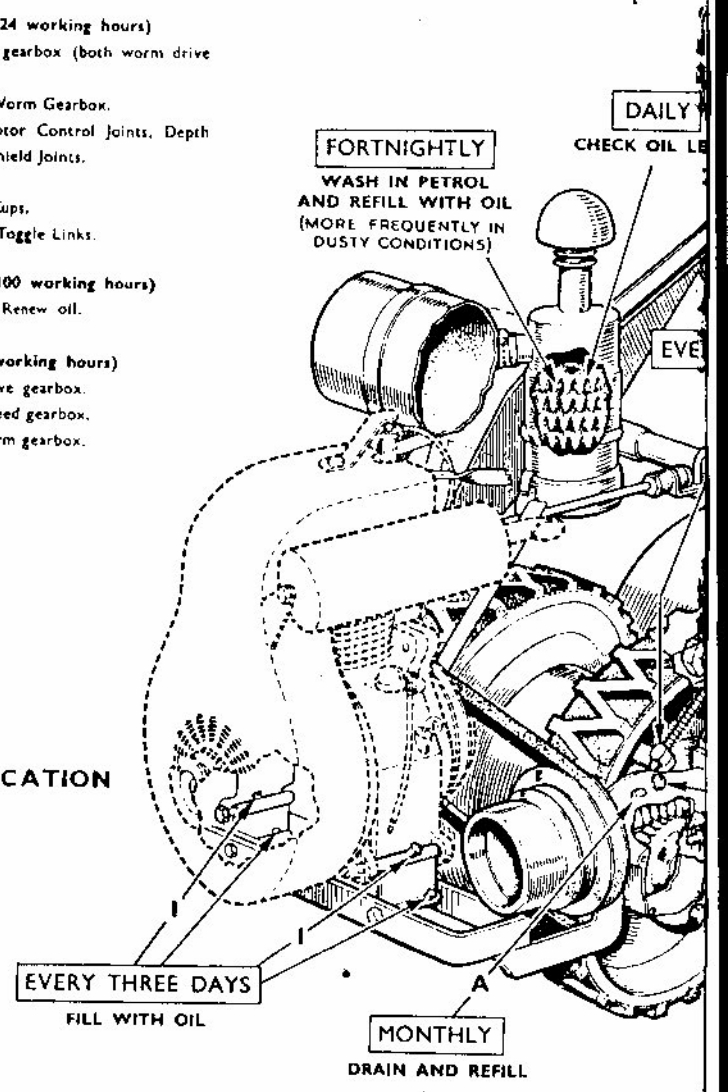

DIAGRAM 1.— **LUBRICATION**

MAINTENANCE AND LUBRICATION GUIDE FOR THE HOWARD ROTAVATOR "BANTAM"

DAILY MAINTENANCE (or every 8 working hours)

1. Check oil level in Air Cleaner and top up if required. (Engine lubrication is dealt with in the relevant Engine Handbook).
2. Check tightness of Bolts.
3. Check tightness of Blades.
4. Check for bent Blades and straighten if required.

EVERY THREE DAYS (or 24 working hours)

1. Check oil levels in Main gearbox (both worm drive and Change Speed).
2. Check oil level in Rotor Worm Gearbox.
3. Oil Clutch, Gear and Rotor Control Joints, Depth Control Lever Pivot and Shield Joints.
4. Oil Rotor Axle Cap.
5. Fill Engine Mounting Oil Cups.
6. Oil Handlebar Pivots and Toggle Links.

FORTNIGHTLY (or every 100 working hours)

Wash out Filter in petrol. Renew oil.

MONTHLY (or every 200 working hours)

1. Drain and refill Worm Drive gearbox.
2. Drain and refill Change Speed gearbox.
3. Drain and refill Rotor Worm gearbox.

IMPORTANT.—Keep a sharp look out at all times for bent Blades and for wire or any obstruction round the ends of the Rotor.

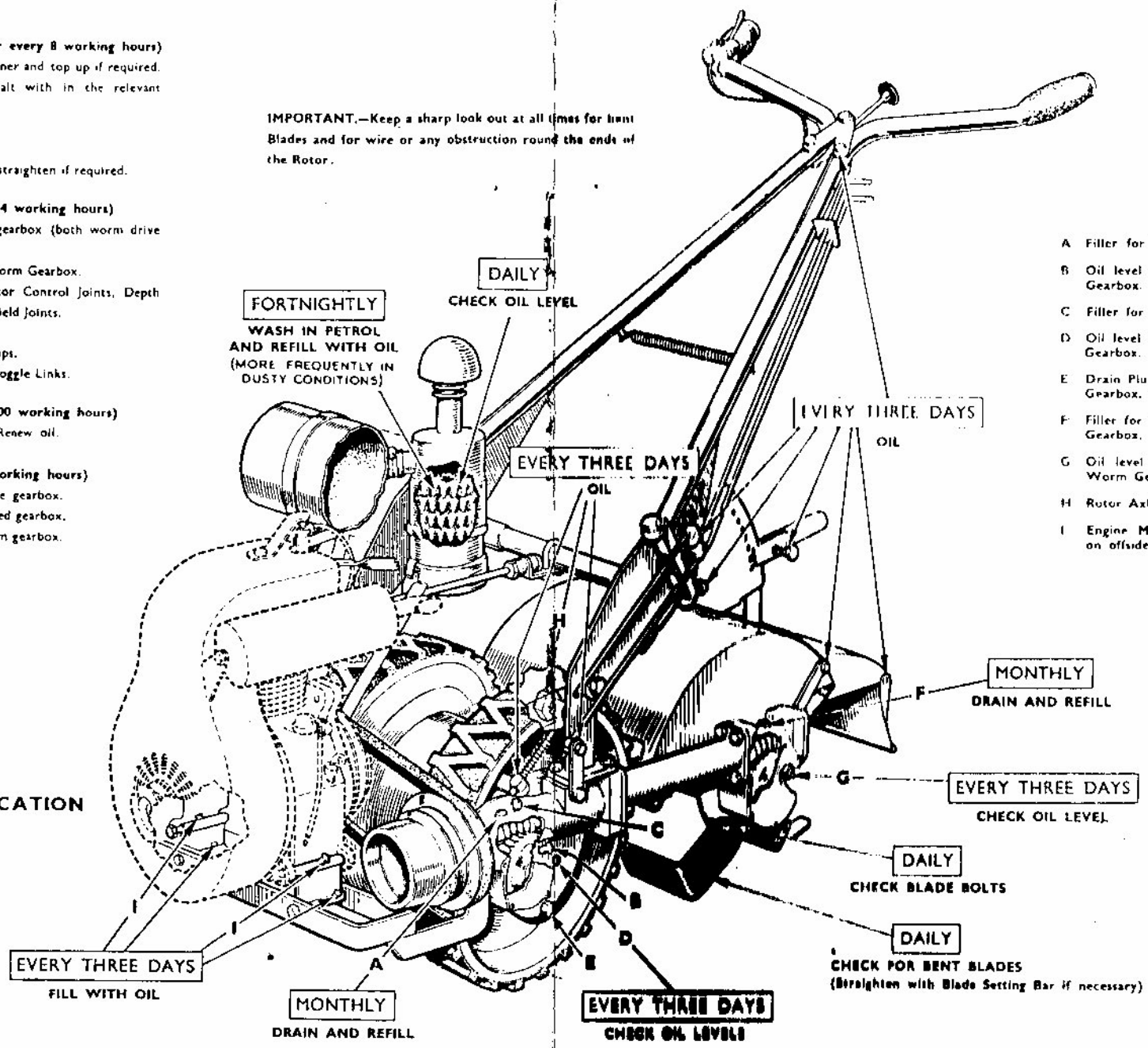

DIAGRAM 1—**LUBRICATION**

A Filler for Worm Drive Gearbox.

B Oil level screw for Worm Drive Gearbox.

C Filler for Change Speed Gearbox.

D Oil level screw for Change Speed Gearbox.

E Drain Plug for Change Speed Gearbox.

F Filler for Rotor Drive Worm Gearbox.

G Oil level screw for Rotor Drive Worm Gearbox.

H Rotor Axle Cap.

I Engine Mounting Oil Cups (two on offside and two on near side).

Illust. No.	Part No.	Description	No. off.
161		Setscrew, $\frac{5}{16}$" B.S.F. × 1" long Hx. Hd.	2
162		Spring Washer, $\frac{5}{16}$" dia.	4
163	20884	Worm Housing—Cover	1
164	20895	Worm Housing—Gasket	1
165		Setscrew, 2 B.A. × $\frac{1}{2}$" L. Rd. Hd.	4
166		Spring Washer, $\frac{5}{16}$" dia. or 2 B.A.	4
167		Setscrew, $\frac{5}{16}$" B.S.F. × $\frac{1}{2}$" long Hex. Hd.	2
168		Spring Washer, $\frac{5}{16}$" dia.	2

COULTERS

169	20897	Coulter, L.H.	1
170		Bolt, $\frac{5}{16}$" B.S.F. × $\frac{3}{8}$" long Hx. Hd.	2
171		Spring Washer, $\frac{5}{16}$" dia.	2
172		Nut, $\frac{5}{16}$" B.S.F. Hx. Hd.	2
173	20898	Coulter, R.H.	1
174		Setscrew, $\frac{5}{16}$" B.S.W. × $\frac{3}{8}$" long Hex. Hd. } Optional Extra	2
175		Spring Washer, $\frac{5}{16}$" dia. } Optional Extra	2
176		Nut, $\frac{5}{16}$" B.S.F. Hx. } Optional Extra	2
177	20891	Side Arm, 10" model	1
178	20905	Side Arm, 14" model	1
179	20561	Pin—Oilseal Housing	1
180		Setscrew, $\frac{5}{16}$" B.S.F. × $\frac{3}{8}$" long	2
181		Spring Washer, $\frac{5}{16}$" dia.	2

STUB AXLE

182	20417	Stubaxle—Nut	1
183	20419	Oil Filler—Screw, $\frac{1}{4}$" B.S.F. × $\frac{5}{16}$" L. Rd. Hd.	1
184	20418	Draw Bolt, 10" model	1
	20910	Draw Bolt, 14" model	1
185	20415	Oilseal Housing	1
186	20416	Bush	1
187		Oilseal, 1.37" O.D. × .87" I.D. × .25" thick	1
188		Oilseal, 2.25" O.D. × 1.50" I.D. × .37" thick R4	1

ROTOR AND BLADES

189	20407	Rotor, 10"	1
190	20565/L	Hoe Blade, L.H.	4
191	20565/R	Hoe Blade, R.H.	4
192		Blade Bolt, $\frac{5}{16}$" B.S.F. × $\frac{3}{4}$" Long	16
193		Spring Washer, $\frac{5}{16}$" dia.	16
194		Nut, $\frac{5}{16}$" B.S.F.	16
195	21083	Picktine Rotor, 10"	1
196	20192	Picktine	8
197	21087	Lucerne Tine	8
198	21086	Bolt	16
199		Spring Washer, $\frac{5}{16}$" dia.	16

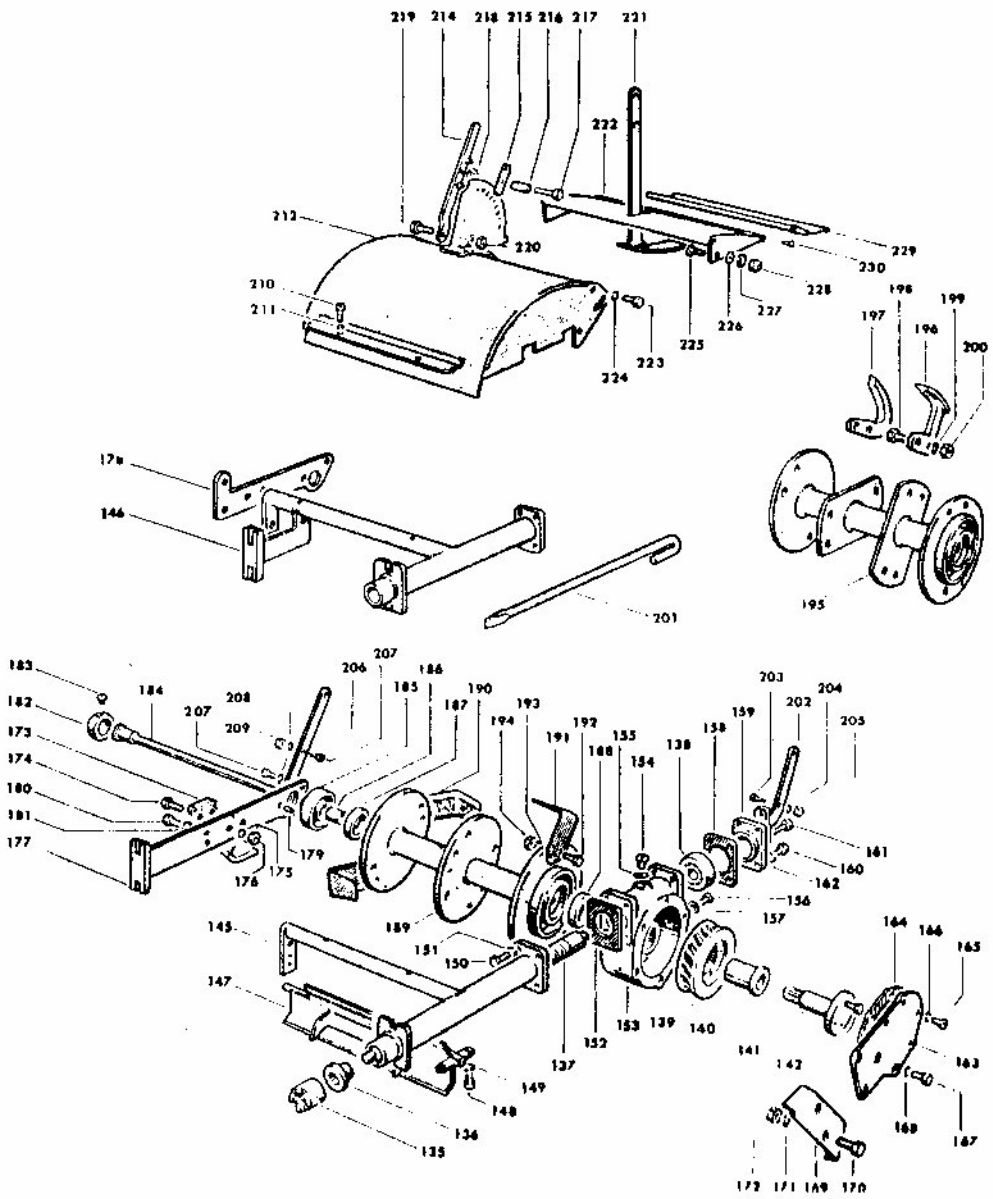

DIAGRAM 6

Illust. No.	Part No.	Description	No. off.
200		Nut, $\frac{5}{16}$" B.S.F.	16
	20902	Rotor, 14"	1
	20917/L	Hoe Blade, L.H.	4
	20917/R	Hoe Blade, R.H.	4
192		Blade Bolt	16
193		Spring Washer, $\frac{5}{16}$" dia.	16
194		Nut, $\frac{5}{16}$" B.S.F.	16
	21084	Picktine Rotor, 14"	1
196	20192	Picktine	10
197	21087	Lucerne Tine	10
198	21086	Bolt	20
199		Spring Washer, $\frac{5}{16}$" dia.	20
200		Nut, $\frac{5}{16}$" B.S.F.	20
201	20710	Blade Setting Bar	1

SHIELDS AND DEPTH CONTROL

202	20887	Left Hand Support	1
203		Screw, $\frac{1}{4}$" B.S.F. × $\frac{1}{2}$" Long Rd. Hd.	1
204		Spring Washer, $\frac{1}{4}$" dia.	1
205		Locknut, $\frac{1}{4}$" B.S.F. Hx. Pln.	1
206	20496	Right Hand Support	1
207		Screw, $\frac{1}{4}$" B.S.F. × $\frac{1}{2}$" Long Rd. Hd.	2
208		Spring Washer, $\frac{1}{4}$" dia.	2
209		Locknut, $\frac{1}{4}$" B.S.F. Hx.	1
210		Screw, $\frac{1}{4}$" B.S.F. × $\frac{1}{2}$" long Ch. Hd.	2
211		Spring Washer, $\frac{1}{4}$" dia.	2
212	20601	Front Shield, 10"	1
	20853	Front Shield, 14"	1
214	20504	Hand Lever	1
215	20505	Clip	1
216	20470	Spring	1
217		Setscrew, $\frac{1}{4}$" B.S.F. × $1\frac{1}{2}$" long Hx. Hd.	1
218		Locknut, $\frac{1}{4}$" B.S.F. Hx. Pln.	1
219		Bolt, $\frac{5}{16}$" B.S.F. × $\frac{1}{2}$" long Hx. Hd.	1
220		Locknut, $\frac{5}{16}$" B.S.F. Hx. Pln.	1
221	20503	Skid	1
222	20521	Rear Shield, 10"	1
	20908	Rear Shield, 14"	1
223		Setscrew (Rear Shield Pivot), $\frac{5}{16}$" B.S.F. × $\frac{1}{2}$" long Hx. Hd.	2
224		Spring Washer, $\frac{5}{16}$" dia.	2
225	20709	Coach Bolt, $\frac{1}{4}$" B.S.W. × $\frac{1}{2}$" long	2
226		Washer, $\frac{1}{2}$" dia.	2
227		Washer (Thackeray), $\frac{1}{4}$" dia.	2
228		Nut, $\frac{1}{4}$" B.S.W. Hx. Simmonds	2
229	20522	Trailing Shield, 10"	1
	20909	Trailing Shield, 14"	1
230		Rivet (Trailing Shield Pivot) $\frac{1}{4}$" dia. × $\frac{1}{2}$" L. Rd. Hd.	2

APPENDIX—ENGINE MOUNTINGS

1. PARTS COMMON TO ALL ENGINES (i.e. Villiers 2 stroke/ Villiers 4 stroke/A.C./Briggs & Stratton/Clinton/Kohler).

Part No.	Description	No. off.
20476	Brake Block	1
	Adjusting Bolt, $\frac{3}{16}$" B.S.F. × $\frac{7}{8}$" long	2
	Washer, $\frac{3}{16}$" dia.	2
	Spring Washer, $\frac{3}{16}$" dia.	2
	Nut, $\frac{3}{16}$" B.S.F.	2
20421	Clutch Tension Spring	1
20378	Tension Bolt	1
20426	Spring	1
20241	Clutch Positioning Lever	1

2. VILLIERS ENGINE (2-Stroke).

A.C.209	Air Cleaner	1
A.C.212	Air Cleaner Bracket	1
A.C.193	Air Cleaner Cap	1
20903	Elbow Bend	1
	Setscrew, $\frac{1}{4}$" B.S.W. × $1\frac{1}{8}$" long Hex. Hd.	1
	Spring Washer, $\frac{1}{4}$" dia.	1
20907	Rubber Hose	1
20913	Jubilee Clip	1
G.276	Jubilee Clip	1
20472	Vee Belt Pulley	1
20707	Vee Belt (24$\frac{1}{2}$" inside length)	1
20636	Engine Pivot Hinge	2
20626	Pivot Hinge Bolt	2
	Locknut, $\frac{5}{16}$" B.S.F.	2
	Shakeproof Washer, $\frac{5}{16}$" dia. INT.	4
	Flip-Flap Oilers, 2 B.A.	4
20652	Clamping Plate	2
20654	Fulcrum Bracket	1
20653	Brake Bracket	1
	Splitpin, $\frac{5}{64}$" dia. × $\frac{1}{2}$" long	1
20810	Engine Stay comprising:—	
20811	Stay Rod	1
20812	Connecting Strap	1
20813	Rubber Sleeve	2
20814	'U' Bolt	1
	Washer, $\frac{1}{4}$" dia.	2
	Locknut, $\frac{1}{4}$" B.S.F.	3
	Spring Washer, $\frac{1}{4}$" dia.	2
	Nut, $\frac{1}{4}$" B.S.F.	2

Part No.	Description	No. off.
3. A.C. ENGINE		
A.C.209	Air Cleaner	1
A.C.212	Air Cleaner Bracket	1
A.C.193	Air Cleaner Cap	1
A.C.225	Rubber Hose	1
20913	Jubilee Clip	1
G.276	Jubilee Clip	1
A.C.198	Vee Belt 27" (Fenner 3270)	1
20896	Engine Pivot Hinge, R.H.	1
20612	Engine Pivot Hinge, L.H.	1
20623	Pivot Hinge Bolt	2
	Locknut, $\frac{5}{16}$" B.S.F.	2
	Shakeproof Washer, $\frac{5}{16}$" dia. INT.	4
	Flip-Flap Oiler, 2 B.A.	4
20659	Fulcrum Bracket	1
20436	Brake Bracket	1
	Splitpin, $\frac{3}{64}$" dia. × $\frac{1}{2}$" long	1
20818	Engine Stay comprising:—	
20815	Stay Rod	1
20816	Plate	1
20812	Connecting Strap	1
20813	Rubber Sleeve	2
20814	'U' Bolt	1
	Washer, $\frac{1}{8}$" dia.	2
	Locknut, $\frac{1}{8}$" B.S.F.	8
	Spring Washer, $\frac{1}{4}$" dia.	2
	Nut, $\frac{1}{4}$" B.S.F.	2
ANTI-VIBRATION STAY		
21072	Bracket (Drive Shaft Housing)	1
21073	Bracket (Cylinder Head)	1
21074	Rod	1
2028	Spring	1
	Nut, $\frac{1}{4}$" B.S.F.	2
	Washer, $\frac{1}{4}$" dia.	1
	Splitpin, $\frac{1}{16}$" dia. × $\frac{1}{2}$" long	1
4. BRIGGS & STRATTON ENGINE (complete with Air Cleaner and Petrol Tank).		
20280	Engine Pulley	1
	Gib Head Key, $\frac{3}{16}$" sq. × $1\frac{1}{2}$" long	1
20298	Engine Pulley Spacer	1
A.C.198	Vee Belt 27" (Fenner 3270)	1
20268	Engine Pivot Hinge, R.H.	1
20269	Engine Pivot Hinge, L.H.	1
20623	Engine Pivot Bolt	2
	Locknut, $\frac{5}{16}$" B.S.F.	2
	Shakeproof Washer, $\frac{5}{16}$" dia. INT.	4

Part No.	Description	No. off.
20262	Pivot Hinge Spacer	2
	Winkley Oiler, $\frac{3}{16}$" B.S.F.	4
20263	Eye Bolt	4
	Nut, $\frac{5}{16}$" B.S.F.	4
	Shakeproof Washer, $\frac{5}{16}$" dia. INT.	4
20259	Fulcrum Bracket	1
20278	Clutch Mounting	1
	Splitpin, $\frac{3}{64}$" dia. × $\frac{3}{4}$" long	1
20279	Engine Stay comprising:—	
20273	Plate	1
20812	Connecting Strap	1
20813	Rubber Sleeve	2
20814	'U' Bolt	1
20815	Stay Rod	1
	Locknut, $\frac{1}{8}$" B.S.F.	6
	Washer, $\frac{1}{8}$" dia.	2
	Spring Washer, $\frac{1}{4}$" dia.	2
	Nut, $\frac{1}{4}$" B.S.F.	2
	Setscrew, $\frac{5}{16}$" B.S.F. × $\frac{5}{8}$" long Hex. Hd.	2
	Spring Washer, $\frac{5}{16}$" dia.	2
5. VILLIERS (4-Stroke) ENGINE		
A.C.209	Air Cleaner	1
A.C.193	Air Cleaner Cap	1
20143	Rubber Hose	1
G.276	Jubilee Clip	1
20913	Jubilee Clip	1
20142	Air Cleaner Bracket comprising:—	
20180	Bracket	1
A.C.212/4	'U' Strap	1
	Setscrew, $\frac{1}{4}$" B.S.F. × $\frac{1}{2}$" long Hex. Hd.	2
	Nut, $\frac{1}{4}$" B.S.F.	2
	Spring Washer, $\frac{1}{4}$" dia.	2
	Setscrew, $\frac{1}{4}$" B.S.F. × $\frac{3}{4}$" long Hex. Hd.	2
	Nut, $\frac{1}{4}$" B.S.F.	2
	Spring Washer, $\frac{1}{4}$" dia.	2
20200	Engine Pulley	1
	Gib Head Key, $\frac{3}{16}$" sq. × $1\frac{1}{2}$" long	1
20196	Vee Belt (Fenner A.26)	1
20268	Engine Pivot Hinge, R.H.	1
20269	Engine Pivot Hinge, L.H.	1
20623	Engine Pivot Bolt	2
	Locknut, $\frac{5}{16}$" B.S.F.	2
	Shakeproof Washer, $\frac{5}{16}$" dia. INT.	4
20262	Pivot Hinge Spacer	2
	Winkley Oiler, $\frac{3}{16}$" B.S.F.	4
21231	Fulcrum Bracket	1
21232	Clutch Mounting	1

Part No.	Description	No. off.
20185	Engine Stay comprising:—	
20812	Connecting Strap	1
20813	Rubber Sleeve	2
20814	'U' Bolt	1
	Washer, $\frac{1}{4}$" dia.	2
	Locknut, $\frac{1}{4}$" B.S.F.	8
	Spring Washer, $\frac{1}{4}$" dia.	2
	Nut, $\frac{1}{4}$" B.S.F.	2
20815	Stay Rod	1
20179	Plate	1

6. UNIVERSAL MOUNTING BRIGGS & STRATTON/CLINTON/KOHLER

20280	Engine Pulley (Briggs & Stratton)	1
21224	Engine Pulley (Clinton & Kohler)	1
	Gib Head Key, $\frac{3}{16}$" sq. × $1\frac{1}{2}$" long	1
20298	Engine Pulley Spacer	1
A.C.198	Vee Belt 27" (Fenner 3270)	1
20268	Engine Pivot Hinge, R.H.	1
20269	Engine Pivot Hinge, L.H.	1
20623	Engine Pivot Bolt	2
	Locknut, $\frac{3}{16}$" B.S.F.	2
	Shakeproof Washer, $\frac{3}{16}$" dia. INT.	4
20262	Pivot Hinge Spacer	2
	Winkley Oiler, $\frac{3}{16}$" B.S.F.	2
21231	Fulcrum Bracket	1
20278	Clutch Mounting	1
	Setscrew, $\frac{3}{16}$" B.S.F. × $\frac{3}{8}$" long Hex. Hd.	2
	Spring Washer, $\frac{3}{16}$" dia.	2
21225	Mounting Pad	2
	Setscrew, $\frac{3}{16}$" U.H.C. × 1" long Hex. Head	4
	Spring Washer, $\frac{3}{16}$" dia.	4
	Splitpin, $\frac{5}{64}$" dia. × $\frac{3}{4}$" long	1
21229	Engine Stay comprising:—	
21228	Bracket	1
	Locknut, $\frac{1}{4}$" U.N.C.	2
21227	Rod	1
20812	Connecting Strap	1
20813	Rubber Sleeve	2
	Locknut, $\frac{1}{4}$" U.N.C.	4
20814	'U' Bolt	1
	Washer, $\frac{1}{4}$" dia.	2
	Spring Washer, $\frac{1}{4}$" dia.	2
	Nut, $\frac{1}{4}$" B.S.F.	2

TOOLKIT*

1 Set Spanner, $\frac{1}{4}$"—$\frac{3}{16}$" B.S.F.
1 Set Spanner, $\frac{1}{4}$"—$\frac{3}{16}$" B.S.W.
1 Adjustable Spanner
1 Screwdriver
1 Oil Can
1 Roll Pack
1 Pliers

TOOLS SUPPLIED WITH VILLIERS ENGINE

1 Tube Spanner
1 Tommy Bar
1 Spanner and Gap Gauge (Magneto)
1 Plug Spanner
1 Starting Cord

TOOLS SUPPLIED WITH A.C. ENGINE

1 Spanner and Gap Gauge (Magneto)
1 Feeler Gauge (Tappets)
1 Plug Spanner
1 Starting Cord

SPARE PARTS

1 Hoe Blade, L.H.
1 Hoe Blade, R.H.
4 Blade Bolts
4 Spring Washer
4 Nuts
1 Spare End Cover (20494)

*Subject to alteration without notice.