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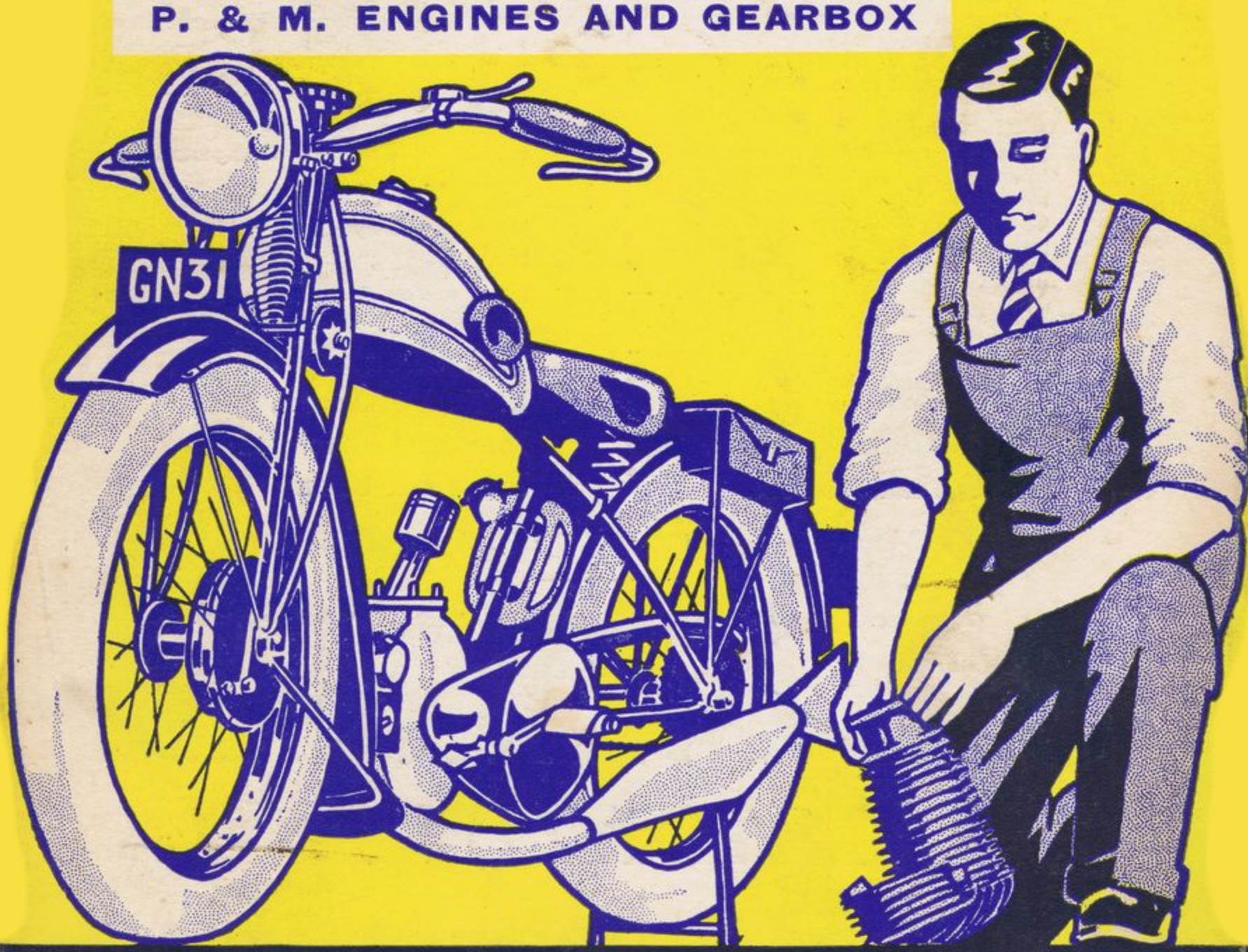
NEWNES

MOTOR CYCLE REPAIR AND UPKEEP

Advisory Editor:- J. EARNEY. M.I.M.T.

IN THIS PART

CONNECTING-ROD REPAIRS — A.J.S. MACHINES — DOUGLAS MACHINES — P. & M. ENGINES AND GEARBOX



1/-

WORTH POUNDS TO ALL INTERESTED IN MOTOR CYCLE REPAIR

PART 11

MAINTENANCE, REPAIR AND OVERHAUL OF P. & M. (PANTHER) ENGINES

By E. F. Chidley

THE outstanding features of P. & M. (Panther) machines remain practically unchanged from 1924 to 1931, but detail improvements have been incorporated each season, and where a part or parts have altered in design, which affect the instructions referring to such parts, a modification is made.

DISMANTLING ENGINE

Preliminaries

Remove exhaust system complete by unscrewing union nuts and bolt fixing silencer to frame. No special spanner is required for the former, as these can generally be loosened by inserting a piece of ½-inch flat wood between the fins so that it fits well down into the corner, and giving this a sharp blow with a hammer. Punch to left to unscrew (right-hand thread). In the case of all models earlier than 1930 Redwing, the pipes are simply a push fit into the ports. Take off front and rear chain guards (after removing footpads 1930 and 1931 models). The chains should be disconnected by the spring clip joint and laid aside for attention later. Remove magneto control wire at magneto end, also sparking-plug wire from plug. This high-tension lead should now be pulled through from under the tank and wound in a coil. Take off petrol pipe complete, and in doing so make sure that the tank union does not unscrew when disconnecting at the tank end (the former should be held by an adjusting spanner).

The Carburetter

The carburetter can now be removed complete by taking out the two ¼-inch bolts which hold this to the inlet port. Unscrew the milled ring on the top of the main body and withdraw the throttle and air slides. The latter, complete with the control wires, should now be tied up to the tank rail to avoid damage to the tapered needle attached to the throttle slide (on models 1926 upwards the wires and slide can be slipped over the pipe connecting saddle tanks). The exhaust valve lifter is uncoupled in the following manner.

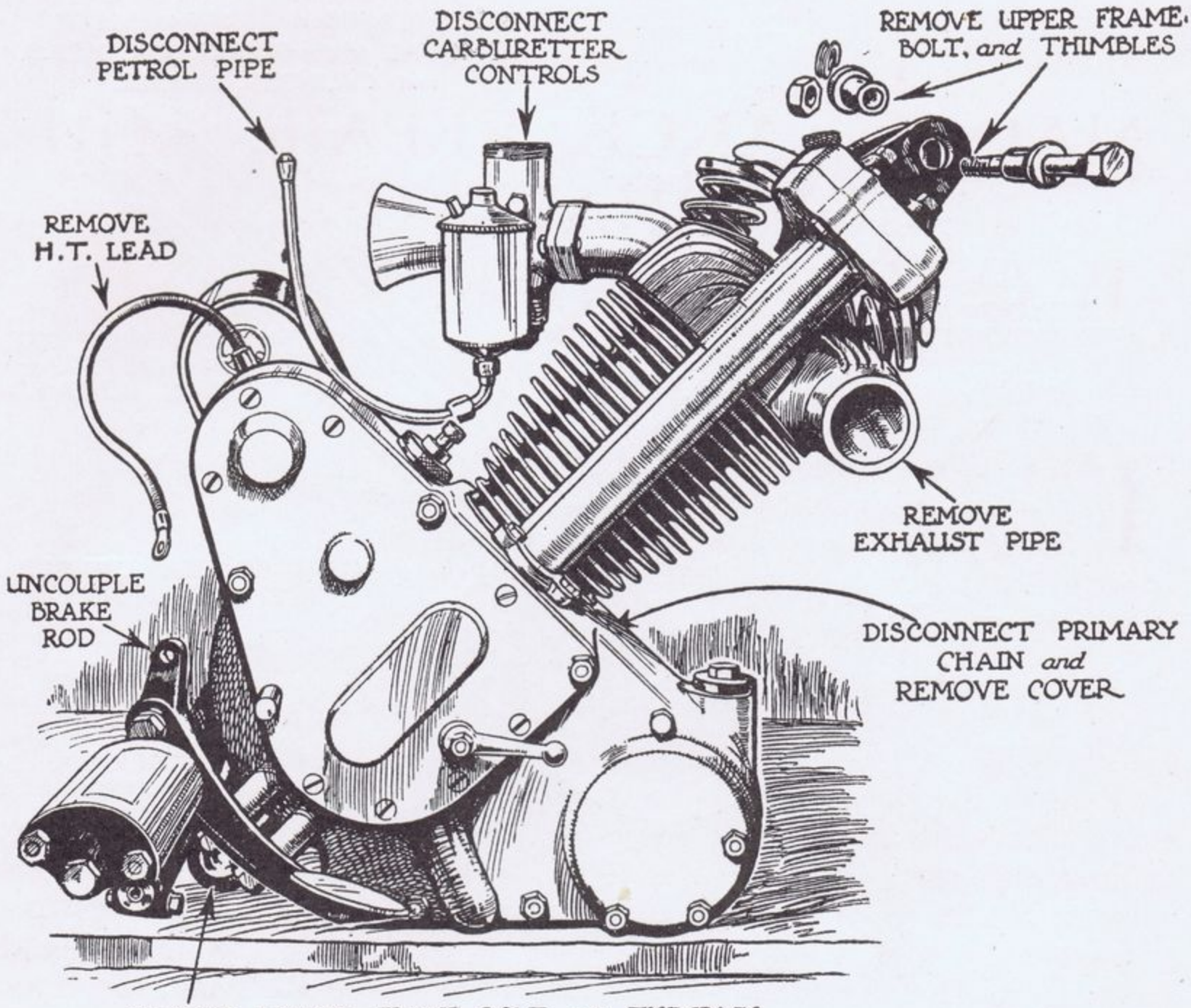


Fig. 1.—How to remove the Complete Panther Unit from the Frame.

Disconnect Controls

Turn engine until the exhaust valve is open. Pull control wire on top of rocker box upwards (see Fig. 3), and with the left hand slide downwards the small barrel (221). This will allow removal of the horse-shoe-shaped collar (222). The barrel piece will now slip upwards over the wire adjuster (220), and permit of the wire nipple being released from the internal valve lifter (40). The back brake should now be disconnected at the pedal end, after which the engine is free from all connections.

Removing Engine from the Frame

The engine is held in the frame both top and bottom in the same manner. Remove both top and bottom engine bolts (both of which are fitted with split pins). The bolts hold in position a pair of parallel cones (see Fig. 1). Punch the bottom cones out first (the second cone being punched out by a piece of round steel or similar article to prevent the engine dropping forward and thereby denting the front mudguard). The

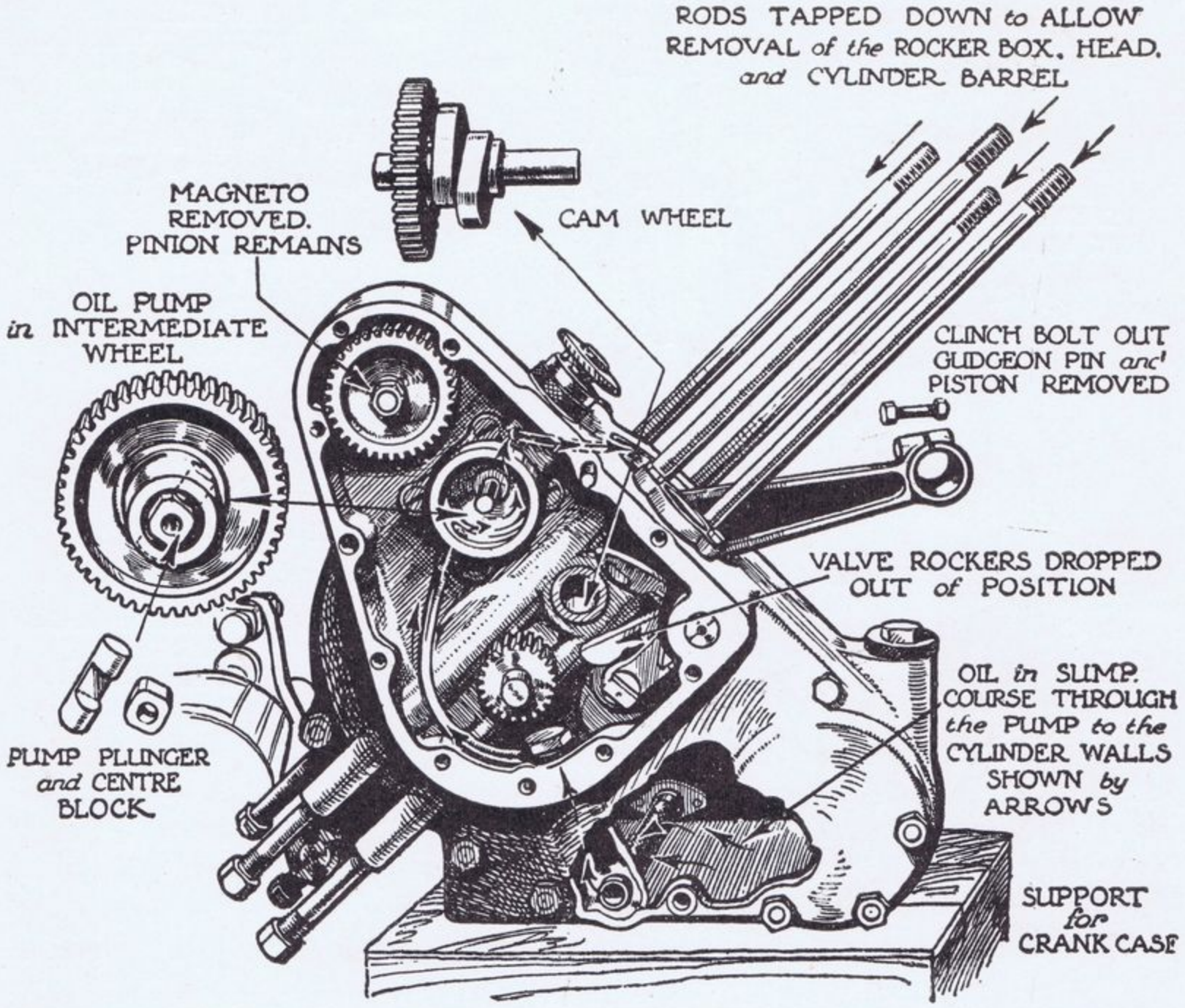


Fig. 2.—How the Panther Engine is dismantled without Removal from Frame.

front wheel should now be turned sideways so that the engine can swing forward, pivoting on the top cones. Place a piece of wood or similar packing under the engine to support it, and then punch out the top two cones, after which the engine can be lifted away to the bench for further attention.

Not Necessary when Decarbonising only

In order to dismantle the engine for decarbonising, valve grinding, etc., it is *not* necessary to remove the engine from the frame or to disconnect front chain, chain guard or brakes (see Fig. 2). Place a petrol tin or similar support under the sump and remove high-tension lead, exhaust pipes, valve-lifter wire, carburetter, top engine bolt and cones and slide upwards the bottom half of the telescopic push-rod tube. The push rods will then be exposed at the bottom end where they fit into the tappet cups. The four nuts at the top end of the long rods passing through the engine must be removed, when the top lugs (201, Fig. 4) will lift off. The long rods should now be tapped downwards.

Removing Rockers

Take hold of rocker box in right hand, and with the left hand on push rods lift bodily until the push rods are clear of the tappet cups (59, Fig. 4). The distance washers (206, Fig. 4) will now lift off, and the engine rods push downwards through the cylinder head.

Take Care to check Distance Pieces

Note that on all models previous to 1931 there are three pairs of distance pieces of different length. Take a note of these when dismantling, otherwise you may get fogged when reassembling. The longest pair go under rocker box on *timing* side; the next size go *under* rocker box on driving side, and the shortest pair on *top* of rocker box, driving side.

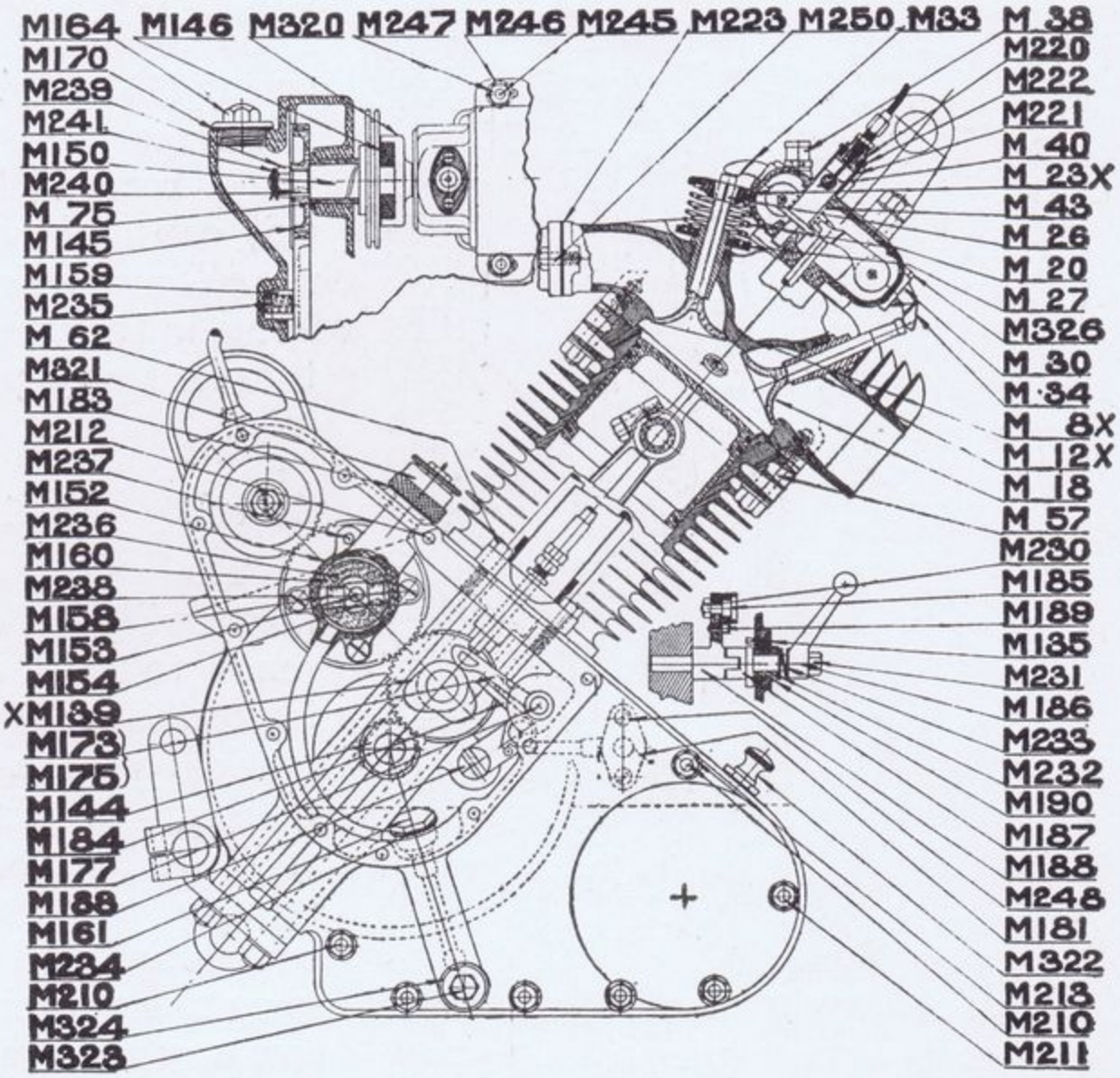


Fig. 3.—Parts of the P. & M. (Panther) and where Placed.

This diagram will be useful for locating the various parts mentioned in the text when dismantling the engine.

Remove Cylinder and Head

To remove the head, two more $\frac{3}{8}$-inch nuts must be removed between cylinder fins front and back, except on models earlier than 1926. The long engine rods should now be pushed down as far as they will go, and after removing cylinder, unless being completely dismantled, place a clean rag in the mouth of the crankcase to prevent any foreign matter from finding its way in.

Gudgeon-pin Fixing

By pushing through the gudgeon pin on models up to 1927 or removing the gudgeon-pin clinch bolt (171) on models 1928–30, the piston can

be taken in hand for cleaning and polishing. It is a wise policy to mark the piston before removing, so that it can be assembled in the same way. Distance washers on 1931 models are cast with the head (see Figs. 3 and 4).

Further dismantling of Engine—Crankcase

Commence to dismantle in the order set out above, and proceed as follows. The three $\frac{1}{4}$-inch nuts and nine screws secure the timing-case cover, and when removing the latter, a cap and spring (159, Fig. 3) will be found in a recess close to the magneto-wheel recess. The purpose of this cap and spring is to keep the oil-pump wheel (238) pressed home in the pump housing (152) to avoid any possibility of air leak.

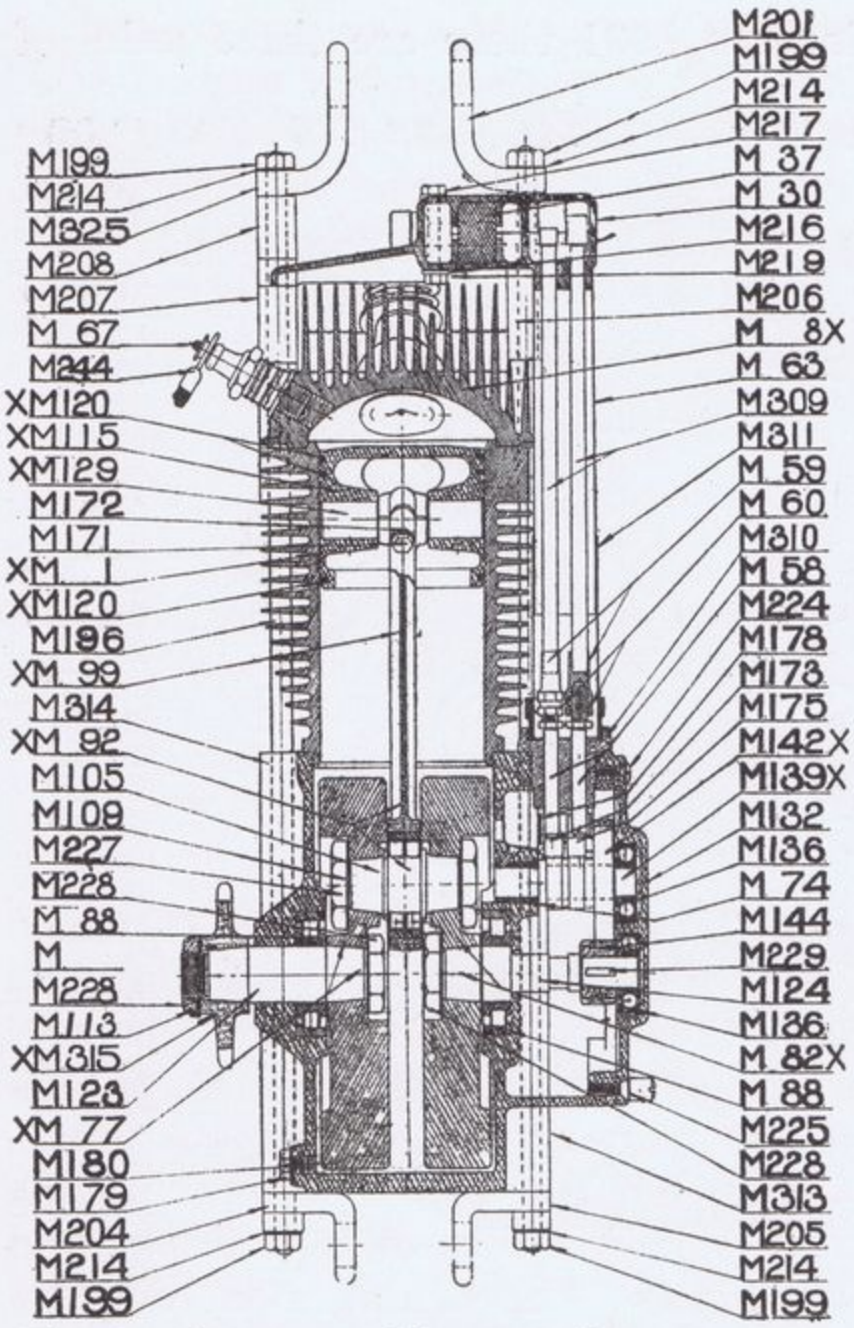


Fig. 4.—Another Useful Diagram for locating the Parts.

The numbers of the parts are referred to in the text.

Carefully examine Timing Gear

The intermediate pinion (238) will lift out (oil suction tends to hold it). It will be found that all timing wheels are marked with a spot, and it is therefore a simple matter to reset to correct timing. On modern motor-cycles cams do not wear until they have run very many thousands of miles, but any wear which may have taken place will be shown by ridges on the cam (139). A more frequent point of wear is the tappet levers (173), and if these show any signs of "flats" they should be replaced. Do not attempt to regrind the surface of these cam levers, as by so doing you will probably get a different radius, which will considerably affect the valve timing. The writer has known of cases where the valve timing was as much as 15° out, and this was traced to the cam levers having been ground to remove the flats.

A Very Useful Tip

The shaft (177) carrying these levers is a push fit in the timing case, but is easily removed in the following manner. The shaft is provided

with an internal thread of $\frac{1}{4}$ inch $\times$ 26. Take one of the crankcase bolts from which you remove the nut to take off timing cover. Screw the nut on to the bolt for a few threads and then screw the bolt into the cam-lever shaft (177). By lightly tapping outwards the nut on the other end of this bolt, the shaft will be found to pull outwards.

Very Important

Remember the small distance washer *behind these cam levers*, and do *not forget this when reassembling* ; also, when reassembling, do not drive the shaft in too far or the cam levers will bind. The end of the shaft should be *just flush* with the timing case. The big-end bearing of the connecting rod (92, Fig. 4) should permit of a small amount of side play, and if there is any up-and-down play the bearing must be renewed. Always dismantle the crankcase from the driving side first.

How the Sprocket is Fitted

The engine sprocket (315, Fig. 4) is not keyed on, and after taking off lock nut and washer the sprocket will usually come off easily if a stout short piece of solid brass is placed between the teeth on the rear side and given a good sharp blow with a heavy hammer. Do not attempt to separate the crankcase with a screwdriver. If a piece of wood is used as a punch, the case will generally separate without force.

The Magneto

Remove magneto by taking off the two $\frac{1}{4}$-inch nuts (247, Fig. 3) which hold the base plate to crankcase, and disengage driving dog (146) by pulling magneto outwards. There is no need to dismantle driving wheel in timing gear (145), as the dog coupling is marked with a centre spot for retiming. A sprocket draw tool is necessary to draw the main pinion (144) from shaft, as this is fitted on a fairly long key (229). After removing the long engine rods by pulling them through bottom engine lugs and remaining bolts, passing through crankcase, the timing side half will lift away.

Taking apart Flywheels

The flywheel assembly should be held in a vice. The crankpin nuts (227) must be removed (note locking washers). A piece of round $\frac{3}{8}$-inch steel inserted in one of the holes in the rim of the flywheel will give leverage. Single-row Hoffman bearings are fitted on all models up to 1926. From 1927 onwards, a double-row bearing is fitted (see Fig. 5).

If Big-end Bearing is Badly Worn

Oversize rollers cannot be satisfactorily fitted unless the crankpin (105, Fig. 4) is ground true. Such work can be dealt with best by the manufacturer of the bearings, but if excessive wear has taken place, both

the crankpin and outer sleeve may have to be ground out to such an extent that special rollers would be required.

More Economical Too !

Unless the reader has facilities for getting such regrinding done locally at a moderate cost, he will find it more satisfactory for the connecting rod to be returned to the makers for a complete bearing to be fitted.

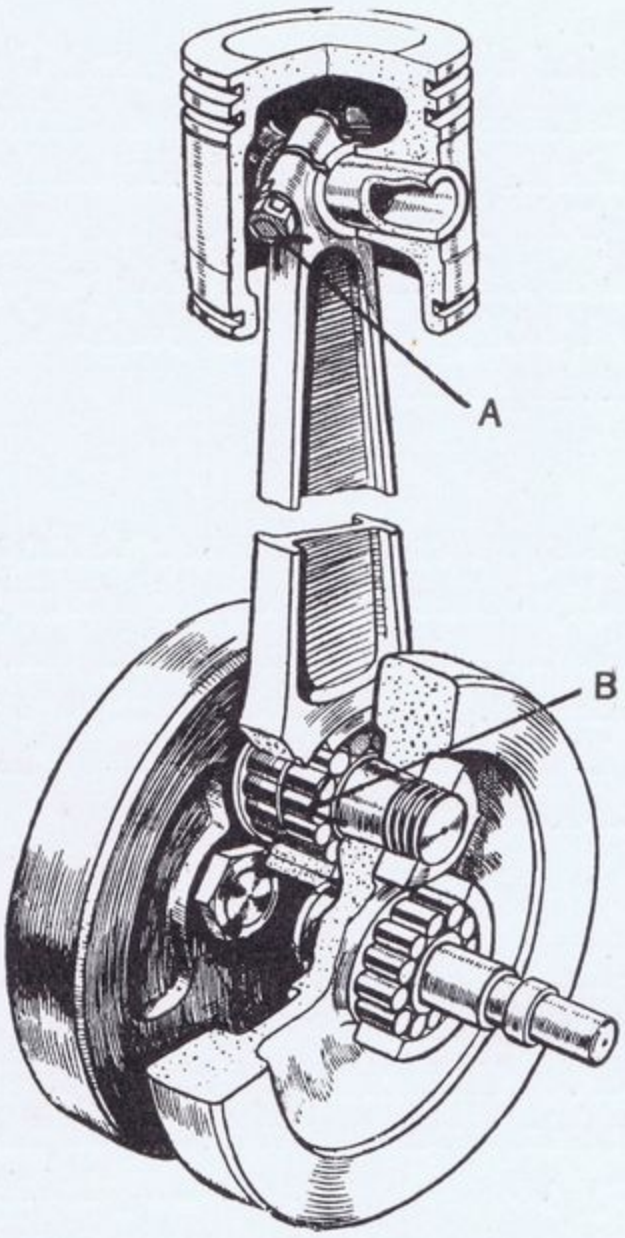


Fig. 5.—DETAILS OF CRANKSHAFT, CONNECTING ROD AND PISTON.

A indicates the clinch bolt. When tightening this up see that it is in line with the recess in the gudgeon pin. B indicates the big-end bearing. This should permit of a little sideplay, but no up-and-down movement. If the latter is present the bearing should be removed.

The Difficulty that Arises

I advise the return of the connecting rod, as when the bearing is pressed into the rod it must be fitted without undue force. The "pressing-in" process causes a certain contraction or shrinkage of the outer race, and the reader will therefore realise that a bearing which is perfectly free *out* of the connecting rod might be binding badly when *in* the connecting rod. Many a new big-end bearing has been ruined in 100 miles through being fitted too tightly. It is for this reason that many manufacturers will not supply these bearings unless the connecting rod is returned for fitting.

If you decide to fit the Big-end Bearing

If the reader has the necessary tools for pressing out the outer sleeve and decides to fit a new bearing, he must first mark the rod so that the new ring is pressed in from the reverse side to that from which the old ring is punched out. The new ring (or outer race) should enter the connecting rod for about half its width without force, and if it will not press fully home with medium pressure the race should be removed and a fraction ground out of the connecting rod until it is possible to press in the race without considerable force.

Assembling the Flywheels

Remember that the crankpin must revolve *quite freely* when *fitted*. When assembling the flywheels, the crankpin should be fitted to the

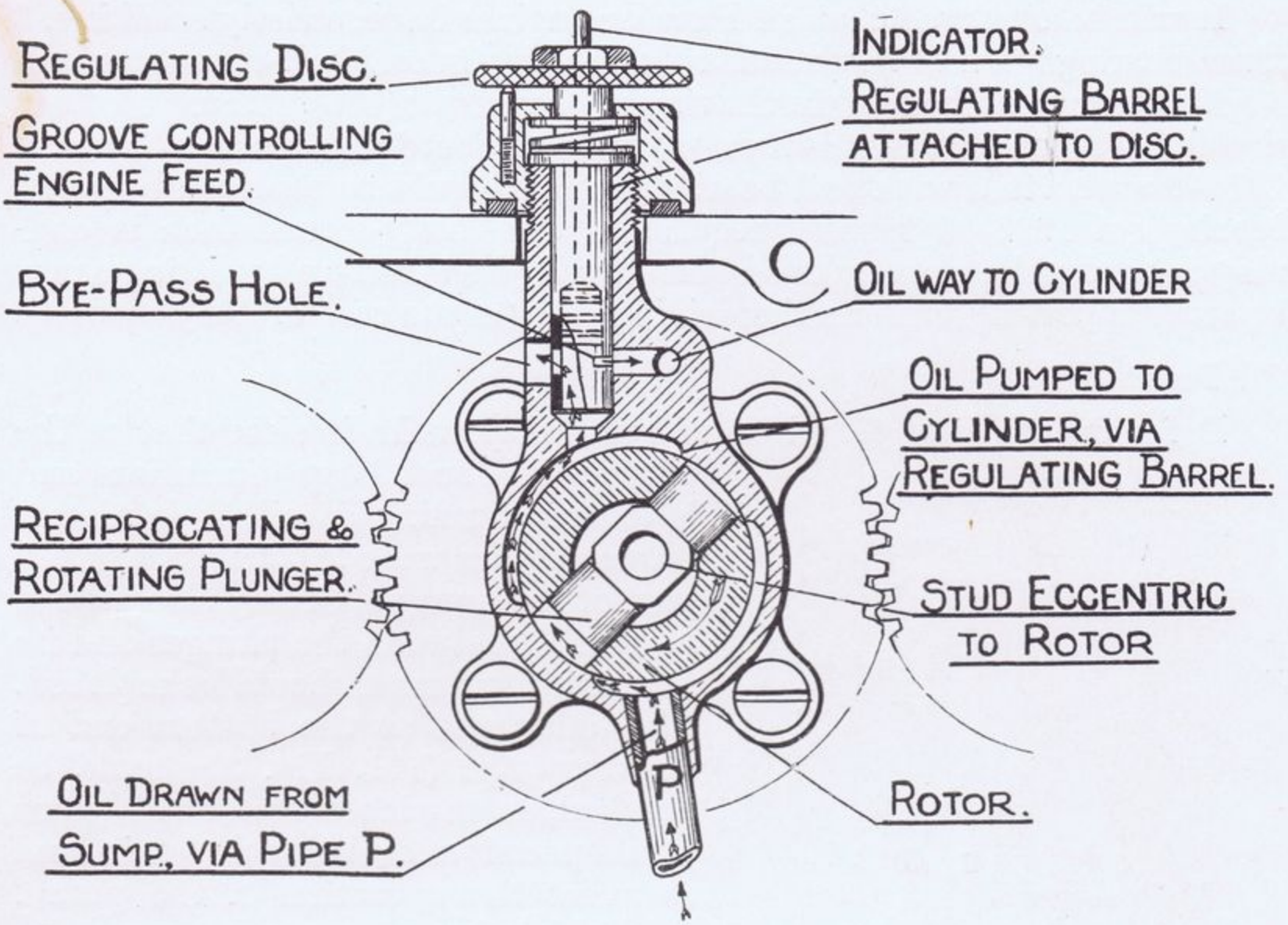


Fig. 6.—Details of the Oil Pump.

driving side first and the lock nut screwed well home, but do not turn down the lip of the lock washer until both nuts are fully home.

For some hints on dealing with faults in flywheels, see the section on " Crankshafts " later.

A Point regarding Small-end Bushes

The gudgeon-pin bushes on models 1924–6 are of phosphor bronze which are pressed in to the rod in the usual way, and call for no great skill in fitting, but here again the writer would emphasise the importance of the gudgeon pin being perfectly free *after* the bush is fitted. A tight gudgeon-pin bearing will cause piston knock and rattle. The reader will appreciate that when the piston is about halfway up or down the stroke, the angularity of the connecting rod will tend to " rock " the piston if it is binding on the gudgeon-pin bearing. On models 1927–30 the gudgeon pin is clamped in connecting rod and floats in piston. Always fit new lock washer and nip up clinch bolt with a good box spanner, taking care that the clinch bolt is in line with recess in gudgeon pin.

Mainshaft Bearing

The remaining point for attention is now the main engine shaft bearing (88, Fig. 4).

It will be observed that all Panther engines have, strictly speaking, a three-bearing mainshaft, viz. one roller bearing in *each* half-crankcase, and a self-aligning ball bearing in the timing-case cover (136). These bearings should be tested for up-and-down play and replaced if necessary. Models 1924–5 were fitted with ball bearings which should be replaced by roller bearings of 1926–30 types if required. One-thirty-second inch in end-play is advisable, but any excess can usually be taken up by fitting a new bronze supporting bush on the driving side (in the case of early models).

Oil Pump

Reference to Figs. 6 and 6A will probably make it clear that as the plunger is of such large dimensions and is always running *in* oil, it is almost impossible for wear to take place in any part of this pump. If any slackness is noticeable between the plunger and its housing, the former should be replaced. The union nut at the bottom end of delivery pipe (161, Fig. 3) should be checked, as any looseness at this point would permit of air being drawn in, and so affect the operation of the pump. Oil leaking from the regulator usually points to a slightly worn indicator rod or defective gland washer (183).

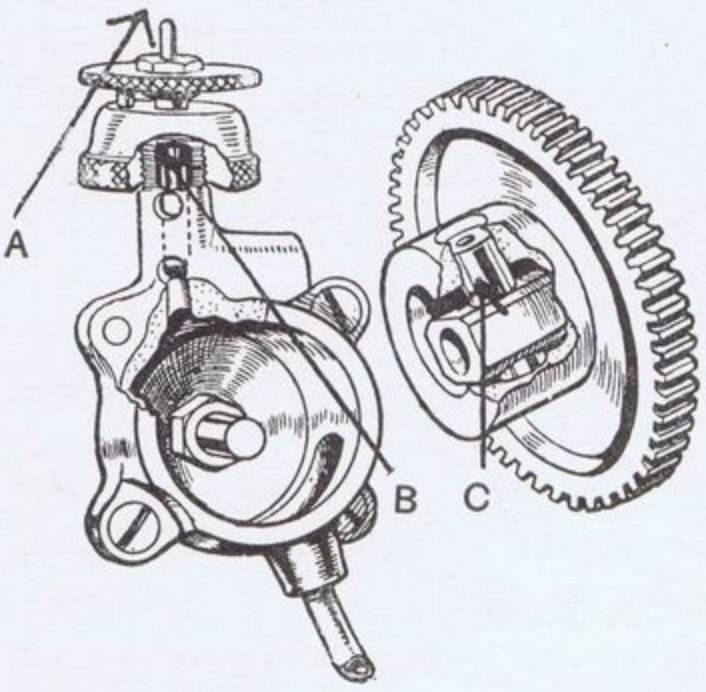


Fig. 6A.—WHERE THE OIL PUMP MAY DEVELOP FAULTS.

Oil leaking from the regulator may be caused by a worn indicator A, or defective gland washer B. The plunger C may become slack in its housing, in which case it should be replaced.

Tappets

By the use of cam levers (173, Fig. 4) side thrust on the tappets (58, Fig. 4) is practically eliminated. If wear has taken place in the guides (310) it is cheaper to fit oversize tappets unless the guides have worn oval. The latter, as will be observed, also form the base for push-rod tubes, and to remove these the two bolts (62, Fig. 3) which secure same should be removed and the guides knocked out from the underside.

Decompressor

Before reassembling the timing gear examine the small tongue piece (184, Fig. 3) attached to the operating shaft (188), and replace if this shows signs of wear. The smallest amount of wear at this point will make the decompressor inoperative owing to the small lift required.

If New Ballraces are Necessary

The self-aligning ballraces (136, Fig. 4) are sometimes loath to leave their housings, and a good plan for the removal of these is to hold the cover

plate over a small gasjet in such a manner as to warm the aluminium around the bearings. Lightly tapping the cover plate will then usually cause the bearings to drop out. If the bearings revolve freely without any feel of catching, there is no need to replace them.

Reassembling Crankcase and Timing Gear

Assuming that all timing wheels have now been replaced, according to the marks, the faces of timing case and cover should be scraped perfectly clean. An even coat of Hermetite or L'Hermitical should now be applied to the cover plate, and in refitting this *do not forget the spring plunger* (159, Fig. 3) which presses against the intermediate pinion (spring in timing cover). Replace the oil filter in crankcase (323) if this is damaged at all, and after fitting magneto the complete crankcase assembly can be placed on one side, with a rag in the mouth of crankcase to prevent dirt entering.

Refer to the sections dealing with Pistons, Cylinders and Connecting Rods for repair hints.

If New Guides are Required

The guides knock out from the inside, and can usually be removed quite easily in the following manner.

On models 1930 and 1931 a $\frac{3}{8}$-inch bolt should be passed through the guide with the head on the inside. A stout punch or piece of solid brass should then be placed on the bolt head and given one or two sharp blows with a fairly heavy hammer. In fitting the new guide, however, these must be treated with more respect, and the bolt head should only be tapped lightly in this case, otherwise the end of the guide may become " burred over." It is safer to take a piece of brass or copper $\frac{1}{2}$ or $\frac{9}{16}$ inch in diameter, 4 inches long, and get this turned down for 2 inches to $\frac{3}{8}$ inch diameter, so that it is a nice fit in the guide, and leaves a shoulder on the outside; now carefully drive home the guide.

The same remarks apply to models 1924–9, except that a $\frac{5}{16}$-inch mandrel should be used instead of $\frac{3}{8}$-inch.

A Point to observe with 1930-1 Models

When fitting inlet guides on 1930–1 models, see that the oil hole in guide coincides with the oil lead in the cylinder head. When new valves are fitted to new guides, make sure that the former is perfectly free, especially the inlet, which so often tends to run dry on the early models. The writer once lost a first-class award at Brooklands as a result of fitting a new guide and valve which was too good a fit.

The Rocker Box

The rocker box on all models up to 1930 is composed of a very hard alloy similar to that used for railway locomotives, and the rocker shafts take their bearing direct in this metal (see Fig. 7). Owing to the exceptional length of the shafts and the fact that they are lubricated by a

felt pad, it is very seldom found that any wear has taken place in these bearings. A certain amount of endplay is permissible, but if any direct up-and-down play is found the wear can be taken up in a like manner to the split big ends on car engines. It will be observed that the box is made in two halves. After separating, the surfaces can be reduced slightly and the shaft bearing reamered out to the correct size. This, however, is not a job which can be carried out without the necessary tools, and the writer recommends that the box be sent to the manufacturers for this work. If the rocker ends show signs of wear they should be replaced. Do not attempt to grind out indentations, as unless the same radius or curve is left on the rocker ends, it will cause rapid wear to both push rods and valves.

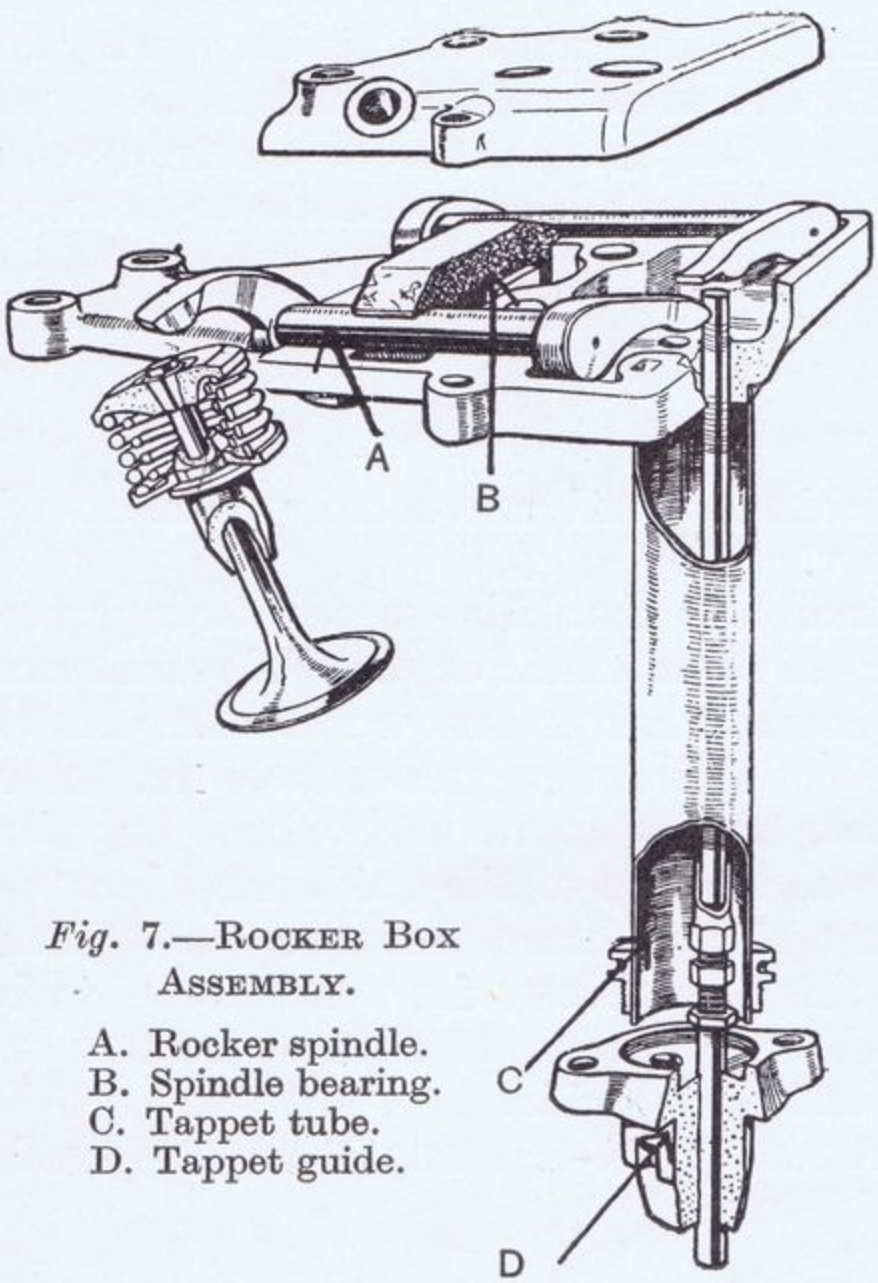


Fig. 7.—Rocker Box Assembly.

A. Rocker spindle.
B. Spindle bearing.
C. Tappet tube.
D. Tappet guide.

1930 and 1931 models have a one-piece rocker box of different alloy, and in this case the rockers are separate from the shafts, the latter running through a phosphor-bronze bush which is pressed into the box.

On reassembly of head and rocker box, adjust tappets to give 2/1000ths clearance on inlet and 3/1000ths on exhaust.

Carburetter

The standard carburetter on all Panthers up to 1928 is B. and B. Sports Model, and from 1929 onwards Amal Sports Model No. 45A. (See Carburetters," p. 403.)

After dismantling and thoroughly cleaning, it is important to use the correct-size jet to obtain the best results. These are as follows :

		Solo.	Sidecar.	
B. and B.	1924	43	45	
	1925	43	45	
	1926	43	45	
	1927	160	170	
Amal	1928	160	170	500 or 600 c.c.
	1929	150	170	
	1930	150	170	
	1931	150	170	

GEARBOX REPAIRS AND ADJUSTMENTS

The majority of Panthers are fitted with P. & M. four-speed gears, to which the following remarks apply.

Detaching from Frame

The gearbox in all cases (whether three- or four-speed) is held in the frame by three large studs which pass through the bottom bracket lug, and removal of the sleeve nuts from the bottom side will permit of the complete gear removal after disconnecting the gear-operation rod. Lift the gearbox upwards until the studs are clear of the frame ; turn gearbox on to its forward side, when it will pass through between mudguard and down tube, clutch side out first.

Remove top cover plate and pour in a cupful of clear paraffin. After swilling round, the drain plug in base should be removed to empty.

Taking down Clutch

Unscrew clutch end cap and take out mushroom-shaped thrust pin. The spring adjusting nut on the end of mainshaft should then be removed, after which the spring cup and spring will lift out and the plates will separate. The sprocket will lift off its bearing, leaving on the shaft the clutch driver or centre. This is keyed on to mainshaft, and after removing lock nut and washer, wooden wedges driven behind the former will bring it off the shaft without difficulty. Remove key from keyway.

Detach Kick-starter and End Plate

Take off kick-starter crank, then the nine $\frac{1}{4}$-inch nuts which secure end plate to case : the end plate will now pull away complete with kick-starter mechanism and gear-operating wheel and arm. The whole set of gears, consisting of main and layshaft, seven gear wheels and striking forks, will now lift out bodily. Take a careful note of their respective positions and slide the wheels off their shafts. Test main bearing (still in gearbox) for wear, and if this must be replaced, push out floating bush (unless this has come out with shaft) and take off main driving sprocket, which on 1924–5 models is screwed on right-hand thread and on 1926 onwards is splined on shaft. The lock nut in both cases is *left-hand thread.*

If Sprocket is Screwed Type

These screwed-on sprockets are sometimes very difficult to remove ; therefore proceed as follows :

Take a piece of flat mild steel, $1\frac{1}{2} \times \frac{1}{4}$ inches and 2 feet long, and attach to one end a 12-inch length of chain. Insert in the gearbox and between the dogs of the high-gear wheel a length of square steel, approximately $\frac{3}{8}$ inch wide. This will prevent the sleeve from revolving. Hold the gearbox firmly in a large vice, and now wind the chain round the sprocket tightly ; push on extreme end of the lever in an anti-clockwise direction. When the sprocket has been removed, the high-gear wheel and sleeve will withdraw through gearbox.

Inspect Parts for Wear

Examine each gearwheel, and if the dogs are rounded or chipped they should be replaced. The same remark applies to worn corners of the splined shafts, worn studs which hold the striking forks to the striking shaft, and a badly worn collar on the floating bush between shaft and high-gear sleeve should any of these defects be found.

Fitting Ballraces

The layshaft ballrace (driving end) and mainshaft (operating end) are interchangeable, and for ease of removal have fitted behind them a disk which is drilled and tapped, into which can be screwed a draw bolt.

Reassembling

Having refitted the high-gear dog and sleeve, the set of gear wheels and shafts should be mounted together and lifted back bodily into the box in the same way as they came out. The fitting of the end plate and the correct timing of the gears might at first present some difficulty.

First remove all dirt from the face of both box and end plate and apply a small quantity of jointing compound to one of the faces. Turn the kick-starter shaft until the ratchet is held out of operation by the cam (after first making certain that the pawl is not worn). Tilt the gearbox slightly upwards and turn the operating shaft by hand to such a position that the striking fork, as seen through the top of the box, moves the gear wheels as far as possible towards the clutch end of the box, and by turning the mainshaft (the one which carries clutch) you will make sure that the dogs on the wheel engage *fully* with the high-gear wheel. The correct position is found when a slight rotation of the shaft in either direction commences to move the fork away from the full-mesh position. The other fork remains stationary in its neutral position during this process (that is, the two lower gears are not engaged). The gearbox is now in top or fourth gear. Now taking the end plate, the operation wheel is located in the various gear positions by means of a spring plunger, which must be removed by unscrewing cap. Through the hole vacated by plunger will be observed four dimples, or recesses, in the operation wheel, into which the plunger falls to hold into position the

respective gears when correctly timed with the operating shaft. Turn this wheel by the lever until the top dimple is dead central with the hole for plunger. With the lever in this position replace end plate and endeavour to engage the operation wheel with the small wheel on the operating shaft without the lever moving in either direction. If the end plate will not go right home easily, you may have to insert a knifeblade under the plate and lift layshaft until it can engage with its bush in the foot-starter shaft (make sure that the latter is at the *top* of its stroke). If the plate will still not go fully home, the operation wheel may be riding on the teeth of the small pinion, and a very slight movement of the gear-operating lever should overcome the difficulty. Check the position of the dimple and see that it is *central* with the plunger hole ; if not, you are one tooth out in timing. You must remove the plate and try again. Secure the end plate by attaching two $\frac{1}{4}$-inch nuts and check each of the gear positions with respect to the positions of the striking forks and the dimples in the operation wheel. This can easily be done by moving the gear-operating lever and turning backwards and forwards the mainshaft. The dogs should be so timed that they are fully meshed at the same time as the dimple arrives in the centre of the hole. If the forks are still moving a gear in or out of mesh when the dimple is central the timing is not accurate. The dimples arrive at the centre of the hole simultaneously with the gear operation. There is no dimple for the neutral position, as this comes between 3 and 4. The spring plunger and cap may now be replaced.

Examination of the Clutch

Attention should now be directed to the clutch. The inserts of the plates, whether ferodo or cork, should be flat and free from grease. If loose they should be replaced. It will be noticed that half the plates are keyed to clutch driver, and the remaining half to sprocket drum. The keyways of the latter usually get worn in the form of " nicks," that is, slightly burred by the constant but light hammering effect of the plates when the clutch is out. If badly worn, this part should be replaced, but in any event the burrs must be removed, otherwise the plates *cannot* separate *properly*, with the result that *it is impossible to get a clean and easy gear change.* The keyways should therefore be cleaned up with a smooth file. This will give a little back-lash to the plates, but will not affect the efficiency of the clutch in any way. It will simply cause a little rattle when the clutch is disengaged, this only being noticeable if the machine is stationary with engine running and gear engaged, such as in temporary traffic stops. Before inserting the clutch plates, make certain that the sprocket is fully home on its bearing, otherwise you will not get all the plates home. Those readers who have machines fitted with Sturmey-Archer three-speed gears should refer to pages 91–102, which deal fully with that subject.