

1920

Indian Motorcycle With Powerplus Motor

*A Textbook for the Guidance of
the Indian Rider in the Proper*

OPERATION—CARE—MAINTENANCE
of his Machine



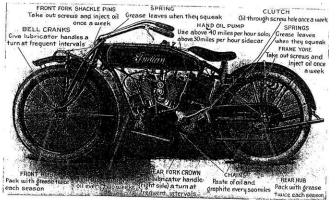
HENDEE MANUFACTURING CO., Springfield, Mass., U. S. A.
Largest Motorcycle Manufacturers in the World

CHICAGO, ILL.

Branches:

LONDON, ENG.

First Edition 1920



Oiling Diagram for 1920 Powerplus Models

INDIAN POWERPLUS

Type N-20 and NE-20

Operation, Care and Adjustment

UNPACKING THE MOTOCYCLE

In practically all cases the customer will take delivery from one of our regularly appointed dealers and the dealer will attend to the unpacking and setting up of the machine before it changes ownership. This is part of Indian service to owners.

When the machine is shipped direct to the purchaser, he will have to unpack and set it up himself. It is best to first remove the side boards on the left side of the crate, then unfasten and take out all parts of the equipment found tied to the motorcycle, knock out the stay blocks holding the machine in the crate and lift out the machine.

On 1933 Powerplus models without electric equipment the handlebars and saddle are not assembled on the machine. On electrically-equipped models, the handlebars, saddle, headlight, horn and storage battery are not assembled on the motorcycle. The handlebars are in all cases secured to the machine, while the other items are in separate packages fastened in the crate. Tools and pump are packed in a wooden box and fastened to the top board of the crate.

Be sure to remove all parts of the equipment from the crate and check them up with the catalogue specifications. Check tools with polished tin inside tool box. The tool box key will be found inside the tool box. Carry the key on your key-ring.

Any claims for shortage should be made to the dealer at once. Do this before working of the machine, as tools are liable to be misplaced and the dealer blamed unjustly.

All domestic machines are enclosed in paper before crating to exclude dampness. Open crates are used for shipping domestic machines.

Batteries are always shipped with electrolyte solution, in SEPARATE peaked top ("This Side Up") boxes.

SETTING UP THE MACHINE

Put on the saddle and handlebars. Be sure the handlebars are attached securely to the frame head.

Put the flexible casing for the magnets control from the right side of the handlebars through the left side of clip A, Figure 1, and bring it through to the left side of the machine, connecting it to the arm on the magnets contact breaker E. Be sure that the casing passes through clip D as in the illustration.

Connect the flexible casing from the left side of the handlebar with the throttle on the carburetor C. Put this casing through the clip A on the right side of the frame opposite clip A.

The flexible casings should be adjusted so that the handlebars can swing freely from side to side without damaging the casings or exerting a pull on them.

The throttle casing goes through the clip E on the control wire bracket and the magnets casing through the clip F. Test the controls to see that both throttle and magnets get their maximum range of action. Make adjustments by moving the flexible casings back or forth in the clips D and E.

On electrically equipped models remove the handlebar bracket and headlight bracket, then put on the handlebars. Next attach the headlight to its bracket. Put the horn, to the right of the headlight, in the handlebar. Attach the long wire from the armature to the lamp socket and the shorter wire to the horn. The third wire in the cluster is already attached to the generator; do not disturb it.

Put on the battery positive wire, connecting it to the block on top of the tool box (left side). Attach the negative wire from the battery under the plated head screw in the frame close to the battery box.

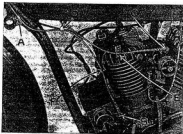


Fig. 1—Connecting Control Cables. Note that Magneto Cable is Attached at A and F and Passes through Left Side of Clip D.

See that the tires are inflated to 40 pounds. Don't try to ride them soft; it shortens their life.

Try all nuts and bolts before putting the machine in commission.

If the speedometer is fitted, the driving shaft will be found to have a snap coupling close to the rear set of gears. This coupling is left disconnected when the machine is shipped, to prevent factory handling of the motorcycle from registering on the mileage dial. The snap coupling is contained in the sleeve at the rear end of the shaft, the sleeve carrying a flat circular spring. Pushing backward on the sleeve couples the shaft to the driving gear. Pulling forward on the sleeve disconnects the drive shaft. When opening the sleeve listen for a click, which indicates that the shaft is connected or disconnected as the case may be.

MANIPULATION OF CONTROLS

On Powerplus models the grip control system is uniform. Turning the left grip inward (toward the frame) opens the throttle and gives more gas to the motor. Turning this grip outward (away from the frame) closes the throttle, slowing the motor.

Turning the right grip inward (toward the frame) advances the spark; turning it outward (away from the frame) retards the spark.

When the throttle is closed, the motor draws a very small charge of gas, sufficient to allow the motor to run up to 20 miles an hour by the use of the right grip (spark grip) alone. More speed and power are obtained by opening the throttle.

The exhaust valves are lifted by operating a lever below the right handbar. Lifting the lever raises the valves. The valves drop automatically when this lever is released.

The Powerplus clutch is operated in either of two ways. A pedal at the left foot-board—the clutch foot lever—when pushed forward disengages the clutch. A spring on this pedal causes the clutch to engage when the pedal is released. On the right side of the motorcycle is a long lever—the clutch hand lever—which works over a quadrant. When this lever is forward, the clutch is disengaged; when near the rear of the quadrant, the clutch is engaged. The hand and foot clutch controls are interconnected and either may be used as desired.

Any movement of the clutch hand lever acts correspondingly on the clutch pedal, but the latter does not actuate the hand lever. The hand lever can, therefore, be set to permit any desired degree of clutch engagement, depending on riding conditions, and this setting will not be interfered with by movement of the clutch pedal. If the roadway of the machine is controlled from the clutch pedal and the clutch is disengaged for any reason, it will re-engage only to the extent permitted by the hand lever.

It is advisable to use the hand lever when slowing down in traffic or coming to a stop, and when starting again in traffic. You may need both feet in an emergency and if the clutch pedal is used, the pedal may be released and the clutch engaged without meaning to be. For gear shifting, the clutch pedal should always be used.

The gears are shifted by means of a gear shift lever on the right side of the tank. This lever has a quadrant giving positions or "stages" for three speeds and a neutral or "out of gear" position. These steps are as follows: Upper end of quadrant, low gear; first step down, intermediate or second gear; lower end of quadrant, high gear. Neutral is between low and intermediate steps.

The brakes are controlled by a pedal close to the right footboard and by hand lever below the left handbar grip.

It is highly important that the rider familiarize himself with the operation of all controls before attempting to ride the motorcycle on the road. The good rider never needs to look at his levers or controls, but locates them by a sense of touch. This instinctive operation of the motorcycle can easily be learned by any beginner after a little practice.

FILLING TANKS

After the motorcycle is set up, the equipment fitted and the manipulation of the controls learned, fill the gasoline and oil tanks. The gasoline tank is in two sections, one occupying the right half and the other the left half of the tank assembly. Note that there are two gasoline tank units.

The total capacity of the gasoline tank (both units) is $1\frac{1}{2}$ gallons, sufficient to give a mileage of from 200 to 240 miles of average running.

The filling nozzles are near the rear of the tank, see nozzle for each unit. There is a

needle shut-off valve in each unit in rear of each filling nozzle. One of the filling nozzles has a priming syringe while the other has a filler cap.

Use only the best grade of gasoline obtainable and strain it before pouring in the tank. Straining the fuel will catch any sediment which will clog the fuel line and carburetor and cause motor trouble. Clean cheese cloth or chambray cloth make the best strainers. They also screen water in the gasoline, which may cause trouble if it reaches the carburetor.

Never fill the gasoline tank in the presence of a flame. It may result in serious injury to you and in the destruction of your motorcycle. Keep the filler caps tight and both shut-off valves closed when the machine is not in use.

The oil tank is in rear of the motor along the seat post tube and has the hand oil pump on its left side. The filling nozzle is at the top of the tank. The capacity is three quarts, sufficient for 150 miles running under ordinary conditions. Use Indian Oil, obtainable from all Indian dealers, to get the best results.

Indian oil is a specially-compounded lubricant, adapted for the Powerplus motor. It has been manufactured from our own formula since we began building motorcycles. It costs more than automobile oil, due to the fact that it is of exceptionally high fire test which is necessary in an air-cooled motor.

Do not use automobile oil, or any other low grade oil in the Powerplus motor. While such oils may be cheaper, they are destructive to bearing surfaces in the long run and lead to high repair bills. The most expensive automobile oils will not give good results because they have not the proper high fire test and other qualities necessary for correct lubrication.

After filling the oil tank, inject two or three pumpful of oil into the motor base by means of the hand pump. Be sure that the pump draws oil and not air. Draw up slowly as the pump handle, noting that there is some resistance when pulling on the handle. If so, the oil is being drawn into the pump. Pour down slowly and firmly on the handle.

As all oil is drained from the motor base before a machine leaves the factory it is necessary to inject a temporary supply with the hand pump before starting. The mechanical oiler commences to deliver the proper quantity of oil as soon as the motor starts unless the oiler is air-locked.

To be certain of this, after filling the tank make a test for air-lock in the oiler as per directions on Page 14. Do not neglect an air lock or a big repair bill will be the result.

Always keep the oil tank filled. If it becomes empty, air will be drawn into the mechanical oiler, making it necessary to release the air-lock which forms.

If you cannot obtain Indian Oil from your dealer, notify us and we will arrange to supply you promptly. Don't use an unsuitable oil unless you wish to run the risk of ruining your motor.

WHAT TO DO BEFORE STARTING

Put the machine on its stand.

See that the clutch lever is at the rear of its quadrant (clutch engaged) and the gear shift lever is at the neutral position.

Turn on the gasoline by unscrewing one of the needle shut-off valves there or four turns. Nothing will be gained by unscrewing it further. Draw up the plunger of the priming syringe in the left hand filler cap to load the syringe, then unscrew the cap. Open the primers at the side of the cylinders and squirt a charge of gasoline into each cylinder with the syringe. Close the primers tight immediately.

Pull out the starting stem 12 on the carburetor, Figure 2, until the stop pin rests against its lug. Depress the flapper slightly and hold it down for a second. Turn the

right grip inward (toward the machine) to advance the spark and use the left grip inward to open the throttle slightly.

Don't forget to inject two or three pumpfuls of oil into the motor base with the hand pump before starting the motor. Be sure there are no air locks in the oiling system. (See page 14).

STARTING THE MOTOR

Turn down the head of the kick starter crank and place the foot on the head. Lift the valves by means of the exhaust valve relief hand lever and press quickly down on the starter crank. When the crank is half way down release the exhaust valve relief hand lever, but continue the thrust on the starter crank until it reaches the bottom.

When the motor starts, open the throttle a little to warm up the motor, but not so much as to cause it to race. Release the kick starter crank and the latter will come up to its stop. **Disengage the clutch by pushing forward on the clutch hand lever.**

If the motor will not start or misfires when running, see page 8. When the motor "warms up," turn the starting room until its pin fits in the slot in the guide, which is the normal running position for the room.

Do not open the throttle wide for starting as the motor will race, which is the worst abuse that can be inflicted upon it. The motor must not be raced when the clutch is disengaged, either.

Weather conditions effect ease in starting the motor and it may be necessary to crank it more than once. Under ordinary conditions it should start in a few seconds. If the motor is cold, starting is facilitated by priming as mentioned above.

Except under very low temperatures, a motor can generally be started by proceeding as follows: With the spark fully advanced, and the throttle about one-quarter open, lift the valves and crank the motor two or three times. This draws a charge into each cylinder. Then drop the valves and crank the motor against compression, when it will start.

Proceed as before when the motor "warms up."

STARTING THE MACHINE

With the clutch disengaged by pushing the clutch hand lever forward or by pressing down on the left hand or clutch pedal, pull up slowly on the gear shift lever at the right of the machine until it goes easily into the upper step on the quadrant. This engages the low gear. Open the throttle slightly and at the same time bring back the clutch hand lever gradually or raise the left foot gradually, when the motorcycle will move off on the road.

Throttle and clutch should be operated simultaneously when getting the machine under headway. In other words, the clutch should be engaged as the throttle is opened to maintain a constant load. When the motorcycle is moving on the road, close the throttle to slow down to the speed desired.

Do not engage the clutch suddenly as it may stall the motor.

Always start on low gear, as it imposes the least strain on the driving mechanism.

If the machine runs jerkily, push forward on the clutch hand lever until the jerking is eliminated. The position of the clutch hand lever on the quadrant regulates the cushioning effect between the motor and the rear wheel. This position will be found very close to the rear of the quadrant, depending on the speed of the machine. A positive yet smooth drive can easily be obtained by moving the clutch hand lever on its quadrant until the drive is steady and the clutch does not slip. Experience will quickly indicate the happy medium where the best results are obtained.

It is well to bear in mind that a jerky drive is very injurious to chains, tires, motor and the entire machine. There should be no hesitation about moving the clutch hand lever forward gradually on its quadrant to eliminate this jerking. A pounding of the motor in a jerky manner is often mistaken for a knock, when it really is due to too tight a clutch.

SHIFTING THE GEARS

The clutch must always be disengaged before any attempt is made to shift the gears. There is a safety lock on the three-speed gear which prevents moving the gear shift operating lever when the clutch is engaged and this lock is withdrawn when the clutch is disengaged by the foot lever or the hand operating lever.

For the low gear, the gear shift lever is pulled up to the upper step of the quadrant. To shift to second gear, close the throttle by turning the left grip outward, at the same time disengaging the clutch. Move the shift lever smartly to the second step on the quadrant. As soon as the lever has reached this position, engage the clutch and open the throttle. To shift to third or high gear, proceed as above, except that the shift lever is moved to the lowest step on the quadrant.

TO SHIFT TO A LOWER GEAR—The speed of the motorcycle must be reduced by partially closing the throttle before a shift to a lower gear is made. The clutch is disengaged and the shift made quickly to the lower gear, when the clutch is immediately re-engaged. Making a shift to a lower gear when the speed of the motorcycle is not reduced, sets up heavy strains on the whole machine as soon as the clutch is engaged.

The shift to a lower gear should be made the instant the motor shows signs of lurching, as when ascending a steep hill, going through deep sand, mud, etc.

After getting into high gear, the speed of the motorcycle is regulated by the throttle. Always drive with the spark as fully advanced as possible without causing the motor to knock. If knocking occurs, slightly retard the spark by turning the right hand grip outward, when the knocking will cease.

ADJUSTMENT OF INDIAN-SCHERLER CARBURETOR

The Indian-Scherler carburetor is of the floatless type, the supply of gasoline to the mixture being controlled by a cam and needle adjustment which regulates the proper amount of gasoline at all speeds. The primary air for vaporizing the gasoline is taken into the carburetor through an air-vent at the bottom and this bend should always be kept turned to as to draw warm air from one of the cylinders.

The carburetor is properly attached and adjusted to the motorcycle before leaving the factory. It is important, therefore, that the rider study the following instructions carefully, in order to get the best results from the motor. These depend in a large measure on the proper adjustment and care of the carburetor. It may be that the factory adjustment might not be the best for abnormal climatic conditions.

If when attempting to start the motor for the first time it does not run perfectly, first see that the ignition is correct. If the difficulty seems to lie in the carburetor, proceed as follows:

LOW SPEED ADJUSTMENT—See that the air-valve A, Figure 2, seats lightly; then turn needle knob E to the right until needle E seats in the spray nozzle, cutting off the flow of gasoline. Now turn I to the left about three turns and slacken the little screw just above low speed adjusting screw L, turn in latter about three turns. Open throttle about halfway to start motor. After starting motor close the throttle and turn I to the right until mixture becomes so lean that the motor backfires or misfires; then turn I to the left, north by north, until motor runs smoothly. If with this adjustment, motor runs too

fast, turn low speed adjusting screw L to the right. When satisfactory, screw down the little screw above L to lock the latter in place.

HIGH SPEED ADJUSTMENT—The carburetor is now ready for high speed adjustment. Open the throttle and advance the spark fully. The high speed adjustment is made by the pointer Z which moves over a figured arc. Moving Z from 1 toward 3 increases the supply of gasoline; moving it from 3 toward 1 cuts down the flow of gasoline. When the pointer Z reaches the right position, the motor will run without misfiring or backfiring.

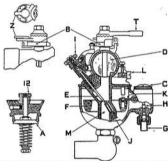


Fig. 2—Schebler Carburetor, Showing Construction. Auxiliary Air Valve Section at Lower Left; High Speed Adjustment at Upper Left.

If when Z is turned toward 3 the mixture is still too lean, causing popping or backfiring, increase the tension of the air-valve by turning the adjusting screw 12 to the left. Open high speed auxiliary air valve by means of its handle at the side of the carburetor body when extreme speed is desired. This valve should be kept closed when making adjustments.

STARTING—Before operating the kick-starter, lock the air-valve closed by pulling out knurled button 12 and giving it a quarter turn. When motor is started turn button 12 back, until the little pin fits flush in the hole in the center lug. This is the normal position for the air-valve, and permits it to operate in the customary manner. The locking feature of the air-valve does not interfere with the instructions for the adjustment of the air-valve.

When first starting motor, it will be inclined to pop back in the carburetor, caused by the parts being cold. However, do not adjust the carburetor, but wait until the motor is warmed up, when the results will be the same as before.

FLOODING AND ITS REMEDY—When gasoline runs out of the air bend at the bottom of the carburetor, the float valve H which controls the flow of fuel into the carburetor is generally prevented from closing by dirt or other foreign substances. To clean, remove the cap and take float valve H from seat, allowing the carburetor to be flushed thoroughly, thus removing any particles which might be in the line. Dirt, etc., passing from the tank may clog the gasoline pipe or reduce the flow of gasoline to such an extent as to cause misfiring. Strain all gasoline before putting it into the tank.

To clean the carburetor, disconnect the gasoline pipe, remove locknut at bottom of carburetor, take off bowl and clean thoroughly.

The top of the cork disk should be bent and measure $\frac{1}{8}$ of an inch from the top of the bowl to the top of the float when float valve is seated.

ADJUSTMENT OF THE CLUTCH

The Indian clutch is of the dry plate multiple disc type. It consists of five discs with eight friction surfaces, four of which are smooth and four friction lined. When the discs are all in contact with each other, the clutch is engaged. A set of springs, eight in number, keep the discs in contact.

When the clutch discs are separated, the clutch sprocket, D Figure 3, slides on a series of twenty-two hardened steel rollers EE. When the discs are separated the clutch is said to be "disengaged." The separation is made by the movement of a shaft F—the clutch release worm shaft—in the hollow main shaft of the three-speed gear; this shaft forcing the front plate H outwardly and taking the tension of the clutch springs from the discs.

Should the clutch not hold when the hand lever is drawn up the rear of the quadrant and the motor races, loosen the lock nut C, Figure 4, and unscrew A half a turn. Tighten C and test the clutch. If it still slips, screw A out another half turn. Two or three adjustments may be necessary to get



Fig. 3.—Clutch and Starter View, Showing Locking Ring and Tension Screws.

the clutch to hold properly. The screw A should not be unscrewed more than half a turn at a time. This screw is acted upon by the release worm shaft F and as the discs wear thin, the ends of F and A eventually come into permanent contact and prevent the discs engaging tightly. Backing off the screw A compensates for wear on the discs and allows them to engage fully as when new.

The screw A must positively be held from turning whenever nut C is tightened, otherwise the adjustment will be upset.

If the adjustment of screw A does not remedy slipping of the clutch, loosen screw I, Figure 3, and put a screw driver blade in the slot of screw A to prevent it from turning. Then move locking ring 2 to the left as far as it will go. This releases the clutch tension spring screw B for adjustment. Tighten each screw B one turn and try the clutch under load for pull. It may take two or three adjustments to get the clutch to hold properly.

Replace locking ring; hold screw A from turning and tighten locking ring and screws I. Turn all screws evenly.

If the friction fabric, G, becomes glazed so that increasing spring pressure on the discs will not remedy slipping, remove front plate H, withdraw the discs and wash the lining with gasoline. Take out the four screws B to free plate H.

If continuous tightening of the clutch tension spring screws B does not remedy slipping, new clutch linings should be put in. See your dealer about this. There are normally eight springs in the clutch, but this number can be increased to 12 or 16 for extra heavy service if desired.

Removing screws I, ring J, nut C, spring cap, spring, starter pinion and the four adjoining screws B will release cover plate J of the spring housing and give access to the springs.

Always leave the clutch engaged when the machine is idle. This relieves the tension on the springs and increases their life. It should not be necessary, with a properly adjusted clutch, for the hand lever to be at the extreme rear of the quadrant to get correct contact of the discs. It is better to adjust the clutch so that when running on level roads it will be at least two inches from the rear of the quadrant. This will enable the rider to increase the tension for hill-climbing and hand going by drawing the lever to the rear of the quadrant.

Do not put any oil on the clutch discs.

ADJUSTMENT OF BRAKES

The Indian is fitted with an external and an internal brake, acting on a drum fitted to the rear hub. The internal brake is expended within the drum and is operated by the brake pedal above the right footboard. The external brake is connected around the drum and is operated through a cable from a small lever on the left handlebar.

Test the brakes occasionally when riding, to make sure that they are in working order. When the need arises, you want your brakes—you want to be sure of them and you have no time to fix them. You cannot pay too much attention to the brakes. It's the best and cheapest motorcycle insurance.

Except in emergencies, apply the brakes gradually. This avoids putting an unnecessary strain on the machine and tires, and is more effective. Locking the rear wheel is not

good braking; a machine can be brought to a stop quicker by a gradual application of the brakes than by locking them suddenly. Never apply the brake without first disengaging the clutch and retarding the spark. It is very injurious to the machine and tires.

TO ADJUST THE INTERNAL BRAKE—Remove cover pin 1 (Figure 5) and loosen nut 2 by turning it to the right. Then loosen lock nut 3 and turn screw 4 to the right three or four turns. Test the brake with the motor running on the stand. When

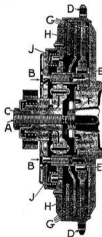


Fig. 4.—Section of Clutch; Adjusting Screw for Tension at A and Lock Nut at C.

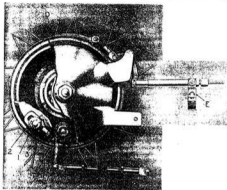


Fig. 5.—Internal and External Brakes Operating on Drum D. External Brake Adjusted by Moving Clamp E or Turning Clevis B; Internal Brake by Turning Screw 4.

the brake is hard on, the brake pedal should be at least 1½ inches above the footboard. This will enable the brake to be properly operated without lifting the foot from the footboard.

After proper brake adjustment has been made, tighten nuts 1 and 3 and replace cover pin 1. If the brake pedal comes too close to the footboard, proper braking power cannot be obtained.

A screw in the brake pedal body just below the pivot regulates the rise of the pedal above the footboard. The front edge of the pedal pad or shoe should not be over ½ inches above the footboard when the brake is off. Proper position is obtained by loosening locknuts 5 and 6 on the long brake rod 7 and turning this rod. Turning rod 7 to the

left pushes back the outside operating lever and slackens the internal band. Turning it to the right draws forward the outside operating lever and tends to expand the internal band. After making an adjustment, tighten the locknuts.

TO ADJUST THE EXTERNAL BRAKE—Remove cotter pin that keeps pin A in place and take out A. Lift up screw B from the clevis where it is connected to A and turn B to the right two or three turns, screwing it into C. Replace B and A and test brake by running motor on stand. If brake does not hold satisfactorily, screw B into C another turn.

When the brake is released it should not drag on the drum D. To test for dragging, spin the rear wheel by hand with the gear in neutral and the clutch engaged. If the wheel does not spin freely, the external brake is dragging.

To slack the brake band, loosen the clamp E on the rear fork side and move the clamp backward (toward end of fork) a trifle. Test brake for dragging, and if this still exists, move clamp very gradually until wheel runs free with the brake released. Then tighten the screws of clamp E and replace cotter pin in A. When the external brake is hand on



Fig. 6—Mechanical Oiler; to adjust, unscrew cap 1 (on timing gear case cover) and cap 2 (on forward end of pump). Loosen lock screw 3 and screw plunger 4 to left to cut down amount of oil fed to motor. To increase amount of oil, screw plunger to right. Then tighten lock screw 3 and replace caps 2 and 1.

there should be 1½ inches clearance between the hand lever and the handlebar grip. If the lever comes too close to the grip, maximum power cannot be applied. If too far from the grip to give a good purchase for the fingers, full braking power cannot be obtained.

The brakes should be tested after every adjustment of the chains has been made. Watch the brake linings. When they become worn, have them replaced by your dealer.

Keep oil away from the brake lining.

Keep all brake nuts tight and all cotter pins in place.

Put a few drops of oil on all working joints once a week. By keeping the brake linkage well oiled and free-working, the brakes will always release promptly and there will be no mysterious loss of power through dragging.

ADJUSTMENT OF MECHANICAL OILER

The Indian mechanical oiler, located on the right side of the motor base, is driven by worm gears off the main shaft. It positively delivers a charge of oil to the motor, the quantity being proportionate to the speed and variable to meet road conditions.

The oiler is entirely automatic in its action and is adjusted at the factory to feed sufficient oil for average operating conditions. Ordinarily, it will require no attention on

the part of the rider and will guarantee positive lubrication of the motor while there is oil in the tank. The oil tank should be filled daily to ensure ample lubrication for emergencies.

If the nature of the country in which the machine is being used makes it desirable to alter the pump adjustment, pointed as is the directions under the Mechanical Oiler illustration, Figure 6.

Continuous smoke from the muffler indicates too much oil. Staggishness of the motor and falling off in speed and power indicates insufficient oil.

The oiler can fail only under one condition—if the oil tank is allowed to become empty. When this occurs, the pump draws air and an air lock forms which prevents oil flowing until the lock is relieved. After refilling the tank, remove screw 5 Figure 6 and run the motor a few minutes until oil flows freely and regularly from this hole. Replace the screw and make sure that it is tight.

If for any reason the pipe leading from the oil tank to the oiler is disconnected, reconnect the pipe and remove screw 5 to make sure oil is passing as before.

USING THE AUXILIARY HAND PUMP

The auxiliary hand pump is carried at the side of the oil tank. It is intended for supplying additional oil for sidecar work or for racing, and also for recharging the motor base with fresh oil after draining off the old oil. Above 45 miles per hour (riding solo) the mechanical oiler cannot furnish sufficient oil for adequate lubrication, as the requirements are greater than its capacity, and the hand pump must be used to supplement it. Do not disturb the mechanical oiler adjustment unless your machine is to be used continuously for racing; use the hand pump for the additional oil required.

Draw up on the hand pump handle at moderate speed to ensure sufficient vacuum to lift the check valve and bring oil into the pump. If the handle is pulled up fast, the pump will draw mostly air and little oil and the rider may think he is giving the motor plenty of oil when such is not the case. The downward stroke of the handle should be steady and powerful enough to get the oil into the motor base.

For sidecar driving on high gear at over 25 miles per hour, the hand pump should be used to supplement the mechanical oiler on account of the increased load. Pump half a pumpful every ten miles. Do not depend on the mechanical oiler alone for sidecar work.

When the motorcycle is run on intermediate or low gear for over three minutes at a time, the hand pump should be used to feed more oil. The motor under these conditions is exerting a strong pull and running fast, hence the need of extra oil. The actual amount of oil supplied by the hand pump depends upon the operating conditions.



Fig. 7—Removing Valve; Lower Dust Cover Sleeve is Slid Upward on Upper Sleeve and Retaining Ring Withdrawn.

ADJUSTING THE VALVES

The condition of the valves is a most important factor in the proper running and development of power of the motor. All valves are mechanically operated and are interchangeable. They are provided with adjustable tappets to compensate for wear. The intake valves are those nearest the carburetor, while the exhaust valves are those farthest away from the carburetor.

If the tappet clearance is not kept at the proper space, the valve timing will vary and the motor will lose power and speed and become noisy. For the intake valve, the clearance is three thousandths of an inch. For the exhaust valve the clearance is six thousandths of an inch. Tappets should always be adjusted when the motor is COLD.

The exhaust valve needs more clearance than the intake valve as it expands with the cylinder and whether hot or cold the clearance remains the same. The intake valve does not expand with the cylinder and when the latter gets hot it lifts the intake valve stem, leaving six thousandths of an inch between the stem and the tappet.

To inspect the tappet clearance, unscrew the lower half of the dust cover sleeve A, Figure 8, by turning it to the left. When free, slide it upward over the top sleeve, exposing the tappet.

To adjust the tappet clearance, see directions under Valve Tappet Illustration, Figure 8.

Be sure to tighten the lock nut B on the valve tappet. Lower the dust cover sleeve A and screw it down. All valve tappets should be inspected once a week.

GRINDING VALVES

If the motor shows a falling off in power and speed and there is an undue "play" between the valves and tappets, test the compression by standing on the starter pedal with valves dropped, or pulling the rear wheel over slowly with the gears and clutch engaged.

There is a leak, either past the valves or piston rings, if the motor turns over easily against compression. It is usually the valves and is remedied by grinding with fine emery powder and oil mixed to a paste or with valve grinding compound, on a file by all dealers.

To remove a valve, first unscrew the hexagon cap in the cylinder head directly over the valve. A special wrench is provided which fits these caps. They unscrew to the left.

Unscrew the dust cover sleeve, Figure 7, and slide it upward. The valve spring retaining ring is now exposed. Push up on the spring retaining washer with a screw driver to free the retaining ring. This ring is a split ring, thus O, and fits into a groove in the valve stem. When the two parts of the ring are withdrawn, the valve spring will drop down and the valve can be lifted out of the cylinder.



Fig. 8—Adjusting Tappet Clearance. After raising dust cover sleeve A, loosen lock nut B with special wrench in tool kit. Hold nut D with wrench and turn C to right or left until proper clearance is obtained.

Stuff a rag or piece of waste into the passage leading to the cylinder, to prevent any paste entering as this will injure the piston and cylinder and ruin the compression. Place a small quantity of the emery paste or grinding compound evenly around the seat of the valve and replace the valve on its seat. Insert a screwdriver blade in slot in top of valve head and scrape back and forth a quarter turn, using light pressure. Raise the valve from its seat frequently and remove it, cleaning off the paste with gasoline on a rag and note progress of the work. The seat must be bright and smooth all around to ensure tight compression.

After grinding the valve, wash it and its seat thoroughly with gasoline to remove all traces of the emery paste. Be sure to remove the rag or waste from the cylinder passage before replacing the valve.

VALVE AND MAGNETO TIMING

If the timing gears are removed from their housing they should be replaced according to the diagram, with all marks registering. All five gears in the train have marks, the



Fig. 9—Timing Gear Train. When all Marks Register Valves and Magneto are Correctly Timed.

three middle gears having two marks each, while the piston shaft gear A and the magneto piston have one mark each. Piston A is keyed on its shaft and retained by a washer and screw.

When marks on all gears register the valves and magneto are correctly timed.

Piston A drives cam gear B directly. Gear B drives gear C directly; this gear has a rotating valve portion which permits of the escape of oil from the motor base to the timing gear and provides the timing gear with lubrication. It is known as the compression release valve gear. Gear D is an idler to transmit motion to the magneto gear.

REMOVING CYLINDERS

Cylinders should be removed from the motor at least once every 2,000 miles to inspect for carbon deposit.

Too much oil, as well as dirt taken in through the carburetor causes carbon to form

on pistons and in the combustion chamber; this deposit causes overheating and "knocking" and lowers the efficiency of the motor. It is advisable to have the dealer remove carbon, unless the rider has had experience in this work.

To **disconnect the front cylinder**: detach spark plug wires and remove front exhaust tube. Great care must be taken in removing the exhaust pipe nuts, as the heat of the exhaust has a tendency to bake the nuts to the cylinder nipple. If the motor is not warm, a small quantity of kerosene oil should be squirted around the nut and allowed to stand for a short time to loosen the nut. If the nut does not loosen from the kerosene readily, it will be necessary to run the motor a short time to warm the nuts and nipples. Then tap the nut lightly and use great caution in putting strain on the nut with a wrench.

Without these precautions, the cylinder head may be broken at the nipple by a man putting the wrench on and trying to jerk the nut loose.

Next disconnect clutch band lever from bottom of rocking plate and push lever backward. Disconnect and remove carburetor. Disconnect and remove relief valve on timing gear case; disconnect oil pipe to front cylinder. Unscrew lower dust cover sleeve and remove cylinder cap nuts. Remove the spark plug. Bring piston to bottom of stroke. Lift the cylinder straight upward until it touches the frame, then tilt sideways. See the Illustrations Figs. 10, 11, 12 and 13.

To **disconnect the rear cylinder**, follow the same procedure as for the front; disconnect lift rod from lower arm and disconnect feed pipes from oil tank to both pumps.

REMOVING CARBON

Carbon deposit can best be removed with special scrapers which can be bought of the dealer or from an automobile accessory house. A long screwdriver or wood chisel will do in place of a scraper.



Fig. 10—Removing Cylinder; Disconnected and Ready to Remove.



Fig. 11—Removing Cylinder; Lifted Upward Clear of Piston.

The carbon will be found to have collected in the combustion chamber and valve pockets. It is well to take out the primers and clean them at the same time.

Carbon should be removed at least once each season. If the rider has not had experience in removing carbon, this operation should be left to the dealer. The dealer has the necessary equipment to make a first class job of this.

When replacing a cylinder, see first that the cylinder seat gasket is in good condition. Replace it if it is not; otherwise there will be an oil leak at this point. Be sure that all the surfaces and the gaskets are perfectly clean.

Screw down on the cap nuts evenly, a little at a time. Do not tighten one all the way and then the next, and so on. The cylinder may not seat properly if the nuts are not set up evenly. After a day or two the cap nuts should be tried again to see that the cylinders set properly on the motor base.

Reverse the procedure for taking off the cylinders when putting them back in place. Piston must be at bottom of stroke when putting cylinder on. Be sure and enter the piston carefully into the cylinder so as not to injure the rings.

Under no circumstances should oxy-acetylene or oxy-hydrogen apparatus be used to remove carbon. The heat from such apparatus may damage the piston and cylinders by warping, injuring the motor, and, in extreme cases, requiring new parts. Use the scraper.

With the cylinders off, bring the piston to its approximate position. Put a clean rag under the piston to keep dirt out of the motor base. Scrape carbon from the top of the piston and from the ring grooves, if any is there. Look at the under side of the piston in each case and scrape off any carbon which has accumulated. Wash each piston with gasoline or kerosene after removing the carbon. Take out the rags and flush the motor base, removing the screw plug in the left motor base half below the magneto vent while flushing. When the old oil and gasoline is drained from the motor base, replace the drain plug, making sure that the leather washer is intact.

To remove the carbon from the cylinders, take out the hexagon caps above the valves and work with the scraper through the openings thus exposed, as well as from below.

FLUSHING THE MOTOR

About every 1,000 miles or less, the motor should be flushed with kerosene. This is to loosen carbon and keep piston rings free, as well as to cut old oil and remove it from the motor.

Have the motor hot when flushing. Disconnect the spark plug cables from the plugs to prevent accidental firing of the kerosene vapor. Open the primers and inject three full syringes of kerosene. This will loosen all carbon inside the cylinder.

Disconnect the oil pipe from the hand pump (left side of motor base) and inject not less than 10 full syringes of kerosene. Reconnect the oil pipe immediately. Crank the motor briskly about a dozen times to circulate the kerosene in the motor base. Remove the drain plug in the lower front of the left half motor base and crank the motor a few times while the kerosene and old oil are draining out. Rock the motorcycle a few times from side to side to assist draining. Replace the drain plug when you are sure all kerosene has left the motor base.

Send two pumps of oil into the motor base with the hand pump and crank the motor a few times to distribute the oil before running the motor.

DETERMINING THE OIL LEVEL

In the left-hand side of the motor base near the bottom is a screw plug for verifying the level of oil. When this plug is removed, oil should flow out slowly if the level is correct, the motor being stopped. If it does not flow out, more oil is needed in the motor base; half a pumpful should be given by means of the hand pump immediately after replacing the plug.

In the front part of the motor base left half is a drain plug for draining off old oil when flushing the motor, etc. Both this and the oil level plug should be kept tight at all times.

Another oil level plug is fitted to the right half of the motor base and is used in the same manner as given above.



Fig. 12—Removing Cylinder: Tilted Toward Operator to Withdraw.

ADJUSTMENT OF THREE-SPEED GEAR

The Indian three-speed gear is of the progressive type. On high gear, power is transmitted through the engagement of the heavy driving dogs A-B, Figure 14. Sliding gears 2-4 meshing with fixed gears 3-5 on the countershaft C give the intermediate (second) and low gear positions.

When gears 1 and 2 are locked together by dogs A-B, high gear is engaged. When gears 2 and 3 are in mesh, intermediate or second gear is engaged. When gears 4 and 5 are meshed, low gear is engaged.

When the gear shift lever is in neutral position (between top and second) so that the gears are idle and no noise should come from the gear box. If there is a slight chattering in the gear box when the shift lever is in neutral, there is not enough clearance between the driving and driven gears and the gear shift should be adjusted as below.

ADJUSTING GEAR SHIFT—Place gear shift lever in second gear position on quadrant. Disconnect and attaching this lever to fan-shaped outside operating lever on a three-speed box. Push clutch hand lever forward to disengage the safety lock (the T-shaped arm engaging in the notches in the outside operating lever.) Move outside operating lever up and down slightly to determine the exact position when a plunger within the

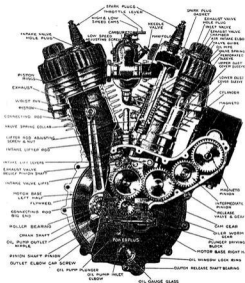


Fig. 13—Cylinder Free From Motor Base.

three-speed box seats properly in the V-notch formed in the shifter lock rack. This can be determined by feeling. Next pull clutch hand lever back to determine if safety lock engages easily with outside operating lever.

If the edge of the safety lock does not easily enter the notch, slightly turn the hexagon head on the safety lock pivot which is eccentric. Move the safety lock on its pivot until the edge engages easily in the notch. Tighten the head. Adjust the rod from the outside operating lever to the gear shift lever so that the hole in the clevis lines up with the hole in the lever. Put in the pin and insert the cotter pin.

This adjustment may be necessary every time the three-speed gear has been moved



Sectional View of 1920 Powersplus Motor

to adjust the short chain. The gear shift should be tried with the power on the motorcycle on the stand after every chain adjustment.

A screw plug on the right side of the gear box about half way from the top is provided for injecting lubrication. Use a heavy oil, preferably steam engine cylinder oil. Do not use grease. Inject oil with squirt gun until oil runs out of filler hole. Test oil supply at least twice a month by removing lower drain screw on the right side of box. If oil does not run out freely, inject fresh supply through filler hole above.

Watch oil supply carefully to prevent gears and bearing running dry. The lower screw plug is used also for draining old oil from the three-speed. Be sure to replace the plug.

CARE AND ADJUSTMENT OF CHAINS

Keep the chains at the proper tension at all times. For the long chain, this will be when the underside can be raised about one inch at the center. For the short chain, some

what over half an inch on the underside of the shell.

Loose chains may jump the sprockets and break or tear out spokes and chain guards. Tight chains cause extra wear on the bearings and cause the chains to break.



The oil from the relief pipe lubricates the shaft chain. Both chains will be longer in service if they are removed every 500 miles and cleaned and lubricated. Clean with kerosene thoroughly, then wipe dry and dip in a mixture of light oil and graphite. After a short time in the mixture, hang the chains to drip. When dripping stops, wipe off the excess oil and put the chains on the sprockets. Be sure that the clip of the detachable links snaps into proper position.

Fig. 14—Indian Three Speed Gear; Main Shaft Above, Countershaft C Below. Clutch is Mounted on Taper Shaft at Left; Clutch Release Lever at Right.

TO ADJUST SHORT CHAIN—Loosen the four bolts on the anchor studs and move the three-speed box backward until the chain has the proper tension. Draw nuts up tightly to secure the three-speed box in place. See that the gear shift is working properly after each adjustment of the short chain.

TO ADJUST LONG CHAIN:—Loosen the left hand nut on the axle and draw the rear wheel backward until the chain is at the proper tension. Revolve the wheel and note that the chain runs true on the sprockets. Adjust the position of the wheel by means of the axle nuts and see that the wheel runs squarely in the frame. Turn the rear wheel adjusting screws snug against the forced distance plates. Tighten the axle nuts before putting the rear wheel on the ground.

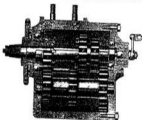


Fig. 14—Indian Three Speed Gear; Main Shaft Above, Countershaft C Below. Clutch is Mounted on Taper Shaft at Left; Clutch Release Lever at Right.

ADJUSTMENT OF KICK STARTER

When the short chain has been adjusted, the kick starter must also be adjusted, to have the segment mesh properly with the ratchet pinion. Loosen the nut on the gear segment stud and move the starter arm and segment until the end of a tooth is about $\frac{1}{16}$ of an inch away from the space between the two teeth on the pinion which it engages. The kick starter crank must be half way down for this measurement. Tighten the nut and try the starter. Too close a mesh will result in difficulty in operating the starter. Too wide a mesh will cause the pinion to lose its teeth by stripping. This adjustment is important.

CARE OF SPRING FRAME AND FORK

When the springs in the Cradle Spring Frame and Spring Fork are assembled they are coated with grease to insure smooth and noiseless action and to prevent rusting. Spasmodic indicates that this lubricant needs renewing. To grease the springs, jack up the frame with a box under the motor base to take the weight off the leaves and pry the leaves slightly apart with a sharp screwdriver. Insert grease between the leaves with a tallow knife. This should not be necessary often than twice a season.

Once a week oil should be put in the oil-holes at the end of the struts on all spring groups. Take out the small screw marked "Oil" and inject until oil runs out of the hole. Be sure that the little washer is in place in each case when putting the screw back. At frequent intervals, turn down on the T-handle lubricators on the bell-cranks of the front spring regularly to insure proper lubrication of the cranks. Put oil in the lubricators of the pivot of the spring frame fork crown. See Oiling Diagram, Page 25.

A broken spring will not prevent the machine being ridden, but it should be replaced at the first opportunity.

CARE OF WHEELS

Keep wheels perfectly true. A wheel out of true causes rapid tire wear and more power to drive the machine than ordinarily. Replace broken spokes as soon as possible. Riding thru soft causes spokes to loosen and weaken the wheel. Go over spokes at least once a week and tighten when necessary. In replacing a spoke make sure that it does not project inside the rim sufficiently to injure the inner tube.

CARE OF TIRES

The proper pressure for a 28 x 3 inch tire is 40 pounds. The use of a pressure gauge is recommended. It is not expensive and will more than repay its cost in increased tire mileage.

Riding a tire soft causes rim-cutting and breakage of the fabric as well as rendering the tire more susceptible to punctures. Riding a tire flat for any distance will ruin both tube and casing.

Take care of cuts in the casing immediately. Vulcanize them as soon as possible. A cut permits water and sand to enter and rot the casing. Inspect tires every few days for cuts, etc.

Always carry a generous supply of tire patches and cement and make sure they are protected against damage from tools in the tool box.

Keep the valve nuts tight to the rim to prevent creeping of the tube. Keep the valve cap screwed on tightly. If the pump becomes dry or leaks, inject a few drops of light oil in the barrel.

CARE OF MAGNETO

The Aero Magneto is used on all twin cylinder Powerplus models. It should be oiled every 1,000 miles with magneto oil or 3-in-One and the contact breaker points should be looked at and cleaned at least once a month. Use sandpaper, 00-grade for dressing the points. Emery cloth should not be used, it leaves small particles in the platinum which cause trouble.

Full instructions for the adjustment and care of this instrument are found in a special book in the tool box of the motorcycle.

For timing the magnets, see Page 16. Do not put grease or other lubricant in the timing gear casing, as the motor automatically takes care of the lubrication of all the gears in the train.

CARE OF ELECTRIC GENERATOR

The Sphindorf DGI generator supplies current for the battery and lights. It is driven by a coiled wire belt from a pulley attached to the motor shaft sprocket. It is independent of the magneto and is carried in front of the motor. An instruction book for this generator is found in the tool box of every electrically-equipped Powerplus motorcycle. Write the Sphindorf Electrical Company for additional information.

CARE OF ELECTRIC WIRING

All ignition wiring is heavily insulated and thoroughly waterproof. The cable from the front of the magneto leads to the rear spark plug, while that from the rear leads to the front cylinder spark plug. Keep all connections tight and inspect cables occasionally for chafing. If chafing occurs, tape worn places and fasten cable to prevent recurrence of trouble.

The wiring for the lighting system is heavily insulated, also. Keep the connections tight. Watch the ammeter and light as a check on the condition of these cables.

OPERATION OF LAMP AND HORN

The headlight has two bulbs, a main and a pilot. The small or pilot bulb is above the main bulb; it is used when riding in cities and towns and other places where a bright light is prohibited. It is also used when the motorcycle is standing at the curb.

The main bulb is of 21 candle power and is provided with a focusing attachment. Both bulbs are controlled by a push-button switch and a bypass-joint switch. The latter is connected to a wire from the ammeter. When the bypass-joint switch is pushed in and turned to the right, one of the two bulbs is on. To light the other, use the push-button switch. One pressure changes the light from one bulb to the other. Both lights are extinguished when the bypass-joint switch is turned to the left.

An electric horn is of the vibrator type, mounted on the headlight close to the head. A wire leads from the ammeter to the horn socket, while a second goes from the horn to the horn switch on the right handlebar. Pressing the horn switch blows the horn.

WHAT THE AMMETER INDICATES

The Indian ammeter, fitted to electrically-equipped Powerplus models, gives an indication of what is going on in the entire electric system. It is also a first-class trouble detector, when any arise.

The ammeter shows a range of 5 amperes charge and discharge. The zero of the scale is at the center; all marks to the right indicate that the battery is charging. All marks to the left of the zero indicate discharge. The long marks are whole amperes while the short marks are half amperes.

HORN SWITCH AND WIRE

Leads to horn

AMMETER

Main wire on left, generator, lamp and horn wires on right side

MAIN WIRE

Between tanks

TAIL LIGHT WIRE

Run through bend in mud guard

BATTERY

Plus wire to switch block on foot board, negative wire grounded on frame

GENERATOR

GENERATOR WIRE

Wiring Arrangement on 1928 Electrically Equipped Powerplus

When motor is stopped and lights not being used, the pointer should cover the zero on the scale. When the motor is running and the lights are off, the pointer will indicate the amount of current sent into the battery. Normally this will be between 2 and 3 amperes, according to the speed of the motor and the condition of the storage battery.

When tail light and pilot bulb are on and the motor stopped, the pointer will indicate half an ampere discharge. With main headlight bulb and tail light on, motor stopped, the pointer will show 2 amperes on discharge side. When motor is running and lights are on the ammeter will show the difference between the amount of current the generator is giving and what the lamps are taking. This will be shown on the charge side of the scale. Horn blowing is shown on the discharge side of the scale, as the horn takes 2-3½ amperes.

AS TROUBLE DETECTOR—With motor stopped and lights off, if the pointer shows a discharge, there is a short circuit in the system. Hunt for it. With motor running, if the ammeter pointer jumps quickly or moves continuously from side to side, there is a loose connection. If the pointer moves to the charge (right) side, the loose connection is between generator and battery. If it moves to the discharge (left) side, the trouble is between the battery and lamps or horn.

If there is an open circuit between battery and generator (very rare), the ammeter will indicate normal discharge for the lamps which are lighted, whether the motor is running or not. Trace the broken wire and repair immediately. If the open circuit is between the battery and lamps or horn, the ammeter will show excessive discharge when the lamps are on. If this is not corrected, the lamps may burn out. With motor stopped and lamps switched on, if the pointer shows zero and the lamps do not burn, there is a break between battery and lamps.

A break or open circuit between the main wire and any lamp will be indicated by that lamp not burning, and the ammeter will indicate the discharge for the remaining lamps only.

If when the motor is running and no lights on, the ammeter pointer stays at zero, the driving belt may be found to be loose or broken.

MAINTENANCE AND CARE OF BATTERY

If the following points are adhered to in regard to the battery, it will give practically no trouble:

- 1—Add distilled water regularly each week.
- 2—Keep the battery and battery box clean.

The water in the battery solution (electrolyte) evaporates when the battery is in use and must be renewed or the plates will be affected. By adding this water regularly each week, the solution will be kept of the proper strength and the battery will always be in best clean condition. If distilled water cannot be had from the dealer, use rain water caught in a vessel which is not made of metal and which is clean. Put in the water until the level reaches the plugs in the side of the battery casing. Take out the filler plugs on the side to do this, keeping the battery in a vertical position. There are three plugs, one for each of the three cells which comprise the battery and each cell needs its charge of water. Be sure to replace the plugs before putting the battery in its box on the right of the motorcycle.

Dirt and overflowing acid will ruin a battery, the acid eating through the terminals and injuring the casing. Therefore, keep the battery and box clean.

See that all connections are tight and clean or corrosion will set in and the battery used ineffectively.

The battery used is the WICO type 6N and is designed to be used with an electric generator which supplies the charging current. It may sometimes happen that more current is used in burning the lights and sounding the horn than is put into the battery by the generator. This will gradually exhaust the store of current in the battery until the lights

are dim, showing that the voltage of the cells is less than normal. If running the motorcycle and thereby charging the battery when in this condition does not bring the battery back to a serviceable condition of charge, take it to a charging station. Your motorcycle agent may have facilities for charging; if he has not, he can probably direct you to a man equipped for this work. Insanations for charging are given below; show these at the charging station.

AS SOON AS BATTERY IS RECEIVED—Remove filler plugs located in the side of each cell (three plugs, one for each cell) and see that the electrolyte is up to the edges of the filler plug holes when the battery is standing upright. The plates must be kept covered, and the filler holes are drilled a sufficient height to allow just the proper amount of electrolyte. Don't lay the battery on its side for filling unless you turn it back upright before putting in the filler plugs so as to let any excess of electrolyte run out. Then give the battery a freshening charge at one ampere. (See Instructions for Charging, Page 28).

To secure the level of the electrolyte, add distilled water. It is rarely necessary to add acid and it is far better to have this done by an experienced battery man. Add the distilled water regularly once a week. Don't use tap water, as this contains minerals injurious to the battery. Melted artificial ice will do in place of distilled water, if kept clean.

If a battery has been turned upside down in shipment and the electrolyte spilled, it is best, wherever possible, to take it to a battery man for refilling. The batteries are so constructed that they do not leak when turned on their sides, but they cannot be left in an upside-down position indefinitely, as sometimes happens in shipment without loss of the electrolyte.

All the connections on the top of the battery are of lead alloy and, therefore, not affected by contact with the electrolyte. If a terminal wire should become broken and it is impossible to take the battery to a battery repair man, who has a lead-burner outfit, a small brass machine screw (size 8-32) can be used in the following manner: Drill a hole in the exact center of the terminal post, using the round part as your guide, with a drill (size No. 28). It is not necessary to tap a thread in it, as the brass screw will cut its own thread. The wire can be twisted around under the head of the screw and then the screw tightened down gently on it.

It is well to have a piece of cardboard, fibre or rubber, completely covering the top of the battery, but not pressing down on the vent plugs so as to prevent the escape of gas. This will prevent any possibility of a short circuit from the metal terminals on the top of the battery to the top of the metal case in which it is placed on the machine.

Do not allow your batteries to stand in a discharged condition. If your machine is not to be in use, for instance during the winter, keep the batteries charged—once every two months is sufficient—and the electrolyte at the proper level by adding distilled water, not acid, as above described. There is very little danger from freezing unless the batteries are permitted to stand in a discharged condition—even in temperatures as low as 5 degrees below zero.

THE ELECTROLYTE

The acid solution or electrolyte is made up of two parts (by bulk) of chemically pure sulphuric acid (obtainable in any good drug store), specific gravity 1.835, and five parts distilled water. Do not use undistilled water. Melt artificial ice if necessary and keep it clean. Rain water is good. Test the acid solution frequently with an acid hydrometer and always at the end of charge. To do this, draw out of each cell separately with an acid syringe enough acid to float the hydrometer in a glass jar. The height at which the hydrometer floats, as shown in the scale, indicates the strength of the acid. When fully

charged the acid should read from 1.275 to 1.300 on the specific gravity scale. If it is lower than this, take out some of the acid with the acid syringe and add a stronger solution not exceeding 1.300 specific gravity. If it is higher, add distilled water. The acid must be chemically pure.

INSTRUCTIONS FOR CHARGING—Direct current must be used (alternating current will not charge a battery and must be converted or rectified to direct current if there is no direct current at hand). Information on charging equipment given to dealers on request.

Determine the polarity of the charging wires before connecting them to the battery. The positive charging wire must be connected to the positive terminal (+ red) of the battery. Should the positive wire be connected to the negative (-black) terminal of the battery, the plates would be reversed and rendered useless—as long until they can be repaired, which is not always possible. The polarity of the wires can be determined by the use of a polarity indicator or by the following test:

Add a little salt to a tumbler of water and place the two ends of the wire leading from the charging circuit in the water, being very careful not to let them come in contact with each other. Small bubbles will gather around the negative wire; this should be connected to the negative terminal of the battery and the other to the positive.

When the battery is connected as above explained the current should be turned on and the amperage reduced to the normal charging rate—two amperes—by means of a rheostat or other suitable resistance. The battery should be allowed to charge at this rate until the cells begin to "gag" freely.

The charging rate should then be reduced to one ampere and the charge continued until the voltage ceases to rise. The voltage of each cell at end of charge will read 2.5 volts or more with the charging current on, depending on temperature or age. At the low finishing rate, the battery can be over-charged several hours without injury and it is of utmost importance that the charge be complete. Temperature of the electrolyte must not be allowed to go above one hundred degrees Fahrenheit. If the battery overheats, reduce the charging rate. The specific gravity of the electrolyte also indicates the state of the charge. No battery is fully charged until the gravity of the electrolyte ceases to rise. If hydrometer readings, taken at an interval of one hour during the finishing charge, show no rise in gravity, the battery is fully charged. Overcharging at a high rate is very injurious. If batteries cannot be watched closely while on charge, use the low rate exclusively.

DEVELOPING PLATES—When plates are renewed, it is necessary to develop them with an initial charge, using electrolyte of 1.140 degree specific gravity. As soon as the cells are filled, they must be placed on charge at 1 ampere and this rate must be maintained until the specific gravity of the electrolyte and the voltage of each cell have come to a maximum and remained constant for at least ten hours. It is of the utmost importance that the charging rate be kept at 1 ampere. Add distilled water to keep the plates covered. This initial charge takes about forty-five hours.

CONCERNING REPAIR OF BATTERIES—A battery that has been reversed in charging can sometimes be remedied by reversing the connections and charging the battery very slowly at about a 1 ampere rate. A low charging rate is helpful also in bringing up a battery that has been allowed to stand too long without charging.

Sediment will gradually accumulate under the plates and should it rise high enough to touch them, a short circuit will be developed, discharging the cell and seriously injuring it, as if it is not promptly attended to. If the electrolyte after charging is found to be below 1.190 specific gravity for any of the three cells or the voltage reads below 2 on the

voltmeter, the battery should be taken immediately to a competent battery man for attention or returned prepaid to the Witherben Igniter Co., Springfield, Mass.

A broken jar must be renewed at once, for the leakage of the electrolyte will expose the plates to the air and this is harmful.

To open up the cells take a $\frac{1}{8}$ drill and drill into the center of the cell connections and lead wire terminals to the depth of about $\frac{1}{8}$ inch. These parts can then be easily removed by inserting a screw-driver, or knife-blade, under them, prying up. Very little pressure is needed. If they do not loosen readily you have not drilled deep enough to break the connections.

Next run a warm knife blade along the edge of the top cover, after which you will find it a very simple matter to slip the knife blade under the cover, gradually work it around, prying up gently until cover is removed.

Then pass the warm knife around the edges of the inside cell cover, cutting down through the sealing compound, which is about one-half inch thick. When the inside cover is free, take two pairs of pliers and grip each terminal post. Place the battery on the floor and have some one hold it firmly while the element is drawn out with the pliers. The plates fit snugly to prevent injury from vibration. The inside cover can be removed from the element after it has been taken out of its cell. Note the position of the vent tube and replace as found, taking care to see that tube is free to permit of the passage of gas. If it is injured in the removal, order a new one (it is an inexpensive part.)

If the battery is taken down simply for cleaning, it will be unnecessary to separate the groups of plates or to remove the inside cover, vent-tube, etc. New wood separators can likewise be put in without separation. If, however, the groups must be taken apart, it is advisable to order new hard rubber post sleeves, as they are put on tight after being immersed in warm water to make them flexible. The joint between the sealing compound and the jar can be made by passing a gas flame or alcohol torch over the compound (don't burn the rubber). It is well to put a wooden plug into the end of the vent tube while flaming the compound which must be removed as soon as the operation is completed.

If you do not have a lead-burning outfit, cell connections and terminals can be put on with a soldering iron but care must be taken to see that the connecting surfaces are scraped clean or they will not join.

The Witherben Igniter Company is only too anxious to co-operate with the users of Wico batteries to the fullest possible extent. Do not hesitate to write the Company for further information, or assistance.

GENERAL MAINTENANCE OF MOTOCYCLE

Keep it clean. Give it this attention regularly, as it will keep the mechanism at its best working point. The appearance of the machine also reflects on the rider.

Use kerosene on enamelled parts, not gasoline. Use gasoline to remove grease and oil from the motor base, motor, etc. Gasoline will dim the luster of the enamelled surfaces; hence it should not be used on them. Do not use either gasoline or kerosene in the presence of an open flame, or a fire may result.

The use of a good nickel polish will prevent rusting of plated parts. Kerosene can also be used on these parts if polish is not available. A clean motorcycle adds to the pleasure of operating it and also makes it worth more when offered for sale.

Tidy all bolts and nuts at least once a week. Any loose parts will be detected by regular inspection of this kind and prevent trouble on the road.

WHAT SPARES TO CARRY

For average riding, carry the regular tire and tool kit, spare chain links and connectors, a spark plug, an extra valve, a roll of tire tape, some copper wire.

For long trips, in addition to the above, carry a spare inner tube well wrapped and NOT placed in the tool box, a few cutter pins, miscellaneous nuts and washers, a valve inside or plunger (tire valve), and an inside blow-out patch. It is not necessary to load the machine with enough parts to rebuild it. Genuine Indian parts can be obtained from Indian dealers in every important city and town.

WHERE TO OIL AND WHEN

Study the Oiling Diagram on Page 25 and follow the directions carefully.

To remind you:

ONCE A WEEK—Oil slide pins of rear springs and front fork fork. Oil clutch-working joints of brake, clutch and gear shift linkage. Oil hinge of rear fork crown.

500 MILES—Put on a paste of oil and graphite. See Care of Chains.

1,000 MILES—A few drops of light oil in magnets and electric generator.

HUBS—Pack with grease twice a season.

THREE-SPEED BOX—See Oiling directions under Three-Speed Gear.

MOTOR—See Mechanical Oiler, page 15.

BELL CRANKS—Give a coat on the articulator handles at frequent intervals. Re-fill with cup-grease when empty.

TIPS WHICH SAVE TROUBLE

Don't race the motor on the stand. This abuse has ruined more motors than road

use. Don't use inferior oil; use the oils recommended. They keep the motor new.

Don't neglect to oil all parts needed, as indicated in the Oiling Diagram.

Don't oil electrical apparatus any closer to anywhere than where directed to.

Don't forget that the motorcycle will serve you in proportion to the way you operate it and care for it.

Don't forget to keep the motorcycle clean; inspect it regularly and make necessary adjustments in the garage. It is more convenient and pleasant than having to do it on the road.

Don't forget you can obtain service from over 1,800 Indian dealers. You don't have to carry a repair shop with you.

Don't expect to get from the battery more than 90 per cent. of the current you put in it.

Don't use counterfeited Indian parts. They are made of poor material, wear out rapidly, require frequent replacement and void the guarantee. Genuine Indian parts are better and cheaper in the long run.

Don't fail to keep tires properly inflated at all times.

Don't spin the rear wheel when starting. Let the clutch engage gently. Each time the wheel spins, rubber is worn off the tire, cutting down its mileage and rendering it more susceptible to punctures.

Don't day-dream while riding. Keep your eye on the road at all times.

Don't look at the control levers every time you operate them. Get the habit of using them instinctively.

Don't open and close the throttle suddenly. It injures the motor and makes enemies for motocyding.

Don't force the machine to climb a hill on high gear when the motor is laboring. It strains the motor and transmission. Change early to a low gear.

THE INDIAN SIDECAR

The Indian sidecar should be fixed up with the motorcycle so that the sidecar wheel is parallel to the rear wheel of the motorcycle and both wheels are vertical. If the sidecar leans away from the motorcycle, the tire will be worn on the side of the tread and their life materially shortened. If the side car leans toward the motorcycle, the tire will be worn on the side of the tread instead of on the crown and steering will be interfered with. Misalignment of the sidecar may result in bent connections, in addition to causing rapid wear on the tires.

ATTACHING AND LINING UP—Have the motorcycle perpendicular. Insert the axle in the sidecar lugs (in steering head forging, seat post cluster and above three-speed bracket). Put in the studs from right to left and put the nuts on the left side. Turn the studs so that their joints will be in line. Be sure to tighten the nuts.

See that the clamp on the short connection (the one which clamps the double tube at the left side of the sidecar frame) is loose. Put the front connection on the study; then put the short connection in place and tighten the clamp nut with the fingers.

Tighten the nuts on the front and short connections at the studs. Bring the sidecar wheel vertical and with its track approximately parallel to that of the rear wheel. Prevent the wheel from moving out of this position; then put on the rear long connection (from the lug under the seat post cluster to the sidecar rear frame tube). Set up the nuts and clamps. Put on the long front connection and set up its nuts and clamps. Go over all nuts and see that they are tight before using the sidecar outfit.

DRIVING POINTERS—In taking a right hand turn with a sidecar combination, approach the turn at reduced speed, and with the clutch disengaged. As the turn, move the bars to the left and let in the clutch. The outfit will pivot on the sidecar wheel and will go off smoothly in the new direction when the throttle is opened.

To make a left turn, approach at reduced speed with the clutch disengaged. Keeping the clutch disengaged, move the bars to the right and when the turn has been completed, engage the clutch and proceed. If these directions are not complied with the sidecar will tend to rise off the ground when making a right hand turn and will tend to skid to the right in making a left hand turn. Neither of these are good for tires or frame.

Don't do monkey stunts with a sidecar, such as riding with the car in the air. The sidecar is meant to ride with the wheel on the road. Lifting it puts an enormous strain on the tire and on the frame for which they were never intended.

Don't forget to use the hand oil pump when driving with a passenger aboard the sidecar.

GEAR RATIOS FOR TYPES N-38 and NE-38

Motor Sprocket	Countershaft Sprocket	Clutch Sprocket	Rear Wheel Sprocket	High	RATIO	Low
15	21	38	36	4.14	6.80	10.60
15	21	38	40	4.73	7.43	11.69
16	21	38	36	4.08	6.30	10.07
16	21	38	40	4.55	7.15	11.23
17	21	38	36	3.82	5.99	9.43
17	21	38	40	4.34	6.63	10.47

INDEX TO CONTENTS

Assembly, What It Indicates	21
Battery, Maintenance and Care of	25
Battery, Instructions for Charging	25
Battery, Repair to	29
Before Starting, What to Do	6
Brakes, Adjustment of	11
Carbon Removing	17
Carburetor	17
Chain, Care of	22
Clutch, Adjustment of	22
Control Cable, Connecting	10
Controls, Manipulation of	4
Cylinders, Removing	16
Electric Generator	24
Filling Tanks	2
Flushing the Motor	19
Gear Shifting	8
Gear Ratio	8
General Maintenance	29
Grinding Valves	15
Hand Pump, Using the	14
Head, Elevate	14
Kick Starter	24
Lamps, Care of	23
Magneto, Care of	24
Magneto Timing	26
Mechanical Oil	25
Motor, Powerless	13
Motor, Norming the	13
Motor, Flushing the	19
Oil, Where to	30
Oiling Diagram	30
Oil Level, Determining	19
Removing Carbon	17
Removing Cylinders	16
Setting Up the Machine	3
Sidecar, Indian	31
Sidecar Driving Position	31
Spring Frame and Fork	23
Starting the Machine	7
Strapping the Motor	20
Spare to be Carried	20
Tappets, Adjusting	15
Three-Speed Gear	15
Timing Gear Train	20
Tips Which Save Trouble	16
Tire, Care of	10
Unpacking the Motorcycle	21
Valve, Adjusting	15
Valve, Grinding	15
Valve Removing	16
Valve Timing	14
Wheels, Care of	25
Wiring, Care of	21
Wiring Diagram	24