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### PURPOSE AND APPLICATION

The 9-0020 tool package was developed by Crane to aid the mechanic in the installation of cams, tappets and pushrods in "Big Twin" engines. With the aid of these tools, it is not necessary to remove the rocker boxes for changing cams, pushrods, tappets or while performing work within the timing case.

As with any mechanical work on your motorcycle, you must have the knowledge and experience to perform the job, or seek qualified assistance. Always have a service manual for your model when performing mechanical work.

### TO CHANGE A CAM IN A "BIG TWIN" HARLEY-DAVIDSON® ENGINE EQUIPPED WITH CRANE ADJUSTABLE PUSHRODS

1. Disconnect the battery. Secure the motorcycle on a suitable stand with the rear wheel off the ground if no kick starter is on your model. Remove all components necessary for easy access to pushrod covers and gear case cover. Remove spark plugs.
2. Remove pushrod cover keepers, then lift covers, exposing the pushrod adjusting hex nuts. Hold each cover up by placing a Crane pushrod clip on the pushrod above the hexes and allowing the cover to rest on it (Fig. 1). With kick starter, or rear wheel with transmission in high gear, turn the engine over until both front tappets are in their down position (top of the compression stroke). Loosen the lock nuts on the front pushrods, then turn them and the lower portion of the pushrods up until no thread shows. Holding each pushrod up into the rocker arm pushrod seat, move the clip to the lowest point possible on the pushrod. Keeping the pushrod centered over the

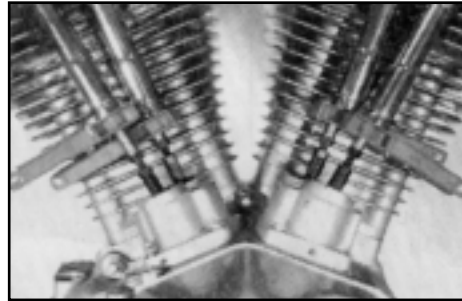


Fig. 1

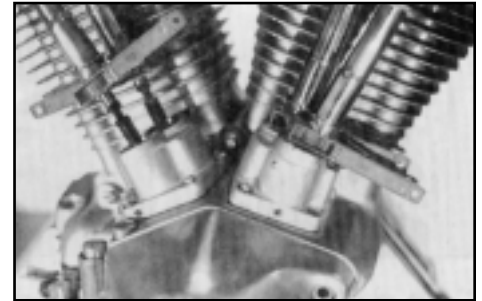


Fig. 2

tappet pushrod seat, allow the pushrod cover to rest on the clip (Fig. 2).

3. Slowly turn the engine over until the rear cylinder is on top of the compression stroke where tappets are in their lowest positions. Be sure to keep the front cylinder pushrods centered and lined up with the pushrod seats in the tappets and rocker arms to avoid damage. Shorten pushrods and hold them centered as you did with the front cylinder pushrods.
4. Remove the ignition cover, adjusting plate, and rotor as necessary to remove gear case cover. While removing gear case cover, **hold the end of the camshaft** in so that it does not pull out with the cover, and allow the tappets to fall out.
5. Turn the engine over until timing marks on the cam gear are aligned on the pinion and breather gears. Rotate engine backwards until pinion gear timing mark is approximately 3 teeth to left of the crank gear (Fig. 3).
6. Insert Crane installation tools through slots of the tappet guide and into the tappets, just above the rollers. Hold tappets up as high as possible, being sure that the pushrod ends are in their tappet seats and rocker arms. Now with an allen wrench, turn the adjustable clamping screw in to lock the tools onto the tappet blocks. Again, be sure pushrods are centered and tappets are up as high as possible in guides (Fig. 4 & 5).

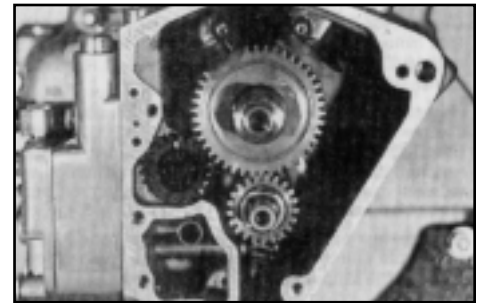


Fig. 3

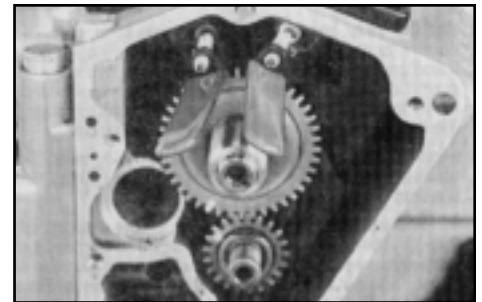


Fig. 4

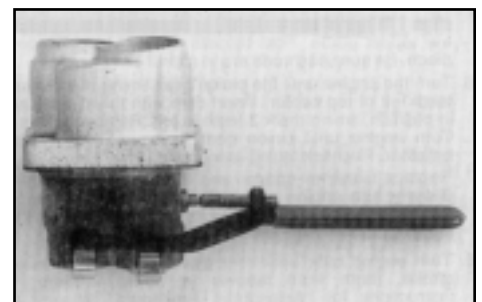


Fig. 5

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7. Now remove cam. It will pull out easily and the tappets and pushrods will stay in place (Fig. 6).
8. Install new cam and spacers; recheck timing marks. Remove Crane tappet tools; replace breather and washer and replace timing cover and gasket. Check camshaft end play.
9. Take up the slack in the pushrods, making sure that both ends are in their seats. Slowly bump the engine around while continually taking up slack in the loose pushrods. After all slack is taken out, adjust lifters as described in your pushrod or lifter kit instructions.

## TO INSTALL ADJUSTABLE PUSHRODS IN YOUR "BIG TWIN®" EVOLUTION® ENGINE

### REMOVAL

1. Disconnect the battery. Secure the bike on a suitable stand with the rear wheel off the ground. Remove components necessary for easy access to pushrod covers and gear case. Remove spark plugs, ignition cover, and sensor plate and rotor.
2. Remove pushrod cover keepers and lift covers. Place Crane pushrod clips on pushrods to hold covers up (Fig. 1). Rotate engine forward and watch **front intake** tappet as it raises and falls; stop rotating as it reaches bottom. Protect the tappets from chips while cutting the front exhaust pushrod with a saw, bolt cutter or cutting wheel (fig. 7). Remove it from the engine.
3. Rotate engine until rear intake tappet raises and falls; stop at bottom. Now you can remove the gear case cover. Slide the cam out and remove the tappet guides, pushrods, and breather.
4. Clean and inspect gear case and loose parts. Do not wash oil out of lifters.

### INSTALLATION

1. Shorten the pushrods by turning in lower portion until no threads show. Remember that the short pushrods are intakes and long pushrods are exhausts.
2. Set the rear tappet guide and gasket in place without screws. With covers and O-rings in place, insert the intake pushrod in the guide by lifting it enough for the pushrod to clear the head (Fig. 8). Hold pushrod up and

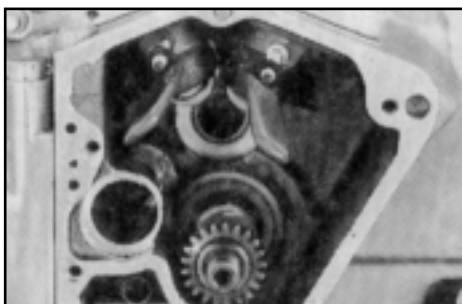


Fig. 6

centered with the Crane pushrod clip (Fig. 9). Lift tappet block again just enough to insert the tappet from the bottom. Release the tappet and then screw the guide into place.

3. Insert rear exhaust pushrod with covers and O-rings into the tappet guide. Hold it up and centered with pushrod clip. Insert the rear exhaust tappet from the bottom.
4. While holding both rear tappets up, insert tangs of the rear tappet tool through the slots of the tappet block into tappets just above rollers. Hold tappets up as high as possible while snugging the adjustable swivel foot of tool against tappet guide with allen wrench. Be sure pushrods are in rocker arms. Rear tappets and pushrods are now held in place (Fig. 10).
5. Set front tappet guide in place without screws. Insert front intake and exhaust pushrods, covers, and O-rings. Hold up and centered with clips. Lift tappet block slightly to insert tappets from bottom. Screw down the tappet guide. Hold tappets up with tappet tool while locking it in place. Be sure pushrods are in rocker arms.
6. Turn the engine until the pinion gear timing mark is approximately three teeth left of top center. Insert cam with thrust plate and spacer washer in position, timing mark 3 teeth to left. Remove tappet tools from blocks. Turn engine until pinion gear timing mark is straight up and insert breather. Recheck timing marks (Fig. 11).

7. Replace breather spacer and gear case cover, and tighten screws. **Slowly** turn engine over two revolutions while stopping frequently to take up the slack in the pushrods by lengthening them, making them finger tight.
8. Turn engine over until front cylinder is on the top of its compression stroke. (Both front tappets in down position.) Now, follow the instructions for "Adjustment Procedure" in your Crane Adjustable Pushrod Instructions supplied with the pushrods.



Fig. 7

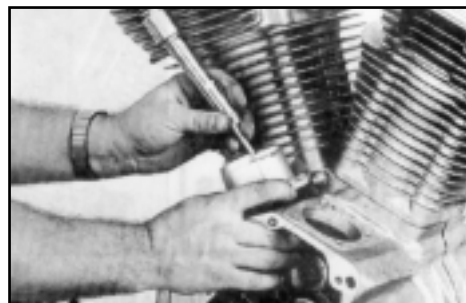


Fig. 8



Fig. 9

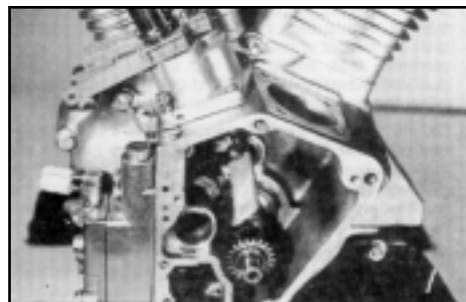


Fig. 10

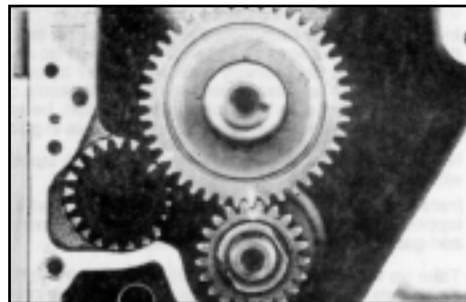


Fig. 11