FAULTY OPERATION & ADJUSTMENT
KNOCKING OR POUNDING

Undoubtedly the sense of hearing is more useful in detecting irregularities in the running of an engine than any other sense.

By means of the sounds produced, the engine talks to the operator, and with a little intelligent study he will soon understand the language. Even at a distance, it is often possible to tell whether and engine is running regularly or whether, as indicated by the sound of the exhaust, some of the charges admitted to the cylinder are expelled without being exploded. Standing in close proximity to the engine, the operator may distinguish a variety of sounds indicating defects about the engine and calling attention to the necessity of applying proper remedies at the first opportunity. A sharp, knocking sound in stationary engines may be due to any one of the following causes:

1. Lost motion in the bearings of the connecting-rod, either at the crankpin or the piston-pin end.
2. Lateral movement of a piston ring, the groove in the piston having become widened by wear.
3. A loose key in the flywheel or pulley.
4. Lost motion in the gears, causing the gear-shaft to be retarded in its revolution for a fraction of a second when the exhaust or inlet valve cam hits the roller and lever.
5. Piston or cylinder worn to a considerable extent causing an up-and-down movement of the piston.
6. The piston having a worn shoulder in the bore of the cylinder, and striking the shoulder if any play in the bearings is developed.
7. The piston striking any foreign body that may accidentally have been drawn into the cylinder.

Knocking in engines may also be due to looseness or rattle in some external part, owing to nuts having worked loose or to bolts being sheared off or being too small for their holes. Knocking due to such causes is readily detected by a careful inspection while the engine is running, and this inspection may be aided by laying the hands on parts suspected of being loose, when vibration will easily be felt also by careful scrutiny with an electric flashlight for evidences of movement where two parts are bolted together.

About the most likely place to find looseness of this description is in the holding-down bolts that hold the engine to the frame on which it is mounted; but in certain horizontal engines it was also found that the caps over the main bearings are loose, owing to the fact that they have not been properly tongued into the bottom halves or pillow blocks of bearings. Looseness at either of these two points should be remedied at the repair shop, as it always necessitates the substitution of larger bolts, aided perhaps by dowel pins; and in the case of the bearing cap, it may be necessary to make a wholly new cap, with proper tongues fitting into grooves that must be machined or chiselled in the pillow block. A more probable cause of knocking is looseness due to wear in the main shaft bearings, crankpin bearings, or the wristpin bearings. In a four cylinder vertical engine, the main shaft bearings may be quite loose without causing a knock, because the weight of the shaft and flywheel holds the shaft down; but a horizontal engine will, under certain conditions of speed and load, pound with a small amount of looseness. Only a very limited amount of looseness should be permitted in the main shaft bearings of any engine, both on account of the danger of springing the shaft and be-cause a bearing worn beyond this extent is liable to begin cutting, as it is difficult to keep sufficient oil in it. Looseness in the flywheel bearing of a vertical engine is disclosed by putting a jack under the flywheel and working it gently up and down. ln the case of a horizontal engine, it is necessary to move the shaft approximately in line with the pressure of the explosions, and a lever will have to be applied to the flywheel or shaft in whatever manner seems most practicable.

Occasionally, looseness of the shaft can be detected by rocking the flywheel back and forth against compression in the cylinder. If the pull of the sprocket chain comes on the engine shaft, it maybe possible to detect looseness in the adjacent bearing by alternately stretching and relaxing the chain, which can be done by grasping it midway between the sprockets and pulling it up and down as far as it will go. A novice should not attempt to refit the main shaft bearings, as this requires a good deal of skill and experience for its correct execution.

Wear in the crankpin is disclosed by setting the cranks at about half stroke, and rocking the shaft back and forth. Knocking in the wristpin, due to wear of the pin and its bushing, is not among the commoner troubles, and it does not need to be attended to at once unless aggravated. It is well, however, not to neglect it too long, as the bushings and the pin will be worn out of round, so that they cannot be used. When it is taken out, the wristpin should be callipered all round. lf it is out of round, it should be ground true; or, if this is impracticable, a new pin will have to be supplied, and the bushing reamed or scraped to fit.

This, of course, should be done in a repair shop. A cause of knocking occasionally found is due to the wristpin and the crankpin not being quite parallel. This causes the connecting-rod to oscillate from end to end of the wrist pin and crankpin bearings; and if, as is customary, there is 1/16" or more of end movement in the bearings, the knocking may be quite noticeable.

FAULTY OPERATION & ADJUSTMENT
KNOCKING OR POUNDING

If, as is likely to be the case, it is impossible to make the pins parallel, the only recourse is to take up the lost motion at the end of one or the other bearing, and possibly both bearings, by the use of washers or cheeks soldered to one end of the bushing and brasses. This is not a common cause of knocking, particularly in the better class of engines. The best construction is to secure flywheels to short shafts by bolting them to flanges instead of keying them. Some times, however, a flywheel is held on by a common key, or by two keys 90 degrees apart, and frequently it will work loose on its keys. This will inevitably result in a knock, which will be very loud if the engine has less than four cylinders. The crankcase should be opened and the cranks blocked so that the shaft cannot turn, and then force should be applied to the flywheel to disclose the looseness, if any. Some times the flywheel will be as tight on its shaft as to resist turning in this manner by using any ordinary force. In this case, it is best to take the engine to a repair shop if a thorough search has failed to disclose any other cause for the noise.

A sprung shaft will always cause knocking, and also rapid wear and cutting of the bearings. Besides the foregoing mechanical causes of knocking, there is a class of what may be called combustion knock that are altogether distinct from the preceding, in that the may occur without appreciable looseness in the bearings, and are due to excessive rapidity of combustion, coupled generally the too-early ignition, the charge being completely burned before the piston has reached the end of the compression stroke. Combustion knocks are due to a variety of causes, the most obvious of which is simply too early ignition, as when running a heavy load without suitable. retarding the spark. A contributing cause is a slightly weak mixture, since such a mixture burns faster than a normal or over rich mixture. Pounding in particular cylinders of a multicylinder engine may be due to unequal rapidity of combustion, which itself may be due to unequal charges, as when the valves are unequally timed, or to irregular spark timing, such as may result from a wobbling timer or a badly adjusted vibrators. If the thinner contact surfaces have been roughened by sparking or by wear, they will cause the contact maker of the timer to jump when running fast and therefore to make erratic contact, resulting in irregular firing. The classes of combustion knocks just mentioned are easily traced to their causes. The knocks are not necessarily violent, and they may sound a good deal like the nocks due to loose bearings, except that, if caused by faulty action of timer or vibrators, they will occur irregularly instead of regularly.

There is however, another and very common sort of knocking due to spontaneous ignition of the charge before the spark occurs. This may be caused by overheating of the engine from lack of water or other trouble with the circulation a trouble at once identified by boiling of the water in the radiator or by smoking of the exterior of the engine. It is a temporary phenomenon, and involves no harm to the engine if the latter is promptly stopped and allowed to cool. Much more troublesome, and also more common, is spontaneous ignition, or pre-ignition, as it is termed, due to deposit of carbon in the combustion chamber or on the piston head. A carbon deposit of this nature may be caused by too much gasoline or by too much cylinder oil, and it will accumulate gradually even with the carburettor and lubrication correctly regulated. A small quantity of carbon will give no trouble, but as the deposit thickens some portions of it will remain incandescent from one explosion to the next, and will ignite the fresh charge at some point in the compression stroke, depending on conditions. The fact that the charge is not ignited until some time during compression is due to the fact that the more highly it is compressed, the more easily it ignites. True pre-ignition results almost always, except at the highest engine speeds, in the charge being completely burned before expansion begins, and it is easily distinguished, especially if the engine is taking full charges, by the resulting sound, which is a sharp, metallic Bing! Bing! Bing! Closely resembling that produced by a hammer striking a block of cast iron. Usually, though not always, an engine that pre-ignites in this manner will continue running by spontaneously ignition for some seconds after the igniter switch has been opened. The hammering due to pre-ignition, as would be expected, is most marked when the engine is running slowly with the spark suitably retarded, and it will generally manifest itself under load, owing to the fact that the throttle is then wide open and the spark necessarily retarded to suit the slow speed of the engine is stationary engines, a heavy, pounding noise, such as is caused by premature ignition, may also be due to excessively high compression for the grade of fuel employed. In addition to its initial effect in producing a pounding noise, either pre-ignition or too-high compression pressure may cause the piston to expand unduly and to stick in the cylinder, which it would not do if the conditions were normal. This sticking of the piston would produce a knocking sound due to the small amount of play in the connecting-rod bearings necessary for smooth running. A coughing or barking sound is caused by the escape of pressure past the piston, and would indicate the necessity either of replacing any worn or broken piston rings or of reboring the cylinder and fitting a new piston.

With marine engines, a loose coupling may cause a pound, as may also a loose propeller wheel, but these pounds can easily be located.

This article is printed with the permission of John Vincent editor of the Oily Rag.