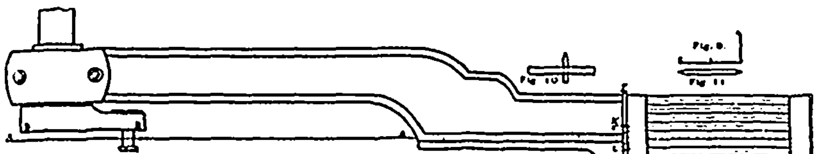
LINING UP AN ENGINE.

By W. E. CRANE.

ENGINEERS are often bothered by the pounding of their engines, and as pounding can be heard by everyone in the neighborhood, it is very annoying. There are many things that cause pounding, so that in some engines the cure of it is quite a complex subject. Being out of line is the general cause. Either the shaft is not in line with the cylinder, or the crank pin is not put in straight, or something else of the kind is the matter. A high speed engine perfectly in line will be very apt to pound with a light load, unless there is considerable depression, owing to the heaviest thrust coming on the end instead of the commencement of the stroke. The thrust is caused by the momentum of the moving parts. To ascertain if an engine is in line, the back cylinder head should be taken off, the piston, piston rod, and cross-head should be taken out of the way, and a line A A, Fig. 1, should be put through the cylinder and extended beyond the crank. To hold this line in the cylinder we take a strip of board, A, Fig. 4, and bore a couple of holes to fit over two of the studs at the end of the cylinder, and in the center of the board we bore a larger hole, say 1½ or 1¼ inches in diameter, and attach the cord to a little stick B, that stretches across the hole. The strain on the cord will hold this in position, and it can be readily shifted.



Lining up an Engine—Fig. 1

In front of the crank set up an upright, A A, Fig. 5, with a hole in it and a stick B across it. The hole should be in line with the middle of the crank pin. The cord used for this purpose should be strong and small, and should be made of something that will stretch perfectly straight. A silk hair line, such as is used by fishermen for fly fishing, is the best. Some men use annealed wire, but wire gets hard and stiff, and kinks get in it which can never be perfectly straightened, and one of these kinks is very apt to come where you want a perfectly straight line. Wire is not recommended. Be sure that the stuffing box K, Fig. 1, is perfectly clean. Attach one end of the cord to the stick B, Fig. 4, and the other end to the other stick. The cord should then be drawn so tight as to be perfectly straight. It can be tightened by turning the stick B over and over. To center the string cut a stick a trifle over one-half the diameter of the cylinder in length, and try the cord in the end of the cylinder, cutting off the caliper stick as occasion requires, until the cord is exactly in the center of the cylinder. Then get a shorter stick and try in the stuffing box, moving the end of the cord that is beyond the crank until the cord is centered in the stuffing box. Then go to the back end of the cylinder and try that again, and so on from one to the other until the line is exactly in the center in both ends of the cylinder. There is now a line to work from to bring everything straight with the cylinder.

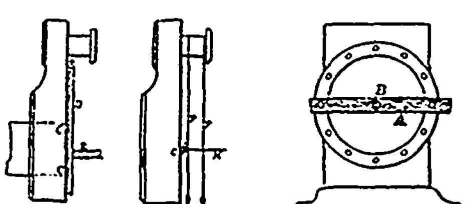


Fig. 2 Fig. 3. Fig. 4.

The first thing is to find out if the guides are in line. Take a stick (Fig. 10) with one side straight. Bore a small hole in it and put in a second stick, as shown in the cut, so that it will be held snugly but will still be loose enough to be easily moved. Set this stick against the edge of the guides at I and J, Fig. 6, and move the small stick up to just touch the line. The end of this stick should be sharpened so as to bring a small surface to the line. If the guides are in line, the stick should just touch the line when tried at both ends. If they are not in line it will touch the line at only one end. If that is the case there is but one remedy, and that is to swing the cylinder around and put in strips of brass at L, Fig. 1, as this is the place that the guides are usually out. This is quite a job and requires some time and considerable patience. It is occasionally necessary to shim the cylinder up on the other side. The line will now have to be set over again until it is once more straight with the cylinder and guides. Fig. 7 is a cross section of the guides through the line XX, Fig. 6. A plumb line suspended from point P will tell if the guides are perpendicular. If not, the bed should be swung over, or around, until they are. In case this cannot be done, either the cross-head will have to be changed in the shoes, or the shoes themselves changed so as to run straight in the guides, and at the same time bring the cross-head pin level. Knowing the style of cross-head it would be easy to tell how to do this. It is a very good test for an engineer's judgment.

The next thing to consider is the crank. Cut a small stick that will just fit into the crank, and mark a line across the center. Bring the crank pin up under the line till it touches, and note whether the line crosses the mark on the stick, or how much of it is out; and then turn the crank around and bring the pin up under the line on the other side. Note how much it is out on that side, and if out, whether it is on the same side of the mark as before, or on the opposite. If on the same side, it shows that the center of the pin is not in line with the cylinder, and the shaft must be shoved endwise until the line crosses it at the middle. If the construction of the engine will not allow this with the means at hand, take off from the side of the crank-pin boxes the amount that the line shows that it is out. Then fit pieces of brass on the other side of the crank-pin boxes to make up what has been taken off. If the boxes can be recessed for these pieces, all the better; but if not, they can be fastened in with pins. If the line is on one side of the mark when the crank is on the center, and on the other side when on the other center, it shows that the shaft is not square with the cylinder, in which case the outer end of the shaft should be swung around to bring it straight with the line. If it should happen that the shaft could not be moved at that time, the distance that it must be moved can be calculated, and then it can be done any time afterwards.

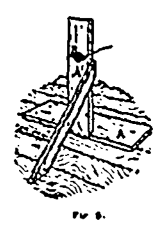


Fig. 6.

Suppose that Fig. 8 is a shaft and crank. It is plain that as the distance from the angle to 1, in either direction, is the same, moving one of these points a certain distance will move the other one the same distance; but if we double the distance to one of them, carrying us to 2, then we should move 2 twice the distance that we should 1, so that to find the distance we should move the end of the shaft we must divide the length of the shaft up to the outer pillar block by the length of the crank (not the length of the stroke), and multiply the result by the distance that the line is out from the mark on the pin. For instance, if the mark on the pin is out 1-16, the shaft 2½ feet long, and the crank one foot long, we multiply the 1-16 by 2½, which makes 5-32 that the outside pillow must be moved. To find if the shaft is level, place the crank upright and suspend the plumb line down over the end of the pin, and then turn the crank down and note how much it is out. A similar calculation will give the amount the end of the shaft must be raised or lowered.

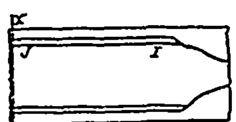


Fig. 8.

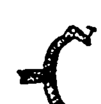


Fig. 7

To determine if the crank pin is straight with the shaft would be an easy matter if the face of the crank was flat; but as a general thing, when the shaft is finished it is left uneven, as can be seen by putting on a steel straight edge. Even if the face is flat it is possible that it is not square with the shaft. To determine, then, if the pin and shaft are parallel, take two thin blocks C C, Fig. 2, and a straight edge D, and hold them in position by the stick E placed against any handy support. The blocks C C should be placed against the end of the shaft the same distance from the center. The straight-edge D will then be at right angles to the shaft, and a square placed against the face of it and against the pin will show if the pin is straight one way. To determine if it is straight the other way, place the blocks C C and the straight-edge D in a horizontal position, suspend two plumb lines, F F, over the pin, as shown in Fig. 3, and run the square H along the straight-edge to the lines, when it should touch both lines. Should the pin become loose in the hole, and it be necessary to bore out the hole before putting in another pin, the boring can be set in the same way.

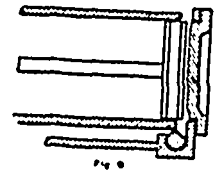


Fig. 5

It should be remembered that a crank-pin wears only on one side, and also that, if it has been out of line, one end may be worn more than the other. This can be ascertained by calipering, and if the pin is not straight the difference must be allowed for, according to the circumstances of the case in hand. When the brasses have been babbitted, there will be a small ring on each end of the pin that will not be worn. Pounding is sometimes caused by the piston running over the ports, as shown in Fig. 9. The piston may then be thrown to one side, or raised up from the bottom, even when the steam enters the top. When such is the case, nothing can be done except to make the piston fit the cylinder as well as possible. Fig. 11 is a caliper stick for setting the line, and can be whittled out of any handy piece of pine.

SPLIT PULLEYS.

HAS it ever occurred to you, says J. A. Allen in the Iron Trade Review, that there are some methods coming into vogue that are cheaper in the long run to use than to be without? Among these is the split pulley. It costs money, and big money, too, at times to cut a keyway in a shaft when a new pulley is to be located. Have you ever used a good split pulley? If not, do so. A short time since I fitted out a whole shop with pulleys and shafting, and used nothing but split wooden pulleys. Hold? Well, not at first. Each pulley was tightened as well as we could do the work at the start and then watched. At the first indication of a slip the wrench was put on again and that settled the matter for all time. I had those pulleys driving every conceivable kind of ironworking tool, from a light drill to a heavy hammer, and never had the slightest indication of trouble. Then, when new tools were bought and old ones had to be shifted, ten minutes sufficed to take down the pulley. But when I did that job, I didn't know as much as I do now. I allowed builders to sell me tight and loose pulleys on the counter-shafting, so that for every machine having a four-inch belt I had to buy a nine-inch split pulley. If I had the job to do again I would specify clutches. Of course the clutch would cost more than the extra paid for the double width split, and the additional loose pulley, but not so very much. And then I would save weight on my main line; and room also.

CAUSES OF EXPLOSIONS.

THE causes of explosions may be summed up in one sentence, namely, lack of strength to withstand the pressure. This want of strength may be due to faulty construction, but as a rule it is due to some acquired weakness, unknown simply because unlooked for. Weakness results from unequal heating, which produces unequal expansion, from corrosion, improper setting, scale, low water and want of circulation. It may not always be possible to avoid unequal heating, as for example, in getting up steam many boilers will be hotter in some parts than in others, but scale can be prevented by "boiler compounds," and low water by a little care. In some types of boilers no provision is made for water circulation, and unequal heating is bound to occur. A thorough inspection from time to time will inform the engineer if his boiler is weakened by it, but the best plan is to use some other type. To sum up, the engineer must understand and act upon the motto, "eternal vigilance is the price of safety."—Safety-Valve.