THE LATHE INDICATOR AND THE CENTER INDICATOR

John A. Grening

CONSTRUCTION OF THE LATHE INDICATOR—TESTING WORK—CONSTRUCTION OF THE CENTER INDICATOR—HOLDER FOR INDICATORS

THERE are two instruments that are extremely useful to the machinist and toolmaker for doing lathe work requiring the utmost degree of accuracy. These are known technically as the lathe indicator and the center indicator. Both of these instruments have but recently been placed on the market, and are still comparatively unknown except in the best shops. Nearly all of those in existence have been made by the machinist or toolmaker himself; as a consequence, there is a great variety of designs, gotten out in accordance with the ideas of the men who made them for their own use.

The following are descriptions of these two instruments, which have been designed, made, and used by the writer, and of a holder for them that was designed and made by a friend, who intended to use it for a thread-cutting tool. The designs given are not claimed to be the best that could be devised, but are given merely as a suggestion of how such instruments may be made. Actual use has proven them to be satisfactory as far as the writer is concerned. Their construction is not covered by patents, so that any reader who thinks the designs given will suit him is at liberty to construct them.

The lathe indicator is shown in Fig. 1, the illustration being full size. The purpose of the indicator is to magnify any untruth of the work, in order to make the error more visible. The most obvious and direct method is to use a lever with a long and a short arm. The short arm bears against the work. When the latter is revolved in the lathe any error, due either to the work not being round or to its not being set centrally, causes the end of the long arm to describe an arc, the length of which is directly proportional to the ratio between the lengths of the two arms. In other words, the longer the long arm is made in proportion to the length of the

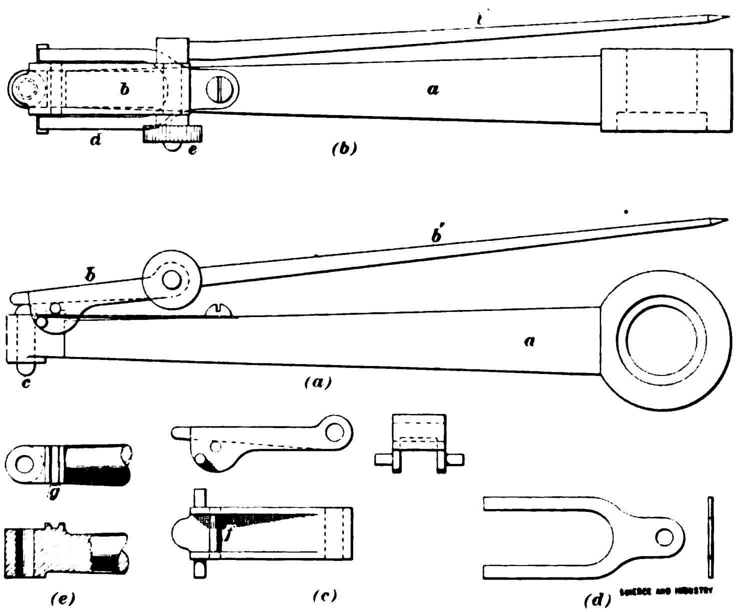

FIG. 1

short arm, the more sensitive the indicator will be. In practice, it is rarely necessary or advisable to make the ratio more than 1 to 50; with this ratio, an error in the work amounting to only .0001 inch will cause a movement of the long arm through an arc fifty times as long, or .005 inch in length. This is an amount that can plainly be seen with the naked eye. If the indicator is more sensitive than this, it is too liable to be affected by the vibrations of the floor and machinery that exist to a greater or less degree in all shops. For special work requiring the greatest degree of accuracy, an indicator may be constructed with a greater degree of sensitiveness than that here recommended as the limit for general work; in that case, it must be used in a place free from vibrations.

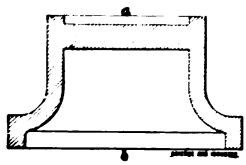

FIG. 2

Referring to Fig. 1, views (*a*) and (*b*) are, respectively, a side elevation and a plan view of the indicator. It consists essentially of four parts. These are the body *a*, the lever *b*, the feeler *c*, and the spring *d*. For convenience, the lever is divided into two parts, *b* and *b′*. They are so formed that *b′*, which forms part of the long arm of the lever, can be swiveled to any convenient position within range. By means of the locknut *e* the two parts may be locked together after the adjustment. The division of the lever into two separate parts also allows the degree of sensitiveness to be increased or decreased by the substitution of different arms. The end carrying the feeler is hardened; the hole that receives it is lapped true and smooth. The feeler itself is hardened, ground, and lapped so as to be a good sliding fit in the hole. Both of its ends are hemispherical; the upper end is enlarged, to form a stop. The chief peculiarity of the lever is the manner in which it is fulcrumed, the fulcrum being so designed that not only is all wear taken up automatically, but also the possibility of any lost motion at the fulcrum is done away with. This is done without the introduction of any complicated device.

Referring to view (*c*), which is a detail drawing of the main part of the lever, it is seen that the fulcrum pin *f* is held by its ends in the two wings that straddle the end of the body *a*. This pin is hardened and lapped smooth; it is then driven home. The seat or bearing for the fulcrum pin is shown in view (*e*). A slot *g*, about two-thirds of the diameter of the pin in width, is cut to a depth sufficient to have the pin clear the bottom of it. The upper edges of the slot are slightly beveled; the fulcrum pin rests on these two edges. It is held down to its seat by the straddle spring, which, by reason of its bearing on the lever between the fulcrum and point of contact at the feeler, holds the fulcrum pin down, prevents any lost motion, takes up any wear, and also causes the lever to follow any sliding motion of the feeler. The straddle spring is shown in view (*d*). It should be a rather stiff spring; if made of the size shown in the drawing it should be made from sheet steel $\frac{1}{32}$ inch thick.

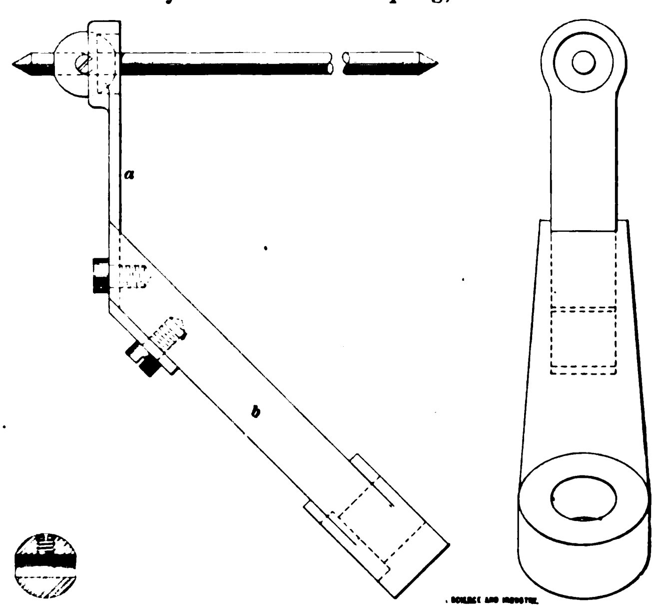

FIG. 3

Suppose it is desired to test a piece of work to find out whether it runs true on dead centers. Place the work between the centers of the lathe, and, after attaching the indicator to its holder, which is shown in Fig. 4, adjust it so that the feeler will bear hard on the work to be tested, and be about perpendicular to the surface of the work. Rotate the work between the centers by hand and watch the end of the long arm. If it moves, it indicates one or both of two things: (1) the work may not be cylindrical; (2) the work may be eccentric in regard to the centers on which it has been finished.

A good idea of the kind of error may be formed by carefully watching the movement of the end of the lever. If it vibrates steadily just once for each revolution of the work, the latter is most likely to be round, but not central in regard to its centers. If the pointer moves in jumps, i. e., makes several vibrations during one revolution, the work is most likely to be out of round and it also may be eccentric. To test its roundness, caliper it in a number of directions, preferably with a micrometer. When the work is eccentric, it can often be made central in regard to its centers by carefully lapping the center or centers with a brass lap charged with emery, provided the error is very small, say .0005 inch. When the end of the long arm remains stationary it shows the work to be both round and concentric with its centers.

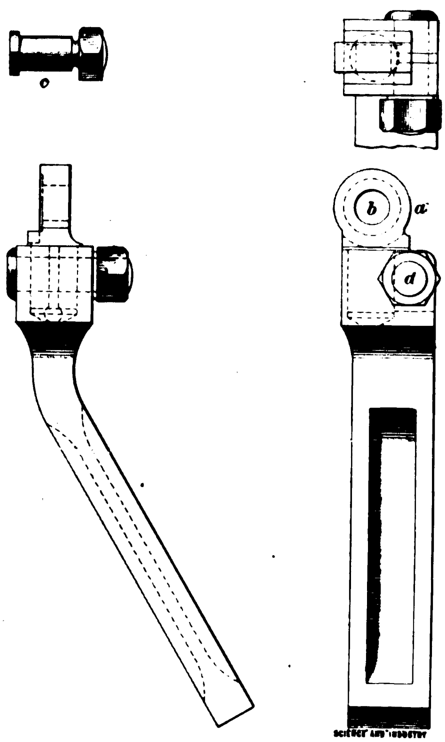

Fig. 4

The indicator may be applied to a hole in a piece of work held in the chuck or on the face plate, for the purpose of finding out whether the axis of the hole coincides exactly with the axis of the spindle; in other words, to find out whether the hole runs true. If the hole is too small to admit the feeler of the indicator, grind up a cylindrical plug to fit the hole nicely, and apply the indicator to the outside of the cylinder. The indicator may also be applied to the face of work, to see whether it has been faced true or whether it runs true sidewise; likewise, it is of great assistance in rechucking or resetting cylindrical work that is required to be chucked with great accuracy.

The particular design of indicator here shown, being removable from its holder, can be attached to a surface gauge and may then be used for testing the parallelism of straight surfaces. As is well known, it is very difficult to measure the parallelism of straight surfaces when they are far apart; in many cases calipers cannot be applied at all. For instance, consider the piece shown in Fig. 2. The question arises as to whether the plane of the circular ring at *a* is parallel to the plane of *b*. Evidently, this cannot be measured by calipering. But if the indicator is attached to a surface gauge, the work may be placed on a surface plate and the feeler brought in contact with the ring *a*. If its pointer remains stationary while the feeler is moved around the ring, the surfaces are parallel.

In order that a small motion of the end of the pointer will be visible, it is necessary to have some stationary point near it. The writer has used for this purpose a thin metal disk with a piece of soft brass wire, pointed at the end, soldered to it. The disk was placed between the joint of the holder and the joint end of the indicator; the brass wire was then bent to the shape required. If desired, some more elaborate construction may be employed.

The center indicator shown full size in Fig. 3 is intended to aid in the proper location of work that is to be chucked, so that a center punch mark will coincide with the axis of the live spindle of the lathe—that is, run true. The tool is essentially a lever with a long and a short arm turning about a ball joint as a fulcrum. The indicator is clamped to the tool holder shown in Fig. 4, which is held in the tool post of the lathe; the carriage is then run forward until the pointed end of the short arm bears lightly in the center punch mark in the work. The part *a* is made thin so as to form a spring that will hold the pointer in the center punch mark. If, on revolving the headstock spindle, it is found that the end of the long arm moves in a circle, it shows that the center punch mark is not in the axis of the spindle, and the work needs moving until the end of the pointer remains stationary, when the spindle with work attached to it is revolved. It is necessary to have some stationary point by which to observe the motion of the pointer; the dead center is the most convenient point to use.

If the indicator is connected to a holder in such a manner that it can be swiveled up and down, it can readily be used in all sizes of lathes. The center indicator shown possesses the advantage that there are no joints, and its accuracy is not disturbed by wearing of the joints. Furthermore, the pointer is adjustable for different degrees of sensitiveness; a small setscrew in the ball, a section of which is shown separately, is used for clamping the pointer and ball together. It is scarcely advisable to make the pointer longer than 15 inches; this length will be found to answer very well indeed. If made longer, the tool will be affected too much by the vibration of the machine.

The pointer, the ball, and the head *a* should be made of tool steel and afterwards hardened. The head *a* must be drawn to a spring temper, since it serves as a spring. The ball and the end of the pointer may be drawn to a straw color. Grind together the ball and the seat in the head, using the finest flour emery. The shank *b* may be made of machinery steel and case hardened.

The holder shown in Fig. 4 is made of tool steel. Its head *a* has a cylindrical hole *b* to receive the clamping bolt *c*, by means of which the indicators are attached. The head has a cylindrical shank closely fitted to a hole in the holder proper. The holder is split at the front end; a clamping bolt *d* allows the head *a* to be locked in any position after rotation to the desired place. The combination of two joints allows a movement of the indicator in two planes perpendicular to each other; hence, the indicator can be swung through a very wide range of positions, and is then adapted to almost any size of lathe and any kind of work conceivable. It is advisable to harden the holder at a rather low heat, and then draw it to a spring temper.

TESTING, ADJUSTING, AND READING THOMSON RECORDING METERS

W. H. Fellows

TOOLS AND INSTRUMENTS REQUIRED—TESTING TWO- AND THREE-WIRE METERS—ADJUSTING AND CALIBRATING—DIRECTIONS FOR TAKING READINGS

THE flat-rate consumer has been, and is now, gradually disappearing; in his place is found the one that pays for his electrical energy on a meter basis. Now, the electric meter is held responsible for nearly all the earnings of a company, with the exception of what comes from the series arc system.

Since a very large proportion of the station's total output goes to supply loads of one, two, or a few lamps, the meter should register with a fair degree of accuracy on these light loads, as well as on the greater loads. The up-to-date central-station manager has come to realize that the meter will soon more than pay for time spent on it in putting it in good running order. On the other hand, a consumer complains that his meter certainly must be running too fast. (It can be counted on that he will not complain in the other direction.) It will, therefore, be seen that methods should be available for testing meters so as to bring about a feeling of security and satisfaction to the manager; also, to ascertain whether the consumer has just grounds for complaint.

In the following, the writer will endeavor to describe some methods and hints applicable in testing and adjusting Thomson recording watt-hour meters, which he has picked up in a company having installed over 1,300 meters, about half of which are Thomson meters.

The meter will be regarded as installed in

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THE HOUSING OF THE STEEL STEED

H. T. Bentley

MAMMOTH ROUNDHOUSE OF THE CHICAGO AND NORTHWESTERN RAILWAY CO.—ELECTRICALLY-CONTROLLED TURNTABLE—PNEUMATIC OIL TANKS AND ASH CONVEYORS

"*Brave racer, who hast sped the living light*
With throat outstretched and every nerve a-strain!"

IN ACCORDANCE with the decree of Dame Nature, every one of her children, whether animate or inanimate, in order to maintain their normal strength, must have rest and relaxation. The modern locomotive, with its hundred tons of "tissue, bone, and muscle" and a complete system of "nervous fiber" under the highest tension when in service, is not exempt from this mandate. This sinewy centaur, whether a "pony" or a "hog," must be regularly side-tracked from the race course to the stall, where it can rest while being groomed, broomed, and fed. Dusty roads, a scorching fire, and an inexorable driver, who must "make time," have rendered Hercules much the worse for wear and tear. His lungs must be cleared, his digestive organs flushed, his muscles and joints lubricated, his system toned, and his trappings polished like "the handle of the big front door."

To meet the fastidious demands of this latter-day son of the chase, Science and Art have willingly become his handmaidens and continually cater to his care and comfort. Substantial structures, known to the world as "roundhouses," have been erected and equipped with every conceivable device for "tabling," "bathing," and "massaging" this brave racer at the close of his daily contest with time and the elements. His headlight is lowered, and when "no long-streaming beam of light comes trembling through the gloom" he is turned over to his house attendants.

Who, having entered a roundhouse, has not been impressed with the majesty of Hercules and Goliath at rest?

"At intervals they darkly stand,
No words come forth:
Each soul is rolled into itself!"

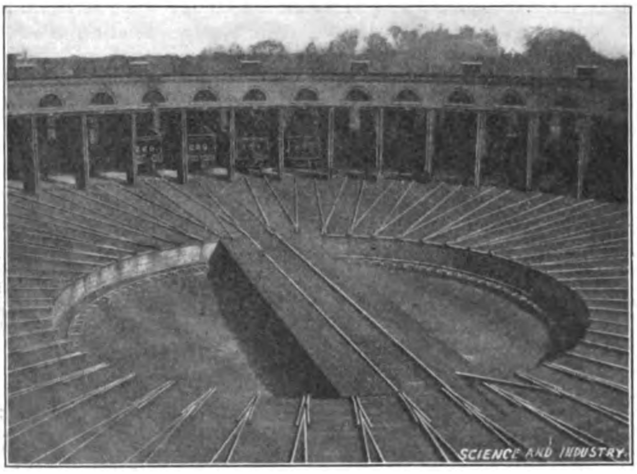

FIG. 1

Among the recent acquisitions to the homes for fatigued motors is the splendid roundhouse lately completed for the Chicago and Northwestern Railway Company, at Clinton, Iowa, which is said to be the largest and finest in the United States, if not in the world. This mammoth rotunda contains no less than fifty stalls for the largest type of