

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN

A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

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NEW YORK, SATURDAY, OCTOBER 11, 1884.

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For the Week ending October 11, 1884.

Price 10 cents. For sale by all newsdealers

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LEVELING AND LINING SHAFTS.

With the best of care, the main line of shafting and the intermediates and counters will sometimes get "out of kilter," from several causes. It is difficult to make a building perfectly secure in its foundations and superstructure; the walls settle, the foundations may be affected by frosts and by profuse rains, the floors become unlevel; the main shaft is unduly loaded and unevenly pulled by newly added machinery; oil holes become clogged, and other small causes may combine to disturb the relations of prime mover, main shaft, and the other lines that are intermediate between main shaft and machines.

It will not pay to go over the entire work of hanging the shafting as originally done, so some data should be established at that initial period to rectify by, when minor changes occur. It is a very good plan, therefore, after lining out, or squaring out from the prime mover to the main shaft, to keep the lines. In practice the writer has found that the brass nails, convex-headed, which are used for ornamental furniture purposes are good, or copper tacks, either of them being driven into the floor at convenient distances to designate the exact lines, the lines having been originally found by the plumb bob. One word as to this implement; as usually made, it is not a tool of precision; a pear-shaped pointed weight can rarely be suspended by a central string so that the point will touch a point at all times, and not describe a minute circle. A plumb bob should be a circular weight like a solid ring suspended horizontally by three lines, like an old fashioned balance, meeting in one, and have a projecting downward center. Some toy tops show the proper shape for a plumb bob.

If these brass-headed or copper-headed marks have not been left on the floor from the original lining of the shafting, they should be made subsequently, taking, by square, the central line of the engine as a basis. This square having been established, plumb from the center of one end of the shaft or from one side of the shaft, and then at intervals to the other end. By drawing a connecting chalk line on the floor a determination of absolute line may be made by squaring to the engine. Of course, when the main shaft is lined all the other shafts may be brought parallel with it by means of rigid reachers, as light wood staffs, or flexible ones, as linen tape lines. But for all living purposes the writer never found anything better than the ordinary fishing line of flax, of the size suitable for fresh water perch or pickerel fishing. It keeps its length under quite considerable hygrometric changes of the atmosphere, and one hundred feet of it may be conveniently carried in the pocket. All this relates to the lining of the shafts; now as to the leveling, which is of fully as much importance.

A shaft may be in line with the prime mover and in relative line with the intermediates, and not be right. It may be, also, perfectly straight, so that a line stretched from end to end through the boxes would show no deflection, and yet not be right. The shaft should be level; and then, if the pull on it is evenly balanced, or nearly so, there will be no "creeping," even if there are nether coupling hubs nor stay collars set up against the ends of the boxes to prevent end movement. It is possible (because it has been done) to run a line of two and three-quarter inch shafting 220 feet without a turned journal or a guard collar in its entire length; but to do it the shaft must be level.

A handy implement for leveling the shaft can be made in any carpenter's or patternmaker's shop. It is a frame, well braced, made of light wood, pine or spruce, consisting of two upright arms of a length sufficient to reach from the shaft to the operator's shoulder. These have at the upper end a cross piece secured at a right angle, or an angle somewhat more acute, so that the elbow thus formed would embrace or rest on the shaft. These uprights are connected by cross bars at a convenient distance for handling the uprights and for reaching between pulleys, so that each upright can rest on the shaft. The lower cross piece should carry a spirit level, or one may be carried separately to use with the appliance. It is evident that the frame must be strongly braced to prevent any "wibbling," or sagging, and that the lower, or spirit level, bar must be at an absolute and exact distance from the forked ends of the upright. In use, the shaft to be tested must be at rest.

With this simple implement the exact level of a shaft may be found, or rather any deviation from the level may be ascertained. A combined level and plumb, such as is used by carpenters and masons, can be used to determine the accuracy of the implement at any time. It is handy to have in the shop.

TURNING METALS TO PATTERNS.

A workman in a machine shop had a job of turning, tapping, and finishing some ornamental brass nuts of an almost globular form—hemispherical with a moulded base. At first he drilled into the end of a bar of the metal of the proper diameter for finishing, tapped the hole, cut off the nut in a lathe, mounted it on a threaded arbor, and finished it with a hand tool. Each nut was treated separately. It was a process too slow to suit his tastes; and after ascertaining that the job would extend to several thousands of dozens of nuts, he obtained permission to contract for it. He procured the use of a lathe and a turret head screw machine. He removed the transverse feed screw of the tool carriage of the lathe, and substituted a strong spring.

On the back of the lathe he mounted a guide for the tool carriage in the form of a series of steel plates with scalloped edges mounted on a horizontal spindle. There were

four of these plates, each successive one having deeper indentations, until the fourth one presented a profile of the almost completed nuts. The spring held the tool carriage firmly against one of these scalloped guides, compelling the cutter to make a chip in accordance with the profile of the guide. The successive guides had indentations, or scallops just suited to the taking of a fair chip. The bar to be turned and the guides were of the same length. Soon as the tool carriage had reached the end, a star wheel and pin changed the pattern or guide. At first the lathe was allowed to stand still until the tool carriage was again returned to its starting point, but after a while a simple attachment reversed the longitudinal feed automatically, holding back the spring until the tool carriage came into place, thus making the lathe an automatic machine.

When the bar was turned into the nuts, they still, however, being slightly connected by their necks, they were broken apart and each one put separately into the chuck of the turret head machine, drilled, squared at one of the ends, and tapped. For the finish, a short threaded arbor was inserted in the chuck, the nut mounted and polished. The practical machinist will readily understand these processes and the increase of rapidity caused by the automatic turning and the use of the turret head machine, which carried all the tools ready fixed in place for use—the drill, the squaring up bit, and the tap.

It seems to be apparent that an extension of this method of turning to pattern steel, iron, brass, and other metals is feasible, and might be applied economically in many instances where reproduction of forms is required from the lathe. It is a modification of the Slate taper attachment to lathes, and is carrying only a little farther that principle which has already been extended to the crowning of pulley faces and the finishing of iron hand wheel handles.

Car Couplers on Massachusetts Railways.

According to the provisions of a law enacted last winter, requiring Massachusetts railroads to adopt safety couplers on all new freight cars after this year, the railroad commissioners of that State devoted Sept. 25, 26, and 27 to a consideration of the claims of various styles of couplers for superior excellence. There were applications for the examination of 173 different couplers, which were called up in alphabetical order according to the names of their inventors, some of whom were represented by counsel. In so long a list of course only the merits and demerits of each can be but briefly touched upon in the following synopsis of the results of the examination:

Among those presented were the Archer (hook and link), which has been in all the tests, and is recommended by the National Car Builders' Association for further trial. It has been in use on 100 cars of the Delaware and Hudson for two years, also on the Lackawanna. It couples automatically with itself and all others.

The Ames coupler is a combination of link and hook, fixed, automatic with itself but not with others, and was represented as strong, durable, unailing; it has been in use on 150 Boston and Albany cars four years, and about 50 Lake Shore cars six years; has not broken for two years; costs, all steel, \$20 a car; malleable iron, \$18; iron, \$14. The patent has been passed upon by both the Eastern and Western Railroad Associations. Mr. Adams, the master car builder of the Boston and Albany, testified to its success, and in reply to a question by Chairman Russell, said he should prefer it to any other if all roads would adopt it.

The Best automatic has link and pin, couples with "anything or nothing," uncouples easily without much slack if desired, and never if not desired, and both the link and pin are adjustable by one lever and with use of only one hand. The promoter said it was open to only one objection, and that was a loose link, which is liable to get lost or stolen. The pin is protected from ice and gravel, and free from breakage. Total weight, 250 pounds; cost, \$11.20 a car, exclusive of royalty. The pin is flat and broad. It is in use on 12 cars of the Denver and Rio Grande, where it has stood the severest possible tests. No cars are here.

The Barnes automatic couples by a hook underneath the head, movable from six different standpoints, works on shortest curves, and will uncouple at an angle when a car tips over. Eight pairs are in use on the Rochester and Pittsburg.

The Brown automatic has link and pin, and works in a double head (for high and low), inside of which is a simple device, costing only 15 cents, with gives the automatic action. Fifty cars equipped with it are in use on the Chesapeake and Ohio, and some on several other roads. The pin is fast, does not bend or break, and ordinary links are used. It will require new drawheads on most roads.

Byron's self-acting coupler is of the hook variety, somewhat like the Mille, but the hook has a deeper angle. The cars stand but 27 inches apart, while with others they are from 26 to 42. It will couple and uncouple on the shortest curve in use. It has been tried on one of 56 feet radius, and with both hooks drawn back there were 8 inches of space to spare. It will not couple automatically with other kinds.

The Beal coupler, link, and pin, the latter secure, works automatically with all, and is in successful use on the Florida Railway and Navigation Company's roads.

The Boston automatic comes from Minneapolis. It is of curved vertical hooks, automatic with each other only. Couples and uncouples easily; is strong, safe, and durable. It costs about \$30 a car, exclusive of royalty.