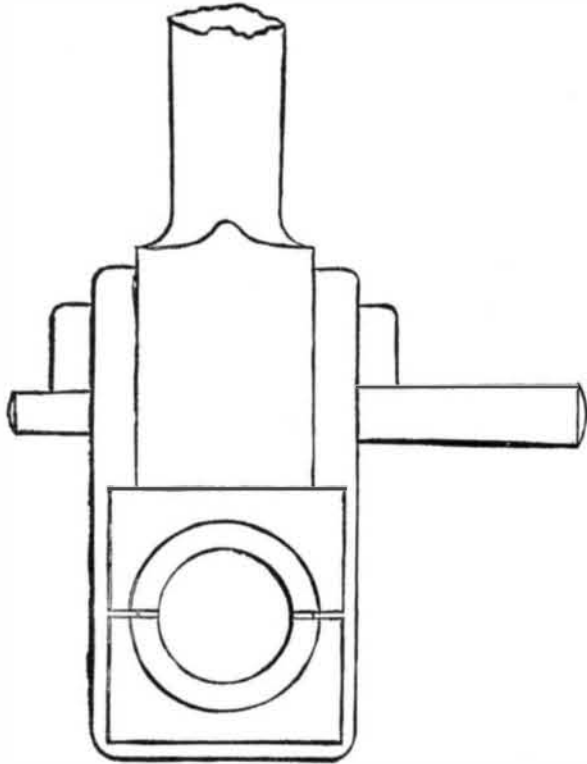


ADJUSTING CONNECTING ROD BRASSES.

P. D. H. says: "I inclose you a drawing of the connecting rod end, to connect with the crank pin on a tugboat engine. In trying to adjust the brasses, I drive the key hard in, then mark it, and draw it back about an inch. The idea of leaving the brasses apart is that, in case of heating and wearing, the lost motion may be taken up. I have asked many engineers as to the advisability of keeping the brasses butted and the key driven tight, but I receive no answer."

This is one of those minor details of mechanical construction in which there is much difference in practice, and which is of considerable importance. The cause of the trouble in our correspondent's case is easily perceived on referring to his drawing; for the key has a taper of only $\frac{1}{8}$ inch to the



foot, and therefore would of its own weight alone place sufficient pressure upon the brasses to cause them to heat and abrade. In many cases, however, it is a difficult matter to adjust brasses that have the joints left open, for the following reasons: If the flanges of the brasses do not quite fit the length of the journal, as is very commonly the case, it is customary to tighten the key until the rod end can just be moved by hand so as to force the brass flanges against, first one, and then the other, end of the journal. This is an approximate adjustment; and if the journal heats at all, the key is slacked back a trifle: whereas if it pounds, the key is set up a little. As a matter of fact, then, nothing is actually known of the precise fit of the brass to the journal; and while looseness may be detected by the pounding, the brass may be tight enough to cause undue wear without very sensibly heating the journal, especially if the latter is freely lubricated. If, however, the brasses fit the length of the journal, and do not butt, as it is called, when the joint faces of the brasses meet it is usual to drive the key in till the brasses bind the journal, and to then slack the key back to the necessary amount. What that amount should be cannot be stated, because it varies with the taper of the key and the force with which it is driven home. As a result, then, the operation is left to the judgment, or, in other words, to guess-work, of men, many of whom are not well experienced in the operation; while under any circumstances the actual fit is not positively known. A plan not infrequently adopted is to insert a piece of lead wire of small diameter. After inserting it between the brasses, the key is driven tightly home; then the key is slacked back until the lead wire is just freed. It is estimated that the adjustment will then be correct; there is no actual certainty of the fit, however, even in this case.

If it be desired to insure a perfect fit, the brasses must be made to butt or meet together when the key is driven home; and in this case the brasses may be adjusted in position in the rod and upon the journal, with the other end of the rod free, so that it can be moved; and the fit can then be felt by moving the rod. If the rod is a heavy one, the brasses may be placed in the strap and tried in connection with the rod, as explained, so as to ascertain if the rod leads true to the other journal; then the fitting may be done with a half round file and scraper, and the brasses tried in the strap independently of the rod. The adjustment being nearly completed, the rod should again be applied to assure that it leads true to make any necessary alteration during the finishing of the adjustment. The journal having a faint coat of red marking, the brasses must be fitted until the fit can scarcely, if at all, be felt when the key is driven lightly home. The key should be marked with a line to show how far it was driven in during the adjustment; so that, in putting the work together, it may be driven in to the same distance. By this method, any number of bearings may be fitted, with the certainty that neither heating nor undue wear will take place; and if the bearings are properly proportioned to the duty, and if the metal of which they are composed is of suitable quality, the bearings may, if kept properly lubricated, be left to take care of themselves, even when quite new.

A compromise between these two methods is to put a strip of sheet brass between the brasses, and to file it down as the

brasses wear; and this is most desirable for brasses the position of which is such that it entails much labor to take them out to let them come together. The wear on brasses butted together is not, as a rule, more than one half as great as upon those left open. In English and in a majority of American locomotives, and in small stationary engines, the brasses are made a butt joint; and in English shops, in all engines and machines, open brass joints are interdicted unless the position renders it difficult to take them out for adjustment.

THE ENGINEERS' EXAMINATION OF THE NIAGARA SUSPENSION BRIDGE.

The suspension bridge over the Niagara river was constructed by John A. Roebling in 1855. It has a span of 821 feet, and a deflection of 59 feet; 14,560 wires are employed in the cables, the ultimate strength of which is 12,000 tons. Since its completion, in the year above mentioned, the bridge has been subjected to the almost constant strain of heavy railroad trains; and thus for a period of 22 years it has undergone a trial of the greatest severity. Quite recently, it was deemed advisable to overhaul the structure thoroughly in order to determine whether any repairs were required, or whether the jarring or straining to which the wires had been submitted had—as some theorists believed possible—impaired the quality or tenacity of the iron. Accordingly the bridge was closed to travel; and to Colonel William H. Paine, Assistant Engineer of the East River bridge, was assigned the duty of critically inspecting the structure. We are indebted to Colonel Paine for an account of his investigations, which have resulted in his conclusion that the safety of the bridge is in nowise lessened. The detailed report of the engineer will be looked for with great interest, as it will undoubtedly add much to our knowledge relative to the durability and strength of the suspension system of bridge building.

The anchorage cables were imbedded in masonry and cement, which it was necessary to remove in order to admit of their examination: a task of no small difficulty, as the masonry was like solid rock. It was found that out of the 14,560 wires less than a dozen were seriously corroded, and these were in the first anchorage. The metal on the other wires showed the original grain with distinctness. Not content, however, with this highly favorable appearance, Colonel Paine proceeded to experiment upon the wire, in order to discover whether the means provided to allow of its expansion and contraction—namely, the placing of the bed plates which receive the cables on top of the towers, on rollers—had been sufficient to prevent the longitudinal stress upon the filaments destroying their elastic quality. An apparatus was used capable of marking a stretch to $\frac{1}{10000}$ of an inch; and this being adjusted, a heavy freight train was moved upon the bridge. The elongation of the wire was found to be very nearly equal to that which the formula, used by engineers for ascertaining such results, showed the stretch of a perfect cable, similarly made, should be under like strain: so that not only had twenty-two years' service not resulted in any corrosion of the wire, but the elasticity of the same under the enormous strains had not been impaired.

In the second experiment, a single wire from one of the main cables was tested. A strand of 520 wires was selected, and the binding removed, so that every wire was perfectly free. Three wires were then chosen, and across them a knife-mark was made. The middle wire of the three was cut at the mark; and on testing it by the delicate instrument above noted, it was found to have contracted to within a small fraction of what it should have reached when relieved from its portion of the weight of the bridge. In experiment No. 3, a single wire was detached and weighted until it broke. The object here was to see whether the nature of the metal had been altered; for if the iron had become granular and had lost its cohesiveness, the fracture would be a straight one, similar to that of cast iron. On the contrary, the wire, when subjected to the stress, extended until its diameter was reduced fifty per cent before it broke.

A cable guy was next selected and made to sustain a dead weight. The construction estimate places the maximum burden which that guy would ever be required to bear at 15 tons. The guy parted at 53 tons. To show how perfectly the wire had retained its original characteristics, Colonel Paine, having observed that the wire, on being removed from the cable, tended to coil in a circle of about 5 feet in diameter, sent to the person who had originally prepared the wire for its place for information as to the size of its former coil. He learned that it had been wound on a drum 2 feet in diameter, and that it had been subjected to a straightening process which took about half the curve out of it. Certainly no more remarkable proof could be adduced to show that the spring of the wire had in no respect been overcome.

Although the bridge has thus been shown to be thoroughly safe, and to have wonderfully withstood wear, still more elaborate examinations are to be made, and the structure will not be open to traffic until these are completed. We shall publish further extracts from the complete reports of the engineers either in these columns or in those of the SUPPLEMENT at as early a date as possible.

SINGULAR EXPLOSION OF AN ELECTRICAL MACHINE.

Professor A. E. Haynes, of Hillsdale College, Mich., sends us the following account of the explosion, 20th ult., of an electrical machine:

"While our Holtz electric machine was being used it suddenly exploded, blowing the fixed and revolving plates into thousands of pieces. It was in fine order, was working nicely at the time, with a student on the insulating stool,

while the revolving plate was being turned quite slowly. Did you ever hear of a similar occurrence?"

"During the evening of the same day, we had very much thunder and lightning, quite a rare occurrence when the snow is so deep, some 18 inches. The machine seemed to gather itself for an instant before the explosion, as does the battery of jars, sometimes charged by it. The report was as loud as several rifles. Please give your opinion of the explosion."

REMARKS: The cause of this explosion was, probably, the imperfect annealing of the glass, producing unequal strains, the stronger of these strains, assisted by vibratory impulse, at last overcame the cohesion of the plate, and it burst into fragments. Such examples are not infrequent. Last year we gave an account of the sudden shivering at Troy, N. Y., of a sheet of plate glass, eight feet square, from this cause. The glass was leaning against the side of a building at the time, when it suddenly exploded with a loud noise, breaking into a thousand pieces. One of the fragments struck a workman in the leg, and inflicted a serious wound.

Professor Hagenback has suggested that when plates and other glass objects are examined by polarized light, they will exhibit the prismatic colors if under the influence of unequal strains; and in this way defective glasses may be readily detected.

THE GREAT SUSPENSION BRIDGE BETWEEN NEW YORK AND BROOKLYN.

The work of arranging, testing, and preparing for the laying the wires of the main cables is steadily progressing, and is watched with much attention by engineers and others interested in this remarkable work. As a matter for convenient reference, we subjoin the following epitome of principal facts and dimensions:

Construction commenced January 2, 1870.
Length of river span, 1,595 feet 6 inches.
Length of each land span, 930 feet (1,860 feet).
Length of Brooklyn approach, 971 feet.
Length of New York approach, 1,562 feet 6 inches.
Total length of bridge, 5,989 feet.
Width of bridge, 85 feet.
Number of cables, 4.
Diameter of each cable, 15½ inches.
Each cable consists of 6,300 parallel (not twisted) steel wires, No. 7 gauge, closely wrapped to a solid cylinder.
Ultimate strength of each cable, 11,200 tons.
Depth of tower foundation below high water, Brooklyn, 45 feet.
Depth of tower foundation below high water, New York, 78 feet.
Size of towers at high water line, 140 x 59 feet.
Size of towers at roof course, 136 x 53 feet.
Total height of towers above high water, 277 feet.
Clear height of bridge in center of river span above high water, at 50° Fah., 135 feet.
Height of floor at towers above high water, 119 feet 3 inches.
Grade of roadway, 3¼ feet in 100 feet.
Size of anchorages at base, 129 x 119 feet.
Size of anchorages at top, 117 x 104 feet.
Weight of each anchor-plate, 23 tons.
Estimated total cost of bridge, exclusive of land acquisition, \$9,000,000.
Estimated cost of land, say, \$3,500,000.
Total estimated cost, \$12,500,000.

Mortification and Water.

Professor J. M. Merrick, writing to the *American Chemist*, says: "In *Hoffman's Manual*, and doubtless in many other chemistries, directions are given for exhibiting the decomposition of water by sodium, the hydrogen gas being collected in a tall, narrow jar by pushing pellets of sodium under its mouth with a wire gauze spoon, etc. In both cases I used very small bits of sodium. Having blown an expensive glass tube to fragments in my own laboratory by this process, and having, in the presence of a large class, blown into minute atoms, with a noise like thunder, a large tube and porcelain cistern, covering myself with mortification and water, and cutting gashes in my hand, I venture to suggest that possibly there is a risk in this experiment, as laid down in the books."

You are right, Professor. There is certainly a "possibility of risk;" indeed, we are willing to go further, and say that there is absolute danger. Lucky that your eyes escaped injury. Such experiments should be banished from the lecture room.

School Life and its Influence on Light.

Under this title, Professor George Reuling, M.D., surgeon in charge of the Maryland Eye and Ear Institute, Baltimore, contributes to the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT a large amount of valuable practical information concerning the human eye. He explains its general construction, the operation of controlling its muscles; points out how school children become near-sighted; shows the proper remedies; and gives many particulars concerning the uses and care of the eyes that ought to be read and remembered by everybody.

Bursting of a Reservoir Dam.

Recent heavy rains in New England resulted in the breaking down of the dam of a reservoir at Staffordville, Conn. A body of water covering over 400 acres was freed, and rushed through the valley, overthrowing smaller dams in its path and devastating a portion of the valley of Stafford Springs. The flood moved slowly, so that time was afforded to people to get out of the way, but the loss of property was great, amounting, it is estimated, to over \$350,000.

BELGIAN anti-friction metal is composed of copper 20, tin 4, antimony ½, lead ¼ parts. Mix all the other ingredients before adding the copper.