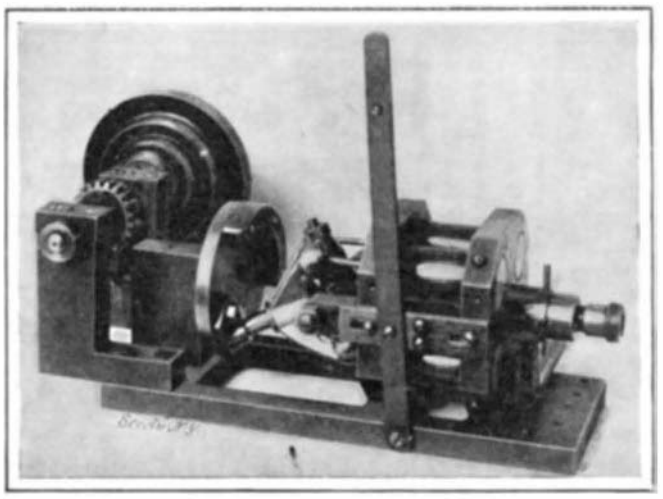
A NOVEL GYRATING STEAM ENGINE.

A new form of steam engine, with which a constant thrust is obtained on the driven shaft, is shown in the accompanying illustration. The engine is the invention of Mr. Frederick Egge, of Bridgeport, Conn., and it will be found particularly useful for any service where a powerful, compact, and light-weight engine that can be instantly reversed is desired, such as for hoisting work and for automobiles. As can be seen in the illustration, the engine consists of four horizontal cylinders placed symmetrically around a central tube containing, near its right-hand end, ports opening into the cylinders (one port for each). The piston-rods are fitted with ball and socket joints at both ends. Their outer ends are connected to a sort of spider set at an angle with the transversely-placed disk on which it is mounted. The thrust of the piston rods on the arms of this spider tends to push it off the periphery of the disk, but as the spider is firmly secured to the disk, this is revolved instead, and the spider goes through a gyrating motion as it is successively driven by each of the four pistons. The spider is mounted on and pinned to a short rod having a bearing at its upper end near the periphery of the disk and at its lower end in a block on the extremity of a small central shaft that actuates the rotary valve for supplying live steam to and carrying off the exhaust steam from all four cylinders. The gyrating movement of the spider causes this rod (which has a universal joint near its lower end) to make one turn to every revolution of the disk, and thus the valve also is driven at the same speed as the disk. The valve consists of a sleeve having two sets of ports—one set for running in either direction—as well as a suitable exhaust port. The lever on the side of the engine slides the valve laterally, and instantly reverses the engine. This feature is the result of the constant thrust at an angle of 30 deg. obtained from one or another of the four pistons.

The photograph which we reproduce is that of a working model designed to show the use of the motor as a hoisting engine. It could also be applied to an automobile by direct attachment to the rear axle with a bevel or spur gear drive. An engine of this type can be built of very light weight, and so should be useful in all cases where a portable motor is needed.



A NOVEL GYRATING STEAM ENGINE.

THE NEW BRITISH YARD STANDARD.

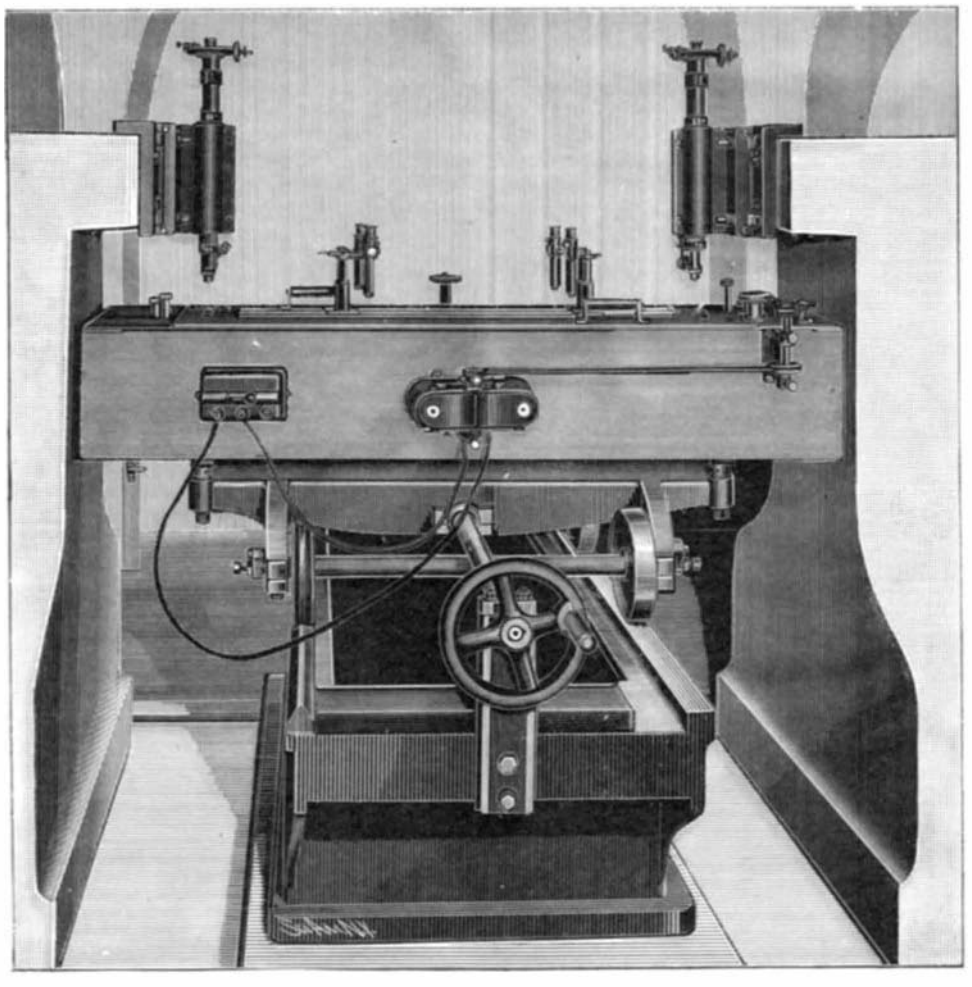
BY HERBERT T. WADE.

During the past year the Standards Department of the British Board of Trade has been engaged in studying and verifying a new yard standard, in which have been incorporated all the refinements made possible by the modern science of metrology. The present imperial standard or legal yard of Great Britain is a bronze or gun-metal bar of rectangular section legalized by Act of Parliament in 1855. The true or legal yard is taken as the distance at 62 deg. F. between two fine lines on the surfaces of two gold plugs that are sunk in wells or holes near the ends so that their surfaces lie in the median or neutral plane of the bar where any effects of flexure are reduced to a minimum. A number of copies of this standard bar were made when it was constructed and one of them, No. 11, was given to the United States government, and is now in the fire-proof vault of the National Bureau of Standards at Washington. It has twice been taken to England for comparison with the British standards, and for many years served as a standard of length for the United States. A study of the various bronze standards, however, showed that they were not absolutely invariable and that their length was likely to be altered some minute but appreciable amount by molecular and other changes taking place in the alloy of which they were formed. In fact, the unsuitableness of bronze for a prototype standard was recognized at the time when the construction of an international standard meter was proposed in 1872, and the commission determined on an alloy of platinum and iridium, not only for the international prototype, but also for the various national standards which were to be similar in size, form and composition. In making these standards, it was necessary to use a material that resembled as closely as possible the original platinum meter of the Archives, but also its composition should be such that it would be free from oxidation and possess as well the requisite strength, elasticity, and other mechanical characteristics. These meter bars when completed represented the most careful and accurate workmanship, so that when the two standards allotted to the United States were received by the government, it was only a brief space of time before they were adopted by executive order as the national fundamental standards of length, from which the yard or common unit was to be derived by using the ratio 3600/3937 specified in the Act of July 28, 1866. Thus the British bronze standard yard was displaced as a standard of length in the United States by the platinum-iridium meter of the International Commission, despite the fact that Anglo-Saxon weights and measures were and are universally employed.

Convinced a few years ago of the necessity of constructing a new copy of the imperial standard yard, the Standards Department of the Board of Trade, under the direction of Mr. H. J. Chaney, superintendent, decided to employ such a material as would best answer the requirement of resistance to oxidation, hardness, density, permanence, elasticity, etc., and select such a form as should be considered best in the light of actual experience with standards of length and the developments of metrological science. These matters had been most thoroughly discussed and investigated at the time of the construction of the international metric standards, when it was realized that such materials as gold, platinum, iron, or even rock-crystal, for various reasons, were quite unsuitable. Accordingly, it was determined to employ an alloy of 90 per cent platinum with 10 per cent iridium. This was possible by the adoption of a peculiar cross section of X shape devised by M. Tresca, of the French committee, whereby sufficient strength and rigidity were obtained without the employment of an undue amount of metal such as would render the cost prohibitive or the bar of unwieldy mass. Furthermore, the platinum-iridium alloy expands but little with an increase in temperature, while its surface can be given a high polish so that the lines marking the standard distance could be engraved directly on its surface. These international standards had not only proved eminently satisfactory in their use at the Bureau of Weights and Measures and in the various national laboratories, but no essential improvements could be suggested, so that the British metrologists concluded that they could do no better than to copy the composition and their form in constructing their new standard yard. Thus they would have a standard whose constants would be known not only independently, but also in terms of the International Prototype Meter. Fortunately, they were able to obtain one of a series of bars made from an ingot of the specified alloy which was cast at the Conservatoire des Arts et Métiers at Paris for the use of the Bureau International des Poids et Mesures. In 1902 this bar was polished and adjusted at the laboratory of the Société Genevoise pour la Construction d'Instruments de Physique at Geneva, and was then sent to the International Bureau of Weights and Measures at Sevres, near Paris, where a meter and a yard were traced on the bar by M. J. Rene Benoit, the director. This was accomplished with the dividing engine of the bureau, and the same general means and methods were employed as were used when the standard meter bars were constructed and graduated. The construction and form of the new standard will be apparent on reference to the accompanying illustration, which shows clearly the X or Tresca section. The rigidity of the bar is manifest from its design, while provision is made whereby the neutral or median plane coincides with the upper surface of central portion or cross bar on which the lines are traced, reducing to a minimum any effects of flexure caused by inequalities of the supports. On this surface parallel with the axis of the bar are traced two fine lines, 0.2 millimeter distant from each other, and across these is another fine line which marks one extremity of the standard length, the latter being measured between two such lines, points being taken which are included between the longitudinal lines, the general appearance when seen under the microscope being as shown in the accompanying engraving. In the new British standard one such transverse line marks the beginning for both the meter and the yard, while at the opposite end of the bar there are similar sets of lines to indicate the limits of each. In short, the new standard is practically a standard meter with a yard marked on it, and thus the British Standards Office now has on a single bar a determination of the value of both of these fundamental units of length as given by the officials of the International Bureau in terms of the international standards, and also, after the conclusion of the present investigation of the bar, its value in terms of the Imperial Standard, which doubtless will be legalized in some form or other. According to the officials of the bureau the new British standard when referred to the International Prototype Meter at 0 degree Centigrade is too long by 2.9 microns or 29 parts in ten million, while the yard marked when referred to the yard standards and equivalents of the Bureau was too long by 0.000226 inch when reduced to 62 deg. F., the British standard temperature. After its determination and study at the Bureau, the new bar was then carried to London, where it has been the subject of a most careful investigation by the officials of the Standards De-

British Iridio-Platinum Yard Standard Showing Cross-Section. The Bar is in the Position it Occupies in the Comparator.

The Standard Turned on Its Side and Showing the Two Defining Lines (Magnified) on the Neutral Surface of the Bar.



THE NEW MICROSCOPIC COMPARATOR OF THE BRITISH STANDARDS OFFICE.