NEW ELECTRIC CHRONOMETER FOR TIMING AUTOMOBILES.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The Mors Company, of Paris, has lately brought out an ingenious electric chronometer apparatus which is intended to replace the ordinary method of timing races by the stop-watch. It is especially designed for automobile records, where the need of an accurate method has been felt for some time past. The device consists essentially of two instruments, one of which is placed at the start and the other at the finish, with a single wire running between them. The instrument at the receiving station unrolls a band of paper like that of a telegraph apparatus. When the start takes place a current is sent through the line, thus causing a needle point to be brought momentarily against the paper and to make a dot. When the automobile comes to the finish, a second dot is made, and the time of the run is deduced from the length of the paper which has been unrolled. The apparatus, which was designed by M. Pottier, is illustrated in our engravings. In Fig. 1 is seen the complete outfit. On the left is the apparatus at the starting end, which consists mainly of the device for making the contact. This is accomplished by means of a wire stretched across the course in a suitable manner and attached to a contact device for sending a current through the line. When the front wheels of the car pass over the wire, it is stretched and operates the contact, registering the moment of the start in the receiver. At the other end of the course is a similar wire which registers the exact moment of the finish. The receiving apparatus is seen on the right. The horizontal box of this apparatus, seen in Fig. 1, acts as a table and is similar to that of the apparatus at the start. Both contain a call bell and telephone outfit for signaling between the stations. The chronometer apparatus is contained in a portable case which is placed upon the horizontal box.

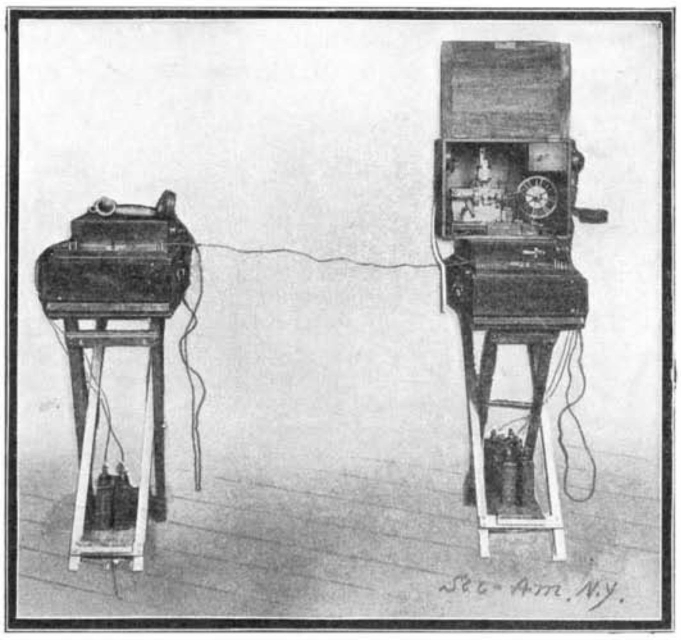

Fig. 1.—The Complete Timing Apparatus.

The horizontal boxes contain telephones and the contact device for making and breaking the electrical circuit when the machine crosses the line.

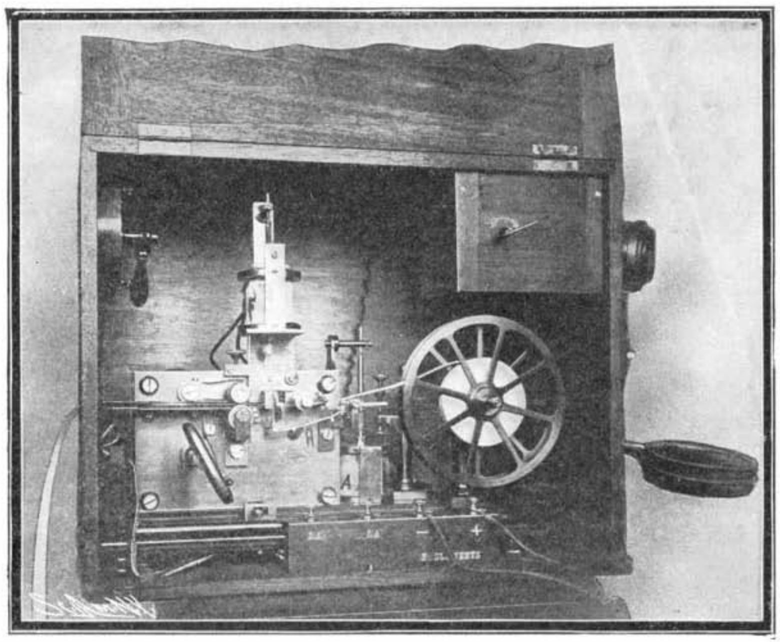

Fig. 2.—The Registering Part of the Mors Timing Apparatus.

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The details of the chronometer are shown in Fig. 2, which shows the receiving apparatus in the vertical box. A clockwork mechanism draws a band of paper from the drum on the right by means of a set of rollers. The paper passes through a slot in the cubical brass piece. The band can be punctured from below by a needle which is mounted on a lever. The lever is operated by the solenoid, *A* (Fig. 2), and is controlled by a spring and a pair of thumb screws above the solenoid. A chronometer contained in the box sends current impulses through the solenoid, *A*, at intervals of 1-5th second, and the needle point thus punctures the paper from below. When the band unrolls normally the space between the dots is about a quarter of an inch, which represents the time of 1-5th second. The passage of the car is registered by the upper solenoid, *F*. It contains a core which is held up by a spring. On the lower end of the core is a long needle which passes through a hole in the cubical piece and comes just over the band. When current is sent through the solenoid, *F*, the needle makes a puncture in the paper, which registers the time of the start. The paper continues to unroll while the car is being timed, and the time of the finish is registered by a second puncture. The exact time from start to finish is obtained by counting the number of spaces and fractions which have been unrolled between the two punctures. The position of the dots representing the start and finish can be easily estimated to within 1-20th of a space, and as each space represents 1-5th second, the time can be accurately registered to within 1-100th of a second. Besides all this, the band forms a permanent record of the time. Although the unrolling of the band is not absolutely uniform, the spaces between the dots are practically alike, and the error due to this cause is negligible. M. Pottier has devised an ingenious apparatus for measuring the exact position of the dots showing the start and finish. It consists of a brass plate, *A* (Fig. 3), which slides in a second plate, *B*. The latter holds the paper band in a fixed position by the clamps, *C*. Over the band passes a fine wire, *W W'*, which is held below by the fixed piece, *F*, and above at the second point, *E*. The other end of the wire is held in the sliding piece, *D*, which is adjusted by a thumb screw. To find the exact position of the dot, *n* (representing the start or finish), with reference to the chronometer dots, *m* and *o*, which include the space equal to 1-5th of a second, the plate, *A*, is slid until the upper edge of the band coincides with division No. 20 on the vertical scale. The paper is also shifted so that the point, *o*, comes under the right-hand wire, which is at right angles with the scale divisions. The left-hand wire is then brought over the point, *m*, by shifting the slide by means of its thumb screw. This adjustment is necessary, seeing that the distances, *m o*, are not always exactly equal. The plate, *A*, is now slid so as to bring the wire, *W*, over the point, *n*. If the place where this occurs is at division 14, as shown, the point, *n*, is 14-20ths away from *o*, according to the well-known proportional method. This ingenious and compact device gives a rapid reading of the time between the two punctures, and is one of the essential features in making such a system practical. The Mors apparatus can be also operated by contacts made by hand at the start and finish. In the competitive tests of automatic chronometer apparatus, which were held on the road near Paris, the present device carried off the first honors, as it was considered the best for practical use.

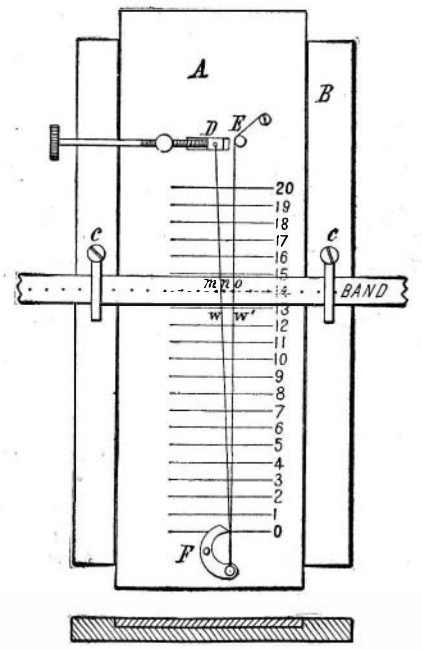


Fig. 3.—Diagram Showing Method of Reading to Hundredths of a Second the Time Registered.

A NEW ENGLISH ALUMINIUM WELDING MACHINE.

BY FRANK C. PERKINS.

A number of machines have been designed in recent years for welding aluminium, which have given only partial success. Among the more important welding apparatus for aluminium should be mentioned the machines of Dick, Schmidt, Heraeus, and Emme. Schmidt designed apparatus for welding aluminium plates, and Jones for welding aluminium tubes, the plate welding being accomplished by an electric arc.

The new welding machine, as well as the new process for welding aluminium designed by the English engineer and electro-chemist, Mr. Sherard Cowper-Coles, is shown in the accompanying illustration, Fig. 1, and described below.

By means of this machine, no solder or flux is required, and the hammering of the joint when in the semi-fluid state is not necessary. It is stated that this process is particularly suitable for wire rods, tubes, and other sections which are drawn or rolled. The aluminium materials to be welded, after being faced off square, are placed in the machine shown in the illustration, Fig. 1, which is fitted with clamping screws capable of moving horizontally on suitable guides.

The machine consists essentially of a double-deck framework with a reservoir, *F*, located under the upper platform. This tank or reservoir supplies water under pressure for quenching the welds instantaneously by turning a handle attached to the screen, *A*. Turning this handle allows the water to run from the tank and be projected on to the welded joint. The pressure in the reservoir is maintained by an air pump, the handle of which is indicated at *E*. The levers, *D*, are arranged for controlling the movement of the clamping screws and the aluminium bar, *B*, which is to be welded. The benzine or gasoline lamp or torch is noted at *C*, and the flame

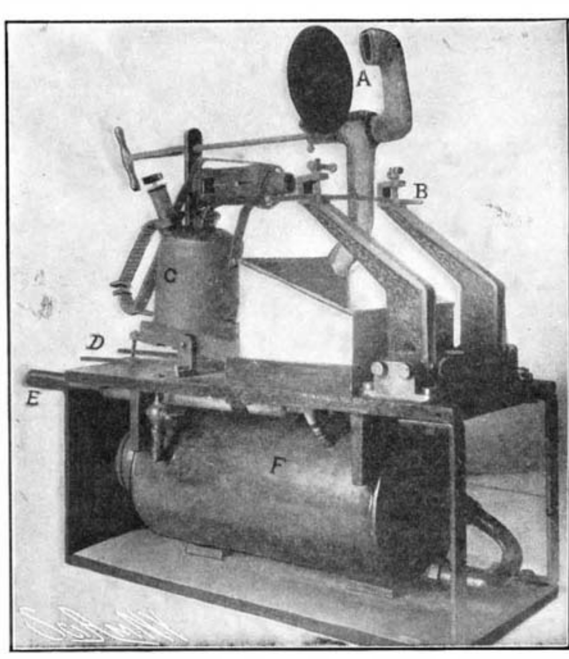
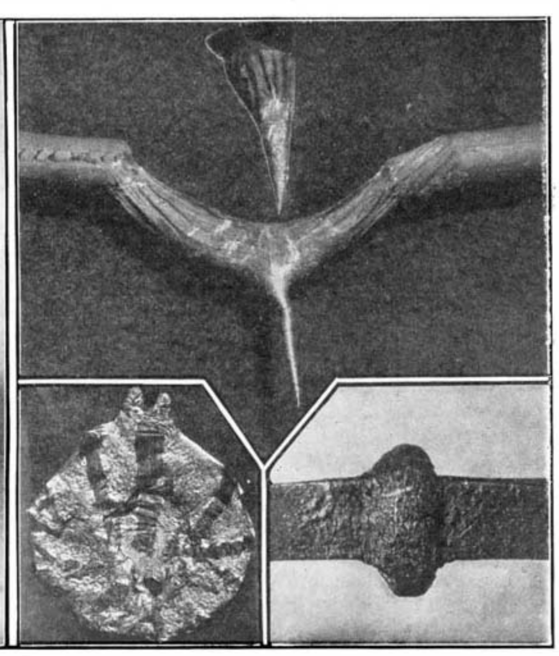


Fig. 1.—A NEW ALUMINIUM WELDING MACHINE.



Figs. 2, 3, 4.—THE WORK OF THE ALUMINIUM WELDING MACHINE.

from this torch is directed upon the joint of the aluminium bars to be welded at *E*, a box being provided on the top of the platform for catching any molten metal.

The flame from the benzine lamp, *C*, is projected against the aluminium joint to be welded between the clamps at *B*, and when the necessary temperature has been reached by the rods to be welded, a slight pressure is applied to the levers *D*, causing them to unite, and the metal is squeezed out in the shape of a ring, as shown in Fig. 2. It is stated by Mr. Cowper-Coles that this ring of metal is largely composed of aluminium oxide, which acts as an insulating and supporting collar, the molten metal being retained within this collar. The tank, *F*, having previously been supplied with water, and charged with a considerable air pressure by means of the pump located under the upper platform and operated by handle *E*, is ready for supplying through *A* the necessary cooling liquid when the handle controlling the same is moved.

The aluminium bars to be welded, having been placed in the jaws, raised to the proper welding temperature by the flame from the lamp, and pressed together at the proper moment by the levers *D*, a perfect weld is formed at the joint, and as soon as the weld is made, it is rapidly cooled by turning the handle attached to the screen *A*, which allows water under pressure to be projected from the reservoir *F*. The screen, *A*, is placed in front of the heating flame by the same handle which turns on the water, and the water pressure is maintained by the hand pump *F*, which supplies compressed air to the tank. After the rod has been removed from the machine and the collar filed off, it is claimed that the joint is as strong as the rest of the rod.

It is well known that soldered aluminium joints have not been found satisfactory, as they do not stand a great length of time, on account of the galvanic action which takes place between the solder and the aluminium, the former electro-negative to the latter in a voltaic couple. One of the principal difficulties found in the welding of aluminium is that it passes into a mushy or brittle state a few degrees under smelting point, and the solder freezes before flowing properly, it cools so rapidly. The best welding temperature for aluminium, it is claimed, lies just below the point where this pastiness occurs, and this metal has been welded at temperatures varying from 420 deg. C. (788 deg. Fahr.) to 600 deg. C. (1,102 deg. Fahr.), the latter being the temperature proposed by Wiszniewska and Strzelecki for welding aluminium in a non-oxidizing manner, this being accomplished by a heated plate, and in contact with a volatile compound with an affinity for aluminium, say flouride or nitrate of aluminium in a powder or solution. Mr. Cowper-Coles states that an oxy-hydrogen flame or gas with or without air blast can be used instead of the benzine lamp. The accompanying illustration, Fig. 3, shows the case or pipe of aluminium oxide, which supports the molten aluminium within. This view shows the outer shell of aluminium oxide, which has been pricked with a steel point, allowing some of the molten metal within to flow out. One of the beads of molten aluminium, which is incased in aluminium oxide, is shown in Fig. 4, the drop of metal having been allowed to fall on a metal plate. The broken aluminium oxide casing or shell may be noted by the dark portions. In a recent paper before the Faraday Society in London, on "Some Notes on the Welding of Aluminium," by Sherard Cowper-Cowles, he states that Dick in 1900 devised a machine for welding aluminium by the removal of the oxide mechanically, combined with pressure, while Heraeus, of Hanau in Germany, takes advantage of the fact that aluminium becomes plastic at a certain temperature, and can be kneaded into any shape. He further states that electric welding of aluminium has not been successful commercially, either by electric arc heating or by allowing the joint to be welded to form a resistance to the electric current. Aluminium welds have been made by Anderson by means of an electric arc drawn down by a magnet and a special tool and flux, while Schmidt uses a carbon-graphite or platinum stick through which he passes an electric current. By this process, the flow of current is such that the carbon stick acts as an anode with the metal to be welded as a cathode, the carbon stick being used somewhat as in soldering, it being moved over the portions to be welded, removing the oxide formed, the latter being reduced by the heat of the carbon.

On a test of several of a number of welds, made by the Cowper-Coles aluminium welding machine for tensile strength, the fractures occurred at quite a distance from the weld, showing that the metal was not deteriorated. One of the specimens having a diameter of 0.249 inch and an area of 0.0487 square inch was found to have a reduction of area at the fracture of 7.4 per cent, the extension on four inches being 8 per cent, while the break occurred on none of the twelve specimens tested at the welded portion. The specimen above mentioned had an elastic limit of 11,491 pounds per square inch (5.13 tons), while the maximum stress was found to be 20,249 pounds per square inch (9.04 tons). It is stated that in some cases very minute holes were found in the welds, but they were not large enough to affect the strength of the rod which was welded.

Another specimen having a diameter of 0.25 inch, with area of 0.0491 square inch, had a reduction of area at the fracture of 7.7 per cent, the extension on four inches being 9 per cent. The elastic limit was 12,320 pounds per square inch, or 5.5 tons, while the maximum stress was found to be 20,070 pounds per square inch, or 8.96 tons. One of the specimens had an extension of 14 per cent, with a reduction of area at the fracture of 7.7 per cent, the elastic limit in this case being 10,236 pounds per square inch, or 4.57 tons, and the maximum stress 19,152 pounds per square inch, or 8.55 tons per square inch.

Mr. Cowper-Coles states that the Jones process for making aluminium tubes consisted in simultaneously winding a flat strip of the metal in spiral convolutions, welding the abutting edges of the convolutions by the heat generated by the local passage, through the immediate parts to be joined, of a low-tension current of electricity, and pressing the heated edges toward each other with the necessary force.

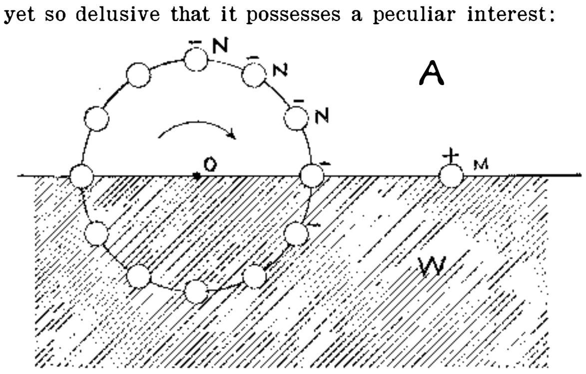
The subject of welding aluminium is a most interesting one, and is of considerable importance, on account of the extensive way in which this new metal is being used in the arts.

AN INTERESTING PARADOX.

BY DANIEL F. COMSTOCK.

Although the chimera of perpetual motion has retreated so far into the distance that scientific men consider themselves absolutely safe in assuming some fallacy in all propositions which involve the creation of energy, yet it sometimes happens that the various components of a system may be so arranged that this fallacy is by no means easy to detect. The common characteristic of such cases is thus rather a psychological than a physical one, for it is in the mind of the observer and not with Dame Nature that complication really exists.

The following is a paradox so apparently simple and yet so delusive that it possesses a peculiar interest:



AN INTERESTING PARADOX.

Referring to the figure, *W* is water and *A* is air. A wheel made of insulating material is constructed to turn about an axis, *O*. The wheel has metal balls, *N*, placed around the periphery, and these are charged negatively, while the fixed metal ball, *M*, is charged positively. Each ball has a thin layer of insulating material surrounding it, in order that the electricity may not leak into the water.

The fixed charge, *M*, will now attract all of the movable charges which are above the surface, but will have practically no effect upon those below the surface. This follows immediately from the fact that the dielectric constant of water is nearly eighty times that of air. In other words, air transmits electrostatic force with eighty times the readiness of water. Hence the astonishing conclusion that the wheel will continuously rotate in the direction indicated by the arrow.

The discovery of the fallacy, which is more or less hidden, is left to the insight of the reader.

The Pollok Prize.

Owing to the unsatisfactory results obtained at the two competitions which have been held for the Pollok prize, it was decided that an investigation should be made for the purpose of securing the opinion and advice of the various maritime associations, boards of trade, and chambers of commerce in the leading cities of the world, as to the best means of accomplishing the end in view.

The International Association of Paris undertook this mission, and, after an extensive investigation, submitted a report some few months ago, in which it was recommended that the Pollok prize be transformed into a permanent endowment fund, the interest to be awarded periodically to the inventor or inventors of the best methods or devices for preventing collisions and loss of life at sea. The founders of the Pollok prize decided to accept the recommendations made, and to place the endowment fund in charge of the International Maritime Association, 3 Rue des Mathurins, Paris. The rules and regulations governing future competitions will be published shortly.

Engineering Notes.

Despite severe competition from American and German locomotive builders, the contract for fifteen powerful compound express locomotives, required by the Chilian railways, has been secured by the North British Locomotive Company, of Glasgow.

The British consul at Trieste, in a recent dispatch, reports that a large establishment for the manufacture of Portland cement will be erected near Albona, in Istria. The output is destined entirely for exportation. It is said that immense quantities of stone adapted for the manufacture of cement exist in the neighborhood, as well as a coal mine. All are situated close to the port of Rabaz.

At a meeting of the Royal Statistical Society held recently, Mr. Edgar J. Harper read a paper on "Statistics of London Traffic." Mr. Harper showed that there were about 600 miles of railway in greater London, of which 222 miles were in the county itself. It would seem that South London was better equipped with railway facilities than North, especially in proportion to population. The number of stations per square mile was almost the same on both sides of the river, but on the north side each station had to serve a population 10 per cent greater on the average than on the south side. The length of railway per square mile in the south was nearly 30 per cent more than in the north, while the population per mile was 45 per cent less. As many long-distance trains arrived from the south as the north, although the local trains were 20 per cent less.

We are accustomed to think and speak of the enormous and steady progress made in modern industrial machinery. While in general this may be true, in the office building it is only true of the details. We are beginning to put into effect improvements suggested years ago, and have made real progress in the direction of carrying out our plans more quickly, and all things considered, more cheaply; but our plans have not changed substantially, and the limiting conditions are the same. We are still aiming to make our buildings attractive, easy to rearrange to suit tenants, well lighted, with convenient internal communication, polite and efficient service, quick elevators, and as accessible as possible to elevated and underground stations. We supply them with every necessity and many luxuries, and do all in our power to get the maximum return for the money invested. The writer considers it certain that for at least a generation there will be an imperative demand for office buildings, and that the present type will be practically unchanged in its broad outlines. The improvement made during the past ten years may be briefly stated. There has been a very slight increase in net elevator speeds obtained mainly by improved signaling devices. Automatic heat regulation is practically unchanged, but it is a little generally used. Gas has practically been entirely replaced by electricity. The finish of the buildings is a little more luxurious and the exterior a little more expensive. The average height of a building is increased. To-day the highest practicable speed for a way elevator is 450 feet per minute, and for an express 600 feet to 700 feet per minute, depending on the distance traveled. We may, therefore, safely say that the future will see but little improvement, except in details.—Architectural Record.

Cornelius Voet, of Haarlem, Netherlands, has invented a novel coal-saving apparatus which seems promising. The company for the management of the State's Railways in the Kingdom of the Netherlands tested the apparatus at the Central Electric Works in Utrecht during 11½ successive hours, during which trial a saving of 18.2 per cent was found. The Steam Navigation Service of the Royal Dutch Navy, Section Amsterdam, applied the apparatus to the boiler of a dispatch boat. The inspector declares that the apparatus upon trial gave excellent saving results, and upon further use proved quite satisfactory. On a German steamer of the firm Fried. Krupp at Essen, on twelve voyages from Rotterdam-Bilbao and Santander and back to Rotterdam, the following results were obtained: Without apparatus, 13.13 tons of coal used per 24 hours; with apparatus, 12.01 tons of coal used per 24 hours. The apparatus supplies the furnaces of boilers with the air necessary for combustion and to apparatus therefor. In the ordinary way such supply of air is obtained either by artificial draft or by a blower or blast device. In the case of artificial draft the air is drawn by the chimney through the grate and the fire-tubes, while in cases where blast is used the air is forced through the grate at a pressure in excess of that of the surrounding air. This excess pressure is produced in all known cases by means of a blower or blast device. Mr. Voet's invention relates to an arrangement whereby such excess pressure is produced by the outer air itself, the air being received and pressed by the pressure of the outside air or current into air-collecting heads communicating through pipes with the space under the grate, into which the air rushes with the excess pressure thus acquired.