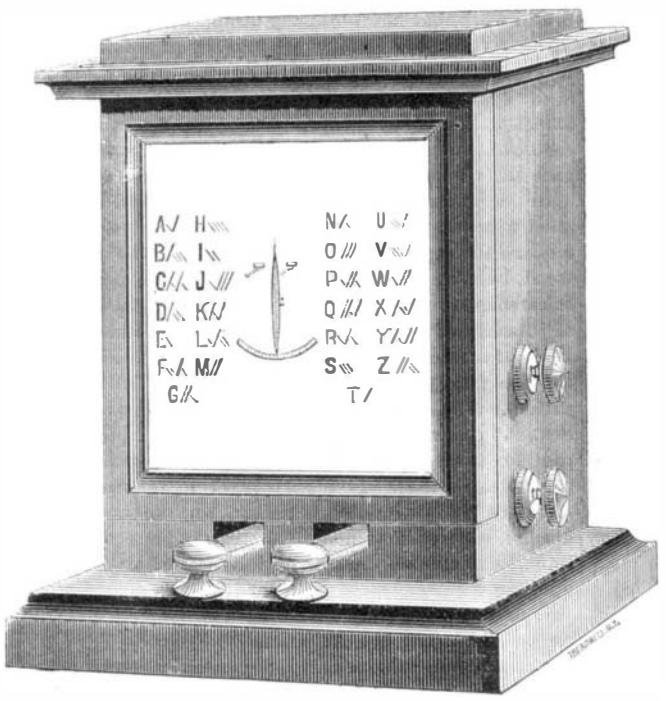
THE ENGLISH TELEGRAPHS.

The apparatus employed upon the English lines embraces almost every form which has ever been practically used, but the bulk of the traffic is performed with the Morse ink writers, the greater part of which are worked in connection with the double current key and Siemens' polarized relay. The speed of these instruments depends mainly upon the skill of the operators who work them, being generally about the same as that of the Morse recording apparatus employed upon our own lines. The speed of the Bright's bell apparatus is about the same as that of the Morse sounder, depending, like the latter, upon the skill and experience of the operators. "I timed the operator at Edinburgh," says a correspondent of the *Journal of the Telegraph*, "and found him receiving by the bells at the rate of 32 words per minute."

The Hughes type printing instruments are only used to a limited extent in England, and the speed attained is not much in excess of the Morse sounder. The instruments are carried by weights, and the type wheels make about 120 revolutions per minute, or a little more than half the speed of the Phelps combination instrument.

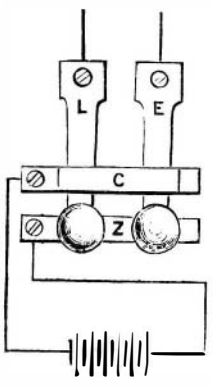
FIG. 1.



Wheatstone's automatic instruments are employed upon 33 message circuits, varying in length from 159 to 515 miles each, and upon six new circuits, varying in length from 166 to 475 miles each, making a total of about 11,000 miles.

The speed of these instruments varies from 38 words per minute upon the London and Cork circuit, to 120 words per minute upon the London and Liverpool circuit. The average speed of the apparatus is about 70 words per minute, or about twice as fast as the speed of a first class sound operator. The time occupied in the preparation of the messages for transmission depends somewhat upon the skill of the operator, but an expert clerk will easily prepare them at the rate of 25 words per minute. The automatic system, as compared with the Morse, requires rather more than double the number of clerks to do a given amount of business, and, therefore, for distances less than 200 miles, it is cheaper to put up additional wires than to make use of it.

FIG. 2.



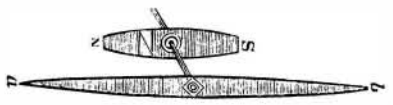
The automatic system finds its most appreciative use in forwarding press messages, which are transmitted over several circuits in succession with only one preparation.

The single needle instrument, of which there are over three thousand employed on the English lines, is one of the simplest forms of telegraph apparatus in use, being simply a combination of a vertical galvanometer or galvanoscope, and a current-reversing key.

Fig. 1 represents the exterior of the instrument. In the center of the face is suspended the index or pointer, attached to the magnet, which can deflect only a short distance to the right or left of its zero, on account of the stops. The alphabet is formed by movements of the needle or pointer to the right or left. A turn of the top point of the needle to the left indicates a dot, a turn to the right a dash. Thus A is made by a movement to the left and one to the right; H by four movements to the left.

The interior of the apparatus consists of two helices of fine silk-covered copper wire, in the middle of which is suspended a small magnetic needle, having at the end of its axis a pointer, seen on the outside face of the instrument. There is also a current, changing key, the two knobs of which protrude through the front of the instrument near the base. The key is represented in Fig. 2. L and E are two levers connected respectively with the line and with earth. When they are not depressed, they both press against the upper bar, C, which is connected with the positive pole of the battery. Either lever can be depressed so as to come in contact with the bar, Z, which is connected with the negative pole of the battery. If L is depressed, a negative current flows into the line; and if E is depressed, a positive current flows into the line. The receiving instrument at the other end of the line is so constructed that the depression of the left hand key causes a deflection of the pointer to the left; a depression of the right hand key, a deflection to the right. The needle, S N, and pointer, *a b*, are shown in Fig. 3.

FIG. 3.



The alphabet used in England contains precisely the same combinations as the Morse alphabet, but differently expressed.

THE HEBERLEIN BRAKE.

Herr Von Heberlein, Locomotive Superintendent of the Royal Bavarian States Railway, has recently invented a novel railway brake which, it seems, is eliciting considerable attention on the continent. The device, which we find described in the *Engineer*, is not a continuous brake, though it may be fitted to every vehicle in the train. The inventor prefers to divide the train into sections, including one brake car in each, and the operator in this car can apply the brake to his own coach, and to one or more others in connection with it.

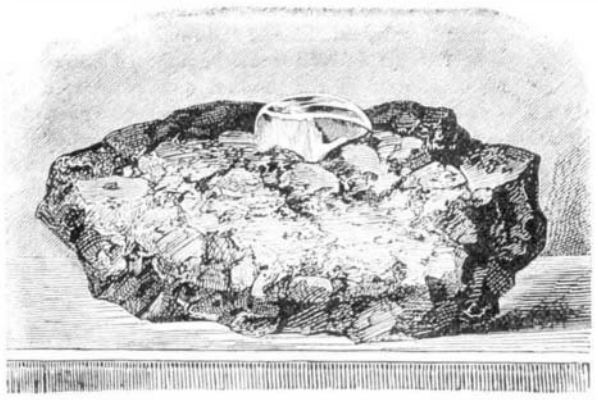
The brakes are applied to the wheels by the agency of a friction pulley which engages with a friction wheel on one of the axles of the engine or of the brake car above noted. The revolution of this friction wheel winds up a flat link chain, like that of a watch, and this, pulling on a set of rods under the carriages, applies the blocks to the wheels. The pulley is of iron, but the friction wheel on the axle is built up of wooden segments, with grain radiating, and jammed between two plates set up tight with screws and nuts. The wheels of the brake car are not intended to stop running. The friction wheel instantly revolves, and its friction against the iron pulley supplies the force which applies the brake.

The mode of throwing the apparatus into action is exceedingly simple. A line extends over the roofs of the seats from end to end of the train. By pulling this cord, a detent is thrown out of gear, and the friction pulley, which is hung on a weighted bell crank lever, is suffered to fall into contact with the friction wheel on the axle, and the brake is applied as soon as the train has run far enough to wind up the slack of the chain. The cord is kept taut, so that in case a car run from the track or become detached, a strain is brought upon the line and the brakes instantly applied. Similarly also the same effect can be produced by any of the employees about the train, as readily as they can now pull the ordinary bell cord.

The *Engineer* says that, on trials with the invention on an English railway, no jar was apparent on the application of the brake, which was fitted to the two cars at each end of a train of five. On the first test all the brakes were applied, both to the engine and train, up an incline of 1 in 123, and round a curve, speed about 35 miles per hour; train stopped in 135 yards, and in 19 seconds. Another case is given on the Royal Hanoverian Railway, with a train weighing 76 tuns, with 17 axles, to eight of which the Heberlein apparatus was applied, when the train, traveling 35 miles per hour, was stopped on a down grade of 1 in 64 in 25 seconds.

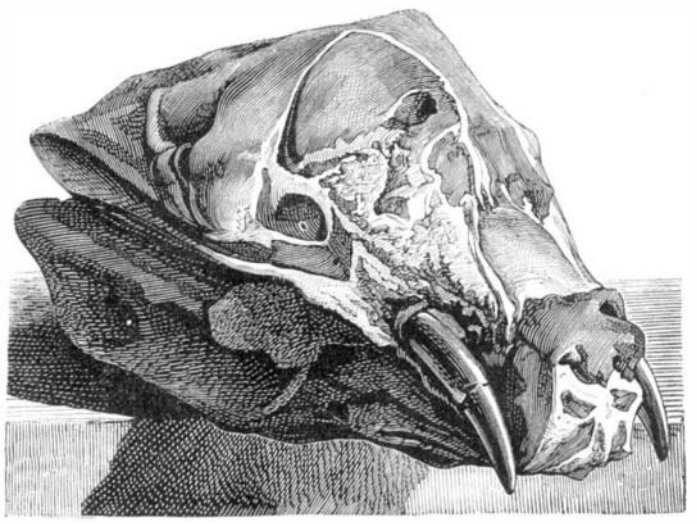
SOUTH AFRICAN WONDERS—EXPLOSIVE DIAMONDS AND TURTLES WITH TEETH.

Diamonds liable to explode spontaneously, and turtles provided with canine teeth, are two natural marvels indigenous to the fields of Southern Africa. The former are found at the present time, the latter existed ages ago, and are recognized by their fossil remains which have been discovered in the same deposits with the gems. One of these disintegrating diamonds is represented in our first engraving in its natural size. It is a rounded octahedron, imbedded in a conglomeration of fine grained sandstone. Some idea may be gained of the richness of the South African beds from the fact, it is stated, that more than three thousand diamonds have been found during the past eight months. The mines are of two distinct kinds; the first, called "dry," are located in the centers of plains, and consist of layers of rock, in which the precious stones are mingled with garnets, pyrites, etc.; the others, termed "river mines," are established on the beds or banks of water courses, and the diamonds in these are mixed with agates, emeralds, and chalcedony. In both, however, the gems are rarely found other than in a fragmentary state, and this is ascribed to the strange peculiarity of the finest and largest stones in suddenly disintegrating or exploding. Ordinarily rupture takes place during the first week after the diamond is brought to light, but cases are known where it has occurred three months subsequently. It is said that covering the stone with tallow will prevent the trouble; but of course, if the grease has to remain permanently upon the diamond to preserve it, its value is destroyed.



EXPLOSIVE DIAMOND, IN ITS NATIVE SANDSTONE.

Although the geological age of the African diamond fields has not been absolutely fixed, it is generally believed that they date from the triassic epoch. In the strata are found the remains of crocodiles, denosaurians, labyrinthodontes, and other monsters of antiquity, but the most interesting and curious are those referred to in the beginning of this article. The skull, from which our engraving was made, strongly resembles that of the turtle, but it has two long tusks analogous to those of the walrus. Professor Richard Owens, who has profoundly studied this remarkable fossil, believes that the animals, or *dicynodontes* (the name is derived from the Greek, and means literally two dog's teeth), were, when living, oviparous, cold blooded, and yet with pulmonary respiration; and he also recognises peculiarities which ally them closely to the lizard family. Huxley is of opinion that they were provided with long tails. The peculiar genus to which the reptile, the remains of which our engraving represents, belongs is termed *ptychognatus*, and the species, *depressus*. The bones are not perfectly preserved, and were found in hard sandstone of fine grain and greenish color. In the lower jaw two cavities are noticeable, resembling incisive alveolæ which may be really rudimentary teeth.



FOSSIL SKULL OF A TURTLE WITH TEETH.

The characteristics of the animal are remarkable from the fact that they seem borrowed from those of creatures most widely separated in Nature. As a whole, the bones indicate a reptile between the lizard and tortoise. That is, the forward portion of the head resembles that of the former; and the edges of the edentulated jaws, covered during life with a bony covering like a beak, relate to the latter. The oblique manner of opening the mouth recalls the same peculiarity in certain fish. Huxley, on the other hand, asserts that the nostrils and various points in the osteology are those of birds. The tusks are more analogous to the teeth of mammifers, while the sutures of the skull resemble those of the latter, and are never met with in the case of reptiles.

Sunday Science.

There exists in Switzerland a "Society for the Observance of the Repose of Sunday" (*literatim*), and this body invites the views of the world generally on the subject of resting on the Sabbath, considered from a hygienic point of view. A prize of two hundred dollars is offered to the author of the best essay on the question. The points requiring especial discussion are: (1) The favorable effects of rest on Sunday on people of various ages, and their influence on the family and the nation. (2) Diseases which may be engendered or increased by continuous work in persons who, by the nature of their calling, are deprived of this weekly recreation, as, for instance, railroad employees, journalists, telegraph operators, bakers, etc. (3) Practical results drawn from the observation of cited facts. The essays must be written in French or German, and sent in, before September 30th next, to the President of the above named society, at Geneva, Switzerland.

THE NEW AUSTRIAN ATHENÆUM.—An institution destined to survive the Vienna Exposition, and at the same time to serve as a memorial of that event, is the Austrian Athenæum, an establishment founded in the interest and for the instruction of mechanics and working men, and constructed after the plan of the *Conservatoire des Arts et Métiers*, in Paris. Large numbers of articles left by exhibitors at the Exposition have been transported thither, together with a quantity of models and other instructive apparatus, and a library of 3,412 volumes.

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