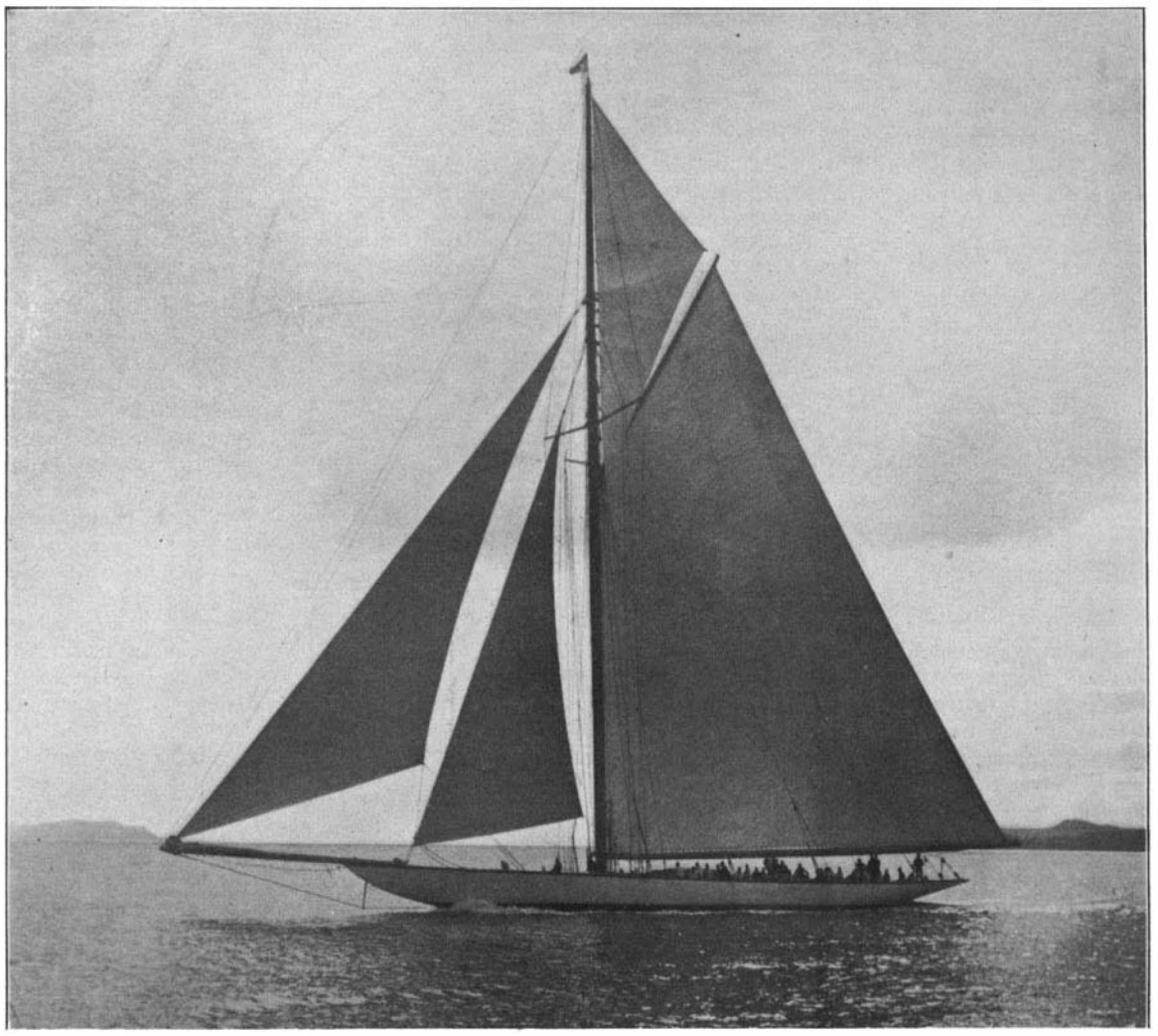
"SHAMROCK III." UNDER SAIL.

From our photograph, which shows "Shamrock III." under sail for the first time after her launch, it will be seen that Fife has given her a lofty and relatively narrow rig. This is apparent, even if we make allowance in the photograph for the fore-shortening of her boom. Experience with the more recent yachts has shown that a narrow and lofty rig gives better results than one that is low and long on the base; for although the center of effort is higher in the lofty rig, and the heeling effect greater, this is more than compensated for by the superior ability of this type in driving a yacht to windward. No doubt it is this feature in the sail plan that has much to do with the fine windward work of the challenger. In the formal races and informal trials in which "Shamrock I." and "Shamrock III." have met, the latter was able not only to point considerably higher than the older boat, but to do so and foot faster through the water at the same time. In running and reaching she is also superior to "Shamrock I.," although not so strikingly so as in windward work. In the earlier trials, indeed, she seemed to be only just about able to hold the older boat in running; but some changes made in her trim appear to have brought out the speed of the boat when running under spinnaker, and she now seems to be consistently faster on this point of sailing. It is in reaching that the older boat is best able to hold the challenger, but "Shamrock I." is conceded to be very fast in reaching. In the first trial race sailed for cash prizes, in which there was a strong inducement for the skippers and crews of both boats to sail their craft for all that was in them, "Shamrock III." won over a triangular course of 34 miles by 6 minutes and 10 seconds actual time. The reports of this race that have reached this side seem to agree that the margin would have been greater, had not a shift of wind assisted the older boat. The best work of the new boat was on the first round, when she gained 2 minutes and 31 seconds on a run of 7 miles down the wind under spinnakers, and on the second leg when she gained 3 minutes 11 seconds in a beat of 7 miles to windward. On another occasion, in a 30-mile course of 15 miles to windward and return the challenger beat "Shamrock I." by 17 minutes and 26 seconds, gaining 10 minutes on the 15-mile run down the wind and 7 minutes on the beat back to the starting point. On another trial of 10 miles to leeward and return the challenger gained about 2½ minutes down the wind, and 6 minutes and 3 seconds during the hour that was consumed in beating back 10 miles to the starting point.

There is no denying that these performances on the part of a comparatively untried boat indicate that the defending American yacht will have a worthy competitor when they meet outside Sandy Hook. Of course their value depends entirely upon the speed of "Shamrock I.," which is claimed by the designer of both boats, and by Capt. Wringe, who formerly sailed "Shamrock I.," to be faster than she was in 1899.

"Shamrock III.," however, has just had the misfortune to be dismasted during a squall, as she was starting on a trial race off Weymouth. The wreck was caused by the parting of one of the weather shroud turnbuckles. This accident unfortunately robs the challenger of the advantage of her early completion, and places her, because of the delay of the sea voyage, one month behind "Reliance" in her opportunities for tuning up.



NEW CHALLENGER, "SHAMROCK III.," RECENTLY DISMASTED IN THE ENGLISH CHANNEL.

"SILOXICON"—A REFRACTORY FURNACE LINING.

BY ORRIN E. DUNLAP.

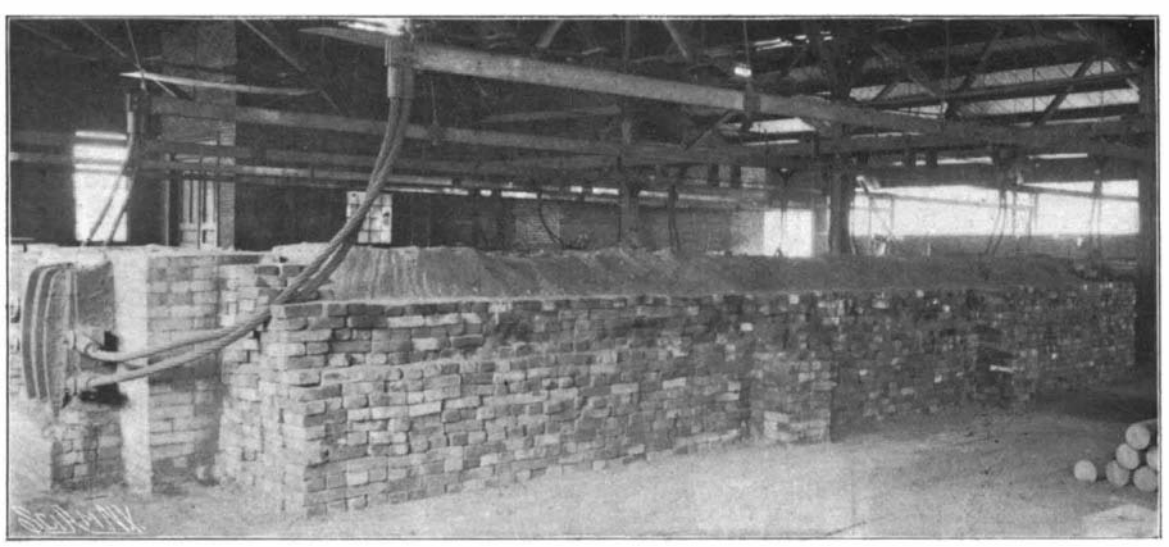
Mr. E. G. Acheson, of Niagara Falls, has invented a process for making a new refractory material which he has seen fit to call "Siloxicon," and which has been referred to in a note published in these columns some time ago. It is an artificially made composition containing silicon, oxygen, and carbon in chemical combination; very refractory under high temperatures, insoluble in metals, inert to both acid and basic slags, and readily shaped into any desired form of lining or article. While siloxicon is self-binding, and the use of a binding agent is not essential in the manufacture of articles, it can be satisfactorily mixed with clay. But alone, in powder form, it can be moistened with water, formed into any desired shape, and fired. It provides a refractory composition suitable for use as a refractory lining for furnaces or converters or as a material for fire bricks, crucibles, muffles, tuyeres, and the like.

SILOXICON AS IT COMES FROM THE FURNACE.

Mr. Acheson found that by heating carbon and silica or material containing these substances, compounds containing silicon, oxygen, and carbon in chemical combination are produced which are practical substitutes for refractory clays, magnesia, lime, and graphite in their application to high temperatures. While carbide of silicon, carborundum, is made from carbon and silica mixed together in such proportions that the carbon present will be sufficient to reduce the silica and form a carbide with the freed silicon, Mr. Acheson's latest discovery is that when the amount of carbon is insufficient for the reduction of the silica and conversion of all the contained silicon in carbide, the reduction of the silica is incomplete, and a certain amount of oxygen is retained in chemical combination with the silicon, and compounds containing silicon, oxygen, and carbon are formed.

The first electric furnace for the manufacture of siloxicon has been erected in the plant of the International Acheson Graphite Company, on the lands of the Niagara Falls Power Company, at Niagara Falls. It is about 30 feet long, 8 feet wide, and is built up to a height of about 6 feet. It is larger than a carborundum furnace, but shorter than a graphite furnace. The walls are erected of brick loosely placed without the use of mortar. The raw material used is ground coke and sand to which sawdust may be added to increase the porosity. One thousand electrical horse power is used in the operation of the furnace. It is Mr. Acheson's discovery that the manufacture of siloxicon requires that the temperature of the furnace be kept below that of the formation of carborundum, as at or about that temperature decomposition occurs, the silicon and carbon monoxide escaping from the furnace as vapor and gas, while the carbide of silicon remains in the furnace as carborundum crystals. To make it more clear, it may be stated that siloxicon is formed at a temperature ranging from 4,500 to 5,000 degs. F., carborundum at about 7,000 degs. and graphite at a still higher temperature, estimated.

The carborundum furnace has a single core, while siloxicon is made in a furnace that has multiple cores, which is a feature patented by Mr. Acheson. The raw material is heaped about these cores, and when the furnace is opened the siloxicon appears in a gray-green, loosely coherent mass. It is ground in a mill so as to pass through a No. 40 sieve. In this powdered form it is ready for shipment in barrels to consumers, the present price being about four cents per pound. For many of the articles that will be made of siloxicon it will be mixed with from 10 to 25 per cent of plastic clay. The discovery of siloxicon solves a problem of great importance in metallurgical work. It has been difficult to get a material that will withstand very high temperatures, especially when played upon by fluxing slags. Such a material must be



SILOXICON FURNACE. LENGTH, 30 FEET; WIDTH, 8 FEET; HEIGHT, 6 FEET. DOUBLE CORES ARE USED.

insoluble in metals and unoxidizable. Siloxicon possesses all these qualities. At present most metallurgical operations are conducted with high-grade fire clays. These have been improved upon by the use of chrome, silica, and magnesia, but the best of these fall far short of active needs, because of their low melting points or the reaction between the slags. As siloxicon is formed at a temperature of from 4,500 to 5,000 degs. F., it is unaffected by a lower temperature, so that it cannot be touched injuriously by the heat of any flame or fuel combustion. Where oil is used as fuel, siloxicon will be received as a great boon, because it will not melt under the intense heat thus formed.

Crucibles have already been made of siloxicon, and if it proves the marvelous success expected in this field, it will do away with the necessity of going to Ceylon for crystalline graphite. The importance of this is best illustrated by the fact that in 1901 the consumption of Ceylon graphite in the United States amounted to $1,031,289, the greater part of this expenditure being in the steel crucible work.

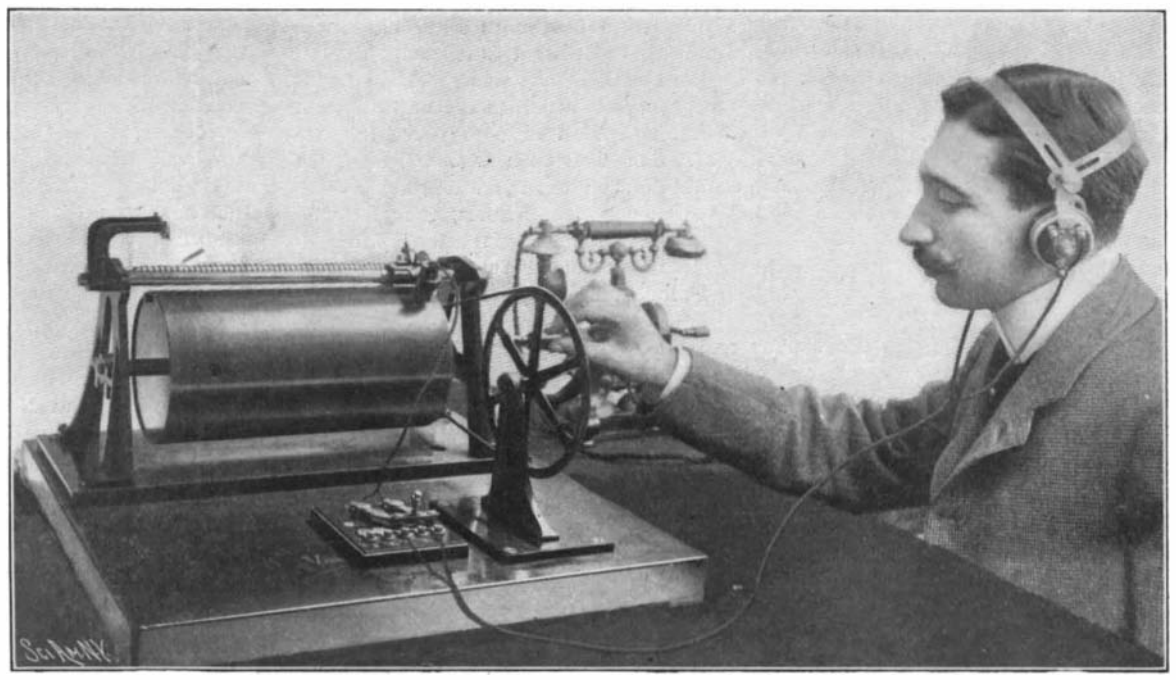
In one of he illustrations the first furnace for the commercial manufacture of siloxicon is shown, while in another illustration is pictured the form of siloxicon as it is taken out of the furnace. To the left in this illustration will be seen two crucibles made out of the new material.

THE TELEGRAPHONE AND THE BRITISH POST OFFICE.

BY HERBERT C. FYFE.

I was privileged the other day to witness the working of an invention which has already been described in these columns and which is likely to prove of immense value to many different classes of the community. The "telegraphone" is a "recording telephone," that is to say, a telephone that records and reproduces messages spoken into it.

The photographs illustrating this article were specially taken when the telegraphone was being exhibited at a recent conversazione of the Institution of Civil Engineers. Thanks to the submarine cable, messages can be sent to and received from all parts of the earth, and the purchaser of a halfpenny evening paper can read of events happening in every quarter of the globe. The telephone cannot as yet rival the telegraph, but each year the distance increases, and telephoning under the sea is now possible across the Channel. While the telephone has done much to facilitate communication in cities and large towns, it cannot be denied that there are many drawbacks connected with its use. Nothing is more annoying to find, after you have succeeded in "getting through" to the person to whom you wish to speak, that the individual in question is "not at home" or "busy." The telegraphone records the message, so that it can be read by the recipient after he has returned or is no longer "busy."



USING THE TELEGRAPHONE AS A PHONOGRAPH.

The advantages of the telegraphone over the telegraph are many. It is much easier to speak than to write, and the telegraphone does your writing for you. The message takes less time to go, there is no chance for mistake, because your words are automatically recorded, and you can make your message so private that it is known only to the person for whom it is intended. The telegraphone, as readers of the SCIENTIFIC AMERICAN know, is the invention of Herr Valdemar Poulsen, a Danish electrician, and was exhibited at the Paris Exhibition of 1900.

Briefly, the Poulsen telegraphone enables a telephonic conversation to be permanently recorded on a steel wire and reproduced at any time.

The manner of working is as follows: A steel wire or a steel band is moved by any suitable means at a considerable velocity between the poles of a small electro-magnet.

The steel wire is wound on a cylindrical drum and receives the record in the form of magnetization induced on it by a small two-pole electro-magnet which is used in place of the telephone receiver of an ordinary telephone circuit. The magnet travels along horizontally, touching the steel wire, while the cylinder revolves as in a phonograph.

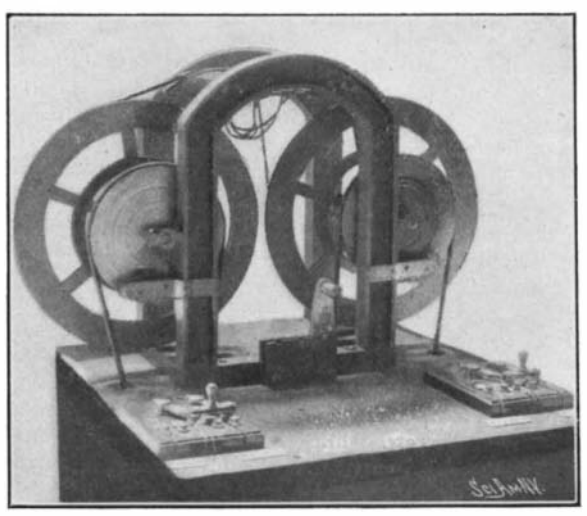
On speaking into a telephone transmitter joined on the circuit at one end of the line, the undulatory currents set up on the transmitter react upon the electro-magnet and cause a continuous variation in the direction and in the degree of magnetism at the poles of the electro-magnet.

These variations are permanently recorded on the steel wire as it rushes by, and when the message is complete, the steel wire retains a definite record of what has taken place in the shape of a continuous series of transverse magnetized lines varying throughout in their polarity and in their strength. On connecting a telephone receiver to the electro-magnet and again starting the steel wire on its course, this magnetized wire generates electric currents in the coils of the superimposed magnet as it passes between its poles, and these electric currents, which are the exact counterpart of those generated by the original wire, cause the telephone to repeat what was said in an almost absolutely perfect manner.

The record can either be permanently kept for future reference or it can be obliterated in such a way that the steel wire can be used for fresh messages. In the latter case the same magnet is again employed, a continuous current being passed around its coils by the microphone battery, whereby turning the wire past the magnet as before, all trace of the record is removed. When very long messages require to be sent, a special "steel ribbon telegraphone" is requisitioned. In this a flat steel ribbon is employed, and run off from one reel to another, across the poles of the electro-magnet. As in the case of a phonograph, the cylinder may be turned by hand, by clockwork or by a motor. The cylinder on which the wire is wound is 140 mm. in diameter, 265 mm. long. On it are 150 turns of steel piano wire, 1 mm. diameter and 1.2 mm. pitch.

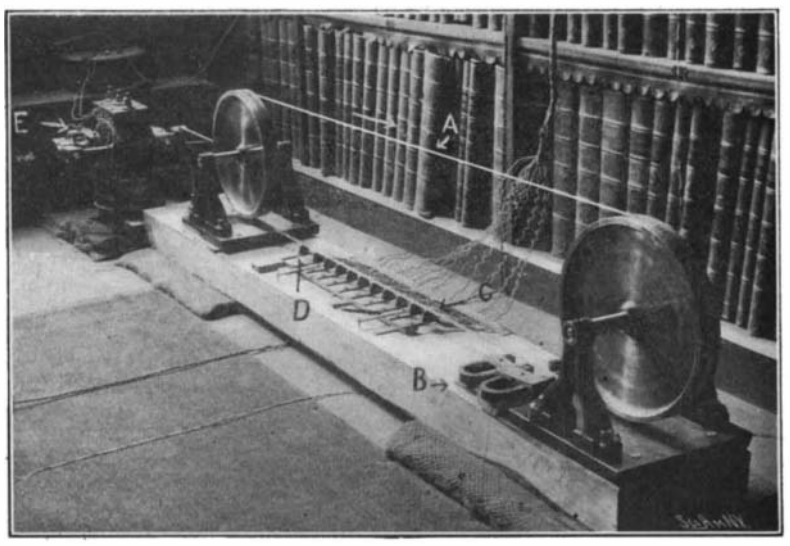
The articulation of the telegraphone is almost perfect and a vast improvement over that of the phonograph. The voice is reproduced quite clearly and free from disturbing noises. Mr. Poulsen says that a message, speech, songs, etc., inscribed on the wire may be reproduced indefinitely without any perceptible diminution in clearness; the tone of the voice remaining perfectly distinct.

Sir William Preece, at a recent meeting of the Institution of Electrical Engineers, said that the greatest novelty in the telegraphic and telephonic line that he had recently seen was the telephone of Mr. Poulsen. It was, he said, a very marvelous thing, and bound to come into use. "It is not only in itself," said Sir William, "beautifully designed and based on beautiful principles, but it is one of those things that is going to open the eyes of all our physicists, scientists, and theoretical men on the question of the molecular character of magnetic and electric operations."



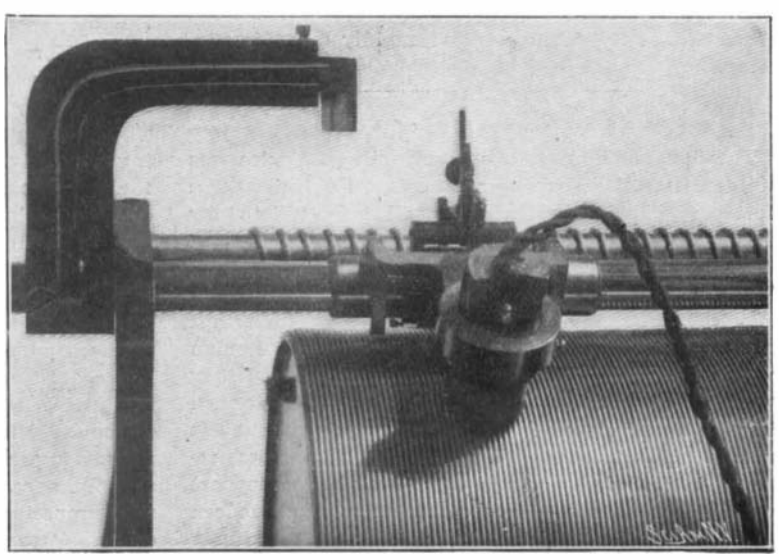
A LARGE TAPE TELEGRAPHONE FOR RECEIVING MANY MESSAGES.

A DESK TELEGRAPHONE.



A, endless steel tape; B, wiping-out magnets; C, recording electro-magnets; D, reproducing magnets; E, electric motor.

RIBBON TELEGRAPHONE EXHIBITED AT THE LONDON INSTITUTE OF CIVIL ENGINEERS.



DETAIL OF THE CARRIAGE AND MAGNETS.