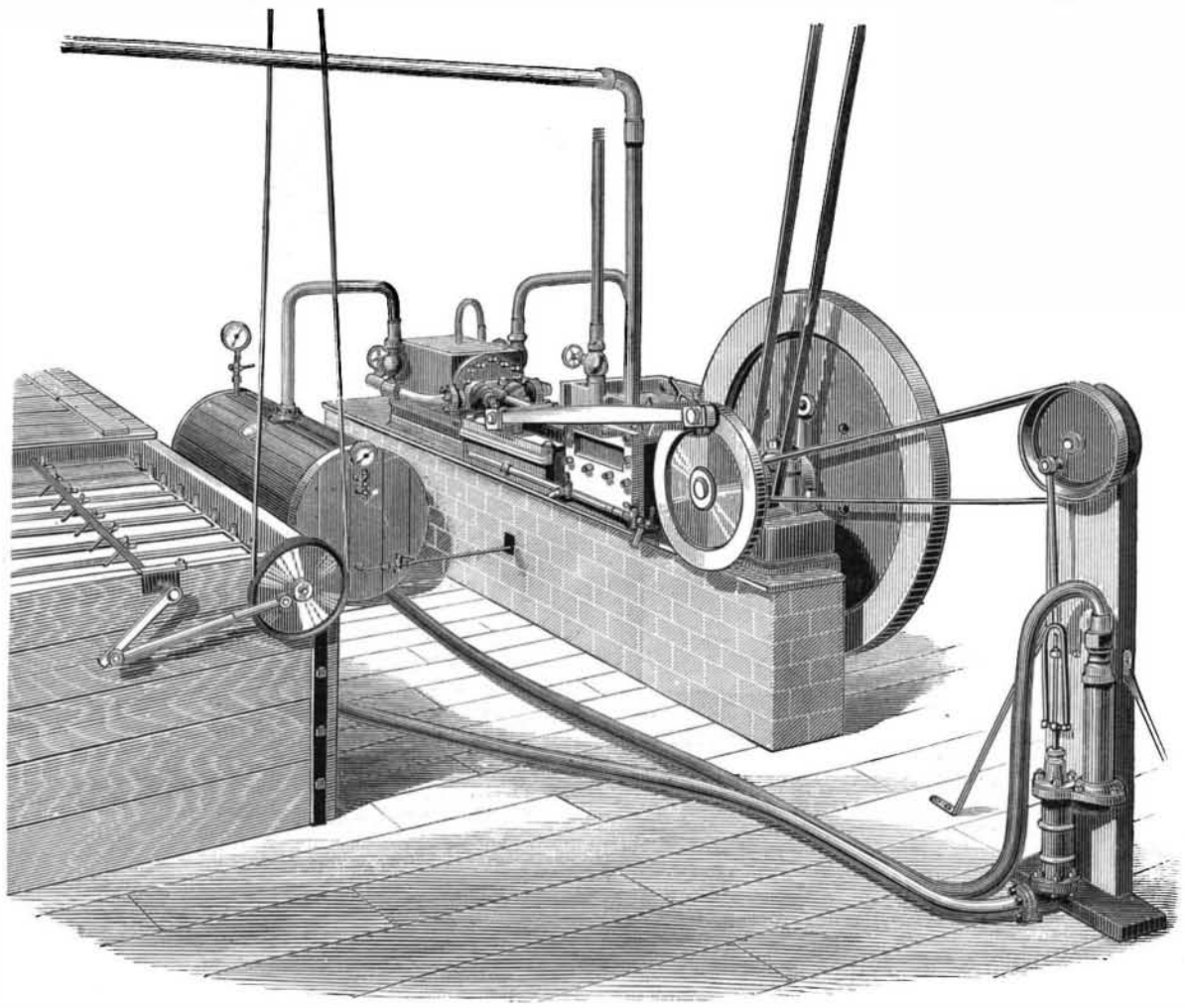
a dozen men, we see the evil of something worse than convict and Chinese cheap labor in our midst. We have an enormous addition to our population in the shape of automatic labor-saving machines. If one superintendent can take care of ten or twenty men, so here one man can take care of a half dozen machines doing each ten men's work. The machines have the advantage that they cost nothing for provisions—slaves unfed, unclothed, and harnessed down for life, breathing steam and living on fire.

While there is such an enormous increase in the power of production, with no increase in the demand for consumption, it is necessary that much invention and effort should be at work to increase the industrial employment of the people, and to increase the wants and requirements of a higher civilization now rendered feasible. While our people are thus thrown out of one employment, another should be offered. It is a fixed law that every citizen should have what he pays for—all the benefits and opportunities which the nation has power to bestow. Employment is the first right of man; traffic, pleasure, or associations resulting from labor are secondary considerations. To have employment the people of the United States should be engaged in producing everything which the world produces, not incompatible with climate or nature. A close observer of the industrial economy of Germany, France, and Great Britain finds such a number of profitable industries there existing, and of which America has no knowledge, and for the productions of which we pay our money, as would give every person in America steady employment. The care of the United States should be, while affording an asylum to the over-crowded population of other nations, to enable them to bring their industries with them.

AN ETHER ICE-MAKING MACHINE.

The machine shown in the accompanying illustration is one made by Messrs. Duvallon & Lloyd, of Birmingham, England. It uses ether, and the apparatus consists of an engine and air pump combined on the same bed plate, a refrigerator, an ether condenser, a circulating pump, and one or more ice boxes, according to the quantity of ice required. In the machine illustrated the air pump is 9¼ inches in diameter, driven direct by a steam engine, with 7½ inch cylinders, the stroke being 21 inches. The two cylinders are arranged in line, the two piston rods being cottered to the crosshead. The guides consist of hollow angle pieces working on the corners of the square bars. The air pump is double-acting. The connecting rods, one at each side of the cylinder, work on crank pins inserted in disks keyed on to the main shaft, one of these disks being of considerable weight, so as to act as a fly wheel. In the center of the main shaft is a pulley for driving overhead shafting, from which the circulating pump and the agitator derive their motion. The two inlet passages of the air pump, one at each end, are connected by a copper pipe, from which branches another copper pipe, placing them in communication with the refrigerator. This is a cylindrical vessel, similar in construction to a multitubular boiler, covered with felt and lagged with wood; the tubes are made of copper and riveted to brass end plates. On the other side of the air pump, the two outlet valves, connected in the same manner as the inlet valves, are placed in communication with the ether condenser, which is similar in construction to the refrigerator, but is of rectangular section and has no copper shell. The tubes communicate at each end with metal chambers, one of them acting as a receptacle for the air which finds its way inside the condenser. The whole is immersed in a tank of wood or galvanized iron, through which a constant stream of water is made to pass for cooling and condensing the vapor of ether. A vacuum of about 25¼ inches, it is stated by *Iron*, from which we obtain these particulars, is maintained by the air pump in the refrigerator, vaporizing the ether at a low temperature. The absorption of heat due to this operation lowers the temperature of the strong brine, made to circulate, by means of the pump provided for that purpose, through the tubes and the ice box. The latter is a tank of red deal, varnished inside, with partitions having holes bored in them for allowing the brine to circulate slowly. Between the partitions are suspended zinc moulds of rhombic form, varying in width according to the shape of the blocks of ice required, and filled with pure water.



ETHER ICE-MAKING MACHINE.

IMPROVED SHOE BRUSH.

Mr. Frank H. Kean, of Cincinnati, Ohio, has added a useful attachment to blacking brushes, in the shape of an adjustable scraper knife, by which hardened mud, etc., may be easily removed from the shoe. The arrangement of the device is perfectly plain from our engraving. It will be noticed that the knife is curved at its front end, and that by the thumb nut it may be clamped so as to project as much as desired. This device was patented April 30, 1878.

IMPROVED SHOE BRUSH.

Burns and Scalds.

Dr. G. F. Waters, of Boston, Mass., author of the alkaline treatment, now so widely known for its remarkable success, says:

"My treatment is to apply to the burned surface bicarbonate of soda, if it is a wet surface, in fine powder; but if is a dry burn, use a paste of bicarbonate of soda and water, or a strong solution of the bicarbonate of soda in water, and apply to the burned surface. This relieves sunburns as well as burns from hot coals, melted sulphur, hot iron, steam, etc.

"Always dispose the burned surface so that the blood can gravitate toward the heart if possible, as otherwise a continuous pain may be felt, due to the dilatation of the blood vessels from the weight of the contained blood.

"If bicarbonate of soda is not at hand, bicarbonate of potash is the next best; biborate of soda does as well, but is not often found handy. Then the emulsion of lime water with oils makes a good dressing where the skin is broken. But vaseline is preferable, as there is no odor from it and it is quite as bland."

FIFTY thousand dozen of American hay rakes, says a writer in the *Sheffield Daily Telegraph*, have been ordered and partly received by a single firm in Sheffield for this season's demand only.

New Inventions.

Mr. W. C. Phillips, of Norwalk, Conn., has invented an improved Stair Fire Escape, made in parts, the number of which in use is determined by the height of the point to be reached, each part consisting of hinged sections capable of being locked in line or at angles by means of bolts operated by cords, suitably braced and capable of a variety of adjustment.

An improved Ice Pitcher, invented by Mr. H. B. Beach, of West Meriden, Conn., has an interior china, glass, or other suitable lining, strengthened by a metallic layer spun around it, and secured to the body of the pitcher by a screw bolt and nut at the bottom. While the usual air space about the bowl is left, the strengthening obviates the danger of cracking the lining by dropping lumps of ice upon it or in case of falling.

Mr. A. R. Sherman, of Natick, R. I., has patented a convenient Book Rack for church pews, in which a number of improvements are introduced, designed to hold the books shut, and also adjustable to hold small books in place.

Mr. H. S. Cate, of Millerstown, Pa., is the inventor of an improved adjustable and removable rubber Packing for Oil Wells, which is attached to the casing head, surrounding the tubing or cable, for the purpose of preserving the vacuum or controlling flowing oil or gas while withdrawing tubing or drilling.

Mr. J. R. Pierce, of Orfordville, N. H., has patented a Horseshoe Spring which is claimed to spread the hoof of a horse's foot without injury and without affecting the attachment of the shoe. The spring is V-shaped, pivoted at its angle to the toe of the shoe, and so formed that its arms extend back along the sides of the frog and bear against the inner sides of the rim of the hoof, at its heel.

Mr. Emerson Cole, of Brooklyn, N. Y., has patented an improved Bung Fastener, made of a tapering pointed strip of sheet metal, having near its wider end burrs, which enter the sides of the bung hole as the bung is driven in with the fastener between it and the hole. The fastener is also made in convenient form to bend over the bung after it is driven in.

An improved Sled, the invention of Mr. R. Armstrong, of Portland, New Brunswick, is so constructed that each runner is allowed sufficient mobility to pass over inequalities of road without disturbing the position of its fellow to any material extent.

In an improved Cooking Stove, patented by Mr. H. R. Smith, of Minnesota Lake, Minn., the arrangement is adaptable to burning hay as well as wood or coal, mainly for the purpose of utilizing the cheap hay crops of the Western States, after the hay is properly prepared or baled for the purpose.

An improved Oil Well Torpedo, invented by Mr. W. Haus, of Church P. O., Pa., consists of an interior exploding shell and an exterior case filled with a sawdust or paper mixture. The object is to furnish means for exploding the torpedo in case the regular caps fail, without drawing it out of the well; and to this end a supplementary exploder, with capped rods and a second anvil, operated by dropping a weight from above, are provided.

In a new Iron Fence the inventor, Mr. A. Zimmerer, of Nebraska City, Neb., provides the lower ends of each fence post with a screw thread corresponding with a screw hole in a metallic base plate attached to a block set firmly in the earth. Each post is notched at its upper end, and the top rails have oblong slots, so that the rails may be secured to the posts by inserting the ends through the slots and then turning the posts in their screw sockets.

Mr. J. Gallaspie, of Russiaville, Ind., has patented an improved Trace Holder, constructed with a view to keeping the traces straight and preventing them from swinging about when slack. It is formed of two pieces, hinged together at their lower ends, notched upon their inner sides to allow a space for receiving the trace, and secured to each other by a thumbscrew at the upper end of the smaller part. An eye in the upper end of the longer part receives a supporting strap, which is secured to the hip strap of the harness.

A Rainwater Filter, designed to filter the water passing from a roof to a cistern, has been patented by Messrs. W. H. Thomas and T. H. Carter, of Mount Sterling, Ky.

Freezing in winter is avoided by the automatic draining off of the water in the filter as soon as the supply from the roof ceases; but it is closed again, so as to cause the water to pass through the filtering material, as soon as water is supplied from the roof.

Interesting Electrical and Magnetic Experiments.

At a recent evening lecture at the Royal Institution, London, a discourse was delivered by Sir William Thomson, Dr. Siemens being in the chair. The subject was "The Effects of Stress on the Magnetization of Iron, Cobalt, and Nickel." Sir William first pointed out that certain magnetic bodies possessed the power of retaining magnetism in a greater degree than others, iron possessing this force in a high, and nickel and cobalt in a lesser degree; paramagnetic bodies do not possess this power.

The magnetic property in bodies might be different in different directions; that is, it varied according to the structure of the body. Some bodies could be isotropic; that is, their magnetic properties might be the same in all parts of their mass; thus, a lump of dough, when uniformly kneaded and placed between the poles of a powerful magnet, was unaffected; but when compressed in one direction, became influenced by the magnetism.

The influence of the magnetism of the earth on a bar of soft iron was next pointed out, the bar becoming magnetic when held in the line of the dipping needle, the upper end of the bar always taking the same magnetism, even when the ends were reversed, after the bar had been held in one direction.

One interesting experiment consisted in inverting a bar of iron, part of the weathercock of Oxford Cathedral, which had stood upright in the steeple for over 300 years, and had been carefully treasured by Faraday in the same position, with the same end up, ever since. It would have been a scientific sacrilege to have done so idly, but the object was to see whether, after three centuries of fixity in position, it had acquired a fixity of magnetization. No one had a better right to perform the act than the philosopher to whom Faraday has handed on the lamp, and no one could have done it with more reverence. The result could not be predicted, and it was awaited with considerable interest. Before inversion, the upper end of the bar was a true north pole by virtue of its position, and the lower end a true south pole. After inversion, the latter became a true north pole, and the former upper end a true south pole, showing that the magnetic induction of 300 years had not taken a permanent hold upon the iron.

The effect of striking a bar of iron, cobalt, or nickel, held in the line of the dipping needle, was shown to give a very perceptible amount of magnetism to them, even when the blows were very slight.

It was pointed out that this effect was very much more considerable in long than in short bars, and that therefore it was advisable to avoid the use of such bars, long in proportion to their breadth, for stanchions in ships, as compass errors might become considerable from the magnetism which such bars might acquire.

Villari's discovery was next alluded to, namely, that the effect of stretching a magnetized wire was to increase its magnetism, this increase reaching a maximum at a certain point, and then decreasing as the strain was still further increased. On the relaxation of the strain the magnetic condition of the wire was nearly, but not quite, restored to its normal power.

Sir William had extended these experiments by determining the effect of transverse strains such as is produced by applying hydraulic pressure in an iron tube; this transverse strain was found to decrease the magnetic force in the tube when the magnetic power was feeble, a maximum being reached at a certain strain; when the magnetism was strong the opposite effect was produced, a transverse strain producing an increased effect, rising to a maximum at a certain strain.

The effect of torsion on a wire was found to be to decrease the magnetic power in a wire, no matter which way the twist was made; but on the relaxation of the twist, the magnetic power remaining in the wire was less than it was at first.

In conclusion, says the *Telegraphic Journal*, Sir William said that the values of the discoveries did not necessarily lie in their immediate practical application, but in the fact that every new law brought to light added a link to the chain of human knowledge, and must be a gain to mankind.

The Annual Soirée of the Royal Society was held at the society's rooms in Burlington House on the 1st of May. A large and distinguished company was present. Among the objects exhibited, those of an electrical nature came in for a fair share of notice. The Telephone Company exhibited various forms of apparatus; the "telephone harp," of Mr. F. A. Gower, being the most prominent instrument. This invention enables some of the sonorous properties of the telephone to be rendered perfectly audible to a large audience. The telephone being a most unsatisfactory instrument for audible demonstration to a large audience, the harp of Mr. Gower will prove very useful for keeping up the interest of lectures on the subject.

Mr. Henry Edmunds exhibited his method of showing variations in the pitch of sonorous vibrations by means of a revolving vacuum tube.

Mr. Robert Sabine exhibited his discovery of the effect of light on selenium in generating an electro-motive force.

Mr. Ladd exhibited a large Holtz electrical machine, and specimens of Byrne's American pneumatic battery, lately illustrated in the SCIENTIFIC AMERICAN.

Messrs. Siemens Bros. exhibited one of their dynamo-electric machines capable of giving an electric light equal to 1,200 normal sperm candles; an electric lamp was also shown by the same firm.

Among the other scientific apparatus, the Edison "phonograph" was shown in action by Mr. Stroh, and explained in a short lecture by Mr. W. H. Preece.

The "mechanical chameleon," the invention of Mr. A. B. Kempe, excited much interest among the more scientific portion of the visitors. This ingenious apparatus, by mechanical means, enables all the gradations of tint of any two colors to be obtained and to be varied at will, the one tint dissolving gradually or suddenly into any other, or remaining stationary if required.

Mr. Francis Galton, F.R.S., exhibited a curious optical instrument, by which portraits of different persons could be combined so as to form a new face possessing the characteristics of each individual portrait.

Mr. Nathaniel Holmes showed in action his flashing light signal apparatus, in which a brilliant "flare" is produced by the action of water dropping on phosphuret of lime.

Communications.

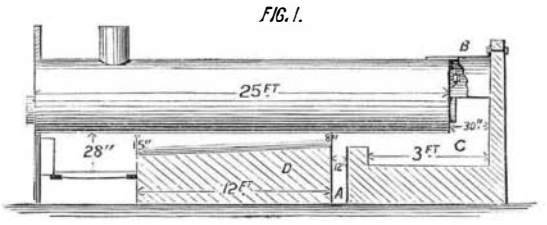
Setting Boilers.

To the Editor of the Scientific American:

Some years since I took charge of a sugar plantation on the Spanish Main, S. A. Four hundred tons of coal (when it could be procured) and about three hundred cords of wood were consumed every season. I had not time to make any changes the first season, but although the average was increased I decreased the coal bill eighty tons and the wood bill one hundred cords. The second year I made the changes below described in boiler settings, and consumed two hundred tons of coal and one hundred and forty cords of wood. I burned all the bagass.

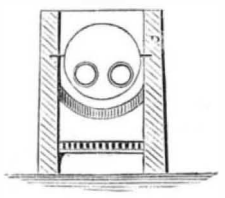
The boilers were three in number, twenty-five feet between

FIG. 1.



heads, four feet diameter, each containing two twelve-inch flues. The old settings were of tiles and stone, sixteen square feet of grate surface for each one, and were in independent settings. There were two bridge walls straight across, one at the back end of the grates, the other at the back end of the boiler. The boiler was eighteen inches above the bridge walls. The space between the bridge walls was about four feet deep and vacant. The alteration consisted in making a bridge wall twelve feet wide on a circle with the boiler, the front end fifteen inches therefrom, and the back end eight inches below the boiler, like part of a conical tube, shown at D, Fig. 1. Back of this wall a straight wall was placed, between which and the former was left a space 12 inches wide, and on each side of which was placed a door with a register, A, of four square inches, for the admission of air. Back of the last wall was constructed the combustion chamber, C. B is a bonnet of boiler iron; P, Fig. 2, cast iron plates. The masonry was not in contact with the boilers.

FIG. 2.



The grate surface was increased for each boiler from sixteen to 20·5 square feet by putting in bars five feet long in place of four foot bars taken out. My method of firing was as follows: Our coal was usually about one third slack. Coarse coal sufficient to make a good fire was separated from the dust with rakes, and after a good fire was obtained, bagass or wood was thrown on, followed by a light but frequent firing of slack coal. Before the alterations were made we made a great quantity of ashes, lodging under the boilers and in the flues and front bonnet. After this no ashes of any account were made, but a small amount of fine whitish dust collected in the combustion chamber. The heat in the combustion chamber was intense. No blower was used at any time. The fires were run down and hauled every run and new fires made. Everything which came from the furnaces and ash pits was screened, and whatever passed through a No. 8 screen was thrown away. No coal dust of any account passed through the grates. This method of boiler setting is not patented, as far as I know.

Bangor, Me. FRANK B. CORT.

Driving Piles in Sand.

To the Editor of the Scientific American:

Referring to the communication of F. L. James, M.D., in the SCIENTIFIC AMERICAN of June 1, 1878, page 340, permit me to give my experience.

Some 30 years ago I made a contract with the United States Government to build a granite basin at the Pensacola navy yard, which required the driving of about 3,000 piles, to the depth of from 30 to 40 feet, in the hard, sharp sand at that yard.

After signing my contract, I was informed by the then Chief Engineer of the Navy Department that a corps of engineers had tried the experiment of driving piles at that yard, and that the maximum depth to which they could possibly be driven was 15 feet; at that depth the heads of the piles were boomed up, though banded with iron hoops, and that the hammer rebounded without moving the pile.

I inquired how heavy a hammer had been used, and was informed that it weighed 1 ton; it struck me at once that it was like trying to drive a 6 inch spike with a tack hammer instead of using an 8 lb. maul.

I obtained hammers weighing two tons and a half, and allowed them to fall but 12 feet: the result was that I drove my 3,000 piles without banding the heads, the effect of the blow being to polish the heads of the piles.

If you will publish the above it will be of more benefit to the practical mechanic than the long article on the same subject illustrated by letters, figures, and hieroglyphics which I recently saw in a scientific magazine.

New York, May 23. JOHN S. GILBERT.

HUGHES' MICROPHONE AN ALLEGED PIRACY.

Mr. Thomas A. Edison sends us a communication in which he points out in some detail that Professor Hughes' microphone is a piracy on his carbon telephone, which, it will be remembered, is based on the great changes of resistance to the electrical current which occur in carbon under minute pressures. We illustrated both of these inventions in our issue of June 8, 1878, and at the same time pointed out the close similarity between them. Mr. Edison states that Hughes' discovery is not merely identical with his, but that the correspondence continues down to the minutiæ which many who concede the similarity of the investigations in other respects believe to constitute a distinctive feature in favor of Hughes. Mr. Edison says that "the subdivision of carbon has been repeatedly tested by me in my experiments on the telephone," and that he has employed the metallization of the carbon by plunging it in mercury for many years past. The change of electrical resistance with enormous rapidity by plumbago under pressure was published, as we have previously stated, in this journal on July 28, 1877, and we have already pointed out a fact dwelt upon by Mr. Edison in his present letter, namely, that Edison some time since abolished the vibrating plate in the carbon telephone, substituting a solid plate, and thus removing the last possible distinctive difference between the completed form of his device and the same form of the pirated microphone of Hughes.

It is not necessary to dwell on these points, because they are very few and simple, and the reader can review them by turning back to the illustrated description, above referred to, of the devices of both Hughes and Edison. The more interesting part of Mr. Edison's letter is its conclusion, wherein he implicates Mr. William H. Preece, the coadjutor of Professor Hughes, in introducing the microphone.

Mr. Preece is electrician to the London Post Office, the author of several works on electrical subjects, and an expert of considerable ability in that line. In the early part of last year, Mr. Edison states in the letter before us, he came to this country and visited Mr. Edison at his laboratory. With that freedom which is characteristic of the man, Edison exhibited to him the experiments which he had under way, including those involving the carbon telephone. At Preece's expressed desire Edison made him his agent for the presentation of this telephone in England. Subsequently Preece was also charged with the introduction of the phonograph in that country, and thereafter Edison kept him fully advised of his advances, both by private letter and by mailing him published accounts. Among other journals sent to Preece was a copy of the Washington *Star*, of April 19 last, containing an account of Edison's modification of the carbon for measuring minute degrees of heat; and that this was received by Preece before the presentation of the microphone to the Royal Society is amply proved by the fact that that gentleman embodied an extract from the account in an address delivered, in May, before the London Society of Arts. This extreme sensitiveness to heat, it will be remembered, is claimed to be a special discovery of Hughes in relation to the microphone. It is somewhat remarkable besides, in view of the above, that the announcement of Hughes' observation of the capabilities of the microphone as a thermometer appears as an addendum to the *Engineer's* publication of the paper, read by Huxley, announcing the invention of the microphone to the Royal Society, and that our cotemporary stated that the discovery had been made by Hughes since the presentation of the communication by Huxley.

Mr. Edison says, in conclusion, that he considers the conduct of Mr. Preece, in this matter, "as not merely a violation of my own rights as an inventor, but as a gross infringement of the confidence obtained under the guise of friendship." Mr. Hughes' part, under this aspect of affairs, is inexplicable, and responses from both him and Mr. Preece, in answer to these charges, will be awaited with interest.

THE DIRECT CABLE DUPLEXED.—Dr. Muirhead has just successfully applied the duplex system to the direct cable between Torbay and Ireland, the longest line yet duplexed. Trial tests show an actual speed in working commercial messages of from seventeen to twenty words a minute, thereby doubling the capacity of the cable.