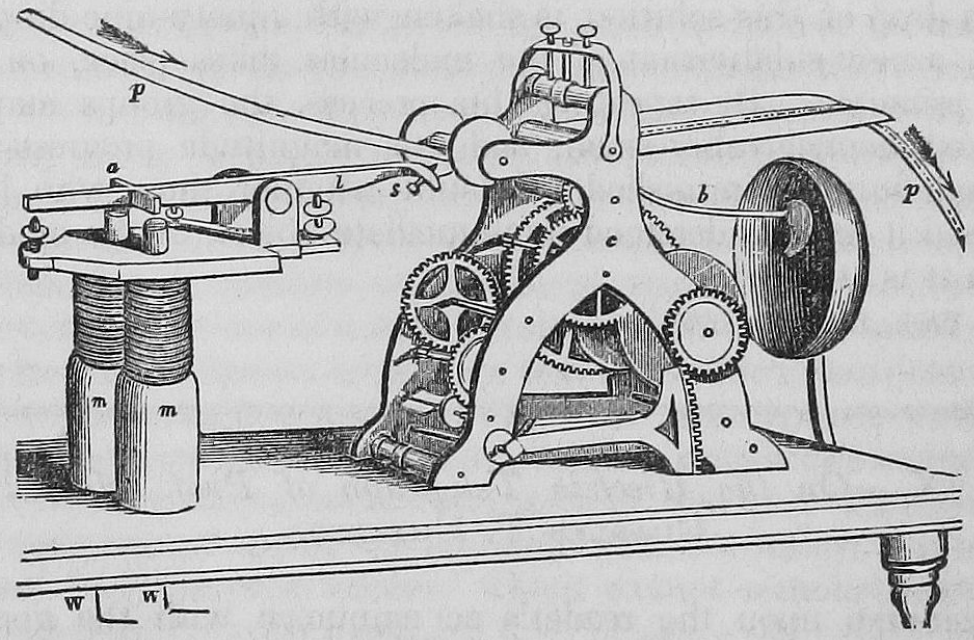
ART. IX.—*On the Electric Telegraph of Prof. Morse;* by CHARLES T. CHESTER.

PRESUMING upon the reader's acquaintance with the general principles of modern electric telegraphs, a brief review of them as they relate to Professor Morse's system will suffice. Its elements, the battery, electro-magnets, with the circuit of connecting wire, are becoming in their theoretical relations a part of popular knowledge. Their practical operation and those peculiarities of the American telegraph which have given it the prominence it enjoys, alone need an explanation. It is one of those inventions

whose simplicity is more wonderful than their effects; its excellence is its easy practicability, requiring but small capital either mental or pecuniary.

For a considerable period three lines have been in operation. Although they have failed to realize the sanguine expectations of the public, they have already rendered themselves indispensable to the business community. This apparent want of success does not detract from the excellence of the invention, as it has arisen from the inadequacy of the *structures* to supply the wants of the public. The invention, in its application, must like steam pass through stages of progress before it secures perfect public confidence. The lines to which I refer connect New York with Washington, Boston and Buffalo. All have been built with limited capital and experience, and all are imperfect and liable to accident. Hence there is never a positive certainty of communicating between any two points at any given time. If there were, and if the assurance continued for any length of time, experience proves that four times the number of wires and operatives would be scarce sufficient to dispose of the accumulation of business. For the full understanding of the economy of our telegraph, its advantages, practicability, and the obstacles and difficulties which have hitherto rendered it unreliable, a brief description of the apparatus in its application seems necessary, even though it be already familiar to some readers.

Fig. 1.




The accompanying figure (1) presents a view of the essentials of the "register," the recorder of the telegraph character. *m m* represents its main feature, the electro-magnet, whose armature in its alternate attraction and withdrawal gives motion to the lever *l*, of which it is a part. The other end of the lever carries with corresponding movement the steel point *s*, which (accurately corresponding with a groove in the roller) indents at each upward

stroke the paper, kept running with uniform motion above it. The *attraction* of this armature is due to the magnetism induced in *m m*, by the current passing through a circuit, consisting of a distant battery, the helices *m m*, and two conducting media continuing from w w to the battery poles—when this circuit is broken and the magnetism discharged from *m m*, a spring withdraws the armature. Now were the wire composing one part of this circuit broken in any part, and its ends repeatedly brought into contact, the armature would vibrate in precise accordance with these motions. This breaking and closing is accomplished by the key, (fig. 3, K,) the pen of the telegraph, whose operation is obvious: as it is depressed, so is the armature, each at the same instant, practically irrespective of the length of the circuit. Hence, a uniform motion being given to the paper, the key being kept down, the armature depressed, and the pen raised, a continuous line is impressed on the paper. If the key be thrice quickly depressed, three dots are in like manner impressed. An alphabet of combinations of dots and lines is thus easily produced from the dexterous manipulations of the key. The sole use of the wheel-work represented in the figure, is to give the paper a steady onward motion. The wheels are driven by a weight regulated by a fly, and liberated or stopped by a "break" originally acted upon by the pen lever, now controlled by the operator's hand. This "break," ingeniously releasing the clock-work during the motion of the lever, has with the bell been dismissed as a neat contrivance, whose utility the telegraphic business has not yet sanctioned.

Every variety and change, preserving the original idea and relation of electro-magnet and pen lever, has been tried in the construction of "registers." In some the levers are perpendicular, in others horizontal, while in one form, a shaft playing horizontally through a tube carries, at one end the pen, at the other the armature. But of these instruments the least complicated are preferred, so accurately constructed as to give the paper a perfectly uniform and rectilinear motion, allowing of its being repeatedly indented with the telegraph characters in parallel lines,* and so adjusted with reference to the lever that no accident can displace the steel point from its appropriate groove.

The register, thus briefly described, with the battery and conducting wires, forms the sum of a popular description of Morse's telegraph. A clear idea of their relations is enough to convince one of the beautiful simplicity of the invention, nor is it improbable that such an application of the electro-magnet had often

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* This is a very essential requisite of a good register, and none but the most carefully constructed possess it. "Paper guides" embrace the slip before it meets the rollers, and being adjustable to the right or left, direct the course of the paper with such accuracy, that it may be rewritten fifteen times in parallel lines. The instrument represented here does not exhibit them.

suggested itself to electricians. The arrangement described is however entirely impracticable through long distances, and a certain combination of circuits, requiring the aid of another instrument, becomes necessary. It is on the exclusive use of this instrument and this combination, that the value of the Morse patent is based. The "receiving magnet" is simple in construction and effect. Fig. 2 represents one form of it. The electric fluid, attenuated, as it were, in the great extent of metallic conductor it traverses, would not perceptibly affect the magnet described as the foundation of the register, and this though the circuit may be comparatively short (say thirty miles), and the battery fresh and extensive. Not only would the magnetism developed be insufficient to perform the mechanical operation of indenting the paper, but with the most careful adjustment the armature would be scarcely moved. To render available this attenuated current, the receiving magnet is interposed, differing from ordinary electro-magnets in the great length and fineness of its helix, 3000 feet of the finest covered wire being no uncommon length. As the diameter of these helices is but an inch and a half, each of the numerous coils is brought within inducing distance from the soft iron, which thus becomes a tolerably vigorous magnet, although the inducing current may be extremely feeble. The armature of this magnet is attached to a lever susceptible of delicate vibration and adjustment, an adjustment often rendered constantly necessary from the inconstant power of the current. The immediate use of this little instrument is the breaking and closing of a circuit, consisting of the register magnet, a small battery, with sufficient wire to con-

Fig. 2.

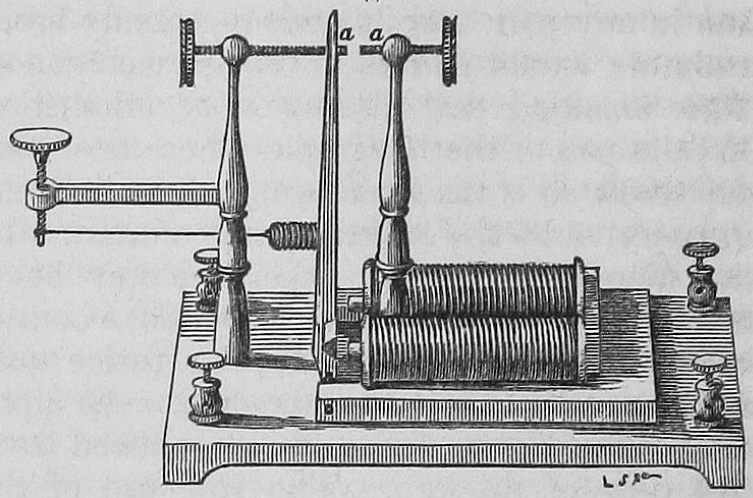
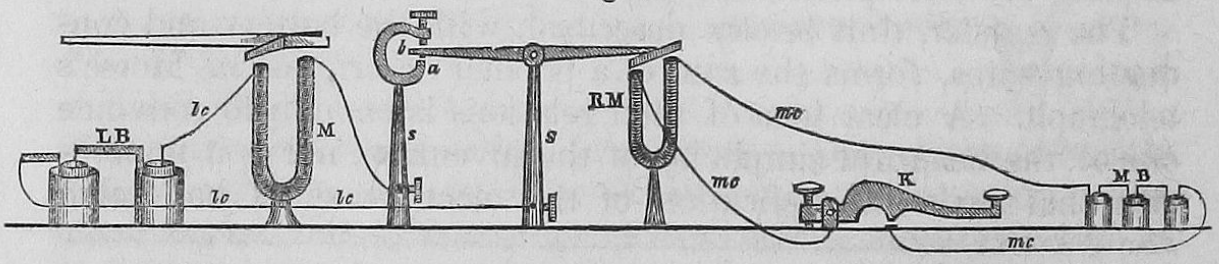



Fig. 3.




nect. Fig. 3 represents this arrangement and the relations of the magnets, batteries and circuits; RM representing the small magnet, *mc* the main circuit of indefinite extent, MB the distant battery, K the key which breaks and closes this extended circuit;

*lc* and LB represent the *local circuit* and battery, M the helices of the register magnet included in this circuit, which, as the standards *s*, *s*, are metallic, is broken only at the points *a*, *b*. Now the least possible space between these *points* effectually interrupts the current, and as they are covered with platinum, a very slight contact is sufficient to establish the connection. The little instrument is so delicately adjustable, that often when the breath could stop the vibrations of the lever, the circuit is broken and closed with certainty and regularity. The points are carefully kept free from dust, and the lever is adjusted by the elasticity of a spiral spring with its silk thread attachment. Very much of the operator's skill depends upon his management of this adjustment.

In the economy of our telegraph the battery is an interesting and important feature; in its employment as the motive power of the telegraph it has shewn capabilities which have surprised the most thoroughly scientific. The power now employed is about one-thirtieth of the original estimation. Grove's was the arrangement originally adopted, and it answers its purpose so admirably that it is almost universally retained. The objections to its use were the expense and offensiveness of nitric acid; a brief description of its economy will shew that these objections have no weight. The battery as an auxiliary to a business enterprise, differs essentially from the same agent in the laboratory. The zincs are cast with great care, and are in weight about two pounds each—the platinum member is substantial and valuable. Ordinary nitric acid is used for the porous cells—but in the best arranged batteries the diluted sulphuric acid is saturated with sulphate of soda with very great advantage and economy; not only is local action almost entirely prevented by this expedient, but reamalgamation is almost unnecessary. A little brushing of the surface of the zinc each night being all sufficient. So great a resistance to the free passage of the current in the main circuit is afforded by the great length of the conductors, that in the main battery scarce any save local action is perceptible, an assertion sustained by the fact that the battery charged as above, requires, if separated each night, fresh acids, but once in five or six weeks. Smee's battery, an arrangement so remarkable for its small local action, has afforded a uniform current for two weeks without separation.

The numerical extent of the series seems principally to give efficacy to the battery. It has worked competently with acids reduced almost to water and with metals scarcely immersed. Eighteen members of Smee's battery whose plates exposed but a square inch of surface, have worked competently through eighty miles; a single member, that might be contained in a thimble, through six miles. Of Grove's battery, a series of thirty is the average number for 150 miles of wire. The acids—of the "local battery"—require a daily replenishment.

A description of the out-door arrangements of the telegraph would seem superfluous—but a few particulars may possess some interest. The use of poles for the support of the wire is in this country universal. These poles vary in size with the resources of the company—the standard being thirty feet in height, buried five feet in the earth, and having a diameter of six inches at least at the smaller extremity. The copper wire that has been heretofore used, weighing from 80 to 100 pounds per mile, is now universally displaced by iron wire of a weight of 300 to 330 pounds per mile. This is single or twisted, unprotected or galvanized. The advantages of the protecting coat are counterbalanced by loss of pliability and toughness; and good iron having withstood the test for years, the naked wire is generally preferred. Its cost is about 6 to 10 cents per pound.

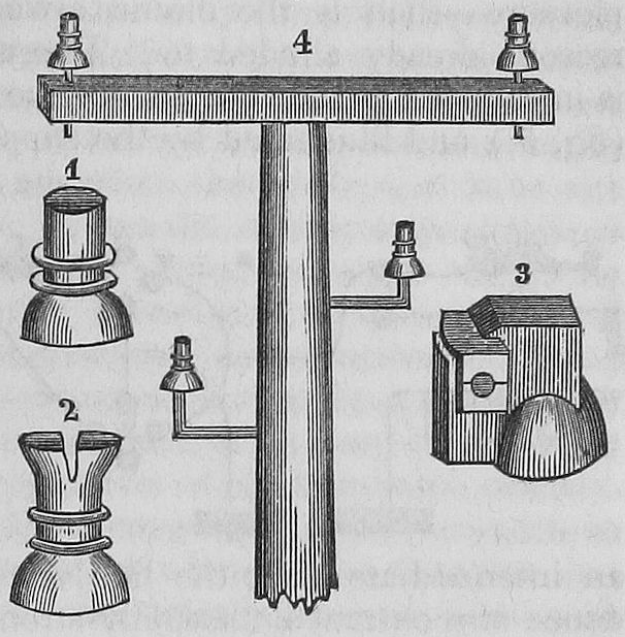
Among the elements of simplicity that give character and practicability to the American telegraph, is the use of the ground as return conductor. In the imperfect state of our original structures, the invention would have been almost unavailable but for this facility, as it has been found very difficult to keep two wires separated through any great distance, for any length of time. The use of the ground renders only one insulated wire necessary. The ground thus used proves moreover, a better conductor than wire; it requires less battery to produce equal magnetic effects, and when the choice of conductors is given, the current seems to prefer the heterogeneous to the homogeneous circuit. Communication with the ground is very easily established. A gas pipe in cities—a metallic plate buried in the ground or immersed in a well or river accomplishes this end. A few feet of wire thrown into a stream of water will establish the connection. If a wire, as fine as a hair, leading from the conducting wire as it crossed a river, were immersed in the stream, the interruption to communication would be as effectual as if the conductors were broken, the current from either battery would be returned.

In the economy of the telegraph, there is no more important requisite than careful insulation. A solution of the perplexities and difficulties that have opposed the successful working of lines, will shew the importance of insulation to be absolute. To attain it, several methods have been tried, generally varying in excellence with the expense. Experiments on various lines have proved the best available non-conductors to be imperfect.

With a view of protecting as much as possible the fragile insulator, the wire is supported from it in various ways. It has been usually belayed to glass "caps" shaped like those in fig. 4, either supporting the wire from their side (1) or sustaining it (2) in the groove. These caps fit over wooden or iron pins. In some cases two blocks of glass are dovetailed to each other in such a manner as to allow a central opening for the wire. In

other words, the wire at the point of insulation is imbedded in a glass parallelopiped. The glass in its turn is protected and surrounded by wood, and the wire slides through the glass generally without fastening. One of the latest plans of insulation, to be employed on the line from Troy to Montreal, makes use of these glass blocks, fitted immovably in a cast iron cap, the cap again insulated from the supporting peg by a heavy glass tube (3). The caps, of whatever form, are either upon cross-bars or supported by iron staples driven into the post (4), the latter method now prevails.

Fig. 4.

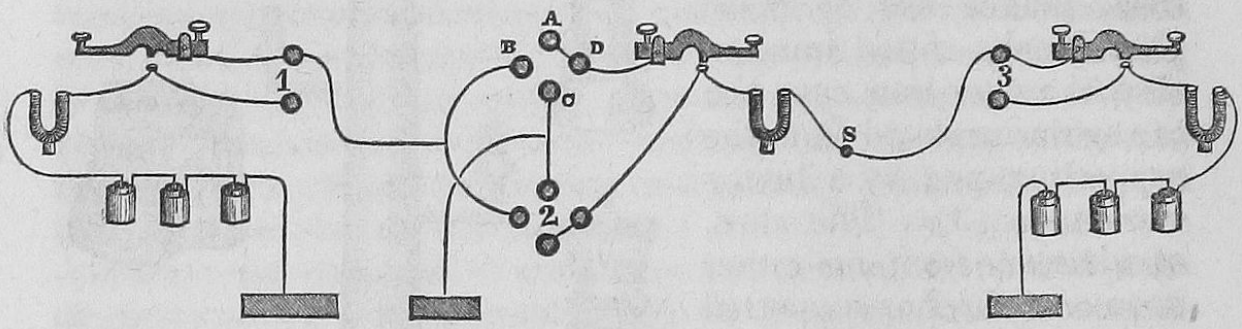



Such being the general construction of our lines, a few words as to their general business arrangements may not be inappropriate, as explanatory of their uses, capabilities, and the obstacles they have had to encounter. Each line has its termini generally giving name to the company that owns and governs it. Intermediate, are "stations" varying in number and importance with the length of the line. It matters not how many of these stations are interposed, provided the arrangements for the introduction of the wire at each secure its insulation. No perceptible difference in the current would result, were fifty or one hundred of these interposed on a well insulated line. On one of the lines, sixteen are included in the circuit, each of which can unite to each or all the others—each receiver preserving a closed circuit while the transmitting operator manipulates with his key. Of course but one writes at a time. The business of the offices is conducted by operators, copyists, book-keepers, battery-keepers, messengers and inspectors or repairers. Messages to be transmitted are received, prepaid, the price estimated by a tariff whose elements are the distance transmitted and the number of words. The average rate being 25 cents for ten words 100 miles; these messages vary in value from 10 cents to $100. Messages thus received are filed according to destination, and sent in order of reception as nearly as the business of the line admits. As a general rule, the stations are written to in rotation, commencing with the most distant; the time used in performing the circuit varying, of course, with the amount of business and the condition of the wires.

The introduction of these stations to the circuit is sometimes perplexing. In Mr. Vail's work, "dependent" and "independ-

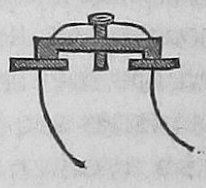
ent" circuits are described. The first consisting of a *single* wire and the ground. The wire broken by keys and the receiving operator, keeping the circuit closed, and breaking or closing at pleasure—such is the circuit always employed, for the various reasons already alluded to. The way in which this single wire is introduced at the stations may be understood from the diagram, (fig. 5,) and illustrated by the supposition of a break. When at

Fig. 5.




an intermediate office the line is found deranged from the evidence of a current unnaturally strong or weak, or from the entire want of a current, the inference is that the wire is broken on one or both sides of the office. Supposing the wire continuous from one terminus of the line to the other, and a battery at each, the current passes through the intermediate magnet without interruption, and the circuit established is termed a "through circuit." Now a derangement existing, the intermediate operator alters this "through circuit," and by connecting with the ground, makes two "short circuits." If the line is broken only on one side, a current is at once obtained from the battery of the unbroken side, and the arrangements for repair are guided accordingly. The diagram exhibits a means of instantly applying this test, as also a convenient method of dividing a long line into sections as the business may demand. The black dots A, B, C, D, represent brass terminations of conducting wires, sunk to a level with the surface of the operator's table; over their surface a metallic button plays, (Fig. 6.) This button connects each brass stud with its opposite, and a change in its position changes the direction and channel of the current at pleasure. Thus the intermediate operator wishes to break and close the "through circuit." He turns his button bringing B in connection with D. The course of the current can be easily traced. But again, cutting off his left-hand neighbor, he wishes to correspond with the right, the button, changed so as to connect A with C, the current passes directly to the ground through his instruments. Supposing a binding screw at S, the left or right-hand wire may thus be brought in connection with the ground. The buttons 1, 2 and 3, are simply used as convenient duplicate keys, or circuit closers, when the operator is receiv-

Fig. 6.



ing. In the economy of our lines the number of intermediate offices is of advantage, if their management is competent, as they facilitate the discovery and repair of difficulties and breaks, a consideration rendered important hitherto by the weakness of our structures. Each office has its peculiar call or signal, to which, when the line is in order, an immediate response is expected. Thus *n* expresses New York. The sound is so familiar as instantly to arrest the operator's attention, though he should be at a distance from the instrument. Thus the American telegraph is phonetic—it appeals to two senses. Long messages have been faithfully recorded from attentive listening to the peculiar sound of the instrument. There are systems of abbreviations too, many ordinary words and sentences being expressed by a single letter or numeral. By the aid of these and a quick ear, conversation may be carried on between operators with wonderful celerity. To the skillful operator, the little brass instrument becomes an articulate creature; it not only conveys his written thoughts, but expresses his passing emotions. He detects the *individual* with whom he converses and can recognize the effect of his own conversation as producing pleasure, vexation or indifference. In business correspondence too, abbreviations render the transmission so rapid that an ordinary penman fails to keep pace with it. On one occasion, with no allowance for repetition or delays, twenty-five thousand letters were transmitted in an hour and a half, by the aid of two instruments and wire.* That the actual business capabilities of the wires may be better understood, the brief statistics of a single day's business at one office may not be uninteresting. Two wires were at work, one through 200, the other through 500 miles. Four hundred and fifty private messages were sent or received, comprising every variety of business and information. The average length of these messages was twenty-five chargeable words, in addition to address, &c. Beside these, three entire hours were occupied in transmitting market and other intelligence, for publication, abbreviated as above. The line was pretty actively employed for sixteen hours, and being in good order, sixty or more messages were transmitted in rotation, without a word of repetition. A numerical statement of the operations of the telegraph can give however, but a faint idea either of their importance or value. It should be considered that the invention is used *only* in cases of urgency and importance—its *receipts* are not like those of other business, a trifling per-centage on previous outlay.

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* This estimation may not be as readily appreciated as one made from newspaper columns; these however, vary very much in their amount of matter with the type and composition. Some containing eight times as much as others. The report alluded to embraced about three average columns, or ten pages of this Journal. A like amount of matter is now regularly telegraphed on the arrival of each ocean steamer from Europe.

Such being the capabilities of the telegraph, and such the simplicity of its details, its frequent derangement becomes an object of wonder, and it would seem that the invention might be made more reliable. The most thorough experience proves, that, setting aside *natural* difficulties, the requisites for reliability are few and simple. Firm structure, good instruments, efficient battery, competent human skill, but especially, thorough insulation. A want of any of these destroys reliability at once. The first, structure, have been generally incompetent, the poles so weak and small as to make it sometimes doubtful whether, in relation to the wire, it supported or was supported, the wire so badly secured as to break often without any violent external cause. If not broken, each of the ductile wires has been constantly liable to contact with its support or its fellow cord. Let us trace the effect of such contact. As the ground is used as a return conductor, as a wire of the tenuity of Wollaston's platina thread would be sufficient to conduct the current, and as the capacities of conductors vary with their size, defects in insultation become conductors to the earth. Suppose a line erected as our ordinary lines with a battery however at but one end. The current passing from the positive pole proceeds through the miles of conducting wire to the distant station, thence its *destination* is the negative pole, its conductor thereto the earth. As the wire acts as an obstruction in a certain proportion to its length, a connection with the earth at some point between the two stations would be preferred to that at the distant station. Thus a certain part of the battery current would be returned at the point of non-insulation, the force of the battery would be unequally distributed, the magnets on the battery end having a preponderance in proportion to the *extent* and *relative position* of the non-insulation. The best non-conductors we have are insufficient for perfect insulation. On a long line, a sufficient current is always returned through the posts to work the instruments, though the insulation be practically entire. The want of a few glasses makes a difference quite perceptible. The crossing of wires acts as described above, throwing upon the wire used, the aggregate non-insulation of the two. Did defective insulation act as a constant quantity, less difficulty would be experienced, but its effects are highly inconstant and variable. They are often such as might be attributed to the violent agitation, contact and separation of the wires, in a gale of wind.

Slight variation of current exists almost always—generally less at night than during the day, and being more prevalent on long than short circuits, they may be attributed to the electricity of the atmosphere; doubtless the wire in its passage through 500 miles of country is exposed to very different electrical states of the atmosphere.* For some time it was supposed impossible to work two

* See a valuable paper on this subject, by Prof. Jos. Henry, ii Ser., vol. iii, p. 25.

independent wires; experience has proved that the inability lay solely in the imperfection of structures. Two *copper* wires have worked independently and well through 300 miles. The wire is expected to work equally well through twice the distance. No mutual influence is exerted by the two currents. Some careful experiments, made with a view to ascertain whether a secondary current might not be induced in one wire from the primary current in the other, proved conclusively that no appreciable effects could be traced on either from any arrangement of the other with relation to battery or ground.

Rain, snow, &c. act as disturbing influences with less power than would be supposed, but in proportion to the excellence of insulation; since at times during severe storms, lines have worked well through their entire extent, and at others a light shower cuts off even the nearest station.

Aside from the enumerated difficulties, there is one which will probably always act temporarily and to some extent. During thunder-storms, elevated metallic conductors affording for the lightning a passage to the earth, the wires will often become so charged, that the fluid in its passage encountering the small wire of the receding magnet as an obstacle, will dart off to the nearest and largest conductor, or melt the small wire. Or if less of the fluid be present, its magnetic effects will be disclosed in the instruments, producing on them a spasmodic effect. To remedy or prevent such effects, two instruments, simple enough in idea and construction, have been devised. The one consists of a metallic globe surrounded with a ring of metal presenting to the globe a number of sharp points. The ring is adjustable so as to bring the points in the closest possible proximity to the globe and yet prevent contact. It scarcely need be added that the globe is thrown into the main circuit, (the current entering by a large, and passing out by a very fine wire,) the ring is connected with the ground. The other device consists of an arrangement, in construction, resembling the receiving magnet, (fig. 2.) The *main wire*, before coming to the instruments, connects with and includes the helices of this magnet, (whose wire is quite coarse,) and it connects also with the upright lever. The right-hand standard connects with the ground. The atmospherical current powerfully charges the magnet, the armature is attracted and the lever brings the points (*a a*) in contact—thus a ground connection is instantly formed and the current passes out. In this case, both dynamical and atmospherical currents are "turned out of doors." Though these devices may prevent the destruction of receiving magnets, neither can secure regularity to the working of the instruments, since currents will take each and every ground conductor, and enough passes through the receiving instrument to derange its adjustment.

To those interested in the subject of telegraphs, the conflicting claims of the Morse and House patents are at present discussed with some warmth. An accurate description of the latter is at present impossible, from the fact that the existing instruments are in pieces with a view to the construction of new ones for the use of western lines, and from the justifiable unwillingness of the proprietor at present to expose his devices. The relative complication of the instruments may be judged from the fact, that the House machine costs in construction more than ten times the amount of the other. The object of House's machinery is to make at one end of a wire, the revolution of a disc, upon whose edge the Roman letters are raised, synchronous with the operations of a lettered finger-board at the other end of the wire. So that at the touching of A on the finger-board, the wheel presents and impresses A on a slip of paper. The paper is moved so that the letters succeed each other as in ordinary printing, and a visible impression is made by an arrangement similar to the manifold writer.

The most conflicting opinions exist in regard to the practicability of the above arrangement, some asserting its accurate performance through several hundred miles, others again bringing forward good reasons for the improbability of the thing. Such discussions are however necessarily interested. The use of Morse's receiving magnet with the accompanying combination of circuit, is probably the chief security to that gentleman's patent; and the most important question at issue is, whether the House patent is available without this combination. If it prove to be, competition will doubtless place it throughout the country in opposition to Morse's. Meanwhile the advocates of Prof. Morse's claims, stoutly deny the possibility of its operation "per se," and anxiously await a fair, open and impartial trial of its practicability.

*Lines Complete and in Operation, Nov.* 1, 1847.

| | | | | |
|---|---|---|---|---|
| From | New York | to | Carmel, N. Y. | |
| " | " | | Poughkeepsie, " | |
| " | " | | Hudson, " | |
| " | " | | Troy, " | |
| " | " | | Albany, " | |
| " | " | | Schenectady, " | |
| " | " | | Little Falls, " | |
| " | " | | Utica, " | 509 miles. |
| " | " | | Rome, " | |
| " | " | | Syracuse, " | |
| " | " | | Auburn, " | |
| " | " | | Geneva, " | |
| " | " | | Canandaigua, " | |
| " | " | | Rochester, " | |
| " | " | | Buffalo, " | |

| | | | |
|---|---|---|---|
| From Troy to | Saratoga, | N. Y. | 36 miles. |
| From Auburn to | Springport, | " | 84 miles. |
| " " | Ithaca, | " | |
| " " | Elmira, | " | |
| From Ithaca to | Owego, | " | 46 miles. |
| " " | Binghampton, | " | |
| From Syracuse to | Oswego, | " | 38 miles. |
| From Buffalo to | Lockport, | " | 25 miles. |
| " " | Niagara, | " | 12 miles. |
| " " | Chippewa, | C. W. | |
| " " | Queenston, | " | 150 miles. |
| " " | St. Catharine's, | " | |
| " " | Hamilton, | " | |
| " " | Toronto, | " | |
| From Hamilton to | Dundas, | " | 75 miles. |
| " " | Woodstock, | " | |
| " " | London, | " | |
| From Toronto to | Oshawa, | " | 376 miles. |
| " " | Port Hope, | " | |
| " " | Coburg, | " | |
| " " | Belleville, | " | |
| " " | Kingston. | " | |
| " " | Brockville, | " | |
| " " | Prescott, | " | |
| " " | Cornwall, | " | |
| " " | Montreal, | " | |
| From Montreal to | Berthier, | C. E. | 180 miles. |
| " " | Three Rivers, | " | |
| " " | Quebec, | " | |
| From New York to | New Brunswick, | N. J. | 224 miles. |
| " " | Princeton, | " | |
| " " | Trenton, | " | |
| " " | Philadelphia, | Pa. | |
| " " | Wilmington, | Del. | |
| " " | Havre de Grace, | Md. | |
| " " | Baltimore, | " | |
| " " | Washington, | D. C. | |
| From Washington to | Georgetown, | " | 175 miles. |
| " " | Alexandria, | " | |
| " " | Fredericksburg, | Va. | |
| " " | Richmond, | " | |
| " " | Petersburg, | " | |
| From Philadelphia to | Lancaster, | Pa. | 296 miles. |
| " " | Harrisburg, | " | |
| " " | Carlisle, | " | |
| " " | Chambersburg, | " | |
| " " | Bedford, | " | |
| " " | Pittsburg, | " | |

| | | | | |
|---|---|---|---|---|
| From Philadelphia to | Port Richmond, | Pa. | } | 106 miles. |
| " " | Reading, | " | | |
| " " | Pottsville, | " | | |
| From Lancaster to | Columbia, | " | } | 25 miles. |
| " " | York, | " | | |
| From Pittsburg to | Wheeling | Va. | } | 120 miles. |
| " " | Wellsville, | " | | |
| " " | Zanesville, | O. | | |
| " " | Columbus, | " | | |
| " " | Dayton, | " | | |
| " " | Cincinnati, | " | | |
| " " | Massilon, | " | } | 130 miles. |
| " " | New Lisbon, | " | | |
| " " | Cleveland, | " | | |
| From Cincinnati to | Lawrenceburg, | " | } | 85 miles. |
| " " | Madison, | " | | |
| " " | Louisville, | Ky. | | |
| From New York to | Stamford, | Conn. | } | 237 miles. |
| " " | Bridgeport, | " | | |
| " " | New Haven, | " | | |
| " " | Hartford, | " | | |
| " " | Springfield, | Mass. | | |
| " " | Worcester, | " | | |
| " " | Boston, | " | | |
| From Boston to | Portland, | Me. | | 74 miles. |
| " " | Lowell, | Mass. | | 26 miles. |

Total extent, 2989 miles.

*Lines in Progress or Contemplated.*

In progress.

| | | | | |
|---|---|---|---|---|
| From Petersburg to | Raleigh, | Va. | } | 1427 miles. |
| " " | Fayetteville, | N. C. | | |
| " " | Cheraw, | S. C. | | |
| " " | Camden, | " | | |
| " " | Columbus, | " | | |
| " " | Charleston, | " | | |
| " " | Augusta, | Ga. | | |
| " " | Savannah, | " | | |
| " " | Macon, | " | | |
| " " | Columbus, | " | | |
| " " | Franklyn, | Ala. | | |
| " " | Montgomery, | " | | |
| " " | Mobile, | " | | |
| " " | New Orleans, | La. | | |

| | | | |
|---|---|---|---|
| From | Buffalo to Detroit, . . . . | 350 | miles. |
| " | Detroit to Milwaukie, . . . | 350 | " |
| " | Bridgeport to Montreal, . . . | 300 | " |
| " | Norwich to Worcester, . . . | 85 | " |
| " | Louisville to St. Louis, . . . | 300 | " |
| | | 1385 | " |
| | | 1427 | " |
| | | 2812 | " |

*Contemplated.*

| | | | |
|---|---|---|---|
| From | Macon to Florida. | | |
| " | Macon to Tennessee, . . . | 1000 | miles. |
| " | St. Louis to New Orleans, . . | 1000 | " |
| | | 2000 | " |

In computing the extent of lines in operation, the length of duplicate wires has not been taken into consideration; this will swell the amount to 3500 miles of telegraph at this moment in full operation,—(November, 1847.) The actual extent of *erected* wire is however much greater. The numerous branch lines that will shoot from the great southern route are not yet definitely arranged. The line projected from Buffalo to Milwaukie may be embarrassed in its progress, from conflicting claims in regard to priority of right to the territory, Mr. Henry O'Reilly insisting on its embracement in his great original contract. No doubt exists that the ground will be covered. The following general estimation is pretty nearly correct.

| | | |
|---|---|---|
| Lines complete, . . . . . | 2,989 | miles. |
| Second wires complete, . . . . | 511 | " |
| Lines in progress, . . . . . | 2,812 | " |
| " contemplated, . . . . . | 2,000 | " |
| Second wires in progress, . . . | 2,678 | " |
| | 11,000 | " |