THE POLYTECHNIC ASSOCIATION OF THE AMERICAN INSTITUTE.

The usual weekly meeting of the Association was held at its room at the Cooper Institute, on Thursday evening, Sept. 19, 1861. We publish an account of such portion of the proceedings as we think will be interesting to our readers.

EFFECT OF THE WAR ON THE MECHANIC ARTS.

President MASON read his paper on this subject. The first effect of the breaking out of the war was to draw off a large portion of mechanics. In the county opposite his residence on the North River, which has large manufacturing interests, it was easy to raise a regiment, while in Duchess county, a purely farming district, it was difficult to recruit a single company. Whatever else may be the result of the war, the South will learn *not to despise the mechanic arts*. Even if separation should result, this would not prove disastrous to the North.

Mr. GARBONNETTI—If the war should continue two or three years, cotton will be supplied from other places, and will cease to be produced in this country. If the cotton culture is abandoned, the cause of the war, slavery, will be permanently removed.

Dr. STEVENS—If the war should be short, as we all hope and pray that it may, it will produce only a temporary effect on our mechanical operations, but if it should last five or seven years, it will destroy our largest manufacturing interest. The machinery in the cotton manufacture must be adapted to the kind of staple worked. I have been told by manufacturers that a difference of a quarter of an inch, even, requires a change of machinery. Now there is no country except the United States that can raise the various kinds of cotton to which our machinery is adapted. To produce cotton successfully, several conditions of climate are required. Frequent showers combined with abundant heat must prevail in the early part of the season, while the plant is growing, and then a long period of dry weather is necessary for the gathering of the crop. Were the heat and moisture alone sufficient, the tropics would be the best places for cultivating cotton. The plant grows with great vigor in South America, but three quarters of the fiber always rots before it can be collected. Our glorious autumn days are to be found nowhere else on the face of this earth. The trade winds, which come across the Atlantic, become loaded with moisture, and as they are deflected northward over the land, they pour down their showers upon it. In the fall these winds are diverted to the south, and the showers cease, giving that long dry season which is devoted to picking cotton. A belt of country along our coast, stretching from Texas to the southern boundary of North Carolina, and extending inland from 100 to 300 miles, has peculiar advantages for producing the cotton fiber, which do not exist in any other place on the surface of our planet.

President MASON—I will remark, that in the early part of the year I devoted a good deal of time to investigating the efforts that have been made for procuring a supply of cotton for England. A very full history of these efforts is contained in the Reports of Parliamentary Debates, of which a set is to be found in the Astor Library. I read the reports relating to this subject from beginning to end. The great effort to introduce the culture of cotton in India commenced in 1841. The plan was then adopted of sending experienced cultivators from this country to India, with seed, utensils and all conveniencies for prosecuting the labor. The enterprise was persevered in, notwithstanding its discouraging failures, for fourteen years; finally, after all these efforts, and the expenditure of vast sums of money, the scheme was abandoned as hopeless. The last entry in the records is in these words:—"*It is resolved that the cotton on hand shall be sent to China and sold for what it will bring, and the experiment shall be considered as closed.*"

SUBJECT FOR THE NEXT MEETING.

Mr. DIBBEN—I offer as the subject for the next evening, "Piers and Docks."

This was adopted, with the usual understanding that the proposer will open the discussion with an elaborate paper on the subject.

THE large carpet manufactory of E. S. Higgins & Co., Forty-third street, this city, which had been closed since the month of April last, commenced running again on the 16th ult.

Extracts from Fairbairn's Address.

At a meeting of the British Association for the Advancement of Science at Manchester, on the 3d of September, the President, Mr. William Fairbairn, made an address on the general state of science and art, from which we take the following extracts:—

SCIENCE BENEFICIAL.

At no former period did science contribute so much to the use of life and the wants of society. And in doing this it has only been fulfilling that mission which Bacon, the great father of modern science, appointed for it, when he wrote that "the legitimate goal of the science is the endowment of human life with new inventions and riches," and when he sought for a natural philosophy which, not spending its energy on barren disquisitions, "should be operative for the benefit and endowment of mankind."

CONSTITUTION OF THE SUN.

Our knowledge of the physical constitution of the central body of our system seems likely, at the present time, to be much increased. The spots on the sun's disk were noticed by Galileo and his cotemporaries, and enabled them to ascertain the time of its rotation and the inclination of its axis. They also correctly inferred, from their appearance, the existence of a luminous envelope, in which funnel-shaped depressions revealed a solid and dark nucleus. Just a century ago, Alexander Wilson indicated the presence of a second and less luminous envelope beneath the outer stratum, and his discovery was confirmed by Sir William Herschel, who was led to assume the presence of a double stratum of clouds, the upper intensely luminous, the lower gray, and forming the penumbra of the spots. Observations during eclipses have rendered probable the supposition that a third and outermost stratum of imperfect transparency encloses concentrically the other envelopes. Still more recently, the remarkable discoveries of Kirchoff and Bunsen require us to believe that a solid or liquid photosphere is seen through an atmosphere containing iron, sodium, lithium, and other metals in a vaporous condition.

We must still wait for the application of more perfect instruments, and especially for the careful registering of the appearances of the sun by the photoheliograph of Sir John Herschel, so ably employed by Mr. Warren de la Rue, Mr. Welsh and others, before we can expect a solution of all the problems thus suggested.

DYES IN COAL TAR.

What would now be the condition of calico-printing, bleaching, dyeing, and even agriculture itself, if they had been deprived of the aid of theoretic chemistry?

For example:—Aniline—first discovered in coal tar by Dr. Hoffman, who has so admirably developed its properties—is now most extensively used as the basis of red, blue, violet and green dyes. This important discovery will probably, in a few years, render this country independent of the world for dye stuffs; and it is more than probable that England, instead of drawing her dye stuffs from foreign countries, may herself become the center from which all the world will be supplied.

It is an interesting fact that at the same time in another branch of this science, M. Tournet has lately demonstrated that the colors of gems, such as the emerald, aqua-marina, amethyst, smoked rock crystal and others, are due to volatile hydro-carbons, first noticed by Sir David Brewster in clouded topaz, and that they are not derived from metallic oxyds as has been hitherto believed.

THE COMPOSITION OF STEEL.

In noticing the more recent discoveries in this important science, I must not pass over in silence the valuable light which chemistry has thrown upon the composition of iron and steel. Although Despretz demonstrated many years ago that iron would combine with nitrogen, yet it was not until 1857 that Mr. C. Binks proved that nitrogen is an essential element of steel, and more recently M. Caron and M. Fremy have further elucidated this subject; the former showing that cyanogen, or cyanide of ammonium, is the essential element which converts wrought iron into steel; the latter combining iron with nitrogen through the medium of ammonia, and then converting it into steel by bringing it at the proper temperature into contact with common coal gas. There is little doubt that in a few years these discoveries will enable Sheffield manufacturers to replace their present uncertain, cumbrous, and expensive process, by a method at once simple and inexpensive, and so completely under control as to admit of any required degree of conversion being obtained with absolute certainty. Mr. Crace Calvert has also proved that cast iron contains nitrogen, and has shown that it is a definite compound of carbon and iron mixed with various proportions of metallic iron, according to its nature.

INTERNAL HEAT OF THE EARTH.

It is well known that the temperature increases, as we descend through the earth's crust, from a certain point near the surface, at which the temperature is constant. In various mines, borings, and Artesian wells, the temperature has been found to increase about 1° Fah. for every sixty or sixty-five feet of descent. In some carefully-conducted experiments during the sinking of Dukinfield Deep Mine—one of the deepest pits in this country—it was found that a mean increase of about 1° in seventy-one feet occurred. If we take the ratio thus indicated, and assume it to extend to much greater depths, we should reach at two and a half miles from the surface strata at the temperature of boiling water; and at depths of about fifty or sixty miles the temperature would be sufficient to melt, under the ordinary pressure of the atmosphere, the hardest rocks. Reasoning from these facts, it would appear that the mass of the globe, at no great depth, must be in a fluid state. But this deduction requires to be modified by other considerations, viz., the influence of pressure on the fusing point, and the relative conductivity of the rocks which form the earth's crust. To solve these questions a series of important experiments were instituted by Mr. Hopkins, in the prosecution of which Dr. Joule and myself took part; and after a long and laborious investigation, it was found that the temperature of fluidity increased about 1° Fah., for every 500 lbs. pressure, in the case of spermaceti, beeswax and other similar substances. However, on extending these experiments to less compressible substances, such as tin and barytes, a similar increase was not observed. But this series of experiments has been unavoidably interrupted; nor is the series on the conductivity of rocks entirely finished. Until they have been completed by Mr. Hopkins, we can only make a partial use of them in forming an opinion of the thickness of the earth's solid crust. Judging, however, alone from the greater conductivity of the igneous rocks, we may calculate that the thickness cannot possibly be less than nearly three times as great as that calculated in the usual suppositions of the conductive power of the terrestrial mass at enormous depths, being no greater than that of the superficial sedimentary beds. Other modes of investigation which Mr. Hopkins has brought to bear on this question appear to lead to the conclusion that the thickness of the earth's crust is much greater than that above stated. This would require us to assume that a part of the heat in the crust is due to superficial and external rather than central causes. This does not bear directly against the doctrine of central heat, but shows that only a part of the increase of temperature observed in mines and deep wells is due to the outward flow of that heat.

STEAM PLOWING.

I cannot conclude this notice of the steam engine without observing the changes it is destined to effect in the cultivation of the soil. It is but a short time since it was thought inapplicable to agricultural purposes from its great weight and expense. But more recent experience has proved this to be a mistake, and already in most districts we find that it has been pressed into the service of the farm. The small locomotive, mounted on a frame with four wheels, travels from village to village with its attendant, the thrashing machine, performing the operations of thrashing, winnowing and cleaning at less than one-half the cost by the old and tedious process of hand labor. Its application to plowing and tilling on a large scale is, in my opinion, still in its infancy; and I doubt not that many members of this association will live to see the steam plow in operation over the whole length and breadth of the land. Much has to be done before this important change can be successfully accomplished; but, with the aid of the agriculturist preparing the land so as to meet the requirements of steam machinery, we may reasonably look forward to a new era in the cultivation of the soil.

THE BESSEMER STEEL.

Previously to the invention of Henry Cort the manufacture of wrought iron was of the most crude and primitive description. A hearth and a pair of bellows were all that were employed. But since the introduction of puddling the iron masters have increased the production to an extraordinary extent, down to the present time, when processes for the direct conversion of wrought iron on a large scale are being attempted. A consecutive series of chemical researches into the different processes, from the calcining of the ore to the production of the bar carried on by Dr. Percy and others, has led to a revolution in the manufacture of iron; and although it is at the present moment in a state of transition, it neverthelsss requires no very great discernment to perceive that steel and iron of any required tenacity will be made in the same furnace with a facility and certainty never before attained. This has been effected, to some extent, by improvements in puddling; but the process of Mr. Bessemer—first made known at the meetings of this association at Cheltenham—affords the highest promise of certainty and perfection in the operation of converting the melted pig direct into steel or iron, and is likely to lead to the most important developments in this manufacture. These improvements in the production of the material must, in their turn, stimulate its application on a larger scale and lead to new constructions.

IRON SHIPBUILDING.

In iron shipbuilding an immense field is opening before us. Our wooden walls have, to all appearance, seen their last days; and as one of the early pioneers in iron construction as applied to shipbuilding, I am highly gratified to witness a change of opinion that augurs well for the security of the liberties of the country. From the commencement of iron shipbuilding in 1830 to the present time, there could be only one opinion among those best acquainted with the subject, namely, that iron must eventually supersede timber in every form of naval construction. The large ocean steamers *Himalaya*, the *Persia* and the *Great Eastern* abundantly show what can be done with iron, and we have only to look at the new system of casing ships with armor plates to be convinced that we can no longer build wooden vessels of war with safety to our naval superiority and the best interests of the country. I give no opinion as to the details of the reconstruction of the navy—that is reserved for another place—but I may state that I am fully persuaded that the whole of our ships of war must be rebuilt of iron, and defended with iron armor calculated to resist projectiles of the heaviest description at high velocities.

WROUGHT IRON GUNS.

The rifling of heavy ordnance, the introduction of wrought iron, and the new principle of construction with strained hoops, have given to all countries the means of increasing enormously the destructive power of their ordnance. One of the results of this introduction of wrought iron, and correct principles of manufacture, is the reduction of the weight of the new guns to about two-thirds the weight of the older cast-iron ordnance. Hence follows the facility with which guns of much greater power can be worked, whilst the range and precision of fire are at the same time increased. But these improvements cannot be confined to ourselves. Other nations are increasing the power and range of their artillery in a similar degree, and the energies of the nation must, therefore, be directed to maintain the superiority of our navy in armor as well as in armament.

IRON BRIDGES.

We have already seen a new era in the history of the construction of bridges, resulting from the use of iron; and we have only to examine those of the tubular form over the Conway and Menai Straits to be convinced of the durability, strength and lightness of tubular constructions applied to the support of railways or common roads, in spans which, ten years ago, were considered beyond the reach of human skill. When it is considered that stone bridges do not exceed one hundred and fifty feet in span, nor cast-iron bridges two hundred and fifty feet, we can estimate the progress which has been made in crossing rivers four hundred or five hundred feet in width, without any support at the middle of the stream. Even spans, greatly in excess of this, may be bridged over with safety, provided we do not exceed eighteen hundred to two thousand feet, when the structure would be destroyed by its own weight.

SUPPLY OF WATER FOR LONDON.

We may reasonably look forward to an extension of similar benefits to the metropolis, by the same engineer, Mr. Bateman, whose energies are now directed to an examination of the pure fountains of Wales, from whence the future supply of water to the great city is likely to be derived. A work of so gigantic a character may be looked upon as problematical, but when it is known that six or seven millions of money would be sufficient for its execution, I can see no reason why an undertaking of so much consequence to the health of London should not ultimately be accomplished.

OCEAN TELEGRAPHY.

It is well known that three conditions are essential to success in the construction of ocean telegraphs—perfect insulation, external protection and appropriate apparatus for laying the cable safely on its ocean bed. That we are far from having succeeded in fulfilling these conditions is evident from the fact that out of twelve thousand miles of submarine cable which have been laid since 1851, only three thousand miles are actually in working order; so that three-fourths may be considered as a failure and loss to the country. The insulators hitherto employed are subject to deterioration from mechanical violence, from chemical decomposition or decay, and from the absorption of water; but the last circumstance does not appear to influence seriously the durability of cables. Electrically, india rubber possesses high advantages, and, next to it, Wray's compound and pure gutta percha far surpass the commercial gutta percha hitherto employed; but it remains to be seen whether the mechanical and commercial difficulties in the employment of these new materials can be successfully overcome. The external protecting covering is still a subject of anxious consideration. The objections to iron wire are its weight and liability to corrosion. Hemp has been substituted, but at present with no satisfactory result. All these difficulties, together with those connected with the coiling and paying out of the cable, will no doubt yield to careful experiment and the employment of proper instruments in its construction and its final deposit on the bed of the ocean.

Reopening of the Polytechnic College.

This institution commenced its Ninth Annual Session in Philadelphia on the 16th ult., after a vacation of nine weeks. Advantage has been taken of the interval to increase and rearrange the cabinets of mineralogy, geology and paleontology, to refit the chemical laboratory and add to the instruments and other apparatus of illustration. The faculty has been increased in numbers and efficiency by the appointment of Col. Charles M. Eakin, formerly instructor at West Point, as Superintendent of Military Instruction, and Mr. Emil Pollmer, formerly of the Royal School of Mines, Freiberg, Saxony, as assistant in the Schools of Mines and Chemistry. The other members of the faculty are Henry Vethake, LL. D., Professor of Higher Mathematics; L. Geo. Franck, C. E., Professor of Engineering, Mechanics, Architecture and Drawing; Alfred L. Kennedy, M. D., Professor of Geology, Mineralogy and of General and Applied Chemistry; Furman Sheppard, A. M., Lecturer on Industrial Jurisprudence; V. de Amarelli, LL. D., Ph. D., Professor of Modern Languages and Literature; D. Dwight Willard, Adjunct Professor of Mathematics and Instructor in Scientific School; and J. F. Holt, M. D., Instructor in Scientific School. The classes of the Polytechnic are annually increasing in numbers.

GALVANIZING CAST IRON.—The *Moniteur du Commerce* says that all the difficulties of coating cast iron with copper by the galvanic process have been overcome by M. Oudry, of Paris, by the simple process of varnishing the iron before placing it in the bath. The *Moniteur* states that there are in the *Bois de Boulogne* three kinds of candelebra, the first in bronze, the second in cast iron painted, and the third in cast iron covered with copper by M. Oudry's process; and those of the last kind alone have preserved their luster. "They are as brilliant and perfect as at the moment of coming from the work shop." The kind of varnish employed is not given.

On the Manufacture of Collodion.

The following record of experiments are given in the *Journal of Maryland College*, by Mr. Wm. S. Thompson. He says:—

For the purpose of testing the solubility of the cotton in menstrua of ether and alcohol mixed in various proportions, I prepared a series of three, which I will designate by numbers, as follows:—

No. 1.

Ether, parts, by measure	....	5
Alcohol,	do.	1

No. 2.

Ether, parts, by measure	....	4
Alcohol,	do.	1

No. 3.

Ether, parts, by measure	....	3
Alcohol,	do.	1

FIRST EXPERIMENT.

Sixty grains of carded cotton were immersed in the following mixture: Nitric acid (sp. gr. 1.41), 1 fluid ounce; sulphuric acid (commercial), 1 fluid ounce. Having mixed the acids in a shallow porcelain dish, the temperature rose to 90° Fah., and fell to 80° Fah., when the cotton was immersed. At the expiration of ten minutes, the cotton was thorougly washed with water and dried at a low temperature. One part of this cotton and 150 parts by weight of menstruum No. 1 formed a very thick collodion, leaving a small quantity of undissolved sediment. With menstruum No. 2, in the some proportion, it also formed a good collodion, with about the same amount of sediment as in No. 1. With menstruum No. 3, in the same proportion, it formed a thick collodion with scarcely a trace of sediment or undissolved cotton.

SECOND EXPERIMENT.

Sixty grains of cotton were immersed in the acid mixture in the same proportion as in the first experiment, in a deep porcelain mortar. Upon mixing the acids, the temperature rose to 105° Fah., and fell to 95° upon immersing the cotton. By this experiment, a more soluble cotton was formed than in the first experiment; but menstruum No. 3 proved to be the best solvent.

THIRD EXPERIMENT.

This experiment was made with double the amount of material used in the preceding, in the same mortar. Upon mixing the acids, the temperature rose to 120° Fah., and fell to 110° Fah. when the cotton was immersed. The resulting cotton was entirely soluble in menstruum No. 3, but with Nos. 1 and 2, leaving a small quantity of sediment.

From the foregoing experiments, I infer that an elevated temperature, say from 110° to 130° Fah., is favorable to the formation of a very soluble collodion cotton, and that a menstruum containing a large proportion of alcohol is the best solvent.

Ginseng for China.

A short time ago no less than fifty tuns of ginseng was shipped from St. Paul's, Minn., for China, *via* New York. We receive tea and silk and pig tails from the Mandarins, and in return send cotton cloth, ginseng and gold. No less than one hundred and fifty tuns of ginseng are sent from Minnesota annually, all of which, we believe, goes to China. It is shipped in casks which contain about two hundred and fifty pounds each, and the price is about eighty cents per pound. It is said to be quite a profitable herb to dig up for export. It grows in the Northern, Middle and Western States, and the root is largely used as a favorite medical drug by the descendants of Shem in China.

Ginseng contains starch, gum, resin and a peculiar essential oil. Before it is taken as a medicine the custom pursued by each Chinaman is to rest in quietude for several hours, communing with the ghosts of his forefathers; afterward it is a sure cure, we suppose.

EIGHTY YEARS' PROGRESS OF THE UNITED STATES.—We have received from the publisher, L. Stebbins, of Worcester, Mass., a work in two large volumes bearing the above title. It is designed to show the various channels of industry and education through which the people of the United States have arisen from a British colony to their present national importance. It contains elaborately illustrated articles on the fur trade, the hat manufacture, improvements in the means of travel and transportation, manufactures of cotton, wool, paper, leather, boots and shoes, firearms, cutlery, carriages and coaches, clocks and watches, electroplated ware, pins, refined sugars, silk, fireproof safes, bank locks, glass, india-rubber, &c., &c., &c. It contains a vast mass of valuable information in a form accessible to all, and we think every family in the land ought to possess a set of these volumes for ready reference.

THE ROTHSCHILDS are now chief owners of the London *Times*. Suspicious people see in this fact an explanation of its persistent attacks upon American credit, which they hope will enable them to get the loan cheaper. It would be singular if we should bring the war to a close without going to Jew or Gentile in England for help.

Testing Tubes.

We have received a pamphlet by Charles Legge, Civil Engineer, entitled "A Glance at Victoria Bridge," giving a very interesting history of the rise and progress of that gigantic structure. The author gives the following account of the manner in which the great tubes were tested, and of his personal experience in connection with the experiment:—

On the 15th of December, preparations were completed for a final test of the strength of the tubes; singularly enough at the same time, with the close of navigation, when vast fields of ice, under nature's superintendence, were hurling their solid masses against the masonry of the piers and testing their efficiency and strength by over one million tuns a minute. Any force or weight man could bring into comparison with this, would be puny in the extreme.

Yet notwithstanding the inability of competing with nature's test, a load had been obtained such as seldom before was seen for alike purpose. A train of platform cars 520 feet in length, extending over two tubes, was loaded, almost to the breaking limit of the cars, with large blocks of stones, and in readiness for the experiment.

Prior to this a steel wire was extended the entire length of the tubes for the purpose of measuring the deflection, and strained by heavy weights as tightly as possible over pulleys at every bearing of the tube. This wire formed the datum from which all movements were to be measured on slips of card attached to vertical staves at various points along the tube.

During the two days occupied with the test the public were rigorously excluded, none being admitted by Mr. Hodges to witness the experiment but Mr. Keefer, Deputy Commissioner of Public Works, Canada, the engineers belonging to his staff, with Mr. Ross, and the two engineers from England. At each slip of paper one of his assistants was placed and provided with a lamp and a pencil by which to make the necessary marks.

The loaded train was then taken hold of by two of the most powerful engines belonging to the Grand Trunk and, with extreme difficulty from the great weight, brought into the first two tubes, beyond which all their united efforts failed to draw it. A third engine having been obtained, the three were barely able to force the load along to the centre of the bridge; when night coming on, the test of the remaining portion of the bridge was deferred until the following day.

Early next morning, the interesting experiment was resumed, and concluded during the day.

In giving the result of the fearful ordeal to which the tubes were subjected, we will only note the deflection on a pair of the side tubes, the others being similar, and the central one.

When the train covered the first tube, the deflection in the centre amounted to $\frac{1}{8}$ of an inch, and the adjoining one, to which it was coupled, was lifted in the middle $\frac{3}{8}$ of an inch. The load then being placed over both tubes, the deflection was the same in each, or $\frac{3}{4}$ of an inch in the middle; and on being entirely removed, both tubes resumed their original level.

The large centre span, entirely disconnected from the other tubes, on being covered with the load throughout its entire length, deflected in the centre only $1\frac{7}{8}$ inches, and came back to its previous level on the load being removed.

All these results were considered highly satisfactory, as being considerably within the calculated deflection for such a load according to formulæ well known and generally made use of.

Nothing exemplified more strongly the confidence felt by Mr. Hodges in the strength of the work, than the severe test to which he exposed it. The writer well remembers the "peculiar feelings" he experienced when standing at the marking-post assigned him, surrounded at the same time by an Egyptian darkness, dense enough to be felt, arising from the condensed steam and the smoke of the engines, and totally obscuring the light of a glass lamp two feet distant. To thus stand closely pressed up against the side of the tube, with eyes and lamp brought within a few inches of the datum-line intently watching its movements, and leaving but sufficient room for the slipping, groaning, puffing but invisible engines and their heavily loaded cars to pass, with but a quarter of an inch of boiler-plate between time and eternity; or when mentally reasoned back to safety and security, and while listening, during the stoppage of the train, to the surging, cracking, crashing ice far below, as it swept past, to have those feelings of personal security dissipated in a moment by the thought of an over-loaded car breaking down and burying the deflection-observer beneath its weight, was surely reason enough for the existence of the "peculiar feelings" alluded to.

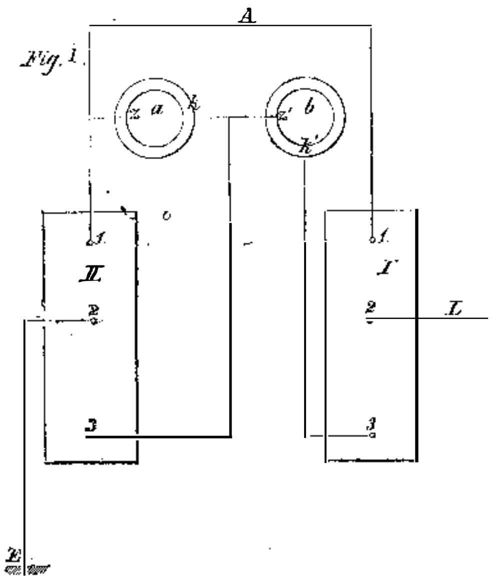
NEW METHOD OF TRANSMITTING SIMULTANEOUSLY TWO DISPATCHES ON ONE WIRE.

[Translated from the Journal of the Austrian Telegraph Association.]

In order to transmit two dispatches from one station to another simultaneously through one wire, the instruments have to be so arranged that the same make four different results possible in the four different cases. In transmitting two dispatches simultaneously in the same direction through the same wire, either two signals have to be transmitted at once, or one signal of the first or one signal of the second dispatch only, or, finally, no signal at all. Those four cases must be distinguishable at the transmitting station, and particularly at the receiving station.

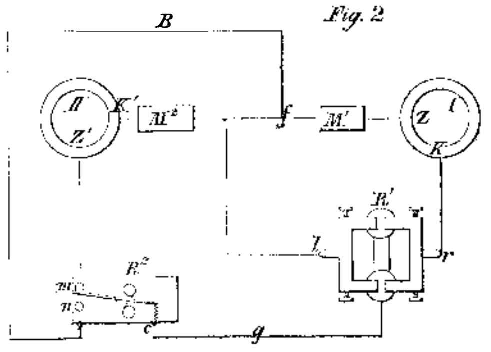
In the transmitting station two ordinary Morse keys, I and II, Fig. 1, are employed. The fulcrum, 2, of the key, 1, is connected with the line wire, L, and the fulcrum of the key, II, with the earth, E. The working contact, 3, of the first key connects with the rest contact of the second key, and in this connection the double line battery, *a b*, is inserted. The rest contact of the key, I, connects with the rest contact, *i*, of the key, II, and consequently with the zinc pole, *z*, of the battery, *a*; and, finally, a wire extends from the working contact, 3, of the second key to the wire connecting the copper pole, *k*, of the battery, *a*, with the zinc pole, *z'*, of the battery, *b*. In transmitting two dispatches simultaneously, one through each key, the following four cases may occur:—

First, Two signals are transmitted simultaneously. In this case both keys are depressed, and the battery, *b*, is closed; a positive current passes from its copper pole, *k'*, through 3 and 2 of the key, I, and through the line wire, L, to the receiving station, B, thence down into the earth, and through 2 and 3, of the key, II, back to the zinc pole, *z'*, of the battery, *b*.



Second, One signal of the second dispatch only to be transmitted. In this case the key, II, is depressed and the battery, *a*, is closed, and a current of equal power passes in an opposite direction through the line wire. If the former current is positive, this is negative, passing from the zinc pole, *z*, of the battery, *a*, through 1 and 2 of the key, I, and through L to the receiving station, thence to the earth and through the earth, and 2 and 3 of the key, II, back to the copper pole of the battery, *a*.

Third, To transmit one signal of the first dispatch only. In this case the key, I, is depressed, and



thereby both batteries are closed. A positive current of double power passes through the line wire, starting from the copper pole, *k'*, in the battery, *b*, through 3 and 2 of the key, I, and through L to the receiving station, thence down into the earth, and from E, through 2 and 1 of the key, I, to the zinc pole of the battery, *a*.

Fourth, To transmit no signal. In this case neither of the keys is depressed, and no current passes through the line wire.

The four cases in transmitting therefore are as follow:—Single positive current; single negative current; double positive current; no current.

In the receiving station three different receiving instruments are employed, one to be operated by the negative, the other by the single positive, and the last by the double positive currents. This latter instrument consists of an ordinary relay, R2, Fig. 2, the armature of which vibrates between the two points of contact, *m* and *n*, the point, *c*, being continually connected with said armature. When at rest, the armature is in contact with the point, *m*, and it is brought in contact with the point, *n*, whenever a positive current of double power passes through the line wire.

The first and second receiving instruments consist of a double relay, R1, connected and provided with two armatures, *r* and *l*, the armature, *l*, being operated by negative, and the armature, *r*, by positive currents of ordinary power.

The balance of the fixtures of the receiving station will be easily understood. M' and M2 represent the two Morse instruments; I and II two local batteries, the copper pole, K, of the first being connected with the armature, *r*, and its zinc pole, Z, with one end of the helix of the instrument, M', while the other end of this helix is connected by means of the wire, *f*, with the first end of the helix in the instrument, M2, and the second end of the latter with the copper pole of the local battery, II. The zinc pole of this local battery connects with the point, *m*, of the relay, R2, and the point, *n*, of this relay is connected with the wire, *f*, between the two instruments, M' and M2. Finally, the armature of the relay, R2, connects through the point, *c*, and wire, *g*, with the cores of the relay, R', and the armature, *l*, of this relay is connected with the wire, *f*, between the instruments, M' and M2. Consequently the relay, R', is inserted in such a manner that the local current always passes through the cores of the electro-magnets in R', and through the wire, *g*; the line current, on the other hand, circulates round the cores of the relays, R' and R2, one after the other. The spring of the relay, R2, has a greater tension than that of the relay, R', and in order to be able to regulate both springs simultaneously, according to the power of the current, they connect both to one nut, which serves to adjust the springs. The four different cases of transmitting signals produce the following results on the receiving station:—

1st. Two signals given; that is, a single positive current in the line wire. By this current the the armature, *r*, is attracted, while the armature of R2 remains in contact with the point, *m*; both local batteries are closed, the current passing from K, in the battery, I, through *r* and *g*, to *c*, and through *m* to Z' and K' of the battery, II, and through M2, *f* and M', to the zinc pole, Z, in I. Both instruments, M' and M2, operate and produce the signal on the paper. Both local batteries being closed the local current has sufficient power to operate both instruments.

2d. One signal of the second dispatch given; that is, a single negative current in the line wire. By this current the armature, *l*, of the relay, R' is attracted, and the armature of R2, remains still in contact with the point, *m*; by this the local battery, II, only is closed and its current passes from K' through M2, and *f* to *l*, thence through *g*, *c* and *m*, back to Z', in II. The signal of the key, II, therefore, is recorded by the instrument, M2.

3d. One signal of the first dispatch given; that is, a double positive current in the line wire. By this current the armature of the relay, R2, is brought from the point, *m* to *n*, and at the same time the armature *r*, of the relay, R', is attracted and brought in contact with the core; by this the local battery, I, is closed and its current passes from K through *r* and *g* to *c*, thence to *n*, and through *h*, *f* and M', back to the zinc pole, Z, of the battery, I. The signal of the key, I, is recorded by the instrument, M'.

4th. No signal is transmitted, that is, no current in the line wire. In this case neither the local battery, I, nor II is closed, since the armatures of both relays remain unaffected, and consequently no signal is recorded by either of the instruments, M' M2.

It remains to describe the arrangement of the several instruments for transmitting and recording two dispatches sent simultaneously through the same wire in opposite directions.

The district immediately around Manchester, England, contains two hundred cotton manufacturing settlements. The amount of English capital embarked in the cotton manufacture in 1836 was £35;-000.000. In 1861 it is £100,000,000.

State and county fairs are now in full blast all through the Eastern and Western States, and appear to be kept up with unflagging interest. The exhibitions of agricultural products, too, appear to be as good as usual.