

THE ELDER STATUE.

OUR illustration shows the statue lately erected at Govan, by public subscription, to the memory of John Elder, engineer and ship builder.

John Elder was born in Glasgow on March 8, 1824, and received his elementary education in the high school of that city. In those arts associated with mechanical science he was an apt pupil, and made rapid progress in acquiring the fundamental principles which he, in after years, so successfully carried into practice. The only university education he received was in the civil engineering classes in the Glasgow College. The workshop was, indeed, his great school, and his father was his most painstaking and valuable teacher. He served his apprenticeship of five years as an engineer with Robert Napier, under the direct control of his father, David Elder, and after a brief sojourn in one or two works in England, he returned to Napier's works to take charge of the drawing office. Here he gained great experience. In 1852 he joined the firm of Randolph, Elliott & Co., who were then millwrights, but on the accession of young Elder became marine engineers, the title of the firm being at the same time changed to Randolph, Elder & Co. Shipbuilding was added in 1860, and eight years afterward John Elder became sole proprietor, but subsequently the title was changed to John Elder & Co. The subject of this notice was seldom content with machines and tools as he found them, and was continually improving. His great idea was to add to the efficiency of the marine engine by reducing the friction of the parts, increasing the power, and at the same time decreasing the consumption of fuel. Among his first acts was to experiment on Watt's old steam jacket, greatly improving it, and he thereby brought it again into favor. The crowning act of his genius, however, was the application to the marine engine of the principle of expanding steam in two cylinders, now called the high and low pressure cylinders. The new engine was described by himself in the patent taken out by Charles Randolph and himself on January 24, 1853, as "an arrangement of compound engines adapted to the driving of the screw propeller. The engines are vertical, direct acting, and geared. The pistons of the high and low pressure cylinders move in contrary directions and drive diametrically opposite cranks with a view to the diminution of strain and friction." These engines were placed in the SS. Brandon, built in 1854. In July the vessel went on her trial, which was closely watched by all engineers. The consumption of fuel was reduced from about 4½ lb. per indicated horse power to 3¼ lb. Encouraged by the success of this, the first venture, Mr. Elder continued his experiments and made several improvements on the engine. The Admiralty, in 1863, adopted, in the Constance, the compound engine as improved, and to test the invention in a thorough way, this vessel, with two of similar dimensions, Octavia and Arethusa, having other kinds of engines, went on a trip from Plymouth to Funchal, in Madeira. When the Constance was within 30 miles of Funchal, she was 130 knots ahead of the Octavia and 200 knots from the Arethusa. The engines of the latter two had then to be stopped, owing to the coal on board being nearly exhausted, and they finished the distance under canvas. The superiority in power of the Constance's engines was established, and her consumption of coal per indicated horse power was less, being 2.51 lb., while it was 3.17 lb. in the Octavia and 3.64 lb. in the Arethusa. The mean indicated horse power of the engines in the three vessels during the trip was 1747, 1399.8, and 1052.2 respectively. In other respects, too, the Constance gained the advantage, and so thoroughly was the value of the compound engine established that it was almost universally adopted thereafter. Mr. Elder and his partner continued to improve the engine, over a dozen patents being taken out by them for various apparatus, but it is too late in the day to write more on the subject.

The Elder statue, as is most fitting, is erected within the bounds of the beautiful park of 37 acres given by Mrs. John Elder to the people of Govan, at a cost of upward of 50,000*l*. It is situated in the west end of Govan, opposite the Fairfield works, which by the genius and perseverance of John Elder attained such an eminent position among shipbuilding and engineering establishments. The park, as is testified by an inscription on the band stand, was laid out by his widow as a memorial of her husband, John Elder, and his father, David Elder, both of whom had always taken a deep interest in the working classes. While such a gift was well fitted to remind passing generations of the man, the people of Govan had decided to do something as much to show their respect for and gratitude to the man as to commemorate his name his genius, and his good deeds. The beautiful erection which we illustrate is the result of this decision.

Mr. J. E. Boehm, R.A., the artist, must be congratulated on the excellence of the production, not only from an artistic point of view, but in consideration of the good likeness. In effecting the latter, he was assisted principally by a bust of the late Mr. Elder, executed by Mr. Power, of Florence, and by photographs. The statue, which is 10 ft. in height, represents John Elder standing in an attitude which those who knew him best will at once recognize as a favorite one. It is easy and very graceful. The countenance clearly indicates the reflective habits of the man, while the contented, almost sweet, smile in the eyes betokens a measure of success. This one might reasonably trace from his glance to the compound engine, a model of which stands on his left side, and which his hand touches approvingly. The pose of the head, which slightly inclines forward to enable the eyes to rest on the engine, must have been a difficult one to model; but it has been successfully done, and the statue, as we have already hinted, is a true example of Mr. Boehm's art. It was cast in bronze at the works of Mr. Moore, of Thames Ditton, Surrey.

The masonry on which the statue and engine stand is 12 ft. in height, and the base is 9 ft. square. The pedestal proper is composed of three massive blocks of red Peterhead granite highly polished, elevated on two steps of finely axed gray Aberdeen granite. The red granite blocks, which make up the larger and more important part of the structure, are magnificent stones of "brilliant color." It is difficult to find such large masses of this mineral without large spots of dark color, which very much detract from its beauty, but the sculptors in this case have been fortunate in get-

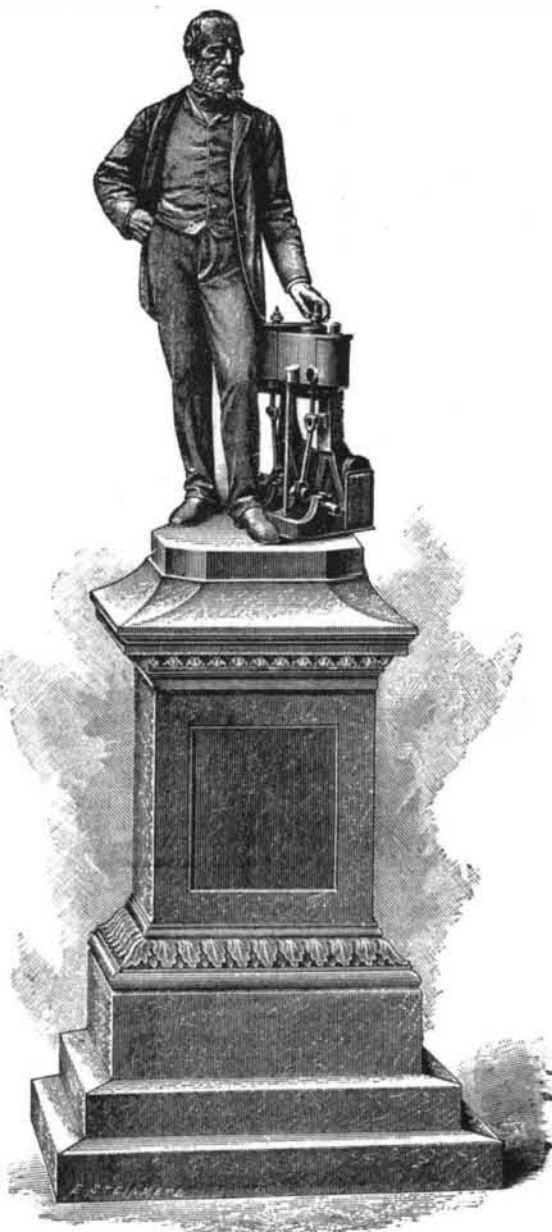
ting stones remarkably free from this disfigurement. The designer has been equally happy in the adornment. The mouldings of the upper base and the cornice of the pedestal, the only carvings on the structure, are similar to those usually found on pedestals of Corinthian columns, but boldly treated to suit the material. The ogee moulding on both base and cornice is covered by bronze acanthus leaf ornament, supplied by the sculptor. The effect is to very much enhance the appearance of the dado, which on all four sides is about 5 ft. high by 4 ft. broad. On each side there is a recess into which has been fitted a bronze panel, and each of these tablets bears a different inscription as appended. The order in which the paragraphs are given indicate the inscriptions on the front, right, left, and back panels.

"John Elder, engineer and shipbuilder, born at Glasgow, March 8, 1824, died September 17, 1869."

"To commemorate the achievements of his genius, and in grateful acknowledgment of his services to the community among whom he lived, this statue was erected by public subscription, July, 1888."

"By his many inventions, particularly in connection with the compound engine, he effected a revolution in engineering, second only to that accomplished by James Watt, and in great measure originated the developments in steam propulsion which have created modern commerce."

"His unwearied efforts to promote the welfare of the working classes, his integrity of character, firmness of purpose, and kindness of heart, claim, equally with his genius, enduring remembrance."



THE JOHN ELDER MEMORIAL.

The pedestal is surrounded by a number of pillars made of Aberdeen gray granite, connected by wrought iron chains. The sculptor work was done by Messrs. Alex. MacDonald & Co., limited, at their celebrated Aberdeen granite works. The red and gray granite blocks, of course, are from their own quarries, and were worked at Aberdeen. The statue was also raised into position by them at the request of Mr. Boehm.

An interesting ceremony took place during erection of the masonry. Ex-Provost Campbell, Govan, who, as chairman of the executive committee, has taken an energetic part in carrying out the proposal, placed in a cavity in the center of one of the stones forming the pedestal a casket containing several documents connected with John Elder and his family, including a portrait in enamel of the deceased gentleman, a photograph of his wife, an engraved portrait of his father, a printed memoir of John Elder, a patent specification of improvements by John Elder on steam engines and boilers, marked "A.D. 1862, 25th April, No. 1214," and several documents in connection with the Govan Park and burgh. The casket was hermetically sealed, and on the cavity itself was placed a granite cover similarly sealed.—*Engineering*.

ELECTROLYSIS BY ALTERNATE CURRENTS.

A VERY interesting paper has been communicated to the Académie des Sciences by MM. G. Maneuvrier and J. Chappuis with reference to the evolution of gas by means of alternate currents. When alternate currents are sent through an ordinary voltameter, with plates or large platinum wire electrodes immersed in water acidulated with pure sulphuric acid, no evolution of gas occurs, and it appears as if the acidulated

water were not decomposed at all by alternate currents. For instance, with current of four or five amperes at 250 to 300 volts, which would easily light either arc or incandescent lamps, no traces of evolution of gas at the electrodes can be observed, provided the dimensions of the electrodes exceed one millimeter ($\frac{1}{8}$ in.) diameter, and four or five centimeters ($1\frac{1}{2}$ in. or 2 in.) in length. The opinion has thus been promulgated that alternate currents do not produce electrolytic action. But the authors observe that this opinion is erroneous, and the absence of electrolytic action is only apparent. If very fine wires are substituted for large electrodes in the voltameter, the same alternate currents immediately cause an abundant discharge of gas. The authors consider that a double chemical action goes on where large electrodes are used, and indicate that, with proper precautions, the reactions, direct and indirect, are strictly proportionate to the quantity of electricity traversing the voltameter. The total effect may be realized by utilizing the double chemical effect by forming sub-oxides, and in this manner it would be possible to construct an electric meter for use on alternate current systems. They remark, however, that the evolution of explosive gases in this way renders the experiments exposed to continual small spontaneous explosions if certain precautions, which they intend to indicate in a further communication, are not taken.

ON THE PROPER SIZE OF TELEPHONE CONDUCTORS.

By DAVID BROOKS.

THE long distance telephone company work metallic circuits of No. 16 American gauge between Philadelphia and New York, the length of conductors being slightly over 200 miles, the distance by line being 100 miles, four miles of which are under ground or water, making eight miles of conductors under ground and water. The telephones work well; far better, indeed, than the local service in the city for even as short a distance as one quarter of a mile, even if they use the same gauge conductor. With the metallic circuit the resistance is fully eight hundred times that of these short lines. I mention this to show that conductivity or low resistance has very little to do with good telephonic service. In the one instance we get rid of inductive disturbances, and in the other we do not. Take an ordinary circuit, say one mile in length. Say that each receiver has a resistance of 100 ohms, and the induction coil 300 ohms, making a total of 400 ohms for the resistance of one instrument. Calling the conductor 20 ohms, we have a total resistance of 600 ohms in the circuit. Now, substituting a No. 21 gauge conductor, which has a resistance of about 70 ohms per mile, we have increased the resistance of the circuit about six per cent., and theoretically increased the magnetic effect six per cent. Now the No. 16 gauge wire has twice the surface of the No. 21 gauge, and gathers twice the quantity of inductive disturbance. It has twice the electro-static capacity and twice the retardation if electro-static capacity and retardation are identical.

There is no trouble hearing the voice in these short circuits in either case, but the difficulty lies in getting distinct articulation. As an illustration, we have a telegraph cable of 53 conductors on the Pennsylvania Railway between Broad and Thirty-second streets, a distance of $1\frac{1}{2}$ miles. Twenty-eight of the conductors are in use, mostly for telegraphic purposes. The other 25 are idle. Using one of the wires with the telephone, it works fairly well, but if we bunch all the idle wires at each end and use them as a single conductor, we reduce the resistance of the conductor twenty-fivefold, and we increase the inductive disturbances to that extent, and develop a noise resembling that of a million promiscuously-tuned Chinese gongs. We can get no speech over that bunched conductor.

There is another view which may be taken of the case and the effects ascribed to self-induction, or as our European electricians now express it, "electro-static inertia." In reference to that phenomenon I will quote from Dr. Oliver J. Lodge. He states: "There is a remarkable fact concerning electrical currents of varying strength, which has been lately brought into prominence by the experimental skill of Prof. Hughes, viz., that a current does not start or stop equally and simultaneously at all points in the section of a conductor, but starts at the outside first. The fact is naturally more noticeable with thick wires than with thin, and it is especially marked in iron wires. . . . To illustrate this matter further, rotate a common tumbler of liquid steadily for some time and watch the liquid, dusting powder, perhaps, over it to make it more visible, you will see first the outer layer begin to participate in the motion and then the next, and then the next, and so on, until at length the whole is in rotation. Stop the tumbler and the liquid also begins gradually to stop by a converse process." Again he states: "We learn from all this that whereas, in the case of steady currents, the sectional area and material of the conductor or are all that need be attended to, the case is different when one has to deal with rapidly alternating currents, such as occur in a telephone."

I am not familiar by practice or experiment with electro-static inertia, but infer from what I read that it is unfavorable for the use of large sized conductors for telephone purposes. I am firm in the belief, however, that small conductors, when used for ordinary lengths, are far preferable to those that have been heretofore employed. That for overhead wires strung on poles or house tops, a phosphor-bronze conductor, on account of its strength and small diameter, is far superior to iron or copper, because it can be made with very small diameter, and yet have sufficient strength and conductivity. I believe also that there have been thousands or hundreds of thousands of dollars spent for copper which could have been saved and a better service obtained by using smaller sized conductors.

Before the conductors referred to in the iron pipe were connected to the overhead conductors, a number of experiments were made with telephones, using the iron pipe for the return circuit, so as to compare its effect with that of the complete copper metallic circuit. No inductive disturbance was perceived in either case, nor did the copper metallic circuit show any advantage over the circuits using the pipe for the return current. In the center of the cable is a smaller sized wire, No. 18 American gauge, upon which we still use telephones; and, although there are heavy dynamo currents upon four of the No. 16 conductors in the same cable, or

group, the No. 18 conductor for telephone purposes, using the pipe for the return circuit, works much clearer and better than any of the circuits of the local telephone company, whose wires are strung upon poles or house tops.

And this brings to my mind a suggestion of Oliver Heaviside, that electro-static inertia, or self-induction, might be neutralized by mutual induction, since it does appear that the iron pipe has something to do with the good working of the telephone conductor.—*The Electrical World*.

THE MECHANISM OF ELECTROLYSIS BY ALTERNATING CURRENTS.

It is considered as an established fact, say MM. J. Chappuis and G. Maneuvrier in *Comptes Rendus*, that we cannot decompose sulphate of copper by alternating currents. The absence of all electrolytic phenomena in this case is explained by supposing that the copper deposited on each electrode is immediately redissolved by the inverse current. This negative experiment is even presented as a proof of the equality of the two successive induced currents as far as their quantity of electricity is concerned. We have been enabled to justify this explanation by rendering the decomposition of sulphate of copper visible, just as we have done with acidulated water, though this novel experiment is both more complex than the former (*Comptes Rendus*, June 18, 1888) and more difficult to carry out.

If we substitute in the platinum wire voltameter a strong solution of sulphate of copper for the acidulated water, currents of a mean intensity of $2\frac{1}{2}$ amperes, which previously produced a plentiful escape of detaching gas, produce nothing in the sulphate except a considerable heating, but if we then reduce the dimensions of the electrodes to 0.1 millimeter in diameter and 20 millimeters in length (= about 6 square millimeters of surface), there appears at once an escape of gas and a deposit of copper.

The electrolysis succeeds equally well with copper electrodes of the same dimensions. As soon as the current passes, we see arise a sheet of fine bubbles and a reddish brown cloud of pulverulent copper, and the electrodes themselves quickly take the aspect of spongy copper freshly reduced.

It seems, therefore, to follow from the whole of our experiments that, in electrolysis by alternating currents, it is always possible to reach a sort of equilibrium between the rate of decomposition of the electrolyte and the rate of recombination of its elements.

When once this equilibrium is reached, there is no longer, or, at least, there no longer appears, an electrolysis properly so called. But then all the circumstances which may make the former rate predominate over the latter will cause the products of the electrolysis to reappear; and, on the contrary, all which tend to make the rate of decomposition predominate will make such products again disappear.

In the first rank of the conditions which accelerate the electrolysis, we must name the *density* of the current, that is, the ratio of its mean intensity to the surface of the electrodes. It is evident that if, on the one hand, we increase the quantity of electricity which traverses the electrode, and, on the other hand, diminish the surface of the electrodes, we shall cause the rate of decomposition to predominate over the rate of recombination and promote the appearance and the liberation of the products of electrolysis, as our experiments have verified in the electrolysis of acidulated water.

We conceive equally that the electrodes and the electrolyte may affect the rate of recombination by their chemical affinities or their physical properties. The facility of electrolysis must, therefore, depend also on the nature of the electrodes and the electrolyte. This is what our comparative experiments have verified in the electrolyses of acidulated water and of sulphate of copper, both by platinum and copper electrodes.

We may further foresee that the greater or less rapidity of the alternations, all other things being equal, must play an important part in the appearance or disappearance of the electrolytic phenomena. For if we suppose that the succession of the two induced currents becomes so slow that the electrolytic products of the first current have disappeared from the electrode, whether by direct disengagement or by diffusion, before the products of the inverse current have appeared there, no more recombination will be possible: each of the alternating currents will behave successively in the voltameter like a continuous current of brief duration. We see, then, that, all other conditions being equal, a retardation of the alternations must facilitate the appearance of electrolysis, while the acceleration of the alternations produces the contrary effect. This we have been able to verify by direct experiments.

The use of dynamos with a separate exciter has enabled us to vary the rapidity of the alternations without affecting the mean intensity, nor, consequently, the density of the currents. On the one hand, by raising the speed of the machine from 1,500 to 2,600 turns per minute, we could raise the number of inversions from 100 to 173 per second. On the other hand, by suitably modifying the intensity of the inducing magnetic field, by means of the exciting current, we could keep the mean intensity of the induced currents constant. Under these conditions we have made the two following experiments:

1. The machine turning at its ordinary speed (2,000 turns per minute, corresponding to 133 alternations per second). We regulate the intensity of the currents so as to maintain the state of equilibrium, that is, to cause all liberation of gas in a voltameter with acidulated water to disappear. If at this moment we let the velocity sink to 1,500 turns, we see the gas reappear and freely liberated at the electrodes.

2. When the machine is turning at its ordinary rate of 2,000 turns, we regulate the density of the current so as to give a distinct and regular escape of gas. If at that moment we raise the speed to 2,600 turns, all the escape at once disappears.

In either case we can annul the effect of this variation of speed by a suitable modification of the density. Thus in the first experiment we can cause the gas to disappear again by enlarging the surface of the electrodes, and in the second experiment they can be made to reappear by reducing this surface.

We see, then, that the rapidity of the alternations and the variations in the density of the currents affect the

electrolysis in opposite directions, and that it may be manifested with currents of low density if the alternations are sufficiently slackened. This explains how, in 1837, De la Rive could easily decompose acidulated water by the alternating currents of the magneto-electric machines then recently invented. He succeeded in realizing the development of detaching gas on large platinum electrodes, having a surface of 8 square centimeters. His difficulty seems to have been to make the gas disappear, while ours was to make it appear. This difference results from the fact that the electro-motor employed by De la Rive gave at most 50 alternations per second, while our dynamos give 100 as a minimum.

From this experimental study of the circumstances which affect electrolysis by alternating currents, we may deduce, along with the numerical laws of these phenomena, the general rules which ought to direct the utilization of these currents for this kind of application.—*Electrical Review*.

WOOD WOOL MAKING MACHINE.

WOOD wool is the name given to an article which, although it has been in use for some time on the Continent, has only recently been introduced into this country. It consists of very thin wood shavings, which

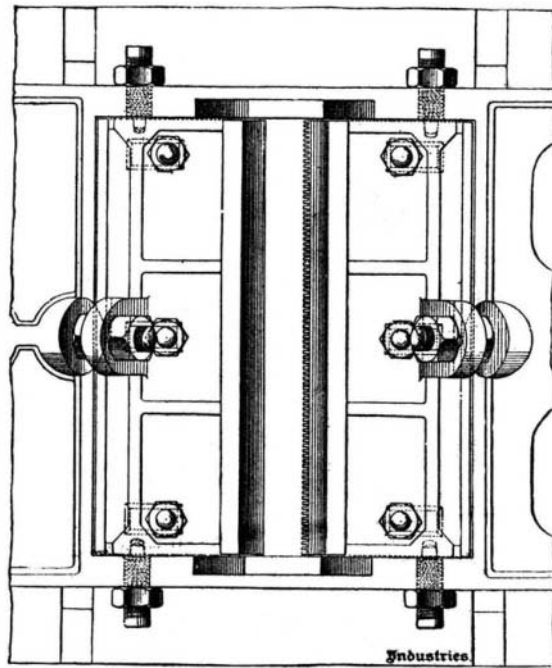


FIG. 1.

may be of any breadth, some of the samples we have seen being so narrow as to look like hemp. The coarser varieties are intended to be used instead of straw for packing goods, while the intermediate kinds are chiefly intended for stuffing furniture, such as chairs, sofas, mattresses, and pillows. Some of the finer varieties are also used instead of lint, and for various other hygienic purposes. We give herewith illustrations of a machine for making wood wool, which has been invented by M. Louis Arbey, of Paris, and has been patented by him in this country. Fig. 3 represents an elevation, and Fig. 4 a plan of the machine. A cast iron bed, resting on three feet, carries at one end the driving apparatus, and at the other a carriage for holding the wood and the slides which guide the cutting knives. The machine is driven by a strap, and at one end of the driving shaft is a fly wheel which carries a crank for giving the necessary oscillating motion to the knife frame, while at the other end of this shaft there is an eccentric which actuates the feed for the

carriage holding the wood to be operated upon. The knives are vertical, and the frame in which they are held moves in slides, which are reversible, the top coming to the bottom, and *vice versa*. The knives are placed opposite to each other, so that one cuts when the slide moves forward and the other when it moves back again. One of the knives is a smooth blade, while the other is formed of a blade cut into teeth, so as to give a series of small blades separated by spaces of equal width. The toothed knife supplies shavings by cutting grooves in the face of the wood during the motion in one direction, and during the return the plain knife cuts shavings from the tops of the ridges which separate the grooves, these shavings being exactly similar to those cut by the other knife. In order to vary the angle of penetration of the knives according to the required thickness of the shavings, the knife holders are movable upon a vertical axis, and are easily adjusted by means of the nuts shown in Fig. 2. Figs. 1 and 2

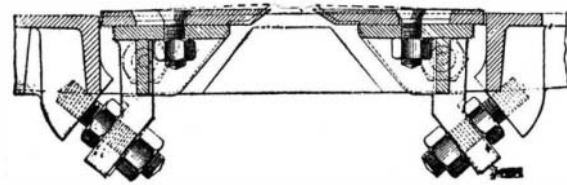


FIG. 2.

show in detail the knives and the method of mounting them. It will be seen that each knife is carried by a piece pivoted to the slide, and readily adjusted by means of the nuts acting against a lug. The blades are fastened to this piece by three bolts, and as the blades are slotted, they may be readily moved backward or forward. This facility for adjustment is of the greatest importance in machinery of this character. The machine is so constructed that the fineness of the shavings can readily be regulated as desired, by varying the velocity of the feed of the wood and the angle of penetration of the knives, the pitch or width of shaving being altered by changing one of the knives. The rest or headstock which carries the wood is made to travel on a transverse slide, and is moved forward by means of a screw, at the end of which is keyed a ratchet wheel actuated by a pawl at the end of a lever worked by the eccentric from the driving shaft, as shown in Fig. 5. The amount of feed is varied by raising or

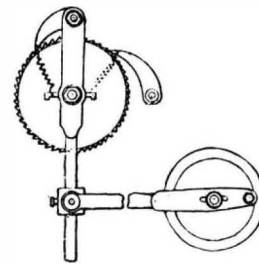


FIG. 5.

lowering the sleeve which connects the lever with the eccentric. It will thus be seen that the machine is at once simple and ingenious, and the samples of work which we have seen are of first class quality, being soft, elastic, clean, and free from that harsh, woody feeling which one would naturally expect, and which is actually found in the samples produced by the German, American, and other machines. In fact, they are so much like fiber, that the finer samples might easily be mistaken for hemp or horse hair. It is probably owing to fineness of texture that the material made by the Arbey machine in France is called "erin," or horse hair. Wood wool has already been introduced into several hospitals, where it is used for stuffing beds, and if made of certain woods, as pine, which contain gums or resins,

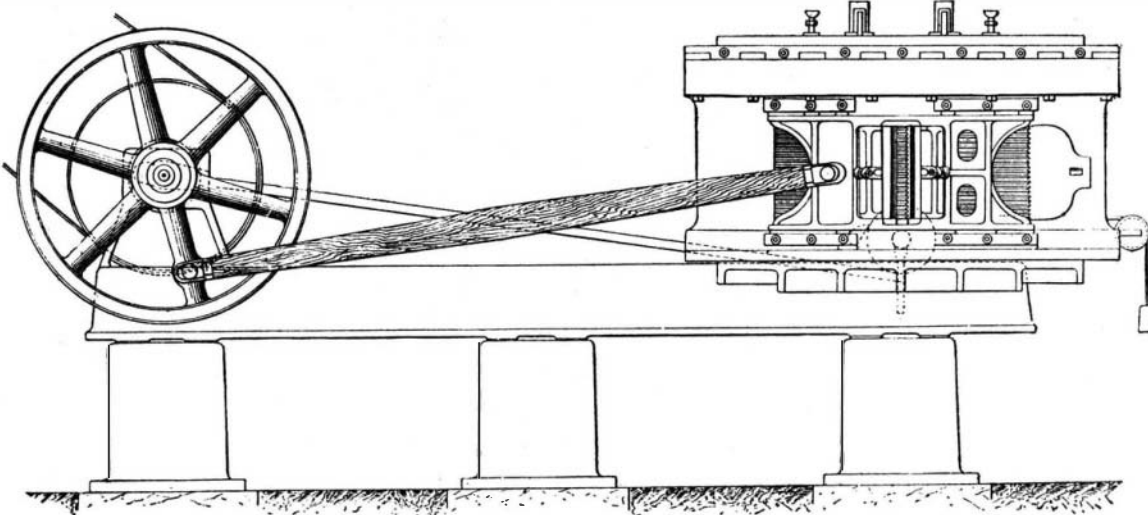


FIG. 3.—ELEVATION.

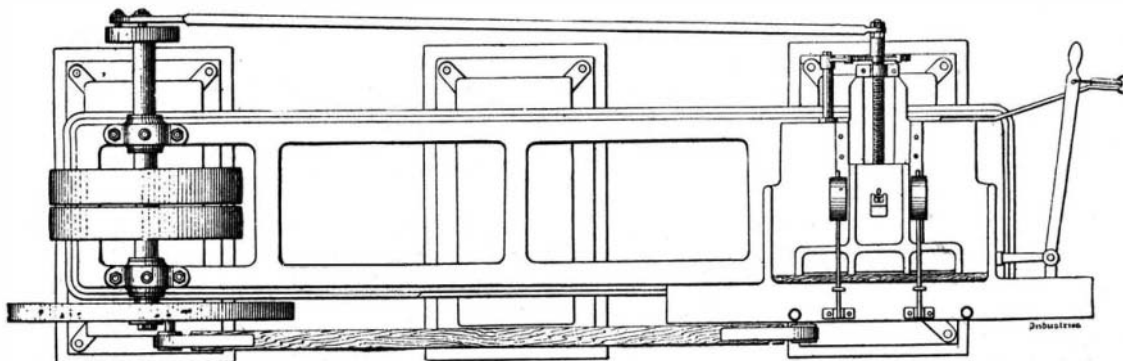


FIG. 4.—PLAN.

MACHINE FOR MAKING WOOD WOOL.