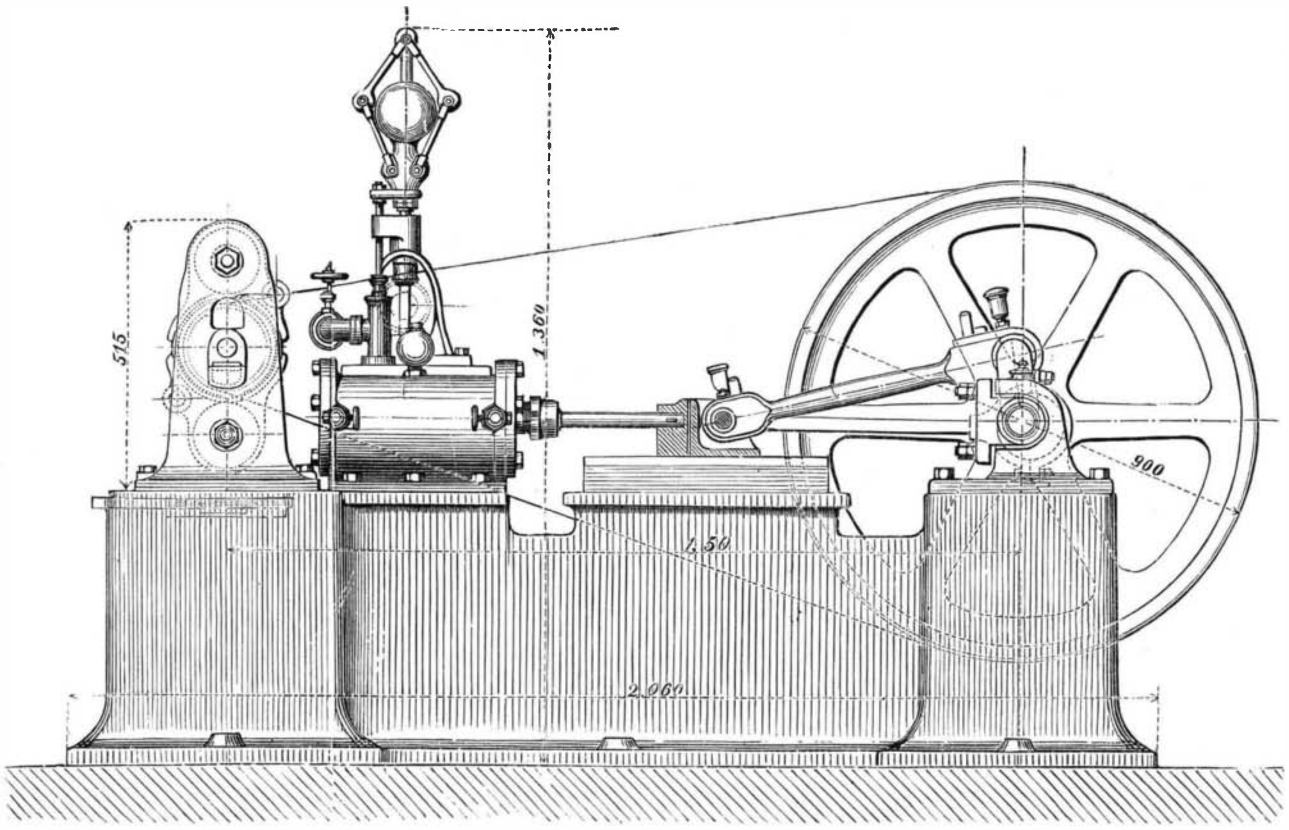
THE INDUSTRIAL APPLICATIONS OF THE ELECTRIC LIGHT.

We have from time to time noted the extension of the application of electric illumination to workshops, factories, railroad depots, and other establishments in France. In the following article based on a work recently published on the subject, in the above country, by M. Hippolyte Fontaine, the practical details of many instances where this mode of lighting is in successful employment are reviewed.

The electric lamp furnishes the only means of illumination whereby industrial work of almost every description may be continued as well by night as by day. The light produced is so abundant that, reflected by all objects, it becomes diffused like daylight, so that there are no absolutely black shadows, and in a properly illuminated shop it is possible everywhere to handle tools or to read. It is generally necessary, however, to use two lights, so that one may illuminate the shadows cast by the other. One lamp usually lasts for from three and a half to four hours, at the end of which time new carbons must be inserted. This, however, is the work of but a few seconds, so that the temporary extinction of the light is not materially inconvenient, especially if more than one lamp is used. Even this may be avoided in cases where continuity of light is a necessity, by arranging duplicate lamps, so that one is automatically ignited the instant another is extinguished. The light is not fatiguing to the eyes. In workshops where opal globes were first introduced, such screens were afterward found superfluous; and they were removed at the desire of the workmen. Under the electric light, colors appear the same as by sunlight, so that for dyers, weavers, and painters, a single lamp often proves a great convenience.

As a general rule one lamp will illuminate sufficiently an area of 5,120 square feet in a machine shop, half that area in a printing or weaving establishment, and four times that area on a quay, shipyard or other locality where fine work is not carried on. With these data it is easy to determine the cost of installation, knowing that of the complete apparatus. In France the expense of the latter, including lamp, magneto-electric machine, wires, etc., is about $480. The following instances exhibit the results of practical use:



ELECTRIC LIGHT.—GRAMME MACHINE DRIVEN BY A STEAM ENGINE.—Fig. 1.

WORKSHOP OF THE GRAMME COMPANY.

In this establishment the light was first introduced in 1873. A single lamp is used, taking the place of twenty-five gas burners. It has operated regularly for four years, and the average expense, incidentals included, has not exceeded 12 cents per hour. The room lighted is 16 feet high, and 1,468 square feet in area.

DU COMMUN WORKS AT MULHOUSE.

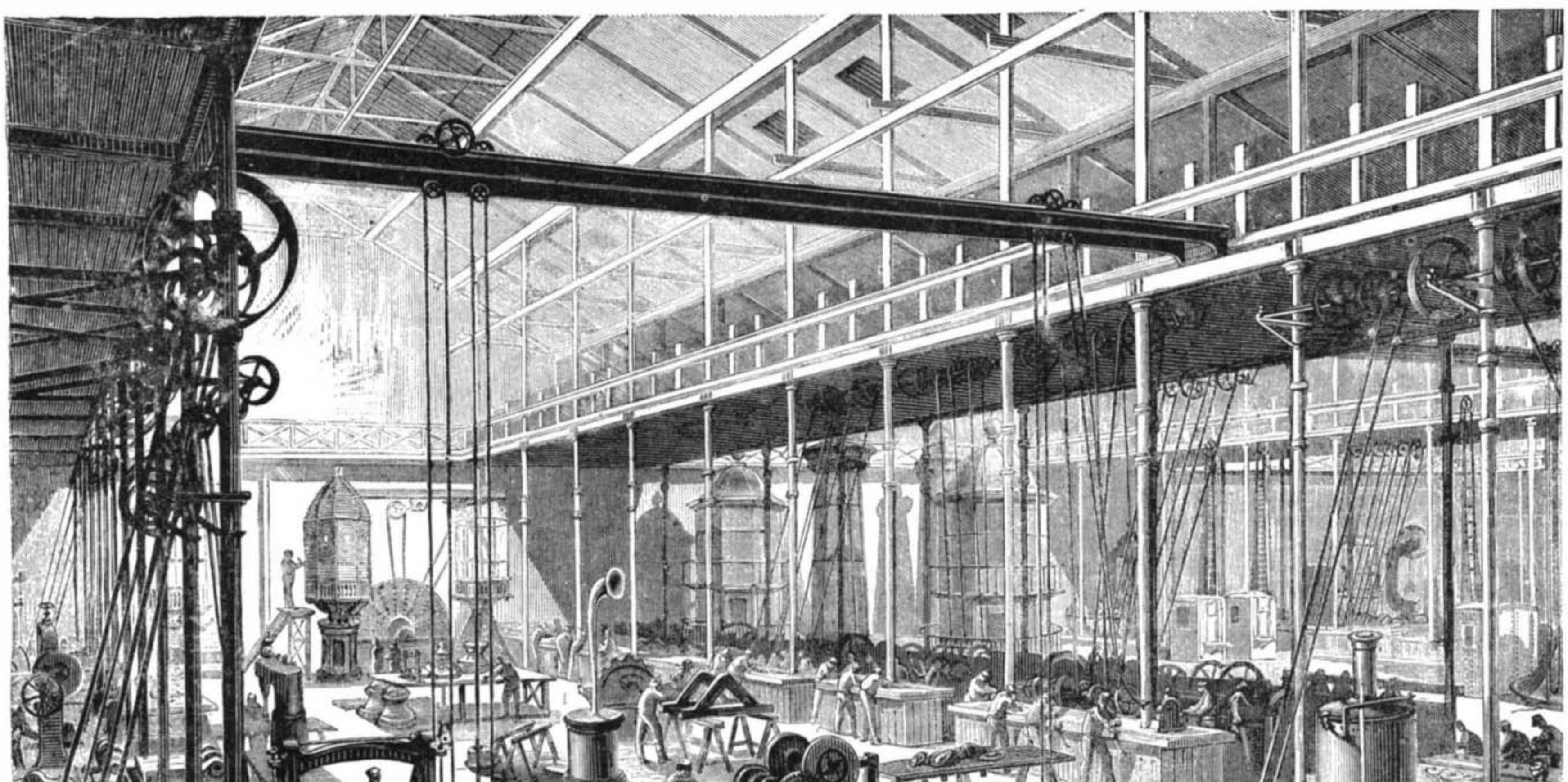
Four lamps each, worked by a Gramme machine, are employed in the foundery, a large hall of nearly 16,000 square feet area. The lights are attached to crossbeams sixteen feet above the floor. Cost of installation $2,000, or about the same as the expense would amount to for two hundred and fifty gas burners. The light obtained exceeds that of four hundred burners. MM. Heilman and Steinlen, of this establishment, have devised a special arrangement of magneto-electric machine and steam engine, which is represented in Fig. 1, and which is adapted for use in shops or aboard ship. The bed is made heavy in order to avoid all vibration, and the apparatus is quite compact, occupying a floor space of but twenty-three square feet. The fly wheel, to which the Gramme machine (which rests on the same support as the engine) is belted, makes 150 revolutions per minute, the Gramme machine 850 revolutions. The entire apparatus is sold in France for $800.

SAULTER, LEMONNIER & CO.'S SHOPS, PARIS.

This is a well known manufactory of lighthouse lanterns. The workroom consists of two bays or sections, each 96 feet long by 80 feet wide; the intermediate space is 32 feet in width. On the lower floor are machine tools, and on the story above the patternmakers and moulders work. Three Gramme machines each maintain a light equal to one hundred gas burners, and the three lamps illuminate all the shops sufficiently to admit of the use of machines of precision, requiring delicate adjustments. The electric machines are located in the engine room, and are driven at the rate of from 850 to 900 turns per minute. About two horse power is required to operate each machine. Carbons are consumed at the rate of 2·7 inches per hour and cost about 40 cents per yard. So that each machine, equivalent to 100 Carcel burners, costs for maintenance 2·8 cents per hour *plus* the expense of motive power. In Fig. 3 the interior of the above named shops is represented, from which an excellent idea of their arrangement as well as the brilliancy of the illumination may be obtained.

MENIER FACTORIES AT GRENELLE, NOISIEL, AND ROYE.

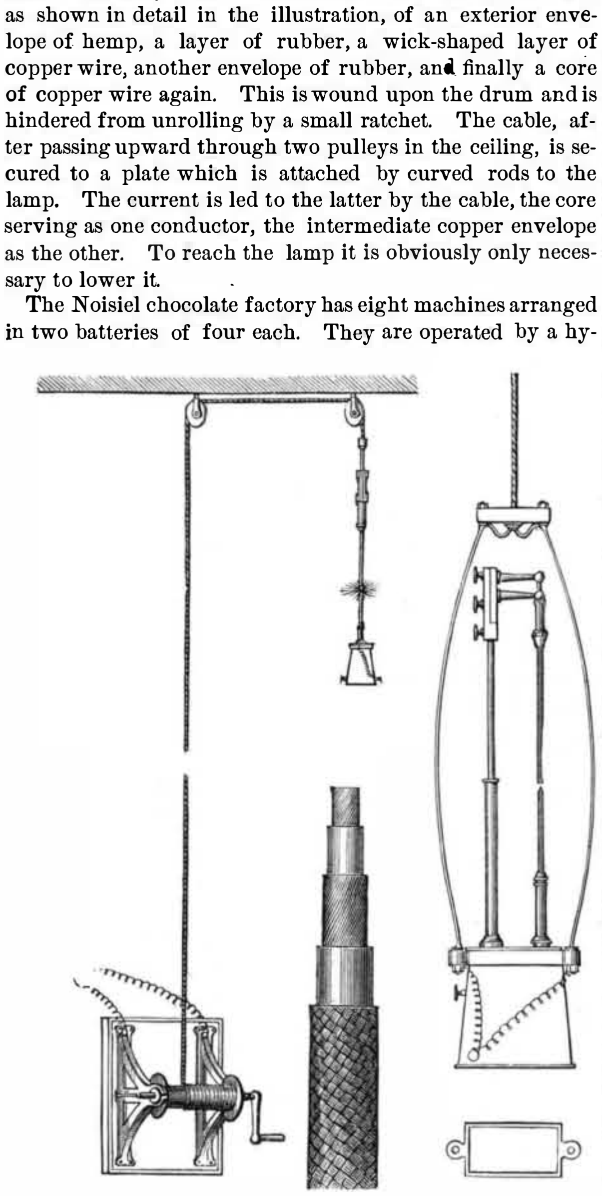
These establishments include one factory for preparing india rubber, a sugar works, and the factory where the famous Menier chocolate is made. In each of the first two, three machines, each equivalent to one hundred and fifty



INDUSTRIAL APPLICATION OF ELECTRIC LIGHT.—Fig. 3.

burners, and the last, eight machines are used. In connection with the lamps employed is a novel invention of M. Menier (Fig. 2), whereby the lamps can be reached for replenishing carbons, etc., without the use of a ladder or stairs. It consists of two cast iron brackets, mounted, supporting a hard rubber drum, and to each of which one of the conducting wires is attached. The brackets communicate metallically with the ends of the cable which is formed, as shown in detail in the illustration, of an exterior envelope of hemp, a layer of rubber, a wick-shaped layer of copper wire, another envelope of rubber, and finally a core of copper wire again. This is wound upon the drum and is hindered from unrolling by a small ratchet. The cable, after passing upward through two pulleys in the ceiling, is secured to a plate which is attached by curved rods to the lamp. The current is led to the latter by the cable, the core serving as one conductor, the intermediate copper envelope as the other. To reach the lamp it is obviously only necessary to lower it.

The Noisiel chocolate factory has eight machines arranged in two batteries of four each. They are operated by a hydraulic wheel. The wires lead to a commutator on the ground floor, which allows of the current of each machine being transmitted in fifteen different directions. In this way any machine may be used to supply the lamp in any particular room, so that, in the case of failure of any one apparatus, others are always ready. As this establishment is said to possess the most complete system of electric illumination ever employed, it is interesting to note the disposition of the lights. One lamp placed in a square lantern and suspended at a height of 22 feet illuminated a courtyard of 20,400 square feet area. Two other lamps each illuminate an interior court of 5,700 square feet. The torrefaction room, 141 feet long by 35 feet wide, and 24·6 high, is lighted by a single lamp placed on the floor. The light is projected by a parabolic mirror up to the ceiling, whence it is reflected and uniformly diffused. The moulding and weighing room is occupied by 90 workmen. It is 166 feet long by same width and height as above. Two lamps are used 80 feet apart and hung 19 feet high. The repair shops, of 4,080 square feet area, are illuminated by one lamp.



APPLICATION OF ELECTRIC LIGHT.—Fig. 2.

SPINNING ESTABLISHMENTS.

The employment of the electric light in several spinning establishments is noted. In that of MM. Ricard fils, the room on the first story is 10·5 feet long by 66·6 wide. Two lamps here illuminate 10 self-acting mules. The Gramme machines are placed at the extremity of the shops, and are operated by the motor of the works. The lamps are located 63 feet apart and are suspended at a height of 10·8 feet. This arrangement proved successful under the bad conditions of very low ceilings. The apartment in the second story is much smaller, and one lamp suffices for five mules.

FREIGHT DEPOT OF LA CHAPELLE, PARIS.

The space to be illuminated consists of a hall 192 feet long, 80 feet broad, and 25·6 feet high; a court 64 feet wide; and a car house 224 feet long, 48 feet wide, and 25·6 feet high. The hall is lighted by two lamps placed at a height of 5 feet, and arranged in lanterns, the glass of the lower part of which is painted white, so that the eye is not dazzled by the electric arc. The lamp is ample to allow of the business of expressage in all its details being carried on. The engineer of the depot reports that 25 per cent less men are now needed for night work. One lamp suffices for both car house and court.

HARBOR WORKS AT HAVRE.

In constructing the extensive operations required to enlarge the outer harbor of Havre, involving the removal of a large amount of rockwork and masonry, it has been necessary to labor principally during the hours when the tide is low. In order to carry on work at such times at night, the contractor has used two electric lamps, by which means 150 workmen, distributed over an area of 36,000 square feet, have continued the operations of blasting, etc., with the same facility as by day.

A large number of other instances are given, showing other applications of the electric light, but the above will suffice to exhibit its utility in a sufficiently varied range of industrial pursuits. It seems probable that the invention of the Jablochkoff candle, admitting as it does of the divisibility of the light, will result eventually in the employment of electric illumination everywhere in lieu of gas. In this view such details as are above given are of timely interest.

Communications.

Concerning a Small Steam Launch.

To the Editor of the Scientific American :

On page 140, (2), current volume of the SCIENTIFIC AMERICAN, T. and D. say they are greatly disappointed in the speed of their steam yacht. After comparing the performance of their yacht with that of the Flirt, described in SCIENTIFIC AMERICAN SUPPLEMENT No. 81, I think their disappointment is unjust, and for this reason, the Flirt is described by "Paddlefast" as "a very fast steam launch." She makes 10 miles an hour with 700 revolutions a minute, and pitch of propeller 25"; the steam pressure, cut-off, etc., not being an essential factor as far as the speed *per se* is concerned. Supposing nothing to be lost by slip, the Flirt ought, with the above figures, to make 16 miles an hour; as a matter of fact, however, she only makes 10, so there is about 0·375 of the 16 miles lost by slip. T. and D. say they made 5 miles an hour with 210 revolutions a minute and $3\frac{1}{2}$ feet pitch of propeller. If nothing be lost by slip, they would make a little over 8 miles an hour, but they only make 5, so there is in this case as in the other $\frac{3}{8}$ or 0·375 of the theoretical distance lost in slip. T. and D. say they want to make 10 or 12 miles an hour with her. If they do, they will have to either increase the number of revolutions, or put in a propeller with more pitch, or both. I would like to hear from T. and D. concerning the cut-off, size of ports, etc., of their engine, as it strikes us the fault lies more in the engine than the propeller. I. N. PHILLIPS.

Knoxville, Tenn.

REPLY BY "PADDLEFAST."—With the above correspondent we believe a 5 x 5 engine ought to do more work. The boiler is far too heavy for the boat, causing too great a displacement for good speed. A smaller boiler, a higher steam pressure, and a two-bladed screw 28 inches diameter with 35 inches pitch, ought to give good results.

A Much-Needed Postal Convenience.

To the Editor of the Scientific American :

The large circulation of the silver currency, which has almost entirely superseded the paper fractional currency, brings with it some inconveniences. Large numbers of letters are mailed daily, which contain small sums of money—frequently less than one dollar. Even now, it is difficult to obtain the necessary "change" in paper fractional currency, and many persons substitute postage stamps, to the great annoyance of the individual receiving the remittance.

This state of affairs greatly increases a previously existing necessity for some method of transmitting small sums through the mails in some such manner as the larger postal orders are now transmitted. Perhaps the most advantageous plan would be to have stamps of the usual fractional denominations, kept for sale by postmasters at a sufficient advance on their face value to cover expenses, which would entitle the holder to their face value, and which might be cancelled or destroyed by the postmaster to whom presented. These stamps should be so designed as to be attached to postal cards if desired, and should also extend down to three cents, so that if a correspondent wishes he could "enclose a stamp" even when sending a postal card. W. J. MCGEE.

Farley, Iowa.

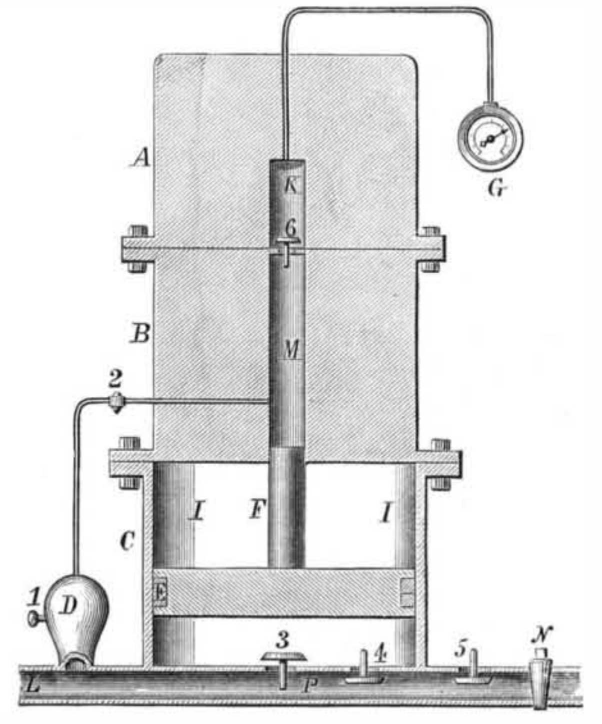
The Keely Motor.

To the Editor of the Scientific American:

The accompanying sketch was prepared at the time the Bailey & Farrell motor came out. I consider the Keely motor a humbug and constructed on the same principle. I do not know that I have hit the Farrell motor or the Keely humbug, in construction; but there is no secret about it, and an apparatus made on this plan will accomplish the same results.

The following is a description of the working of the machine: It is connected to the water main at L; the cock, N, is turned off. As soon as the water is turned on from the main, it will instantly compress the air in the machine in a ratio corresponding to the pressure in the main pipe, and the gauge, G, will so indicate. The cock, N, is now opened, and the machine goes to work automatically as follows: The valves, 4 and 5, are loaded until they will close only when the water has reached its maximum velocity. This would bring the water to a sudden stop if it was not for the valve, 3, which opens and allows the blow to be delivered on the piston, E, forcing the plunger, F, into the chamber, M, displacing the air into the chamber, K, the valve, 6, holds it from escaping. After the blow is spent, the valve 4 opens at the same time valve 5 opens, allowing the water to escape from under the piston, E ; the compressed air, I I, driving the piston, E, back to its former position. The air chamber, D, having inlet valve, 1, and outlet valve, 2, furnishes the chamber, M, with a new supply of air for the plunger, F, on its return stroke. The air in the chamber, D, is compressed at the same time the blow is struck on piston, E, it being connected with the pipe, P.

I will suppose for convenience in calculation that the pipe, P, is one inch area, the piston, E, 12 inches diameter, and the plunger, F, ·75 inches diameter. The pressure of the water 30 lbs. per square inch, somewhere near the pressure Mr. Keely used. I may remark the size of the pipe cuts no figure in the case as long as the head of water remains unchanged. Leaving out the coefficient of friction, then we have $30\times2{\cdot}26=67{\cdot}8$ height due to pressure. Then $(\sqrt{67{\cdot}8\times64{\cdot}3})=65{\cdot}1$ velocity in feet $\times12=781{\cdot}2$ inches $\times0{\cdot}036=$ $28{\cdot}1$ lbs. of water. We have now 28·1 lbs. of water moving at the rate of 65·1 feet per second; $28{\cdot}1\times65{\cdot}1=1829+$ lbs. effect delivered at the valve 3. But this opening is only 1 inch area. We have therefore 1829 lbs. to the square inch. The piston, E, is 12 inches diameter. $D^2\times7854=113+\times1829=206{,}777$



lbs. pressure at the start, decreasing to $113+\times30=3390$ at the end. Then $206{,}677-3390=203{,}287+2=101{,}643+$ lbs. average pressure. But the plunger, F, which delivers this pressure, is only ·75 inches diameter. Again $D^2\times7854={\cdot}44+$ inches area. We now have 101,643+ lbs. pressure delivered by a plunger of ·44 inches area. Hence $101{,}643+{\cdot}44=231{,}006$ lbs. pressure per square inch in the chamber, K. When that gets full it may be removed and another put in its place. This is the theoretical view, but we can throw away half and still have enough left to create that goneness Mr. Keely complains about when one burst. This machine will fulfil all the conditions of the Keely motor.

If the piston, E, is made 21 inches diameter, and the other conditions same as above mentioned, the pressure in K would amount to 693,018 lbs. to the square inch, a pressure which Mr. Keely would likely find trouble in managing.

Frankfort, Ky M. A. JONES.

The Sea in Sahara.

To the Editor of the Scientific American :

Last spring there appeared in the SCIENTIFIC AMERICAN an elaborate and thoughtful article upon the formation of a sea in Sahara. I beg leave to say that the Red Sea, just beside the proposed one, has not evaporated to a bed of salt during some centuries, on account of lack of tributaries; it, like the Mediterranean, has two currents at the strait—an under current of heavy and excessively salt water flowing out of it, and a surface current of ordinarily heavy and salt water flowing into it. Thus the salt is carried out and the sea is prevented from becoming a salt bed. The object of the project is to produce rain in the adjacent lands. Doubtless this effect would be produced. The secondary results would be increased vegetation, a damper soil, and, proportional to the present and contemplated rainfall, less evaporation; hence stream-rivers would be produced, and most of them would flow into the new sea, thus supplying it with fresh water. The number of ports that would be closed by a depression of two feet in the ocean would be small, perhaps none. T. MARCELLUS MARSHALL.

Glenville, W. Va.

TYPOGRAPHICAL ERRORS.—In a recent number of the *English Workman*, Richard A. Proctor bewails some of his typographical misfortunes. One journal, speaking of his charts of 22,434 fixed stars, made it "chart of $2{,}243\frac{1}{2}$ stars." This mishap he forgives in consideration of the dulness of a compositor's life; but in the following he thinks a severe test of any one's good nature. He wrote of the solar spectra, "lines, stripes, and bands of the violet end of the spectra," which appeared when printed as "links, stripes, and bonds for the violent kind of spectres."