safely be said that that is the best machine which has the highest electromotive force and the least internal resistance.

Now for Mr. Upton's examples.

In the first case we have "$\frac{130 \times 130}{1 \times 1} \times 5 \times \frac{44 \cdot 3}{33000} = 11$ H. P.," and in the second, "$\frac{130 \times 130}{5 \times 5} \times 4 \cdot 5 \times \frac{44 \cdot 3}{33000} = 4$ H. P."

If Mr. Edison's claims were just, why did not Mr. Upton give the H. P. used in each case? Had he so done the coefficient of efficiency could at once have been obtained. But in order to state the case properly and fairly, information should also have been given as to what power was applied to excite the field magnet.

On page 265 of your issue of October 25, we do find a statement as to power used, and we assume that the machine was then working under the conditions of so-called maximum efficiency, and, conceding Mr. Upton's examples, how will the results obtained compare with the claims made on page 242?

Since, according to Ohm's law $C = \frac{E}{R}$, and Mr. Upton says the electromotive force is 130 volts, we should have in the second example $\frac{130}{5} = 26$, or a current of 26 webers per second through a resistance of 5 ohms. Now, according to Joule's law, $H = C^2 Rt$, this multiplied by 0·73726542 (taking 1 H. P. = 746 volt ohms) the equivalent in foot pounds of 1 weber per ohm per second, gives the number of foot pounds in the circuit (or if any one prefers he may take the equivalent in foot pounds of 1 weber per ohm per minute as 44·2359252), we shall then have $26^2 \times 5 \times 60 \times \frac{\cdot 73726542}{33000} = 4 \cdot 53$, or about $4\frac{1}{2}$ H.P. in the entire circuit, while in the external circuit we shall have $26^2 \times 4 \cdot 5 \times 60 \times \frac{\cdot 73726542}{33000} = 4 \cdot 077+$, or about 4 H. P., thus indicating a loss of 20 per cent of the power applied to the machine, without taking into consideration the power applied to excite the field magnet.

I think Mr. Upton, when he wrote the letter on page 308, did not have in mind the very remarkable passage on page 242, which is as follows, viz.: "While this generator in general principle is the same as in the best of the well known forms, still there is an all important difference, which is, that it will convert and deliver for useful work, nearly double the foot pounds of energy that any other machine will under like conditions," or he would not have appealed to a general law to prove so remarkable an exception; and I would very respectfully recommend to Mr. Upton the careful study and consideration of the causes of loss in dynamo-electric machines before he again uses the calculus to support such statements as are contained in the article on page 242.

In conclusion, I think I may say that I am possessed of sufficient "sense and science" to prevent my falling into such manifest absurdities as are contained in Mr. Edison's statements on page 242, or Mr. Upton's elucidation on page 308. EDWARD WESTON.

Newark, N. J., Nov. 15, 1879.

### The Future Water Supply of Philadelphia.

*To the Editor of the Scientific American:*

In the SCIENTIFIC AMERICAN of November 15 there is an article under the above title, in which the following statement occurs: "The latest project—that of Mr. James F. Smith, C.E.—contemplates a gravity supply by aqueduct, to be drawn from the upper portion of the Perkiomen Creek and its tributaries." This is not a new project, but was presented to the City Councils of Philadelphia, in 1865, by Henry P. M. Birkinbine, then Chief Engineer of the Water Department. The plan, as presented to councils in 1865, was as follows: At a point on this stream, the largest tributary of the Schuylkill, 26½ miles from Broad and Market streets, the creek passes through a narrow chasm in a ridge of trap hills. Above this point the stream falls rapidly, and drains an area of 220 square miles of hilly and rocky country, some of the hills rising one thousand feet above tide. Most of the surface is still in forest, and a very small percentage is under cultivation. Perhaps there is no section of country within so short a distance of a great city that possesses all the requisites of desirable drainage area, or from which water of such good quality for all the purposes for which it is required can be drawn. The quantity collectable would be an average of over 200,000,000 gallons per day. This water could be brought to the city and delivered into a reservoir at an altitude of 170 feet above city datum. The project as presented was to construct a large impounding reservoir at the point above designated, covering from 1,700 to 2,000 acres, and having an available storage capacity of from 5,000,000,000 to 10,000,000,000 gallons, and conveying the water to the city by aqueduct, principally of masonry. Mr. Smith, in his paper (see Journal of the Franklin Institute for October, page 248), says: "I very cheerfully resign to Mr. H. P. M. Birkinbine the credit of pointing out the stream, and for myself only claim the plan of tapping it at a higher and more favorable point, and intercepting and utilizing the headwaters of its principal branches."

Mr. Smith's suggestion is simply to take one of the principal tributaries six miles further up stream than the original location, and by that means bring the water into the city at a greater elevation, adding other branches of the stream as the demands of the city make it necessary.

The objections to his plan are the increased length of aqueduct; complication by making it necessary to construct a number of impounding dams upon the tributaries, instead of the one large impounding reservoir suggested in the original plan; the increased expense of carrying the line of aqueduct at a great elevation; the loss of the water collected from six miles of the main stream. The greater elevation secured by Mr. Smith's plan would be of little practical value, as the pressure would be too great for the low-lying districts, and would be destruction to the entire old pipe system. The additional head secured by the new location would not increase the area which could be supplied by gravitation one per cent.

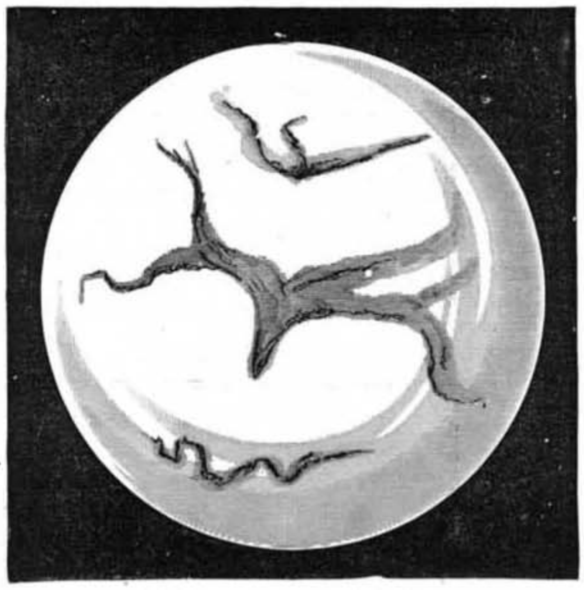
Mr. Birkinbine defended his location and plan in a paper read before the Franklin Institute at the monthly meeting on October 15.

There is no doubt but Philadelphia will at some future day draw its supply from the Perkiomen by gravitation, and were it not for the traditional slowness of the city it would have done so before this time. The improvements in the supply of New York, by the construction of large impounding reservoirs in the Croton drainage; the addition to the supply of Boston, by the construction of the Sudbury aqueduct, and in Baltimore by the introduction of the water from the Gunpowder, may induce Philadelphia to some action in the near future. At present the city has an unsatisfactory and precarious supply, both as to quantity and quality, furnished by 8 pumping stations, 8 water wheels propelling 14 pumps, 16 steam engines and 28 boilers operating 25 pumps, and 16 reservoirs at various elevations, from 94 feet to 348 feet above city datum. HARRIS.

### Astronomical Notes.

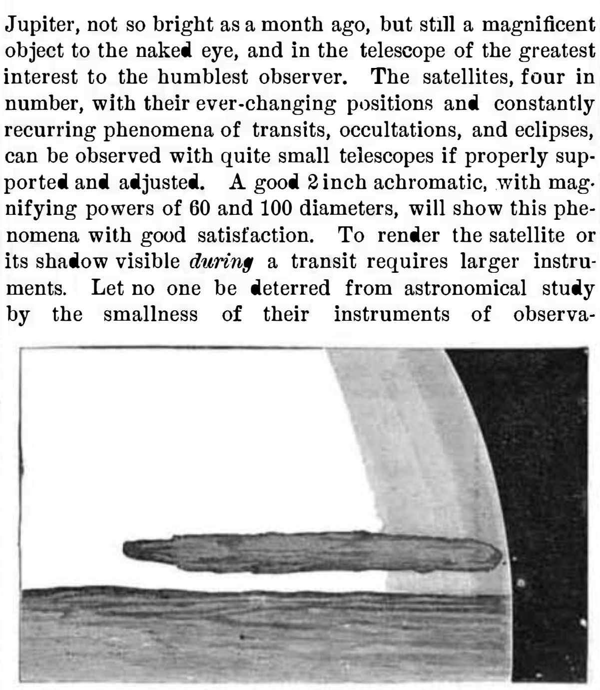
*To the Editor of the Scientific American:*

Three of the most conspicuous planets are now visible in the early evening. In the south shines the ever resplendent



MARS AS SEEN NOV. 11 1879.

Jupiter, not so bright as a month ago, but still a magnificent object to the naked eye, and in the telescope of the greatest interest to the humblest observer. The satellites, four in number, with their ever-changing positions and constantly recurring phenomena of transits, occultations, and eclipses, can be observed with quite small telescopes if properly supported and adjusted. A good 2 inch achromatic, with magnifying powers of 60 and 100 diameters, will show this phenomena with good satisfaction. To render the satellite or its shadow visible *during* a transit requires larger instruments. Let no one be deterred from astronomical study by the smallness of their instruments of observa-



JUPITER'S SPOT.

tion, for the lowest power will show much more than the unaided vision; and in the *attempt* to conquer these sublime visions with their present instruments, a taste and experience will be developed that will enable them to appreciate a larger telescope much more than they otherwise would, and at the same time have educated them, in hand and eye, to use it with greater efficiency.

The belts of Jupiter are very plainly visible this season. Also the *great red spot*, the present one first noticed in Europe about two years ago and now readily seen with moderate telescopic power. I append a sketch of it as seen a few evenings since in the 5 inch Newtonian reflector, just as it had fairly entered upon the face of the planet. In the southeast shines Saturn, not a very attractive object to the naked eye, but in the telescope the marvel of the heavens. Its stupendous multiple ring system—the despair of astronomers—may be seen with moderate telescopic aid. A 2 inch glass will show the main division of the ring, the space between the ring and planet, and one or two of the satellites. The rings will be more open next year than this. In February, 1877, they disappeared, or in the largest telescopes were seen only as a fine thread of light. Their thickness, which then only was seen, is estimated at one hundred miles. In the east sweeps up the heavens the ruddy-faced Mars in company with the gentle Pleiades. On the 12th inst. Mars was in opposition to the sun and at its brightest for this season. This planet presents to astronomers greater indications of being a habitable globe than any of the planets. It is clearly divided into two grand divisions of land and water. Some of its markings can now be seen in small telescopes, but large ones are necessary to bring out all the details. The annexed engraving shows Mars as seen on November 11, 1879, in the 5 inch reflector, at 10 P.M.

The two satellites of Mars can only be seen in the largest telescopes, and then appear as mere points of light. They were discovered by Asaph Hall with the great Washington telescope in the favorable opposition of 1877. It is reported that they were first seen this season in Europe with a three foot reflector.

WILLIAM R. BROOKS.

Red House Observatory, Phelps, N. Y., Nov. 15, 1879.

### How Ice Boats Sail Faster than the Wind that Drives Them.

*To the Editor of the Scientific American:*

I would thank you to allow me to make a few observations on a question which you spoke of in your last number, viz., "the speed of ice yachts."

I am convinced your opinion is the true one. You base it moreover on facts; no doubt this is the best proof. But it may also, I think, be proved theoretically according to the most elementary principles of mechanics.

It is demonstrated in mechanics that when a force acts continuously on a movable body the motion of this body increases every moment. Now, in the case under consideration the force is the wind, the movable body is the ice yacht. The force is continuous (we suppose the wind continues to blow); therefore the ice yacht should go faster and faster, and if it be a sufficient time in motion, its velocity will at a given moment exceed that of the wind.

In this reasoning I suppose the friction of the yacht on the ice to be sufficiently small not to entirely destroy the increase of speed which the wind tends to communicate to the boat.

It must be observed that the velocity of the wind may vary during its action, though this by no means weakens our proof. It is sufficient that it acts continuously. If the constant force vary in intensity, the increase of speed will be less each moment, but the velocity will, notwithstanding, increase, supposing always that it is not annulled by friction.

Let us observe, in fine, that it is quite possible for a boat to go faster than the wind which drives it. For this it suffices that during the whole time of its course the boat moves through air already put in motion by the same wind.

A. O.

Montreal, November, 1879.

### Energy in Foot Pounds.

*To the Editor of the Scientific American:*

In a communication on page 337, current volume (No. 22), Mr. Upton correctly states that: "Foot pounds are always measured by the square of the current, and the method of measuring is analogous to that employed for measuring the energy in a stream of water." His deduction is not quite right, "for if twice the amount of water flows from a given sized jet against a turbine, it will be able to do" *eight* "times the work" instead of "four" times as he has it. The reason is plain enough; for to double the velocity through the jet the pressure must be increased by four; therefore twice the quantity and four times the pressure (or head) equals eight times the power. A. M. SWAIN.

North Chelmsford, Mass., Nov. 24, 1879.

## MECHANICAL INVENTIONS.

An improved lawn-edge mower, patented by Mr. Timothy Hanley, of Boston Highlands, Mass., consists in a cutter revolving in a vertical plane against a knife whose edge lies in a vertical plane.

Mr. William L. Longley, of Cumberland Mills, Westbrook, Maine, has patented an improved revolving screen for treating paper pulp, so constructed as to screen the pulp rapidly and thoroughly, and expel it promptly from the machine. It consists in the combination, with the interior surfaces of the screen plates, of corresponding bellows plates, the latter being so arranged and operated in connection with the screen plates that when the pulp screen revolves a motion will also be given to the bellows plates, whereby the pulp will be sucked through the screen plates, and an effective pulsation thereby imparted to the pulp.

Mr. George E. Passage, of Nunda Station, N. Y., has patented an improved device for adjusting the shoe to give any desired inclination to the sieve or screen, and which shall be so constructed that the said shoe may be adjusted while the machine is in motion, so that the operator can see the effect of the change, and can thus be able to adjust it so as to give the best effects.