A New Traveling Torpedo.

The details of moving torpedoes, as regards their steering power, propulsion, and explosive charge, have for some time past formed a special study with Mr. R. Paulson, who has effected what would appear to be some important improvements in these respects. Electro magnets are the chief agents used in the steering arrangements, although their exact construction and arrangement are points upon which the inventor prefers to preserve silence at present. So with regard to his improved means of propulsion and the explosive charge; the most that he is just now prepared to state publicly respecting these is that propulsion is effected by a system differing *in toto* from any of those at present employed.

Broadly stated, it consists in the use of chemically generated gas, which is utilized either for forcing a column of water direct astern or for causing it to actuate machinery for driving a propeller. The explosive charge consists of a species of gun-cotton possessing 50 per cent more power than ordinary gun-cotton, but having an equal degree of safety. The steering device is that upon which Mr. Paulson is most communicative, and this is stated to consist of two batteries, one pole of each of which is placed in connection with the coils of two sets of electro magnets, from which leads are conducted to two metal pins fixed on a disk of insulating material. Both the other poles of the batteries are placed in communication with a balanced magnetic needle of special construction. The metal pins are placed one on either side of the needle, and the course of the torpedo having been set, it is started. Any deviation of the torpedo from its assigned course causes a relative movement of the needle, which touches one or other of the pins, thus establishing the circuit through the coils of one or other of the two magnets. An armature connected with the rudder is attracted, and by this means the torpedo is again placed on its right course. The depth of immersion of the weapon is also regulated and maintained in a similar manner by a vertically balanced needle. Another feature is that the torpedo can be directed toward iron ships, irrespective of the predetermined course, by means of another balanced needle.

A demonstration of the steering powers of the apparatus was recently given by the inventor at 15 Cockspur Street, Charing Cross, a model torpedo, about 2 feet 6 inches long and 7 inches in diameter, being used. The model was not placed in water, but was swiveled on a stand, and it was clearly shown that when it deviated from the course upon which it had been laid, the electro magnetic arrangement—which was, of course, concealed within the torpedo—came into operation and restored it to its normal course. More could not be shown, but it was stated that a full sized torpedo, 16 feet in length and 14 inches in diameter, had been made and successfully tried on the coast in England. On the last occasion, however, the torpedo had managed to get away from its inventor, and had been no more seen. The material of which Mr. Paulson proposes to construct the shell of his torpedo differs from that hitherto used in that it is a species of papier mache, of a tough and fibrous nature.

The new weapon is to be discharged from the shore or from any ordinary boat, thus obviating the cost of a special torpedo boat. This feature points it out as valuable for coast and harbor defense, for which purposes it is the opinion of several naval authorities by whom it has been examined that it is especially adapted. In view of its apparent merits, it would appear desirable that the government authorities, who have had the matter under consideration for some little time past, should lose no time in constructing a torpedo of the proper working size and having it practically tested. This course is the less objectionable, seeing that the cost is stated to be only about £150. At any rate, the invention appears to justify prompt and thorough investigation, in order that its practical usefulness or otherwise may be ascertained.—*London Times.*

Freezing and Melting Points of Water.

Although water usually freezes at 32 degrees F., and ice melts when above that point, the result is not uniform in either case. If water, for instance, be kept in a clean, smooth-sided vessel, and perfectly still, it is possible to keep it from freezing until it reaches a temperature of 15 degrees. Under other conditions such a temperature would produce half an inch of ice in a single night, thus clearly indicating the influence of motion on crystallization. If this water at 15 degrees be disturbed in the least degree, the crystals will at once begin to form, and simultaneously therewith the entire mass of water will gradually rise to 32 degrees and freeze solid. In the same way the presence of salt and acid in water retards freezing. Again, it has been ascertained by experiments that if water be boiled in a glass flask, and the neck of the flask be plugged with cotton, the water may be cooled down to 9 degrees F. before it will freeze. With regard to the melting point of ice, the temperature is more uniform, as the solid ice is not subject to the law of motion as water is, but there are ways of precipitating the melting of ice, as has been frequently tested. Thus, for instance, if a block of ice be subjected to a heavy pressure, the melting point can be reduced to 18 degrees F., a point which would produce sharp freezing in a stream or lake, where the ordinary laws of nature were not interfered with.

ASTRONOMICAL PHOTOGRAPHY.

As a few experiments in celestial photography tried last year by means of quite rudimentary instruments gave good results, the Director of the Observatory has been pleased to authorize the construction of a special apparatus, which we illustrate herewith.

This new instrument consists of two juxtaposed telescopes inclosed in an oblong rectangular metallic case, and separated through their entire length by a thin partition. One of the objectives, of 9½ inches aperture and 12¾ feet focal length, is designed for visual observation, and serves as a finder. The other, of 11·4 inches aperture and 11¼ feet focus, is achromatized for chemical rays, and serves for photographing. As the optical axes of these two objectives are parallel, every star kept in the center of the ocular field of the first telescope produces an impression in the center of the sensitized plate of the photographic apparatus.

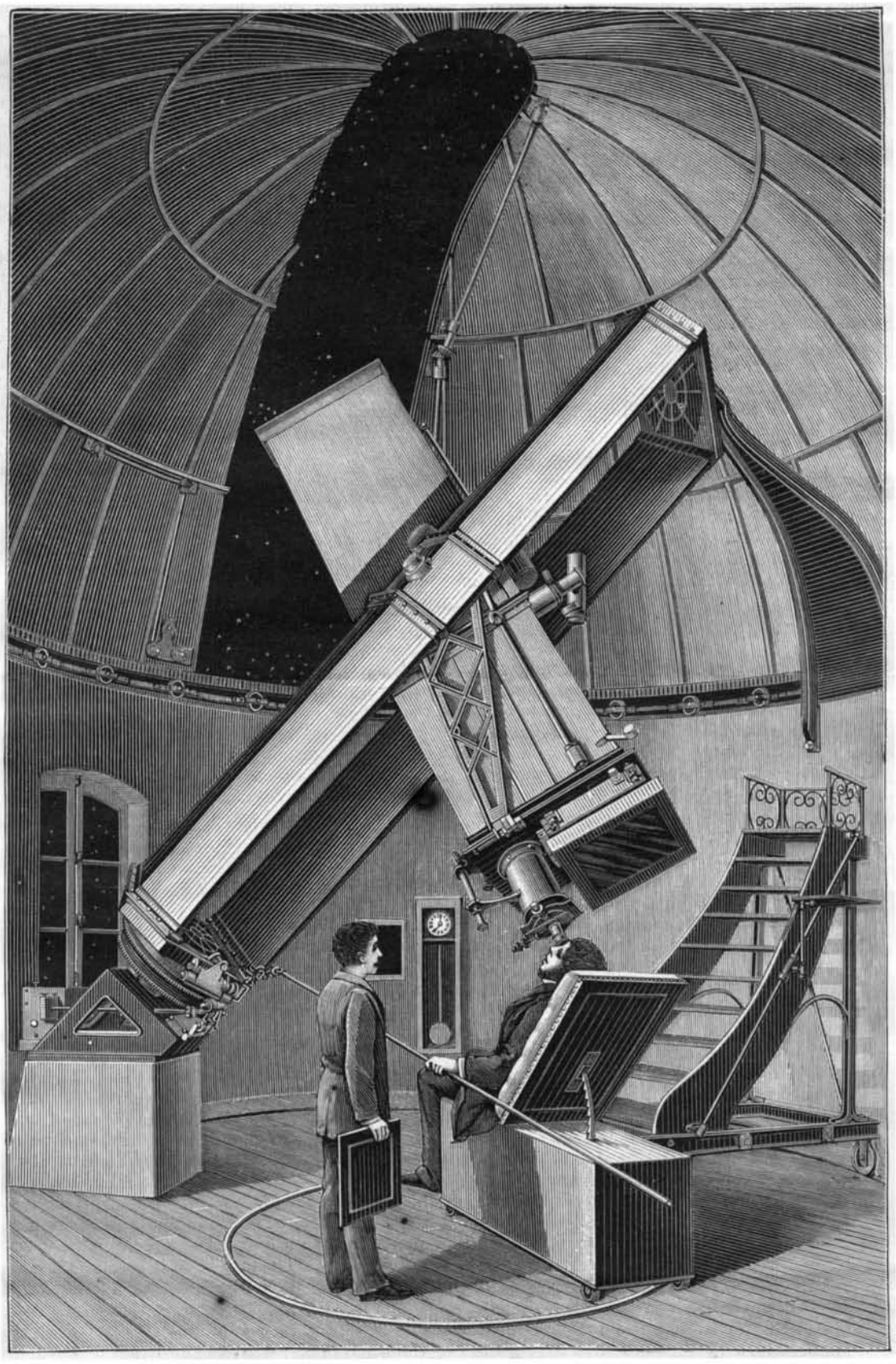


Fig. 3.—PARALLACTIC APPARATUS AT THE PARIS OBSERVATORY.

The equatorial is mounted after the English style, that is to say, the center of the tube always remains in the polar axis of the instrument. This arrangement permits of following up a star from its rising to its setting, without the necessity of turning back the instrument near the meridian, and, moreover, it has the advantage of giving the direct and inverse positions for every region of the heavens, thus allowing of the elimination of certain errors in centering.

Like a horary equatorial, it is provided with horary and declination circles, and a clockwork movement, which carries the apparatus along for three hours without rewinding. In addition, there are very slow, independent, back movements that permit of holding the axis of the telescope upon a given point of the heavens, in spite of any slight irregularity in the clockwork motion and in the setting of the telescope, or of variations in atmospheric refraction. The photographic objective, which is the largest that has hitherto been made, consists of a simple, achromatic system, and, although of extremely short focal proportions, is capable of covering a field three degrees in diameter without the use of a diaphragm.

Although it has been mounted but a short time, this apparatus has already permitted of considerable work being done. The very reduced chart shown in Fig. 2 is a specimen of what it is possible to obtain. In a surface representing an area of about five square degrees of the heavens, we can count more than three thousand stars of between the sixth and fourteenth magnitude, two only of which are visible to the naked eye. We can even distinguish in the negative traces of stars of the fifteenth magnitude, that are too faintly indicated to show up in the positive. Stars of the fourteenth magnitude exhibit themselves under a diameter of 0·00098 of an inch. It will be easily seen that points so small as these might be readily confounded with imperfections in the sensitized film, were not the precaution taken to make many exposures.

In the annexed chart, each star is formed of a group of three points forming an equilateral triangle, each side of which is no longer than 0·0033 of an inch. To the naked eye these three points appear to be confused into a single one; but, if we examine them by means of a strongish lens, the three exposures will become distinct, and it will then be easy to distinguish in the negative everything that does not belong to the heavens, and to eliminate it. By the ordinary processes, it would certainly have required a diligent labor of several months to obtain a chart such as we get here in three hours.

The time of exposure necessary for obtaining an image of the stars is as follows:

1st magnitude, 0·005 s.; 2d magnitude, 0·013 s.; 3d magnitude, 0·03 s.; 4th magnitude, 0·08 s.; 5th magnitude, 0·02 s.; 6th magnitude, last stars visible to the naked eye, 0·05 s.; 7th magnitude, 1·3 s.; 8th magnitude, 3 s.; 9th magnitude, 8 s.; 10th magnitude, 20s., 11th magnitude, 50 s., 12th magnitude, 2 m.—mean magnitude of the asteroids; 13th magnitude, 5 m.; 14th magnitude, 13 m.; 15th magnitude, 33 m., 16th magnitude,

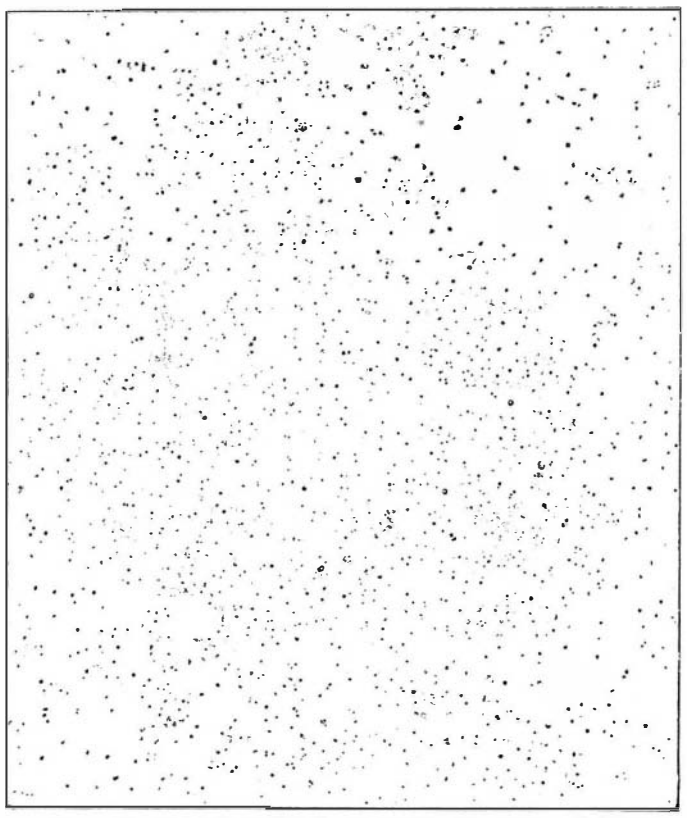


Fig. 2.—PHOTOGRAPH OF A PORTION OF THE CONSTELLATION CYGNUS.

1 h. 23 m.—last stars visible with the average of large instruments.

All these figures represent a minimum. In order to obtain good reproductions upon paper, the time of exposure must be tripled.

It will be seen from this table that between the first and last magnitudes the time of exposure varies from 1 to 1,000,000. (The proportion adopted between the brilliancy of two consecutive magnitudes is 2,512.)

Aside from the construction of celestial charts, we may mention as another very important study the discovery of asteroids, which has now become possible through photography. The small stars appear upon the negative as, so to speak, a mathematical point, while the planets are distinguished therefrom by a small, well defined dash that indicates their proper motion, with magnitude and direction, during the time of the exposure. It is thus that we have been enabled to obtain the track of a small planet of the eleventh magnitude, showing its course through an exceedingly well defined line amid the fixed stars. In the same way it is possible to study the motion of the satellites around their planet, and perhaps to discover new ones.

The study of double and multiple stars will be greatly facilitated, and it will be possible, likewise, to apply photography to researches on the parallaxes. Finally, we must cite photometry as one of the branches of astronomy that will now be enabled to collect very useful data through the use of photography.

Let us remark, in conclusion, that this recent progress has perceptibly increased the power of human vision. It permits, in fact, of obtaining the image of a star that would remain invisible with instruments of the same aperture as those that photography employs.—*La Nature.*

Dialyzed Pitch.

The healing properties of vegetable resins are well known, and extracts therefrom in various forms are extensively employed in medicine; but they are more or less objectionable, as heretofore no means of removing or separating the foreign and hurtful substances have been used. Mr. Charles J. Ulrici, a chemist of Havana, Cuba, has succeeded in obtaining, by dialysis, a new and pure preparation, which is believed to be of importance for medical purposes.

The first operation is the filtration of the pitch to separate certain substances, which in its natural state are incorporated with it, such as vegetable remains, carbon dust, bits of leaves, earthy matters, deposits of smoke, and other impurities. These substances are separated and removed by the filter, while the heat applied drives out a portion of the bad or poisonous principles, which become volatilized by the heat.

Vegetable pitch may be said to be composed of two parts, one portion consisting of combined dense empyreumatic resinous matters of dark color; and, second, another of liquid nature, which holds in solution the first part. The acrid and nauseous odor of the raw pitch is due to the poisonous or hurtful substances, some of which are pyroligneous acid, formic acid, wood spirit, or methylic alcohol, aldehydes, acetones, methylic acetates, creosote, cyanides of ammonia, and benzines, and these substances, by means of bicarbonate of soda, become capable of being removed by the operation of dialysis.

The dialyzing apparatus is made with vegetable parchment in the usual manner. The dialyzer is placed within a suitable vessel containing distilled water upon a level table, care being taken that the level of the exterior liquid is the same as the level of the liquid contained within the parchment or dialyzer. The whole is allowed to stand three days, at the end of which time the exterior water is removed and a new quantity substituted. The first water is then tested with sulphuric acid, and note is taken whether there is any effervescence or discharge of carbonic acid. If there is, the dialyzation is continued for three days more, when the exterior liquid is again tested in the same manner described. If there is no effervescence, then the operation of dialyzation is complete, and the poisonous and injurious principles contained in the mixture will have been extracted therefrom and carried over to the exterior liquid, together with the sugar and the bicarbonate of soda, that which remains in the dialyzer being a neutral solution of colloidal and chemical nature derived from the useful principles or components of the pitch, the poisonous or hurtful principles or components having been removed.

The dialyzed pitch is then concentrated by the application of a gentle heat to evaporate it slowly. It is then mixed with coarse sand, and then evaporate from this mixture, with gentle heat, a portion of the water. The sand, after losing the water, will remain damp. Allow this to become cool, and then place it in a lixiviating apparatus.

This operation has for its object to dissolve the concentrated and dialyzed pitch that is imprisoned in the sand. This is accomplished by means of a suitable liquid vehicle, whereby the dialyzed pitch will be liberated from the sand and taken up by the liquid vehicle, and in this manner is constituted the extract of dialyzed or colloid pitch. The lixiviation is prepared for use with a liquid vehicle composed of alcohol and glycerine.

The operation of lixiviation makes a complete extract of the pitch which is imprisoned in the sand. Every portion of the liquid vehicle, when it comes in contact with the sand containing the pitch, becomes charged with a proportional quantity thereof, and each portion of the liquid vehicle takes up a portion of pitch until the whole has been completely dissolved and all the pitch contained in the sand joined to the water, alcohol, and glycerine, these three bodies being powerful and inoffensive solvents, and being the vehicle of which most fluid extracts are made.

This compound or fluid extract of dialyzed pitch thus prepared is of great medicinal value, as the hurtful substances have been removed. It is used for various medical purposes, such as the treatment of bronchitis, of throat diseases, of ulcers of all kinds, herpes, chronic rheumatism, scrofula, sores, and diseases of the skin.

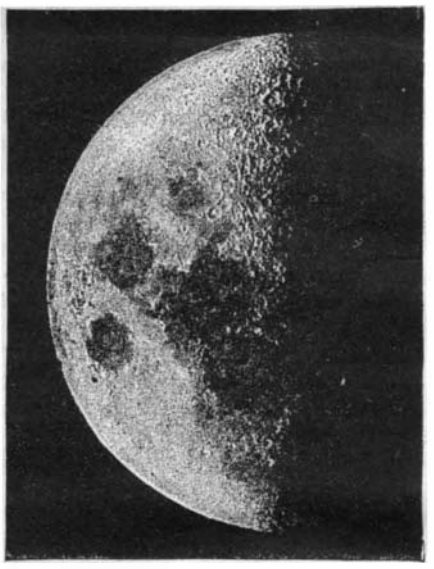
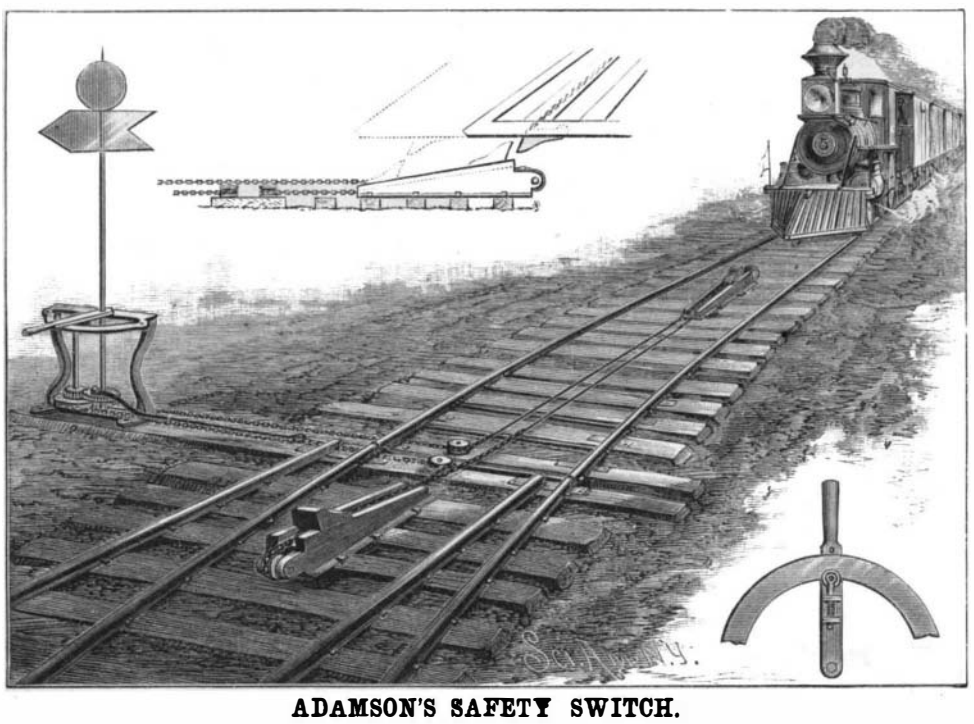


Fig. 1.—PHOTOGRAPH OF THE MOON.

A RAILWAY SAFETY SWITCH.

The invention herewith illustrated shows a plan of constructing a switch by which a train moving on the main track will automatically close an open switch and bring the rails into alignment. To this end, sliding blocks are mounted to slide in inclined ways securely fastened to the ties in the center of the track beyond the ends of the switching rails. These sliding blocks have eyes at each end, to which are attached chains, one communicating with a rod connecting with the sliding block at the other end of the switching rails, and the other passing around a sheave in the inclined way, then around another sheave in the center of the track, to and around a chain wheel mounted in the switch stand. A dog or catch is pivotally connected to the under side of the locomotive, and when the train approaches a switch set for a siding, as shown in the engraving, this dog strikes the sliding block, moving it in the manner indicated by the dotted lines in the small view, drawing the chain to revolve the chain wheel in the switch stand, and thus moving the switch bar to bring the switching rails in conjunction with the main rails. The switch lever rides above a circular rack which projects from one side of the switch stand, and has a yielding roller catch. The various parts are so arranged that when the main line is open the sliding blocks will be at the lower ends of their inclined ways, so they will not then engage with the dog on the lower side of the pilot; but if the train is to be switched, the dog is raised by a simply arranged device, so as not to throw the switch to the main line. With some slight changes in details, which are set forth in the patent, this form of switch is also adapted for use where there is a switch or siding on each side of the main track.



ADAMSON'S SAFETY SWITCH.

This invention has been patented by Mr. Robert Adamson, of Auburn, N. Y.

Monument to Friedrich Wohler.

The great German chemist Friedrich Wohler died in 1882. In recognition of his eminent services, the German Chemical Society at once proposed the erection of a monument at Gottingen, where most of his life's work was accomplished. A sum of $4,000 has been collected, but as this is not sufficient for the purpose, an appeal has been made to American chemists to aid in honoring one who has done so much to elevate their calling to the rank of a true science. The American committee particularly appeals to those who formerly studied under Wohler, and to all who are interested in the science to which he devoted his life. Contributions may be sent to Prof. Ira Remsen, Johns Hopkins University, Baltimore, Md.

THE following is given as a cheap mode of rendering fabrics uninflammable: Four parts of borax and three parts sulphate of magnesia are shaken up together just before being required. The mixture is then dissolved in from 20 to 30 parts of warm water. Into the resulting solution the articles to be protected from fire are immersed, and when they are thoroughly soaked, they are wrung out and dried, preferably in the open air. — *New York Times.*