or 4,950,000 bricks for the eleven engines. This added to the number of bricks used in the stack makes a total of 8,300,000 bricks for the foundations and stack alone.

Flags of Our Warships.

In the Equipment building at the New York navy yard there is a large manufactory where most of the flags of our navy are made. A large vessel carries forty American flags, and a smaller vessel almost as many. This does not include the fleet and international signal flags and the flags of other countries. There are three rooms in the Equipment building which are given up to flag-making. One of these is very large and the others on either end are much smaller. There are sewing machines, scissors, pincushions, and flatirons scattered around, so that the place does not look unlike a patriotic dressmaker's establishment. The flags are all made by women, though a few men help to cut out the stars and do the finishing. The wind and weather destroy flags so fast, and new vessels are put into commission so rapidly, that it is necessary to employ a number of people even in time of peace. The working hours, during the present war, were extended from eight o'clock in the morning to five o'clock in the evening to eight o'clock in the morning to ten o'clock in the evening. In one week eighteen hundred flags were made at the flag department, and this was when the rush of work was about over. The women cut all the square flags and the devices for them. The men cut the stars and bias pennants and put on the finishing touches and the heading through which the rope runs. They also put in the rope and stencil the flag with the size and nationality. There is a pattern for every flag, and the patterns are put away in paper bags when not in use. There are forty-four flags in a set of general signals used in the navy. These are in three sizes, while the regular flag is made in nine sizes. The largest flag measures 36 feet long, while the smallest is only 30 inches. Pennants are made up to 70 feet long. There are nineteen international signal flags and forty-three foreign flags which are made at the navy yard. There are no specialists in the workroom, and the women make any flag which may be assigned them. Of course it is necessary to have the flag exactly the same on both sides, which makes the work very difficult, especially with foreign flags, where the devices are in much detail. It may be truly said that some of the flags are fancy work on a Gargantuan scale. Here are wonderful landscapes, with round-faced suns with halos coming up from behind gay colored mountains over which run rainbows in four or five lines of outline or chain stitching, making a scene which would surprise an artist. Water must be indicated with some kind of embroidery stitch. Whole menageries of animals have to be represented on some flags. Flags of Costa Rica and San Salvador are considered the most difficult to make, says The New York Times, from which we glean our facts. The German flag is also considered difficult. The largest foreign flag is only 25 feet long. The largest sized American flags are made of 19 inch bunting and the narrow pennants are made of 4¼ inch bunting, which comes on purpose for them. Each flag which is made is measured on the floor over the seams and sewed to insure the exact measurement. There are metal pieces let into the floor and each one is marked for the different flags. It is an inspiring sight to see the manufacturing of these flags, and it seems curiously appropriate that women should be selected to make them. Preparing the colors for gallant warriors who go to fight seems to have always been an essentially feminine duty which has obtained from very early days. In the middle ages fair ladies embroidered the banners under which their knights fought, and although flag-making is now put on a business basis, it has been the work of the women in the United States since the first flag of the country was made down to the present day.

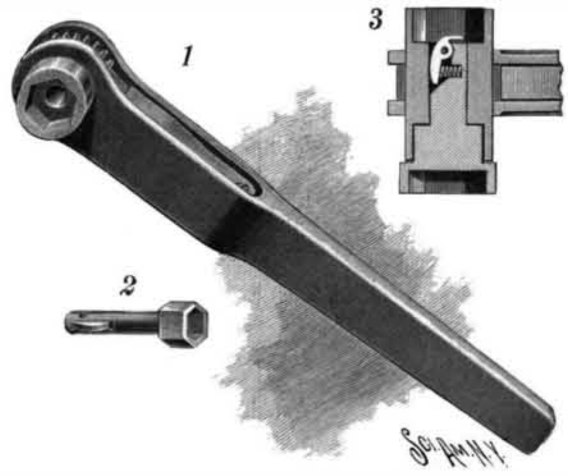
AN ATTACHMENT FOR SOCKET-WRENCHES.

In order to enable a socket-wrench to engage nuts of different diameters, a device has recently been invented which, when applied to a wrench, permits a wider use of that wrench than would otherwise be possible.

Of the annexed illustrations, Fig. 1 represents a ratchet-wrench in perspective; Fig. 2 the removable device or socket piece; and Fig. 3 an enlarged section of the socket-end of the wrench, showing the socket-piece applied.

The ratchet-wrench illustrated is provided at one end with a rotatable barrel having sockets in each end formed to engage nuts of a certain size. These two sockets are connected by a central aperture, circular in cross-section. The auxiliary socket-piece has a stem or shank, which, when the socket-piece is in use, is inserted in the central aperture of the wrench-barrel, as indicated in Fig. 3. On the stem a head is formed which coincides in shape with the socket of the wrench-barrel. The head of the socket-piece is provided with an auxiliary socket, the diameter of which may be smaller or larger than that of the wrench-socket. In Fig. 3 the auxiliary socket is shown projecting from the wrench-barrel to engage nuts of a diameter larger than that of the wrench-socket.

In order that the socket-piece may not be displaced from its position, a spring-pressed friction-block is pivoted in a slot formed in the end of the stem of the socket-piece. The block being pressed against the barrel of the wrench, holds the socket-piece with a



HAGGERTY'S ATTACHMENT FOR SOCKET-WRENCHES.

force sufficient to prevent its dropping out in whatever position the wrench may be placed.

The attachment forms the subject of a patent controlled by J. Henry Haggerty, of 50 South Street, New York city.

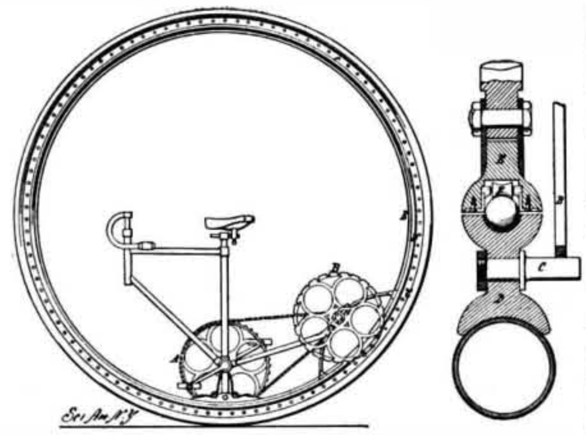
A UNICYCLE OF NOVEL FORM.

In the accompanying engraving we have illustrated a unicycle which, by reason of its novel construction, has attracted not a little attention.

The main feature of this unicycle is found in the formation of the spokeless wheel, the rim of which is made in two sections, turning upon each other. The driving gear is secured to the inner section of the rim.

As shown in our side elevation and section, this rim is composed of the two parts, *D* and *E*. The part, *D*, has a concave portion which receives the tire of the wheel and which is connected by a web with another portion semicircular in form, constituting a ball raceway. Between this raceway and the recessed portion of the part, *E*, balls are placed which are engaged by rollers, *F*, adapted to take up the wear. Thus constructed, one portion of the rim will turn upon the other, the friction being reduced by means of the balls and rollers.

Of the two parts of the wheel rim, *E* is the stationary



SIDE ELEVATION AND SECTION.

THE UNICYCLE IN OPERATION.

section and *D* the traveling section. The web of the traveling section, *D*, is provided with pins, *C*, extending horizontally from one side.

By means of the pedals, the rider drives the sprocket-wheel, *A*, the motion thus produced being transmitted by means of a chain and small sprocket-wheel to the drive wheel, *B*, slotted to engage the pins, *C*, of the traveling section, *D*.

The drive wheel, *B*, and the small sprocket-wheel are mounted on a single shaft moving in a slot concentric with the wheel rim. The shaft is connected with the seat mast by links, the forward ends of which receive the ends of the pedal shaft. By throwing his body toward the front, and thus bringing his center of gravity forward, the rider, it is claimed, is relieved of much of the work necessary to drive the wheel. The movement of the saddle naturally produces a corresponding movement of the drive wheel shaft in its slot. The inventor states that the wheel may be steered by inclining the body to the right or to the left.

The unicycle has been patented by Vernon D. Venable, of Farmville, Va., and has been in actual use for two months.

The Measurement of Sunshine at Health Resorts.

Jones (Lancet) has been measuring the actinic value of the sunshine, in summer and winter, in London and at Llangammarch Wells, a mountain resort in Wales, where the air is particularly pure and clear. He found that the actinic value of the sunshine in the latter place was in an hour of a summer's day from three to five times that of London under similar conditions of clear or clouded skies. In the winter the difference was not so marked, but the Wales sunlight was about twice as strong as that of London. A comparison with the results of similar tests made in the high Alps shows that the air may be just as pure in a mountainous district or far less lofty elevation. These tests are essentially a test of the purity of the air, as the amount of heat in the sun's rays has no effect upon the result. The method employed is briefly as follows:

A solution of potassium iodide is prepared containing 20 grammes to the liter of water; also, a solution of pure sulphuric acid, 11·6 grammes to the liter of water; and a third solution in which a liter of water contains 0·39 gramme of powdered arsenious acid and 1·5 grammes of potassium bicarbonate. To make a test of the sunlight, 10 cubic centimeters of solution No. 1 and an equal amount of No. 2 are placed together in a glass stoppered bottle on a white porcelain plate, and exposed to the action of the sunlight. At the end of an hour the bottle is removed and enough sodium bicarbonate is added to it to just neutralize the acid. The bottle is then placed under a burette containing the solution of arsenious acid, and the latter is run in until the color of the iodine is completely discharged. The results are expressed in milligrammes of iodine liberated per 1,000 cubic centimeters of solution used. Since in practice 200 cubic centimeters of the mixed solution are used, the results obtained were multiplied by five to bring them up to the accepted standard.

Sunlight has a well known inhibitory effect upon the life of pathogenic organisms. Direct sunlight will kill tubercle bacilli in a few hours or perhaps in a few minutes; whereas they will live for days if exposed to a very strong diffused daylight. The exhilarating effect of a burst of sunshine in the spring is probably not due to mere luminosity, but to an increased actinic action, a chemical action which we cannot very well explain, but which every one feels. In estimating, therefore, the value of a health resort, the amount of this actinic value in the sunshine ought to be taken into account, no less than the number of days upon which the sun shines during the month or the year.

The Mitis Patent Sustained.

The United States Circuit Court of Appeals on October 21 affirmed the decision of Judge Acheson in the United States Circuit Court at Pittsburg, sustaining the Mitis patent for the use of aluminum in the manufacture of steel ingots and castings. The litigation has lasted nearly four years, suit having been brought by the United States Mitis Company against the Carnegie Steel Company, to restrain the latter from alleged infringement of patent. The Carnegie Company appealed on decision of the lower court and was enjoined from using the patent, and now that the Court of Appeals has upheld that finding, it is said that the Carnegie Company has taken out a license under the patent and made settlement for the past infringement.

Oscillation of the Eiffel Tower.

According to a report to the Academy of Sciences in Paris, by Colonel Bassot, the Eiffel Tower is subject to variations of inclination. He thinks that this is only due to the contraction and expansion of the enormous mass of iron caused by the changes of temperature. From sunrise to night the difference to and fro amounts to 20 centimeters, but the stability and strength of the iron structure are not influenced thereby.

Miscellaneous Notes and Receipts.

Gold Solder or Gold Alloys for dentists' purposes are obtained by fusing together 53 parts (by weight) of refined copper with 25 parts (by weight) of pure silver and 12 parts of tin. According to the admixture of gold, every carat is obtained. If very high carat gold is wanted, the tin is left out and the quantity of copper is correspondingly reduced.—Technische Berichte.

Osmium threads which are to take the place of the platinum wire, and give an exceedingly bright light when the electric current passes through them, have been patented by Auer von Welsbach. The manufacture of these incandescent light tubes consists in covering a thin copper wire with osmium metal and annealing the wire at the highest temperatures. The copper evaporates, while the coating of osmium remains unchanged in the shape of a hollow thread.—Neueste Erfindungen und Erfahrungen.

Italian Earth Colors.—Chief emporium and mart for all Italian colored earths is Leghorn, where a special branch of industry has developed for working them. The principal firm of the branch there is that of Enrico Ganni & Company, the chief products being sienna (Terra di Siena), ocher, and umber. All these different varieties of earth are mostly found in the vicinity of Monte Amiata, Province of Grosseto, while the Province of Siena only has very insignificant beds of them, and none at all are found in the environs of the city of the same name. Why the term of "Terra di Siena" (earth of Siena) was adopted therefore seems inexplicable. Yellow ocher is almost exclusively found on the surface of the earth, while sienna earth is met with in deeper strata, the inferior qualities lying higher, the better ones deeper. Thus the upper stratum furnishes "bolo di terza," third quality; the mean one, "bolo di secunda," second grade; and the lowest, "bolo di prima," first quality. From the latter another grade of the very best quality is sorted out by hand, which is called "spurgo di bolo" or "giallone" in Italy and is known in Germany under the name of "electa." The earth raised from the depth generally contains 70 to 80 per cent of water, and, therefore, is first cursorily dried by air and sun. Raising is, as a rule, only done in summer, because during the rest of the time the damp weather renders the work very difficult. Burning, however, is performed at almost any time, at the place of production, charcoal being employed, unless it be preferred to send the material in a raw state to Leghorn and to treat it there. But, as a general rule, only the breaking up and grinding of the products of the country are done at Leghorn. Thus it is that the color earths get there in four different forms, viz.: 1, Entirely raw; 2, burnt and unground; 3, unburnt and ground; and 4, burnt and ground.

The working in Leghorn is simple enough. The raw earth, which has only been superficially dried at the place of production and still contains 20 to 25 per cent of moisture, is dried before the breaking up, in moderately heated furnaces, whereby the percentage of water is reduced to about 5. Then it is burnt in stone furnaces at an exceedingly high temperature and only superficially broken up on the first mill, finally grinding it into fine dust between granite stones in huge steam mills.

Turkish umber, from Cyprus, is also sent in sailing vessels to Leghorn, and is stored in vaults which date back to the time when the city possessed the principal harbor of the Mediterranean Sea. Of this Turkish umber, three special varieties are distinguished. "Lisamol," very light; "Larcana," darker; and a very dark one, virtually black. The material is always brought on in a raw condition, and carefully assorted before the working. Same is dutiable upon importation into Italy at 4 lire per centner, but a drawback is paid when the finished merchandise is re-exported. The burning of the umber is not essentially different from that of sienna and of ocher. The material is shaped into lumps of the size of melons and placed on iron gratings in the furnaces. By this method the color is said to be improved. Frequently, however, it is burned just the same as the other kinds. In 1897, 721,000 kilos of Turkish umber earth were imported into Leghorn, of which 550,000 kilos were again sent abroad after being worked up. From Sardinia, Leghorn receives light and dark ocher in a raw condition, but it is far inferior as regards quality to that of Tuscany.

The price of the different products on the spot varies greatly according to the shades and qualities. In 1897 the price for unburnt sienna fluctuated between 80 and 240 marks ($19–$57) per ton, according to quality; that for raw unwashed ocher ranged from 70 to 110 marks ($16–$29); for the washed product from 160 to 200 marks ($38–$48); while umber earth was sold at 40 marks ($9.50) per ton. The three varieties of sienna known in Italy under the denominations of "chicco," "gripolo," and "polvere" cost 80 to 400 marks ($19–$96); "Spurgo di Bolo," burnt, 1,200 marks ($288); the first three varieties powdered, 120 to 600 marks ($28.50–$144); the latter up to 1,400 marks ($336) a ton; umber burnt, 60 marks ($14); powdered, 110 marks ($26).—Translated from the Färben Zeitung.

Filtration and the Water Supply of Cities and Towns.

Filtration, as a means of securing the desired purity in the water, is strongly advocated in some cities where the improvement of the supply is being made the subject of investigation, and the subject is just now one of increasing interest and very vital importance.

The value of the filter for domestic use is not to be denied. They have the advantage, because of their portable character and moderate dimensions, of being readily cleansed or renewed; but if they are neglected, they may become a source of the very danger that is sought to be avoided.

A city filtration plant is a more difficult problem. It is expensive to install, requires an immense area, demands constant inspection and a frequent renewal of material, all of which will add materially to the annual municipal burdens.

Whether the best known methods of filtration, as applied to large water plants, afford the desired protection, especially as regards the dissemination of disease, appears to be open to some doubt.

From time to time, during the last two decades, the filtration and purification of water have been made the subjects of special investigation by the Franklands and by the British government through the medium of the laboratories of the Army Medical School at Netley, some of the investigations being undertaken on behalf of companies supplying East London with water. These and other investigations on a smaller scale have supplied us with sufficient data to permit reliable deductions to be made.

Ordinary filtering plants, as applied to municipal supply, consist of an upper stratum of sand superimposed upon a layer of gravel of gradually increasing coarseness; these strata vary in thickness, from 14 to 28 inches of sand and 24 to 36 inches of gravel.

Common silicious sand that is not too fine—that presenting clean, sharp, angular particles is best—acts to a certain degree mechanically. As the water passes through, the impurities held in suspension, whether organic or inorganic, adhere to the angles and plane surfaces of the grains. The result is highly satisfactory as far as it goes; but the action upon organic matters is very imperfect. Further, as the sand becomes incrusted with inorganic material, it rapidly loses its effect upon the organic, and thus ceases to act as a filter. On the contrary, if not frequently renewed, it may, after a considerable period, become an actual source of danger, by further impregnating water with material removed by previous filtrations.

Green ferruginous sand is more effective. It will, for a time, arrest all, or nearly all, organisms; but after being in constant use for a fortnight, in contact with water of the average character afforded by running streams, its value is considerably reduced. Safety, then, would demand that such filtering material be replaced with new, at certain stated intervals. Nearly as good, but not quite, is fine, well washed white sand that has been roasted to redness; and its virtues may be renewed by subsequent treatment at high temperatures.

The material obtained by roasting hematite ore, and which from time to time has obtained unstinted praise, is merely a porous metallic iron with manganese oxide. It occupies a space of about twenty cubic feet to the ton. As regards water, its action is both mechanical and chemical. Like sand, it arrests inorganic matters, and at the same time oxidizes organic material held suspended in solution; it even in a measure decomposes the water, setting free a portion of its oxygen to reinforce that evolved from the manganese. The experiments of the Franklands, and of Parke, prove that this material can be depended upon to remove the greater part of dissolved organic material, and, indeed, all such, if the exposure to its influence be sufficiently prolonged, and the resultant filtrate is bright, clear, and pure, and may, moreover, be stored for a long time without undergoing change. Its power is much more enduring than that of any other known substance or combination of substances; the great drawback being that, when once it is loaded with organic matters, it must be immediately renewed. Moreover, as hematite ore is very abundant in many districts of the United States, its cost for this purpose is fairly low.

"Magnetic carbide," so called, is prepared by roasting in a retort equal parts of red hematite and sawdust. Its value is not equal to that of any charcoal, and is decidedly inferior to hematite alone. "Manganous carbon," or "carbide," is another compound, of about equal value. It is claimed to be a mixture of animal charcoal and manganese oxide surrounding a block of "specially prepared carbon." "Carbolite" is of a similar nature, but is reputed to be even more expensive, without proportional increase of value. "Polarate" is another substance for which extravagant claims have been advanced. It is a magnetic, spongy carbon, consisting chiefly of iron oxide, along with some silica, alumina, and carbonates. It is understood to have given good satisfaction as regards house and small filters, but, like all other agents, requires to be renewed. It can readily be imagined that, like all filtration materials, by neglect it may defeat its end and become a positive source of impurity.

A compound that has obtained no little reputation in France among the non-expert—perhaps because it is a purely Gallic product—is made up of manganous carbon and lime permanganate. It purports to be not only equally effective as regards either mineral or organic substances, but also to completely sterilize any fluid brought in prolonged contact therewith. Manifestly this is a case of claiming too much, since there is no substance available for domestic or corporation purposes that is capable of removing all bacilli. Further, certain bacilli are essential to the purity of water that is to be stored and exposed, as in a corporation reservoir. Even the solid block of specially prepared porcelain, operated in connection with an air pump, as employed in physiological laboratories, is not invariably efficient. The theory advanced, however, becomes plausible, doubtless, when sounded in the ears of the laity; for it is declared that decomposition is induced by the manganese in the presence of organic matters, whereby they are "turned into oxygen," while the lime "consumes the micro-organisms." Even accepting the foregoing as possible, it at once is made obvious that the value of the material as a filter would be limited. Having once parted with its oxygen and become simple metallic manganese and lime, new sources of oxygen and renewal of chemical composition would speedily be demanded.

Animal charcoal, deprived of its calcium phosphate and carbonate by repeated washings or by treatment with hydrochloric acid, has long been deemed one of the best of filtering materials—and this is true as regards many fluids. Brought in intimate contact with water, it removes the suspended matters, organic and inorganic alike, the filtrate yielded being very clear and bright. But this substance also has its limitations. At first the organic matters are completely oxidized, but after a very brief period it becomes wholly inoperative.

In connection wth the experiments conducted at Netley, personally repeated and verified by Percy Frankland, it was discovered that while animal charcoal, for a considerable time, has a very rapid and powerful effect upon dead, decaying, or wholly decomposed organic matter, it speedily allowed fresh organic matter to pass through but very little, if at all, changed. Also that the filtrate requires to be utilized almost immediately, since it is prone to be speedily charged with new organisms. Again, its value is in a measure determined in proportion to the pre-existing purity of the water filtered, and to be at all efficient it requires to be replaced as often as every three months, and with very bad water, as frequently, perhaps, as every fortnight.

Vegetable charcoal, as had from the combustion of wood, peat, and seaweeds, is less efficient than the animal product; but reduced coke is in general more efficient than either, retains its essential filtration qualities longer, and for a time may be renewed by heating and the addition of a modicum of new material. It ranks second to hematite.

Railroad Signaling.

On the evening of October 31, in this city, Prof. George W. Blodgett, of Boston, and electrical engineer of the Boston and Albany Railroad, gave an interesting illustrated lecture, before the Academy of Science, on the past and present methods of railroad signaling. He illustrated the Hall method of automatic electric signals, which on some roads has been in use for over twenty years. It is a less expensive system than the separate cabin block method.

One of the most interesting improvements is the change from the mechanical interlocking lever and rod systems (which but a very few years ago was the most up-to-date) to the combined interlocking electric and compressed air (electro-pneumatic) system, which, he stated, was particularly well adapted to large yards. The latest yard equipped in this way is the new great Union station yard at Boston, which has nearly thirty tracks. The signal station building is large and is furnished with a series of horizontal switch bars operated separately by a handle on one end. At the rear of the bars, rising in a vertical plane, is a miniature model map of the entire system of tracks, showing the location of every switch and signal. Each switch is operated by compressed air stored in a reservoir adjoining the switch. The pressure is enough to work the switch five or six times in case the general supply, by accident, ceases. A boiler operates a compressor which keeps the air pressure uniform.

The electricity is furnished from storage batteries supplied by current from a general source. The operator first rotates the electrical switch bar to move the rail switch; as he does so, the switch on the miniature track before him moves, which assures him that the switch outside has also moved, then he rotates the signal electric switch, which causes the compressed air to set the large signal at a distance and allows the train to pass. All of these operations are done easily without difficulty and with a less number of men than by the old system.