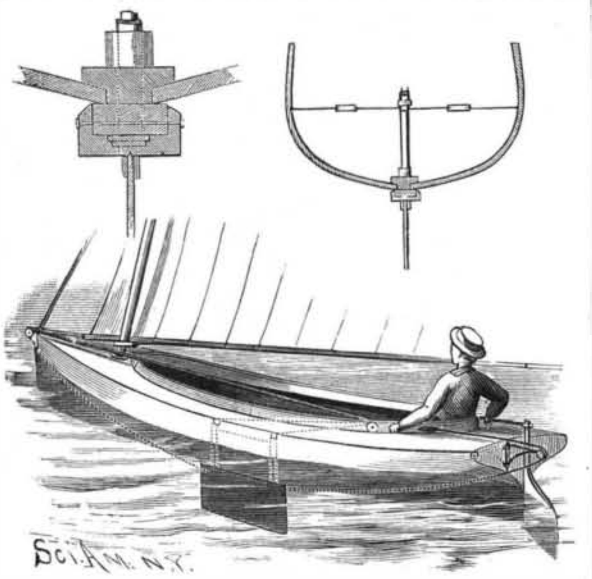
CENTERBOARD FOR VESSELS.

The centerboard here illustrated is so arranged that it may be almost instantly set and removed as the sailing conditions and emergencies may require, the operations being performed by the helmsman at the stern of the vessel. Where the centerboard is inserted the keel is made in two parts, as shown in the enlarged sectional view, between which the side planks of the hull are held. To the lower part is fixed a metal shoe having a longitudinal ranging slot, in which fits the upper edge of the centerboard. Hollow metal plugs having fixed collars at their lower ends are passed upward through the keel, and are screwthreaded at their upper ends to receive screw collars, which, when screwed



McFALL'S CENTERBOARD FOR VESSELS.

home, draw the shoulders tightly to the bottom of the keel and clamp the two parts together, the joints being all water tight. The screw collars project above the plugs to receive the ends of tubes, which are only long enough to substantially support rods whose lower ends are screwed into thimbles fixed to the upper edge of the centerboard. These thimbles have shoulders that fit tightly to the lower ends of the plugs when the centerboard is in place. To the tops of the rods are attached ropes or chains, which are guided over blocks to within easy reach of the helmsman. The tubes are firmly braced by stay rods fixed to their tops and to the sides of the vessel.

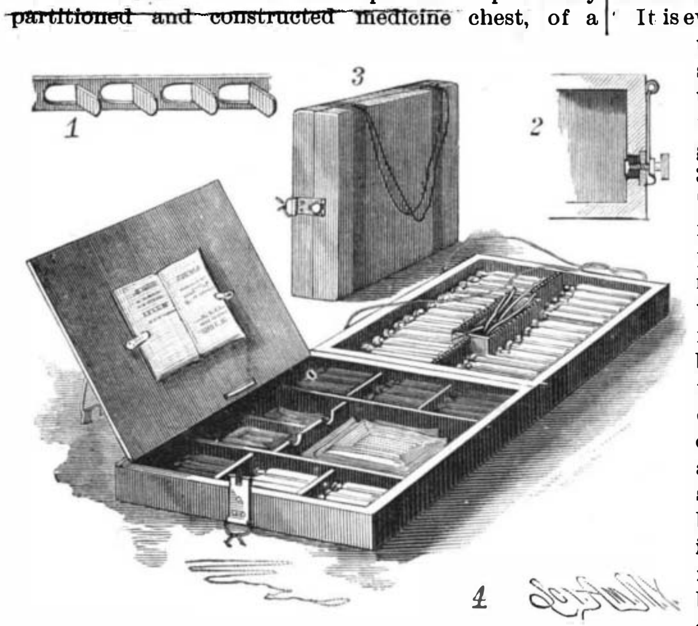
Should the helmsman wish the vessel to drift or make leeway, he will unfasten the chains and let the centerboard fall away some little distance from the keel, and thus become inoperative. By drawing upon the chains, the centerboard may be again brought into use.

Should the centerboard be run hard aground, the rods will be unscrewed from the thimbles, when the boat will be free. If the centerboard is lost, a new one can be easily set by pulling chains attached to the rods of the new one through the tubes, by means of lines. If at any time the centerboard is not needed, the chains are slacked off, and it is pulled on board by chains arranged to pass over either the stem or stern.

This invention has been patented by Mr. David McFall, 213 East 35th Street, New York city.

A MEDICINE CHEST WITH MANY CONVENIENCES.

The illustrations herewith represent a peculiarly partitioned and constructed medicine chest, of a



HUTTON'S MEDICINE CHEST.

flat shape, which has recently been patented by Mr. Terry J. Hutton, of Fergus Falls, Minn. Fig. 1 is a perspective view of a piece of a struck-up metal strip for holding the lower ends of the vials in position, and Fig. 2 is a vertical section of the front end part of the chest when closed, illustrating the fastening, Figs. 3 and 4 showing the chest closed and open respectively.

The chest forms a case composed of upper and lower main sections hinged together at one end, the lower section being principally divided into two longitudinal vial-holding compartments, one above the other, with a central compartment which can be used to hold a drop measure, surgical needle, brushes, etc. The vial-holding sections are arranged to hold vials of different sizes, the vials being securely held in pockets, but so that the labels indicating their contents can be easily read. The upper section of the chest is divided by transverse partitions and a longitudinal partition, to give compartments for holding plasters, bandage strips, etc.; but the partitions are shallow, to allow room for a handbook of directions attached to a cover which fits over this compartment. The lock used is a simple one for the purpose, so the chest may be easily closed or opened, and always carries its own key. When the chest is fully thrown open, and the lid set inclining in its open position, all the contents are exposed to view, and there is no necessity to remove some of them to get at the others. The inventor has likewise obtained a copyright on an appropriate trademark for this chest.

Erosion of Gun Barrels by Powder Products.

At a recent meeting of the Iron and Steel Institute, a paper on this subject was read by Sir Frederick Abel, and Colonel Maitland, superintendent of the Royal Gun Factories, Woolwich. The peculiar action of powder products upon the inner surface or bore of a gun, as they rush from the seat of the charge toward the muzzle, whereby more or less irregular scoring or erosion is produced, is ascribable to the co-operation of three causes, viz., a softening if not a fusing effect, exerted upon the surfaces of the metal by the high heat of the explosion; an increase of this softening or fusing effect by the chemical action of the sulphur upon the metal at the high temperature to which the surface of the latter is very rapidly raised; and the mechanical action of the rush of gases, vapors, and liquid products upon the softened or fused surfaces. The great increase which has been taking place during the last twenty years in the power of artillery has brought the subject of the erosion of gun barrels into prominence, and it is not too much to say that it now forms one of the chief difficulties to be encountered by the maker of a heavy gun. As far as can be seen at present, its sufficient mitigation is the one great difficulty which seems likely to impose a limit on the size and power of ordnance in the future. Erosion is of two kinds, technically known as muzzle loading scoring and breech loading scoring, though both kinds occur to some extent in all guns, whether muzzle loading or breech loading. Muzzle loading scoring is produced by the rush of the powder products over the top of the projectile through the clearance, or windage, which has to be allowed for facility of ramming home the shot along the bore in a muzzle loader. Breech loading scoring is produced by the rush of the powder products behind a shot, acting as a gas-tight plug, during and immediately after its passage through the gun.

Muzzle loading scoring takes place almost entirely in the upper surface of the bore, and its effect diminishes greatly as the velocity of the advancing projectile increases. Breech loading scoring, on the other hand, erodes the bore almost equally all round, and extends toward the muzzle, till the pressure of the expanded gas is so much reduced as to render it ineffective.

It is evident that, *cæt. par.*, erosion will increase with the amount of the powder products, with pressure in the bore, and with the duration of the time of action. Its inconvenience first began to be seriously felt in the 7 inch muzzle loading gun of 7 tons weight, which fired a charge of 30 pounds of powder with a shell of 115 pounds. The great strides which have since been made in the weight of projectile and the amount of powder charge fired from heavy guns have resulted in increased rapidity of the deterioration of guns from this cause; and now that it is proposed to arm the Benbow with 16¼ inch breech loading guns of 110 tons weight, which will fire a shell of 1,800 pounds weight with a charge of 900 pounds of powder, the question of erosion becomes one of paramount importance. The 7 inch gun above mentioned was able to fire about 600 full charges before the bore had become so badly scored as to require its interior to be fitted with a new tube; this number of rounds was increased to about 1,000 by the introduction of an expanding copper gas check, fitted on the base of the projectile. The adoption of breech loading further increased the life of the gun by sealing the muzzle loading scoring still more effectually; but on the other hand, it permitted the use of greatly increased charges of slow burning powder; and the extensive erosion now speedily produced in some of the heavier breech loading guns renders it probable that the interior surface of the 110 ton gun will require renewal after only a brief existence. Under these circumstances, it becomes of very great importance to ascertain what material best resists erosion by powder products, or, what treatment of the material is best calculated to increase its powers of resistance to erosion.

UMBRELLA SUPPORT.

By means of this simple device, an umbrella may be attached to the side of a wagon, boat, baby carriage, etc., and held in any desired position. A clamp attached to the side of the boat is arranged to receive a tube held in position by a set screw. This tube may be placed in either of two sets of holes in the clamp, to hold it in a

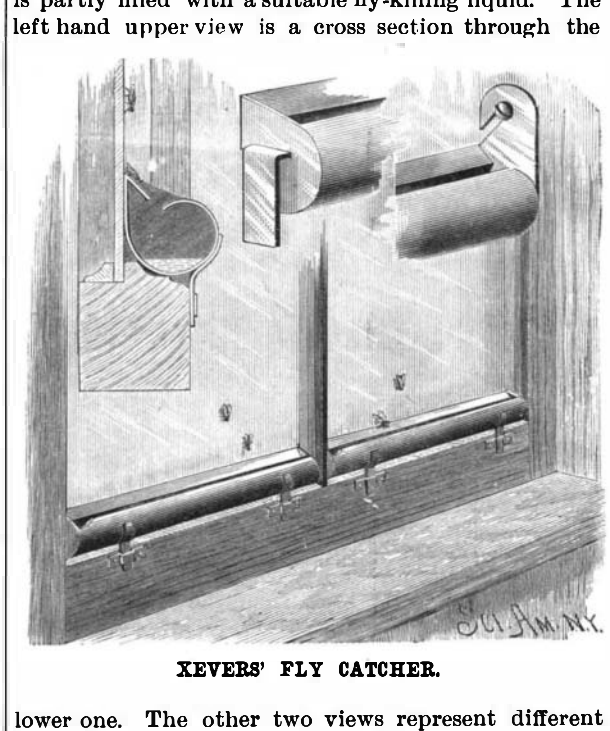
TOSSO'S UMBRELLA SUPPORT.

horizontal or vertical position. Near the upper end of the tube is a set screw, that holds a rod formed at its upper end with a right-angled arm provided with a disk serrated on one side. To this disk is clamped a similar one on an arm whose free extremity is concaved to fit the umbrella handle, which is retained therein by a clamp provided with a screw that presses against the back of the arm and secures the handle. It will be seen that the construction allows the placing of the umbrella in any suitable position for shielding the user from sun or rain.

This invention has been patented by Mr. Hippolyte Tosso, of 227 and 229 Decatur St., New Orleans, La.

FLY CATCHER.

The accompanying engraving represents a simple device for catching flies, which has been recently patented by Mr. Z. F. Xevers, of 208 Brannan Street, San Francisco, California. An approximately semi-cylindrical trough is provided with tongues, which are received in clips secured to the lower rail of the window sash, as shown in the large view in the annexed engraving. That side of the trough touching the glass is made plain, to fit closely against the glass, so that the flies on the window can readily gain access to the trough. Near the upper edge of this side is secured a strip, arranged so as to form a barrier, preventing the return of the flies to the glass. The trough is partly filled with a suitable fly-killing liquid. The left hand upper view is a cross section through the



XEVERS' FLY CATCHER.

lower one. The other two views represent different methods of holding the trough to the sash.

THE Great Eastern steamship has been converted into a show vessel, and for the first time since her construction is making money for her owners. The ship, which for several months has been on exhibition at Liverpool, has lately gone to Dublin, where she will stay for the winter. Only her screw propeller is now used.

Improvements in Making Sugar.

The following has been received at the Department of Agriculture:

FORT SCOTT, KAN., November 8, 1886.

To the Commissioner of Agriculture:

We finished boiling 83 tons of Louisiana cane to-night. Made nearly 19,000 pounds of strike. A weighed portion run into centrifugal gave 54 per cent of dried sugar. This will be more than 120 pounds first sugar per ton. Cane sugar had 10 per cent of sucrose, 1·8 per cent of glucose, and 14½ per cent of total solids. It would have made only 80 pounds by the old process. We have increased the yield fully 40 pounds per ton, sugar of fine quality.

WILEY, *Chemist.*

This dispatch is regarded by the authorities at the Agricultural Department as the fulfillment of the promises of important results given by the first incomplete experiments in the diffusion process as applied to sugar cane. The process was developed in Europe for application in the manufacture of beet sugar, and has been several times tried in this country upon the sugar cane, but without decided success, owing to imperfect machinery and the necessity of considerable modifications to meet the difference in the material to be worked. In 1883, experiments in the new process were begun on a small scale in Washington upon sorghum, and after a time such a measure of success was attained that the Commissioner determined to put the process into operation upon a larger scale. To this end, a plant was established in connection with a sorghum sugar making establishment at Ottawa, Kansas, and this season the new process has been carried on under the supervision of Professor Wiley with marked success. Meanwhile the sugar cane growers of Louisiana have become deeply interested in the process, and have anxiously desired to learn whether it could be made applicable to their products. To test the matter, the Commissioner has decided to undertake the experiment in Louisiana upon a scale of sufficient magnitude to determine its practicability, but as a preliminary test he caused a train load of sugar cane to be shipped from Louisiana to be worked up in the Kansas sorghum mills. It is the result of this experiment which Professor Wiley announces in his telegram.

The diffusion process above referred to has long been operated in Europe, but from some unexplained cause our sugar makers have been backward in giving it a trial. One writer finds a reason in the idea that sugar cane men here have more money than brains.

The diffusion process for making sugar is very simple. It consists, in brief, in chopping up the cane into small bits, say slices an eighth of an inch thick, then steeping the mass in tubs for two or three hours with hot water. This extracts the saccharine matter much more effectively than the ordinary mode of squeezing the cane between rollers. The warm juice thus obtained is then heated and stirred with the addition of lime, and finally brought to a boil; it is then allowed to stand a while and the clear part is then run into the vacuum pans and boiled into sugar, in the usual manner. The refuse from the tubs may be fed to cattle. Any intelligent farmer may work the process. The cost of apparatus is small. A full account of the mode of working this process will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 532.

The National Academy of Sciences.

The fall session of this society met on November 9, at the Massachusetts Institute of Technology, Boston. Dr. Othniel Charles Marsh, its president, in the chair. Professor S. P. Langley read a paper on "The Solar-Lunar Spectrum." It detailed the last results of his experiments on heat waves in the invisible spectrum, and dealt with his discovery of the lowest form of them in the radiations of the sun—radiations formerly detected only in the moon's emanations. Formerly the moon's radiations were supposed to extend further down the spectrum than the sun's. He concluded that the temperature of the moon when illuminated was about equal to that of melting ice. Professors Lyon Fairchild and Alfred Russel Wallace, of England, were at this point invited to participate in the proceedings. Professor T. Sterry Hunt read a paper on "A Basis for Chemistry." It is impossible to give any abstract of it here. It is of special interest, because in his remarks he promised a book on the subject under the same title. The general tendency was to extend the domain of chemistry into the physical field. Professor Edward D. Cope read papers on "Human Dentition" and on the "Auricular Anatomy of Tailed Batrachians," and on the same day Professors Morse and Packard spoke on palæontological subjects, the first on "Change in Mya since the Pliocene," the other on "Cave Fauna of North America." On the second day's session, Professor Alpheus Hyatt spoke on the "Primitive Forms of Cephalopoda," giving a history more especially of Ammonites. This he followed by two other geological papers. Professors Peters of Hamilton College, O. T. Sherman of Yale, and W. S. Elkin of Yale contributed astronomical papers. On the third day, Professor Wallace, by invitation, addressed the meeting. His subject was "The Wind as a Seed Carrier in Relation to One of the Difficult Problems in Geographical Distribution." The title indicates clearly the scope of the paper, Dr. Wallace is well known as one who has given special attention to the distribution of life and plants on islands. His well known studies in the Malay Archipelago naturally took this direction. The general claim was made that wind could transport seeds from much greater distances than was usually believed possible. Professor Edward C. Pickering then spoke on the "Draper Memorial Photographs," which include the photographic investigation of star spectra, principally at the expense of Mrs. Henry Draper. Professor F. W. Putnam spoke on "Archæological Explorations in the Little Miami Valley, Ohio," and was followed by Professors Charles A. Young, Raphael Pumpelly, Cleveland Abbey, and T. Sterry Hunt with papers on special subjects.

The meeting adjourned to meet at Washington, D. C., on the third Monday of April, 1887.

Among those present, and not named above, were Professors C. F. Chandler, Wolcott Gibbs, H. A. Newton, Henry A. Rowland, and Francis A. Walker.

Manufacture of Small Arms in Belgium.

In general, piece work is the system adopted, and the earnings of the men range from 50 cents to $1 per day, working from ten to twelve hours a day. The following is given by the United States Consul (Mr. G. D. Robertson) as to the details of the cost of a double barreled breech loader, costing $20 or 4*l.*:

"For the barrels is paid about 7s. or $1.75. The barrels received by the manufacturer are at once given to the 'garniseur.' He is instructed in regard to the length, height of band, and for what kind of breech action they are intended. It is also his duty to take the barrels to the proof house, where they are proved before and after being put together. If imperfections are discovered, the barrels are returned to the barrel maker to be rewelded or replaced. Putting together, proof, portage, etc., costs about 4s. The barrels having been returned, the proof marks are inspected, and the band which holds them together tested as to its firmness and strength. The piece which is intended to hold the barrels to the breech action is subjected to several hard blows of a hammer to test its rigidity before it passes out of the hands of the examiner into those of the borer and polisher, who bores and polishes the interior, at the same time chambering the barrels for the cartridges. Cost, 10d. The barrels are now given to the 'basculeur,' or action maker, by whom the breech action of the gun is carefully made of iron and steel. The material costs about 2s., and the labor about 28s. or 30s. The wood for the stock costs in this case 10d., and is given in the rough to the stock maker, with the barrel, breech action, and locks, which have been carefully fitted. The operation of shaping the stock requires much skill, and only a first class stock maker can be expected to give well finished lines to his stock—making stock, about 4s. The gun is again inspected, and given to the 'equipeur,' who adjusts the screws, etc. It is then taken apart and given to a number of workmen to finish the various parts, viz., to the 'systemeur,' who files the hammer to shape and receives 1s.; 'rhabilleur,' who does nothing but put the locks in order, and receives 2s. 9d.; 'polisseur,' who polishes the exterior and receives 6d.; 'decheur,' who brings out the design of the damascus The operation requires about two days, but the workman has, of course, a great many on hand at once in different stages of preparation. This costs, say 10d. It is then given to the engraver. This operation may cost from 1½d., as on very common guns, to almost any amount. To the 'trempeur,' or casehardener, who hardens one-half of the exposed parts or 'furniture' of the gun is paid 1s.; to the bluer, who blues the other half of the 'furniture,' 5d.; incidental polishing, cost of screws, pins, triggers, sights, buttguard, name plate, and cost of adjusting same, 6s.; cost of locks, 4s.; refiling of stock, 'relimer,' 5d.; checkering stock, 'quadriller,' 7d.; oiling and finishing of stock, which consists in rubbing down to a polish with pumice stone and oil, 7d. The gun is then 'reassembled' by an 'assembler,' who returns it to the factory in working condition, and receives 5s. The gun is next repassed, that is, is completely taken apart, the interior of the locks, action, etc., polished, the springs tried, and everything adjusted to perfection, when several cartridges are fired to test the strength of the mainsprings. It is then oiled to prevent rust, and is ready for packing. This finishing and the various inspections that the piece is subjected to in the course of its construction cost about 4s. Packing is charged extra, and is, therefore, not included in the cost of the gun. Covers are put on, and twenty-five packed in a case. The total cost is 3*l.* 17s. 4d. The 'basculeur,' or man who contracts for the making of the breech actions, probably employs a number of men, and may make per day 4s.; the 'garniseur,' who puts the barrel together, perhaps 3s. 9d.; and the 'faiseur de bois,' 3s. 6d."

The cost of making a good "six shooter," in the rough, is said to be about 30 to 38 cents. The same weapon is retailed in England at half a guinea, and if nickeled at 15s. or 16s.

The extremely poor pay here indicated will account for much of the success claimed by the Belgian manufacturers in meeting their English and American competitors, notwithstanding that the latter have the advantage of the most improved machinery as against manual labor. In England it is said that the wages earned in Belgium would hardly suffice to keep an English mechanic in beer and tobacco, and there is doubtless a good deal of truth in the remark; but this only serves to illustrate and emphasize the unequal conditions under which the makers on both sides compete with one another.

The Proposed Rocky Mountain Railway Tunnel

A project is on foot for tunneling the "Great Divide." The Divide is the Rocky Mountains, and the point proposed to be tunneled is under Gray's Peak, which rises no less than 14,441 ft. above the level of the sea. At 4,441 ft. below the Peak, by tunneling from east to west for 25,000 ft. direct, communication would be opened between the valleys on the Atlantic slope and those on the Pacific side. This would shorten the distance between Denver, in Colorado, and Salt Lake City, in Utah, and consequently the distance between the Missouri River, say at St. Louis, and San Francisco, nearly 300 miles; and there would be little more required in the way of ascending or descending or tunneling mountains. Part of the work has already been accomplished. The country from the Missouri to the foot of the Rockies rises gradually in rolling prairie, till an elevation is reached to 5,200 ft. above the sea level. The Rockies themselves rise at various places to a height exceeding 11,000 ft. Of the twenty most famous passes, only seven are below 10,000 ft., while five are upward of 12,000 ft., and one, the Argentine, is 13,000 ft. Of the 73 important towns in Colorado, only twelve are below 5,000 ft., ten are over 10,000 ft., and one is 14,000 ft. Passes at such a height are of course a barrier to ordinary traffic, and the railways from the Atlantic to the Pacific have in consequence made detours of hundreds of miles, leaving rich plains lying on the western slopes of the great snowy range practically cut off from Denver and the markets of the East. The point from which it is proposed to tunnel is 60 miles due west from Denver, and although one of the highest peaks, it is by far the narrowest in the great backbone of the American continent.

Simple Water Tests.

Test for Hard or Soft Water.—Dissolve a small quantity of good soap in alcohol. Let a few drops fall into a glass of water. If it turns milky, it is hard; if not, it is soft.

Test for Earthy Matters or Alkali.—Take litmus paper dipped in vinegar, and if, on immersion, the paper returns to its true shade, the water does not contain earthy matter or alkali. If a few drops of sirup be added to a water containing an earthy matter, it will turn green.

Test for Carbonic Acid.—Take equal parts of water and clear lime water. If combined or free carbonic acid is present, a precipitate is seen, to which, if a few drops of muriatic acid be added, an effervescence commences.

Test for Magnesia.—Boil the water to a twentieth part of its weight, and then drop a few grains of neutral carbonate of ammonia into a glass of it, and a few drops of phosphate of soda. If magnesia be present, it will fall to the bottom.

Test for Iron.—1. Boil a little nut gall and add to the water. If it turns gray or slate, black iron is present. 2. Dissolve a little prussiate of potash, and, if iron is present, it will turn blue.

Test for Lime.—Into a glass of water put two drops of oxalic acid and blow upon it. If it gets milky, lime is present.

Test for Acid.—Take a piece of litmus paper. If it turns red, there must be acid. If it precipitates on adding lime water, it is carbonic acid. If a blue sugar paper is turned red, it is a mineral acid.

Public Rights in the House Telephone.

We illustrated in our last issue the House Phonetic Receiver of 1868. It would be a matter of much interest to see how the Bell company would treat the extensive introduction of this device. If they tried to obtain a preliminary injunction, it seems doubtful if one would be granted, as it would amount to enjoining the employment of the device of an expired patent. If they failed in preventing the use of a pair of these instruments, it is not easy to see how one could be prevented from introducing an unpatented microphone in the same circuit. This would at once give a perfect telephone system. Were the House patent in force, the Bell company would undoubtedly try to secure it. As it has expired, the devices shown in it are public property.