

The doom of the centerboard was further sounded by the visit subsequently paid by "Vigilant" to Great Britain when she lost eleven out of eighteen races to the "Britannia," a sister cutter to "Valkyrie."

The third phase of yacht construction may be said to date from the construction of the American yacht "Defender" in 1895. Just as the "Genesta"- "Puritan" year saw the introduction of more thoroughly scientific methods of design, so does the "Valkyrie III."- "Defender" series witness the full recognition of the fact that scientific construction is only less important than scientific design. Of course, it would be manifestly unfair, both to the British designers and to Herreshoff himself, to infer that no attention had been paid previously to what might be called the engineering features of the problem, for "Genesta" in 1885 was of composite construction, with wood planking on steel frames, and "Galatea" in 1886 was built entirely of steel, at a time when we were still clinging to cumbersome wooden frames in "Puritan" and "Mayflower"; moreover, Herreshoff had already introduced, in 1893, the use of bronze in the underbody of "Vigilant." But it was in "Defender" that the engineer and metal worker were first given a free hand, while hollow steel spars first made their appearance on both challenger and defender. It is probable that "Defender" was, and will always remain, the lightest yacht for her size ever constructed; she has also the unenviable distinction of being the only boat built either for challenge or defense that was useless as soon as her racing days were over—for, contrary to popular belief, the three "Shamrocks" and their competitors are as sound to-day as when they were launched. "Valkyrie III." was of composite construction; but in her we see the last of the wood-sheathed cutters.

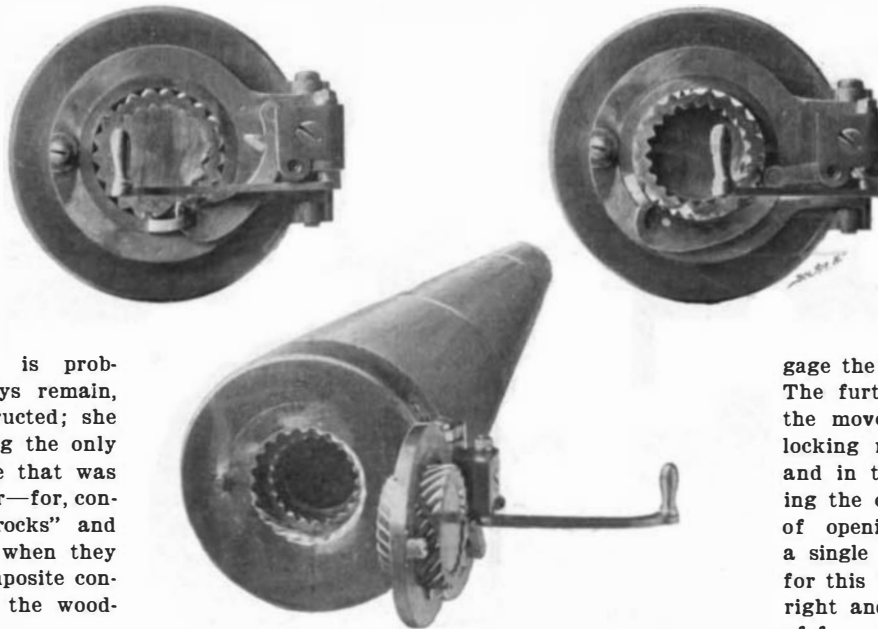
With the advent of Sir Thomas Lipton to the great international contest, there was assured for the challenging yachts the necessary capital to meet the enormously-increased cost of construction due to the use of expensive alloys and high-grade steel; and although in this respect it has been one man's purse against a syndicate, no stint has been put upon either the designer or the builder. The first "Shamrock" was a bronze boat with aluminium topsides and deck, and in "Columbia" she met a boat with bronze underbody, steel topsides and wooden deck. The second "Shamrock" was plated with bronze from keel to rail; but in "Shamrock III." we see a return to steel plating for the hull, the necessary smoothness of surface being secured by the use of a special enamel paint, each coat of which is carefully rubbed down before the next is applied. The result is a remarkably smooth surface which it is claimed is not surpassed by the polished bronze. "Reliance" is built on the belt-frame and longitudinal system which Herreshoff introduced in "Constitution." It is possibly a trifle lighter than the customary bulb angle method of framing; but it possesses the drawback that the wide frame-spacing renders it difficult to build the boat with perfectly fair lines, the plating having a tendency to straighten out between frames, rendering the longitudinal lines a series of chords instead of true continuous curves. In this last period of cup designing there has been a wonderful development in the sizes and power of the boats, until the climax has been reached in "Reliance." As compared with "Defender," the beam has gone up from 23¼ feet to 27 feet, and the overall length from 126 to 145 feet, while the sail spread of 12,640 feet on "Defender," thought to be prodigious in 1895, would be insignificant against the towering fabric on "Reliance," with its total area of 16,199 square feet.

As we go to press, only one meeting of "Reliance" and "Shamrock" has taken place. The wind, light at the start, died away at times to a calm. Although the race was called off, "Reliance" showed indications of being the better drifter. As long as the wind held true, there was but little appreciable difference between the boats, although "Reliance" gave indications that in a true breeze she could draw out to weather of the English yacht. The conditions were those in which "Shamrock" has done her best work, and if she cannot drop "Reliance" in a light breeze and rolling sea, she is not likely to do so in stronger breezes.

The largest complete mounted mammal in existence can be seen in the American Museum of Natural History. The specimen is the clumsy little skeleton of the pantolambda, whose age is placed, with doubtful accuracy, at three million years. The fossil was found in New Mexico and presents an impressive example of the possibilities of evolution.

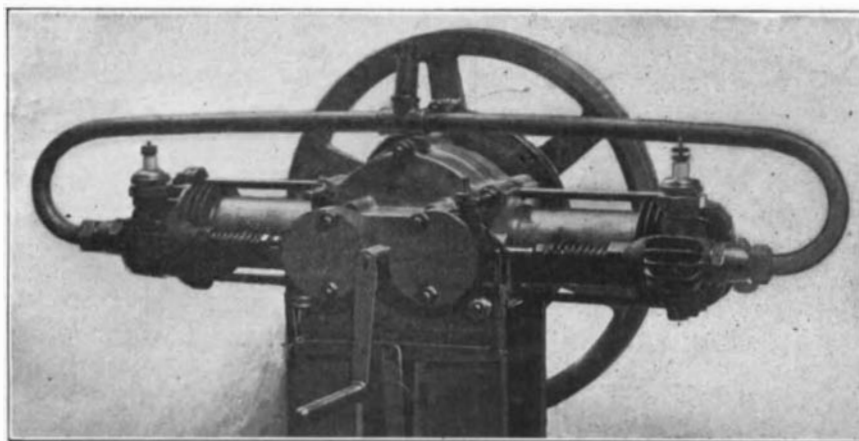
IMPROVED BREECH MECHANISM FOR HEAVY GUNS.

The vast improvement that has been made of late years in the rapidity of fire and general handiness of heavy guns is due largely to the great amount of attention which has been given to the breech mechanism. So important an element is this in the construction and manipulation of heavy ordnance, that it has had more to do with decreasing the weight and increasing the rapidity of fire than perhaps any other single feature. If we except the guns made at the Krupp works, the breech mechanism of all modern ordnance is of the threaded type, that is to say, after the charge has been introduced, the breech block or breech plug depends for its ability to resist the rearward force of the explosion of the powder upon the



IMPROVED BREECH MECHANISM SHOWN IN THE LOCKED, UNLOCKED, AND FULLY OPEN POSITIONS.

total strength of the threads by which the block is screwed home to its position in the breech box. As usually constructed, equi-distant parallel channels are cut through the threads both of the block and the box, so that the breech block can be thrust right home into position and locked by giving a third or quarter turn to the block as the case may be. This cutting away of so large a portion of the thread, thereby reducing the shearing section, necessitates an increase in the length of the block and, therefore, an increase in the length of the gun at the point where it carries its greatest diameter. To provide a breech block of less depth, but presenting an equal section of thread, there has been the constant aim of gun-makers for several years past, and in the accompanying illustrations is shown one of the latest and most ingenious attempts to solve this problem. In the new breech mechanism, which was designed by John B. Moore, of Washington, D. C., the breech box is stepped so as to present two different diameters, and the outer or larger section is threaded with a left-hand thread, and the inner or smaller section adjoining the powder chamber is threaded with a right-hand thread, the threads in



GASOLINE MOTOR WEIGHING 24½ POUNDS, YIELDING 2½ HORSE POWER.

both cases being uninterrupted. The breech block, which has a diameter corresponding to that of the interior section of the breech box, is cut with a left and right-hand thread, corresponding to that of the breech box, the length and pitch of the threads corresponding to those of the two sections of the breech box, although the diameter of the breech block is the same throughout and matches that of the inner section of the breech box. Over the outer left-hand-threaded portion of the block is carried an annular locking ring which is cut both on its interior and exterior surface with a left-hand thread. This locking ring is threaded on over the outer part of the breech block, and it is itself carried by a swinging carrier, which is hinged in the customary way to the right-hand edge of the base of

the gun. The carrier for this breech block is swung into an open or closed position by means of a handle lever, and by the co-operation of a pair of bevel pinions suitable motion is transmitted, during the swinging of the handle lever, to a rocker which is pivotally connected with the operation ring in such a manner that this operating ring is moved in one direction or the other according to the opening or shutting swing of the handle lever.

Our three engravings show the breech first, in an entirely closed and locked position; secondly, with the breech block unscrewed, but still in position against the breech of the gun; and thirdly, with the breech block swung wide, clear of the gun, ready for the insertion of the charge. Let us suppose now that the charge has been inserted and it is desired to close the breach. By pulling the handle lever round to a quarter turn the block will be brought up with the ends of its threads in position against the ends of the threads of the breech box, ready for screwing home to position. The further movement of the handle lever toward the gun then operates to turn the breech block into the threaded portion of the gun breech. This is accomplished by turning the locking ring on the threads of the breech block, when the threads of the block will en-

gage the outer ends of the threads of the gun breech. The further movement of the handle lever reverses the movement of the operating ring and turns the locking ring in on the threads of the breech block and in the threads of the gun breech, thus completing the operation of closing. Each of the operations of opening and closing is thus accomplished by a single swing of the lever. The advantages claimed for this form of construction are that by using these right and left-hand multiple threads there is a gain of from 30 to 50 per cent of strength over any block of the same weight and general dimensions that is at present in use. The considerable shortening-up of the breech of the gun, due to the shortness of the breech block, not only greatly lightens the weapon, but it allows for more advantageous disposition of loading and hoisting machines, particularly in large gun mounts. There is a further advantage in the fact that by dividing the strain occasioned by firing the gun equally between a right and a left-hand thread, there is obtained the advantage of equilibrium of forces; the operating mechanism is relieved of strain or shock, and there is no tendency, as in a block carrying the ordinary type of thread, for the block to unscrew itself. Another advantage is that when the swinging carrier strikes the gun, the momentum of the breech block causes it to enter its threads in the block for a considerable distance, thereby rendering a rebound of the carrier before the block enters impossible, and because of the great pitch of the threads the momentum of the block is almost sufficient to screw it home to its closed position.

LIGHT MOTOR FOR A ST. LOUIS CONTEST AIRSHIP.

The coming race of airships at the St. Louis Fair is doing a great deal to interest inventors in the problems of aerial navigation, and as a result we may expect to find substantial advances made in this most fascinating effort of man to master the element which has so long baffled him.

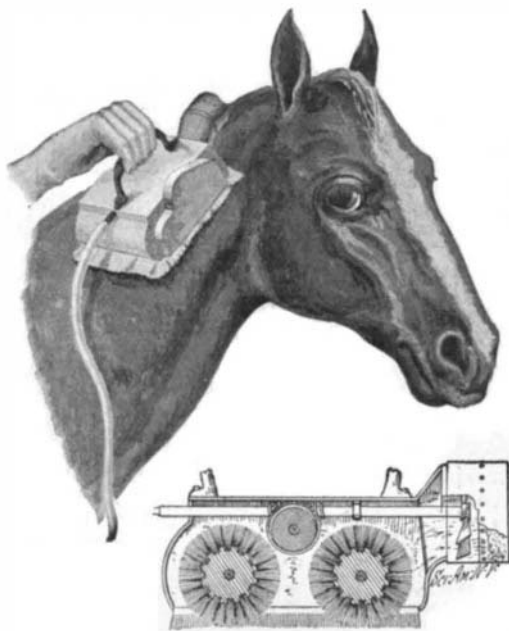
One of the goals toward which all designers of airships are striving is the construction of a propelling motor which shall have a minimum weight per horse power. A prominent contestant in the St. Louis race has just succeeded in obtaining an exceedingly light gasoline motor for his airship. Our illustration shows the motor with the carbureter removed, mounted on the testing block. The motor was built by the Walters Power Company, of 62-66 Van Winkle Avenue, Jersey City, N. J. The contract stipulated that the motor alone should weigh not more than 26 pounds and should yield at least 2 horse power.

The completed motor comes well within these requirements, having a weight of about 24½ pounds and an efficiency of 2½ horse power. Even with the addition of the carbureter, the weight is but 25½ pounds, and naturally the builders are much elated with their success. In the construction of the motor aluminium is, of course, used wherever possible, and the other parts are made as small and compact as practicable. The general design, however, closely follows standard lines. The motor is of the four-cycle type and the cylinders have a 2½-inch bore by a 2.7-16-inch stroke. One feature which is particularly noticeable is the absence of radiating ribs on the main body of the cylinders. Mr. Walters, who designed the motor, has found that the heat of the cylinders could be dissipated with suff-

cient rapidity from the smooth surface of the cylinder. However, in order to insure sufficient strength, he retained the ribbed formation on the cylinder heads and the valve casings, for at these points the pressure is, of course, the greatest. A special form of carbureter is used, which comprises a double valve and insures separate control of the gasoline and air supply. Control of the sparking may be had by operating a lever depending from the lower part of the motor. This changes the position of the sparking contacts with relation to their operating cams, and thus advances or retards the time of the spark in the cylinder. A friction clutch and pulley shown at the rear of the motor were added after the motor was built, and these increase the total weight to 33½ pounds. On completion of the motor it was subjected to thorough tests and proved highly satisfactory in every particular.

MACHINE FOR GROOMING AND SHAMPOOING HORSES.

Two Western inventors have just received a patent for an ingenious machine adapted to be used for grooming and shampooing horses. The machine is designed particularly with a view to doing the work rapidly and in a cleanly manner, means being provided for confining the dust and sweepings to a specially-constructed dust chamber. The apparatus may be operated by a flexible shaft connection with any suitable motor. The flexible shaft is attached to the main shaft which passes lengthwise through the center of the machine. A worm gear formed on this shaft meshes with a gear on a shorter shaft lying at right angles therewith. At one end of the shorter shaft a friction device of cup-shape is formed, within which the main pulley projects. The diameter of this pulley is smaller than the diameter of the cup so that it may be shifted from one position to another without interfering with its rotation so long as its periphery has frictional contact at some point with the cup. Lying on either side of the shorter shaft are two brushes which are rotated by means of friction disks engaging a large disk connected with the main pulley. Ordinarily both brushes will rotate in the same direction, but by reason of the freedom of movement allowed the main pulley the friction disk directly connected therewith may be shifted, so as to bring it into contact with an "idler," through the medium of which the direction of one of the brushes may be reversed. The entire mechanism is covered by a casing open at the bottom to permit operative contact of the brushes with the animal to be groomed. In order to prevent spread of dust raised by the brushes, the dust is confined to the casing by screens of fringe work which hang from its lower edges. It will be observed that the right-hand end of the main shaft is provided with a suction fan lying in the dust chamber which projects from the main casing. This chamber is closed by a perforated cap provided with a sponge or other dust-absorber, so that when the fan operates to draw out the dust raised by the brushes, the dust will lodge in the absorber while the air passes out through the perforations. In operating this machine the operator needs simply to guide it over the animal's body and the work will be



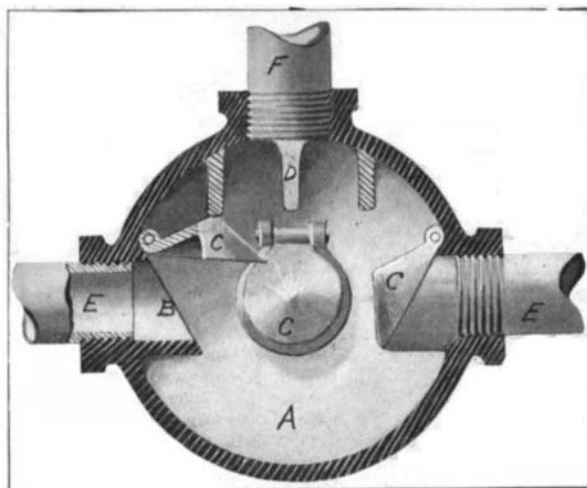
A HORSE-GROOMING MACHINE.

easily and expeditiously done. Messrs. Anders and Pehr Bolund, of 16 Hancock Street, East San José, Cal., are the inventors of this grooming and shampooing machine.

The Pennsylvania Railroad tunnel under the Hudson River was begun on June 25. The tunnel work is divided into two sections, known as the northern and the eastern sections. The first drill holes for first shaft were started at noon at the foot of 32d Street and Eleventh Avenue, New York.

IMPROVED VALVE MECHANISM.

The accompanying engraving illustrates an improved valve mechanism which is especially adapted for connecting a battery of boilers with a main steam pipe. The valve has been designed with a view to effecting a great saving of fuel and to act as a safeguard against explosion of the boiler. A patent for the improved construction has recently been obtained by Mr. Thomas Simpson, of New Iberia, La. The valve mechanism comprises a casing *A*, and opening into this are a number of passageways *B*, preferably four in number. These are threaded to receive the pipes *E*. The end walls of the passageways are beveled or inclined and over them the conical valve caps *C* are situated, being hinged to the casing. The passageways are arranged diametrically opposite each other,



VALVE MECHANISM FOR A BATTERY OF BOILERS.

so that when one of the valves is open and steam is passing therethrough, the valve directly opposite will be held in its closed position unless the steam pressure in this closed pipe is sufficient to overcome the pressure from the opposite steam duct. The main steam pipe *F*, which is formed at the upper portion of the valve casing, is adapted to permit the escape of the steam from the casing. A number of lugs *D* are formed on the interior of the casing. These serve as stops for the valve caps when they are suddenly forced upward by the pressure in the pipes. In large sugar refineries explosion of the boilers frequently occurs, due to the fact that when a connection is made between boilers the pressure of one battery exceeds the pressure of the other. This may be obviated by the use of Mr. Simpson's improvement. It will be observed that an excess of steam in the boiler is immediately relieved and is permitted to escape through the valve mechanism, without the necessity of an attendant being present to regulate the same, and such an advantage is obviously very important.

Across the Continent by Automobile.

The crossing of the continent of North America in sixty-one days is the latest achievement of the automobile.

The test was undertaken by the Packard Motor Car Company in order to demonstrate the trustworthiness and ability of their 12-horse power standard touring car. Mr. T. E. Fitch, their most experienced operator, was chosen to run the car, and he was accompanied by M. C. Krarup, an newspaper man. The start was made from San Francisco on June 20, and the mud-covered car, christened "Pacific," reached New York at 8.30 P. M., August 21—just two months and one day later. The route followed was across the Rocky Mountains to Carson City, Reno, Battle Mountain, and Wells, Nev.; Tacoma, and Salt Lake City, Utah, the latter place being reached on the 4th of July; Glenwood Springs, Buena Vista, Colorado Springs, and Denver, Col., Denver being arrived at July 20; then through Nebraska to Omaha, which was reached on July 31 and stopped at till August 2; Des Moines, Iowa, was reached on August 4, and Chicago, Ill., on August 10; while ten days were consumed in covering the last 1,000 miles from Chicago to New York. Aside from tires, but one serious breakdown occurred on the machine, which consisted in the breaking of a front spring. A new spring was obtained *en route*. One of the original tires on the machine at the start is said to have survived to the finish. Beside this tire, seven new outer casings were used in replacing the other three. The weight of the machine complete was about 2,700 pounds.

Regarding the character of the roads traversed, Mr. Fitch is reported to have said that neither Utah desert nor Colorado mountains were half as bad as the common mud met with in all sorts of places. In Iowa the mud was so bad that with chains on the wheels it was difficult to get sufficient traction to run through it. The shortest day's run in the entire journey was twenty-four miles in this State. The roughest going was in Colorado, between Grand Junction and Colorado Springs.

The Packard single-cylinder car is the second to accomplish the feat of crossing the continent. The first machine to cover the distance was a Winton 20-horsepower touring car driven by Dr. Nelson Jackson, of Burlington, Vt., who arrived about a month ago, accompanied by a chauffeur. Dr. Jackson took a longer and more northerly route, and had a great deal of tire trouble; but, in spite of many difficulties, he succeeded in making the trip in only four days' longer time than the Packard party. A third expedition, with an Oldsmobile light runabout, is now being undertaken by two other men. A motor-cycle driven by George A. Wyman was the first motor-driven machine to ever complete this journey. This arrived in New York several weeks before Dr. Nelson, after having been ridden by Mr. Wyman many miles over railroad ties when no roads were to be had.

Food Frauds Abroad.

In Paris snails are popular, and the adulterators mix them with lungs of cattle and horses. Even entirely artificial snails are manufactured. The shells, recoated with fat and slime, are filled with lung and then sold as "Burgundy" snails. Lovers of fresh rooster combs are imposed upon by a substitute cut out of hogs' intestines.

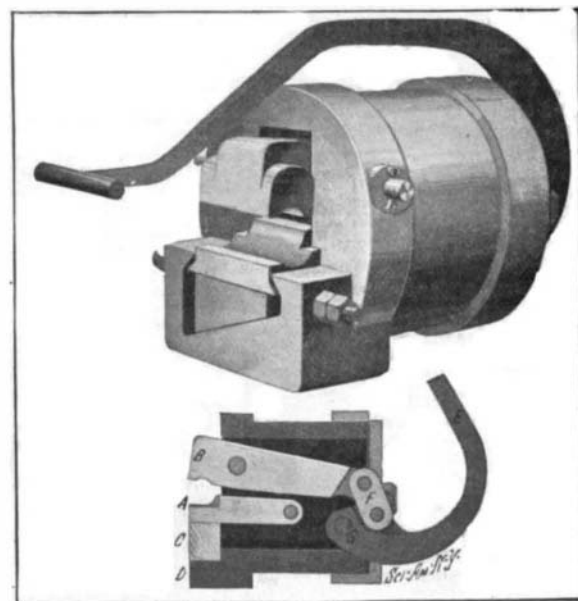
Chopped artificial truffles are made of black rubber, silk, or softened leather, and even whole truffles are made out of roasted potatoes, which are flavored by adding ether. They are said to sell well.

Fish spoiled in spite of ice and borax is treated with salts of zinc, aluminium, and other metals. Rubbing the fish with vaseline to give it a fresh look and coloring the gills with fresh blood or eosin—a coal tar color—is resorted to. The latter is also used to intensify the red color of inferior crabs.

Imparting a greenish color to oysters is another adulteration. An oyster requires about one month in the beds to acquire the greenish color. As this is too long a time, the dealers help them along with an artificial color. The chemists in the Paris municipal laboratories have shown that tomato jelly is adulterated with turnips and powdered pepper contains a large admixture of powdered hardtack.

CABLE GRIP OR CLUTCH DEVICE.

Messrs. Ludwig Schuler and Joseph Ericson, of Telluride, Colo., have just obtained a patent on an improved cable gripping device, for use in connection with traveling ropes or cables of traction or other similar railways. The device is very effective and reliable in operation, besides being capable of easy control, and it contains no parts which will get out of order or be easily broken. It comprises a cylindrical block, in which is formed an opening of rectangular cross section which is adapted to receive the two jaws *A* and *B*, as shown in our detail view. The lower jaw *A* is pivoted to the block at its inner end, and at its outer end rests on a wedge *C*. This wedge is provided with slots in the corresponding sides of an extension *D* on the block, as shown best in the perspective view of the device. By means of nuts on these screws the wedge *C* may be moved toward the right or the left, thus



AN IMPROVED CABLE-GRIPPING DEVICE.

raising or lowering the jaw *A*. The purpose of this adjustment is to adapt the device for gripping various sizes of ropes or cables. The upper jaw *B* is hinged to the block near its gripping end, and at the opposite end is connected to an operating lever *E* by a toggle link *F*. The operating lever is pivoted to the block at *G*, so that when the lever is swung about on its axis, the lower end of the toggle link will be moved inward, raising the inner end of jaw *B* and causing its gripping end to come down with a powerful grip onto the cable resting on the lower jaw *A*.