

**THE ROMAN GALLEYS DISCOVERED IN LAKE NEMI.**  
BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The remains of two Roman vessels of unusual size, sunk in Lake Nemi, have been recently brought to light, with the result that much has been added to our knowledge of ancient shipbuilding. Most of the remains have been acquired by the Metropolitan Museum of Art of New York and will be shortly placed on exhibition. Lake Nemi, which lies in the Alban hills to the south of Rome, is a small, beautiful sheet of water a few miles in circumference, filling a basin formed by an extinct crater. From the clearness and smoothness of its water, it was known in ancient times as the Mirror of Diana. Around it were temples and many handsome villas, rendering it one of the most charming sites in the neighborhood of Rome. That a large ship belonging to one of the Roman emperors was sunk in the lake, was a matter of local tradition. Cardinal Colonna in the fifteenth century and others after him succeeded in bringing up a few fragments of a ship. Nothing very satisfactory was done, however, until the Italian government had the present researches made by Sig. Borghi and Vittorio Malfatti. Experienced divers were employed to explore the bottom. Two large vessels were found, one lying near the shore and a second farther out. Both are nearly buried in the sand. The larger vessel must measure 230 feet long and 80 feet center, and the smaller one 200 by 65 feet. Owing to their great size, larger than the usual war galleys, and their exceptional width, they were no doubt used by one of the emperors, perhaps Caligula, as pleasure barges.

Among the pieces which have been brought up so far are a large cylindrical cap of bronze which carries a lion's head (Fig. 1). The whole is cast in one piece, and beautifully worked. This is one of the largest pieces; its height is 12 inches and exterior diameter 17 inches. The lion holds a movable bronze ring in its teeth. The piece formed the top of a wood column, proved by the timber still attached to it. It seems to have been used to hold a rope. The cap was no doubt forced on to the end of the column, there being no trace of nail holes. This specimen has the highest artistic value of any which have been found as yet. Another bronze piece appearing to the extreme right of Fig. 1 was placed on the end of a beam. It has the form of a rectangular cap or box. On the outer side is mounted a wolf's head which is somewhat larger than natural size. The head holds a large ring in its teeth. This piece is of considerable size and measures over four feet in total length. Like the former, it shows no trace of nail holes. Another piece of similar dimensions, appearing to the extreme left of Fig. 1, simulates a hyena's head holding a ring. These two pieces were no doubt placed at the two ends of corresponding beams. Another pair, shown in Fig. 2, have lion's heads mounted on them and must have been symmetrically placed. A piece of remarkable execution is a Medusa's head (Figs. 1 and 2) mounted upon a cap. With the exception of the piece which forms the head of the column, the others all have a rectangular box form with about 0.7 inch metal. The ornamental casting was soldered on to the front. The caps have a somewhat tapering shape, so that they could be easily fitted on. All the heads are of fine workmanship, and must be ascribed to the first century of the Roman empire.

Another fragment of a different kind is a rectangular bronze grating (Fig. 1) with the two side bars which held it in place. The bars have projections on the ends so that they could fit into beams or metal pieces. The grating was no doubt placed horizontally, and held in place by its own weight; there are no holes. Pieces of lead pipe in sections about three feet long were also found. These bear the inscription C. CAESARIS. AUG. GERMANICI, which is the name of Caligula, and the vessels must therefore be assigned to his reign or from 37 to 41 A. D. A great number of tiles about two feet square were brought up. These no doubt formed a pavement for the deck. Quantities of colored strips and different shaped pieces of a vitreous material form part of the collection, together with disks of serpentine and porphyry, which no doubt formed a brilliant mosaic floor. The second vessel yielded great quantities of timbers and a few objects. One of these has the form of a bronze cap (Fig. 1) for the end of a beam, carrying a hand which the Roman vessels bore as a talisman. The pieces which have been

brought up, together with the explorations made by the divers under water, give us a great deal of information as to the details of construction of the two vessels, even if we are not able to reconstruct them entirely at the present time. As to the kind of wood which was used, some of it is soft, and the other is harder and more resinous. The soft wood, which was em-

one plank down to the next one. The succeeding nail is driven through the second plank to the third, and so on. The planks themselves were held to the beams of the framework by shorter copper nails passing through them. The outside of the boat was first coated with a layer of hard plastering, over which was laid a woven fabric. Upon this came a sheathing of lead plates which were held on by flat-headed copper nails about 2 inches long. The use of the lead is not quite clear, as it does not afford a watertight joint and the absence of organisms in the lake does not seem to justify such a protection. Some of the tissue still remains. It is formed of wool and has now taken a dark brown color; the fibers can still be distinguished.

The different beams of the framework are formed sometimes of a single piece and in other cases of two superposed pieces nailed together. The section in the latter case is as high as 10 by 15 inches. To form a long beam, two pieces are often placed together with a parallel joint which is fastened by three large copper nails. Upon some of the main beams are found the attachment points for cross beams at intervals of 12 feet or more. In one piece we clearly see the construction of the deck flooring. It is formed of planks which are fastened on the beam by two nails. We also find the method of joining the planks by clavettes, which run in two rows alongside the beam. Along the top of the planking runs a shallow groove into which no doubt fitted an upright partition. The different parts of the vessel are fitted together in two different ways, either by nails or by clavettes, which are held by oak pins. The nails are mostly of copper (only one of iron was found) and of these great numbers have been brought up and in all dimensions ranging from 20 inches down to 1 inch for the lead plating. The section of the largest nails is nearly one inch on a side. They still bear the hammer marks on the heads. The larger nails must have been made by forging, while the smallest ones were undoubtedly formed by stamping, as in our day. One very peculiar feature deserves mention. On driving in the nails they often encountered an obstacle, such as a knot in the wood, and in many cases they curved around many times in the form of a spiral. Some specimens were found with the ends wound around in five or six turns.

In the project which he submitted lately to the Italian government, Sig. Malfatti proposes several different methods for recovering the entire remains of the vessels. He considers that the best plan would be to drain off the lake and so obtain a ready access to them. The remains are badly damaged, but the larger vessel is best preserved.

A curious development of cinematography is to be undertaken by a London firm. The North German Lloyd Steamship Company have made arrangement for a complete bioscope record of every phase of life, both recreation and work, upon a transatlantic liner. The vessel "Kaiser Wilhelm II." has been selected for the purpose. One of the most difficult phases of the work will be the photographing of the operations in the engine room and stokeholds, owing to the indifferent lighting facilities. For the illumination purposes, however, special electric arc lamps of high candle power will be installed for the occasion, while a special lens, the largest and most powerful that has ever been designated for cinematograph work, will be employed. This lens has a diameter of 3½ inches by 6 inches in length, as compared with ¾ inch and ⅝ inch, the respective diameter and length of the ordinary type of lens used for this work. The power of the lens will be sixteen times as great as the usual cinematograph lens. The pictures will be taken at the rate of sixteen per second, allowing an exposure of 1-35 second. Two men will be required for the operation, one for the regulation of the focus, and the other will control the rotating mechanism of the camera. The total cost of this enterprise will be between \$6,000 and \$7,500.

For protecting the steel used in the construction of the new coal storage and handling plant at the New York navy yard, the government engineers required that all the structural steel work be given a coat of the best red lead before leaving the shop, all contact surfaces an extra coat before assembling, and after erection two coats of dark green graphite paint.

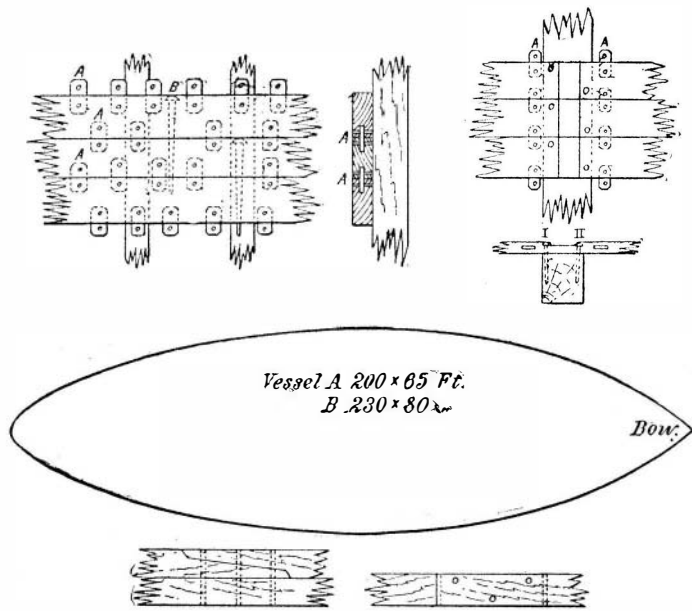


Fig. 3.—Details Showing the Method of Securing the Planking of the Lake Nemi Galleys.

ployed mainly for the sheathing and the deck planking, is white pine (*Abies pectinate*) and was no doubt procured on the spot, for splendid trees still grow in the region. The harder wood is either the red pine (*Abies excelsa*) or the larix, it is not certain which, seeing that the wood is greatly decomposed by the water. The harder wood is used mainly for the beams forming the framework. The pins for holding the

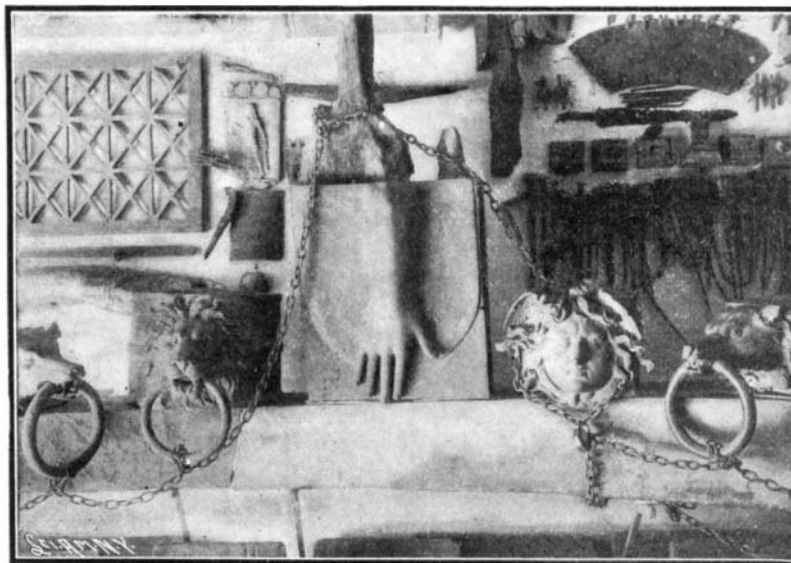


Fig. 1.—The Augural Hand Always Carried by the Roman Navigators as a Talisman.

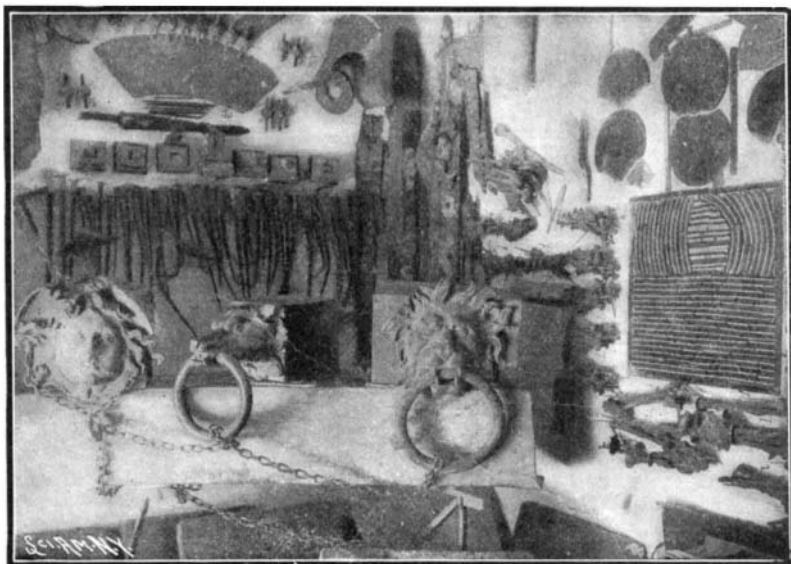


Fig. 2.—Bronze Ornaments for Masts and Anchors Found in Lake Nemi.

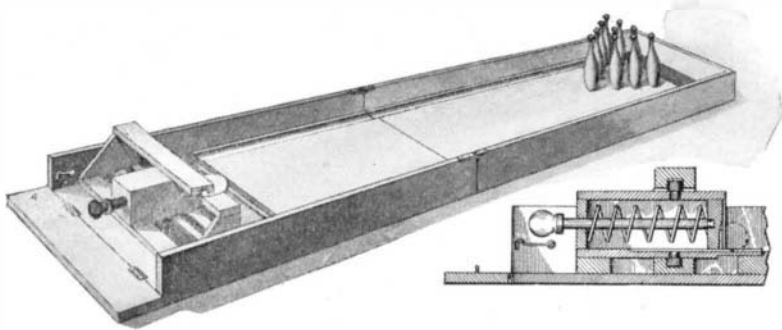
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planking are of oak. The construction of the sheathing of the vessels is quite out of the ordinary. It is formed of planks placed edge to edge and joined by wedges. The planks swell and the edges thus form a tight joint. Another special feature is that the planks are also held together by long copper nails placed at intervals of 4 or 5 feet. The nails pass clear through



#### PARLOR BOWLING ALLEY.

There is always a demand for a good "parlor" game and inventors have found it quite profitable to modify many of the popular outdoor sports and so arrange them that they could be played in the sitting room. An inventor has recently thus modified the game of bowling or nine pins. Bowling cannot be called an outdoor sport, yet it is not a parlor game, because it requires a specially built and expensive bowling alley. To play the "parlor" game, a miniature bowling alley has been provided which may be folded up into small compass and stored away without taking up much room. In use the miniature alley may be placed on any kind of a table. It comprises at one end a device for projecting or shooting the balls at the pins which

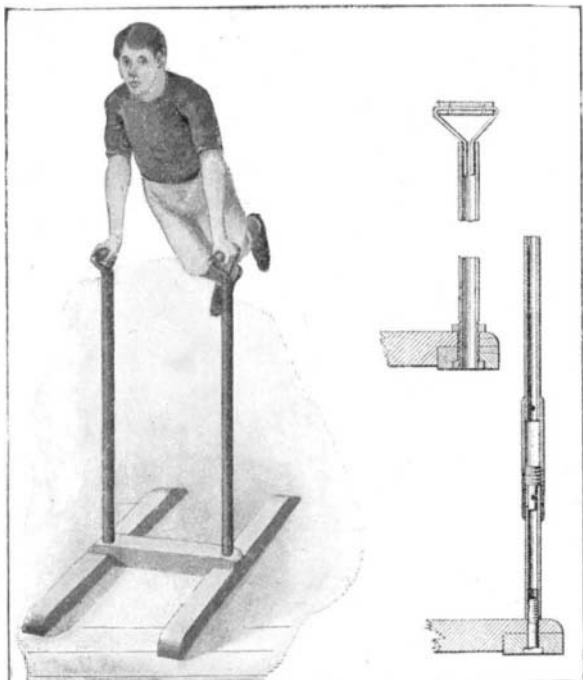


A PARLOR BOWLING ALLEY.

are arranged at the other end. The usual dead runs are provided at the side of the alley; but blocks are supplied with the apparatus for filling up these dead runs, to make a solid alley such as is used in playing the German game of nine pins. The shooting device consists of a casing, open at the front end and fitted with a piston. The piston rod projects through the rear wall of the casing. In operation the piston is drawn back and a ball is fitted into the shallow groove formed in the face of the piston. On releasing the piston it is thrown forward by action of the coil spring in the casing, shooting the ball against the pins. Provision is made for aiming the ball wherever desired. The piston casing is formed with lugs at top and bottom, which are received in grooves cut in two bars extending transversely across the board. This permits the shooting device to be moved laterally to any desired position and it may also be swung on the lugs as pivots to any desired angle. Mr. Robert E. Phillip, of 1709 Pacific Avenue, Spokane, Washington, has just procured a patent on this miniature bowling alley.

#### IMPROVED EXERCISING MACHINE.

A simple but very useful improvement in exercising machines is shown in the accompanying engraving. The machine, which is in the nature of parallel bars, is so constructed that only two standards are employed, firmly supported at their lower ends. Hand grips are provided at the upper ends of the standards. The hand grips are so constructed that they may be turned in the standards at the will of the exerciser while exercising on the machine, or they may be removed from the standard when not required. At the same time the construction is such that when they are subjected



IMPROVED EXERCISING MACHINE.

to a direct downward pressure they will remain as stationary as though fixed in the standards.

The machine comprises an H-shaped base formed of two parallel side bars and a cross bar. The lower threaded ends of the two standards pass through the cross bar and the side bars at their points of intersection, and are provided with nuts, whereby not only are the standards secured to the base, but the members of the base also are firmly bolted together. The hand grips are each formed of flat spring metal bent to a triangular shape with two projecting legs which are fitted into the open upper end of the standard. It will be evident that by this arrangement the hand grips may be readily removed and, when in use, can readily be turned in their standards. This freedom of action permits all the movements practised upon the ordinary parallel bar to be carried out and also a number of movements impossible on the fixed parallel bars. We also show in one of our views another improvement consisting of an adjustable standard whereby the machine may be adjusted vertically within prescribed limits by turning a sleeve which is secured to the upper section of the standard and threaded onto the lower section. The inventor of this exercising machine is Mr. Frederick Bitter, of New York city, southwest corner of 32d Street and Third Avenue.

The electric fan has been a god-send in more ways than one. In the summer months it has been the means of making more tolerable the positions of the men compelled to labor in corners and portions of the office and shop remote from the little air which might find its way into the windows of the place. Besides this it

has been the means of equalizing, in a very great measure, the demands made upon the power companies. These fans create a very considerable drain on the product of these companies at a time when there is almost no demand for current for lighting purposes, with the result that the electric generating concerns have found it quite profitable to encourage their manufacture and use. With this in view almost all of the companies in the larger cities keep a number of the fans on hand for rental to their patrons. The latest thing in this line is a tiny construction, which fits in the socket designed for a lamp. This fan is of such simple construction that it costs but little, and is said to be quite effective in scattering the air. With the use of a plug and cord it can be placed wherever desired. It is said to consume only eleven watts, or five of them may be operated with the same consumption of energy as an ordinary 16-candle-power lamp. It is built only for 110 volts, direct current. The fan has an 8-inch sweep, and the blades have a speed of 1,600 revolutions per minute.

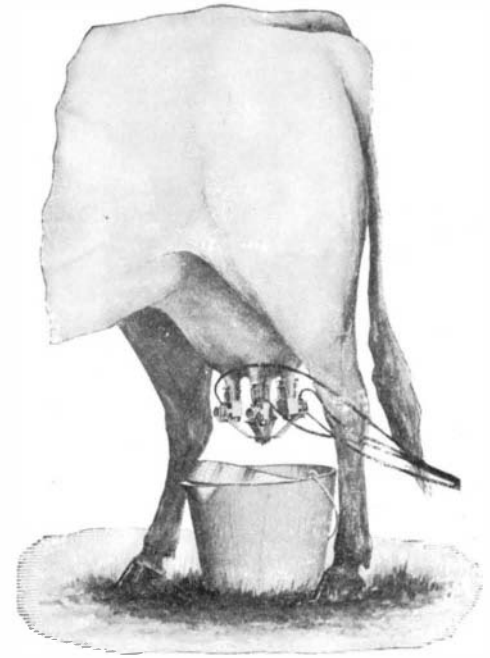
#### SHEET METAL VEHICLE WHEEL.

The accompanying engraving pictures a vehicle wheel which is made of sheet metal almost entirely. The construction, however, is such as to produce a very strong, shapely wheel which may be used either on a light or a heavy vehicle. The wheel is also so arranged that when in motion it will automatically lubricate the axle-spindle. The hub of the wheel which has the usual external form, is made hollow to receive the box bearing which, in turn, receives and rotatably supports the axle spindle. The space formed between the shell of the hub and the box bearing provides a suitable oil chamber for lubrication of the spindle. The oil passes through a perforation in the wall of the box which may be opened or closed to any extent by means of set-screw threaded through the shell of the hub. On the exterior of the hub two parallel radial flanges are formed to which the spokes are secured. The spokes are made of sheet metal bent to the form of channels of U-shaped cross-section. The flanges on the hub are formed to fit the spokes and consequently consist of series of semi-circular or U-shaped abutments. A pair of clamping rings serve to hold the spokes against these abutments. These rings are formed with radial flanges shaped to correspond with the abutment flanges to which they are riveted at intervals. At their upper ends the spokes are riveted to a U-shaped wheel-rim formed of sheet metal. The rim is braced at intervals by shouldered rivets. The method of joining the ends of the wheel rim is shown in Fig. 3, and consists in riveting the ends to a coupling sleeve inserted in the rim.

In assembling the wheel the coupling sleeve is riveted to one end, but is free to slide in the other. After the tire is shrunk on and the rim thereby compressed to the proper degree, the other end is riveted to the coupling sleeve. Fig. 2 shows a double or reinforced rim which is used for extra heavy work. Mr. John Lefler, of San Bernardino, Cal. (Box 223), is the inventor of this sheet-metal vehicle wheel.

#### MILKING MACHINE.

A rather novel machine for milking cows has recently been invented by Mr. Victor O. Johnson, of Pawnee, Oklahoma Territory. This machine is arranged to copy as nearly as possible the action of the hand when milking. A brace of four squeezers is provided, each resting in a box and all the boxes secured on a common frame but in such manner that they can easily be adjusted to any cow. Each squeezer consists of two flat spring metal plates connected at the bottom by a

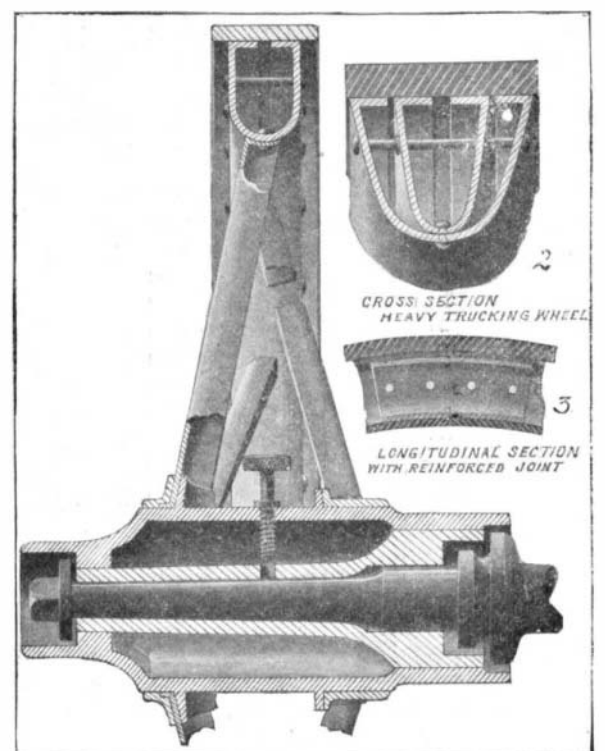


MILKING MACHINE.

U-shaped spring piece and each formed at the upper end with an inwardly-projecting U-shaped bend. These bends are, in operation, adapted to compress the teat at its upper portion to prevent the milk flowing back into the udder while the squeezer plates are moved together. The squeezer plates are provided with a rubber covering formed with ribs at the sides and thus producing channels corresponding somewhat to the form of the teat. The squeezers are operated by compressed air, the outer plate of each squeezer being connected to a piston operating in a small cylinder attached to the box of that squeezer. The plates at each side are formed with pins which project through curved slots in the side walls of the box and are secured to intermeshing segment gears mounted on the box. These segment gears cause the inner plate to move toward the outer plate when the latter is moved inward by the piston, and the pins coact with the curved slots to move the squeezer first upward and then downward while the squeezer plates are still advancing toward each other, thus copying very closely the action of the hand when milking.

#### Brief Notes Concerning Patents.

The collapsible lifeboat invented by Capt. Valdemar Engelhardt, a Danish sea captain, and which has already been the subject of a brief description in these columns, has recently received the official indorsement of the Board of Supervising Inspectors of Steam Vessels of the United States. This places this craft on the list of those which are recognized and approved for



SHEET METAL VEHICLE WHEEL.