A WAVE MOTOR.

BY CHARLES F. HOLDER.

If the experiments which have been made to control the actions of waves and to render this power available to man were to be collected in book form the result would be a large volume. Nearly all such efforts have been unsuccessful, but this has not deterred inventors, who are continually at work endeavoring to solve the problem. At least one attempt has met with success. Mr. Hancock Banning, one of the proprietors of the Wilmington Transportation Company, with Mr. Frank Carey, has been for some time experimenting with a simple contrivance, which, by the aid of wave power, has successfully pumped water and rung a bell. The invention is to be permanently established at the harbor of Avalon to ring a bell as a fog alarm and to pump salt water into a large reservoir from which the streets of the town are watered. The machine is also to be used in pumping out ships.

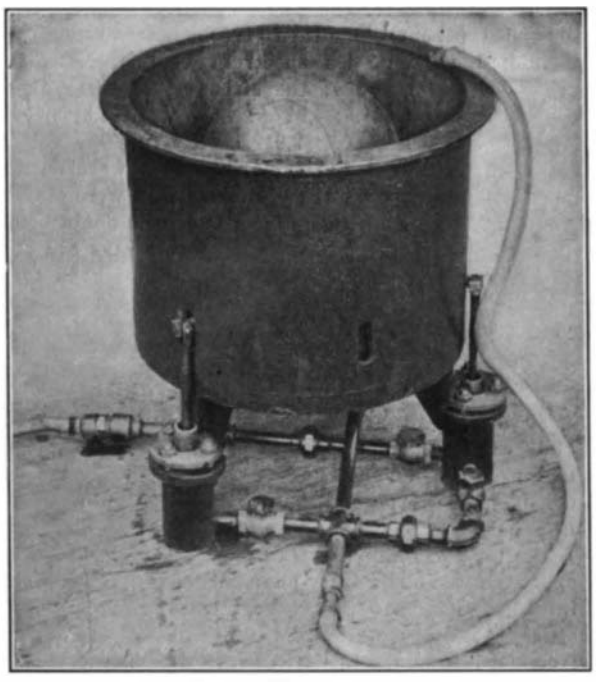
The inventors originally were searching for power to ring a bell, but when the machine was completed it was found that there was more value in the pumping capacity. The photographs shown illustrate both phases of the motor. The machine is shown rigged for both purposes. It is a large iron cheese-box shaped vessel about two feet in diameter, and is intended to be riveted to the deck of a ship, or to a floating platform. The pedestals contain pistons which are connected by levers with metal buffers on the inside, which surround a saucer-like platform, shown in the sectional view. The latter is supported by a pivot. On this rests a ball weighing one hundred and fifty pounds, also shown in the photograph. Experiment has demonstrated that the slightest movement of the water, wave or ripple, is sufficient to move the ball and make it oscillate, and every move it makes one or more of the "buffers," or all of them, are pushed down in succession, thus working the levers and raising the pistons, and so operating the pump. No matter what the conditions, two of the pistons are always up and two down. Experiments have shown that with even a moderate motion, or quiet sea, the number of strokes ranged from eighteen to thirty-two a minute, and the power generated was one-tenth of a horse power, showing thereby that larger motors, which are equally practicable, will provide all power necessary for the purposes named. Mr. Banning is having a larger motor built on the same lines, which is to be used for various purposes in the town of Avalon.

This motor has been tried as a bell buoy with success. Mr. Banning says: "We claim that this motor will ring a bell under very slight wave motion at times when the sea is so smooth that the bell buoy now in use cannot be operated. Experiments in Avalon Bay on a calm day have proven the above claim."

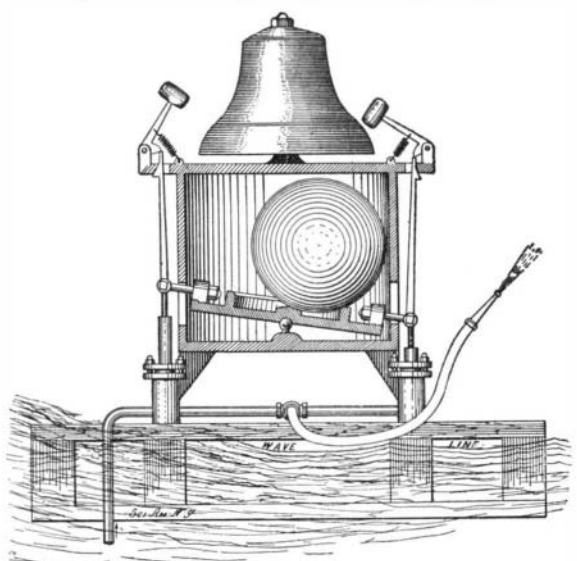
The cost of construction is small and the endurance of the machine is very considerable. At the practical test made in the calm waters of Avalon Bay the motor rang the bell sixteen times per minute, and in a rough sea this would be increased to forty times. The coast of southern California, though abounding in fogs, is singularly unprotected. At San Pedro there is no whistling buoy; yet the port is crowded with vessels, and steamers often are obliged to feel their way in. The islands of southern California have neither lights nor buoys of any kind, and it is hoped that the bell buoy above described will prove a cheap device well suited to the locality.

Observation of Ball Lightning.

M. J. Violle gives an account of a globular lightning discharge which he observed near the west coast of France. On the 9th of June, at 1:30 P. M., toward the end of a rather heavy storm passing above Fixin, near Gevrey-Chambertin, the author observed the ball lightning under the following conditions. He stood in a balcony facing the east, and from there watched the storm, which took the form of lightning discharges, succeeding each other at somewhat close intervals, under the form of fiery lines slightly sinuous in character and nearly vertical. He estimates the distance at about two miles. Then, after the strokes had ceased for a few minutes, he saw a ball of fire which appeared to drop from the heavens like a stone, and in the same place where the rectilinear lightning had occurred; also at about the same height. After an interval the region continued to be illuminated several times by lightning under the form of diffused discharges confined to a limited space. The phenomenon cannot be attributed to an optical illusion, as another person, standing beside the author, observed the same effect. M. Violle assured himself that there had been no fall of an aerolite at that time. The appearance of the phenomenon, besides, left no doubt as to its electrical nature.



WAVE MOTOR WITH COVER REMOVED.



SECTION THROUGH MOTOR, SHOWING PUMPING AND BELL-STRIKING MECHANISM.

THE LARGEST FLOATING DOCK IN THE WORLD.

BY OUR ENGLISH CORRESPONDENT.

Messrs. Robert Stephenson & Company, Limited, the well-known shipbuilders of Hebburn-on-Tyne, England, have recently completed the construction of a self-docking pontoon dock for the Spanish government, which is the largest floating dock in the world. The contract for the dock was placed prior to the American war, and it was originally intended for the port of Olongapo, the former Spanish naval arsenal in the Philippine Islands, for docking ships of the Spanish navy. When the war broke out the work of construction was necessarily interrupted. After the cessation of hostilities, and the annexation of the Philippine Islands by this country, another destination had to be selected for the accommodation of the dock, and it was finally decided to place it in the port of Mahon, in the island of Minorca.

The dock is of very fine workmanship, and of extremely strong construction, in order to comply with the requirements of the Spanish Admiralty, which are that if a ship of 12,000 tons weight, with a length of 328 feet, be placed in the center of the dock, no part of the structure shall be worked to more than 6.33 tons per square inch in extension, and 7.6 tons per square inch in compression.

The principal dimensions of the dock are as follows:

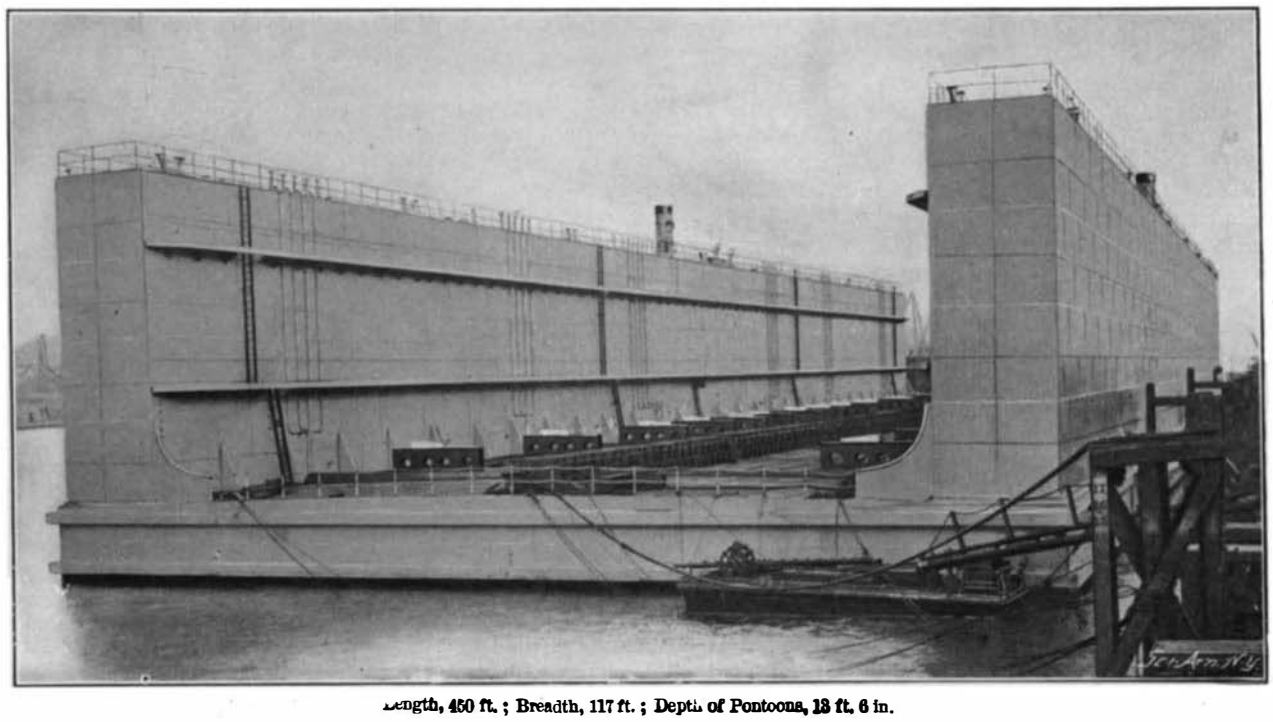
Length between perpendiculars	450 feet.	
Breadth, molded, over pontoons	117 "	
Depth, molded, of pontoons	13 "	6 inches.
Camber of pontoon deck between side girders		9 "
Breadth, molded, of side girders	12. "	2 "
Depth, molded, of side girders above pontoons	38 "	6 "
Distance over side girders, molded	115 "	4 "
Distance between side girders, molded	91 "	
Distance between shoring platforms	85 "	
Distance between pontoons, molded	1 "	
Maximum lifting capacity ..... ship weighing 13,000 tons.		

The bottom portion of the dock is built of iron, and is composed of six pontoons, each measuring 74 feet 2 inches in length, by 117 feet in width, and 13 feet 6 inches molded depth. On the top of these are placed the six towers or girders securely bolted to the pontoons and binding them all together. The pontoons are also connected together by junction plates, extending across the dock at each pontoon end. The side girders are built of steel on account of their having to take the strain when a ship is docked; also, since they are so much out of the water, they are not so liable to corrosion. The pontoons are very strongly constructed, having eleven fore-and-aft bulkheads, nine of which are water-tight, dividing each pontoon into ten water-tight compartments. This makes for the six pontoons an aggregate of sixty water-tight compartments in the bottom of the dock, all of which are tested with a water pressure of 13 pounds per square inch.

Every fifth frame in the pontoons is a strong partial bulkhead, extending across the dock, and over these frames the bilge blocks are placed. The center girder over which the keel blocks are laid is one inch thick, and under the keel blocks, 4 feet from the center on each side, there are two more fore-and-aft bulkheads. These, with diaphragm plates on every frame, make a very solid foundation under the keel blocks. The side towers have a safety deck about 14 feet above the pontoons, which prevents the dock sinking altogether, supposing the inlet valves were by any chance left open. Each tower is also divided into ten water-tight compartments.

The center compartment of each tower is fitted with the pumping installation, comprising two large marine type boilers, working at 120 pounds pressure per square inch; two of Tangyes' 24-inch centrifugal pumps, each driven by a separate engine; one duplex drainage pump and fire pump; two duplex feed donkey pumps, and a feed heater. Together the four main centrifugal pumps are capable of throwing 23,000 tons of water against a 28-foot head in two hours.

The 26-inch main suction pipes and the main drainage pipes run alongside the side towers and branch down at each pontoon to a collecting box, from which pipes lead to each compartment of the pontoons. Each of these pipes has a separate valve worked by a rod and wheel from the top of the side towers. Each compartment has also a wrought iron air pipe which is led up the side towers and placed near the standard and wheel, which operates the valve to the corresponding compartment. At the top of the air pipe is placed a gun metal cock. The inlet pipes, which are 19 inches in diameter, are also connected to the collecting or distributing boxes, and each inlet pipe has a grid and valve worked from the top of the towers. Every water valve in the dock has an indicating plate and pointer showing how much the valve is open. Each pump, by means of valves, is arranged to suck from one or both ends of the dock, and each pump has a 24-inch valve on the discharge branch, and also a balanced flap valve. The drainage pump is ar-



Length, 450 ft.; Breadth, 117 ft.; Depth of Pontoons, 13 ft. 6 in.

SELF-DOCKING PONTOON DOCK FOR THE SPANISH GOVERNMENT.—(Largest Floating Dock Yet Constructed.)

ranged to pump from each compartment through a separate range of pipes, and there is a gun-metal drainage foot valve at the bottom of each branch pipe to each compartment of each pontoon. The drainage pump is also connected to a range of pipes which are carried along the top of the side towers for washing decks, or for fire purposes. The compartments in the side towers are filled and drained through the main suction pipes, and they can also be drained into the pontoons by means of scupper valves worked from the decks of the pontoon. There are speaking tubes from each tower to the engine rooms, and also from side to side.

The keel blocks, which are placed 3-foot centers, are of pitch pine, and are 3 feet 6 inches high. The lower blocks are 18 inches square, and each keel block has a cap piece of oak 6 inches thick. The blocks are fitted between angle irons and are securely dogged together. There are twenty-four bilge blocks of very strong construction, placed on the dock, so that they can be shifted in or out, and on the top of each steel bilge block is a sliding block of oak which is pulled into position under water by means of ropes led to the top of the towers.

There are two shoring shelves inside the dock on each side, 2 feet 6 inches wide, with a facing piece of elm 9 inches by 6 inches. The sides and ends of the dock are protected by two American elm fenders securely bolted between angles. On the tower tops are placed fourteen large timber heads for mooring ships using the dock, and four mooring shackles are attached to the pontoon for mooring purposes. Wrought iron ladders lead up from the pontoons to the shoring shelves and tops of towers.

On the inner side of the towers in the stokehold water-tight doors are placed giving access to the deck of pontoon and for discharging ashes. The engine room and stokeholds are ventilated by cowl ventilators and a range of ventilating pipes. Feed tanks are placed on each side above the boilers, each holding 25 tons of fresh water for feed purposes. There are also bunkers which will hold 30 tons of coal in all.

The dock has been so constructed that in the event of damage to a pontoon, or if a pontoon requires bottom to be scraped and painted, it can be detached and docked on the dock itself to be overhauled. This is accomplished by disconnecting the bolts that hold the pontoon to the side girders and to the pontoons adjoining, severing the suction pipes and valve rods and letting water through the sea valve into the pontoon when it is detached. This causes it to sink below the level of the bottom of the side girders, and it can be easily drawn out at either side. It is then turned round so that the narrow part faces the entrance of the dock. The latter is then sunk sufficiently to let the pontoon float over it. The water is then pumped out and the pontoon raised. When the necessary repairs are completed the process is reversed and the pontoon brought back into place and rebolted to the side girders.

The dock was towed down the Tyne by seven tugs. When it reached the mouth of the river it was taken in tow by three powerful tugs belonging to Messrs. Smit & Co., of Rotterdam, who make a specialty of long-distance towing of this description. Two tugs towed the dock with tow ropes of 20-inch manila, and the other tug steered with a check rope of 13-inch manila. The towing journey from the Tyne to Port Mahon, a distance of two thousand one hundred miles, occupied approximately thirty days.

A lightship has recently been launched in Scotland which is unique in many respects, not the least one being that the vessel will carry no crew. What is known as the "compound gas system" provides for the lights for several months at a time, the gas being carried in a large tank and pipes therefrom being led up a hollow mast to the lantern, 25 feet above deck; communication is doubtless made with the shore to extinguish the light during the day. A large fog-bell is also provided which is rung by the roll of the vessel, and also by the passage of the gas to the lantern when there is not sea enough to toll the bell.

SOME REMARKABLE TREE GROWTHS.

Our engravings represent two remarkable examples of tree growth. The first is a famous yew tree near Kü Chou in southeastern Shantung, China. It is a fine specimen of the *Salisburiana adiantrafolia* and is of so large a size that there is space at the head of trunk, where the branches begin to spread, for eight men to take a meal around a square table. Tradition places the age of the tree at three or four thousand years, and Confucius is said to have rested in its shade. The species is of such slow growth that the Chinese have a saying to the effect that you need not plant the Pei Kwo, as they call it, if you have no grandson. The name "maiden's hair tree" is given to it on account of the shape of the leaf. It is also called a yew on account of its botanical relationship. Our photograph was taken by the Rev. W. O. Elterich and was contributed by W. Reid Faries, of Shanghai.

YEW TREE IN SOUTHERN SHANTUNG REPUTED TO BE 3,000 OR 4,000 YEARS OLD.

CURIOUS GROWTH OF A LINDEN TREE, MAHWAH, N. J.

Our other engraving shows the abnormal development of a linden tree (*Tilia americana L.*) which is also known as basswood, lime-tree or bee-tree. It stands on the Havemeyer farm, which is known as the Hillside Farm, Mahwah, in the northern part of New Jersey. The tree is about 120 years old, 30 feet high, and, including both sections, is 30 feet wide. It stands on the Ramapo River in a wet, swampy place. It is one of the most remarkable botanical curiosities in this part of the country. The twin branches really appear to be horizontal trunks. The photograph was made by A. Denninger, and it was contributed by the Rev. Dr. Kimber, of the chapel of St. Augustine, New York city. The linden tree attains a great age. At Neustadt, Germany, there is a linden tree which measures 399 feet in circumference. The most ancient linden perhaps in all Europe is the Donndorf, near Bayreuth. On a map dated 1390 it is mentioned as a very old linden, 24 yards in circumference. The age is given as more than twelve centuries.

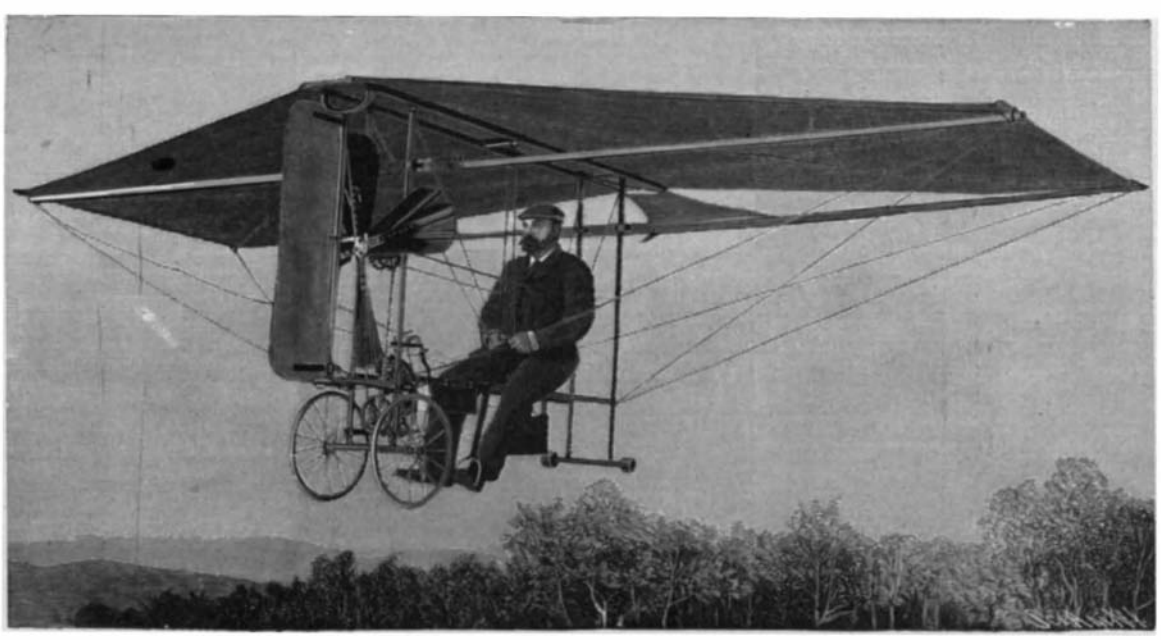
NEMETHY'S FLYING-MACHINE.

Undeterred by the failure of the German engineer, Hofmann, a Hungarian manufacturer, Emil Némethy, has constructed an aeroplane which differs in no essential from the contrivance of his predecessor, but which he believes will meet with considerably more success. Némethy's interest in flying-machines is merely that of a sportsman. Aerial navigation, he argues, can become a sport only if the cost of a flying-machine can be reduced to that of an automobile. His aeroplane is therefore built on a rather small scale. But despite its size, the inventor trusts that his machine will glide through the air as easily as in the somewhat fanciful picture which we reproduce from the Illustrirte Zeitung.

Némethy's machine is an aeroplane weighing only 66 pounds. Originally a motor of three-quarters horse power, weighing 25 pounds, was mounted on the frame of the contrivance for the purpose of driving the single propeller; but the inventor has decided that three-fourths of a horse power are inadequate and has recently fitted the machine with a 2¼ horse power gasoline motor. The current of air driven by the propeller under the wings or air-resisting surfaces will, it is thought, be sufficient to sustain the machine in the air. In order to overcome the inertia of the aeroplane, Némethy will construct a rather steep ramp terminating in a short upwardly inclined path. The machine, according to Némethy, will dash down the ramp at a high speed, then up the short incline, the momentum acquired, supplemented by the power of the rapidly rotating propeller, serving to drive the aeroplane onward in the air.

The saddle for the aeronaut is so connected by wires with the front and rear ends of the machine that, it is claimed, the center of gravity can be shifted longitudinally or laterally in order to change the direction of flight. Némethy believes that, with his machine, the aeronaut will, with a certain bird-like instinct, incline his body to shift the center of gravity in times of emergency.

The wings have an area of 194 square feet. With the new motor the aeroplane will weigh 154 pounds. Hence each square foot of the wings must sustain nearly four-fifths of a pound—a ratio between supporting surface and weight which is said to exist in the case of many birds. The relation of the total weight (300 pounds, including the aeronaut) to the motive power is unfavorable. Némethy has patterned the wings of his aeroplane after those of a swallow.



NEMETHY'S FLYING-MACHINE.

MILK PRESERVATIVES.—M. Wynter Blyth detects the presence of added preservatives in milk by the following simple process. To 10 C.c. of each sample of milk to be tested, and to 10 C.c. of sterilized milk known to be free from preservative, 2 C.c. of very strong solution of alkaline litmus is added. All the tubes are then examined, and if not of the same shade of blue as the control tube, semi-normal NaHO solution is added to them until the tint is identical. All are then plugged with cotton wool and heated in the water bath to 80 deg. C. for ten minutes. After cooling, each tube, including the control tube, is inoculated with 0.5 C.c. of a mixture of sour milk in water (1 C.c. of milk in 200 C.c. of water). They are then allowed to stand at ordinary temperature for twenty-four