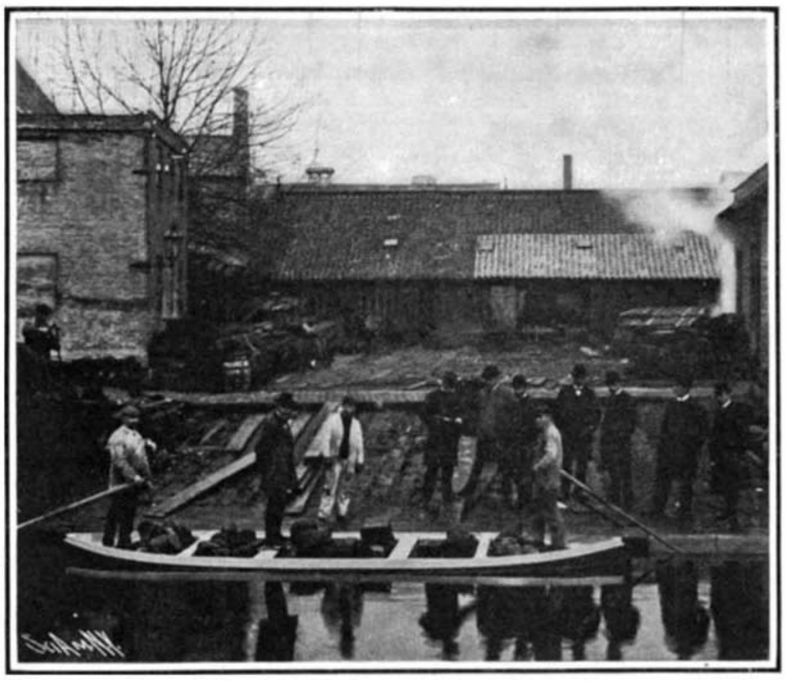
THE ENGLEHARDT UNSINKABLE LIFEBOAT.

BY RANDOLPH I. GEARE.

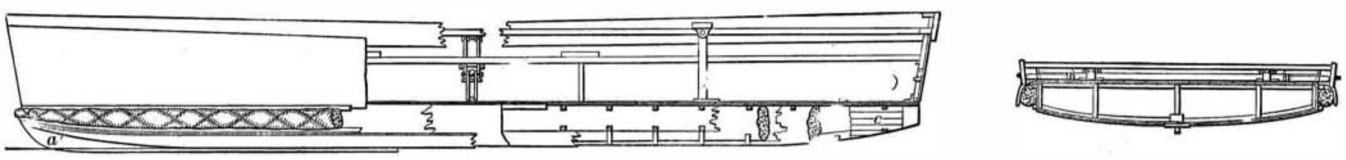
About one hundred and twenty years ago the first patent was taken out for a lifeboat. Four years later (1789) Henry Greathead, of England, patented another kind which proved very successful, and continued to be almost the only one in use till 1851, when fifty models of improved lifeboats were exhibited at London in competition for a prize offered by the Duke of Northumberland. A boat designed by James Peake, of Woolwich Dockyard, then became the recognized model, and was universally adopted as the standard.

The principal essentials in a lifeboat are great lateral stability, speed against a heavy sea, facility for launching and taking the shore, immediate self-discharge of any water breaking in, the power of self-righting if upset, strength, and plenty of passenger space.

The latest lifeboat to aspire for first honors is the "Englehardt," recently invented in Copenhagen. It is about twenty feet long, and is said to combine the requirements of the smallest space with the utmost carrying capacity.



TWENTY-ONE-FOOT ENGLEHARDT COLLAPSIBLE LIFEBOAT UNEXPANDED.
Load 4,500 pounds.



Longitudinal and Cross Sections of the Englehardt Boat.

In case of shipwreck, if time should not allow the lowering of these boats, the lashings need only be cut, and when the ship has sunk, the boats will be found floating like rafts, and easily accessible for passengers who may be swimming or drifting about. Two persons can extend the sides in a few seconds by simply lifting in the cross-beams, and thus converting the boat-shaped raft into a lifeboat containing oars, bread, watertanks, etc.

The principles of this boat are (1) a boat-shaped pontoon of wood or iron, filled with kapok (the product of plants growing in Java and Sumatra) carried in water-tight cushions, which again are placed in water-tight compartments. Kapok is said to combine the greatest floating capacity with the least weight, and will sustain from thirty to thirty-five times its own weight in water; and (2) a superstructure which can be folded down or erected, the whole surrounded by a fender also filled with kapok, in water-tight cushions.

TWENTY-ONE-FOOT COLLAPSIBLE LIFEBOAT EXPANDED.
Twenty-two men are trying to list her over.

In extending the boat, the oars are released, an oval-shaped-thwart supplied with cross-thwarts slides into position, and stanchions and other parts drop into their places automatically.

The lower part of this boat is a buoyant layer, consisting of a keel, one amidships keelson, two side keelsons, two double side-strakes, all of which are connected by cross-timbers and carlins and are fastened to the stem and stern posts. The bottom as well as the deck in this layer is planked with boards laid lengthwise under the bottom, and diagonally on deck. The deck canvas reaches two or three inches down on the side-strake, the bottom canvas the same distance up on the deck. Both layers of canvas are then covered on deck by a second layer of boards crossing the first at a right angle. The bottom canvas is further covered below a layer of boards and on the sides by the second side-strake. On each side of this buoyant layer, two narrow battens are fastened to the side-strakes for lashing the fender, which consists of short cushions made of prepared water-tight canvas stuffed with kapok and surrounded by a strong canvas cover. Between the three keelsons are placed cushions, likewise water-tight and stuffed with kapok, while the peaks "fore and aft" are filled with cork. The top stanchion consists of a rail, to which is bolted a gunwale or sheer strake, and which is connected to the lower structure by toggle joints or hinged uprights. Two cross-beams are likewise bolted to the rail, each furnished with stanchions.

Launch of a New Japanese Battleship.

The latest addition to the Japanese navy is to be launched from the shipyard of Messrs. Vickers, Sons & Maxim, Ltd., Barrow (England) on July 4, by Princess Arisugawa. This is the "Katori," which is practically identical with the "Lord Nelson" class now in course of construction for the British navy, being of 16,000 tons displacement. The vessel has a length of 420 feet; beam, 78 feet; coal supply, normal, 750 tons, full, 1,800 tons; mean draft, 27 feet; indicated horse-power, 16,000; speed, 18½ knots. The fighting armament comprises: Four 12-inch (45-caliber) guns in barbettes of armor 10 inches thick; four 10-inch (45-caliber) in barbettes of 6-inch armor; twelve 6-inch, all protected (ten will be in a 6-inch armored battery); ten 12-pounders and two 12-pounders for landing purposes; three 3-pounders; six Maxims; five 18-inch submerged torpedo tubes, four on the broadside and one aft. The main features of the armor protection are a complete waterline belt 9 inches thick, tapering aft to 2½ inches thick, and an intermediate belt forming the base of the armored main deck battery varying from 6 inches to 4 inches. The conning tower and the communication tube are 9 inches thick, and there is also to be an observation station of 5-inch thickness.

AN APPARATUS FOR INDICATING THE VIBRATIONS OF SOUND WAVES.

BY EMILE GUARINI.

The object of this apparatus, recently invented by Mr. William Stern, of Breslau, and constructed by the Max Kohl establishment, of Chemnitz, is, through an absolutely continuous variation of the pitch of the sound, to embrace, in a large measure, the series of sounds in such a way that any number whatever of vibrations may be immediately produced and read upon the apparatus as soon as obtained. As long as it resounds, the sound has a constant intensity, and does not continue to decrease as in the tuning fork. The apparatus consists of a series of vessels of different sizes, each embracing an octave, and each consisting of a brass cylinder surmounted by a zinc cap provided with a short pipe and soldered to the cylinder. The bottom of the latter is hermetically closed by a piston, the upward and downward motions of which produce the variations of the sound. For the production of the sound the cylinder is placed in the path of a current of air directed obliquely upon the short pipe end by means of a flattened nozzle. The air may be driven into the latter by means of an ordinary bellows arrangement, for which may be substituted the apparatus shown in Fig. 2. A substitution of this sort is advantageous in the first place because it dispenses with the necessity of continually actuating pedals, and, in the second, because it does away with the production of slight vibrations isochronous with pedaling. The new apparatus is based upon the principle of gasometers. It consists of a large iron plate cylinder open at the bottom and descending by its weight into a tank filled with water. This motion drives out the air imprisoned above the water, with a pressure of about 15 millimeters of mercury. This compressed air passes into the tube and enters the regulating one of the diversifier. Now, since as the cylinder enters the water it loses its weight, and the pressure of the air must therefore diminish, a very interesting arrangement has been devised to prevent such diminution. Upon the descending holder there is an annular receptacle which communicates, through another, with a glass tube filled with water and placed upon the side of the table. This is seen at the left in Fig. 2. When the holder, and consequently the annular receptacle, descends, a certain quantity of water passes from the glass tube into the receiver. It is a question, therefore, merely of giving the two communicating vessels dimensions such that the weight of the water introduced shall balance the loss of weight by immersion. When the holder is completely submerged, it suffices to pull a cord in order to raise it to its former level. The pulling of the cord opens at the same time a valve which allows air to enter the holder in measure as it ascends. After the ascent of the holder, it is possible to pursue for several minutes the study of the sounds produced by the apparatus with an always equal intensity. The cylinder resounds as long as the current of air lasts. The pitch of the sound is modified during this time by raising or lowering the piston.

It would evidently be possible, by the use of one or more transmissions, to actuate the piston very slow-

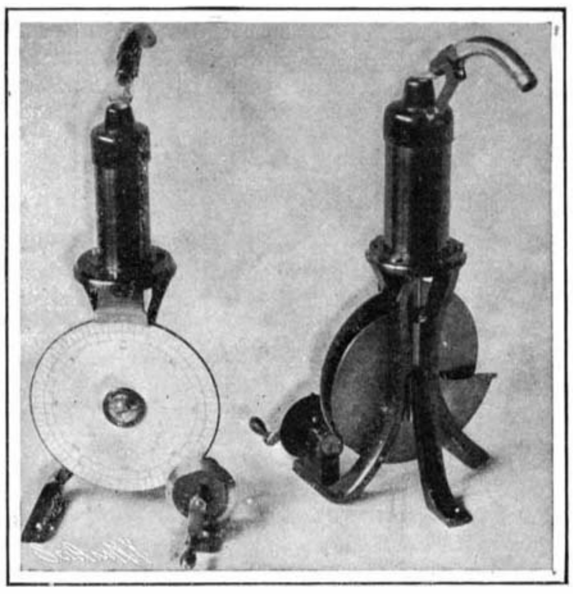


Fig. 1.—FRONT AND REAR VIEWS OF NEW FORM OF VIBRATION-INDICATING SIREN.

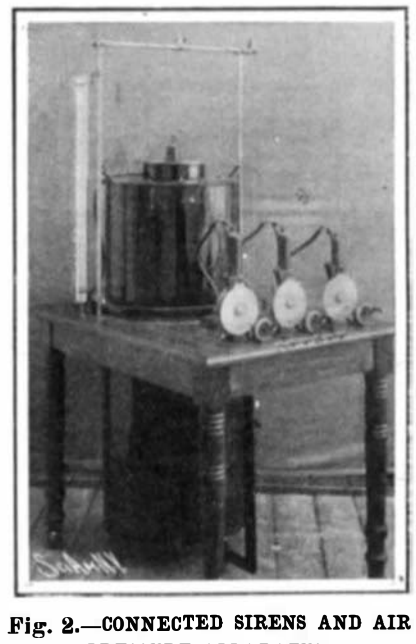


Fig. 2.—CONNECTED SIRENS AND AIR PRESSURE APPARATUS.

ly, and consequently to obtain an infinite and insensible gradation of the sounds. Very great difficulties, however, are met with in the way of satisfying another requirement of great importance in apparatus of precision—and that is the regular and uniform modification of the pitch of the sound. When the piston ascends, the sound does not rise in a regular manner, but with an ever-increasing velocity, because the pitch is not inversely proportional to the height of the column of air in vibration, but to the square root of such height. An inconvenience therefore presented itself. Upon turning the crank in order to raise or lower the piston, each revolution had a different effect upon the variation of the sound. This difficulty has been surmounted in the following manner: The piston rod is displaced by means of a roller upon the edge of a disk revolving vertically. When the roller rests upon the point at which the radius of the spiral is smallest, the bottom of the cylinder will be situated in its lowermost position. If, on the contrary, it rests at the point at which the radius is maximum, the bottom of the cylinder will be in its uppermost position. The spiral is so planned that at the minimum radius it is very narrow, and that in measure as the radius increases it becomes more open. In this way, in proportion as the crank is turned, the elevation (per revolution) of the piston becomes less. It is in this way that the irregularity mentioned above has been overcome. Upon the same axis with the spiral, and turned toward the experimenter, there is a graduated circle that carries the indication of the number of vibrations and of the musical tone, and that revolves at the same time as the spiral and passes before a stationary index. On this, it is possible at every instant to read the number of vibrations obtained. This axis is connected, through a 1:10 transmission, with another to which the crank is fitted. To the crank is adapted a second graduated circle, which permits of inserting fractions between the vibrations indicated on the principal dial.

As may be seen in Fig. 2, several of these apparatus are fixed upon the same table. Their scales of sounds encroach upon one another because it is sometimes necessary to obtain the same sound from two instruments at once.

A front and a rear view of the apparatus are given in Fig. 1. In addition to this type, the maker is constructing one that is less precise, and is adapted for less accurate researches and for school demonstrations. In this the spiral is done away with, and the piston is actuated directly by a rack and pinion. Owing to a special arrangement, it has been possible, despite the unequal variation of the sounds, to indicate exactly the number of vibrations of each sound upon the scale.

THE BIRD AS A MODEL FOR THE AEROPLANE.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Since the fatal results that attended the experiments of Lilienthal and Pilcher in the solution of the problem of aerial flight, further investigations in this direction have been somewhat neglected in favor of aeroplane and balloon researches. During the past few months, however, an impetus has once more been imparted to the problem of flying by three British investigators, Messrs. E. P. Frost, Dr. F. W. H. Hutchinson, and C. R. D'Esterre. The result of their efforts and the data they have gathered from their investigations were recently communicated to the Cambridge University Society, and have aroused considerable interest.

These experimentalists have taken the wings of a bird as the basis of their efforts. As is well known, a bird's wing consists essentially of two portions: (1) That part to the outer side of the wrist joint, the main feathers of which are about ten in number and are known as the primary feathers; and (2) that part to the inner side of the wrist joint, which may be described as the body of the wing, and the main feathers of which vary according to the length of the wing.

The salient characteristic of a bird's wing as a whole is the comparatively rigid and heavy anterior edge and the light, yielding, elastic posterior margin. If the primary feathers be examined carefully, it will be observed that each one differs from its fellows and that they differ in a graduated series. The quill is curved in, and the feathered portion or penna is set around this in a helicoidal curve. Here again the portion anterior to the quill is stiff as compared with the portion behind it. Another feature of a bird's wing is that a fore-and-aft vertical section through the body of the wing discloses a curve somewhat of the following shape:

Record of Wing Motion of Birds During Flight. The Bird Flew from Left to Right.

This curve is somewhat more pronounced about midway between the wrist and the shoulder joint, viz., in the region of the elbow. When the wing is in its extended position for flight, this joint is distinctly behind the front edge of the wing.

For the past quarter of a century Mr. E. P. Frost, who is a well-known member of the council of the British Aeronautical Society, has made a close study of the structure of a bird's wing, its functions, and operations. As a result of these examinations, he concluded more than twenty years ago that for ordinary flight the wing is merely beaten up and down. It is therefore obvious that owing to the yielding elastic posterior edge of a bird's wing, on the wing being beaten downward both a lift and a drive forward are obtained. Furthermore, it is apparent that when the wing is elevated, a forward and downward resistance is imparted. But owing to the shape of the wing, the down stroke must perforcedly encounter greater air resistance than the up stroke, apart from considerations of the amount of energy invoked to the up and to the down stroke. Also the arrangement of the wing feathers causes a valvular suction. Air passes through the body and the wing on the up stroke.

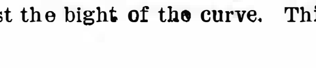
Mr. Frost contends that the result of the arrangement of the primaries must be that on being struck downward in the air, their ends travel forward and upward. In flight the wing tips of a bird, for instance a rook, can be seen to be curved upward. If a shed primary feather be taken and held in its natural orientation and struck smartly down in the air, the tip can be observed to spring smartly forward. Then the posterior edge of the penna becomes tense. But when the feather is not so stressed, the posterior edge is sinuous and has a fullness. Other—normal—movements have been described, notably the so-called "figure of eight" curve generated by movements of the wing tips; but Mr. Frost concludes that the movements of the wing tips (particularly the "figure of eight" curve) in what may be considered normal steady flight, are the automatic results of the peculiar construction of the wing, and of its being beaten up and down against the air.

If, during the down stroke, the primary feathers are strained forward and upward within their elastic limits, it is obvious that energy is stored in them, and its restoration may in part occur even in the up stroke.

Major B. Baden Powell, who is also intimately interested in the problem of flight, recently obtained the interesting results shown herewith. The curve shown was obtained in the following manner: A number of small birds were procured, and tubes of paper were prepared, the internal diameters of which were approximately the distance between the tips of the oustretched wings of these birds. The internal surfaces of the tubes were covered with a coating of lampblack. A tube was then arranged with one end in a room and the opposite end pointing out into the open air through a window. A bird was then liberated within the inner end of the tube. As it flew toward the light at the outer open end, a record of the movements of its wing tips was obtained. Several observations were made, a fresh tube being requisitioned each time. The curve thus obtained is clearly shown in the diagram. The dotted portion was only faintly visible on the record. Major Baden Powell considers this to represent the up stroke, and that it shows the wings to be slightly flexed on the up stroke.

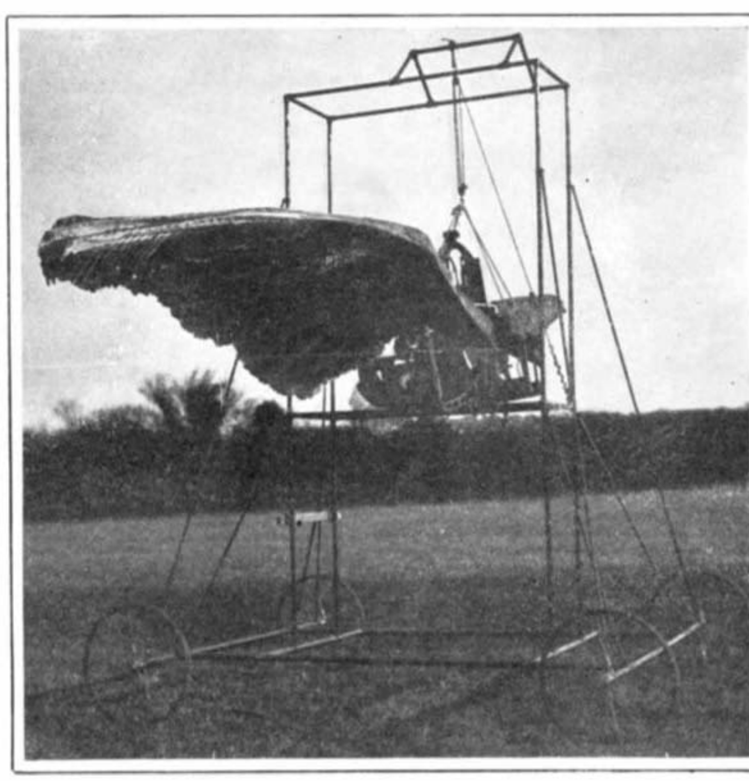
According to Dr. Hutchinson, however, the difference in distinctness between the two portions is due to the wrist being in a slightly flexed condition on the up stroke, in what may be considered the normal position, and that on the down stroke the stressing of the primaries automatically increased the distance between the wing tips, and opened the wrist automatically against its elastic reaction. The wing *as a whole* is essentially an elastic structure. The absence of recurvation at the lower portions of the record, taken in conjunction with the form of the down stroke record, would seem to prove that owing to its being in the tube the bird was not flapping at full vigor, or quite normally, and that the stored energy of the primaries was given out during the latter part of the down stroke. During flapping flight the primary feathers automatically exert a clawing, swimming action.

Referring to the curve mentioned in the earlier part of the article, Mr. Hargrave, of New South Wales, has demonstrated that when air is blown against such a curved surface, thus:



a lift is obtained against the bight of the curve. This

Apparatus for Demonstrating the Lifting and Propulsive Effect of a Bird's Wings.



The Experimental Apparatus with Wing-Planes.

THE BIRD AS A MODEL FOR THE AEROPLANE.