A BABYLONIAN VASE INLAID WITH IVORY AND PRECIOUS STONES DATING FROM 4500 B. C.

BY PROF. E. J. BANKS, FIELD DIRECTOR OF THE RECENT BABYLONIAN EXPEDITION OF THE UNIVERSITY OF CHICAGO.

It may seem to the layman that the Assyriologist and Egyptologist are rivals in the efforts to bring to light the earliest traces of civilization, for during the past decades each has startled the world by announcing that he has discovered traces of civilized man of five, six, and even ten thousand years ago. In confirmation of his statements, he produces strange objects from the ruins of Babylonia or Egypt. Yet such extremely ancient antiquities are rare. At Bismya, the ruin in central Babylonia which, as field director of an expedition from the University of Chicago, I recently excavated, and which has proved to be the remains of the oldest known city in the world, was discovered, among other remarkable things, a blue soapstone vase richly engraved with human figures and inlaid with ivory and precious stones.

The vase, when found, was in fragments, three of which were recovered from among hundreds of fragments of vases of other stone. All were lying in an ancient refuse heap of the temple, where they had been thrown. The position of this heap of rubbish, buried beneath the ruins of structures known to date from 3800 B. C., and containing a number of inscriptions and bricks, as well as the style of art, point to a date not far from 4500 B. C. The original diameter of this vase of blue soapstone was about twenty-two centimeters (8¾ inches); the height of its nearly vertical walls was about twenty centimeters (8 inches), and the three surviving fragments represent somewhat more than a quarter of the vase.

One of the most remarkable features of the vase is that it is unlike anything ever before discovered in any ancient ruins. Upon the three fragments are represented at least thirteen human figures, either entire or partly broken away. The two central figures are musicians, who are playing upon their five and seven stringed harps as they are marching along. If for no other reason, the engraving is remarkable because it gives us the picture of the musical instrument of more than six thousand years ago. Behind the musicians marches a person of importance, possibly the king, for from his hat project three rays to distinguish him from the others in the procession. Behind him are two other figures. One, judging from his size, is a boy; the other is holding up his hands in the attitude of worship. Before and above the musicians are figures, who are represented as running to meet the procession. One man holds in his hand a branch of a tree, while other branches are scattered about among the figures. The engraving may represent one of the religious processions common in later Babylonian history, when the gods were carried about the city. Yet the running figures more likely indicate the triumphal procession of a victorious king, accompanied by music, and an occasion of great joy is represented.

Still more remarkable is the execution of the engraving. While the field of the picture is represented by the blue stone of the vase, the figures are partly composed of inlaid materials. When found, the inlay, with the exception of a few pieces of lapis-lazuli in one of the tree branches, was missing, yet the deep grooves into which it had been set remain to show where it had been. Later I discovered a square piece of ivory, which formed the skirt of the figure bearing the branch. From this one ivory dress we may infer that the dresses of all of the figures were of the same material. The faces, arms, and feet are represented in relief, and the long braids of hair and the hats are also of the stone of the vase. Judging from other objects found in the Bismya temple, it would seem that the eyes were inlaid with blue stone. The material employed to represent the bracelets and head bands and other inlaid parts cannot be known, yet from the dump small pieces of red and blue stone, mother-of-pearl, and engraved ivory appeared. Some of them may have been used in the missing parts of the vase.

A chief peculiarity of the art is that the figures are represented with enormous noses, imparting to the face the grotesque appearance of a caricature. The few specimens of early Babylonian art at hand, while representing the nose in a straight line with the forehead, fail, with the exception of a few terra-cotta statuettes, to exaggerate to such an extent. The faces of the figures are shaved; the hair is braided and hangs down behind. A hat, either with or without a band and rays and a ribbon, is worn; the rays probably distinguish the rank of the wearer. Apart from the hat, the one other piece of wearing apparel represented on the fragments of the vase is the short skirt, which is known to be the Babylonian costume of about 4,500 B. C.

This unique vase of the greatest antiquity, so different from anything previously discovered, therefore opens a new study in the history of early art; it is one of the most highly prized objects from the most ancient civilization of Mesopotamia.

TWO FRAGMENTS OF VASE INLAID WITH IVORY AND STONES FROM BISMYA DATING FROM ABOUT 4500 B. C.

SKETCH OF THE DESIGN ON THE VASE.

THE GYROSCOPE AS A COMPASS.

BY A. FREDERICK COLLINS.

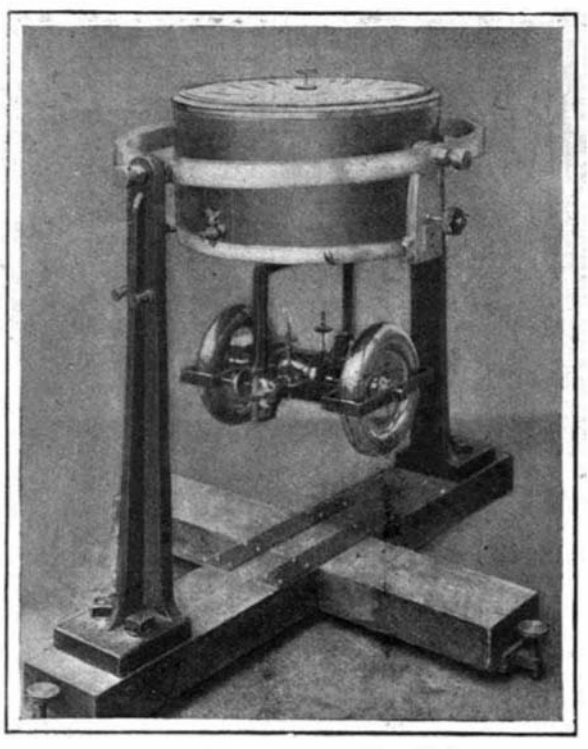
Since the invention of the gyroscope by Foucault, to demonstrate the rotation of the earth upon its axis, this mechanism has been constructed in many modified forms, and the principles underlying it have been utilized for various purposes. But it is doubtful if a more ingenious construction has ever been devised, or a more useful application been found for it, than the one herein described. The Anschütz gyroscope takes its name from the inventor, Dr. H. Anschütz-Kämpfe, and was designed for the purpose of replacing or supplementing the ship's compass, where the latter for any reason is rendered useless or inaccurate. Two models of the gyroscope have been built by a Kiel firm of instrument makers, and both of these are shown in the accompanying illustrations. The second form possesses several improvements over the earlier construction, though the general design is the same in both.

In the compass the needle assumes a fixed position under the influence of the earth's magnetic attraction, while in the gyroscope, on the other hand, there is a rotating system affixed to a horizontal axle, which can turn freely in all directions. The spindle of this device has a strong tendency to retain its momentary direction, and when the binnacle, which is an integral part of the vessel, turns with the movement of the vessel, the indicator carried by the spindle will correspondingly turn against the binnacle, or in the opposite direction. Thus the indicator will point out in degrees, or fixed lines of a scale, the variations in the course of the ship.

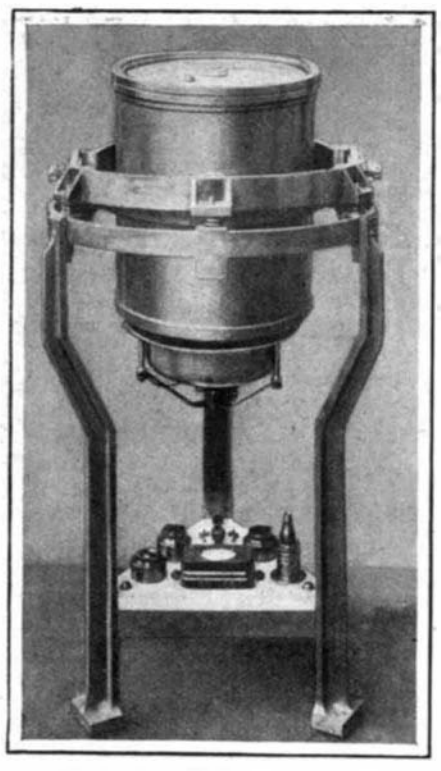
The mechanical construction of the instrument is comparatively simple, and most of the important parts can be recognized in the first illustration, where the lower cover has been removed. The strong iron bases of the binnacle carry a holder suspended in gimbals and filled with liquid. In this liquid is a float fixed to a vertical axle, on which it can revolve. The rose or compass scale is secured to the float, and is controlled by the attached gyroscopic system proper. This system consists of two balls or disks, which are driven by a motor lying between them, the current being communicated by means of brushes. The frame containing the balls and motor is attached to a horizontal axle on ball bearings, which rest on the float. The diameter of the holder is 18½ inches, while the height of the whole instrument is 35 inches. The construction of the new model differs from the old chiefly in that the system does not depend from the float, but is contained within it. The float has a capacity of about 22 quarts, and also contains a pair of electromagnets. It revolves easily on a vertical axle in the basin, and its weight on this axle is almost compensated by the supporting power of the liquid. The basin is hung in gimbals to a strong metal ring, which rests on springs attached to the stand. The latter is three-legged, and is made of bronze. Between the three legs is a small marble shelf, which contains the measuring instruments, ruler, etc. The dimensions of the new form of apparatus are approximately: height 43 inches, diameter of basin 14 inches, and the largest diameter 23½ inches. An improvement consists in a small motor with a perpendicular axle, upon which a bell-shaped balance is placed. The bell-shaped balance is seen below the cylindrical holder in the second engraving. This motor is started simultaneously with the system, and attains a velocity of 3,000 revolutions per minute. Its purpose is to retain the basin in a perpendicular position by means of its rotary force, or at least to permit only slow and slight movements, thus considerably increasing the efficiency of the apparatus. In both instruments the gyroscopic system rotates at the rate of 3,000 revolutions per minute.

Both the compass and the gyroscope possess disadvantages as well as advantages, but fortunately one instrument appears practically to supplement the other. The compass is not subject to certain untoward influences which are liable to affect the gyroscope, because of fundamental differences in action. The compass needle under the magnetic action of the earth assumes one fixed position. The gyroscope, on the other hand, tends persistently to maintain any position in which it is placed, until acted upon by other forces. Obviously, there are opportunities for error to slip into calculations based upon this apparatus, particularly after it has been in use for some time without resetting, and it consequently appears that occasional adjusting would be necessary. Owing to the revolution of the earth upon its axis, the gyroscope's spindle would have an additional gradual movement of rotation, and the rate of this movement would depend on the latitudinal position of the ship. It is interesting to note that this movement would amount to one degree in four minutes at the north pole. The spherical form of the earth also influences the instrument, and in consequence the gyroscope would turn slowly toward the course of the vessel, in accordance with its longitudinal position. The compass, however, is practically unaffected by latitude or longitude.

The disadvantages of the compass may be briefly summed up in saying that it is strongly affected by shocks, vibrations, moving masses of steel or iron, or even by unequally distributed, fixed masses of metal, while the gyroscope is influenced in no way whatsoever by these considerations. The deviations of the compass needle due to the above causes have been only partially overcome by systems of compensation. It is of course impossible to obviate the disturbing causes mentioned, especially in the case of war vessels. Here the compass is often rendered erratic by high speed under forced draft, particularly in torpedo boats, by swinging davits, cranes, guns, or turrets, and by the concussions due to gun discharges. In submarine work the compass is often almost use-



Anschütz Gyroscope. First Model.



Anschütz Gyroscope. Final Form.

THE GYROSCOPE AS A COMPASS.

less because of the close association of masses of metal. Further, when the course of a vessel is changed, the compass will not indicate with absolute accuracy the turning movement, and to all other disturbing factors we must add the friction offered to the indicator or rose in liquid compasses. It is under such circumstances that the gyroscope has proven itself an effectual means for checking compass readings, and in some cases even as a substitute for that instrument, for it is absolutely unaffected by influences derogatory to the other.

The greatest difficulty experienced by the inventor was in attempting to rectify that characteristic of the gyroscope which varied the movements of the rotating element in accordance with the longitudinal position of the ship. This was finally accomplished by the introduction of a pair of electro-magnets, mentioned above, into the holder, thus in a measure converting the instrument into a magnetic compass, or rather into a combination of gyroscope and compass. With this improvement the rose can be set to a certain course, and the vessel then steered as by an ordinary compass.

Exhaustive tests were made by the German navy with the warship "Undine," which was fitted with the instrument for this purpose. Some of the evolutions, which consisted in sailing the ship under forced draft and then suddenly reversing the engines, changing the position of the turrets and other heavy mechanism, and in firing the guns, were severe enough to completely disqualify the magnetic compass. However, when the trials were concluded the gyroscope was found to be in as good order as it was in the beginning. The opinion has been strongly expressed by observers that these tests thoroughly demonstrated the efficiency of the gyroscope as an aid to navigation.

A PERIPATETIC LECTURE ROOM; WESTERN FARMERS ATTENDING AN AGRICULTURAL LECTURE IN A RAILROAD CAR.

AN UNSINKABLE MOTOR LIFEBOAT.

BY L. RAMAKERS.

A series of experiments of great interest alike to engineers, to sportsmen, and to life-saving societies took place recently on the Thames, near London.

For the past two or three years the Royal National Lifeboat Institution has been endeavoring to stimulate the activity of English inventors and boat builders by calling for improved types of lifeboats, for the reason that the boats now in use do not always meet the demands made upon them by the bravery and devotion of the life-savers.

After the seaworthiness of motor boats had been proved in various contests in French and English waters, the Institution published a precise statement of its "desiderata." It demanded a lifeboat propelled by a motor that would not be affected by the waves or entirely disabled even if the boat were capsized.

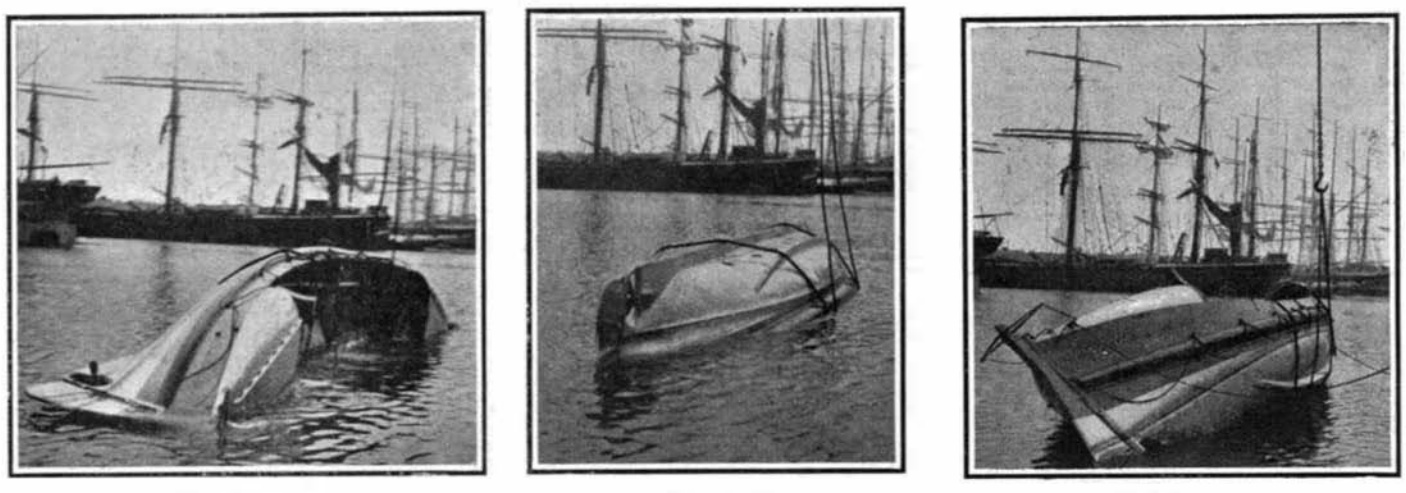
This interesting problem has now been solved by the well-known constructors of seagoing torpedo boats and steam yachts, Messrs. John I. Thornycroft & Co., of Chiswick, England. The completion of their new lifeboat, the "Michael Henry," which is shown in the accompanying illustrations, marks an era in the annals of naval construction. In appearance it differs little from an ordinary lifeboat, propelled by oars, for which it would be taken at a little distance. As a matter of fact it is propelled both by oars and by a 24-horse-power, four-cylinder gasoline motor, which is placed amidships and near the keel so that it does not interfere with the movements of the rowers.

The boat was subjected to various tests in the presence of the officers of the Institution and a representative of the Admiralty. In the trials of speed and stability the "Michael Henry," carrying all its accessories in addition to sandbags equal in weight to a crew of seven men, attained the calculated speed, 7.3 knots, when driven by its motor and propeller.

The speed trial was followed by more interesting experiments, the object of which was to show that the casing surrounding the gasoline motor was perfectly watertight and, especially, to prove that the motor would stop automatically, as required by the Royal National Lifeboat Institution, if the boat should turn completely over and float with its keel in the air. It is scarcely necessary to insist upon the importance of this point, as it will be readily understood that a propeller that should continue to revolve after such an accident would be likely to wound or even kill some of the passengers and crew. Besides, the propeller would be liable to damage by fouling with cordage.

The results of these experiments were completely satisfactory. With the aid of tackle attached to the yard of a ship the "Michael Henry" was first thrown on her beam ends and then completely capsized, as illustrated by the photographs. At the beginning of the operation, that is to say, when the boat began to heel over, the motor, which had just been started at full speed, stopped automatically. It also started automatically when the boat returned to its normal position. The experiment was repeated several times with the same result.

The new type, therefore, represents a real improvement and appears destined to render very great service in navigation and especially in the saving of life.



On Her Beam Ends. Bottom Up. Careened.

CAPSIZING THE UNSINKABLE MOTOR BOAT "MICHAEL HENRY."

A LECTURE ROOM ON A RAILROAD TRAIN.

BY KATHERINE LOUISE SMITH.

For the past two years certain Western railroads have sent out so-called "Good Seed Trains" to assist the farmer in his vocation. Early in the year the trains are started, and through the spring months farmers have free rides and lectures galore until the spring break-up renders it necessary for them to devote their time to the land. These trains are fully equipped for the lecturer and his farmer audience. They pass slowly from village to village, can be flagged anywhere between stations if enough farmers are collected to warrant it, and often stop at some small place long enough for the lecturer to explain the object of the train and to give sometimes a talk on seeds and seed planting. In fact, these trains are among the most interesting of the efforts made by the large railroads to help the farmers along their lines. Usually, the lecturer is a professor from some agricultural college. He stands in one end of the car beside a large chart illustrative of the work, and lectures on such subjects as rotation of crops, seed germination, condition of crops along the line, remedies for defects, the yield to the acre, etc. The cars are always filled with farmers who are appreciative of a chance to get a ride and lecture free. Great interest is taken in the theories advanced by the speaker, and often questions are asked and experiences exchanged. The varieties of wheat or coarse grains raised in the vicinity of a town, the peculiarities of the soil, and the good or bad crops of farmers in the vicinity are topics always discussed. The lecturer, besides covering the general subject of good seed, dwells upon adverse influences that may have been shown in the crops of a county or township, so that farmers desiring information as to the peculiarities of the land may obtain it. The bulletins of the various agricultural stations are distributed generously.

The lectures, whether in hall, station, or car, are well attended. Often a car is so crowded that men sit in the aisle, and some roads plan a stop of forty-five minutes to one hour at a station, so the lecture can be delivered while the car is sidetracked. When a train is scheduled to be at a certain place at a certain hour, the farmers sometimes engage a hall and try to make arrangements for the lecturer to talk there and use his charts or stereopticon. The latest move among the most progressive western roads, like the Chicago, Milwaukee & St. Paul, the Chicago & Northwestern, and "The Soo," which traverse the vast farm lands of Wisconsin, Minnesota, and the Dakotas, is to start this train in winter. The farmers in this way gain the needed information before the time of seeding and when they are not so driven with work. While the attendance is large in the spring months, more farmers can attend in winter, and they have more leisure to discuss the important matters presented and to make their plans for ultimate scientific results.

The general superintendents of the roads are much interested in the "Good Seed" proposition, and further the movement in every way, co-operating with the lecturers and scheduling the towns for the stops. This movement is an entirely different one from the various seed trains which have been sent out by farmers' associations to show the crops that can be raised in their district. While seeds are carried, and specimens of the fruit and vegetable family, this is by no means an exhibit car.

The "Grassland," which is one of the most novel exhibit cars going through the country, is switched from one road to another, and reminds one of a harvest field. Shocks of wheat, oats, and buckwheat are arranged in the center of the car, and apples and other fruits, potatoes, pumpkins, corn, turnips, carrots, in fact everything known to the root family, are exhibited. The sides of the car are also decorated with photographs. There are hunting scenes, camp scenes showing the once-timbered lands, fishing scenes, and views of sheep ranches, stock farms, and comfortable farm buildings.

The "Good Seed Train" is far too practical for this. All available space is needed for the numerous audience. Naturally, the train runs over a wide stretch of territory, and the far-seeing road which furnishes it reaps returns in the prosperity of the farmers along its right of way. In some sections special attention is called to the new durum macaroni wheat. This