will be seen that any proper increase in the load will have the effect of throwing into motion a reed which is shorter and consequently nearer to the right of the bar. So well does this operate in practice, that by lifting on the beam with the hand, thus rapidly increasing the tension of the ribbon, the effect on the row of reeds of a wave moving from left to right is presented to the eye, so nearly instantaneously does one reed drop and the succeeding one take up the active motion. A rule, *D'*, graduated like the beam, *D*, on the scale is fixed in front of the cylinder and just below the tips of the reeds. The length of graduation is equal to the length of the row of reeds and the width of the band of paper. It serves to show in numbers the weight on the scale platform. The tips of each reed are opposite a division line.

The cylinder, *K*, which is properly insulated from the frame of the machine, is connected with a secondary terminal of an induction coil, while the frame is connected with the other terminal of the same coil.

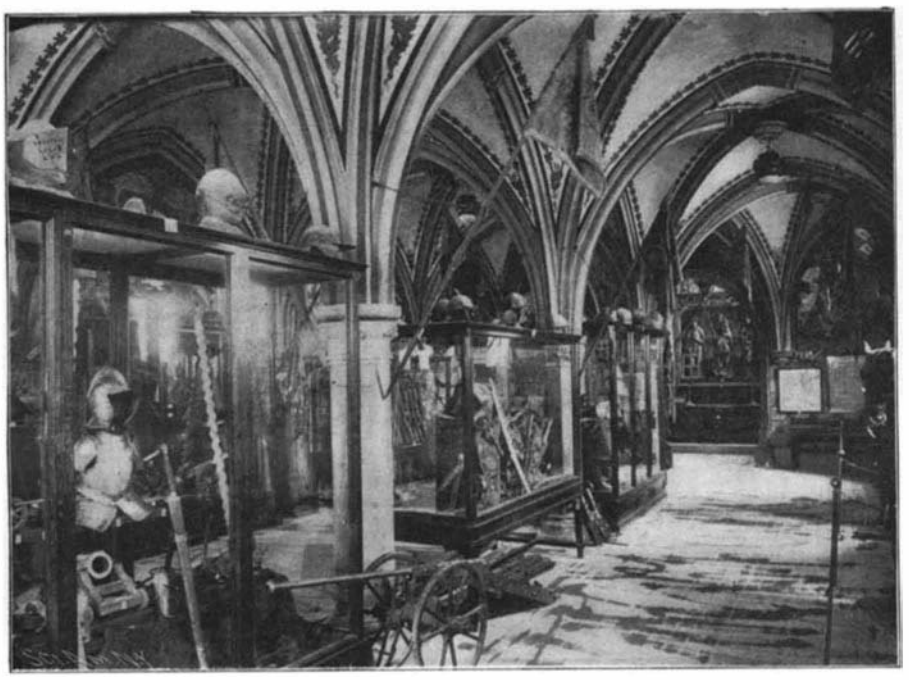
A spark gap adjustable by a screw leads the current until one of the reeds begins actively to vibrate adjacent to the cylinder, whereupon the spark following the path of the least resistance perforates the paper opposite the tip of the vibrating reed. During this time the ratchet motion has been operating to feed the paper forward. Hence, a line of perforations is burned in the paper band, the position of which line relatively to the edge of the paper indicates the weight of the car.

In the completed machine, as shown in photographs, the ratchet movement consists of two electromagnets, each of which drives an oscillating finger against a ratchet-wheel. Either of the magnets develops sufficient power to feed the paper independently of the other.

The dry cells, which operate the feed and the spark coil, are inclosed in a special box, on the front of which is arranged a series of contacts with arms for the convenient addition of new cells as required. The paper band which unwinds from a drum at the back of the machine during its perforation is fed out in front, and underneath a special rule, designed to be pressed down by a key, thereby enabling the operator readily to detach a section of the paper. Rail contacts are provided, by which the car will, when on the scale, automatically close the circuit and make the record. In the same circuit is placed a switch and key to be used by the operator. In order that the closing of a single circuit shall start all of the different movements, a special relay operated from the rail-contacts and key is placed in the base of the machine.

The arrangement of circuits in the apparatus is such that the recording mechanism may be removed to a distance to the scale, and placed for instance in a railroad company's general office, the regular telegraph line being used to conduct the impulses. The recorder will interfere in no way with the regular business of the line, nor will the operation of the regular instruments affect the accuracy of the weight records.

When a car weighing, for example, 96,000 pounds is on the scale and the contacts are closed either automatically or by hand, the ribbon immediately starts to vibrate at a rate governed by the weight of the car, thereby introducing impulses into the main-line circuit leading to the nearby or distant recorder; these impulses of current causes the plate supporting the reeds to vibrate and to transmit the motion to the row of reeds. Now, the only reed having the proper fundamental rate and, therefore, the only one to vibrate with full amplitude, is, if properly tuned, the one opposite the mark denoting 96,000 pounds on the graduated rule. As the feed motion and spark-coil were started by relay almost on the instant with the ribbon, the parts, as long as the circuit remains closed, continue to draw a line of perforations at a position on the band of paper denoting 96,000 pounds by the rule.



THE EXHIBIT OF ARMS IN THE HUNGARIAN PAVILION.

While, for the sake of clearness, mention was made of but a single reed vibrating actively, it is obvious that when the ribbon has a rate at a certain point between that of the two consecutive reeds having the nearest to the proper rate, both reeds will be vibrated with equal amplitude and make a record; and in no way will the accuracy of the record be thereby impaired, as two but slightly separated lines will be drawn, which can be correctly averaged on the rule with the eye. When this system of weighing was recently tested on an 80-ton scale owned by the Central Railroad of Pennsylvania, under the supervision of Superintendent of Motive Power, J. J. Walsh, highly satisfactory results were obtained, and the practicability and merits of the system were fully demonstrated. The tests were made with moving cars, and it was shown that less than one second of time elapses after the circuit is closed, until the ribbon and reed respond to the proper rate. From this and other practical tests, it is not too much to say that the feat of weighing a train moving even at regular transit speed over any properly constructed scales, and of simultaneously recording the weight of the successive cars, is within the capabilities of this system.

THE PAVILION OF HUNGARY—STREET OF NATIONS AT THE PARIS EXPOSITION.

PALACE OF HUNGARY AT THE EXPOSITION.

One of the most interesting of the National Buildings overlooking the Seine is that of Hungary, designed by the architects, Balint and Jambor. Its different façades represent portions of celebrated buildings; the side facing the Seine, shown in the illustration, shows the Tower of Kormocz and part of the Château de Vadja. The tower, which rises to a considerable height, spans the pavement by pointed arches, with a smaller arch in front. The middle portion has three tourelles, forming bays, which, with their connecting portions with gothic windows, give a picturesque effect. A small gothic chapel terminates this portion of the building. The sides, in the Renaissance style, are of a golden yellow, contrasting with the gray of the main façade. In the rear of the building, shown in the illustration, the portal is copied from the ancient Chapel of Gyulafehervar; a smaller Renaissance façade is seen on the left, and on the right is a massive octagonal tower, with pointed roof. The building is entered from a handsome portal; the different portions are built around a central court; the three low galleries opening into it give the effect of a cloister, with arched windows and straight or twisted columns. On one side an exterior staircase leads to the upper story. The gallery nearest the entrance is finished in polychrome decoration, in which reds and yellows predominate. At each end is an arched doorway, surrounded by reliefs and paintings. Here are reproductions of the tombs of George Apaffy XVII. and of Queen Isabella XVI. The rooms on the lower floor contain different collections of ancient arms and armor. In the first room are cases of rude looking Hunnish weapons of iron, swords, battle axes and arrow heads; the second room contains a reproduction of a sarcophagus in bronze relief from the Cathedral of Zara, and a number of ancient manuscripts and documents, besides a richly decorated saddle, battle axes and swords, the latter of the twelfth century. The illustration shows the main hall, which corresponds to the portion next the Seine; it has the form of a crypt, terminated by the chapel, with rich stained glass windows; the main portion is decorated with polychrome designs and by frescoes representing battle scenes, flags, suits of armor and cases of ancient arms.

In the central case is the saddle of Prince Bethlen, seventeenth century, richly embroidered in red and cloth of gold, and a number of ornamented sabers, one of which, seen in front, has a gold scabbard in relief designs. Saddles, guns with carved or inlaid ivory, armor casques, etc., are seen; among the latter is the pointed casque of Nicolas Zrinyi, sixteenth century, and the battle-hat of the Archbishop Fomory de Kalocsa, of leather with steel bands; also the saber of Mathias Corvin, king in the fifteenth century. Another illustration shows a collection of ancient fishing and shepherds"

implements in one of the rooms; in the center is a canoe hollowed out of a log, from Lake Balaton, with nets and harpoons. The various panels contain shepherds' crooks, pouches, utensils, objects in carved horn, and whips with inlaid handles, axes, etc. Harpoons and nets are seen in the rear, the prehistoric collection shows primitive harpoons, fish baskets, and curious bone skates. On the upper floor is a large hall, facing the Seine; it is richly decorated, the roof beams and spaces are in gold and colors, with coats of arms and battle scenes. Above the doors of carved wood is a large battle scene covering the side of the hall, representing the charge of hussars; at one end are two stained glass windows, and at the other a large arch looks down into the chapel. The remaining rooms are devoted to collections of bronzes, manuscripts, and various objects.

Some Mysteries of Our Common Fishes.

BY CHARLES MINOR BLACKFORD, JR., M.D.

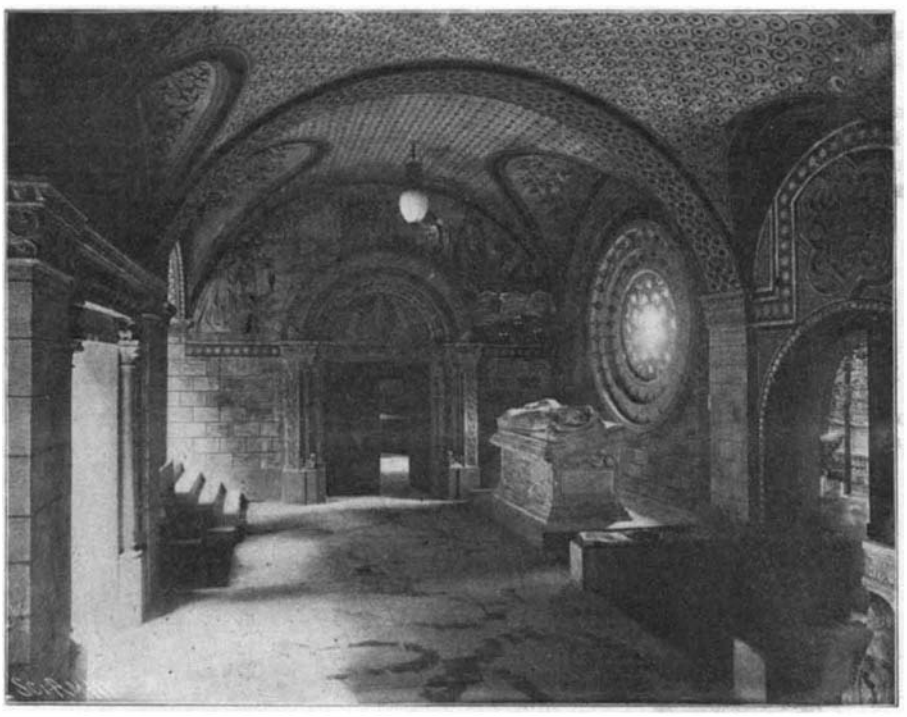
Fishing, for sport or profit, is practiced throughout the world wherever suitable waters are found. Seas, lakes and streams aid in furnishing food to the dwellers on their shores. At the present time few industries rival the fisheries in importance, either in the amount of capital invested or the value of the product; yet it is only within the last few decades that human knowledge and skill have been applied to aiding nature in maintaining the supply of fishes. When we consider the thought that has been given to increasing the yield of grain or number of cattle, it seems remarkable that such should have been the case; for fish enters as generally into the food of human beings as any vegetable or meat item. Were our wheat crops dependent on natural methods of sowing, the world would fare badly for bread; and the fate of the American bison shows what would happen were nature our only herdsman. It was the rapid decline of the fisheries throughout the world, which drew the attention of scientific men to the preservation of our fishes, with the result that the extermination of certain species has already been checked and that many fisheries are more productive than at any time in the past.

In many respects our knowledge of even the commoner fishes is incomplete. Some of them would be of value to commercial fishermen if they were fully known. One of these subjects for investigation is the habits of the migratory fishes, such as the herring. It has been long known that certain fishes migrate in great schools, but aside from the knowledge that they go in quest of food or of a place to spawn, little has been discovered in regard to the laws governing this migration. The fishermen have a number of rules that at times are more or less true, but their lore is so mixed with superstitions or based on such faulty observations as to be of little real value. The fishing fleets often lose much time in searching for the schools, and fares could be obtained much more quickly and surely were the movements more thoroughly understood. Sometimes the fish leave a certain shore for several years and the industry seems to have perished; but they return as unaccountably as they departed and in equal or greater numbers. Such occurrences make it difficult to collect data in regard to fisheries, because an apparent decline or increase may be due to unknown causes that do not enter into our calculations and so vitiate our reasonings. It is, therefore, almost impossible to determine the effect of changes in fishing methods or implements or any other steps that may be taken, because the changes that may follow are not necessarily produced by the innovation.

One of the most familiar of the herring family is the shad, the alosa sapidissima; and yet very little is known of its life history. This fish presents the curious anomaly of a salt water fish that is known only in fresh water, for it is taken when it comes into the rivers to spawn and after this duty is performed, the whole body returns to the sea, leaving but a few stragglers behind. To what part of the ocean they go, on what food they subsist, and at what depth they live are all unknown. About the middle of November the "run" begins in the St. Johns River in Florida, and as the season advances the fish appear with a fair degree of regularity on the successive rivers toward the north. The large catches of the spawning fish, made by means of the dams that barred their access to the upper reaches of the streams and the destruction of the spawning beds by sawdust and other refuse, which, owing to the lack of prohibitive laws and to the short-sighted policy which delayed proper legislation, was thrown into the water courses, so depleted their numbers that the first care of the United States Fish Commission was the restoration of this magnificent food fish. To the intelligent, skillful work of this Commission is due the abundance of this important animal.

Not content with restoring the shad to its native waters, the United States Commission transported it across the Continent and planted its eggs in the Pacific, where shad had been unknown. The experiment proved a brilliant success, and the shad now abounds along the coast from Mexico to Alaska. The habits of the fish have undergone a change, however, for its migratory instinct is not so marked, and instead of appearing only at a definite season it may be taken at any time of the year. There is a tradition on the Atlantic coast that a shad returns to the river in which it was hatched, but if it be true in Atlantic waters, it is not so in the Pacific. The fry were chiefly planted in the Sacramento, from which river the fish have spread along the whole coast, which would be the case if the tradition were well founded.

The salmonidæ are better understood than most fish families, yet much remains to be discovered about them. The Pacific salmon is distinguished by a well-established trait, which is certainly interesting. The adults spawn only once in a lifetime. They reach the spawning ground in good condition, but after depositing the spawn their tissues soften and degenerate, allowing the fish to be attacked by "fungus" and bacteria, so that they all die. The whole adult generation is removed, and the chances of life for the fry are correspondingly increased, as food is more abundant and cannibalism is impossible. This trait may have some bearing on the much-mooted close season problem, as nature seems to preserve the race by removing all the adults in the interests of the young, and to indicate that it is more important to protect fry than to save the full-grown fish.



INTERIOR OF ONE OF THE HALLS, SHOWING TOMBS.

When artificial culture was begun, great were the expectations aroused, and these have been fulfilled only with those fish whose biological history is best known. Great numbers of eggs are hatched, but the production of fry is not the sole aim of piscaculture. Fish, not fry, are wanted, and the success in rearing full-grown fish is dependent on the knowledge of their biological history. The experience obtained with the whitefish shows this to be an unquestionable truth.

The whitefish (Coregonus clupei formis) is abundantly found in the Great Lakes. It constitutes the most important fresh water fish on this continent, and perhaps in the world. In 1897 the catch of this fish alone aggregated 7,048,443 pounds, valued at $250 722. To maintain this fishery the United States Fish Commission and the commissions of the several States interested have established hatcheries for whitefish. During the year ending June 30, 1898, the United States Fish Commision stations hatched 81,688,000 fry, and it is safe to estimate that the various State hatcheries did about the same. Assuming this to be the case, there would be a total of about 163,000,000 fry for a single year.

The addition of this enormous number of young fish annually should materially increase the catch, but it is not evident that it has done so. The whitefish has not been exhaustively studied, and many gaps exist in the knowledge of its life cycle. Neither its spawning habits nor its spawning beds are well known. It is known to be a rapid swimmer, and able to cover many miles a day. The females are able to retain the spawn for a while after they are "ripe," so that the capture of fish from which spawn may be taken does not necessarily point to a given locality as the spawning ground. The fish may be en route, and until the natural environment of the young fish is known the fry cannot be planted to best advantage.

The food of fishes is a field in which further research is needed. Dr. Ryder and others have done valuable work in this direction, but much remains to be done. Before a stream or lake can be successfully stocked with a given fish, the food for that particular fish must exist in sufficient quantity, and it would save time, trouble and expense if this could be determined in advance. It is often difficult to ascertain the nature of the food, and to do so the stomachs of many specimens must be examined and the real food separated from extraneous and accidental ingesta. If one watches a sheepshead feeding, it is hard to believe that it is not a vegetarian. The fish browses among the branches of algæ as though nibbling them, yet a close inspection shows that it is devouring the multitudes of small crustacea and other tiny animals that crowd about the sea-weeds. In pursuit of this prey, the fish sometimes nips off bits of the weed and swallows them, but these particles are accidental and should not be considered food. It is probable that lack of attention to this element in food supply may account for some of the failures of fish culture.

In these unexplored fields of science there is much that will repay patient research; for every addition to the store of our biological knowledge is a valuable aid to the men who have made the preservation of our fish their life work.

Power Plant of Metropolitan Electric Supply Company.

As the original central station of the Metropolitan Electric Supply Company, of London, was found to be insufficient and could not be enlarged, the company decided to erect a new station at Willesden. This station includes two boiler houses, each 350 feet long, and between them is the dynamo room, of the same length and 112 feet wide. When completed, the station will furnish 45,000 horse power. At present but one-fourth of the total plant is installed; of the boiler room, a portion 150 feet long has been built, containing sixteen Babcock & Wilcox boilers, provided with superheaters. The dynamo room, terminated by a temporary wall, measures 162 by 68 feet; it contains three generating groups, consisting of an engine and a Westinghouse alternate current dynamo. The engines have a capacity of 2,500 horse power, giving 116 to 145 revolutions per minute; they are of the vertical compound type, with cylinders of 36½ and 56 inches diameter and 36-inch stroke. The dynamos give two-phase current, and are direct coupled to the engines; their capacity is 1,500 kilowatts, at 500 volts and 60 cycles. The dynamos have 62 fixed poles and movable armature; the exciters are mounted on the main shaft, and are compound-wound. The tension is raised at the station from 500 to 10,000 volts by twelve transformers of 250 kilowatts each. The energy is conveyed to three sub-stations which contain in all thirty transformers of 100 kilowatts; for the transmission, five cables leave the central station; the distance from the latter to the farthest sub-station is about ten miles.

An Automobile Exhibition at Trenton.

An automobile exhibition will be held at the Greater Inter-State Fair at Trenton, N. J., September 24 to 28. An opportunity will be afforded to all manufacturers to show their vehicles, and a special building has been erected for automobile interests. Nearly every manufacturer will be represented, and 30,000 square feet will be needed.

Trenton is well located between New York and Philadelphia, and it seems as though the idea of having an Eastern automobile exposition and race-meet at this point could be successfully carried out. A club run from New York to Trenton two days previous to the opening of the Fair is being organized. A run will also be made from Philadelphia to Trenton. They will be under the direction of the Automobile Club of America and the Automobile Club of Philadelphia. Various races and contests will be held upon the track.

It has frequently been assumed that the collection of dust on electric light wires and fittings was due air currents due to thermal causes. Mr. A. A. C. Swinton's experience has convinced him that electrostatic attraction is the cause, particularly where the supply is at 200 volts from the street mains. He says it is when the switch is off, in the case where it is in the negative conductor, that the accumulation of dust takes place. Having regard to the comparative lowness of the 200 volts potential, from an electrostatic point of view, the rate at which the dust accumulates on the cords is most surprising.