

THE USE OF ELECTRICITY IN DRIVING COAL-CONVEYING MACHINERY.

BY FRANK C. PERKINS.

Electric power is now utilized in almost every department of iron and steel plants in Europe as well as in America, giving excellent service and doing work of almost every description with greater economy than it was previously done by other methods. The accompanying illustrations show some interesting features of the electric coal-conveying apparatus at the works of a large steel company situated at Sparrow's Point, Md. One of the largest sets of coke ovens in the United States has been recently installed at this plant for supplying the necessary coke for the furnaces. This coking plant has a capacity of ten million cubic feet of gas per day of twenty-four hours, and the coal is handled at the rate of over two hundred tons per hour. The elevators require the greatest power, or about 35 horse-power, and the crushers somewhat less, about 33 horse-power, while conveyors serving the storage bins take about 12 horse-power. The two conveyors take about 25 horse-power, and about 11 horse-power for loading the two reciprocating feeders. The total cost of operating this entire plant has been determined to be somewhat less than two cents per ton of fuel used. The accompanying illustrations give a general view of the 200-coke-oven plant at Sparrow's Point; the inclined suspended light conveyors, which deliver coal to the disintegrators, and the overhead horizontal runs of gravity discharge elevators, from which coal is spouted to the belt con-

veyor, are noted in detail, while another view shows the two-way chutes from conveyors to disintegrators, which are made with screens through which the fine coal passes directly to the elevators.

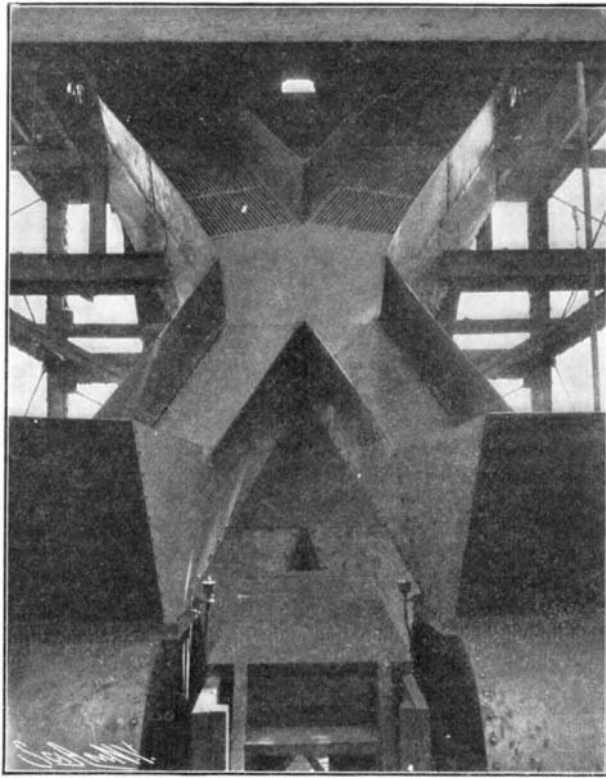
One of the four steel-track hoppers is also shown,

a reversible automatic belt tripper, the belt being made of woven cotton, which has been found to be very durable. The lower run of gravity discharge receives the coal from the screen bars and disintegrators. A compound-wound motor of 80 horse-power capacity, and operating at 500 revolutions per minute, is utilized for hoisting over the surface of the fuel pile, and the overhead trolley for moving the reloading bucket is driven by a series motor of 50-horse-power capacity and the same speed of operation as the above-mentioned motor.

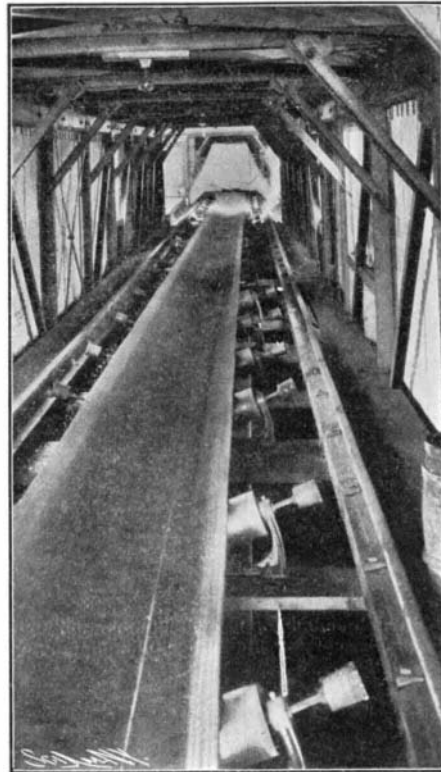
A series-parallel controller is employed for manipulating two 30-horse-power motors, which produce the traverse motion of the swing bridge used for trimming the storage pile. The shakers, which receive the coal from the cars and pass it into the feeding hoppers, are driven by inclosed 5-horse-power motors, while the conveyors running between the hoppers and the crushers are operated by a motor of 25-horse-power capacity, and 50-horse-power compound-wound open-type motors are used for supplying power to the crushers.

Railway motors of 25 horse-power are employed with overhead trolleys to haul the cars serving the ovens to and fro upon the elevated track, the contents of the cars being dumped into the coke ovens by gravity. The endless belt, above referred to, is handled by a 25-horse-power motor, and a 40-horse-power motor of the open type is used for raising each bucket elevator which connects the crushers with the bin-feeding belt.

About 1,600 tons of coal is required each day for



Two-way Chutes from Conveyors to Disintegrators are made with Screen Bars Through Which the Fine Coal Passes Directly to Elevators.

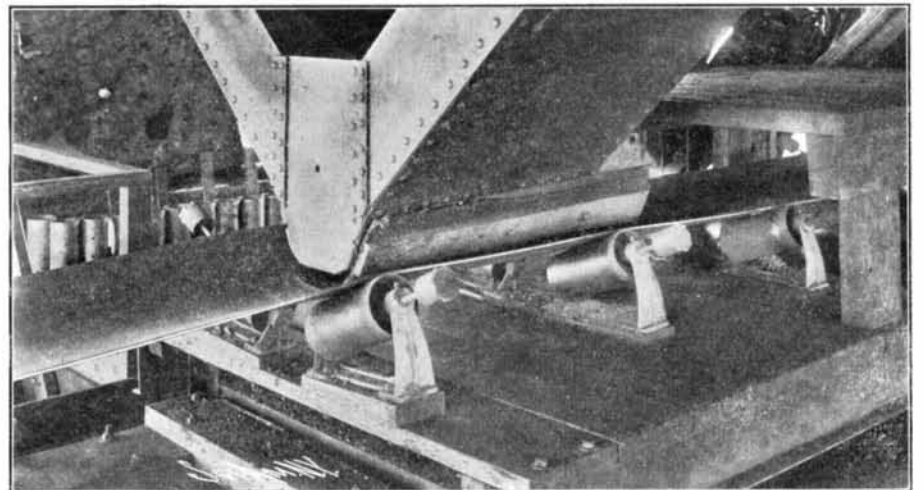


Thirty-inch Distributing Belt Conveyor.

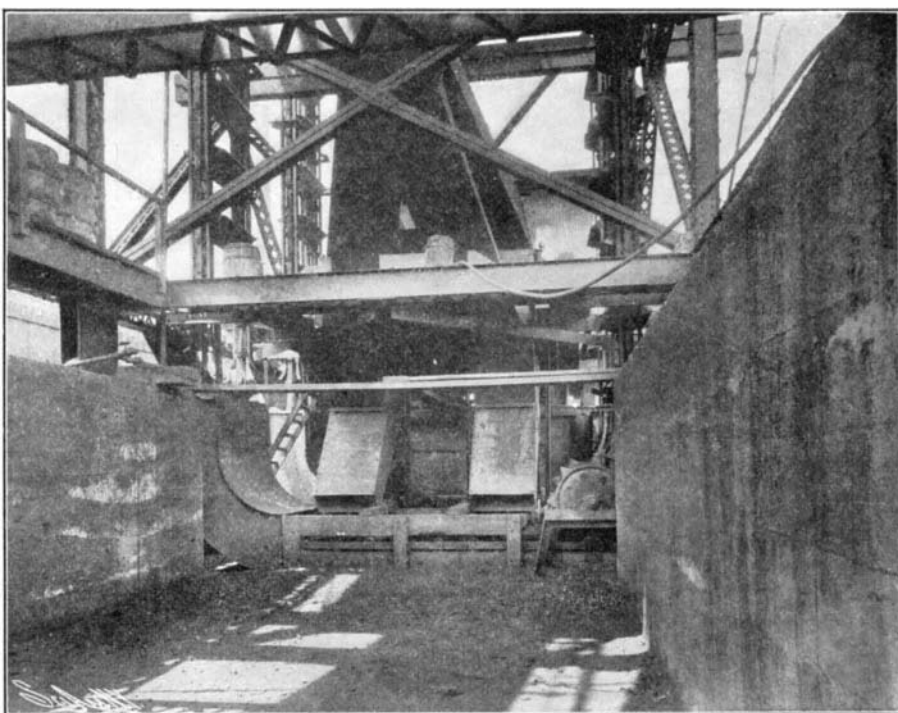
fitted with a reciprocating feeder, which transfers the coal to the inclined suspended light conveyor; and we also show the chute for heavy gravity discharge elevators to the belt conveyor. The 30-inch distributing belt conveyor is one of the most interesting features of the entire plant. It is of sufficient capacity to transport the coal from both elevators simultaneously, and it fills the bins by means of



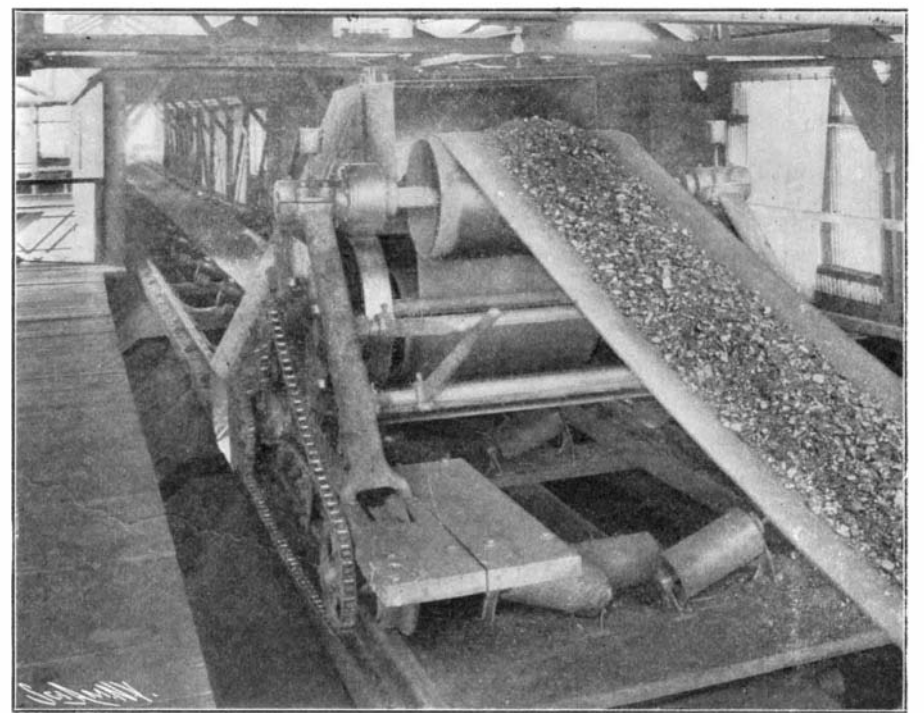
Overhead Horizontal Runs of Gravity Discharge Elevators from which Coal is Spouted to Belt Conveyor.



Chute for Heavy Gravity Discharge Elevators to Belt Conveyor.



Run of Gravity Discharge Elevator Which Receives Coal from Screen Bars and Disintegrators.



Reversible Automatic Belt Tripper.

the four batteries of ovens when all are in operation; and in order to supply the coal as required, there are two 1,000-ton elevated bins provided, and a storage of 50,000 tons, while the coal is all handled automatically, the conveying machinery all being operated by electric power. The fact that the power cost for this work is only a trifle over one cent per ton, not including the manual labor, is ample proof that the electrical system of driving coal-handling machinery is most economical, while the system has shown itself to be more convenient and satisfactory in every way than any method not employing electric power, for doing this class of work.

Anomalies of Ocean Travel.

There have been a number of anomalies this year in the British shipping trade, and one of these is as to emigration and the return of saloon passengers from Europe to the United States. When the cheap rates were established it was the expectation, shared in on both sides of the Atlantic, that there would be a tremendous rush of emigrants from the start, and that these emigrants would be of the lowest and most undesirable character. The facts are that the rush did not take place until late in the season, and the indications are that the total number for this year will be less than for last year (which, however, was an extraordinary year), and the character of the emigrants has not materially changed, nor their status appreciably lowered. For about six weeks the saloon accommodation of all the liners leaving Liverpool (and the same is true as to other British ports, and also the Continental ports) has been unusually crowded. The principal reason for this is that American tourists delayed their departure for home until late in the season, chiefly because the weather over here was very fine all through the summer and early fall.

There are two developments of the ocean passenger traffic, both steerage and saloon, which have not attracted much attention heretofore, and yet which are getting to be important features in the business. The first is the increasing number of citizens of the United States, by adoption, who come over to visit their native land and stay for a season and then return. This has always been the custom of the Scandinavian peoples, but it is also getting to be a growing one among emigrants from the British Islands. The second development is the increasing number of British people, and Europeans generally, who go to the United States, not with any intention of settling, but simply as tourists. It is a common mistake of Americans to suppose that the British people do not travel. As a matter of fact, they are great travelers, but the habit has been to take their holidays either in their own country or on the Continent. Formerly they seldom thought of going to the United States simply for a holiday, but there is a marked change in this regard. Still, on an Atlantic liner, the vast majority of the saloon passengers are Americans and the great majority of the steerage passengers leaving this side are original emigrants.

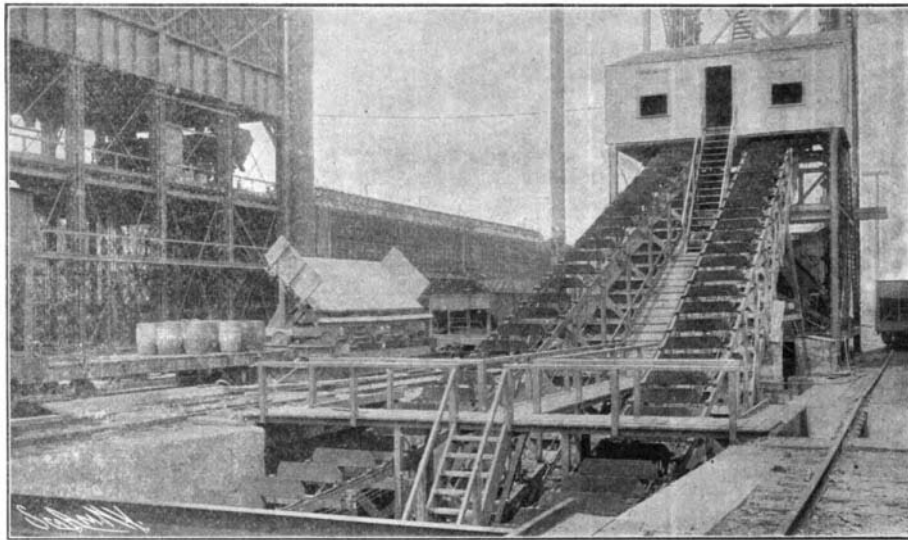
An Insect Pest.

One of the most terrible of insect pests appears to be the minute black fly of the Mississippi Valley, says the writer of Zoological Notes in Knowledge, commonly known as the buffalo-gnat, from a fancied resemblance in outline to the buffalo, or bison. The buffalo-gnat chiefly attacks the larger kinds of live stock, although it will occasionally bite, and even kill, human beings. In the year 1874 it is stated that in a single county in Tennessee these insects killed stock to the value of \$500,000; while within a single week one parish in Louisiana lost 3,200 head of live stock. Horses and mules, during such visitations, are killed while working, or before they can be got under cover when grazing; while in some of the cities on the Mississippi the running of tramcars has been rendered impossible.

Among the new things to be placed in houses of the more imposing character is a combined garbage crematory and water heater. This is in the shape of a small, round stove with a coil of pipe placed in the upper part, and through this a circulation of water is maintained in connection with the regular water supply. A coal fire is kept in the lower portion of the apparatus, and any garbage to be burned is thrown in the top and falls upon the coil of water pipe. The garbage to a certain extent takes the place of fuel and is consumed as such. The moisture of the garbage is driven out by the heat of the coal fire and the residue then burns in the same manner as the fuel and gives out considerable heat.

THE RACIAL EXHIBIT AT THE ST. LOUIS FAIR. (Continued from page 412.)

order were the Arapahoes of old Algonquin stock, engaged in the manufacture of curious symbolic and beaded buckskin articles. In the next inclosure were some Navajo Indians from the Navajo reservation. These were famous blanket weavers, workers in silver and turquoise, and they were seen engaged in the weaving of blankets. Then there was a group of Apache women busy at basket weaving; next some Sioux, skilled decorative artists in buckskin work. On the opposite side of the room to these was the exhibit of the Lawrence Industrial Training School. First there were some students undergoing manual training and learning mechanical drawing; beyond were others engaged in wagon making. Then, in another section, was a complete blacksmith shop, following that a printing outfit in which a daily paper was printed for distribution among visitors. This paper was the journal of the Chilocco Indian Agricultural School, and was published at the school in the interests of the Indian service. Proceeding further down the first floor of the building, on the right, was another group of Navajos engaged in blanket weaving; then a group of Maricopa Indians from Arizona making most exquisite baskets and pottery work, then some Pomo Indians, renowned also for their exquisite basket work. Following them another group of Pomo Indians, makers of stone and shell wampum (money), stone tools, musical instruments, etc., while last and most instructive of all was a room shown by the Chilocco Agricultural School, in which was found a display of native grasses and a model of an educated Indian's farm, with its irrigation ditches and the various crops set out as they would be under actual conditions, while at the back of this model was shown the old Indian home or tepee, set up among the hills near a creek. Under the old native life the Indian went to the water in the hills;



Inclined Suspended Light Conveyors Which Deliver Coal to Disintegrators.

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under the new he brings down the water by irrigation to himself in the plains. Opposite these displays was a set of inclosures representing the work of the Chilocco Indian Agricultural School. First there was a laundry in which the Indian girls were shown at work with the latest modern laundry appliances; then a kitchen where they were seen engaged in thoroughly up-to-date cooking, and lastly, there was a very dainty dining room set out with its china and glass, the table and furniture of which were made by the Chilocco Indians.

After a stroll through the Indian school and among the native tribes surrounding the parade ground, one was pretty thoroughly saturated with the atmosphere of Indian native and civilized life, and it must be confessed that in passing on around the brow of the hill to investigate other tribal exhibits, one was impressed with the fact that the North American Indian, particularly such splendid fellows as the Sioux, are greatly superior to the average savage tribes of the world, at least so far as they are represented at St. Louis. This is particularly true of the first native tribe encountered after the Indian reservation had been left behind, namely, an exhibit of the pygmies, a black race from the Congo Free State. These diminutive specimens of humanity are intellectually far below the average American Indian. Their faces are coarse, features brutal, and evidence an intelligence of an extremely low order, while of the dignity which sits so splendidly upon the Indian as we know him, there is absolutely not a trace. Three tribes were represented, the Badingas, Batros, and the Bacoubas. One of the pygmies, Otto Bang, twenty-seven years old, looked, because of his small and attenuated stature and beardless face, more like a boy of sixteen or eighteen years. Yet he is a father of two children, and for the visitor who was on the lookout for sensations, he must have possessed rare interest, for the reason that his teeth have been filed to sharp points and have done duty in many a

cannibal meal. The average stature of these people is about four feet. Their native houses are made of a framework of flexible bamboo, covered with palm leaf.

Beyond the pygmies was the hut of a group of Patagonian "giants" so called. Although the specimens of these people at the fair were some of them of fair height, they would not by any means pass for giants in America. How the Patagonian race acquired their reputation for giant stature is difficult to explain, except on the hypothesis that the white races of many centuries ago were smaller of stature than they are to-day, and that when the early navigators first saw the Patagonians on their voyages around Cape Horn, they appeared as giants compared to themselves. This suggestion is borne out by the fact that the armor of that day is most of it very small for the average European or American of to-day. In fact, the typical football player of a college team would have to institute quite a lengthy search in an armory collection to find a suit that he could wear with comfort.

For many reasons the exhibit of the hairy Ainus, the aborigines of Japan, was interesting to the average visitor to the fair. This was the first time that these strange people have been represented in America. They come from the far north of Japan, where they engage chiefly in hunting and fishing. Inquiry among the Japanese revealed the fact that even to them the Ainus are a strange race whose beginnings are lost in the obscurity of earlier times. Like so many of the races that were included in this most fascinating exhibit, the Ainus are a very kindly, peaceable, and gentle people, far removed from the typical bloodthirsty savage of childhood's imagination and of much of the juvenile literature of adventure and travel.

Improvements Needed in Torpedoes.

Owing to the success that has attended its utilization in the Russo-Japanese war, the torpedo is claiming greater attention from the various naval powers than formerly. Especially is this noticeable in connection with the British Admiralty. Although the torpedo has proved so deadly, there are two improvements which are urgent: the greater range of the weapon, and greater acceleration in firing rapidly from the tube. The British authorities are carrying out tests with a torpedo 18 inches in diameter, but with an increased range of 1,300 yards, so that it can be effective at 3,300 yards. This increase is deemed to be imperative, not only to augment the destructiveness of the weapon, but to enable it to be effective at a range exceeding that of the small quick-firing arms on the vessels. Owing to the rapidity of the fire of these light weapons, great danger attends the approach of the torpedo boat to the range at which the torpedo is effective, and the risk attending the operation is considered to be too great to compensate for the chance of the torpedo's accomplishing its purpose.

But there is a much more important point in course of development. The present speed of firing torpedoes is far too slow. It is contended that what is required is a lighter rapid-firing mechanism than is now employed. Such an improvement would enable the torpedo to be launched from a smaller type of vessel than the torpedo boat, thereby offering a smaller target to the quick-firing guns on the hostile vessel. By increasing the rapidity of fire of the torpedo, its effectiveness could be considerably enhanced, as a far greater number of weapons could be discharged before the fire from the hostile guns became so withering as to compel the retreat of the torpedo craft than is now possible with the existing discharging gear.

Winds and the Temperature.

In an article on the "Temperature of the Air," which Mr. William Marriott, secretary of the Royal Meteorological Society, contributes to Knowledge as the first of a series on "Practical Meteorology," is a summary of the effects of the prevailing winds of Great Britain on the temperature:

N. winds depress the temperature throughout the year.

N.E. winds do the same, except in summer, when their effect is small.

E. winds lower the temperature very much in winter, and generally raise it in summer.

S.E. winds do nearly the same, but less markedly in winter.

S. winds raise the temperature much in winter, but scarcely affect it in summer.

S.W. winds do nearly the same.

W. winds decidedly raise the temperature in winter, and lower it in summer.

N.W. winds lower the temperature generally, but most in summer.

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 water-tight 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 manipulation of the films, while 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.

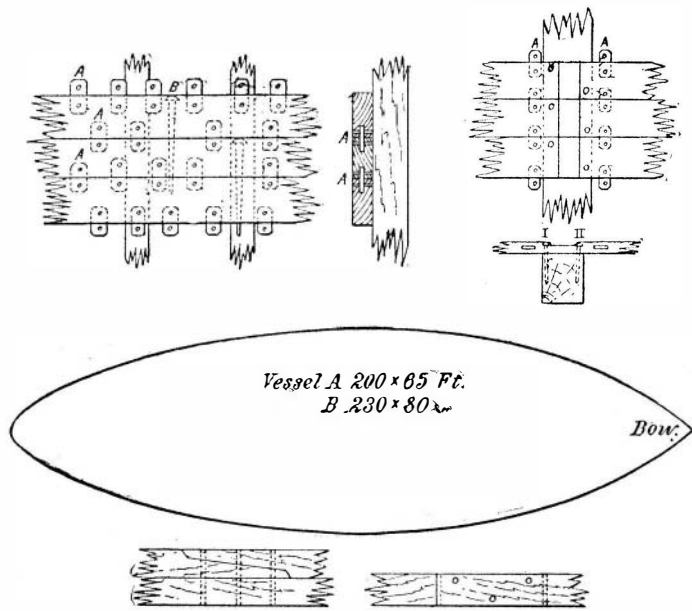


Fig. 3.—Details Showing the Method of Securing the Planking of the Lake Nemi Galleys.

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

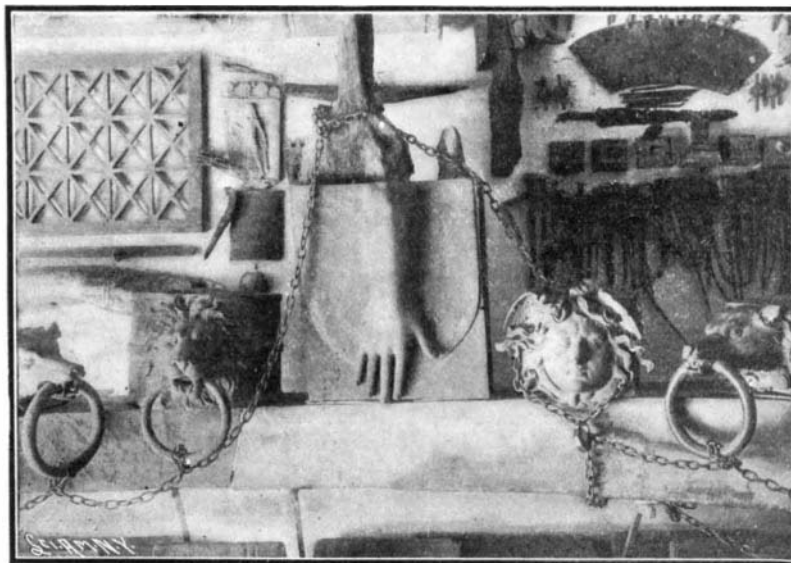


Fig. 1.—The Augural Hand Always Carried by the Roman Navigators as a Talisman.

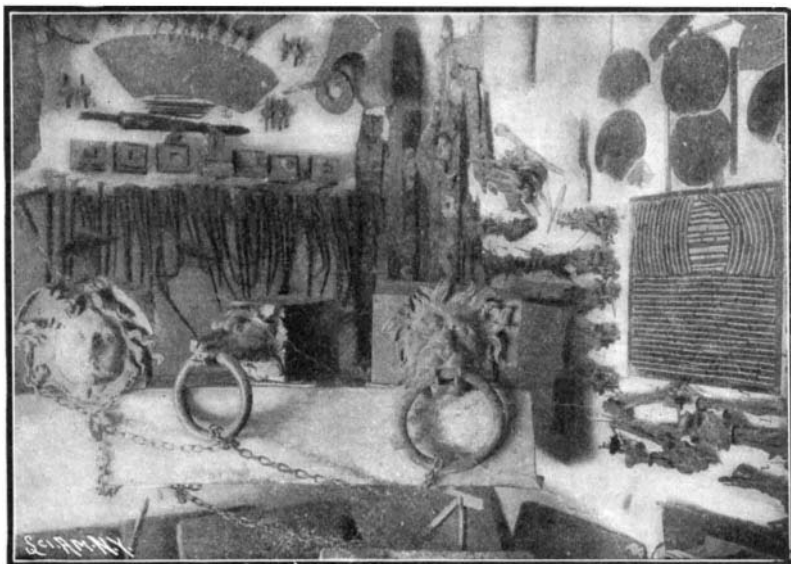


Fig. 2.—Bronze Ornaments for Masts and Anchors Found in Lake Nemi.

THE ROMAN GALLEYS DISCOVERED IN LAKE NEMI.

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