A NOVEL CANTILEVER GRAIN ELEVATOR.

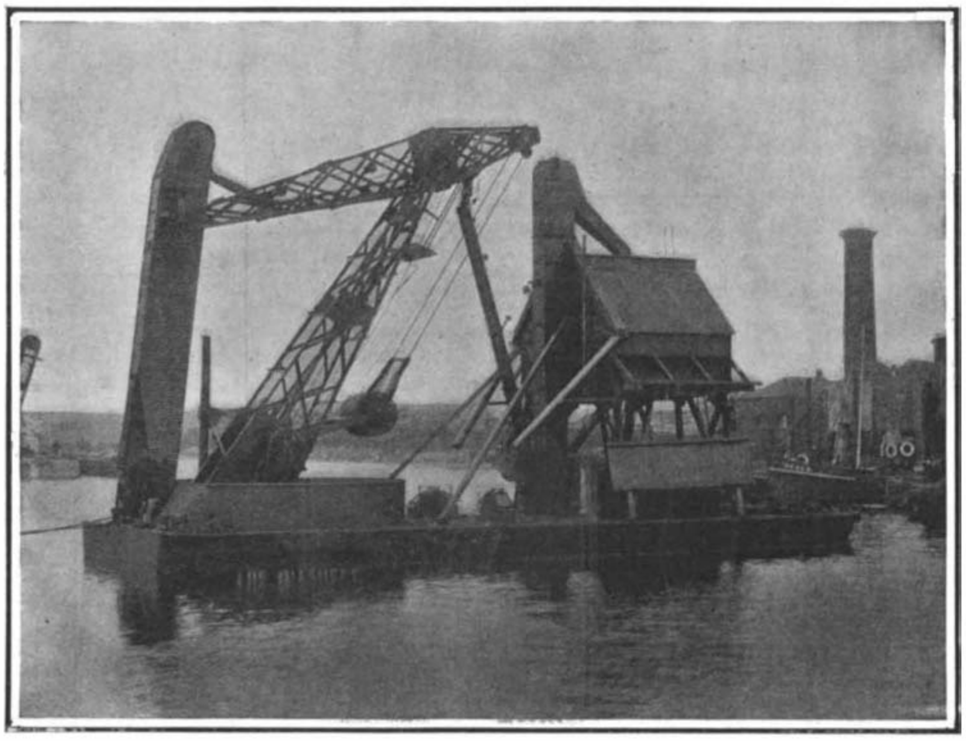
BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The discharge of grain from the holds of vessels economically and efficiently, as well as expeditiously, is a problem which involves the solution of many problems of a peculiar character. During the past few years many developments in this direction have been carried out at the discharge ports of England in the handling of the grain received from abroad, especially in regard to the port of London. There the conditions are probably unique, for not only has the grain to be discharged from the vessel's hold to dock elevators, but also to lighters and other craft for conveyance by water to numerous other points.

Many applications have been devised from time to time for accomplishing this work to the best advantage, and recently conspicuous interest has been centered in a new cantilever elevator with which the grain-handling equipment of the London Grain Elevator Company of Silvertown, E., has been reinforced. This plant has been designed by the grain company's engineer, Mr. Alfred H. Mitchell, to whose courtesy we are indebted for the accompanying illustrations and information, and its operation and convenience in working has compelled general approval. It is designed for discharging grain from a ship's hold to accompanying craft, and as may be seen from the illustrations, it is of the self-propelling pontoon-contained type. It is so constructed that it can be brought to work either side-on or end-on to the ship, and has the additional advantage when working end-on that it can deliver to two barges at the same time, whereas should the conditions, such as a narrow dock or a tideway, necessitate its being worked side-on, its advantages are in no way less.

The outstanding feature of this apparatus depends not so much upon the formation of the elevator proper, as upon the mechanical combination of levers whereby it is manipulated. As is well known, the conditions of working grain from ocean-going steamers vary very considerably in point of size of the steamers to be unloaded and the manner in which the grain is stowed. On commencing to discharge, the grain, being right up in the hatchway, is probably at a height of some 15 or 20 feet above the waterline, necessitating the means of putting the lower end of the elevator into the grain at this height and delivering in the manner required. Shortly afterward, when the elevator has sunk well into the cargo of grain, the bottom point may require to go as low as 20 feet below the waterline; that is, to the bottom of the ship.

When the vessel is discharged, it is necessary to lift the bottom end of the elevator over the highest point of the ship's coamings, which may then be as much as 40 feet above the waterline. This means that the lower or digging end of the elevator must have a vertical range of some 60 feet to comply with the foregoing conditions. It is equally apparent that the clear length of the leg below the supporting arm must be sufficient to bottom the deepest hold of any ship, which may extend to 40 feet for a moderate-sized steamer, and of course much more in some ocean-going grain carriers. Another vital factor in connection with the ship is the width of beam, Most craft being divided by longitudinal partitions placed amidships, and in the after hold by a tunnel over a propeller shaft, it is of the utmost importance that the elevator should be adaptable to working on either side of the ship's center line.



The elevator at rest upon the pontoon's deck for transit. This view well shows the parallel motion of cantilever arm and balance weight.

The elevator in mid-position as it would be when half way down into a ship's hold.

A NOVEL CANTILEVER GRAIN ELEVATOR.

The general method by which this end is accomplished is either by means of a portable machine lifted into the ship by means of the latter's boom, and resting upon beams placed across the hatch coamings, or by means of a pneumatic machine. The first is accompanied by grave risk in lifting the machine in and out, and moreover is slow and costly in operation, owing to the time involved in installing the appliance and removing it when done with, the time consumed in this operation often being in excess of that occupied in withdrawing the grain. With the pneumatic machine great expense is incurred in manipulation, owing to the enormous wear and tear as well as the horse-power required, though it is admittedly useful for dealing with awkward stowages, such as in forepeaks and lazarettes.

The peculiar conditions prevailing therefore can best be met by some such appliance as this new cantilever system, which is independent of the ship's gear, excepting in so far as the latter is used for plowing the grain to the leg of the elevator after it is lowered into the hold. In ordinary discharge elevators an arm of considerable length is fitted to the top of a tower, and counterbalanced by a weight mounted on the back end. In floating elevators, the disadvantage of this arrangement is that in the first place the enormous topweight necessitates the use of a very large pontoon; and secondly, that owing to the radius of the arm being definitely fixed, it cannot be adapted to ships of different widths, or for working to port or starboard of the partitions referred to, except by the slow and difficult process of booming the barge off from the ship, or the ship off the quay if the latter type of machines are used.

The first development in the evolution of the cantilever elevator was the bringing down of this top balance weight, and carrying it on levers at the back of the post. If the lever be equal in length to the back end of the jib, and the suspending link be equal in length to that portion of the post above the link, a parallel motion results, whereby the weight is moved equally with the back end of the jib, and balances it as before. The result of this arrangement is that the top weight, formerly required to balance an effort of some 400 foot-tons in an ordinary-sized machine, is greatly reduced, which brings about a corresponding reduction in the dimensions of the pontoon.

The final development of this design by Mr. Mitchell is that shown in the accompanying photographs. Here the post, which in the former designs was rigid, is now itself supported by a trunnion at the top of a frame, which is mounted on a turntable on the pontoon deck. By this combination it becomes possible to shorten the length of the cantilever arm by the amount which the vertical post could swing forward, thereby not only bringing about an appreciable reduction in the weight of the cantilever jib, but also reducing enormously the amount of weight which is required to balance it. Assuming the elevator leg to be perfectly balanced by the jib balance weight, the center of gravity of the whole combination will pass through some definite point on whichever side is uppermost of the post. This point being found, it becomes possible by ballasting the lower end of the tilting post to bring the center of gravity of the whole combination to the middle of the trunnion pin, at which point it will remain, no matter what the position of the elevator. This arrangement not only secures the bringing down of the weights to a very low point, but by means of the compound balance thus obtained, the elevator can be worked side-on or end-on, in broad or narrow ships, without imparting to the barge the slightest tendency to list or alter trim, so that a very small pontoon can be used to carry it. The smaller the dimensions of the latter can be made, the easier it is to handle and tow, and what is more important, the less space it occupies at the ship's side or in dock. This is a distinct advantage in connection with ocean liners, where often general cargo has to be handled at the same time as grain is being discharged.

In actual practice the full weight of the elevator leg is not absolutely balanced, there being a certain excess allowed on the elevator end for sinking the leg into the grain. This excess in the ordinary way would produce a list or alteration of the trim of the pontoon; and so in order to counteract this, a weight is fixed under the turntable at a certain distance aft of the center line, and of such proportions that the amount of the weight multiplied by that distance is equal to the excess moment of the other side. As a result the horizontal balance remains constant and perfect, and will not produce any list so long as the cantilever jib remains horizontal. When the jib is raised or lowered out of the horizontal, however, it will be apparent that there is a very slight alteration of moments, which however is not sufficient to produce any perceptible alteration of trim in the pontoon.

The elevator shown in the accompanying illustrations is among the first of its type to be constructed on these lines, and is now doing duty in the elevator dock on the Thames at Silvertown. Its leg is telescopic, and has a length when extended of 41 feet clear under the suspending pin. The buckets are carried upon an endless chain, and are so arranged that as the telescopic leg is lifted, the exact amount of chain that is let out on the front of the leg is taken up in the back, so that the chain remains of the same length and of an even tension throughout. The buckets, which are 10½ inches apart, have a capacity of 100 tons of wheat per hour, working at full speed, and deliver at the rate of 320 buckets per minute.

The elevator, carried at the end of a cantilever jib, is 25 feet long center to center, 9 feet 6 inches at the back end, and the weight of the leg is partly balanced by the weight at the back, connected by means of the parallel bars and lever shown and already described. The grain is discharged from the elevator head by means of suitable adjustable chutes on to an endless conveyer band, carried on the inside of the jib. This band is of canvas with rubber on one side, and is provided with diagonal ribs on the face, to facilitate the grain running up hill when the jib is lowered into its lowest position. These ribs are placed diagonally, to permit them to run freely over the supporting rolls, which carry the slack side of the belt. At the top of the post this belt discharges into a second receiver, which by means of the long telescopic chute shown discharges into the boot of a second elevator, which is placed on the deck, which in turn raises the grain and empties it into the weigh-house or hopper, from which it is delivered to lighters alongside.

The jib of the elevator is carried at the top of the inclined post, which in turn is supported at the trunnion pin at the top of the frame, which rotates upon the turntable, the supporting ring and rack of the latter being secured to the bottom of the craft. The length of the tilting post above the trunnion is 30 feet, and the height of the trunnion pin above the bottom of the pontoon is 17¼ feet. The weigh-house is fitted with six automatic grain scales of 250 pounds capacity each, and these can discharge into sacks or loose into lighters, as may be desired.

A noticeable feature of the machine is the celerity and facility with which it can be brought in and out of action. Once it is moored alongside, the leg can be swung round and lowered into the hold ready for working within about four minutes, and this is considerably less than is possible by any other method. A portable machine to be rigged up ready for working takes from two to three hours, according to the position of the ship's winches and the weather. Moreover, the great advantage of facility for instant adjustment of the elevator to any width of ship, or for lifting the leg instantly from one side of the ship to the other over shifting boards or propeller tunnels, is perfectly obvious. Again, not only does this machine render possible the use of a single instead of a double leg, but in the event of there being hatch-beams or other obstructions in the hold, it facilitates the placing of the leg in the position required immediately; while in a big hatchway the possibility of being able to sweep the hatchway to its full extent with the combined movements of slewing and post tilting, thereby saving a considerable amount of trimming, is a conspicuous advantage. The exact adjustment of the telescopic leg or the height of the jib also makes it possible to work different consignments of grain in the same hold which are only separated by mats or cloths, as the depth at which the leg is to work can be adjusted to a nicety. As may be seen in the illustrations, the combination of the two levers and the telescopic leg gives a great range of action.

The precise angle of the jib is controlled by means of an electric winch and wire hauling gear, acting on the back end of the jib, while the tilting of the post is performed by means of a screw and nut carried in a bracket near the trunnion pin of the post. All the controlling actions are performed by series-wound motors of 4 B. H. P., and the elevator is driven by a 20 B. H. P. motor attached to the turntable. The direct current at 110 volts is generated on board the pontoon by means of a gas engine and suction gas plant driving a dynamo by belting. The deck elevator is driven from a countershaft in the engine room and a chain belt as described.

The whole apparatus is controlled by one man, for whom a cabin is provided on the turntable. A deckhand assists in adjusting the chutes when getting the elevator to work, and afterward attends to the suction gas plant. The maneuvering requirements of the machine are signaled by a man on the grain vessel's deck, who indicates the exact desired position of the elevator, and follows its operation.

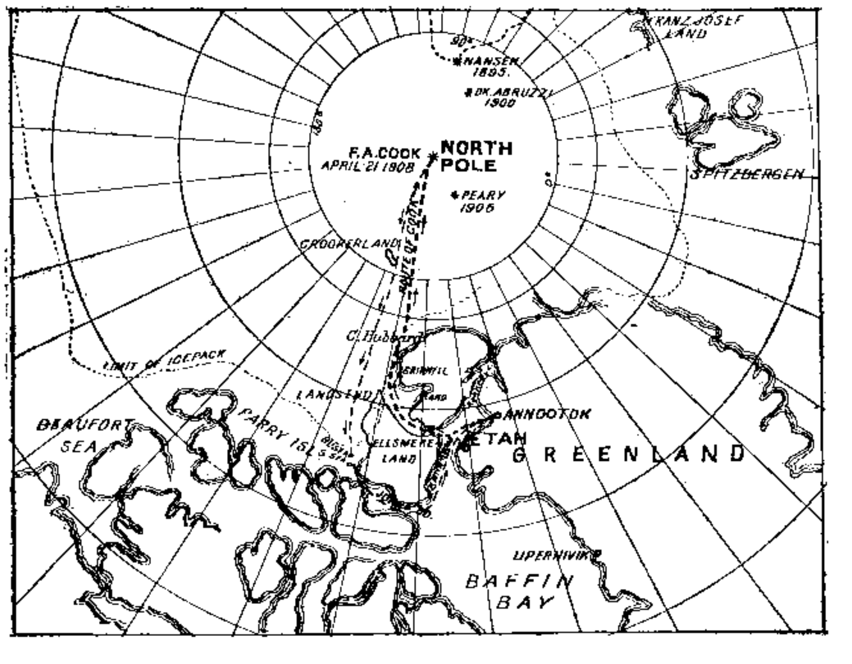
DR. COOK'S DISCOVERY OF THE NORTH POLE.

The search for the North Pole, which began in the Middle Ages for the purely commercial purpose of finding a sea passage to the wealth of the Orient, and which continued to attract adventurous and scientific spirits long after a more direct route to the Far East was discovered, seems to have culminated in the success of Dr. Frederick A. Cook, of Brooklyn, N. Y. Dr. Cook announced the remarkable result of his expedition in a telegraphic dispatch sent on August 24th from the Shetland Islands, where he stopped for two hours on his way south to Copenhagen. Although no definite scientific proof is as yet available of Dr. Cook's claim, there can be but little doubt of his great triumph. His previous experience in Arctic exploration and his acknowledged intrepidity are conceded even by those geographers who are disposed to await his arrival at Copenhagen.

Dr. Cook's polar expedition seems to have been quite unpremeditated. In 1907 he accompanied John R. Bradley, a wealthy sportsman, on an Arctic shooting trip in a small converted Gloucester fishing schooner. When they arrived at the limit of navigation in Smith Sound late in August, 1907, the conditions seemed so favorable for a successful polar dash that Cook determined to make the attempt. In that venture he was undoubtedly favored by a combination of fortunate circumstances. Many Esquimaux had gathered on the Greenland shore at Annootok for the annual bear hunt. Great quantities of meat had been brought in by the hunters. Dogs, too, were numerous. Since food and dogs were plentiful, both prime requisites in any polar expedition, Dr. Cook promptly decided to make an attempt to reach the Pole, 700 miles distant. The entire village of 250 people fell to and fitted him out, so that before the end of the long winter night he was ready to set out and to follow a route of his own choosing over Grinnell Land and northward along its west coast out on the polar sea.

The expedition started on February 19th, 1908, with 11 men and 103 dogs drawing 11 sledges. At the very outset the usual hardships of the Arctic explorer were encountered. The crossing of Ellesmere Sound was accompanied by a drop in the thermometer to 83 deg. below zero Fahrenheit. Several dogs were frozen to death. Eventually Land's End was reached. Game was plentiful. In this march to Land's End no less than 101 musk oxen, 7 bears, and 335 hares were killed; there was no lack of fresh meat.

At a point 460 miles from the Pole, Cook sent back all his Esquimaux but the two most capable, and all his dogs but 26. On March 21st the final effort began. A great stretch of open water was crossed—how, Dr. Cook does not tell us in his dispatch. Presumably he used a collapsible canvas boat, which he casually includes in the description of his outfit. On March 30th new land was discovered in latitude 84 deg. 47 min., longitude 86 deg. 36 min. No time was lost in exploring the new country. This was the last land that Cook traversed. Thereafter his course lay on the frozen polar sea.



THE COURSE FOLLOWED BY DR. COOK AND HIS IMMEDIATE PREDECESSORS.

The game which had previously been so plentiful was conspicuously absent. Even microscopic life could not be found. Curiously enough, the surface of the ice pack opposed fewer obstacles than at the outset. On the other hand, violent winds hampered him. On the night of April 1st, 1908, the sun appeared at midnight over the northern ice. The next day found Cook at latitude 86 deg. 36 min., and longitude 94 deg. 2 min. In other words, he had covered about 100 miles in nine days and was 200 miles from the Pole.

Dog after dog was killed to supply the other animals with food, as well as Cook and his companions. On April 14th latitude 88 deg. 21 min. and longitude 95 deg. 52 min. was reached. The pole was 100 miles away. The few stretches of open water were covered with young ice, so that no difficulty was encountered in crossing them.

On April 21st the first corrected altitude of the sun gave 89 deg. 59 min. 46 sec. The Pole was only a few miles distant. The remaining 14 seconds were covered by April 21st, 1908, on which day Cook planted the American flag at the North Pole, or rather on a shifting bed of ice which was then at the North Pole.

Cook remained at the Pole for two days. On the 23rd he started back. Keeping his course well to the southwest, in order to allow for the easterly drift, he covered considerable distance during the first few days. Food became so scarce that for a time it seemed questionable whether Cook and his companions would not perish by starvation. Cloudy weather, an indication of approaching summer, as well as violent gales made his journey southward difficult. Eventually he reached Crown Prince Gustav Sea, with its vast expanse of open water. Fortunately, a few bears were shot, and the diminished food supply was replenished. In July Cook crossed the Firth of Devon into Jones Sound. Eventually Cape Sparbo was reached, where game was plentiful. An underground den was dug, in which Cook and his companions lived until sunrise of 1909. February 18th a start was made for Annootok, and the Greenland shores were reached on April 15th.

Contrasting Cook's achievement with Peary's exploit of 1906, in which year Peary reached latitude 87 deg. 6 min., 200 miles from the Pole, we find that Peary started about three weeks earlier in the season. Cook's outfit was probably inferior to Peary's, hastily prepared as it was. Peary was compelled to turn back because of the great stretch of open water that confronted him. Cook was undeterred by water, possibly because he carried with him the canvas boat mentioned.

Peary's attempt is particularly interesting because Dr. Cook started out with the avowed intention of avoiding some of the drawbacks which had beset Peary. One of these drawbacks was the general set of the floe to the eastward, with which Peary had to contend. Dr. Cook, it is understood, struck off to the westward for the purpose of making allowance for this floe when he started on his direct north route.

Dr. Cook is not a novice at exploration. He was surgeon and ethnologist in the first Peary expedition in 1891-92; assistant in command of the Miranda expedition, which ended in disaster in 1894; surgeon and anthropologist of the Belgian Antarctic expedition which was gone between the years 1897 and 1899, and surgeon in the Peary expedition of 1901. This record must be amplified by the inclusion of his feat as the first conqueror of Mount McKinley in Alaska, about which there has been some controversy.

It is the prevalent view among geographers that there is no land in the neighborhood of the North Pole. This opinion is based upon the fact that no Arctic land is known to rise, except from the continental shelf, or from comparatively shallow waters. But north and northeast of Franz Josef Land the "Fram" expedition under Nansen found depths of 2,000 fathoms or more, and fifty miles to the north of Alaska the Nikkelsen-Leffingwell expedition was unable to reach bottom with its sounding line, which measured 2,060 feet. These and other ascertained facts have encouraged the belief that there is no land around the North Pole. Dr. Cook now confirms these geographical surmisings.

The mere quest for the Pole itself is not regarded even by Arctic authorities as an especially worthy undertaking. What are the conditions of the sea and its currents, the air, the ice, the life of the region, and other phenomena between the known Arctic and the Pole? The answer to such questions as these is what is expected in these days of trained explorers. No doubt Cook will be able to add much to our scant knowledge on these points.

The Norsemen probably were the first Europeans to visit the Arctic regions and Greenland. The struggles to find a short cut to the riches of the Far East were more productive of adventures and loss of life than the latter-day dashes for the Pole. Perhaps the earliest of scientific explorers was Sir Hugh Willoughby, who sailed in 1553 "for the search and discovery of northern parts of the world." He discovered Nova Zembla, but starved with most of his men in Lapland on the return voyage.

The following explorers emulated him:

	Deg.	Min.
1588—John Davis, England, ship	72	12
1594—William Barents, Holland, ship	77	20
1607—Henry Hudson, England, ship	80	23
1616—William Baffin, England, ship	77	45
1773—J. C. Phipps, England, ship	80	48
1806—William S. Scoresby, England, ship	81	30
1827—W. A. Parry, English, sledge	82	45
1852—E. A. Inglefield, England, ship	78	21
1854—E. K. Kane, American, sledge	80	10
1868—K. Koldeway, Germany, ship	81	5
1870—C. F. Hall, American, ship	82	11
1871—C. Weyprechte, Austrian, sledge	82	5
1875—G. S. Nares, England, sledge	83	20
1879—George De Long, American, ship	77	36
1882—A. W. Greely, American, sledge	83	24
1894—C. F. Jackson, England, sledge	81	20
1895—F. Nansen, Norway, sledge	83	14
1897—W. Wellman, American, sledge	81	35
1897—Duke of Abruzzi, Italy, sledge	86	33
1901—Baldwin-Ziegler, American, sledge	81	45
1901—R. E. Peary, American, sledge	84	17
1903—Ziegler-Fiala, American, sledge	82	..
1905—R. E. Peary, American, sledge	87	6
1908—Dr. Cook, American, sledge	The pole	

SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1909, by Munn & Co., Inc.]

A POPULAR ILLUSTRATED WEEKLY OF THE WORLD'S PROGRESS

Vol. CI. No. 11. ESTABLISHED 1845. | NEW YORK, SEPTEMBER 11, 1909. | 10 CENTS A COPY $3.00 A YEAR.

The illustration shows the height to which the elevator can be raised to go over the side of a ship.

A REMARKABLE GRAIN ELEVATOR FOR DISCHARGING VESSELS.—[See page 182.]