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MODERN SEARCHLIGHTS.

BY FRANK C. PERKINS.

A new form of electric flashlight has been installed in the lighthouse tower at Heligoland by the Siemens-Schuckertwerke, of Nuremberg, Germany. The searchlights or projectors used at this installation are combined, as shown in the views on another page. There are three lower searchlights, arranged 120 degrees apart, and another mounted upon the top, all operated automatically and driven by electric motors. The carbons, which are fed by automatic mechanism, are placed in a horizontal position, as is usual with most large searchlights. The intensity of the light is 30 million candle power as a minimum, and the maximum current used is 100 amperes. The light flashes occur every 5 seconds, and they remain in one position only .1 second.

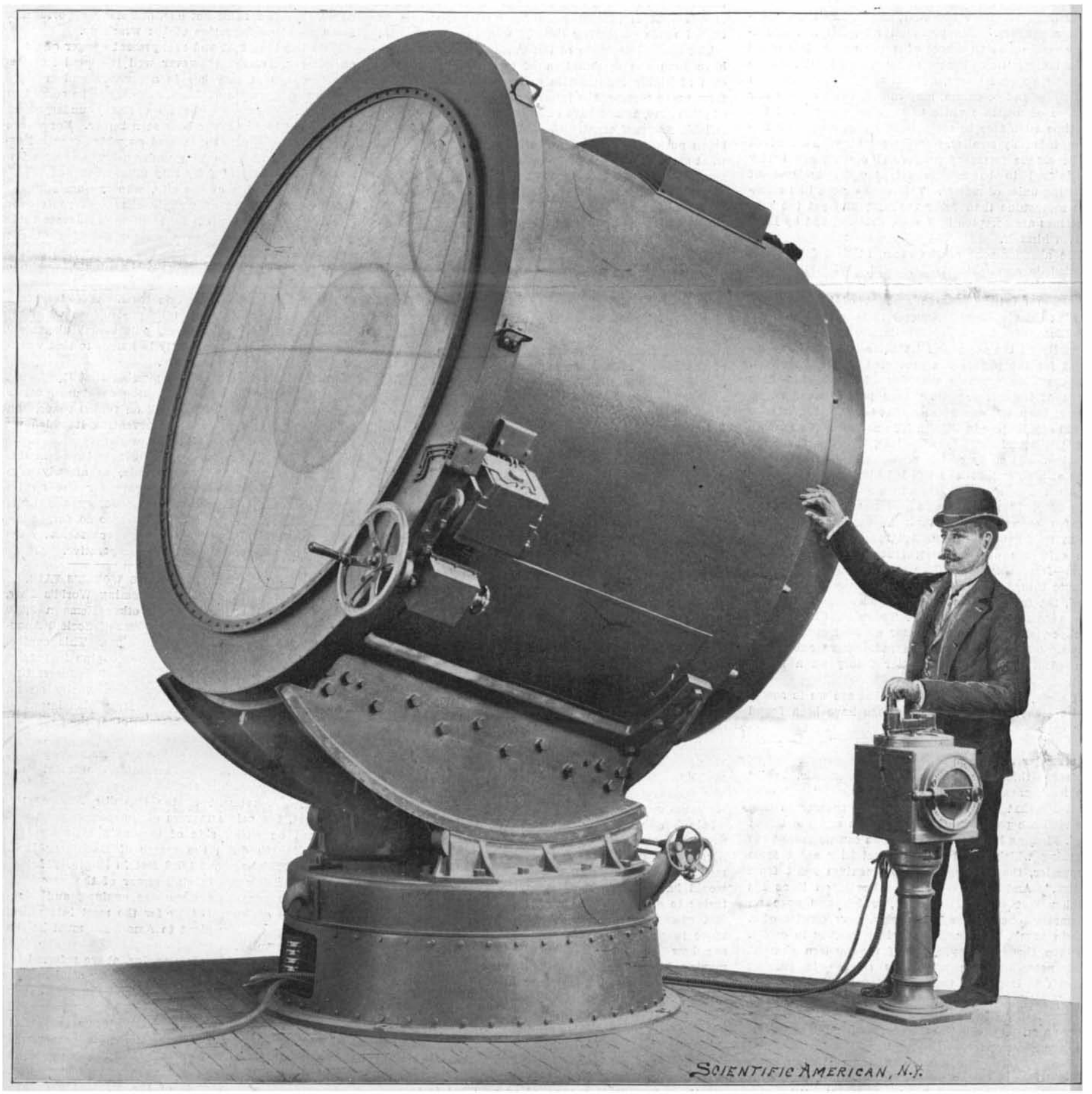
The three searchlights mounted on the lower revolving platform 120 degrees apart have mirrors 29 inches in diameter and utilize a direct current of 34 amperes each, the platform revolving at the rate of four revolutions per minute. The electrical apparatus was constructed by the Elektricitäts-Actiengesellschaft, formerly Schuckert & Co., of Nuremberg. The current is supplied to the tower lights by a lead iron-armored covered cable connected with the power station. The power plant consists of two steam engines directly connected to dynamos of 216 amperes capacity at a pressure of 75 volts.

This new electric beacon is to take the place of the old petroleum light that so long flashed out its danger signals at the mouth of the river Elbe. The new electric light is probably the most powerful at present in operation. Apart from its enormous power, the Heligoland lighthouse is noteworthy for the fact that a return has been made to the old form of parabolic mirror, with a powerful light in the focus, instead of the usual Fresnel lenses and prisms.

The mirrors of the Heligoland light consist each of a piece of silvered glass. No protection against weather is provided in front of the light, and it is asserted that none is needed. Besides the three mirrors mentioned, a fourth mirror and lamp is provided, which will turn three times as rapidly, but which, it is said, will be used only in cases of emergency.

The duration of one-tenth of a second for the flash, a characteristic of most French beacon lights, is here adopted for the first time in Germany. It is, however, a question whether these brief durations have not been

(*Continued on page 133.*)



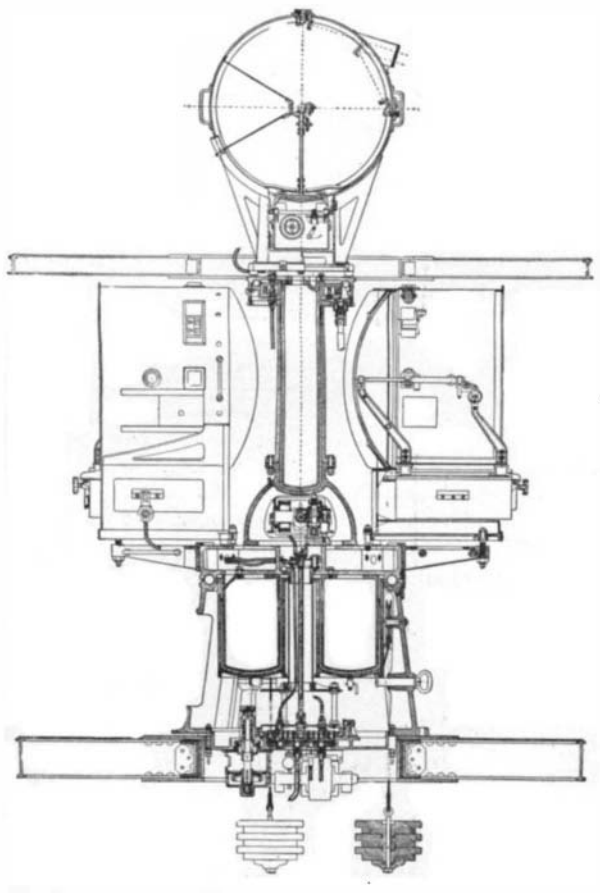
A GREAT SEARCHLIGHT OF 316 MILLION CANDLE POWER, FITTED WITH IRIS SHUTTER. DIAMETER, 6 FEET, 6 INCHES.

After the English company abandoned the construction of the northern tunnel in 1891, it was allowed to fill with water. When the work was taken in hand by the present company the tunnel was pumped out, and it was found that with the exception of some 470 feet, the work already done was in good condition. This was in the latter part of 1896, and from that time until 1902, when orders were given to proceed with construction, the tunnel was regularly pumped out and maintained in good condition. A new building was erected at the Jersey shaft, equipped with a very complete power plant, including hydraulic pumps and air compressors, etc. The shield which was used by the English company was overhauled and is being used in completing the north tunnel. It was designed for use only in silt, and as the tunnel has now reached a point where rock and boulders are encountered in the lower half of the excavation, it has been found necessary to build a heavy apron, extending 6 feet in advance of the upper half of the cutting edge of the shield, and reaching from side to side of the shield. This apron is built of 12-inch I-beams and ¾-inch steel plates, and it is strongly braced. Under the shelter of this apron, which is heavily shored up, the workmen are able to pass forward of the shield and drill and blast out the rock below it. This work is unique in horizontal shield excavation, and so far it has been carried forward with complete success.

The method of operating the hydraulic shield is so well known as to need no detailed description here. It is forced forward into the silt by means of hydraulic rams which are set up between the front edge of the completed iron lining of the tunnel and the rear edge of the shield. As it moves forward, the silt is squeezed through open inlets into the interior of the shield, where it is broken off, loaded into trucks, and drawn away from the heading by a cable. The finished tunnel is divided into three lengths by two air locks, one of which is shown in our accompanying engraving. It should be explained that the lower half of the tunnel, at the point where our picture is taken, was filled with excavated material from the heading, on which the two tracks are laid. Ultimately this material will be taken out and the full diameter of the tunnel exposed. In our engraving the two trolley tracks are clearly shown, together with the doors by which the cars pass through the air-tight diaphragm. Another of our engravings was made from a photograph taken in the rear of the shield at the present heading. In this case the material has been entirely removed, showing the full diameter. The two tracks shown are merely narrow-gage working tracks for the contractors. Ultimately, of course, a single track will be laid for the operation of trolley cars. The cable-hauling system is built in three sections, separated by the two air-locks. The first of these, which is 1,575 feet in length, extends from the Jersey shaft to the first air-lock; the second, 1,660 feet long, extends from the first to the second air-lock, while the third section reaches from the second air-lock to the working face. The cables are driven at a speed of 300 feet a minute and are capable of handling 300 tons of excavated material in every ten hours. One of our engravings represents a profile taken across the North River in the plan of the north tunnel. The completed portion of the tunnel is shown by light shading, while the darker shading shows the amount, about 800 feet, that has yet to be excavated.

TRUNKS AND LIMBS OF TREES GNAWED BY BEAVERS.

On the south tunnel new air-locks have been installed, the necessary machinery is being built, and it is probable that the actual construction of the tunnel will be taken up again in the fall of the present year. The shield for this work, which was designed by Jacobs & Davies, engineers of the company, is shown in the accompanying engraving. It will be seen that it is divided by one horizontal and two vertical frames and by transverse diaphragms. The shell is double and the whole construction is calculated to give great stiffness and resistance to distortion. It is provided in front with a movable working platform which, if necessary, may be carried forward of the cutting edge. In the rear it is provided with the necessary hydraulic jacks, valves, etc., for carrying forward the shield and for swinging the erector—a massive arm which moves something like the hands of a clock, and is used for picking up the cast-iron plates and placing them in position ready for bolting up. It is interesting to know that in spite of the difficult nature of the material through which the tunnel is now being driven, there being rock below and soft silt in the upper half of the tunnel, progress is being made at the rate of between 4 and 5 feet a day. The work is rendered particularly hazardous by the fact that there is a hydraulic head due to 65 feet of water, and that there is only 10 feet of soft silt between this hydraulic pressure and the roof of the tunnel. The successful financing of the company was completed through the efforts of Mr. William G. McAdoo, the president, associated with a few trolley capitalists, and to him we are indebted for the facts given.



SECTIONAL VIEW OF HELIGOLAND LIGHTHOUSE PROJECTORS.

MODERN SEARCHLIGHTS.

BY FRANK C. PERKINS.

(*Continued from first page.*)

carried to an extreme. Undoubtedly one-tenth of a second is sufficient to make the maximum impression on the eye, when the light is brilliant. But with a hazy atmosphere, and the light much diminished, it is doubtful whether a longer duration should not be allowed. The experiment will be watched with great interest, both on account of the bold deviation from the ordinary plan which has been so long followed, and also on the ground of economy, which is claimed for the new method. It is stated that on the first night of trial the light was seen at the pier at Büsum, a distance of 40 miles, which in itself seems sufficient to clear away all doubts of the visibility of a flash of short duration.

The front-page illustration shows a Schuckert searchlight with an Iris shutter, half closed, which has a diameter of 6 feet 6 inches and throws a beam of light of 316 million candle power. This search light is electrically controlled by two levers, one of which controls the motor mounted in the base of the searchlight which operates the projector in a vertical direction through a train of gears, and the other starts or stops the electric motor which controls the horizontal movement of the beam of light. The Iris shutter is used in order to make the projector perfectly light-tight at any moment desired, and it operates similarly to this type of shutter as applied to modern cameras. The leaves of the Iris diaphragm slide within a fixed diaphragm located in the axis of the ray of light and provided with a fold. On some of the German searchlights an apparatus known as a "double disperser" is provided, in order to convert concentrated light rapidly into diffused light. This arrangement consists of two parallel systems of cylindrical lenses, which may be slid against one another, whereby the angle of dispersion of the emitted ray can be varied at will. By means of this apparatus the angle of dispersion of the light can be varied within limits of from 2 degrees to 45 degrees if desired.

THE BEAVER AS A DAM-BUILDER.

A remarkable beaver dam has lately been discovered near Stroudsburg, Pa. The work of the animals is so extensive that it seems almost incredible they could have built the dam in question, but this is proved by the evidence of residents of the vicinity, who are strictly reliable.

The dam in question was discovered about two years ago, by a farmer living near its site. It is located in a swamp, which for many years had been drained of its surface water, except in a few spots. Noting that most of the swamp was under water, although but little rainfall had occurred, the curiosity of the farmer was aroused, and he made an investigation which led to the discovery. The dam has been constructed around the northern edge of the swamp, extending in a zigzag course, evidently to avoid obstruction, and to increase its strength. It is about 125 feet in length, and the top is wide enough for a man to walk upon, without difficulty, ranging from a foot to two feet in width. At present the top is about three inches above the surface of the pond which has been created by the dam, the water being from two to four feet deep.

The farmer who made the discovery at first thought that the work had been done by boys for sport, but noticing the footprints of animals upon the top of the structure, he followed these, and found some pieces of wood, which apparently bore the marks of an animal's teeth. The wood was taken to a naturalist who resided in the vicinity, and after careful examination the latter pronounced the marks to be from beaver

PROJECTORS OF THE HELIGOLAND LIGHTHOUSE.