THE NEW FASTNET ROCK LIGHTHOUSE.

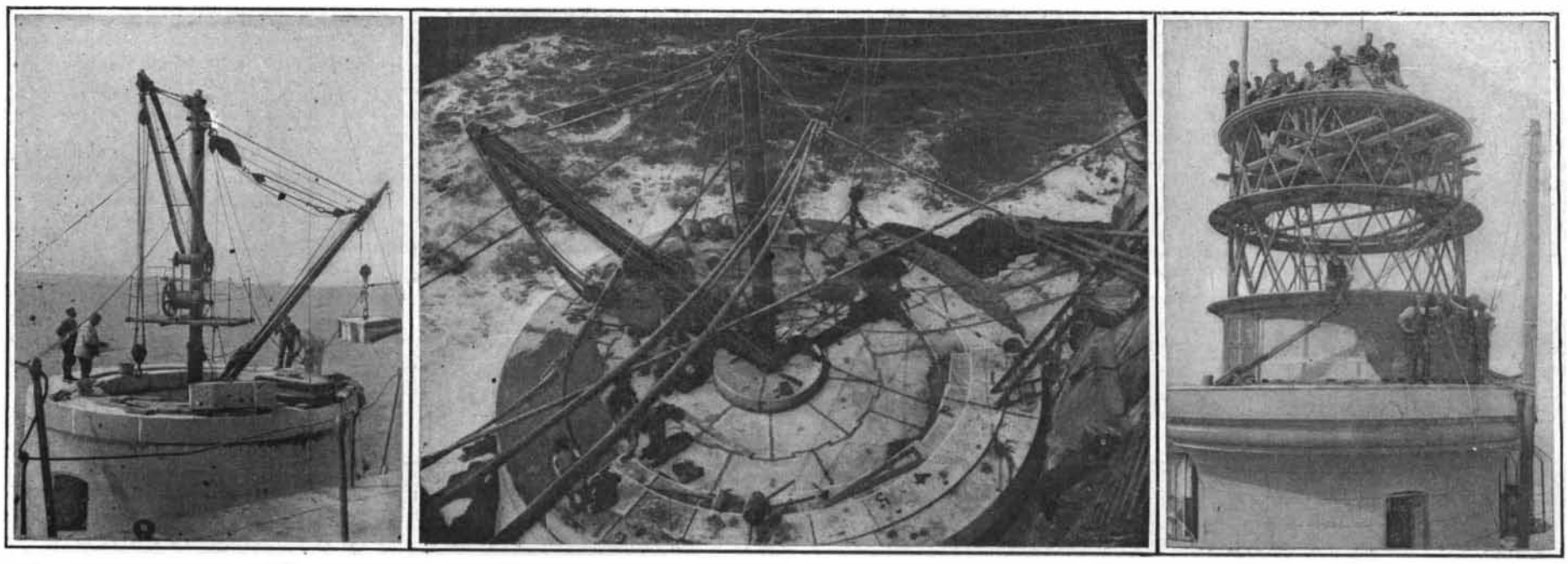
Off the southeast corner of the coast of Ireland is the Fastnet, a small pinnacle, which is one of the most important landmarks to transatlantic traffic, constituting as it does the first and last land bearings to and from Europe. This danger spot comprises a group of islets, the principal of which are the Great and Little Fastnets, and before the year 1848 was in no way indicated to mariners. In that year the erection of a cast-iron tower to a height of 64 feet was commenced by George Halpin, engineer to the Irish Lights Commissioners, fitted with a 38,000-candle-power flashing light recurring every two minutes, at a cost of $86,950, and the light was shown for the first time on January 1, 1854, thereby superseding the light on Cape Clear, 4½ miles away on the mainland.

This structure proved unable to withstand the strain put upon it by the Atlantic, and frequent and costly strengthening works were necessary. Finally, in 1895, it was decided to supersede the old erection with a more modern masonry-built house. The situation of the new lighthouse upon the rock may be gathered from the accompanying illustrations, and it will be seen that it rises from a ledge just above the water level. At its base the tower has a diameter of 52 feet, and the granite portion rises to a height of 147 feet, the focal plane of the light being 159 feet above high-water mark at ordinary spring tide. The site selected is the hardest portion of the rock, and being at the extreme west end of the islet, the base of the tower receives the blow of the heaviest seas before they rise to their full height. The foundations are 20 feet in thickness, comprising thirteen partial rings of masonry, forming a facing to the natural rock. The lower courses are stepped, and help to offer a vide bottom ventilation to the lantern and may be left open in all weathers without any danger of spray being driven in. This room is fitted with a rain-water tank, which collects the water falling on the lantern roof, and with the wireless telegraph apparatus, for this lighthouse constitutes the most westerly and important shipping signaling station in the British Isles.

The external form tapers upward for a height of 116 feet in an easy curve, which is the segment of an ellipse having a semi-axis major of 155 feet. Above this point the shape is cylindrical, 20 feet 8 inches in diameter, with two balconies projecting outward, of 26 feet external diameter at the 133 feet 6 inches and 146 feet 3 inches levels respectively, the masonry being carried out in an easy curve under each balcony.

The whole of granite for the masonry was procured from Cornwall, and the lighthouse was set up in sections at the quarry to secure accurate fitting. For the lower course, where the stone would soon become covered with green seaweed, fineness of grain and color were of secondary consideration so long as the texture of the stone was of a high standard. For the section above the entrance level good hard fine-grained granite of uniform color, free from marks and defects, and very finely dressed so as to present a good flat surface on either face, is used. The whole of the stones were carefully dovetailed together upon the dovetail joggle system, so that the entire structure is bonded into virtually a monolith. It is impossible for any stone to be withdrawn until the whole of those above have been removed, when it is extracted in a vertical direction; and even such action must break off the dovetailed joggle in the course below it, as the cement used in the bed flows in and completely fills the space between the male and female dovetails. remedied by careful cutting out and cementing in of small stones. Each course was carefully checked after laying, and the greatest variation from the figured dimensions of the drawings was only 0.25 inch in the entire diameter, which speaks well for the care and labor bestowed upon the cutting of the blocks.

The lantern equipment is by Messrs. Chance, of Birmingham. It is of the single flash type, recurring every five seconds, the duration of the flash of maximum intensity being 0.122 second. The power of the beam during this period of flash is 750,000 candle-power, and is obtained by means of a biform four-sided apparatus, each tier consisting of four square panels with annular plano-convex lenses of 80 deg. aperture and 920 millimeters (35.5 inches) focal distance. In the center of each tier is placed an incandescent mantle burner of special design, having a minimum and maximum working power ranging from 1,350 to 1,450 candle-power, respectively. The lenses are set forward with their principal foci on the horizontal axis, and 6 millimeters (0.236 inch) in front of the vertical axis of the mantle, this disposition being found to give the best results in the photometric tests, as more light is received from the front than from the back of the mantle, the proportions being respectively 62.5 and 37.5 per cent. The catadioptric prisms are divided into short segments, and each segment is set to throw the center of its beam in a direction truly parallel to the center of the beam from the lens, the latter being dipped to strike the sea at a distance of ten miles by raising the center of the mantle the requisite height above the horizontal axis of the lens. By the adoption of the biform apparatus, should an accident befall one of the burners, the whole light is not extinguished—the beam is only



Gear for Hoisting and Setting the Masonry Blocks.

One of the Solid Masonry Courses of the Tower in Course of Construction. (View from Top of Rock.)

The Lantern in Course of Construction.

THE FASTNET ROCK LIGHTHOUSE.

breaking face by their sharp edges to the waves. At the top of the foundation courses the diameter is 40 feet, and here the complete courses of masonry commence, being continued up to a height of 30 feet 6 inches. These courses are solid except for a central fresh-water tank of 3,250 gallons for the keeper's requirements. The tank is divided into two compartments by a central brick wall, so that one side may be emptied for cleaning without wasting the store in the other compartment. The floor of the entrance room to the light-house is 57 feet 9 inches above high-water mark. Up to this point the thickness of the masonry courses varies from 2 feet, in the case of the foundation partial ring courses, to 1 foot 9 inches thick for the succeeding fifteen solid courses to the entrance room floor. From the entrance level the tower extends to a height of 88 feet 1½ inch to the lantern, and is divided into eight compartments for the services of the inmates.

The four lower floors are used for storage purposes. The second room contains the oil tanks, from which the oil is pumped to a small supply tank in the lantern gallery. From this floor commences the central hollow shaft, in which the weight controlling the revolving mechanism of the lamp moves. The fifth-floor room is the living room, 15 feet in diameter, and above is the principal bedroom. Access is gained to the various apartments from the entrance level by a spiral staircase. The rooms are all well lighted by windows fitted in gun-metal frames up to this level, and protected upon the exterior by storm shutters, the outer surfaces of which come flush with the masonry. Immediately below the lantern is the service room, from which the lower balcony is gained. The windows in this room are not equipped with storm shutters, and have special louvre ventilators over them, which pro-

The total number of stones used in the building of the tower is 2,074, representing a net cubic content of 58,093 feet and a weight of 4,300 tons. The weights of the individual stones range from 1¾ to 3 tons. In addition, 4,500 cubic feet of small squared blocks were used in filling cavities in the foundation and the space between the rock and the tower up to the level of the entrance floor.

Owing to the inaccessible position of the rock and the danger involved in approaching except in the calmest of weather, great difficulty was entailed in the work of construction. A special steamer was built for trans-shipping the building material, workmen, and stores to the rock from the mainland. As the vessel could not approach nearer the islet than 110 feet, special gear was installed for transporting the stones from the ship to the point of erection. A derrick was rigged up on the rock, to haul the stones from the steamer to the base of the tower. When the stone reached the base, it was picked up by another derrick fixed up in the center of the building, and lowered into the position in which it was to be set. The laying of the lowest courses was frequently delayed, owing to the rough weather experienced, but whenever the weather was fine excellent progress was maintained, the greatest number of stones laid in connection with the lowest courses in a single day being 22. The actual building commenced in July, 1901, operations having been retarded considerably by difficulties experienced in connection with the quarrying of the granite, and afterward by inclement weather.

The setting of the masonry was completed in just four years. During the work, despite the difficulties attending trans-shipment of the masonry to the rock, not a single stone was lost or damaged beyond slight chips off the rises of 16 stones, which injuries were reduced fifty per cent in power. Moreover, a flash of greater intensity can be secured thereby, while the principle also facilitates cleaning.

The pedestal of the lantern is of the type designed by Mr. C. W. Scott with mercury flotation. A cast-iron cylinder 5 feet 9 inches in diameter by 4 feet 6 inches in height, divided into six segments, supports six standards, on top of each of which are two vertical rollers on ball bearings, and one horizontal roller rotating on a pivot. Outside these standards is the mercury trough, supporting a float which carries a revolving table of 7 feet 6 inches diameter, on the inner curb of which is a gun-metal toothed rack of 5 feet pitch-line diameter. Within the pedestal is the shaft connecting with the weight-driven clockwork rotation machine, and also two air receivers and two oil bottles, which feed the burners. The weight of the revolving apparatus is 6 tons, and it is rotated by a 290-pound weight falling 49 feet per hour, this being sufficient to give three revolutions per minute, and the rate of variation of the speed of revolution can be easily maintained within five seconds in the hour. The maintaining gear is of the sun and planet type, and so designed that the speed of revolution does not vary while the clockwork mechanism is being wound up. The lantern itself is 17 feet in diameter at the inner surface of the glass by 27 feet high from gallery level to top of dome. Above the roof extend two electrically-fired fog signal jibs placed diametrically opposite each other. Provision had to be made to prevent the possibility of an explosive charge being accidentally fired by the telegraph transmitter of the Marconi station maintained on the lighthouse, and this prevents the telegraphic apparatus being in operation while fog signaling is in progress.

The lower portion of the old tower is now used as an

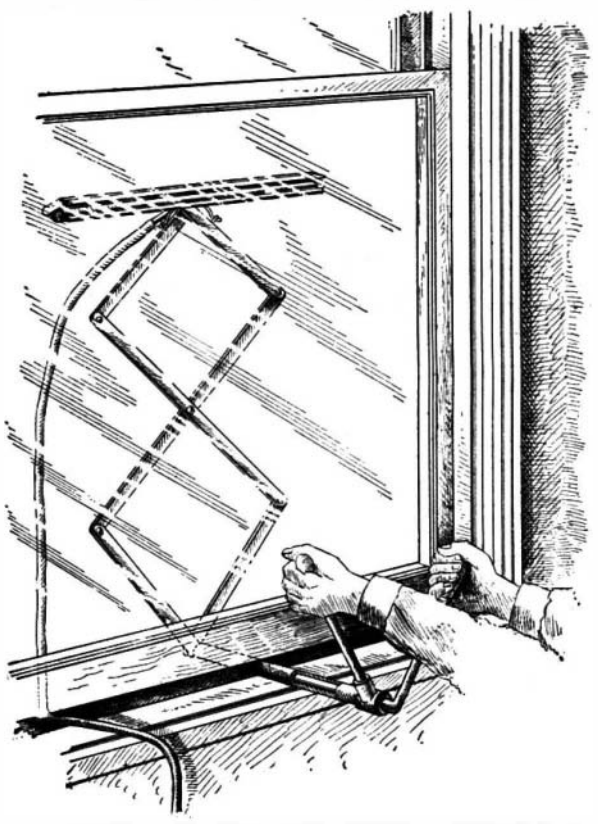
oil store, there being installed therein six 300-gallon cylindrical tanks in addition to five 130-gallon tanks in the lighthouse itself. The reservoirs in the old tower are connected to those in the lighthouse, a stop-cock being fitted to control the flow. The tanks in the old tower being higher than those in the new lighthouse, the oil gravitates from the former to the latter. All tanks are fitted with gages for determining the quantity of oil within. The oil is landed in barrels, and pumped into a 40-gallon sump tank having a removable cover and fine wire-gauze strainer.

The total cost of the undertaking somewhat exceeded the original estimate, owing to the difficulties encountered, aggregating $420,000. The staff for the lighthouse comprises four men, relieved twice a month, weather permitting. The cost of maintenance averages about $5,000 per year, to which $1,000 is contributed by Lloyd's for the privilege of using the lighthouse as a signaling station, this being the first point from which incoming vessels on the Atlantic are notified to London and Europe. The cost of oil and mantles for the burners averages approximately $225, and fog-signal ammunition about $1,300 per year.

The superintendence of the building was intrusted to Mr. C. W. Scott, engineer to the Irish Lights Commissioners; he also designed the special form of lamp used.

A DEVICE FOR WASHING THE OUTSIDE SURFACES OF WINDOWS.

There has long been need for some simple and practical device for washing the outside surfaces of windows. This need has greatly increased in late years with the increased height of modern buildings. The

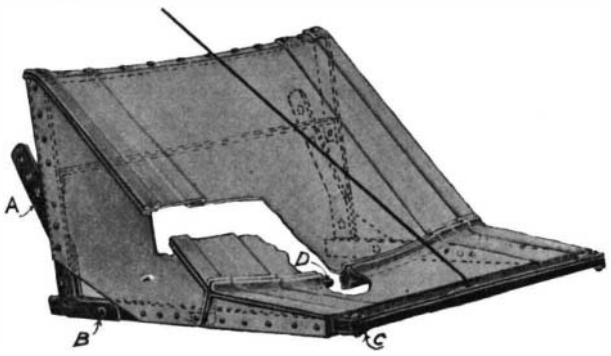


DEVICE FOR WASHING THE OUTSIDE SURFACES OF WINDOWS.

inaccessible exterior surfaces of the windows makes the work of cleaning them especially inconvenient and hazardous, so that trained experts are now commonly employed for this service. In the accompanying engraving we illustrate a device with which the exterior surface of a window may be readily cleaned from within the building, and without imperiling the life of the operator. It consists of a cleaning head, which may be projected to the desired point by means of a lazy tongs mechanism that connects the head with the operating handles. The lower legs of the lazy tongs are respectively secured to a pair of rock shafts which are concentrically mounted, one shaft being tubular to receive the other. Each shaft is provided with a handle, and by swinging these handles toward and from each other the lazy tongs may be extended or retracted. A flexible hose connects the head of the washing device with a source of water under compression, so that a flow of water may be had at the desired point. A patent on this window-washing device has been secured by Mr. William G. Himrod, of Third and G Streets, N.W., Washington, D. C.

A NEW TYPE OF CAR FENDER.

The accompanying engraving illustrates a fender which is particularly adapted for use on street cars, and which is so designed as to present no unflexible portions against which a person may be injured when picked up by the fender. The fender comprises a frame supported on two bars *A*, by which it may be secured to the end of a car. The frame is formed of two L-shaped members, connected at suitable points by cross bars. In order to prevent a person from being injured by the front cross bar or pilot bar of the frame, a strap *C* is provided, which is placed directly before the bar and serves as a guard. The frame is covered with canvas. The fender comprises a forward slightly-inclined portion and a rearward sharply-inclined portion. The boundary between these two portions is marked by cross bar *D*. The canvas is secured to this cross bar in the manner shown in illustration, so that there will be little danger of injury to a person striking this part of the fender. In order



A NEW TYPE OF CAR FENDER.

to strengthen the canvas covering, it is provided with a number of reinforcing folds, so that there is no danger of the canvas giving away when the fender picks up an object or a person. The frame of the fender is hinged to the bars *A* at the points *B*, so that the fender may be lifted up into folded position when desired. The strap *C*, which is placed in front of the pilot bar, is supported at opposite ends on rollers in such manner that it may be moved when pulled in either direction, or when it happens to receive a glancing blow from an obstacle. While the fender is more particularly adapted for use on street cars, the inventor hopes to introduce it on automobiles. Mr. Shozaburo Ishii, of New York, N. Y., has procured a patent on this fender.

Ginseng and Belladonna Growing in California.

Recent investigations made by the State Board of Trade demonstrate that the growing of ginseng can be made very profitable in California, although the plant is not indigenous to the State. All the requisites of soil, moisture, and climate are to be found in California.

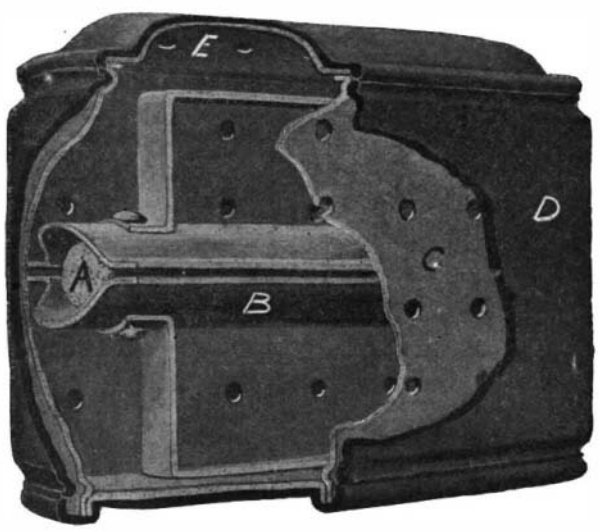
One tract of land located in Santa Clara County, containing over 100 acres, was planted in ginseng about two years ago, and gives flattering promise of good returns next year, when the first crop is to be harvested. Another tract in Marin County was planted a little later than the one in Santa Clara County, and now gives promise of yielding equally well.

Ginseng is a drug used as a basis for almost all Chinese remedies. It sells in the market in its natural state for about $8.50 a pound, while the fluid extract commands a higher price. The Chinese buy all that is to be had, and ship it to China. It is gathered in many eastern States and in the Ohio and Mississippi valleys.

Extensive experiments and investigations have also been made recently in the Gardens of Medical Plants in San Francisco, and at other points in California, in regard to the cultivation of the belladonna plant. These experiments show that it will grow very successfully in the State. There are movements now on foot to engage in its cultivation in California, on a very large scale. The raising, it is claimed, is decidedly profitable, as the price is good and the demand for this drug constantly on the increase.

HAND WARMER AND BODY HEATER.

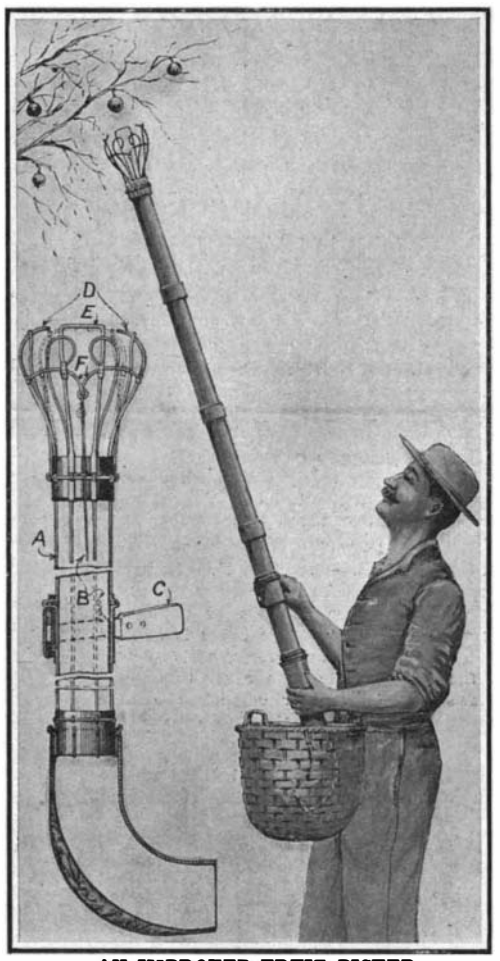
The heater which is illustrated in the accompanying engraving is of the type in which a slowly-combustible substance is inclosed, and after being ignited is carried in the pocket for warming the hands. The device may also be applied to any part of the body to alleviate pain. When so used the heater has material advantages over hot-water bottles, or similar devices commonly used. The combustible material within the case continues to burn for a great length of time, maintaining its heat until the material is entirely exhausted, whereas a hot-water bottle soon becomes cold and is of no further use until reheated. The particular advantage of the heater which we show herewith is that a special means is provided for holding the combustible substance in the center of a casing, so that one side will not become heated more than the other side. The combustible material, which is preferably punk prepared for the purpose, is inclosed in a paper cartridge *A*. The cartridge is supported in a holder *B*, which is provided with brackets adapted to hold it in a central position. Flanges on the holder project laterally therefrom, and serve to space the cartridge from the side walls of the casing. The casing *C* is formed with a series of perforations in the side walls. The cover *E* of the casing is also perforated. A lining of cloth is fitted against the under side of the cover, and the side walls of the casing are covered with cloth, as indicated at *B*. The construction is such that there will be no danger of sparks passing through the perforations in the walls and igniting the clothing of the user. A patent on this body heater has been granted to Mr. Philip Stein, 220 to 226 West Santa Clara Street, San Jose, Cal.



IMPROVED HAND WARMER AND BODY HEATER.

IMPROVED FRUIT PICKER.

Pictured in the accompanying engraving is an apparatus adapted to enable a person standing on the ground to readily remove fruit from a tree without



AN IMPROVED FRUIT PICKER.

injuring the fruit. It consists, briefly, of a long tubular member provided with a picking device at the upper end, which may be operated by a lever conveniently located near the hand of the operator. At the lower end of the tubular member is a discharging elbow, which opens into a basket or other receptacle carried by the operator, so that the fruit when picked will pass down through the tube and into the basket. The tubular portion is formed of a number of rods *A*, connected by collars at suitable intervals, and which serve to support a lining of any suitable textile fabric. The discharging elbow is provided with a soft cushioned portion on which the fruit falls without breaking or bruising. The picker arms at the upper end of the tube are operated by means of rods *B*, which lead to a lever *C*, fulcrumed near the lower end of the tube. The picking device comprises two U-shaped flexible arms *D*, formed by extending a pair of the supporting rods *A*. In addition to these there are a pair of arms *E*, located between the arms *D*. Attached to the arms *D* are links *F*, which pass over pulleys supported on arms *E*, and are connected to the operating rods *B*. The device may be used by placing the picking arms around the fruit to be picked, and then detaching the fruit by a downward or lateral movement of the picker without using the lever *C*. In most instances, however, the fruit is detached by drawing the picking rods inward by means of the operating lever to the position shown by dotted lines. A patent on this improved fruit picker has recently been granted to Mr. Emil Gier, Mount Angel, Ore.

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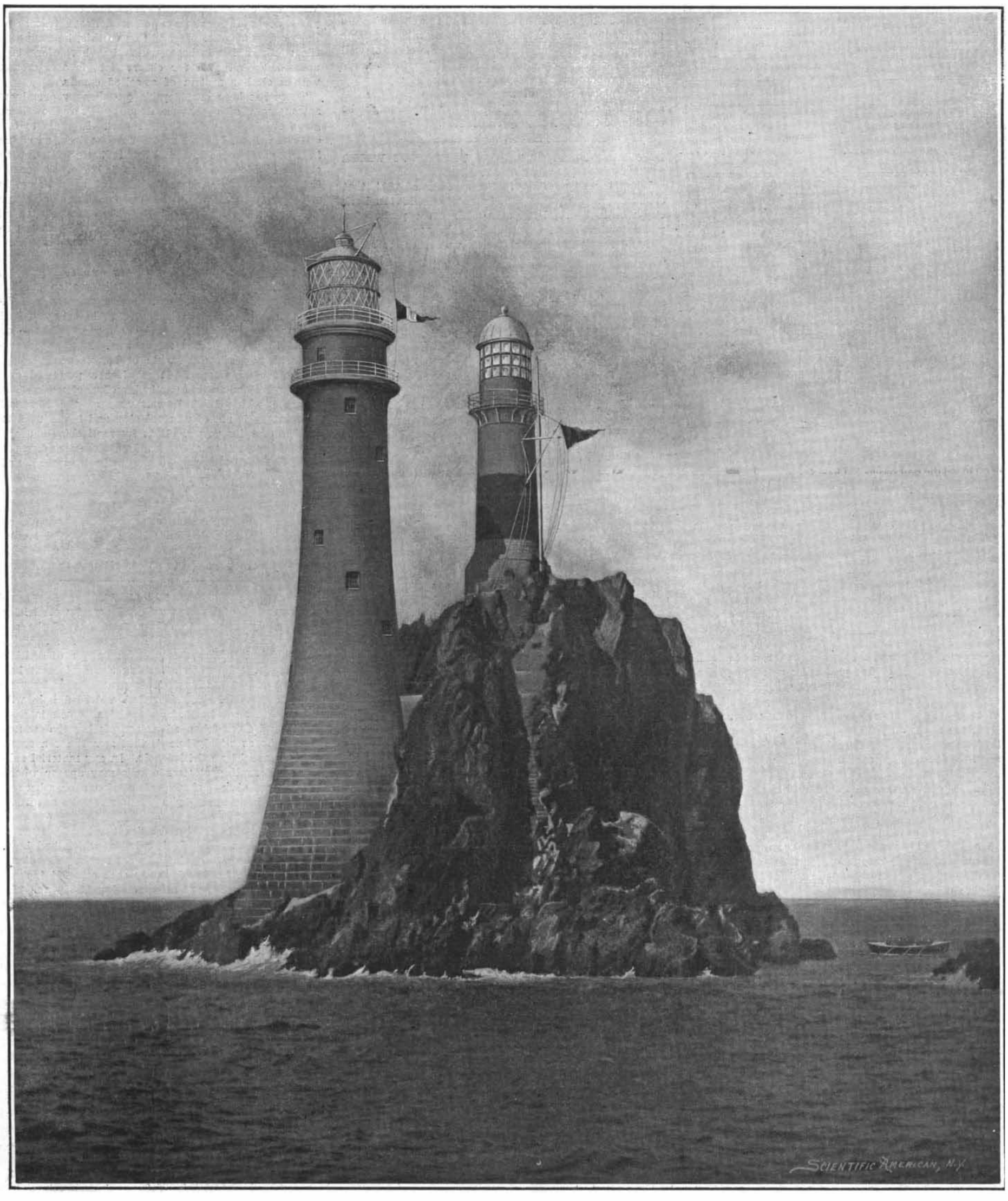

FASTNET ROCK LIGHTHOUSES AS SEEN FROM OCEAN LINERS.—[See page 226.]

Height of Focal Plane, 159 Feet Above High Water.