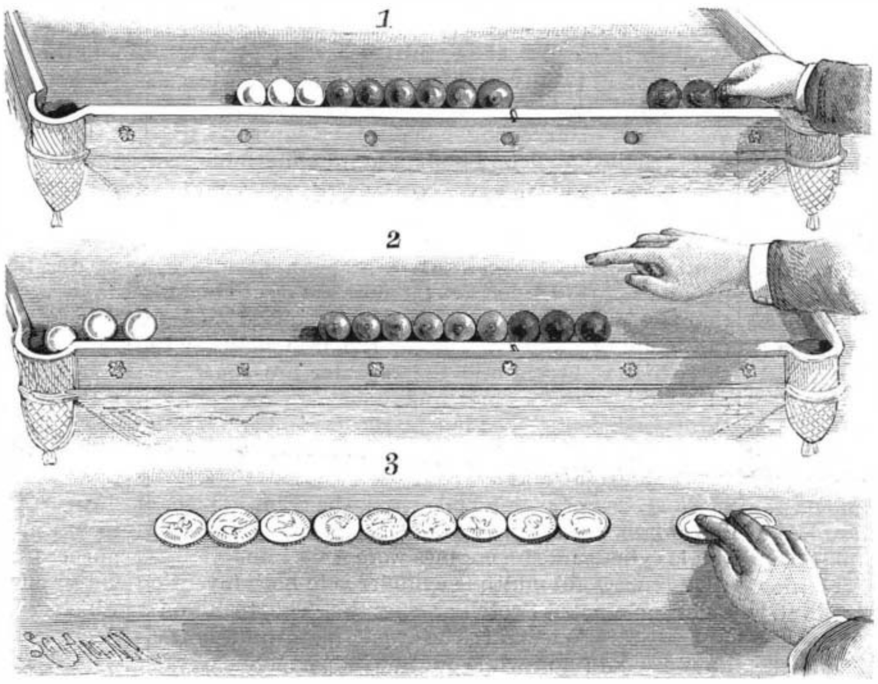
INTERESTING TRICKS.

The clever trick with billiard balls shown in Figs. 1 and 2 depends for its success on a truly scientific principle. A number of billiard balls are placed in a row against the cushion of the table. The player asks one of the spectators to name a certain number of balls to be pocketed without any apparent disturbance of the others. Suppose the number to be three. Then at the will of the player three balls separate from the others and roll into the pocket. The number is perfectly controllable, and when the hand of the player and one end of the row of balls is covered, the trick appears mysterious. It is hardly less so when the entire experiment is visible. The feat is accomplished by removing from one end of the series as many balls as are to be projected from the opposite end, and rolling them forward against the end of the row remaining. An equal number of balls fly off from the opposite end of the row and roll into the pocket. Three balls driven against one end of the series will cause three to roll off, two will drive off two, one will drive off one, and so on.

The principle of this trick is illustrated in the well known class-room experiment in which a series of contacting suspended balls of highly elastic material are made to transmit a blow delivered on the first of the series to the last ball of the series, so that the last ball will fly off without any apparent disturbance of the other balls. In this experiment, the first ball of the series is drawn back and allowed to fall against the first one of those remaining in contact. The impact of this ball will slightly flatten the ball with which it comes in contact, and each ball in turn transmits its momentum to the next, and so on through the entire series, the last of the series being thrown out as indicated.

In the case of the experiment with the billiard balls it is found by careful observation that separate blows are given to the series, corresponding in number to the number of balls removed, so that while the separation of the three balls at the end of the series is apparently simultaneous, in reality they are separated off one at a time.

In Fig. 3 is illustrated a method of repeating the experiment with coins in lieu of balls. Dollars or half dollars may be used, and the effect is produced by sliding the coins.



SCIENTIFIC TRICKS WITH BILLIARD BALLS AND COINS.

LOGGING IN MINNESOTA.

It is now no uncommon sight during the logging season of each winter in this State to see incredibly large loads of logs moved over a road through the forest by a four-horse team. During last winter the record for big loads of logs was broken by teams in the employ of the Ann River Logging Company, operating on the Ann River, a tributary of the Snake River. The scale of one of the loads, as given by the company's scaler, showed that it contained 63 logs, measuring 31,480 feet; weight of load, including sleds, 114 tons; height of load from the sleds, 21 feet; width of load, 20 feet. The load was hauled by four horses a distance of three miles, on one set of sleds and by one four-horse team. S. C. Sargent, an artist of Taylor's Falls, Minnesota, was present at the time these loads of logs were hauled, and photographed the loads as they came on the landing. We present herewith a cut from a photograph made by Mr. Sargent.

LOGGING IN MINNESOTA.

Range of War Ship Guns.

A 12 inch Schneider gun, under an angle of projection of 20° (average maximum angle used on board ship), will throw a 900 lb. shell 10½ miles. There are many guns now mounted on battle ships that have the power to throw projectiles ten miles, under maximum ship angles of projection. So says Lieut. E. M. Weaver, in the *Journal of the U. S. Artillery*. At Portland, Me., the ten mile circle passes out to sea some 3½ miles from nearest land, at Boston 2½ miles from land, at Brooklyn 2½ miles from land off Coney Island. Ships of war, at the above distances, could bombard the cities named with great shells and make frightful havoc. There is pressing need for the immediate provision of effective and abundant means for coast defense. It is to be hoped our law makers will make liberal enactments for this purpose.

THE BRITISH FIRST CLASS CRUISER EDGAR.

The Edgar is a powerful cruiser, being well protected by an armored deck, and by minute subdivision. The class of which she is the prototype comprises nine vessels, designed for the express purpose of protecting commerce on the high seas, and in such a case good offensive powers and high speed were essential. It was also necessary that the cruisers should be able to keep the seas for a long period or make fast voyages to distant parts without coaling, so that it was necessary to reduce all weights to enable the vessels to carry a large fuel supply, and the measure of success is the fact that on a displacement of only 7,350 tons they have bunker capacity for 850 tons, so that they could cross the Atlantic at full speed, and might steam 10,000 miles at a speed of 10 knots.

The engines are of the triple expansion type with three inverted cylinders and three cranks. There are separate sets for driving each of the twin screws, the engines being fitted in separate compartments. Of the two engines an engraving is here given, prepared from a photograph taken while the engines were in the erecting shop at Fairfield.

The high pressure cylinders are 40 inches in diameter, the intermediate pressure cylinders are 59 inches in diameter, and the low pressure cylinders are 88 inches in diameter, and each is adapted for a stroke of 4 feet 3 inches. The cylinders are all independent of each other, and are steam jacketed. The high pressure cylinders are each fitted with a liner of forged steel, and those of the medium pressure and low pressure are fitted with cast iron liners. All the cylinder covers are of cast steel. Each high pressure cylinder is fitted with a piston valve, and the medium and low pressure cylinders are each fitted with double ported slide valves, all of which are worked by the ordinary double eccentric and link motion valve gear. Balance cylinders are fitted to the intermediate and low pressure valve gear; these valves are also fitted with relieving rings at the back. The reversing engines are of the all-round type with worm and wheel gear, and the low pressure levers are fitted with a slot and adjusting screw to allow of the expansion in the cylinder being altered. The back columns are of cast steel fitted with separate guide faces pinned on, and the front columns are of forged steel. The engines are so arranged that the starting platforms are in the wings of the ship. As is shown on the plate, the main condensers are placed alongside the starting platforms and are of cast brass. The steam is condensed outside the tubes, the circulating water passing through the tubes. There are two large centrifugal circulating pumps of gun metal in each engine room. They are worked by independent engines made by Messrs. Tangye, Birmingham. The feed, bilge, and fire engines are all independent of, and separate from, the main engines, the steam being supplied by a special range of pipes. All the exhausts are led into an auxiliary condenser of cast brass, having a small air and circulating pump, one of these condensers being fitted in each engine room.

The crank, tunnel, and propeller shafting is of forged steel and hollow, supplied by Messrs. J. Brown & Co., Sheffield. The crank pins are fitted with centrifugal lubricating apparatus. The propellers are of gun metal, each propeller having three adjustable blades constructed to work outward.

Steam is supplied by four double-ended boilers 16 feet in diameter and 18 feet long, each with eight furnaces, and one single-ended auxiliary boiler, 12 feet 11 inches in diameter and 9 feet 3 inches long, having three furnaces. The furnaces are corrugated and are 3 feet 9 inches in diameter. The total number is 35, and the heating surface in all the boiler totals 20,108 square feet. The tubes are of naval brass. The working pressure is 155 pounds. The boilers are arranged in two water-tight compartments, the steam pipes being so arranged that the steam from the boilers in either boiler room can be used for the engines in either or both engine rooms. There are two funnels, one to each boiler room. As usual in vessels of the Royal Navy, the boiler rooms are so fitted that they can be closed and the boilers worked under forced draught when desired.

When the eight hours' official natural draught trial took place, the engines developed 10,178 indicated horse power with 99 revolutions. Before making the full power trial it was considered advisable to dock the ship and alter the pitch of the propeller. This having been done, the four hours' full-power forced draught took place, the result being 12,463 indicated horse power with 104·5 revolutions. The average speed of the vessel during the four hours was nearly 21 knots per hour, thus making the Edgar the fastest vessel in the British Navy. To ascertain the efficiency of the ship and machinery, the vessel was taken to Stokes Bay measured mile, and a series of progressive trials extending over two days were carried out, the trials being conducted by Mr. W. H. White, C.B., assistant controller and director of naval construction, and Mr. A. J. Durston, engineer-in-chief, assisted by other officials from the Admiralty, the Fairfield Company being represented by Mr. Andrew Laing. On the full-speed mile trial the engines developed 13,101 indicated horse power average, or 13,460 indicated horse power maximum.

During the whole of the trials the engines and