

The Eighty Ton Gun at Shoeburyness.

The fourth of the series of experiments with the 80 ton gun was carried out at Shoeburyness on November 8, in the presence of the War Office Departmental Committee, and other officers of the Royal Artillery and Royal Engineers. The experiments were previously directed with the view of demonstrating the effect of the fire of the heaviest ordnance against forts of the Spithead type, sections of which were built up on the marshes. On November 8 the test was of a slightly different character, a special target being built up on the range, consisting of a compound slab of iron and steel 5 feet square, the iron being 12 inches thick and the steel 6 inches. Colonel Strangways, R.A., commandant of the School of Gunnery, superintended the operations. The huge gun, mounted on an experimental carriage on a line of rails about 200 yards from the target, was loaded with a charge of 450 pounds of prism No. 1 powder and a Palliser projectile weighing 1,700 pounds. Only one round was fired, but this demonstrated again that the 80 ton gun is still superior to any armor plating that has yet been submitted to its powers. The 18 inches of iron and steel were not only cut clean through, but the target, with its 36 inches of oak backing, was completely smashed up. The experiment appeared to give great satisfaction to the committee, and it is probable that a more exhaustive test will be carried out on a future date.

Transmission of Power by Shafts.

In his recent lectures on "Transmission of Energy," Professor Osborne Reynolds said: "In a revolving shaft, neither the stress nor the velocity is uniform over the section, both varying uniformly from nothing in the middle to their greatest value on the outside; so that their mean product is exactly half the product of the greatest values. The greatest power per square unit of section a shaft can transmit is half the product of the greatest stress into the velocity at the outside of the shaft. Taking, then, the greatest safe working stress of steel at 15,000 pounds on the square inch, taking what is the greatest practical velocity at the surface, 10 feet per second—the speed of railway journals—the work transmitted is 75,000 foot-pounds per second per square inch of section—135 horse power; so that we should have to have a shaft of upward of 7 square inches in section to transmit 1,000 horse power; that is, a shaft of over 3 inch diameter. The friction between such a shaft and lubricated bearings is well known—0.04; so that, calculating the weight of the shaft 24 pounds per foot, we have power spent in friction about 52,000 foot-pounds per mile, that is, one-tenth the total power the shaft will transmit. That is, if we put 1,000 horse power into a 3 inch shaft, making 500 revolutions per minute, we ought, at the end of a mile, to be able to take 900 horse power out of it. If we had to go farther, the size of the shaft might be diminished, so that in the next mile we should again lose a tenth, and if we repeat this process seven times we shall, at the end of seven miles, have left about half the original power put in. It will be thought, perhaps, that a 3 inch shaft is very small to transmit so large a force; this is because the speed of 500 revolutions per minute is inconveniently high for purposes of employing the power; but if it were merely a question of transmission, it would be about the best speed. This, then, shows the limit of the capacity of shafts as transmitters of work."

These two lectures of Prof. Reynolds are full of valuable practical suggestions and information. They are given in full in the SCIENTIFIC AMERICAN SUPPLEMENT 413, and occupy over three pages. All the different forms of transmitting energy are discussed.

To Make Casts Larger or Smaller than the Original.

It is well known that ordinary casts taken in plaster vary somewhat, owing to the shrinkage of the plaster, but it is not possible to regulate this so as to produce any desired change, and yet preserve the proportions. Hoeger, of Gmuend, has recently devised an ingenious method for making copies in any material, either reduced or enlarged, without distortion.

The original is first surrounded with a case or frame of sheet metal or other suitable material, and a negative cast taken with some elastic material, if there are undercuts; the inventor uses agar-agar. The usual negative or mould having been obtained as usual, he prepares a gelatine mass, resembling the hektograph mass, by soaking the gelatine first, then melting it and adding enough of any inorganic powdered substance to give it some stability. This is poured into the mould, which is previously moistened with glycerine to prevent adhesion. When cold, the gelatine cast is taken from the mould and is, of course, the same size as the original.

If the copy is to be reduced, this gelatine cast is put in

strong alcohol and left entirely covered with it. It then begins to shrink and contract with the greatest uniformity. When the desired reduction has taken place the cast is removed from its bath. From this reduced copy a cast is taken as usual.

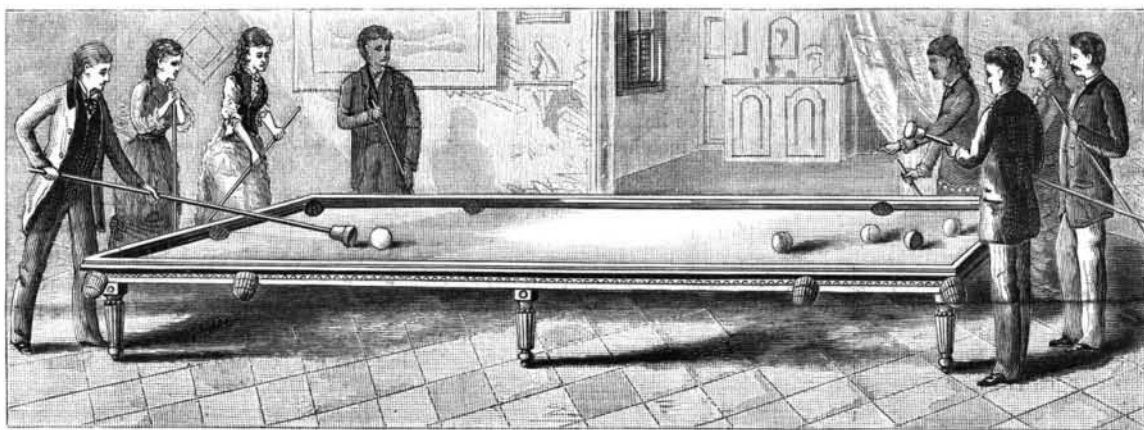
As there is a limit to the shrinkage of the gelatine cast, when a considerable reduction is desired the operation is repeated by making a plaster mould from the reduced copy, and from this a second gelatine cast is taken and likewise immersed in alcohol and shrunk. It is claimed that even when repeated there is no sacrifice of the sharpness of the original.

When the copy is to be enlarged instead of reduced, the gelatine cast is put in a cold water bath, instead of alcohol. After it has swollen as much as it will, the plaster mould is made as before.

For enlarging, the mould could also be made of some slightly soluble mass, and then by filling it with water the cavity would grow larger, but it would not give as sharp a copy.

GAME TABLE.

The platform upon which the game is played is 18 inches high, 8 feet wide, and 20 feet long, and is provided with a spring cushion on the sides and a dead cushion on the ends, and also with pockets in the corners, in the ends, and in the sides near the corners. Smaller platforms may be used for private dwellings. The cue has a concave head which fits snugly upon a heavy 6 inch ball, and in which the ball revolves. Eight persons play the liveliest game, although twice this number can play, or even more if desired, at once. The object of the game is to pocket the balls; but the greater number of cushions or caroms that can be made before pocketing the ball the better. Each cushion, carom, or pocketed ball is termed a "point" and counts five, provided the shot terminates with a pocketed ball. If the shot does not so terminate, caroms and cushions count nothing. All shots must be "called" or "directed." If every point



CALDER'S GAME TABLE.

called or directed is not made, the shot becomes a "chance" shot. Every ball pocketed by chance counts one point, or five to that ball, or the side to which it belongs; but when pocketed by a called or directed shot it counts to the player who drove it in. To play the game sides are chosen, and one-half of each side take position at one end of the platform and the other half at the other end. The balls are distinguished by red spots for one club or side and white spots for the other. Each player has two balls, and plays one at a time. When all have played from one end of the platform the total points are registered, and the players at the other end begin to play. At the conclusion of three rounds the totals are compared, and the side or club having the greater are the winners.

The game has been styled "Captus" by the inventor and patentee, Mr. George Calder, of Mill Creek, Utah.

A New Compass.

Capt. Magnagin has invented and lately introduced in the Italian navy a compass which is thus described by the *Jewellers' Circular*:

"Its needle floats upon a pool of water, tintured with spirits of wine to prevent freezing. The water is contained in a glass vessel, with an elastic vessel to allow its expansion and contraction without breaking the vessel. The needle consists of six bundles of fine magnets, built up of cast ribbon steel, and fixed on a cord. It is inclosed in a hermetically sealed case, which is delicately poised on a brass pivot. The pivot has a sapphire top and a jade point, all highly polished to diminish friction. The advantage of the compass is that the resistance of the water being great to rapid movement is comparatively slight to slow ones, and hence the ordinary movements of the needle are free enough, whereas those due to sudden shocks from without are resisted, with a consequent staying of the indications. Tried on board the Duilio, it is found that the discharge of a 100 ton gun or the motion of the screw does not affect the reading of the compass. The effects of the rolling and pitching of the vessel are guarded against by suspending the floating case a very little above its center of gravity."

How to Clean Stump Lands.

A correspondent of the Ohio *Cultivator* tells how he gets rid of stumps as follows: "Last spring I sent to Indiana and hired a man to come and blast out stumps. I paid 42½ cents per pound for the powder, and 15 cents for each stump taken out, he to furnish caps and fuse. The stumps were mostly white and burr oak, from 20 to 40 inches in diameter, and had been cut from six to twelve years. Sixty-seven of the worst were taken out at an expense of 68 cents per stump. There were only three or four failures in the whole lot. As they were blown into pieces, it was much less work to pile and burn them than when taken out in the ordinary way. I bought material and took out nearly 200 smaller stumps at an expense of about 20 cents each. It took me about ten or fifteen minutes to prepare a blast. I used a 2 inch auger on a 5 foot shaft for boring under the stump. A crow bar will do in soft ground; those who follow the business use a 2½ inch auger. The charge should be put as nearly under the center of the stump as possible. It is not very dangerous to use, as fire will not explode it. The cap is placed in the cartridge and is connected by a fuse. You light the fuse, which in one or two minutes explodes the cap; the concussion of the cap, which is equal to 500 pounds, explodes the dynamite, or Hercules powder. Eight or ten rods is a safe distance if you are facing the stump, for you can easily dodge chunks, if any come toward you. It will not pay to use it very extensively on green stumps, as it will take from three to eight pounds per stump, and will not give very good satisfaction at that."

The Cost of Motive Power from Electrical Accumulators.

MM. Monnier and Guitton have reported to the French Metropolitan Electrical Syndicate upon the use of Faure-Sellon-Volckmar secondary batteries as a source of motive power, with special reference to the driving of tramcars. This is a class of work that has occupied the attention of electricians in England and on the Continent, without much success. Accumulators have been designed to supersede gas engines as sources of power for small users; and it has been considered that if tramcars could be economically driven by stored electricity, the way would be made easy for the introduction of the same system into warehouses and town factories. Hence the success or failure of accumulators on tramways has a secondary interest exceeding that of the immediate application. The experiment referred to by MM. Monnier and Guitton took place on September 26, between Paris and Versailles; the motive power being supplied by 109 accumulators, of the 17.5 kilogramme size,

coupled in such a manner that the power of 50, 70, 95, or all 109 cells could be applied as required. The car itself weighed 3,500 kilos.; the accumulators weighed 3,200 kilos.; while the passengers weighed only 1,100 kilos. The distance run was 23,900 meters; the rise between the point of departure and the end of the journey being 78.4 meters. The total useful work done was 9.17 hour horse power; and the work given out by the accumulators was 17.6 hour horse power. With regard to the return journey, the falling gradient helped the traction; so that the work done both ways is calculated to be 1.51 times that of the outward journey, or a total of 26.6 hour horse power. In the case of an ordinary tramcar the power required for the day's work would be 74 hour horse power. As the cost of one hour horse power at the works is estimated at 51.7 c., the lowest cost of driving an ordinary car would be 38.25 francs per day, without reckoning the lubrication and maintenance of the dynamo electric motors. The *Revue Industrielle*, commenting on these figures, regards them as too favorable; and considers that the cost should be quite doubled. As expressed by MM. Monnier and Guitton, however, they are by no means favorable to the system.

An Interesting Experiment.

During a recent lecture in the Philadelphia Academy of Pharmacy, glass jars were passed around containing samples of cultivated disease germs. Potatoes cut in halves had been lightly smeared with a coating of substances containing germs. The bacteria were nourished on the moist surface of the potato, and presented very interesting appearances. Different results were obtained from different bacteria. Some of the half potatoes were covered with an ordinary deposit of mould. On others the disease germs had developed into thin, peculiarly shaped patches of fungous growth of bright blue, red, yellow, and greenish colors. Others had grown into an intricate and extensive network of fuzzy fibers, the growth on the surfaces of two or three potatoes reaching over and covering a space having a diameter of eight or nine inches.