AN ELECTRIC POWDERLESS, SMOKELESS, FLASHLESS, AND SOUNDLESS GUN.

BY OBED C. BILLMAN.

While but two patents have been issued by the United States Patent Office for electro-magnetic guns, and these within the past two years, yet it appears that scientific men gave this problem their attention a number of years ago.

In 1845, Charles G. Page, of the Columbian (now George Washington) University, Washington, D. C., wrote an article, which was published in the American Journal of Science and Art, vol. 49, page 132, in which he stated:

"Another curious instrument is the galvanic or magnetic gun. Four or more helices arranged successively constitute the barrel of the gun, which is mounted with a stock and breech. The bar slides freely through the helices, and by means of a wire attached to the ends toward the breech of the gun, it makes and breaks the connection with the several helices in succession, and acquires such velocity from the action of the four helices, as to be projected to the distance of forty or fifty feet."

The primary principle involved in the construction of these guns consists in impelling the projectile by the magnetic action of a solenoid, the sectional coils or helices of which are supplied with current through devices actuated by the projectile itself. In other words, the sections or helices of the solenoid produce an accelerated motion of the projectile by acting successively upon it.

A principle somewhat similar is involved in the construction of electro-magnetic rock drills and dispatch tubes. Patents granted to Marvin, Nos. 361,829 and 368,405, are instances of the former, and patent No. 259,817, granted to Cheever, is an instance of the latter.

In the electro-magnetic rock drills, the plunger is moved by the action of a sectional solenoid, through the coils of which current is supplied through contacts closed by the plunger itself.

The electro-magnetic dispatch tube consists of a carrier or dispatch tube surrounded by a series of coils or helices, a galvanic battery having one pole permanently connected with one end of the coils or helices by a series of branch wires, the other end of the coils or helices being left open circuited, a traveling carrier provided with circuit-closing devices for completing the circuit between the open ends of the helices, and a conductor connected directly to the other pole of the stationary battery.

An advance sheet of Consular Reports, dated February 27, 1902, contains an account of an electro-magnetic cannon in Sweden, as given in a report by Consul-General Bordewich, under date of "Christiania, January 25, 1902."

"Prof. Birkeland (who two years ago was sent by the government to northern Norway to study magnetism, the aurora borealis, and cloud formations) is engaged in the construction of a cannon with electro-magnetism as the motive power in place of explosives. A small model of the invention throws projectiles weighing a pound with great force."

A patent was issued to Kristen Birkeland, of Christiania, Norway, for the invention above referred to, March 15, 1904, No. 754,637, and this was the first patent issued by the United States Patent Office for an invention of this class.

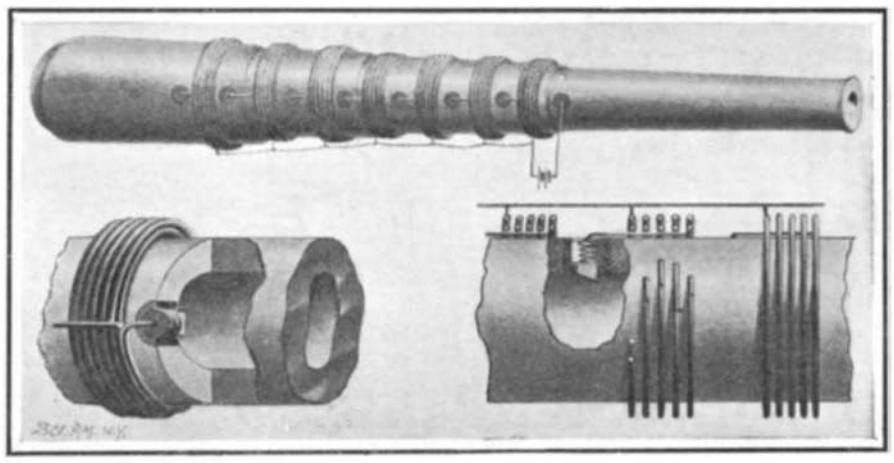
The application of Birkeland was filed January 2, 1902, and Samuel T. Foster, Jr., a native of this country, residing at Victoria, Tamaulipas, Mexico, having read the account of the Birkeland invention, as referred to in the Consular Report, filed an application for Letters Patent December 10, 1902, but owing to the difference in the construction of the guns disclosed in the two co-pending applications, no interference was declared.

The broad claims originally filed by Mr. Foster were held to be anticipated by the Journal article above referred to, but a patent was finally allowed and issued to him February 6, 1906, for an electric gun, No. 811,913, the second patent issued in the United States for an invention of this class. One of the practical difficulties encountered in the construction of a practical electro-magnetic gun arises from the fact that the modern methods of electrical calculation would indicate that in order to obtain service velocities with service projectiles an enormous number of windings would be required, thus involving the use of a barrel whose length would be prohibitory.

Another difficulty arises from the fact that in order to give the projectile a service velocity, without an enormous number of windings, an abnormally heavy current—that is to say, a current beyond the safe carrying capacity of the solenoid—is required, and hence the temperature of the solenoid will be raised to a point sufficient to destroy it.

Prof. Birkeland attempts to overcome these difficulties by supplying an abnormally heavy current to a coil and then cutting off the current from the coil before the temperature of the coil has reached such a point as to injure or destroy it, claiming that the rate of increase of the temperature depends upon a number of factors other than the current.

Mr. Foster says, in the specification of his patent:



THE FOSTER ELECTRO-MAGNETIC GUN.

The projectile is impelled by the magnetic action of a solenoid, the sectional coils of which are supplied with current through devices actuated by the projectile itself.

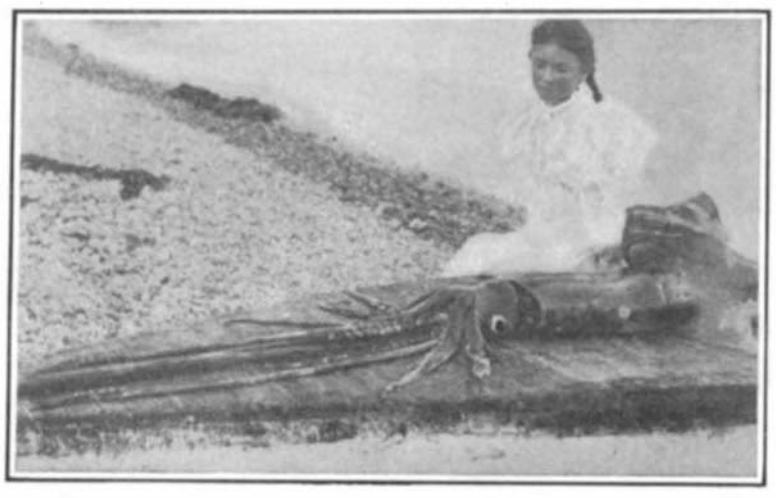
"All projectiles used in this gun must have magnetic properties, and projectiles of iron or containing large portions of iron are preferable. That projectile having the greatest magnetic permeability is most suitable for this gun." The Foster gun is very simple and comprises a barrel surrounded by a series of coils or helices, a series of openings arranged along the barrel and provided with insulated walls, a series of connector-plugs mounted in said openings and normally adapted to be engaged by the projectile, a series of springs mounted in said openings and adapted normally to hold the connector-plugs in contact with the insulated walls, and an electric generator connected with said helices and barrel.

In this way means are provided for energizing and de-energizing the coils or helices in regular sequential order by the projectile completing and breaking their circuits and for automatically keeping the center of their electro-magnetic field just ahead of the projectile until it has reached the center of the last electro-magnetic field. When the projectile has reached the last electro-magnetic field, means are also provided for opening the battery circuit and releasing the projectile of all further electro-magnetic action of the gun.

PHOTOGRAPHING A DEVIL FISH—THE CHAMELEON OF THE SEA.

BY CHARLES FREDERICK HOLDER.

The strange spiderlike creature known as the octopus or devil fish comes of an ancient lineage. Its family tree includes shelled animals which held sway in the Silurian sea millions of years ago. The late Prof. Newberry, of Columbia University, referred to a certain *Orthosceros titan* which may have weighed a ton—a torpedo-shaped creature with a shell twenty feet in length, which doubtless played havoc among the denizens of the abysmal regions of ancient seas. Again, there were others, with nautilus-like shells, as large as a cart wheel; and the most forbidding living animal to-day, the one shrouded by the greatest mystery, is the giant squid, a cousin of the octopus, which lives in deep water, only occasionally being found, as was one recently, off the Southern Californian coast, floating, a great white mass, so bulky that the boatman who saw it told me that not only could he not take it aboard, but it was so huge that he could not tow it in. The arms of this specimen he described as being as large as a man's leg, and doubtless this ten-armed devil fish attains a length of one hundred feet and a weight of several tons.



A Sixty-pound Devil Fish so Powerful That One Man Could Not Tear Its Arms from the Boat.

PHOTOGRAPHING A DEVIL FISH—THE CHAMELEON OF THE SEA.

The keeper of the Avalon zoological station, who had an uncanny experience with a large devil fish, or octopus, related the incident to the writer. He said: "I was fishing at the time with several partners out of San Francisco. It was our custom to go out to the banks around the Farallones and try for deep-sea fish. It was a rough place, nearly always blowing half a gale, foggy and dangerous, and often we had to let lines go and run in to lie in the lee of the rocks. One morning I was hauling in the trawl when it stopped coming. I thought I was foul of a rock, so pulled hard, and after a while felt it give and begin to come up, but very heavy. It's slow work hauling in a trawl, taking off a fish and killing sharks that get hooked, and it was some time before I got what I supposed was a rock. I had just taken a turn about a rowlock with the line, to rest, when it sagged, and looking over I saw a great mottled ball out of which shot a long arm that took hold of the gunwale and held on. We often caught devil fish, and there was a demand for them in the market, so I tried to pull it up; but another arm came up, as big as my own, while another crept over the side near my partner, who started up, shouting that it was coming aboard. I looked over and saw a great red mottled mass hanging to the bottom of the boat; then I reached for a knife—a kind of cleaver—my partner doing the same. The devil fish was caught by several of the trawl hooks, and tried to fasten to the boat to get rid of them. Its arms shot out of the water like fingers, and when I saw one the size of my arm and growing bigger near the base, I didn't wait, but slashed at them right and left, cutting them on the rail. Some of the tentacles near the body looked as big around as my leg, and the whole arm or feeler was nearly twice as long as a man. The arms were probably twelve feet long, and the body two or three times the size of a man's head. The whole mass was so big that we were glad to chop it to pieces as it came aboard, and then to punch it away from the boat with oars and get rid of it; it was too heavy to take aboard, especially in a seaway."

A number of large devil fishes have been taken near Tacoma, and when spread upon the grass are seen to be formidable creatures, with their enormous button-like suckers, which combined constitute a power sufficient to drown men in the open water. Monterey has produced a number of large specimens which would terrify strollers along the weed-covered rocks at low tide.

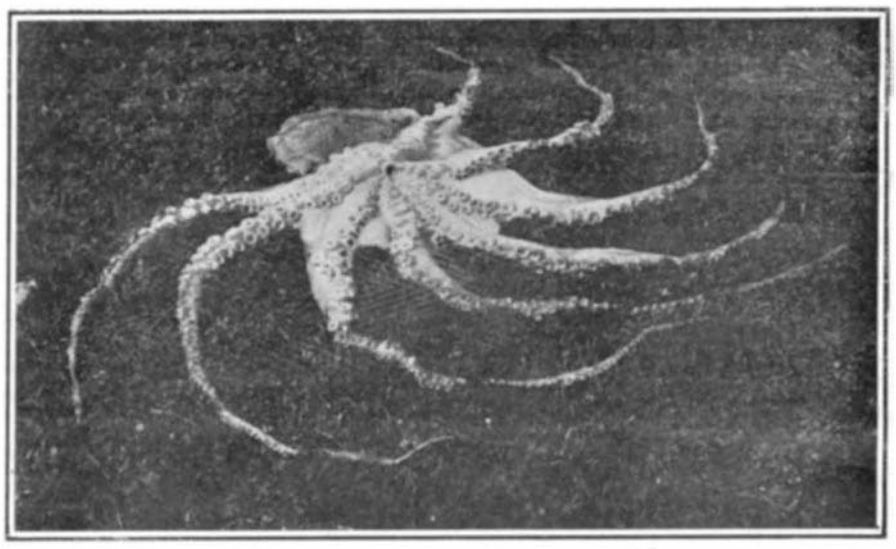
It was my good fortune to have under examination at Avalon, Santa Catalina, at various times, several large living devil fishes and a squid, the latter eight feet in length. The devil fishes were first noticed on a point of rocks at the north end of Avalon Bay. I was lying on a rock watching the movements of some land crabs which kept retreating from the water as the tide rose, when suddenly a crab dashed frantically from the water, and out after it "galloped"—there is no other word for it—a devil fish nearly two feet across. The animal continued the chase a short distance, lifting its tentacles in the air in a sort of overhead motion, then finding the pursuit hopeless it withdrew, with the peculiarly unpleasant writhing, gliding motion characteristic of these animals, and upon reaching the water stationed itself just at the edge, so mimicking the color of the bottom that when I glanced away and looked suddenly back, I could not at once distinguish it. This devil fish had the appearance of a cat watching for mice, and when a crab was seen it would shoot out a long, attenuated tentacle and attempt to seize it. By carefully insinuating my way to the water's edge I quickly grasped the specimen, and after a short struggle tore it from the rocks and secured it. At various times I had from three to five devil fishes in an inclosure, where I could watch them change color and test their strength. In confinement, if the tank bottom was dark, they assumed various tints, generally a dark reddish brown; but the largest one was a tiger-like creature, about three feet across with a ground of livid white covered with black or dark gray blotches, giving it a truly fiendish appearance, especially as the eyes were conspicuous and appeared to emit lambent gleams. The change of color was marvelous in its rapidity. In a special tank

in which two of these prisoners were confined they occupied the corners, facing outward, with arms either coiled under or above them. At any offensive movement on my part, presenting my hand under water, the color scheme would change. A blush appeared to me; but with the tiger, the black and white chameleon, him of the stripes, spots, and blotches, the approach of my hand under water was a menace, and all his movements were essentially cat- or tiger-like. Perhaps you have seen a lynx, wildcat, or mountain lion creeping upon its prey or preparing to jump when treed. There is a concentration of legs, trembling muscles, constant stepping of the feet in a limited area, bending of the back and switch of the tail, long or short. In this devil fish eight arms coiled about it like snakes trembled and vibrated as I thrust my hand down into its den. Colors raced over it as I bent over and watched it closely from the outside, where I could see through the polished plate glass every movement, throb, and change. At a distance of eight inches I could feel the curious current of water shot at my hand by the torpedo-like siphon; see the delicate weed in the water blown aside; and as my hand approached nearer and nearer the octopus crouched low, like a cat, its eight arms fumbling inanely, a trembling, Medusa-like object. Nearer came my hand, and like a flash of lightning, so sudden that it was startling, the octopus shot out one of its arms, that like a snake or lariat seemed to be flung at me, the rings of the end suckers striking my hand sharply, the entire animal springing forward, as shown in our illustration, the photographer, who had placed his camera for the purpose of taking some characteristic poses, catching the animal just as it was about to spring. To brace itself, it threw one arm to the right, one below, one to the left, fastened by many suckers to the glass, while two others, as the sequel will show, seized its companion.

I now gradually withdrew my hand from what may be considered the attack, to allow the photographer to insert a plate. This accomplished I again advanced my hand, and doubtless to the devil fish the situation was momentous and alarming. It crouched a moment, moving forward and back, then launched itself bodily at the enemy (my hand), striking it with several tentacles, dropping back quickly and crouching for another spring, the action so sudden and forceful, so startling, that the corner octopus sprang into the clear water and for a moment literally danced, floated, or poised, uncertain which way to go, then dropped to its corner again, rendering itself as inconspicuous as possible.

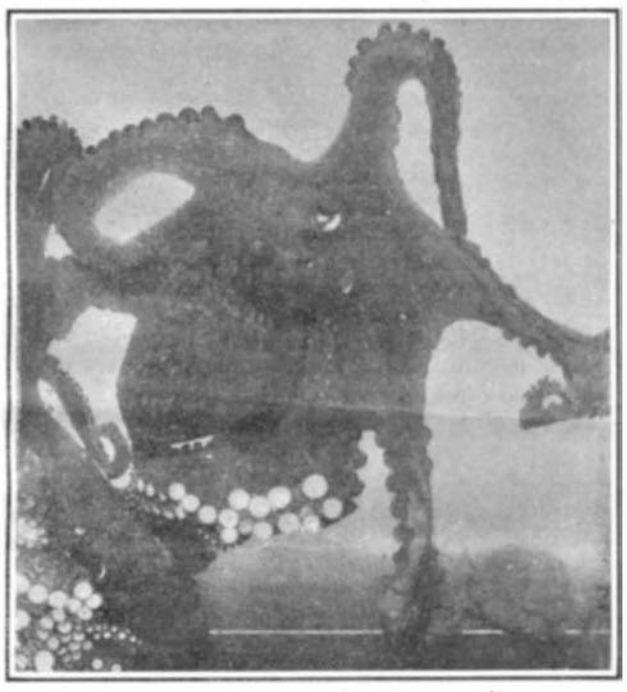
Again I retreated, to allow the photographer to reload with another plate and refocus; the big devil fish meantime crouching and spreading itself out, color melting color, tint, and shade over its broad back, directing its siphon stream at its companion. All being ready, I again advanced, pointing my finger at the animal and moving to within a foot of it. I could see it darken, take on a deep red hue, and then it flung itself bodily at my hand, and endeavored to cover it by a peculiar encompassing motion designed to smother it. A crab or fish is taken in this way, the web being spread over it, shutting the victim in its arms, and the scores of suckers forcing it to the mouth, where the nipping black parrot-like beak is brought into play. But the smothering action is invariable; suggestive and horrifying if we imagine it attempted by an animal thirty feet across. To meet this leap, holding the hand steady, and grasping the octopus, is a nerve-test to a novice. I confess that it was distinctly disagreeable to me, though I have caught and handled many of these animals of various sizes; but I held the devil fish while the photographer took a third picture, showing the duel a second after the contact. The octopus had enveloped my entire hand, and by grasping it firmly I pressed my little finger over its bills, my palm over its eyes, and held it with all my strength.

Upper Surface of a Devil Fish Measuring 20 Feet.



Under Surface of the 20-Foot Devil Fish.

pass over the entire surface; and in a large squid I can only compare it to heat lightning, a rapid and continued series of flushing and paling, from deep brick red to gray. It was very evident that the animals differed much in pugnacity. Some did not resent



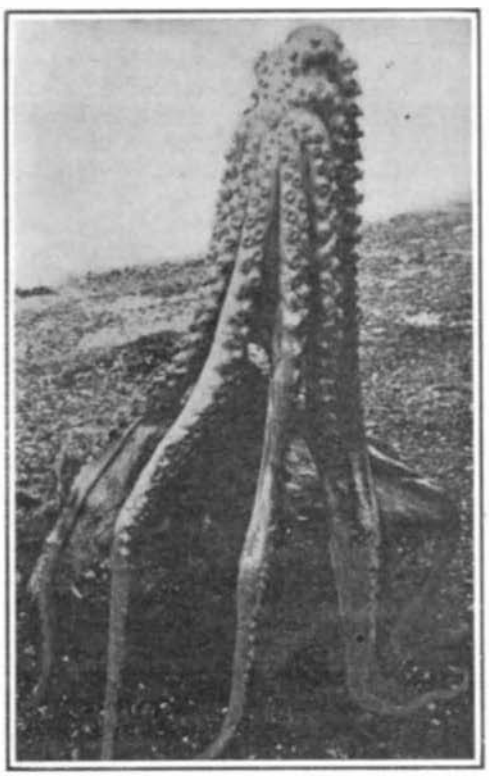
Devil Fish About to Leap.

my touching them; others merely threw a tentacle in my direction, while one never touched me, but directed its siphon at my hand under water and sent a violent current in that direction, apparently endeavoring to blow my hand away. It was fascinating to observe the "range" this water gun had, and how by seeming intuition the devil fish could direct it at my hand as I slowly moved it about while attempting to attract the animal's attention in an opposite direction. The assumption was almost irresistible that the siphon, that is well shown in the figure, just beneath the eye, had a sense of its own, and could be directed at my hand and made to follow it while the eyes of the octopus were looking in another direction. But the latter are elevated, and doubtless not a move of my hand (a supposititious enemy) which was passed about and around it in the tank was lost to this uncanny chameleon of the sea.

This devil fish, that flushed and danced about in the water, assuming strange postures — now crouching in a corner, now poised midway—was in a sense indifferent to

Two Fighting Devil Fishes Preparing to Spring at Each Other.

Holding the Devil Fish to be Photographed.

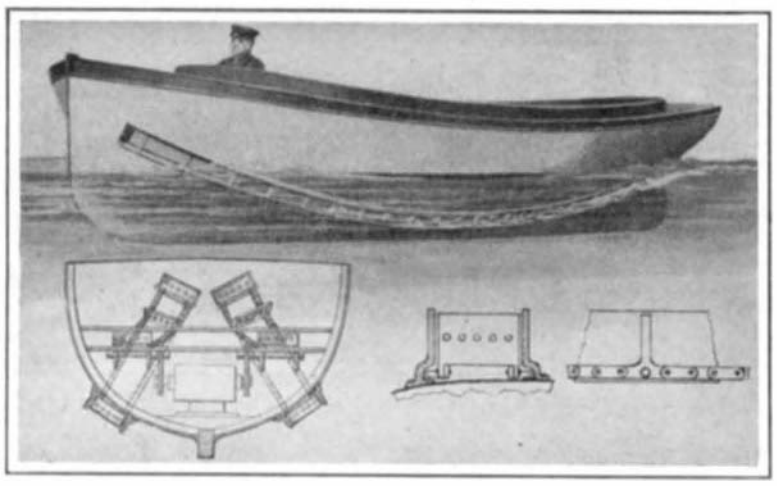


Ready to Spring.

PHOTOGRAPHING A DEVIL FISH—THE CHAMELEON OF THE SEA.

The animal held me tightly with one tentacle over my thumb, another through my fingers, and bracing itself by throwing out three anchors below, which caught the bottom and two sides of the tank, and three behind.

I now endeavored to complete my pseudo-victory by lifting the octopus, but I could not tear this small animal from the sides. The devil fish held on, pumping a stream of ink at me in its rage. By using my other hand I finally succeeded in prying it off; then I pretended to be caught and tried to release it. But the warlike chameleon of the sea would have none of it. It threw its tentacles about my hand, pulled it



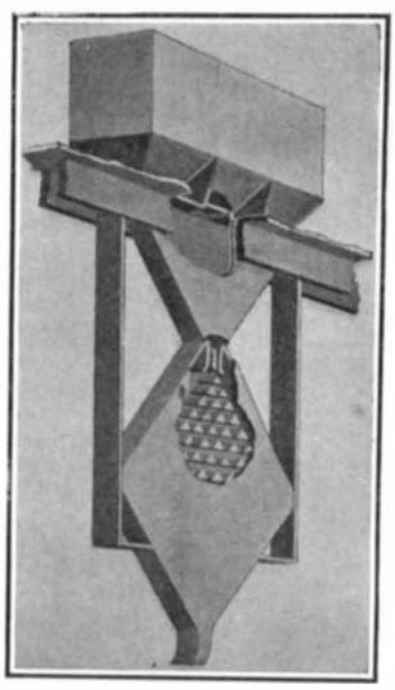
A BOAT DRIVEN BY PADDLE-CHAINS.

slowly down into the corner, covered it as well as it could, but did not bite me. If my hand had been a crab, fish, or other octopus, it would have been attacked and bitten, but for some reason it did not attempt it; in a word, the animal was perfectly harmless, which I knew; there was only a slight scratch on my hand to tell the story, and this was received when I wrenched it away.

This was a laughable conclusion to the threatening and warlike movements of the octopus. The animal, in point of fact, was a "bluffer," and well calculated to demoralize one not acquainted with its limitations. I know of no animal that has the power, by mere attitudinizing and the assumption of menacing gestures, to inspire the same degree of horror in the spectator not familiar with it. This was illustrated when I requested an attendant when displaying this octopus to explain to visitors that it was perfectly harmless, then to enrage it, and ask spectators to take it out of the tank and place it in another, a substantial inducement being offered in one instance. But among the many observers not one could be found who would touch the quivering, color-changing creature poised for its harmless spring; the terror inspired was complete and intense.

APPARATUS FOR MIXING DIFFERENT GRADES OF RICE.

Pictured in the accompanying engraving is an apparatus for blending different grades of rice or other cereals. The design of the apparatus is such that the blending is effectively accomplished in a very simple manner without the use of power-driven machinery. It comprises essentially a series of feed hoppers for the different grades of cereal, a large receiving hopper into which the feed hoppers empty, and a mixing chamber into which the receiving hopper discharges. The mixing chamber has the form of a lozenge, and the interior is provided with a grid or a series of transversely-extending bars of triangular cross-section, which are so spaced as to form passages for the rice to insure a thorough mixing. The series of bars also forms a lozenge-shaped figure, but its sides are not parallel with the chamber, so that tapered channels are provided between the grid and the chamber which, at the top, assist in crowding the rice through the grid and at the bottom flare open to accommodate the flow. The lower end of the chamber is formed with a spout adapted to guide the cereal into a bag or other receptacle. A gate is provided in the lower end of the receiving hopper, whereby the operator can control the flow of the grain. It will be noted that the bars are not promiscuously distributed in the mixing chamber, but that there is a method in their arrangement. They are set in horizontal rows, the bars in one row alternating with those in the next row above or below, and each bar set with its lower face horizontal, so that the other two inclined faces serve as deflectors for the grain. The materials flow downward by their own gravity and, consequently, no power mechanism is required. A patent on this improved mixer has been granted to Mr. P. M. Lyons, of Gueydan, La.



APPARATUS FOR MIXING DIFFERENT GRADES OF RICE.

A NEW METHOD OF PROPELLING A SHIP.

Instead of employing the conventional screw propeller or the paddle-wheel, Fénélon Pélissier, of Gonaives, Haiti, has hit upon an entirely different principle, which he has protected by a patent.

Mr. Pélissier uses two endless chains which pass around the hull from bow to stern, and which carry blades. The chains in question run in and out of openings in the hull, fore and aft, and are guided by sprocket wheels. In order to drive the chains by the ship's engine, sprocket wheels are provided within the hull, which sprocket wheels are carried on a shaft connected with the engine shaft. Thus it is possible to drive the ship continuously.

In order to guide the chains effectively, special keelsons are employed, so formed as to constitute chain-runs, as shown in one of our sectional views.

The chains on opposite sides of the craft are driven independently from the engine. In order to turn quickly, one chain may be driven forward, and the other toward the stern. In order to move forward or astern, both chains are driven in the same direction.

A special arrangement has been devised for applying the invention to existing ships.

Fireproof Celluloid.

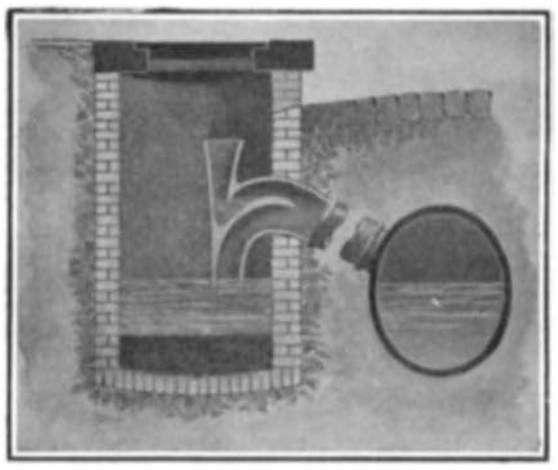
A process has recently been invented for rendering celluloid non-inflammable. In its broad principles the process may be said to consist of introducing into the mass of celluloid, when it has reached the highest degree of fluidity during its manufacture, a certain quantity of a salt, such as phosphate, bicarbonate of ammonia, or magnesium, or still others. These salts possess the property of giving off under the influence of heat a great quantity of gas, which stops the progress of the combustion. It is claimed that quantities of uninflammable celluloid can be manufactured by the new process into any form and size desired.

Feeding Cattle on Sugar.

Recent statistics show considerable progress in the employment of "doctored" sugar for the feeding of cattle. The consumption, which reached 50,000 pounds at the end of December, 1905, rose to 200,000 pounds in January, 1906. If this custom were general, 500,000 tons of sugar would be consumed annually, say half of the present production, giving every day 100 grammes (3.5 ounces) of sugar per head of black cattle. The sugar can be doctored only within the inclosure of the sugar-refinery and under the conditions determined by a regulation of the public administration. To 100 kilos (220 pounds) of sugar are added 2 kilos (4.4 pounds) of salt and 20 kilos (44 pounds) of oil-cake, or of any powder whatever approved by the administration. This mixture circulates freely and is sold at from 20 to 22 francs ($4.00 to $4.40) per 100 kilos, say about the price of the oats, with which, at the moment of serving, it is mixed in the proportion of 20 per cent. Thus 1,000 kilos of oats and 200 kilos of sugar will give 1,200 kilos of sugared oats, which will be distributed, for example, at the rate of 8 kilos instead of 10 kilos of pure oats. This fodder, therefore, is economical. For oxen the sugar is mixed with chaff. Doctored sugar is beginning to be used also for the disinfection of stables, for its combustion gives a plentiful release of formol.

MEANS FOR FACILITATING THE CLEANSING OF STREET CATCH BASINS.

In place of conducting the water of the streets directly into the sewer main, it is customary in large towns to provide catch basins at intervals into which the gutters drain. These basins are then connected by siphons with the sewer main, so that when the contents rise above a determinate level, they will be drawn off through the siphons. Heretofore the only means of cleaning catch basins has been to dip out the contents in bucketfuls and convey them to some other basin, whence they are siphoned off into the sewer after the necessary level has been reached. This method of cleaning the basins is both laborious and expensive. However, a new form of siphon has recently been invented by Mr. William H. Engelbrecht, of Prince Bay, N. Y., which simplifies the cleaning process. This siphon is shown in the accompanying engraving. It will be observed that the shorter leg, or that portion of the siphon which enters the basin, is formed with a double channel or passage, one channel lying above the other. The upper channel is provided

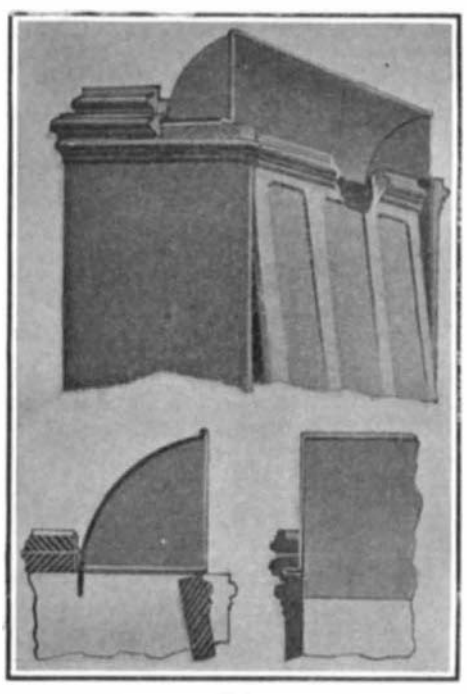


MEANS FOR FACILITATING THE CLEANSING OF STREET CATCH BASINS.

with a funnel mouth opening upward. In use the contents of the basin are dipped up and poured into this funnel, whence they flow down the longer leg of the siphon to the sewer main. The upper passage is so designed as to form a trap or water seal, so that after cleaning out the basin a quantity of clean water is emptied into the funnel, to clear the trap of foul liquid or sediment, and provide an effective seal against the escape of sewer gas through the siphon into the basin.

SOUND DEFLECTOR FOR PIANOS.

It does seem rather odd that the source of music in a piano should be completely boxed up in a case, so that the sound waves must first penetrate the case before they can reach our ears. To be sure, some pianos are provided with a swinging front, and a hinged lid at the top, which may be opened to prevent complete muffling of the sound; but the sound is deflected downward by the hinged front, or passes directly up to the ceiling when the top of the case is open. In the accompanying engraving we illustrate a device which may be placed over the open top of the piano to deflect the sound waves issuing therefrom, and direct them to the audience in the room or concert hall. The deflector is a very simple device of light construction, comprising two end boards connected by a curved back of such form as properly to direct the sound into the room. The end boards are formed with cushioned flanges adapted to rest on the side walls of the piano case, while the curved back is formed with cushioned extension, which fits between the side wall and thus prevents lateral displacement. In consequence, the deflector does not need to be fastened in place, but may be readily set in position or removed without operating any fastening means. By its use the full volume of sound passes in concentrated form into the room without being diffused. A patent on this sound deflector has recently been secured by Mr. T. W. Freeborne, of 228 Spring Street, Newport, R. I.



SOUND DEFLECTOR FOR PIANOS.