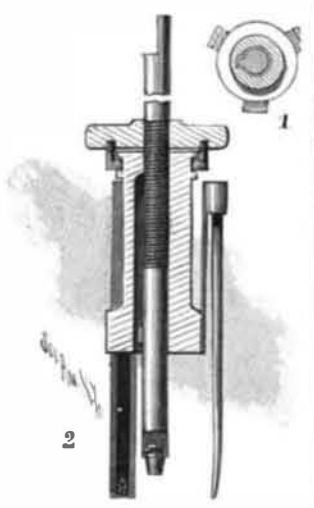
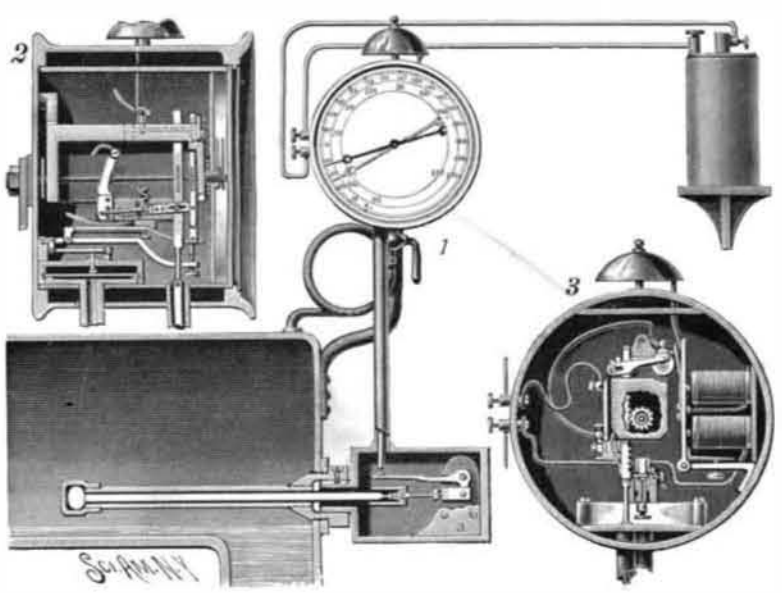
PHILBROOK'S DENTAL TOOL.

This tool, patented by Dr. B. F. Philbrook, of Dunlap, Iowa, is especially adapted for reducing a root to receive a cap, crown or bridge, and may be used in connection with dental engines, hand pieces and right angled attachments. Fig. 2 is a central longitudinal section and Fig. 1 a plan view through the tool. The mandrel is exteriorly screw-threaded, and has an interchangeable pivoted point adapted to enter the nerve seat of a tooth. A hub or tool carrier sliding loosely on the mandrel has in its inner wall a longitudinal groove receiving a feather on the mandrel, so that the tool carrier is free to slide upon, but revolves with the mandrel. An annular groove at the upper end of the tool carrier receives fixed pawls fast to a threaded milled nut, by rotating which the carrier is moved up or down on the mandrel. Two, three or four springs, secured at one end to the lower end of the tool carrier, have at their other ends each a socket to receive the shank of a cutting tool extending in the direction of the operative end of the mandrel. These tools are adapted to engage the peripheral surface of the root at the top, are preferably made of copper or aluminum, and have diamonds or diamond dust in their inner surface at their working ends. The tools are also longitudinally grooved to hold corundum or emery, and in operation, as they are rotated, the springs constantly hold them in engagement with the periphery of the root, which is thus reduced without changing its contour. The tool holder being adjustable upon the mandrel and controlled by the milled nut, the cut can be increased or lessened at will, one size hub or tool carrier being well adapted to reduce any of the human teeth or roots for crown or bridge work.



A GAGE INDICATING PRESSURE AND TEMPERATURE.

Both pointers of this gage are designed to move in unison as long as the boiler is working under normal conditions, the heat indicator hand traveling faster than the pressure gage hand when an abnormal increase of heat takes place in the boiler, an alarm being at the same time sounded. The improvement has been patented by Mr. Albert F. Mallick, Jamestown, North Dakota. Fig. 1 is a side elevation of the improvement as applied and Figs. 2 and 3 are sectional views of the gage. Extending into the boiler just above the crown sheet is a pipe on whose inner end is a cap forming a socket for the head of a rod extending loosely through the pipe and into an outer casing. The rod is preferably of glass or of any material that expands and contracts less than the pipe. The outer end of the rod is pivotally connected with the short arm of a bell crank lever, on the free end of the long arm of which rests a vertical rod connected with the indicator casing. The upper end of the rod is connected by a rack and pinion with a shaft which moves a pointer on the face of the dial, the expansion and contraction of the pipe within the boiler communicating a corresponding movement to its inclosed horizontal rod, and through the bell crank lever to the vertical rod connected with the indicator, and thus indicating the changes of temperature in the boiler.



MALLICK'S BOILER ALARM GAGE.

On the same dial is also indicated the pressure of steam in the boiler, a pipe from the steam space connecting with a diaphragm which is also connected by adjustable levers with a rack in which meshes a pinion on the shaft which carries the pointer. But when the temperature in the boiler becomes abnormal, a swinging motion is imparted to a lever pivoted on one of the racks, whereby a battery is brought into circuit with a magnet within the casing to actuate an armature lever and sound a bell. The alarm is sounded when the steam pressure is reduced and heat is not withdrawn from the water, or when the temperature is increased and steam pressure remains the same, abnormal conditions of the boiler being at once indicated, so that the attendant may apply the proper remedy to avoid or prevent an explosion.

How to Repel Train Robbers.

"How to Repel Train Robbers" is the title of a short paper in the North American Review for February by Lieut. John T. Knight, of the United States Army. His principal suggestion is that the express car should be placed at the rear end of the train, so as to compel the attacking party to divide its forces. The express messenger should be able to communicate instantly to the cars by electric alarm bell or other effective means, and the passengers should be able to get repeating shotguns from a glass-front case in each car. Thus a messenger could give warning as soon as any one approached his door at an unusual time or locality, and the passengers and trainmen, being between the robbers attacking the engine and those attacking the express car, would have a decided advantage. Moreover, it would be necessary, in order to cover the engine, the express car and a sufficient number of points between, to employ so large a force of men that the probable profits per man would not be large; and this would discourage the industry. Mr. Knight has been in the cavalry service in Oklahoma Territory; in sending a guard to protect a paymaster he always ordered it to keep 100 to 150 yards behind the wagon carrying the money, so as to compel the attacking party to divide its forces.

The lieutenant's suggestion seems sensible. If we are going to fight train robbers, the advice of expert fighters is worth attention. But, as we have heretofore said when discussing this subject, the only rational remedy is to civilize our country. Repulsing or punishing the robbers is not a satisfactory remedy, certainly not satisfactory to passengers, most of whom, in any train, even in the Wild West, come under the appellation "tenderfoot." To deter would-be robbers from getting together is the desideratum. That is the main element in the success of the police in large cities in repressing violence; they keep suspicious characters on the move as much as possible, so as to have them out in sight and let them know that they are being watched. Indeed, Lieutenant Knight evidently regards the idea of making robberies unprofitable (by forcing the robbers to see that they will have to have a large force of men in order to accomplish their object) as his most valuable suggestion. This will deter them, if anything will, for their sole object is money, says the Railroad Gazette.

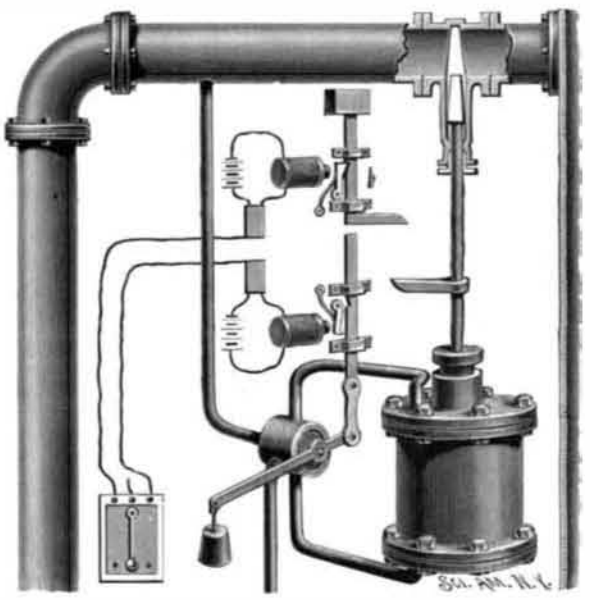
Economy in Cotton Transportation.

It was noted in our columns, says the Manufacturers' Gazette, a month or more ago, that an experiment was to be tried of fetching from Galveston a large lot of cotton by steamer, with a barge in tow. This has been successfully accomplished, and the cotton landed in good condition at one of the Boston wharves. It was an undertaking of more or less concern to marine insurers, and of some interest to those in the cotton trade, because of its originality and the doubt surrounding its success. The barge was a four-masted schooner, and was capable of taking care of itself had it broken loose from the steamer by the parting of the hawser. The latter was nine inches in circumference and was payed out 1,500 feet. At no time was it brought taut, because of its great weight and length. The steamer and barge carried together 7,059 bales, the former 2,962 bales and latter 4,097 bales. The consignees state that there was a saving on the shipment in freight over ordinary ocean transportation of $6,500. What there is in the future for this method of shipping cotton to New England ports we do not venture to say, but it is suggestive of what may be done in lowering the cost of freight from Southwestern points to a figure that will do away with Southern advantages in this particular that now exist.

With favorable freight rates for New England mills, long-stapled cotton from the Mississippi bottom lands and from the Southwest, such as is required for fine counts of yarn, can be landed at these mills as cheaply as at the mills in the Piedmont district. For fine yarns, cotton can or may be soon delivered to Northern mills as cheaply as to the mills of the South Atlantic States. If the mills of South Carolina, for instance, attempt to go into fine yarns, they will have to go outside of their own vicinity for any considerable quantity of the cotton that they may require.

ELECTRICALLY CONTROLLED VALVE GEAR FOR PUMPING STATIONS.

The improvement represented by the illustration is more especially designed for use in controlling supply pipes connecting a pumping station with a distant stand pipe, to enable the engineer at the station to open or close the supply pipe, connecting it with or disconnecting it from the stand pipe. A patent has been granted Mr. William Engberg, of St. Joseph, Mich., for the invention. The gate valve in the supply pipe is on the upper end of a piston rod passing through suitable stuffing boxes to a piston head in a cylinder connected by pipes at its upper and lower ends with the casing of a valve in which is a hollow valve plug, and the latter is connected by a small pipe with the supply pipe, so that water under pressure may pass to the valve plug. In this valve are opposite ports, adapted to alternately register with the pipes from the top and bottom of the cylinder, a channel also connecting with a discharge pipe. A lever carried by the stem of the valve plug supports at one end a weight and is connected at its opposite end by a link with a bar sliding in suitably arranged bearings, a notch in the bar being adapted for engagement by a spring-pressed armature operating in conjunction with an electro-magnet connected through a relay with a switch at the distant pumping station, under control of the engineer in charge. In vertical alignment with the sliding bar is another sliding bar, its upper end carrying a weight, its lower end having a foot adapted to engage an arm on the piston rod, and having in one side a notch adapted to be engaged by the spring-pressed armature of another magnet, also connected through a relay with the switch, the movement of the switch lever closing the circuit for either relay, and causing the corresponding magnet to attract its armature. As represented, the gate valve is open and the piston in its lowermost position. To close the valve, on the movement of the switch lever, the upper magnet attracts the armature lever and thus unlocks the upper sliding bar, which is moved down by the weight at its top and strikes the upper end of the lower bar, moving the latter downward and turning the valve plug to supply water under pressure to the lower end of the cylinder, and open the channel connecting its upper end with the discharge pipe. The piston consequently moves upward and closes the gate valve, the arm on the piston rod at the same time engaging the foot of the upper bar and elevating it, where it is held in locked position on the breaking of the circuit, and the releasing of the armature lever, which then engages the notch, the other bar being also locked in its lower position by the other armature lever. The operator always turns the switch lever to normal position after the circuit is temporarily closed.



ENGBERG'S VALVE GEAR.

A New Russian War Ship.

The Fremdenblatt gives the following particulars of the new Russian ironclad Georgi Pobiedonostzeff. This great war ship, the construction of which was begun on August 12, 1889, has steel armor from 8 inches to 16 inches thick on the sides, while the casements are protected by 12 inches and the traverses by 9 inch to 10 inch plates. The total length of the ship, including the ram, is about 340 feet. The vessel is 69 feet broad and 26 feet 7 inches deep, with a displacement of 10,280 tons. It is supplied with two engines constructed in England, which will develop 10,600 horse power under ordinary pressure and 16,000 horse power under forced draught. The new man-of-war is armed with six 12 inch and seven 6 inch guns, as well as 14 quick-firing guns of English manufacture.

Hard Rubber Casting Patterns.

BY JOHN T. USHER.

India rubber has been employed by the writer with very satisfactory results for making small patterns. Such patterns can be made and finished more cheaply than those made of metal and in many cases more cheaply than those made of wood. Patterns made of rubber are especially adapted to card pattern work, which consists of a number of patterns grouped together and attached to a metal plate, or upon a wooden board, together with the gate and spun channel pattern, the iron moulder being enabled thereby to produce at one operation a mould complete, ready for pouring in the metal. The rubber patterns are also eminently adapted for use in connection with a follower board, for grouping generally or to be used singly. The advantages claimed for rubber patterns are: 1. Their extreme lightness; (2) durability; (3) strength; (4) freedom from shrinkage and warpage; (5) freedom from the attacks of water or acids, heat or cold under ordinary conditions.

It is presumed that all the readers of the India Rubber World are acquainted with the manipulation of rubber in a general way. Therefore only a summary of the methods employed in making the preliminary patterns and moulds from and in which the subsequent patterns are produced will be given.

The preliminary patterns can be made of wood, beeswax, modeling clay, or modeling composition; in fact, of any substance which can be shaped to the desired form and which will retain this form long enough to allow an impression to be taken in plaster of Paris. In many cases the preliminary pattern can be formed all the more easily by making a face pattern of either of its sides. Then pour an impression of the face pattern and form the preliminary pattern therein or thereon with beeswax, and then pouring or making a plaster mould on or of that as the case maybe, the face pattern or mould upon or in which the preliminary pattern is formed serving as one-half of the mould. The other half mould being made by pouring or making a counter impression directly on or in the first impression of half mould, cutting rings, grooves, or depressions some distances from the mould surfaces proper to locate the two halves of the mould in their respective positions.

The moulds can also be made in plates or metal without any preliminary pattern in the usual manner, if preferred. When the plaster moulds are to be used to make patterns in, they must, after being made, be invested in a metal flask. After the first pattern has been made, it may be used as a pattern for making all the subsequent plaster moulds needed. When a preliminary pattern has been made or is available, the plaster moulds should always be made directly in the flasks, thereby avoiding the necessity of inverting the moulds after they have been made.

To pour an impression, and in making moulds of plaster in order to get the best results, the article to be poured should be first shellacked and allowed to dry, and then soaked in water for ten minutes or more, and then poured while it is still wet. If the article to be poured is made of some other material than plaster, it may be dipped in water and then poured while still wet, but on no account must oil or any greasy substance be used to insure an easy separation if the latter are to be used for making the patterns in.

In pouring an impression, the amount of water necessary to saturate the plaster is first poured into a soft rubber bowl, a pinch of common table salt is then added and stirred in, the plaster is then added by shaking it out of a scoop in order to loosen it as much as possible, then let it stand a few seconds until thoroughly saturated; the surplus water can then be poured off, and the plaster stirred or mixed. If this has been done properly, the mixture will then be of the consistency of thick cream. When salt has been added the plaster must be used immediately, as it commences to set very quickly. In no case must the plaster be put into the bowl before the water, as it will nearly always come out lumpy after being mixed, and it is also liable to crumble away during the process of vulcanizing. In pouring an impression, a little of the plaster is first poured on the highest part and is then made to flow to and around the lower parts as quickly as possible by taking the article in the hand or hands and jarring it sharply; a little more plaster is then added again on the highest part and the jarring repeated, and so on until enough has been added. Should the jarring be omitted when pouring, or too much plaster be added at one time, the chances are that the work will be imperfect.

Should the shape of the moulded article be such that the parts cannot be separated by inserting the point of a knife blade between them, without the risk of breaking, then the part that has been poured must be carefully cut away until the shell and surface can be seen through the plaster. This cutting can in most cases be done in such manner that the parts can be lifted away in large pieces, leaving the part it is desired to save intact.

In making hard rubber patterns, where the body of the pattern or any part of it would be more than ¼ inch in thickness, it will be necessary to so arrange the moulds as to produce a shell pattern.

When cores are used, the plaster of which they are made must be mixed with carbonate of lime, as whiting, chalk, or marble dust, in such proportions as to allow of its being readily dissolved in acid after the patterns have been vulcanized. This removes the cores, the plaster of Paris being in itself insoluble. A mixture of half plaster and half whiting will be found to be very satisfactory for making the cores.

If the patterns are immersed in muriatic or sulphuric acid, the whiting will dissolve very quickly, leaving the plaster as a precipitate, which can be easily washed out with water, without in any way injuring the pattern. Paper also makes an excellent core for this purpose; in fact, better than plaster. When metal moulds are desired in preference to those of plaster, it will be found easier and better to first make the plaster moulds, and then, after carefully shellacking them, to use them as patterns from which to cast the metal moulds.

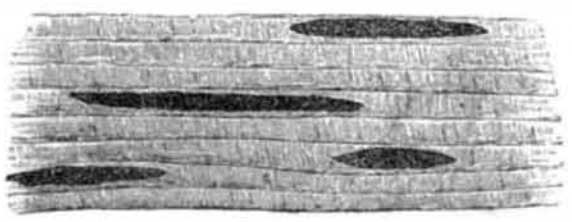
Before packing the plaster moulds, the surfaces proper should be coated with collodion. After being packed, they should be put into boiling water for a few minutes to soften the rubber prior to closing the moulds. The pattern may then be vulcanized. After vulcanization they must not be taken out of the moulds until thoroughly cold, otherwise they are liable to warp.—India Rubber World.

A PARASITE VERY NUMEROUS IN HOGS.

BY PROF. JOHN MICHELS, LATE U. S. DEPARTMENT OF AGRICULTURE.

During the four years in which I had charge of the inspection of hogs for the United States government, my attention was drawn to a parasite which was so numerous that it was found almost daily during the search for Trichina spiralis under the microscope.

This parasite, shown in the cut which accompanies this article, has the appearance of an elongated worm with a blunt point at each end. It assumes many forms, sometimes being narrower and longer than shown in the drawing and at other times broader and shorter, and even almost round. The interior is com-



posed of granular matter, which with a high power proves to be embyros, the worm-like body being only a sac.

These sacs are sometimes very numerous in the muscle, while each sac contains many hundreds of the embyros; taken together the number existing in some hogs must be counted by the million.

This parasite, which is considered to be harmless, is called by the United States Department of Agriculture "Tarcosperidium," and by the Germans "Psorospermien," and it is remarkable, considering their great number in a food product, that little appears to be known of their life history.

I have made preparations of the sac for microscopical examination, and expelled the embryos from the sac, which prove to be the shape of half moons.

Rapid Fire Guns.

One of the most important lessons of the naval battle of the Yalu River was the demonstration of the great importance of the rapid firing guns, especially when the ships to which they are opposed are not protected. The recent trials at Indian Head will probably lead to the adoption of rapid fire mechanism hereafter for our 6 inch guns. Two 6 inch breech-loading rifles fitted as rapid fire guns have been tried. One was fitted with a Dashiell breech mechanism, and the other with Lieut. F. F. Fletcher's new breech mechanism. The record claimed for the Fletcher gun is said to be five rounds in 54 seconds. This invention is a close competitor of the Armstrong gun of the same caliber, six rounds in one minute being fired from a gun of that make a short time ago. The Krupp gun of 15 centimeters, which is equivalent to 5·87 inches caliber, was fired at the Meppen ground at the rate of eight aimed shots per minute, and eight shots were fired at a target 3,000 meters away in 40 seconds. On the British Royal Sovereign a series of ten aimed rounds were fired from an Elswick gun in 1 minute 57·8 seconds. The French rapid fire Canet guns 5·91 inches caliber have been equally successful. In England an 8 inch Armstrong gun has been tested which gave very remarkable results. The interval between the shots for an ordinary 8 inch piece is about 1 minute 15 seconds; the new Armstrong gun fired shots at an interval 15 seconds with a crew of only five men.

The mount for a rapid fire gun is hardly second in importance to the gun itself, as quick loading and firing would be of very little value without special facilities for training, elevating and sighting; mounts are now receiving great attention both at home and abroad.

Water.

Pure water consists of 2 parts hydrogen and 1 part oxygen. Chemical name hydrogen oxide, chemical symbol H_2O. Pure water is a colorless, odorless, tasteless, transparent liquid, and is practically incompressible. Water freezes at 32° F. and boils at 212° F. At its maximum density—39·1° F.—it is the standard for specific gravities, and 1 cubic centimeter weighs 1 gramme.

1 United States gallon... =	231 cubic inches. 0·13369 cubic foot. 8·3311 pounds—distilled water. 8·34 pounds—in ordinary practice.
1 cubic foot.... ..... =	62·425 pounds at 39·1° F., maximum density. 62·418 pounds at 32° F., freezing point. 62·355 pounds at 62° F., standard temperature. 59·64 pounds at 212° F., boiling point. 57·5 pounds at ice.
1 cubic foot..... ...=	7·485 U. S. gallons.
1 pound .....=	27·7 cubic inches.
1 cubic inch.....=	0·03612 pound.

A column of water 1 inch square and 2·31 feet high weighs 1 pound.

A column of water 1 inch square and 1 foot high weighs 0·433 pound.

A column of water 33·947 feet high equals the pressure of the atmosphere at the sea level.

One pound per square inch equals a column of water 2·31 feet in height.

0·433 pound per square inch equals a column of water 1 foot in height.

Water is an almost universal solvent; consequently pure water does not occur in nature. Sea water contains nearly every known substance in solution.

The latent heat of water is 79 thermal units. When water freezes, it gives off its latent heat. The latent heat of steam is 536 thermal units. When steam condenses into water, it gives off its latent heat.—Catalogue of Holly Manufacturing Company.

The Iowa Meteorite.

The Boston Commonwealth says: A close examination of the fragments of the Winnebago County (Iowa) meteorite has been made by Prof. H. A. Newton, of Yale College. More than a thousand pieces of the meteor are in the museum at Yale, and the examination of them results in some interesting deductions. The meteor was a very noticeable one and attracted the attention of very many persons over a large extent of country, from the comparison of whose stories the details of the meteor's approach have been determined. One man, a surveyor, had the presence of mind to direct his theodolite to the cloud left after the explosion, and an accurate reading of his circles gave most reliable data. The fragments were scattered over several square miles, and vary in size from a grain of dust, almost, to some eighty pounds. It is estimated that the meteor must have been at least five hundred pounds in weight and was perhaps as large as a small flour barrel; and that it approached the earth with planetary velocity, or about ten miles per second, in an orbit not unlike that of the earth itself until within about five miles, when it burst. After the explosion, the velocity of the pieces could not have been greater than that of sound, or about a quarter of a mile per second. After the primary explosion, there must have been numerous minor ones, evidence of which is to be seen in the fragments themselves. Their velocity was so great that the friction of the surfaces against the air caused the material to fuse and to flow backward over the edges. Different stages of fusion are clearly noticeable, and in addition many cases of fresh fracture, which must have taken place when the fragment was quite close to the earth.

How to Arrest a Boil, Carbuncle, or Malignant Pustule.

Dr. Barker writes to the Medical Summary that he has used the following procedure for several years with unvarying success: Take a large hypodermic syringe, holding say half an ounce, fitted with a small needle. Fill it with a 1 to 500 solution of mercuric chloride, insert the needle into one of the peripheral openings, in case it is a carbuncle, and wash out the little cavity. Then direct the needle toward and into the surrounding induration and force a little of the solution into it. Treat each opening and its corresponding peripheral circumference in the same manner, carefully washing out the necrosed connective and other tissues that have become separated. Repeat this daily with the solution, gradually reduced to one-half the original strength, until all induration has disappeared and granulations have begun to appear. If the first injection be thoroughly performed, the spread of the carbuncle will be arrested at once and there will be no more pain. Washing out the little cavities is painless, but the injection into the indurated tissues is not free from pain. The same treatment is applicable to the little feruncles that invade the meatus auditorius externus and the inner surface of the ala nasi.—Medical and Surgical Reporter.