is particularly noticeable in thin films of mica and selenite, and it serves as an excellent means for selecting eighth and quarter wave plates, which are useful in the study of circular and elliptical polarization.

As stated in a former article, the writer intends to deal sparingly with the theoretical part of the subject, that having been treated extensively in many physical works and in books especially devoted to light and optics. "Ganot's Physics" is prominent among works of its class, and "Light," by Lewis Wright, and "Polarization of Light," by William Spottiswoode, are excellent books bearing directly on the subject. The writer knows of no better means of securing a good knowledge of polarized light than by reading these three books.*

Returning to the matter of the thin films: It is quite difficult to produce a perfectly uniform thin film of selenite, owing to the brittleness of the material. For this reason, mica is generally used, as it possesses considerable flexibility and toughness. The common method of cleaving off thin films of mica is to split off a moderately thin plate and then separate the laminæ at one of the corners by bending it between the thumb and fingers. A medium sized sewing needle secured point outward in a slender handle is probably the best instrument for teasing the laminæ apart; but after the separation begins, the thin end of the ivory handle of an ink eraser seems to serve the purpose exceedingly well.

A score or so of plates are split, and examined one by one in the Norremberg doubler, by laying them on the mirror and turning them in their own planes, while the polarizer and analyzer are parallel. Should the plates exhibit any unevenness under the test, they should be at once rejected. Such as exhibit an even tint should be preserved carefully, and examined further to determine which, if any, possess the required qualities. Not every piece of mica will split evenly, therefore it may be necessary to make several trials before success is attained.

Should the film, when placed on the stage, exhibit a dull plum color, slightly inclined toward red, when the polarizer and analyzer are parallel, it produces a difference of phase of half a wave length, and is called a half wave film. As a matter of course, if two films of like thickness, superposed and arranged with their axes in the same direction, produce the same color under the same circumstances, they are one-fourth wave films; and if a pair of films exhibit the same color when similarly arranged on the mirror of the doubler, they may be regarded as eighth wave films, as the polarized beam passes twice through the film to produce the same tint. These films should be carefully mounted between glass plates, either dry or in benzole balsam, the latter being preferable.

The practical application of the eighth and quarter wave films will be treated in a future paper. Beautiful and instructive designs made from thin films are described and illustrated in Wright's "Light," to which reference has been made.

* These books may be had at this office at publishers' prices.—ED.

WINDING ENGINE FOR AUSTRALIA.

The winding engine illustrated by the accompanying engraving, which we take from *The Engineer*, was

GERBOZ'S ALARM THERMOMETER.

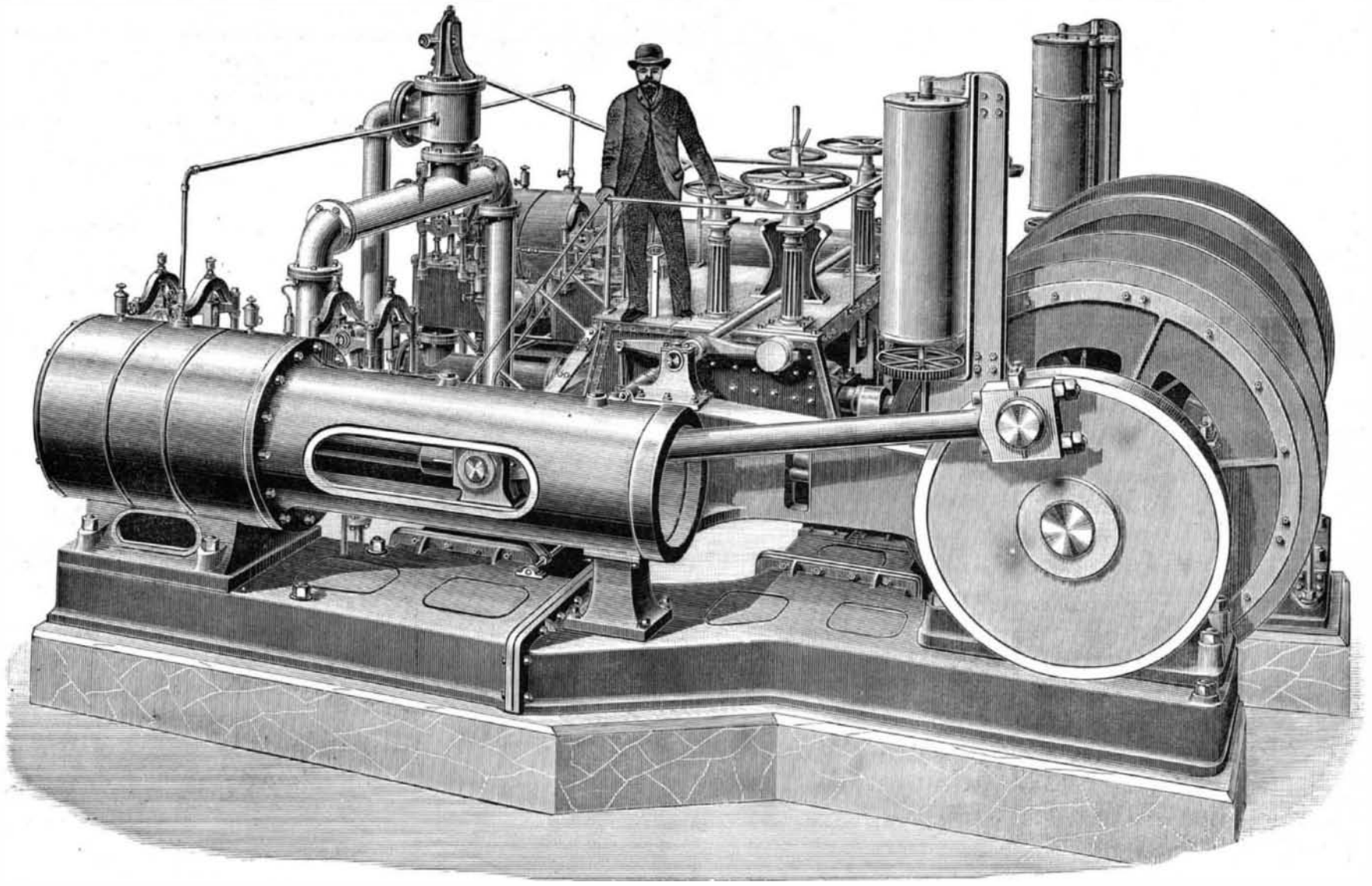
made by Messrs. Tangye, of Birmingham, England, under the instructions of Mr. J. D. Baldry, M.I.C.E., for use in the extensive coal mines of the Australian Agricultural Company, of New South Wales. This design, which, in some respects, is a departure from general practice, has proved satisfactory in all respects, and has met with special approval from mining engineers in the colonies. The cylinders are 32 inches in diameter by 48 inches stroke, and are steam-jacketed, with separate steam pipes and valves for supplying the jackets direct from the main supply pipe. The steam and exhaust valves are of the Cornish type, double beat equilibrium, two separate nozzle boxes being fitted to each cylinder containing the valves.

The crank shaft is of Siemens-Martin steel, 10½ inches in diameter at the journals. The bearings are in three parts, of gun metal, with wedges and screws for adjustment, and arranged so that they can be removed without taking out the shaft.

The hauling drums are 6 feet in diameter by 3 feet wide, are loose on the shaft, and are driven by steel clutches. Each drum is provided with a brake, fitted with oak blocks. Between the engines is a raised platform, on which are placed the clutches, brakes, wheels, reversing lever, steam valve handle, and rods for working the condenser steam cocks. The engines, platform, etc., are mounted on a strong cast-iron bed plate.

As these engines are to haul about 2,000 yards, they are fitted with an arrangement for accurately indicating the position of the tubs at any point in their journey. This consists of a vertical drum rotated by gearing, and having traced upon it a spiral line, along which the positions of the various stations are marked. A pointer moving on a screwed shaft, driven by worm gearing from the main drum, traverses the spiral, and so indicates the position of the truck.

The speed of hauling is 9 miles per hour, and about eighty skips, of 10 cwt. each, make up a load.



COLLIERY WINDING ENGINE FOR AUSTRALIA.

THERMOMETER WITH ELECTRIC ALARM.

The thermometer figured herewith is designed for giving indications as to the temperature of silos, grain depositories, piles of coal, or certain fabrics that are apt to burst into flame spontaneously and set fire to factories or ships.

The thermometer used is a metal one, of the Bourdon type, inclosed in a strong cast iron box, provided with a cover of the same nature. This latter is omitted in the figure, so that the internal arrangement may be seen. This box is everywhere perforated, so that the thermometer may be in contact with the surrounding air. The apertures, however, are small enough to prevent the entrance of particles of coal or fragments of seeds, etc.

The apparatus, when placed in a coal bunker or a silo, is connected with the exterior by means of conductors that traverse the surrounding substance, and that serve to indicate, at every moment, that the temperature has or has not reached a dangerous height. As soon as the needle of the thermometer strikes an index, placed at the degree of temperature that it is important to know (50°, for example, showing that there is danger of fire), a bell rings.

We shall now give a few details of construction: As the rotary axis of the needle and that of the index are on the same line, contact between these two pieces takes place at the same point, whatever be the respective angular position of these two parts. Instead of being a simple rod, making one piece with the maneuvering button, the index is composed of a barrel that forms one piece with the button, and upon which is mounted (1) the index needle properly so called, (2) a spring for holding the index in a constant position with respect to the barrel, and (3) a toothed pinion. This latter gears with a cog wheel upon the same axis with the polarized armature of an electro-

magnet. This armature moves in a plane at right angles with the axis of the bobbins of the electro, and as near as possible to the extremity of the core.

The electric communications are established and the two proposed controls are made as follows: The cable consists of three conductors. One of these runs from the negative pole of the battery to the thermometer needle and one of the wires of the electro. Another runs from the index to the alarm bell, and from thence to the positive pole of the pile. The third runs from the positive pole of the pile to a galvanometer, then to a button or interrupter, and from thence to the second wire of the electro.

When a contact has been established by the button, the current, on traversing the galvanometer and causing it to deflect, indicates that the two wires and the electro magnet are in proper order. When the current traverses the electro, it polarizes the cores, and causes the armature, and consequently the movable index, to revolve around the barrel; and under the action of the armature, the index thus tends to move from the maximum point toward the needle, and, with it, to establish a contact that rings the alarm bell.

When the current is broken by the button or interrupter, the armature, as the current no longer traverses the electro, returns along with the maximum needle to its position of rest, under the action of the spring mounted upon the axis of the index.

Were the maximum index made to bear against a metallic rack, forming an electric interrupter in a special circuit comprising an electric counter, we might count the number of contacts between the maximum point and the needle, and thereby ascertain the latter's position.

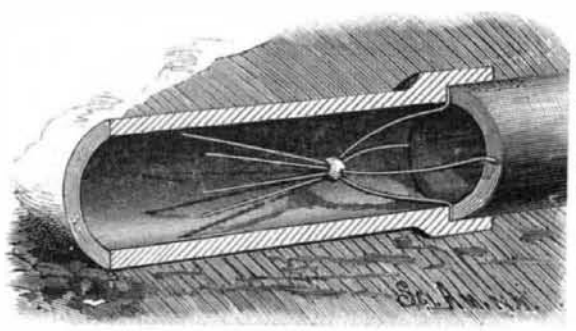
It will be seen from what precedes that the apparatus may be submitted to a permanent control that permits of making sure that it is ready to operate regularly. Such control is of prime importance, since this thermometer is designed to be used in inaccessible places (coal bunkes, silos, and so forth), the dampness of which might interfere with the contacts being kept in a proper condition. Besides, the motions of a ship on the sea might cause a breakage of the cable, notwithstanding that it is covered with steel. These two things cannot occur without attracting attention. —*La Nature.*

Sea Water as a Preservative.

The Vigo Bay Treasure Company, of London, lately received a curious collection of articles taken from the treasure galleons sunk in the harbor of Vigo, Spain, in 1702. There are specimens of logwood and mahogany that, in spite of their 184 years' submersion, are in a perfect state of preservation. Dyers who have experimented with the logwood state that it is even better for dyeing purposes than the wood now imported. The mahogany, too, is very fine and solid. One log has arrived 12 feet long and 22 by 32 inches square, which is now being sawed up to be used in the manufacture of furniture and walking sticks for mementoes. The chief curiosity, however, is an ancient pulley block, 4½ feet high by 3 feet broad, with four solid copper sheaves, 18 inches in diameter. It is of solid oak, and was probably used in hoisting heavy articles of merchandise or the anchors. The wood is perfectly preserved, but an iron band is completely corroded away, while the copper wheels are only slightly oxidized.

DRAIN TILE PROTECTOR.

This simple and efficient device, the invention of Mr. A. L. Shoults, of Bloomingburg, O., is for preventing the entrance of animals into drain tiles and pipes; it can be readily applied to or removed from drains of different diameters. The protector consists of a series of spring arms provided with right angled arms adapted to enter into the joints of a drain, and supporting in the



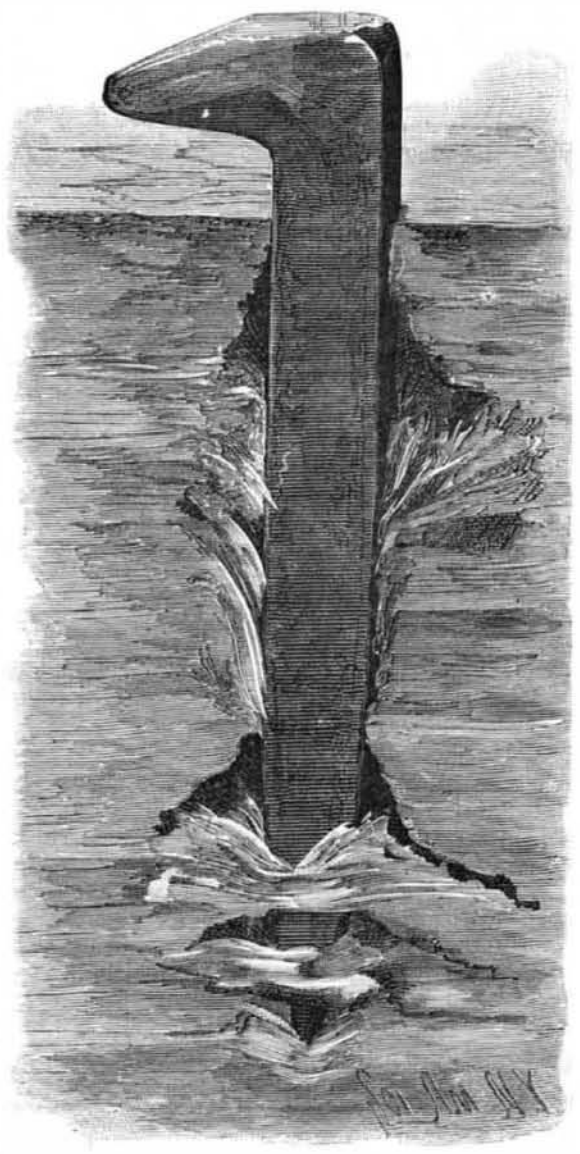
SHOULTS' DRAIN TILE PROTECTOR.

center of the pipe a number of diverging pointed wires, whose points lie in the direction of the open end of the pipe. The use of this protector does not interfere with the free discharge from the drain, while it effectually prevents small animals from entering by presenting a series of sharp points protecting the entire area of the drain. The device is applied by compressing the arms sufficiently to permit the fingers to be introduced into the mouth of the tile, when it is pushed along until the fingers enter the joint. The points of the wires are centrally held in the tile, and cannot be easily displaced.

RAILWAY CROSS TIES.

To the Editor of the Scientific American:

I noticed in your paper of January 16 a letter from Geo. H. Ford relative to railroad cross ties, and I would say that, from extensive observation and special examination, I fully agree with him that there are more ties destroyed by mutilation of the timber by the spikes than there is by natural decay. This is es-



SECTION OF WHITE CEDAR TIE WITH SPIKE DRIVEN IN.

pecially the case with soft wood ties, such as pine, chestnut, white cedar, cypress, and redwood. And the whole difficulty arises from driving a large, dull edged, wedge pointed spike into the tie without first making a hole for it, or else having a special point on the spike, which practically does the same thing.

It is imperatively necessary to good work that the fiber of the timber should be severed before the body of the spike enters it. The whole damage is caused by the point, and is caused in the following manner: The point being dull and nearly always imperfect, as at present manufactured, does not readily cut the fiber of the timber, and it doubles around the point, and is carried down and packed until it is sufficiently dense and hard for the dull edge to cut it; after which the same process is repeated until the spike is driven home.

I send you herewith a section of a white cedar tie with a spike driven in and split open, illustrating this theory, and I think you will agree with me that it is mechanical barbarism to continue such practice. The mode of fastening the rail to the tie and the link and pin coupler are the two twin relics of a past age, but I think from present indications that their days are numbered, and that something better will soon take their place. WILLIAM GOLDIE.

West Bay City, Mich.

"Can Imagination Kill?"

This is, perhaps, hardly the correct form of question that the *British and Colonial Druggist* puts to itself in discussing the death of the young woman at Hackney under circumstances in which Keating's insect powder largely figured. As the powder appears by Dr. Tidy's experiments to be perfectly harmless, the suggestion is not unnaturally made that the deceased, who was possibly of a hysterical, highly imaginative turn of mind, took the powder in the full belief that by its means her death might be accomplished. The writer of the article in our contemporary, we think wrongly, brings forward two remarkable instances of what may be regarded as practical jokes with melancholy terminations. In the case of the convict delivered up to the scientist for the purpose of a psychological experiment (the man was strapped to a table and blindfolded, ostensibly to be bled to death; a siphon containing water was placed near his head, and the fluid was allowed to trickle audibly into a vessel below it, at the same time that a trifling scratch with a needle was inflicted on the culprit's neck; it is said that death occurred at the end of six minutes), fear must have played no inconsiderable share in the fatal result, and we do not know whether all the vital organs were in a sound condition, though they were presumably so. The old story of the case of a college porter is also one in point. The students entrapped him into a room at night, a mock inquiry was held, and the punishment of death by decapitation decreed for his want of consideration to the students. It is small wonder that, under the dominion of fear and belief in the earnestness of his tormentors, the sight of an ax and block, with subsequent blindfolding and necessary genuflexion, a smart rap with a wet towel on the back of his neck should have been followed by the picking up of a corpse.—*Lancet.*

The Sleeping Disease.

There is a singular and invariably fatal malady, called lethargus, peculiar to the negroes of certain districts on the western coast of Africa, which has never, we believe, been noticed in the medical journals of this country except in the *Massachusetts Medical Journal*, from which we copy. But this is not surprising, when we consider that a knowledge of it is practically unimportant to the profession outside of the districts where it occurs. As a curiosity, however, in the form of a disease, it cannot fail, we think, to interest the medical faculty of our country, and we therefore present, in brief, the main facts concerning this singular disorder. As the name implies, the principal, and in fact the only, symptom that presents itself is lethargy; and one case is essentially a stereotype of all.

The patient, usually a male adult, is seized, without any premonitory symptoms, with a sensation of drowsiness, which continues rapidly to increase, in spite of all efforts to throw it off, until he sinks into a profound and seemingly natural sleep. This continues for about twenty-one days, when death takes place. Throughout the course of the disease, the patient preserves a quiet and peaceful countenance, may be easily aroused for a short time, will take nourishment, and generally answer a few questions in a perfectly rational manner. The pulse, respiration, and temperature remain normal throughout, the pupil is neither dilated nor contracted to any noticeable extent, and the urine and fæces are voided with comparative regularity. With the exception of the abnormal tendency to sleep, nothing exists to denote disease.

Many careful post-mortem examinations have been made by competent men, but nothing of an abnormal character has been found, while every remedy that could possibly be of any avail has been used without any apparent beneficial effect. They sleep on, and quietly glide into eternity in spite of professional skill.

CHILD'S CARRIAGE.

To the center of the axle of this carriage is attached a vertically arranged hoop, to which are rigidly secured two side standards, shaped as clearly shown in the engraving. The upper end of each standard is notched to receive the knife-like edge of brackets fixed to either side of the carriage body, which is thus supported by and is free to swing upon the ends of the standards. The range of motion of the body is defined by rubber or spring buffers fixed to the hoop. The front stop or

ENGLAND'S CHILD'S CARRIAGE.

wheel is carried by a bracket attached to the axle. To the rear of the hoop is secured a forked arm, having a handle. The sunshade may be moved to and secured at any desired position on the hoop. In moving the carriage, the forward stop or imitation wheel is slightly raised from the ground by depressing the handle, when the carriage can be moved as desired. When the fixed wheel rests upon the ground, it acts as a brake, preventing the carriage from moving forward by its own gravity when placed upon an incline.

This invention has been patented by Mr. William England, P. O. Box 374, Galveston, Texas.