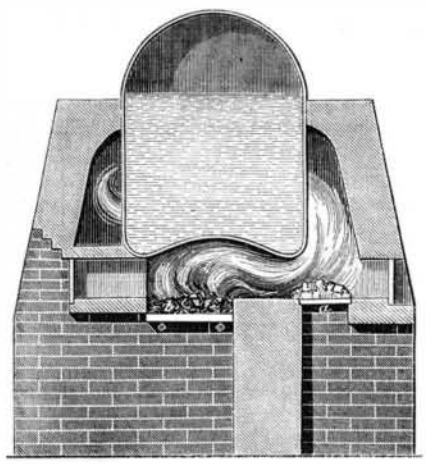
gases from the dry fuel fire pass through the bagasse, drying the latter and carrying its gases into a mixing chamber at M.

The idea of using two fires in the combustion of fuel is not new. We annex a sketch of a method invented in 1785 by James Watt, and intended to facilitate the ignition of the volatile portions of bituminous coal. This device can perhaps be successfully employed in the burning of wet fuels.



Mr. Watt observes:—"In some cases I place the fresh fuel on a grate, as at *a*, and beyond that grate, at or near the place where the flame passes into the flues or chimneys, I place another smaller grate, *b*, on which I maintain a fire of charcoal, coke or coals, which have been previously burned, until they have ceased to smoke, which by giving intense heat, and admitting some fresh air, consumes the smoke of the last fire."

Electrical Atmospheric Phenomena and Disease.

At a late meeting of the Manchester (England) Philosophical Society a paper was read by Thomas Moffat, M. D., on the prevalence of certain forms of disease in connection with snow, hail and rain storms. During observations made for eight years it was found that persons subject to apoplexy, paralysis, and vertigo were affected in a most marked manner when hail and snow storms prevailed. A table had been formed of 236 cases of the above diseases and upwards of one thousand observations were made with the electrometer, and it was shown that the nervous centers were affected according to the electrical condition of the atmosphere. On the approach of great storms the air was electrically negative, and diseases of the nervous centers and convulsions were common. Other forms of disease also frequently accompanied such electrical conditions of the atmosphere, such as cramps, vertigo, and diarrhœa. It therefore appears that negative electricity in the atmosphere plays an important part in relation to the morbid conditions of the human system.

As in England so in America, the condition of the atmosphere affects the human system almost in the same manner as related in the above abstract of Dr. Moffat's paper; and although we are not aware of any observations having been made to determine the electrical condition of our atmosphere during storms, we have no doubt butthe causes are the same on both continents. During the prevalance of east, northeast, and southeast winds on the American Atlantic coast, persons subject to rheumatic and nervous diseases generally suffer acutely. Is there any remedy for this?

A Four Thousand-Dollar Prize.—The French government has founded a biennial prize of 20,000 francs for the work or the discovery most worthy of honoring the national genius, to be decreed in the public annual session of the five academies of the institute. In the recent meeting of the five academies, when the subject of decreeing the first of these prizes was brought up, it was decided, with remarkable promptness and unanimity, to bestow it upon Mr. Fizeau, in consideration of his beautiful researches on the rapidity of light, measured on the surface of the earth.

Patents under the New Law.—The patent claims published under the proper head, on another page, are the first issued under the new law, and therefore are granted for seventeen years.

ROMANCE OF THE STEAM ENGINE.

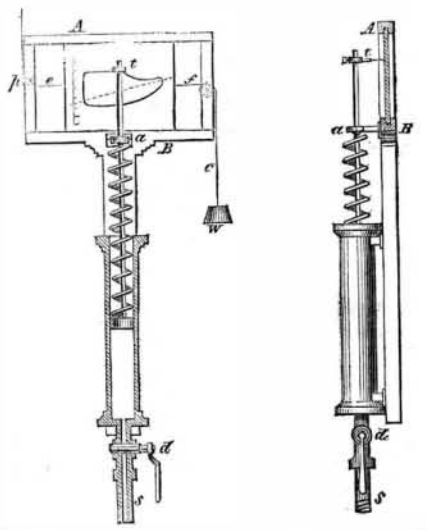
Article XV.

WATT'S INDICATOR.

The actual power of a steam engine is ascertained by a little instrument called the "Indicator," which consists of a small cylinder with a piston in it, moving against a spring, and compressing it to an extent corresponding to that ot the steam pressure. This instrument is also due to the genius of Watt, and by it what are called "indicator cards" are taken from an engine. In America, Stillman's indicators are in quite common use, in England, McNaughton's, but we give a representation in two figures—a vertical section and a side elevation—of the one said to be constructed as designed by Watt.

A small brass cylinder is shown, with a piston inside, and having its rod surrounded with a spiral spring abutting on a button above. This rod passes through a collar at *a*, and it has a pencil holder at *t*. It is screwed at the foot, *s*, into a hole on the top of the cylinder of the engine. *d* is the cock by which communication may be opened or closed between the indicator and the steam cylinder.

When the indicator piston rises, the spring is compressed; and when it falls, the spring is extended. The spring is in equilibrio when the piston is at the middle of the cylinder, and the space through which it rises and falls is proportional to the force which presses the piston upward or downward. When both



extremities of the cylinder are open to the atmosphere, the spring is at rest, and the piston in the middle of the cylinder; but when steam is allowed to pass from the cylinder to the indicator, by opening the stopcock, *d*, such steam will press the piston upward, and compress the spring with a force equal to the excess of the steam above that of the atmosphere. When, on the other hand, a vacuum is produced in the engine cylinder, by the condensation of the steam, the same vacuum will be produced under the piston in the indicator, and the piston will be forced downward by the excess of the pressure of the atmosphere above that of the uncondensed vapor in the cylinder.

An index is placed near the extremity of the piston rod, and *t*, the pencil, ascending and descending on this index, indicates by the space through which it ascends the excess of the pressure of the steam over that of the atmosphere, and by the space through which it descends, the excess of the pressure of the atmosphere over that of the uncondensed vapor. Both spaces added together, or the entire play of the piston, will therefore indicate the excess of the pressure of the steam above the pressure of the uncondensed vapor which resists it, and, therefore, the effective force of the piston, exclusive of friction.

The engine itself records the above effects, as the indicator is a self-registering instrument. The small square, A B, has a card capable of sliding in a horizontal direction in grooves; a string, *e*, is fastened to the side of the card, and, passing over a pulley, is carried upward toward *p*, and attached to some part of the machinery which rises and falls with the piston of the engine. Another string, *f*, is attached to the other side of the card, and carried over a pulley is fixed to a small weight, W. When the piston rises, the string, *e*, is drawn to the left, the card is drawn in the same direction, and the weight, W, rises. When the piston falls, the weight, W, acting on the string, *f*, draws the cord to the right. Thus, as the piston rises and falls, the card is drawn alternately through a certain space left and right.

Let us now suppose steam admitted above the piston of the engine, pressing the piston down. This steam presses the piston of the indicator up, and the pencil, *t*, passing on the card, would, if the card were at rest, mark upon it a straight line, the length of which would indicate the pressure of the steam; but as the card is drawn from left to right while the piston falls, the pencil will describe upon it a curve by the combined effects of the vertical motion of the pencil and the horizontal motion of the card. The suddenness of the curvature thus described will indicate the rapidity of the action of the steam on the piston.

When the piston has reached the bottom of the cylinder, and the upper exhausting valve is closed, a vacuum is produced in the cylinder, which vacuum extends to the indicator, the piston of which therefore descends, the pencil, *t*, descending at the same time and at the same rate. While this takes place, the card is traced from right to left, and has a corresponding curve described upon it by the pencil, the curvature of which will indicate the suddenness with which the vacuum is produced, as well as its degree of perfection.

From what has been stated it will appear that in a single ascent and descent of the piston, or in one stroke, as it is technically called, a diagram is formed upon the card, which will exhibit not only the entire mechanical effect of the steam acting on one side against the uncondensed vapor on the other, but will show the entire character of its progressive action at every point of the stroke.

Cleaning Platinum Vessels and Wires.

Platinum vessels, such as crucibles, that are much used and exposed to a high heat, gradually become tarnished, and the surface acquires a gray coating. When this is examined with a microscope, the metal is found to have acquired a rough surface, which may be removed, as follows, without injury: Take a small lump of soda amalgam, and rub it gently over the tarnished surface with a cloth until the whole surface is brilliantly metallic. Water is then applied; this oxydizes the sodium, and the mercury can then be easily wiped off, when the platinum surface is found to be in an excellent condition for burnishing with a proper tool. Sodium possesses the property of imparting to mercury a power to wet platinum, while the latter does not undergo the least trace of amalgamation. Platinum wires, which are frequently ignited in a gas flame—for example, the triangles which are used to support crucibles—become, as is known, gray and brittle. If such wire is strongly and perseveringly rubbed with sand, the cracks disappear, and the wire becomes smooth and polished; for the grains of sand, acting like burnishers, restore the original tenacity of the metal, very little of its substance being rubbed off meanwhile.

Crucibles may also be rubbed with sand and treated like wires, and they will become as good as new again. This is a more simple method than the amalgam process described above; but we give both methods for the sake of variety. The sand used for rubbing should be well worn—rounded.

Illinois Central Railroad.—From the report of the President of this great work it seems that the total expenditures have been $33,221,720, of which $4,996,213 was for interest. Of this sum $15,654,980 was paid by stockholders; the remainder having been borrowed on various kinds of bonds, of which $1,746,500 have been cancelled. The income of the road has just reached a point at which it will pay the interest on the bonds, so that the suicidal policy of hiring money to pay the interest will be discontinued. The company have sold 1,260,273 acres of land at an average of $12.67 per acre, and they have 1,334.727 acres on hand. They hold $12,598,083 of land notes, and it is estimated that these, with the proceeds of the unsold lands, will be far more than sufficient to pay off all the indebtedness and all the stock, leaving the company in possession of their road, which, including its branches, is 707 miles long, entirely free of cost.

The oil wells of the Birman Empire yield annually 400,000 barrels of oil.