NEW STANDARD GRINDING MILL.

The annexed engravings represent a new standard heavy 20 inch mill, manufactured by Mr. Edward Harrison, of New Haven, Conn., with which is combined a pedestal and temporary dressing frame, on which the stones may be dressed. The mill is thus rendered complete, and despite its high power is portable, requiring nothing to be built for it to rest upon. It is claimed that the grinding surface of this mill, at 1,400 turns per minute, is equal to three quarters more than an old style 48 inch run at 175 revolutions per minute. The grinding capacity per hour is from 14 to 75 bushels and the weight 1,250 lbs. Fig. 2 shows the pedestal and case made in one casting, with a dressing frame bolted on and the burrs turned out upon it for dressing. The frame is made in two parts which are fastened one on each side of the case by tap bolts, the operation requiring but a few minutes.

This mill, in common with others of different sizes, which we shall illustrate in subsequent issues, is constructed in accordance with the principles, the demonstration of which the manufacturer states to be the result of his fifty years' experience in mill building. Mr. Harrisen believes that no process of milling can be perfect without the use of burr stones, and that such furnish the only proper grinding surface; that the stones should not be large and heavy, or horizontally superposed, or run at low velocity, but that on the contrary they should be light, hung vertically face to face, and driven at high speeds. In the former case there is mashing and over-grinding, in the latter there is neither, while high speed produces the necessary grinding surfaces.

In the present new machine, we are informed that the entire construction is of iron and steel except the burr stones. The runner stone is held as firmly to the spindle as a lathe head. All the bearings in which it runs are unusually long, which render it impossible for the spindle to get out of line. The faces of the burrs are protected from injury during the passage of hard or foreign substances through the mill by means of a very heavy safety spring and step, against which the end of the spindle always rests. The mill may be used for any kind of grinding, from wheat to quartz, and either wet or dry. It is hardly necessary to point out that for machines of this type a wide field of usefulness exists in this country. The heaviest tax paid by the consumer for cereals is that due to transportation, and when grain is cheap and transportation high, enormous quantities of the former are wasted because it does not pay to send it over long distances to be converted into flour and meal. The economy and portability of these mills renders such transportation practically unnecessary. Any farmer possessing a small farm steam engine—and no farmer working even a moderate sized farm should be without this most valuable adjunct—can with a Harrison mill grind his own grain and that of his neighbors, and thus secure a double profit. Horse power may be used to drive some of the smaller sized mills, which show a capacity equal to the old style 48-in. mills.

For further information address the manufacturer, Mr. Edward Harrison, 135 Howard avenue, New Haven, Conn.

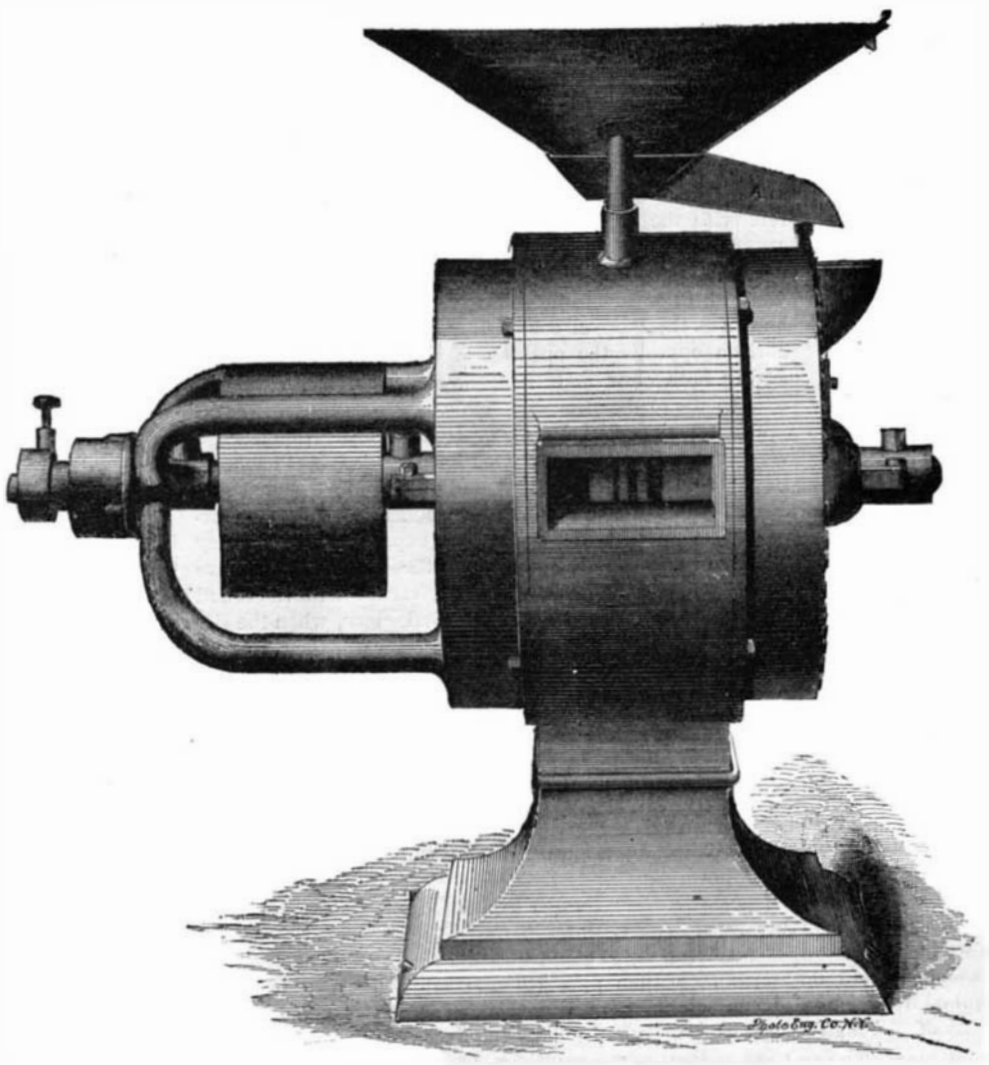

Fig. 1.—HARRISON'S NEW STANDARD GRINDING MILL.

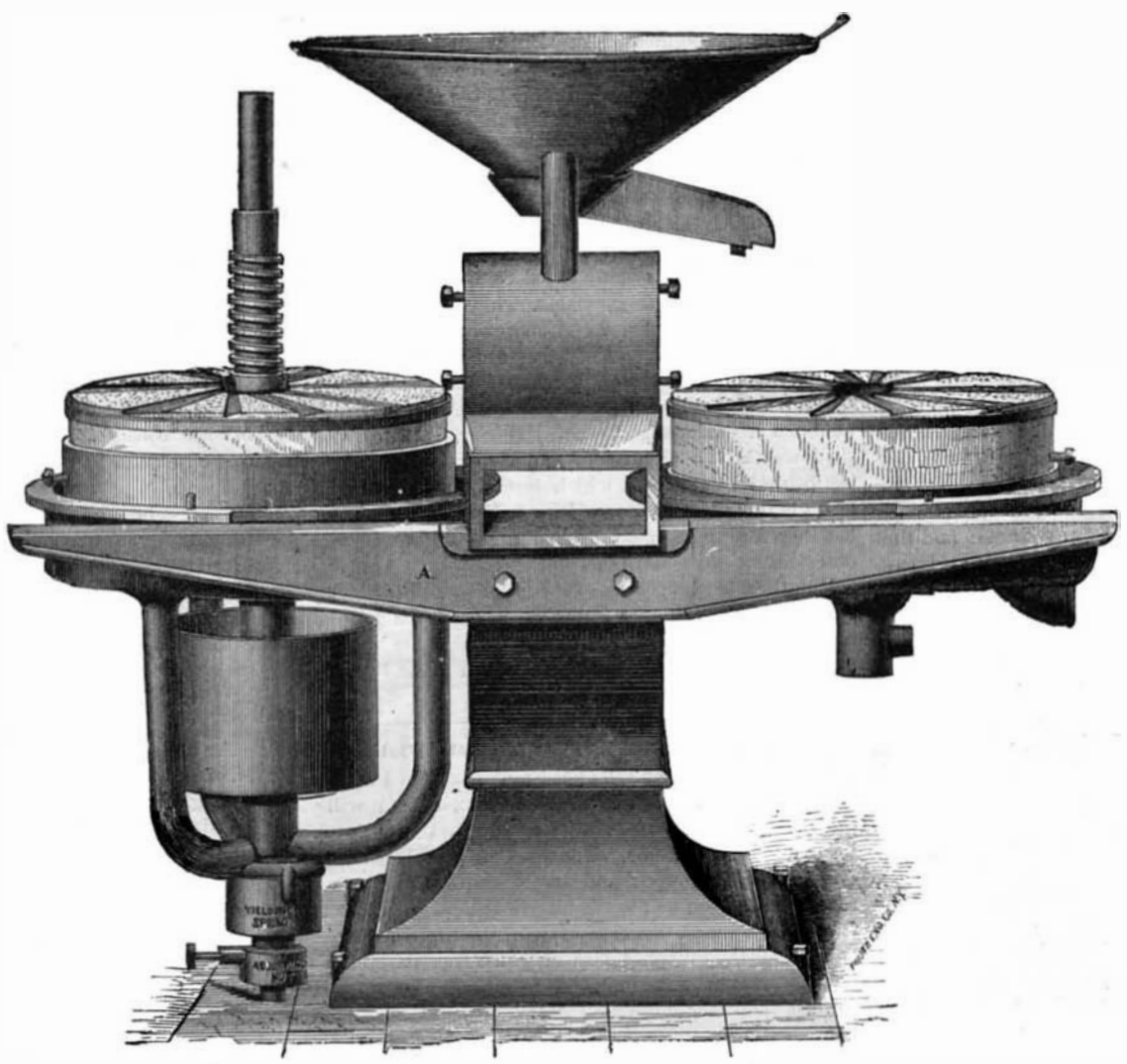

Fig. 2.—GRINDING MILL WITH COMBINED PEDESTAL AND DRESSING FRAME.

Petroleum in California.

It is now an established fact that we have oil in Ventura county in paying quantities. Out of the crude material a fluid can be made better than Pennsylvania oil—because, while it produces as clear a light, it is a safer oil, the poorest of it being non-explosive. It will pay to refine the light dark oil, and very well to refine the light green. Our advantages are not alone in the superiority of our oil, nor in the accessibility of our territory. One of the chief advantages, often overlooked by even our most sanguine oil prospectors, is in the proximity of our oil territory to the sea, and another is in the ease with which the refined oil can be placed on board vessels bound for foreign ports. A vessel at the end of the oil wharf, to be put at the foot of California street, can be loaded with ease from the refineries, which will extend from the wharf eastward to the corporate limits. Our pipe line will convey every gallon to the barrels in the holds of the vessels, thus saving all the immense expense of hauling and storing in hazardous places the oil barrels awaiting shipment. The nearness of the oil springs, facing as they do the great ocean, the highway of nations, and the facilities offered in loading the oil, are advantages not possessed by our Eastern producers, and will be greatly appreciated by them when they come to look at the field. Undoubtedly, with extensive and properly supplied refineries, we could now ship oil to the foreign markets cheaper than it is done from New York and Philadelphia. All the advantages are greatly in our favor, giving margins for profit in every direction.—*Ventura (Cal.) Signal.*

Lake Tahoe Lumber Operations.

A writer in *Appleton's Journal* says the lumber interest and the lumbermen sustain Glenbrook, Cal., and all the neighboring settlements. They are seen nearly everywhere in that beautiful region, which, once clothed from head to foot in pines, is being denuded to supply the Comstock mines with fuel for their hoisting apparatus and supports for their excavations. Penetrating a pine forest to its heart we find an industrious gang of vandals blasting trees out of beds upon which a tangle of roots seems to have fastened for eternity; and standing upon the foot hills we hear the sibilant grind of the sawmills, the crash of axes, and the dull reverberations of the blast. Following one of many devious wagon roads—one out of use, for instance—a curious litter of chips and shavings represents a forest sacrificed; following another road still in use, we discover the lumbermen at work carrying the havoc further.

On one side of Lake Tahoe a steam railway several miles long is used exclusively in the transportation of logs to the shore; the logs are towed across the water in immense rafts to Glenbrook, where they pass through the sawmills; and thence another steam railway, also used exclusively in the lumber service, extends to the summit of the divide. Down the eastern slope of the mountains, leading to the Carson river, flumes 20 and 30 miles long are carried over valleys and ravines on high trestle work bridges, and the wood is floated through them over another stage of its journey toward the mines.

"One morning as I was riding through Truckee cañon, a great wave and a cloud of spray leaped from the river into the air some distance in front of me. I went a few paces further, when, by the merest chance, my eye caught what was intended to be a sign—the lid of a baking powder box tacked to a pine stump, and inscribed with dubious letters: 'Look out for the logs!' In which direction the logs were to be looked for was not intimated, and I paused in uncertainty as to whether security depended on my standing still or advancing. Suddenly my mule shied round, and a tremendous pine log, 80 or 100 feet long, and about five feet in diameter, shot down the almost perpendicular wall of the cañon into the river, raising another wave and an avalanche of spray.

"This was to me a new phase of the lumber industry. A wide,, strong, V-shaped trough, bound with ribbons of iron which had been worn to silvery brightness by the friction, was laid down the precipice; and out of sight on the plateau above, some men were felling the trees, which they conveyed to the river in the expeditious manner aforesaid."

The English Channel Tunnel.

Operations connected with the submarine tunnel have already been commenced on the other side of the Channel, several pits having been sunk to a depth of about 110 yards. At the same time the French and English committees have definitely drawn up the conditions of working for the route. The property of the tunnel is to be divided in half by the length: that is to say, each company is to possess half of the line, reckoning the distance from coast to coast at low tide. Each company will cover the expenses of its portion. The general work of excavation will be done, on the one

hand, by the Great Northern of France, and on the other by the Chatham and South-Eastern companies, the two latter having each a direct route from London to Dover. All the materials of the French and English lines will pass through the tunnel in order to prevent unnecessary expenses and delay of transhipment, as in England and in France railway companies use each other's line, and goods can pass from one line to another without changing vans. It is understood that an arrangement will be established for a similar exchange of lines between all the English and continental railway companies when the tunnel is completed. The tunnel will belong to its founders. At the expiration of thirty years the government will be able to take possession of the tunnel upon certain conditions.—*Mining Journal.*

THE MEETING OF THE ACADEMY OF SCIENCES.

The semi-annual meeting of the National Academy of Sciences was recently held at Columbia College in this city. Professor Joseph Henry presided. Abstracts of the papers read are given below.

Professor Stephen Alexander in a paper entitled

LAWS OF EXTREME DISTANCES IN THE SOLAR SYSTEM

in which he showed the relations of various members of the solar system and the curious proportions existing between them, the whole indicating that in their organization they have obeyed the rule of law. The ratios of the planetary distances for example he pointed out as follows: Neptune to Uranus $\frac{2}{3}$; Uranus to Saturn $\frac{1}{2}$; Saturn to Jupiter $\frac{1}{2}$; Jupiter to Asteroid $\frac{1}{3}$; Asteroid to Mars $\frac{2}{3}$; Mars to Earth $\frac{2}{3}$; Earth to Venus $\frac{2}{3}$; and Venus to Mercury $\frac{1}{2}$, and then he showed that the difference between the distances according to law and in fact were small, not exceeding in any of the preceding instances ·078. Tables of relations for the systems of Jupiter and Uranus were given which also showed remarkable approximations of theory to fact.

VELOCITY OF VIBRATIONS IN EARTH.

General H. L. Abbot gave an account of his series of experiments to test the rate at which tremors from explosions are transmitted through the earth. He stated that for one mile through drift formation, a severe shock gives a velocity of about 8,500 feet per second. The rate for the great Hallett's Point (Hell Gate) explosion was about 8,300 feet per second for the first eight miles and about 5,300 feet per second for the first thirteen miles. These estimates enormously exceed those reported by Mr. Mallet some years ago to the Royal Society, the highest velocities obtained by him being not over a third of the lowest and a fifth of the highest noted by General Abbot.

Professor O. N. Rood presented two essays on the study of color, in which he described a means of determining the effects of a given mixture of colors by means of superposed diagrams, and also a method of comparing the relative brightness of colors.

Professor Alexander propounded the ingenious theory that the inner satellite of Mars is an asteroid which has traveled so near to the orbit of the planet as to be drawn and held within the sphere of the latter's attraction. Investigations of the orbits of several of the asteroids apparently confirm this view.

Professor Elias Loomis read a paper on the

ORIGIN OF STORMS

based upon data obtained by the United States Signal Service. He stated that our great storms begin in the neighborhood of the Rocky Mountains and that no example is found of any considerable storm arising on the Pacific Coast, south of Oregon. At the outset there is generally an area of several hundred miles diameter, through which the barometer stands at mean. On opposite sides of this area, generally east and west, at a distance of 1,000 miles apart, are areas of high barometer. The atmosphere in these side areas begins to move toward the central area. The currents thus established are deflected toward the right by the earth's rotation; and a diminished pressure results over the central area, when the inflow increases and comes from all sides. The area of low pressure assumes an oval form, but if the winds are very violent, it may be more nearly circular. With rotation a centrifugal force is developed which increases the depression, and within the latter there is an upward movement of the atmosphere which carries large amounts of vapor, which on cooling condenses as rain. The heat liberated by condensation increases the rarefaction of the area; and thus rain increases the force of the storm, though never originating it. The upward motion within the storm area takes place chiefly on the east side, so that the depression at the center is constantly transferred toward the east, unless however there is a great precipitation of vapor on the west side of the area, in which case the storm is held stationary or even moved westward.

Professor Joseph Henry summarized the results obtained by the Lighthouse Board to determine the utmost efficiency of

FOG SIGNALS.

These are (1.) Loud sounds spread rapidly from the mouth of a trumpet, and fill the whole horizon at the distance of a few miles. A parabolic reflector only holds the sound in the direction of its axis for a mile or two; at three or four miles the sound is heard as well behind as in front of the reflector. (2.) Sound is heard further when moving with the wind near the surface than when moving against it; but there are exceptions to this rule, and before a change of wind the sound is heard further in opposition than in the same direction as the surface wind. The exceptions are referred to the effect of an upper wind prevailing in a contrary direction. (3.) It is established that neither fog, snow, nor rain interferes with the transmission of loud sounds. (4.) A sound may become inaudible over a certain space and be heard again beyond it. This occurs when the wind blows against the direction from which the sound is moving; and is referred to the tilting of the front of the sound wave so that it passes over the head of the observer, and afterward descends. It is not due to a special condition of the atmosphere in a circumscribed locality by which the sound is absorbed, since there is no such effect when the sound is transmitted in an opposite direction—that is, with the wind. (5.) Independently of the wind, however, the air does not on all occasions transmit sound with equal facility. If intervening air be heated above or cooled below the general temperature, there will be refractions and reflections, which interfere with the progress of sound. (6.) "Sound shadows" are sometimes produced by projecting portions of land, or other obstacles. In these shadows the sound is temporarily diminished, or lost to the observer. (7.) The phenomenon known as the "ocean echo," is a return of sound from the horizon opposite the opening of the trumpet, and occurs during both clear and foggy weather, and with various winds. Its explanation is difficult.

The remainder of Professor Henry's essay described a very interesting series of experiments tried in Penobscot Bay, at a locality where the sound of a loud fog signal suddenly became inaudible for a considerable space, and beyond that was heard again. The experiments were very satisfactory in proving many of the propositions above enunciated, especially that the interference with the sound was due to the opposition of the wind, since, when the signal was carried on the vessel going outward, there was no such interruption to hearing the sounds on the shore.

Professor Alexander Agassiz read a very important essay on

THE DEVELOPMENT OF THE FLOUNDER,

which fish, in early youth, has one eye on each side of the head, like other bony fishes. After three or four months, both eyes are found on one side. Professor Agassiz reaches the curious conclusion that the eye slides around instead of going through.

The notion has been that this fish has its eyes both on one side, because its facilities for securing food are thereby increased. But why should not this process have, by natural selection, resulted in a fish that, when hatched, has both eyes on the same side? We do not find this peculiarity in fossil flounders, and no flounders have yet been found later than the tertiary formation. It is not true that all flounders are destitute of swimming bladders. There are other fishes as flat as a flounder, but with eyes on both sides of the frontal bone.

The sides of the flounder in the young are identical as to color. The color is due to the pigment cells, of which there are three kinds, red, black, and yellow. By contraction of these cells the different colors are produced. Now, if a flounder is left in a vessel with a gray ground it becomes gray; if on a black ground, black; if on a red ground, red. This power of changing color is, however, lost on the side where the eye is absent. The inference is that the nervous system, being affected by a change of color through the eye, originates the change of color in the fish, by means of appropriate contraction of the pigment cells. But when light was continuously admitted to the under side of the vessel holding the young fish, before its eye had gone to the other side, the process of development and the removal of the eye to the other side went on just as before. There was a great deal yet to be learned before this series of facts could be explained.

NEW ASTRONOMICAL THEORIES.

Professor Alexander brought forward a variety of evidence tending to indicate some envelope like an atmosphere for the moon, the hypothesis being based on the bright band seen around the moon during eclipses. This, the speaker thought, could best be accounted for by supposing an atmosphere to the moon, a thin remnant of ancient nebulosity, comparable to that which accompanies the earth and gives rise to the appearance of the aurora. Professor Alexander also propounded a curious geometrical theory, showing that the shadows thrown by celestial objects are retrograde, being left behind by the time which light takes to travel. The effect is that these shadows lean backward, and allowance has therefore to be made for a resulting difference between observations on occultations and on eclipses. Applying the calculations to observations on Jupiter's satellites the following is the result: There is a difference of ten seconds of actual time between all such observations made by means of occultations and those which have been made by means of eclipses.

A New Discovery of Potash Fields.

A deposit of potash salts has been discovered near Stassfurth, Germany, which is said to be so vast that it will yield these salts in sufficient quantity to supply the entire world for many years to come. The uses of potash salts in the arts are very numerous and important, and to obtain them recourse has been had to washing of sheep's wool, the liquor from which cane sugar is crystalized, and to sea water. The entire bed, the immense size of which was determined by borings made with the diamond drill, lies within the triangle formed by the three towns of Magdeburg, Halle, and Nordhausen, and is supposed to be due to the evaporation of an inland sea. The company, which is soon to begin working the mines, has obtained a concession of about 8 square miles.

Mechanical Stoking.

The *English Mechanic* gives the following summary of the various inventions for mechanical firing of furnaces, now in use in England.

It has been generally admitted that the theoretically correct manner of feeding fuel to the fire is to supply *upwards* through the bottom of the furnace from below. It is on this principle that the "Frisbie Feeder" and Mr. Holroyd Smith's "Helix" stoker are constructed; the latter giving a continuous supply of fuel, and therefore more correct in method than the former, whose supply is intermittent. This arrangement causes the smoke and gases, when passing upwards through the incandescent coal, to be thoroughly consumed. Another method is to supply fuel from a hopper to the front of the bars, which rotate slowly backwards, and the desired combustion is the result. Such is the construction of Regan's stoker, which has been very successful as regards economy, both in the quantity and quality of the fuel used, only small coal being burnt.

Another contrivance, applicable principally to marine boilers, has recently been patented by Mr. Regan, and this is known as the "jogglebar furnace." It allows of the agitation of the bars by means of a lever, so as to be free them from clinkers, and to keep the space between the bars clear for the passage of air. The bars are placed transversely, and nothing is easier than their removal and replacement when necessary.

Another method is that of the Henderson stoker, which provides that, as the crushed coal falls from the hopper, it is caught on the vanes of horizontal or vertical fans, and thrown by them over the fire in such a manner that an even distribution can also be made, as mentioned above, by means of a peculiar motion imparted to the bars. The rocking or other motions are produced by means of gearing, eccentrics, etc., driven either by shafting from the main engine or by a small supplementary one. At the same time the bars are either rocked up and down, or from side to side, revolve over spindles, or rotate backwards from the front *en masse* by means of horizontal shafts. In Dillwyn Smith's stoker there are two grates placed crosswise in the same fire, and these are so arranged that the gases given off by the coal on the first grate are burnt, with perfect combustion, on the second. It is unfortunately impossible to speak with any certainty on the comparative merits of the various stokers in use, as no competitive trial has been made. Some inventors assert that the saving effected by their stokers is as high as 30 per cent. Of course such may have been the case where they have been erected, but it only proves that where such an immense percentage is claimed there must previously have been a shameful waste of material. By the use of mechanical stokers hard labor is, of course, almost entirely dispensed with, the filling of the hopper and the raking out of the ashes constituting the only manual work. Sometimes, however, even the filling of the hopper is performed by mechanical means. Such is the case at the General Post Office, where four of Vickers' stokers are at work. They use only small coal, which is lifted by an automatic arrangement, driven by an engine of a small horse power. The coal is then delivered into a trough about twenty yards in length, in which works a helical screw. The fuel is thus forced forward and dropped in measured quantities into the hoppers. At the Royal Mint mechanical stoking on the Juckes' principle has been in active operation for many years. Mechanical stokers can be used with equal benefit on board ship, where an even fire can be kept up in spite of heavy seas, with the additional advantage of a comparatively cool temperature of stokehole. Thus far all the objections advanced against hand stoking have been overcome by these useful labor-saving and money-saving machines; and though the price of some of them occasionally appears rather high, they invariably repay their cost in a short time.

Solar Radiation and Sun Spots.

In an essay on the above subject in *Nature*, Mr. S. A. Hill, of Allahabad, India, considers it to be possible that the excess of tropical and oceanic rainfall in maximum sun spot years may be caused by precipitation near the place of evaporation, owing to the diminished force of the trade winds and anti-trades at those periods, and that if the winter rainfall of Europe and America were examined it might show an excess in minimum sun spot years, derived from vapor brought by an unusually strong upper current from region of great evaporation in the South Atlantic. The registers of nearly twenty years show that the winter rainfall of India, north of the tropic, is probably subject to such a periodic variation, and if this surmise be verified in the future the author thinks, it may prove of the greatest economic importance.

AT a recent meeting of the French Academy of Sciences, M. Duplessis called attention to the infection of grain through the agency of floods in water courses. A case was noted of a field of rye which became partially infected with smut, owing to a river having overflowed its banks and covered a field further up stream, which was already infected. The flood had been the means of communicating the disease or fungus.

THE bakers and pastry cooks of Paris have been forbidden to burn in their ovens wood which has been painted or impregnated with any metallic salt, as it is believed that the articles of food may be rendered deleterious through the agency of the same.