Wood Pavements.

As containing data and deductions of general interest, we publish a letter written recently by Joseph P. Card, of St. Louis, to O. Chanute, C.E. While the fact that the writer is the president of a wood preserving company should be given due weight, it should be also remembered that he is an expert in this line of practice, and has diligently studied all the bearings of the case from a business as well as a constructive standpoint:

"In the first place, "says Mr. Joseph P. Card," it is admitted by all, that it is of little use to lay any pavement without a good and substantial foundation, and none of the substances used requires this more than wood.

"Such being the case, a substantial concrete foundation is first laid, and it should cost the same, whether granite, wood, or other material be placed upon it; consequently the only thing to be considered is the cost of the wearing surface, the lasting qualities of same, and its desirability as a pavement when completed.

"In my opinion, the trouble with wood pavements in this country has been: First, the lack of a proper foundation. Second, the people generally have expected a wood pavement, which should have cost as usually laid (with a board foundation) $1.35 per square yard, to last as long as a granite pavement (with a concrete foundation) that cost $4.50 or more per yard.

"Now we will take Broadway, New York, for instance, which is 44 feet wide, with a concrete foundation, ready to receive either granite or wood blocks, and suppose granite blocks are laid at a cost of say $3.60 per square yard, which would be equivalent to $8.80 per front foot for the abutting property.

"On the other hand, a preserved wood block pavement is laid with blocks say 3½ inches by 5 inches deep, leaving a space of ¼ to ⅜ of an inch between the rows, to be filled with suitable material, at a cost of $1 62 per square yard, or $3.96 per front foot.

"Now what would be the result? The granite pavement would probably last 10 to 15 years with slight repairs, and the wood pavement 5 to 6; but for comparison we will suppose the granite to last 15 years and the wood 5.

"The granite costing $8.80 per front foot, the wood $3.96 for 5 years or $11 88 for 15 years (allowing two renewals), and deducting 79 cents difference in interest at 6 per cent, would make wood cost for this period of time $11.09 per front foot, or a difference of $2.29 per front foot, equal to 15 cents per front foot per year more than granite, which is virtually nothing.

"Now, in my opinion, the wood pavement would be more likely to last over 5 years than the granite to last 15; but if I am incorrect, who is there living or doing business on a street like Broadway, where property is worth thousands per front foot, that would not willingly pay the slight difference, or many times the difference, to get rid of the incessant noise and confusion incident to a stone pavement?

"I think the thoroughfares should be paved with wood, and the by-streets with granite or other stone, as it would last indefinitely.

"My reason for using a 5 inch wooden block is, that when the surface of the street becomes worn down to the extent of 2 to 2½ inches, it becomes so irregular that the remainder of the blocks, whether 2½ or 5 inches, are so softened with moisture, which accumulates in the depressions from rainfall or by sprinkling, that they soon go to pieces.

Wood on end, if it could be kept dry, would outwear granite, as shown by Col. Flad's tests, made at our water works here, consequently the drier the wearing surface is kept the less wear.

"Fully creosoted wood blocks under heavy traffic wear rapidly, as shown on the Brooklyn bridge, for the reason that the oil keeps the fiber soft.

"There was more wear on the St. Louis bridge, which is paved with wood, in the two months that the bridge was salted, to remove slush and ice, than in the balance of the year.

"In other words, the principal wear of any wood pavement occurs during wet weather, and the aim should be to keep the wearing surface of the wood as dry and smooth as possible.

"With a good concrete foundation once down, the wooden blocks could be renewed, when necessary, during night time, with little or no inconvenience to travel.

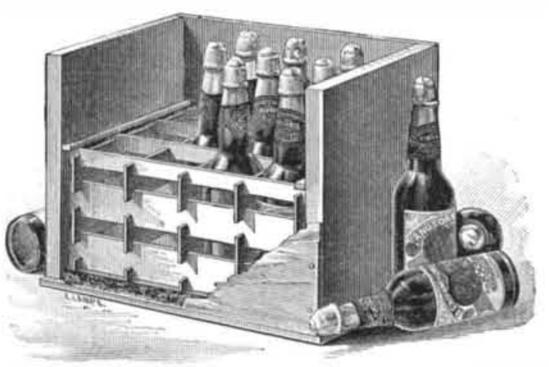
"From a sanitary point of view, the concrete foundation would prevent what most people seem to dread, the leaking through of impurities to the soil beneath, while the treated blocks would disinfect any portion that might enter the same."

Ivy Lawns.

Ivy lawns are known to but few among the many who are interested in gardening economy. They consist, as the name implies, of ivy only, and they offer some peculiar advantages in cases where grass lawns are apt to occasion more trouble than they are worth. According to the *Farmers' Gazette* (Dublin), an ivy lawn may be well made in one season, and if the primary operation of planting be properly performed the lawn will make itself; it will want no cutting, no sweeping, no watering, no protection from the birds that eat the grass seeds to-day and to morrow scratch up the tender plants, as though it were their mission to make grass lawns impossible. And when made, being, as it were, self-made, an ivy lawn will take care of itself for any number of years; but if in need of repair or trimming, the knife, the shears, or the spade may be used with unskillful hands, and with the least imaginable cost of time, for it is not an easy thing to kill, or even to seriously injure, a lawn consisting of ivy solely. Such lawns are unfit for games, and indeed should not be trodden on. They will not therefore supersede grass in a country garden, which perhaps is a matter for gratulation; but they will give us the most delightful breadth of verdure in thousands of places where grass is more plague than profit, and, at the very best, tends rather to disgrace than adorn the position.

PACKING BOX FOR BOTTLES.

The compartment crate or packing structure is formed of thin strips of wood, or veneer, arranged in longitudinal and transverse rows successively one upon the other, the strips in each row being notched on their edges to interlock with those immediately above or below, and spaces being left between the rows for lightness. The ends of the strips project to leave clearance spaces between the outer strips and sides of the box. The compartments thus formed are not made of the full depth of the box, but are sufficient to inclose the bodies of the bottles, this being all that is necessary to give the required protection. This crate rests upon hay, straw, or other soft and yielding material covered by a piece of pasteboard for the bottoms of the bottles to cushion upon. The crate is kept down to its place upon the cushions by cleats nailed on the ends of the box, so that there is no tendency of the material used for the cushion to settle at either end while the box is being transported from the box factory to the place of use. These packing boxes have given the greatest satisfaction during their use of over a year by some of the principal bottlers of St. Louis.



SCHOENTHALER'S PACKING BOX FOR BOTTLES.

Additional information may be obtained from the inventor and manufacturer, Mr. J. C. Schoenthaler, of 1024 N. Main Street, St. Louis, Mo.

Renewal of Brain Cells.

According to the novel computation of a German histologist, who has been calculating the aggregate cell forces of the human brain, the cerebral mass is composed of at least 300,000,000 of nerve cells, each an independent body, organism, and microscopic brain, so far as concerns its vital relations, but subordinated to a higher purpose in relation to the function of the organ; each living a separate life individually, though socially subject to a higher law of function. The life term of a nerve cell he estimates to be about sixty days; so that 5,000,000 die every day, about 200,000 every hour, and nearly 3,500 every minute, to be succeeded by an equal number of their progeny; while once in every sixty days a man has a totally new brain.

The Cost of Making Steel Rails.

A recent issue of the Pittsburg *Penny Press* contains an interesting article on the cost of steel rails. The actual cost of producing a ton of steel rails in Pittsburg is placed at $26.83, as shown by the following itemized statement:

COST OF PIG METAL.	
1·1 tons of coke, at $2	$2.20
Limestone	.50
Ore, scale, etc	10.00
Labor, including repairs	1.75
General expenses	.38
Interest	.35
Cost of a ton of metal	$15.18
COST OF INGOTS.	
1 1-5 tons of metal direct at $15.18	$18.12
Refractories	.20
Lubricants	.02
Repairs	.24
General repairs	.17
Labor	1.13
General expenses	.09
Spiegel	2.31
Interest	.20
Cost of a ton of ingots	$22.48
COST OF RAILS.	
1 05 tons ingots direct with initial heat at $22.48 per ton	$23.62
Labor and office expenses	1.90
Repairs entire	.49
Steam (natural gas)	.10
General expenses	.35
Interest	.22
Tools, files, etc	.15
Cost of a gross ton of steel rails	$26.83

The *Press* also states that the cost of making a ton of steel rails in England at present is $20.17.

Sulphite of Soda Intensifier.

Scolik, of Vienna, has recently experimented extensively with the above intensifier, and in a late number of the *Photographische Correspondenz* recommends the following formula:

Solution No. 1.

Bichloride mercury	1 oz. 437 grs.
Bromide potassium	1 oz. 437 grs.
Water	50 oz.

The above may be diluted four times its volume if desired, in order that the action may be gradual and less energetic. The fixed and well washed negative is allowed to remain in No. 1 until the film becomes well whitened. If a small degree of intensification is desired, it should be left in but a short time.

The plate is next slightly rinsed off (a thorough washing not being required at this point), and immersed in

Solution No. 2.

Saturated solution sulphite soda	5 oz.
Water	5 oz.

The darkening action will be observed to take place gradually, as in the case when ammonia is used, and will impart a rich brown-black color to the negative, which should be well washed; negatives thus intensified are believed to be permanent. Dr. Eder describes the following as the chemical reaction which takes place. The whitened negative contains mercurous chloride (calomel), and this is reduced to the metallic state by the sodium sulphite, just as appears to be the case when cyanide of potassium is used; thus the method now described may be regarded as analogous with Monckhoven's argento-cyanide of potassium method. Mercuric chloride is not reduced in the cold by alkaline sulphites, because stable double salts are formed; still, at a boiling temperature, reduction sets in, the mercurous chloride being first formed, and then the metallic mercury.

The above fact explains why it is unnecessary to wash away all traces of mercuric chloride before treating with sulphite of sodium.

Fires from Belting.

Herr Boher, illumination inspector of Dresden, has been making some experiments to determine what part is played by electricity in causing explosions of flour dust in mills. His investigations have been conducted at the Royal Court Theater, where the powerful dynamos for the electric lights are driven by steam power.

"Here," the inspector says, "the electricity from the belting is so intense that more could scarcely be obtained in the best electric machines. Leyden jars became charged by this means in a few seconds, so that on being discharged sparks leap one and three-fifths inches. Any person standing on an insulator and placing the hand within four to six inches of the moving belts is quickly charged with electricity, so as to give out long sparks. Geissler tubes, having projecting pointed wire at one end, and metallic connection with the earth at the other end, glowed, when placed near the belts, with beautifully colored lights. In short, every experiment possible with electric machines can be performed by this belt developed electricity. At first I thought that the presence of the dynamo electric machines had a great influence on this phenomenon, but I have noticed the same, more or less shown, in many kinds of factories having steam power.

"In many flour and meal mills the dust has become ignited without the cause having been discovered I have now, from experiments, become firmly convinced that electricity devoloped by belts can cause such disaster. In most factories, other than flour mills, the quantity of metal present, and the arrangement of the iron framed machines, is such that a connection among them is established sufficient to conduct safely away the electricity. It is, however, different in flour mills, especially where French burr stones are used, which are made of separate pieces bound together by thick iron bands. The latter are not connected with one another, but isolated by the non-conducting stone. Rims, therefore, which are next to the driving pulleys and belts (generally located just below stones when cogwheels are not used, and pulleys almost equal in diameter to the stones) become surcharged with positive electricity—as shown in the Leyden jar, for instance; the next nearest rim or rims will, by induction, develop negative electricity. These opposite forms of force having arrived at a dangerous degree of tension, the leaping of an intense spark from one stone band to another could ignite the excessively inflammable flour dust. To guard against this danger, it is simply needful to collect the iron spindles of the stones together by a thick wire, a metallic bar being at the same time located nearly touching both stone rim and driving pulley. In all other industrial works the precaution would be advisable that no isolated ironwork should be near pulleys and belting when combustible materials are also in the immediate neighborhood."

[The remedy above suggested, we fear, is of little avail. The connection of the spindles as proposed will not prevent the generation of electric sparks. A better prevention is to keep the atmosphere of the apartments where the belts run thoroughly damp.—ED. S. A.]

AT some of the theaters and opera houses in Europe water curtains are used as a safeguard against fire. Between the acts a wide, tenuous sheet of water descends, separating the stage from the auditorium. Its efficiency was recently proved at the opera house at Munich, Bavaria, when by its means a fire was checked instantly.

The Value of Our Export Trade.

It would be amusing, if the subject itself were not so serious, to see the way the partisan papers, or journals with one idea, handle the grave questions that concern our foreign and domestic trade. The first thing pressing on their attention is the low price of our agricultural products. These are now lower than at any previous date within the remembrance of the present generation. Wheat, which eight years ago sold at Chicago at something over two dollars a bushel, has recently sold as low as 75 cents. There was a time when it was said that Western farmers would let the ground lie fallow rather than grow wheat at less than one dollar a bushel; now the one dollar would seem to them a great price if they could get it.

To remedy this some have a theory ready made and duly patented. We only want, they think, a larger population. If foreigners will not buy our breadstuffs for the pinched and starving laborers now working for a pittance abroad (this is the way they put it), we ought to bring the weary sons of toil with their families to our shores. Once established here and set at work, they will furnish on their tables a ready market at a good price for all that our fields will yield.

But if they are agriculturists, they will only increase the glut by adding to the acres under cultivation. Our theorist has his answer to this all ready: It is the artisans he would bring, the men who work at trades, and whose only connection with the wheat product is to consume it. Here the trades-unions find their toes trodden on, and they cry out against the proposition. Wages, in their judgment, are already too low, and they will not have the number of skilled workmen increased by any foreign importation. And not only the higher class of mechanics, but the miners, the hod carriers, the 'longshoremen, and the ditchers are ready with pistol, club, and slungshot to resist every attempt to flood the country with rivals to share in the labor they would monopolize for themselves. Besides, if the immigrants, of whatever grade or character, did not after their arrival produce more in some way than they consume, they would but impoverish the country and increase the general embarrassment.

The protectionist has, as he thinks, a much more plausible remedy. The country is too much given to plain agriculture, and the business of wheat growing is overdone. Home manufactures are the true relief. Let Congress put a prohibitory tariff on the work of foreign mills, and let the spindle and loom be heard in every valley of the teeming West. If there is no water power let steam be substituted, and the farmer and the manufacturer exchange their products at each other's door.

But the manufacturing business is no better off than the agricultural. Stocks of fabrics have been piled in warehouse, awaiting a demand which would not come. The auctions have been crowded with goods which sold at far less than cost, and in the woolen trade alone looms have been silenced for a period that would have added twelve million yards to the stock already pressing for sale. The cotton mills are no better off, and the curtailment from idle spindles is now reckoned at over 100,000 packages of fabrics, amounting to nearly or quite one hundred million yards. If the West and South set up the factory for themselves, the busy industries of the East, many of which are even now temporarily embarrassed for want of custom, if they are to depend on the home trade as at present, must be altogether abandoned.

What, then, shall be done for the relief of the country? If the farmers and manufacturers alike are piling their surplus in the warehouses, and must either find a new market or check their production, who can suggest a fitting remedy? General Butler's answer is that there is no overproduction, but a want of ability to consume. If this is granted, and the consumption is ever so much stimulated after the Butlerian method, the problem will not be solved. There is no doubt but what some who now fare sparingly could eat a little more, and many who are wearing their old clothes would be glad of a new suit. To satisfy these fully would take off part of the present surplus, but would give no permanent relief. There is a limit even to the capacity of a hungry stomach; and those now poorly clad will be out of market for a while when they have all donned a new set of garments.

It is plain that we must find a demand for our produce and manufactures alike outside of the home trade. The vast fertile fields of the West and Northwest and Southwest will grow more grain than can be digested by American stomachs, and the surplus, growing larger with each succeeding year, must be sent to feed the hungry of other lands. In like manner the manufacturing industries of the country are becoming too large for the home market, and must find customers for their wares and fabrics on distant shores.

Whatever is done in the future in tariff legislation, therefore, if done wisely, will have a special reference to encouraging the export trade of the country. There are still extant some pamphlets from our pen issued over thirty years ago, and compiled largely from editorials in this paper, showing that free trade in raw materials, dye stuffs and the like, with a judicious tariff on manufactured goods, was then what was most needed to promote the welfare of this country, by building up a large and profitable trade with foreign nations. Numerous editions of those treatises were circulated through the interior, and served a very useful purpose in opening the eyes of the people to their true needs, and the simplest remedy for prevalent embarrassments. Isolation is not the road to prosperity; if we would thrive we must take the world into our embrace, and be ready to minister to its wants and to share our profits with others, if we would enhance the measure of our own gains. Service of some sort beyond the requirements of self is the one condition of all true success.—*N. Y. Jour. of Commerce.*

Lord Rayleigh's Experiments on Light.

Lord Rayleigh, the president of the British Association at Montreal, has in the past devoted much attention to the subject of light; his papers on the subject have appeared in the publications of various scientific bodies, and in the *Philosophical Magazine* and other scientific journals.

In some of his earlier experiments he worked at the reproduction of diffraction gratings by means of photography, the latter having such minute delineating power. At first he thought of drawing gratings on a large scale and then reducing them by means of photography, but abandoned the idea, chiefly because he thought it doubtful whether photographic or other lenses were capable of doing the work. He, therefore, began by taking a Nobert's grating with 3,000 lines to the inch, and printing an impression from it direct, upon a dry photographic plate, just as transparencies are taken for the magic lantern. In the printing he used almost parallel rays of solar light, so that if the two plates did not touch at particular places, a shadow image of the adjacent lines might nevertheless be thrown upon the sensitive surface. He thus produced copies comparing not unfavorably with the original. The plates had to be very flat; even patent plate was scarcely flat enough, the use of worked glass being the remedy.

The vehicle for the sensitive photographic salts employed by him was sometimes collodion, sometimes albumen, both of which give delicately thin films. With these vehicles almost any photographic dry process would answer the purpose, and after a little practice he could produce copies equal to the originals in defining power, so far as he could see. After partial development he cleared the more transparent parts with iodine, after which the deposit in the intensifying process fell entirely upon the parts intended to be opaque. With the copies the nickel line between the D lines is easily seen. He worked in a dark room, with a slit in its shutter, and the grating placed at a distance from the slit. No collimator was used. The telescope consisted of a single lens of about 30 inch focus, with an ordinary eyepiece held independently. He prefers this to placing the whole arrangement upon one stand, as in the ordinary spectroscope.

He also experimented on the reproduction of gratings by means of bichromated gelatine, omitting the coloring matters usually added thereto in the carbon process. He poured on the bichromated gelatine as he would collodion, and allowed the film to dry in the dark. The printing was done by a few minutes' exposure to direct sunlight, and the development by treatment with warm water, which dissolved off the gelatine where not acted upon by light. The gratings thus produced were transparent in every part alike, yet they give brilliant spectra; the effect, therefore, must have been produced by the alternate linear elevations and depressions of the surface. By pressing soft sealing wax on these transparent gratings, the wax assumed the appearance of mother-of-pearl. He does not think that in the development any of the gelatine was dissolved away, but this conclusion, when viewed by the experience of those versed in the carbon process, is doubtful. The gelatine may have been rendered insoluble throughout its front surface, yet some of its organic constituents may have found their way through the exterior skin. There was uncertainty in the production of these gelatine gratings, but one or two of much perfection were made, giving spectra surpassing the original in brightness. The reason, he says, is that "on account of the broadening of the shadow of the scratch, a more favorable ratio is established between the breadths of the alternate parts." From the appearance of these earlier photographed gratings under the microscope, he concluded that 6,000 lines to the inch could be printed by the method, by which, also, the cost of diffraction gratings was likely to be considerably reduced.

In later experiments he discovered that he could photograph a piece of striped stuff, to produce an image on such a scale that there was room for about 200 lines in front of the pupil of the eye, capable of showing lateral images of a candle. The reduction was effected in a camera. He soon found that optical appliances are inadequate to the production of very fine gratings, from inherent imperfections in lenses, as well as from impediments due to the laws of light. Nevertheless, he thinks that by means of special appliances it might be possible to get 3,000 lines to the inch by this method, although the prospect is not particularly promising.

Direct printing from cut gratings he, therefore, considers to be the best method. He takes care that during the printing the glass front of the printing frame is at approximately a right angle to the incident light of the sun. Usually he cuts off most of the side light by partially closing the shutters of the room, but he cannot say whether this is necessary. With the more sensitive processes artificial light may be employed. Lord Rayleigh made some copies of gratings by the aid of a moderator lamp with its globe removed; the printing was done at a distance of two feet. All the glass surfaces have to be very clean, the pressure in the printing frame is moderate and even, and when the photographic film is delicate, care must be taken not to scratch it by a sliding rubbing motion. He is careful not to injure the engraved face of a grating, so scarcely ever touches it with wash leather or any other solid. He prefers to wash it, when soiled, with a stream of water from a tap, afterward flooding it with pure alcohol, and then setting it up to dry spontaneously. After taking several hundreds of copies of his gratings, the originals have scarcely, if at all, deteriorated. He finds that out of a package of two dozen 5 by 4 sheets of patent plate, as sold by the dealers, three or four may usually be selected flat enough for the photographing of gratings. Plates of the size mentioned may be cut with a diamond, and will do very well for four gratings, but it saves work and trouble not to cut them until they have been coated with the photographic film.

Lord Rayleigh, after trying many processes, some of which he abandoned, he says, for reasons which might not have necessitated their abandonment in the hands of a skilled photographer, felt most inclined to recommend Mr. G. Wharton Simpson's collodio-chloride process for preparing the plates. The details of this process may be found in photographic works, but it consists essentially in first coating the plate with dilute albumen, and drying it, then coating it in the developing room with an emulsion of chloride of silver in collodion; the emulsion contains a slight excess of free nitrate of silver. The exposure for printing is about five or seven minutes to the autumn sun; no development is necessary. The plates are washed in water, and then, without any toning, fixed with thiosulphate of soda. He increases the brilliancy of the spectra by finally washing these photographed gratings with corrosive sublimate, which, however, probably destroys their permanency. The use of very finely divided diffraction gratings is, Lord Rayleigh points out, not necessarily an advantage in the investigation of the solar spectrum, although it conduces to brilliancy. He has two by Nobert, one containing 3,000 and the other 6,000 lines to the square inch. The spectra of the 3,000 line grating were much the best in respect of definition, and the same was the case with the photograpie copies. The extra brilliancy of spectra with more lines is of no use if a higher magnifying power is necessary than the spectra will bear.

In testing gratings, Lord Rayleigh prefers to work in a dark room with a slit in the shutter, through which a direct beam of sunlight is steadily sent by means of a heliostat. He makes the slits cheaply, instead of using the ordinary appliances, but, at the same time loses the power of regulating the width by a screw motion. His plan is to coat a sheet of glass with tinfoil; weak shellac varnish is used to make the tinfoil adhere; the alcohol is allowed to evaporate, and after application of the tinfoil, the shellac film is softened by heat. Had paste been used, time would have been necessary to permit the drying of the aqueous film between the impermeable glass and tinfoil. To make a slit, it is next only necessary to cut a straight line in the foil with a sharp knife, and to wipe the line of the cut with a rag moistened with alcohol. Broader slits are made by removing the foil between two parallel cuts.

Despite his care in selecting samples of patent plate, it is evident from his records that, altogether, there is much more safety in using samples of worked glass for delicate photographic productions of this kind. With worked glass copies from the 3,000 line grating, he can usually make out nearly, but not quite, all that is shown in Angstrom's map. Among the photographic gratings on picked patent plate there are usually some whose performance is less satisfactory, though most of them, under low powers, will bear fair tests. He is uncertain as to the limits attainable of photographing fine lines in this way, but thinks it possible that with a flexible support to the film, such as mica instead of glass, ten or twelve thousand lines to the inch might be copied. Gratings may also be made on Brewster's principle, by taking a cast. Lord Rayleigh has obtained fair results by allowing filtered gelatine to dry, after being poured on the 3,000 line Nobert grating. This method is attended with risk to the original, and has other objections.

A Revolving Hearth Gas Generator.

A somewhat remarkable form of gas generator furnace, intended, in the first place, for the large productions of gas required in iron and steel works, has been designed by M. Pierrugues, and is illustrated in a recent issue of the *Revue Industrielle*. The generator is circular in plan; the bottom courses of the sides being set in a cast iron curb, supported on short piers or columns above the floor line. The bottom or hearth of the generator is built quite separate from the sides. It is a mushroom-shaped structure of grids slightly inclined from the center, which is pivoted upon a pillar, on which it turns freely. The circumference of the hearth is fitted underneath with a rack, similar to that of a mortar mill; and consequently the whole hearth can be revolved by a band pinion working in this rack. The idea will be sufficiently evident from the following description: The generator is charged in the usual way, through hoppers at the top; the gas outlet being likewise at the top. At any convenient part of the structure, a fixed bar from the side projects a regulated distance over the outer edge of the circular grill; and underneath this point is the truck for removing the ashes and clinker. The clinkering is done by revolving the hearth, by hand or power; so that the fixed bar sweeps off the material into the truck beneath. It is contended that this arrangement facilitates the regular working of the generator, and thereby enables the poorest and dustiest kinds of fuel to be properly gasified. It is evident that with a generator of any considerable size this convenience must be purchased by a large expenditure of power in rotating the grill with its load of fuel in active combustion.