during the progress of the operation is therefore required, nor does the machine, we are informed, need any attention except to replenish its supply and remove its completed product. Our engravings give a general view of the apparatus as set up in the factory, and also perspective elevations of its principal portions in greater detail. The entire length of the machine is 218 feet, including two ovens, respectively 100 and 50 feet long. Referring first to Fig. 2, at A are two hoppers placed above stationary cylinders. Within the cylinder on the left is a horizontal shaft carrying six radial partitions, which divide the interior of the cylinder into as many equal spaces. Into the larger hopper the coal slack is shoveled, and this, descending, fills the spaces between the partitions in succession, and is emptied out as the shaft revolves. The smaller hopper and cylinder are similarly constructed, and are used for the supply of clay. The spaces between the partitions are less in size than those in the coal cylinder, and are so constructed as to discharge regularly five per cent of clay, while ninety-five per cent of waste is supplied from the larger cylinder. The mixture takes place in a chute, B, which conducts the dry compound under the chain elevator, C. At this point the mingled coal and clay is moistened by sprinkling with milk of lime, or water to which five per cent of lime has been added, the liquid being distributed by the rose nozzle shown on the tank, D. The damp compound is now picked up by the elevator buckets and carried up to another chute, whence it passes to a short cylinder, E, within which are revolving spiral blades which force it into the mixer, F. Inside the latter are arranged seven upright shafts, each one of which carries four toothed arms, crossing each other in all directions. By suitable gearing, these shafts are rapidly revolved, working the compound in the mixer into a plastic mass. An ingenious device allows of the removal of any or all the shafts for repair or replacement without moving the frame on which they stand.

Through apertures in the bottom of the mixer, F, the mass next passes to a pug mill, G, in which are spiral wings, rotating on a vertical shaft and arranged to force the compound down through an opening at the bottom, the size of which is governed by devices, one of which is shown at H. Leaving thus in a continuous sheet, the mixture is received between two rollers operated by the wheels, at I, which rotate in contrary directions. The peripheries of these rollers are indented with molds, oval in form, so that the mass emerges, after pressure, in egg-shaped lumps. It should be noticed that this part of the apparatus constitutes the compressing system, and differs materially in its action from other devices, which aim to drive the mass into its smallest compass by a sudden and heavy blow, often causing breakage of the working parts. Here the water is gradually though rapidly squeezed out, leaving the pieces in compact and nearly dry condition.

Under the rollers is one extremity of an endless belt of wire cloth (not represented), strengthened along its length and at the middle by a wire rope. On the latter are attached cast iron balls, which are so arranged as to secure the wire rope to the belt, and which run in a continuous gutter placed under each portion of the band. The object of the gutter is to carry the weight of the belt, ropes, balls, and coal above and to support the return portion of the belt below. The balls, as they pass over the pulleys, fit into concave receivers cut into the peripheries of the same, thus insuring the wire cloth from slipping. Upon the band thus arranged, the lumps fall, and are carried straight into the first long oven, at the further end of which the opposite belt pulley is placed. At each end of this oven is a furnace by which it is heated. As soon as the lumps reach the end of the upper belt, they are thrown off upon an inclined chute, which conducts them to a second endless band below, upon which they travel back again; thence they fall in a similar manner to a third, fourth, and fifth belts; so that they pass through the oven five times, and, over a distance of five hundred feet, are subjected to a powerful heat, and finally emerge thoroughly dry.

The extremity of the long oven is represented on the left of Fig. 3, and at J the end of the lowest endless band is seen. This throws its load into the buckets of the elevator, K, which carries the fuel to a chute from which it passes to another endless band, L. Just above the latter is a tank in which is placed the waterproofing material, a mixture of crude benzine and rosin. The band, L, is forced by balls on its sides, acting in grooves, to pass down under this liquid, a quantity of which is drawn, by the faucet shown, into the shallow reservoir, M; and partitions are placed along the length of the belt to prevent the sudden fall of the pieces into the mixture and also to carry them out of it. The excess of liquid, which drops from the coal as it emerges from the bath, falls through the wire netting to a gutter, N, and hence it is collected in a suitable vessel placed below.

The lumps next fall into the second oven by the spout and hopper at O. Into this receptacle, in order to insure the evaporation of the benzine so as to leave a thin varnish of rosin over each piece, rendering it thoroughly waterproof, a current of hot air is driven by means of the fan blower, P. Subject to this powerful blast, the lumps traverse three belts in precisely the same manner described as taking place in the first oven, and finally drop from the last band into an adjustable chute, and thence pass into a coal car placed ready for their reception.

The advantage of this drying apparatus will be appreciated by comparing it with the labor, necessitated by the European systems, in heaping the large blocks of fuel into perforated cars, by hand, dragging the same into the ovens, waiting for their contents to become almost completely carbonized, then waiting still longer for both cars and load to become cool, when even further handling is necessary to prepare the material for transportation. There is no mixture of resinous matter with the fuel, thus avoiding the loss of cohesiveness due to the consumption of the tar, pitch, or asphalt first taking place, which allows the small particles of coal to fall through the bars before they have given off their full heating power. The waterproofing compound simply forms a light varnish over the surface, which protects the interior from moisture, and, while rendering the handling of the lumps free from the annoyances of dust and dirt, serves also as a kindling material.

At a recent trial of the fuel under one of the boilers, at the present Fair of the American Institute, we were afforded an opportunity to examine its cohesive quality. The pieces were thrown into a furnace where very active combustion was in progress; and although allowed to remain there for a considerable period of time, they did not lose their shape or run together. As regards heating power, the inventor considers the same to be equal to the best coal. No unpleasant odor is given off, there is of course no slate, and we are assured that clinkering does not take place. The ash, being mixed with clay, is heavy; and hence, where the fuel is used for domestic purposes, does not rise in light clouds, covering carpets, furniture, etc., with dust. The oval shape of the lumps is designed to insure a free draft through the interstices. As to cost, the inventor demonstrates that the material can be supplied at about one dollar per tun.

The machinery and process has been patented in this and other countries through the Scientific American Patent Agency, by Mr. E. F. Loiseau, of Mauch Chunk, Carbon county, Pa., to whom inquiries for further information may be addressed.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year..... $3 00
One copy, six months..... 1 50
CLUB RATES { Ten copies, one year, each $2 50..... 25 00
Over ten copies, same rate, each..... 2 50

VOL. XXIX., No. 21. [NEW SERIES.] *Twenty-eighth Year.*

NEW YORK, SATURDAY, NOVEMBER 22, 1873.

Contents.

(Illustrated articles are marked with an asterisk.)

WHAT TO DO IN HARD TIMES.

In consequence of the present inactive state of the financial world, many persons are deprived of their usual employments and know not what to do with themselves, or how to occupy their time to advantage. They are also made to suffer by the constant croakings concerning the lack of money and the gloomy prospects ahead, which now so constantly form the staple of ordinary conversation. This sort of talk is on everybody's lips, spreads like an infection, and tends to depress the feelings of even the most buoyant persons. But we advise our readers to resist and disperse its influence. It is only an incubus, a passing cloud, which must soon break away, revealing new prospects for business and enterprise, better than ever before experienced. The country was never in a more healthy or prosperous condition than at this moment, and the present financial blockade is only of a temporary nature. The curtailment of work or the suspension of industrial establishments cannot long continue; for money holders must employ their capital, which stands idle and unproductive when factories and mills cease to work. A healthy reaction will soon set in, and in a few weeks the hum of industry and the clatter of progress will be heard throughout the land. Meanwhile we urge upon every man or woman who happens at this juncture to be unemployed, to seize the golden opportunity for self improvement of some sort, or the working out of something useful at home. To young men especially, we say: Do not become loafers and topers. Keep away from grog shops and idle companions. Go to the libraries and read good books. Supply your minds with useful and ennobling subjects of thought. Hunt up your arithmetics and refresh your mathematics. Improve your penmanship. Learn to draw. Study the history of your own and other countries. In short, make effort to keep yourself busy about something that is profitable.

It is in hard times generally that new inventions flourish. People have time to study, and are perhaps urged to it by necessity. We shall be happy to assist our readers in this respect, and we invite them to write to us by letter in respect to their new inventions. The effect of thinking and of studying out devices will benefit them, even if nothing novel should result.

As suggestions in this direction, we will mention a few of the subjects in which special calls for improvements are made. In reflecting upon these, the inventor will be likely to be led towards other and better things. All the wants of mankind are open to the improving touch of genius.

It will be remembered that the State of New York lately offered a reward of one hundred thousand dollars for the production of any method superior, in practice and economy, to the present mode of towing canal boats by horses and mules. The time for competition has expired, and no person has as yet satisfactorily produced the required invention. The reward may or may not be renewed. The fact that it has been offered for three successive years shows the need of the improvement.

We lately chronicled the reward offered by the German railway companies for a good self-acting car coupling. Many lives are annually sacrificed in this and other countries for the lack of a really practicable coupling.

The Society of Arts, London, offered several months ago five prizes, each of $250 money and a gold medal, as follows: 1. For a new and improved system of grate, suitable to existing chimneys as generally constructed, which shall, with the least amount of coal, answer best for warming and ventilating a room. 2. For a new and improved system of grate, suitable to existing chimneys as generally constructed, which shall, with the least amount of coal, best answer for cooking food, combined with warming and ventilating the room. 3. For the best new and improved system of apparatus which shall, by means of gas, most efficiently and economically warm and ventilate a room. 4. For the best new and improved system of apparatus which shall, by means of gas, be best adapted for cooking, combined with warming and ventilating the room. 5. For any new and improved system or arrangement, not included in the foregoing, which shall efficiently and economically meet domestic requirements.

Among the simpler articles for which calls are made, the following may be mentioned: An improvement for straightening pins for home use; a new and cheap folding umbrella; a household water filter; stove attachments for cooking and saving fuel; cheap and light washing machine; a combined knife scourer and sharpener; a sweeping machine for floors and carpets; a scrubbing machine for floors; devices for cleaning and washing windows; flexible pipes for water and other purposes, cheaper than rubber or lead; flexible transparent membrane, capable of substitution for glass; folding beds and sofas; self-acting device for regulating the warmth of apartments; instrument for exhibiting to the eye the purity or impurity of the air in public halls and private apartments; electrical alarms and new applications of electricity of all kinds; portable houses; new and more economical methods of building cheap dwellings; new household appliances or combinations of every sort; new methods of advertising; improved styles for putting up articles; new ornamental designs, for furniture, carpets, oil cloths, and goods of every description; new mixtures of medicines; cements; new alloys; new chemical combinations. The subjects for inventions are almost exhaustless, and in future numbers we shall offer further suggestions.

A GREAT "LICK" IN ASTRONOMY---THE MILLION DOLLAR TELESCOPE PROVIDED FOR.

We note, with no small degree of gratification, that the project of a colossal telescope, which is to be the largest and most complete instrument that modern scientific knowledge can suggest, or ingenuity devise, is actually in progress of elaboration. The scheme of a "million dollar telescope," to which we have so frequently referred, and which has encountered such an earnest support among large numbers of the readers of our journal, is in fact to be carried out; though whether it will be found necessary to expend the whole of this large sum of money is not determined. It is known that the cost of the great Washington instrument, which was to be $50,000, has not amounted to a sum greater than $30,000; and hence there is a possibility that that of the mammoth telescope now contemplated may fall below the large aggregate first proposed.

In a recent address before the California Academy of Sciences, Professor George Davidson made the following remarks—words which we are sure will find their way to every quarter of the civilized world, and engender the liveliest pleasure to every lover of science and her advancement: "With a telescope of the largest size and most consummate workmanship that American skill can devise, properly located ten thousand feet above the sea in the clear skies of the Sierra Nevada, with every variety of apparatus commensurate therewith; with masters of observation and ingenuity in research; with ample funds reserved to devise other instruments and methods which those instruments and the highest genius must suggest, we hope at no distant day to see solved the mighty problems of creation that are yet beyond our grasp. Such an outfit and such provision have been the lifelong objects of James Lick; and after much earnest solicitation, I have overcome his shrinking from what he considers vain glory, and obtained his permission to announce to the Academy his intentions, which I have faintly sketched in the preceding sentence. There will be no let or hindrance in carrying out his views; the amplest means are provided; the rarest skill has been invoked, and the plans are taking definite and practical shape."

The *Mining and Scientific Press* of San Francisco, of which city Mr. Lick is one of the wealthiest denizens, notes that the scheme, as already indicated by Professor Davidson, is being quietly perfected, and that the geological, mete oro