A MAMMOTH GYRATORY STONE CRUSHER.

On the front page of this issue we show a huge stone crusher, which is said to be the largest in the world. It is designed to take rocks as large as 3x5x10 feet, and crush them to 6-inch size at the rate of 800 tons per hour. The machine is in operation at a 4,000-barrel cement plant in South Pittsburg, Tenn. The rock is exceedingly hard and tough limestone, which is brought to the crusher in cars carrying 7,000 pounds. The loaded cars run down two tracks by gravity, and are automatically dumped directly into the hopper of the crusher by means of tipples. The machine stands 18 feet 11 inches high, and the mouth of the hopper is 20 feet in diameter with fairly steep sides, so as to facilitate feeding the stone from all sides by gravity.

The crusher belongs to the "suspended" type of machine, that is, the gyratory shaft on which the head is mounted is suspended from a spider at the upper end of the machine. Our illustration shows the crusher partly broken away, in order to reveal the arrangement of the interior mechanism. The massive spider at the upper end of the machine is formed with but two arms, so as not to obstruct the hopper. The openings at each side of the spider arms are 36 inches wide and 138 inches long, so that rock of the dimensions specified above can slide in without lodging against the spider arms. The shaft is supported in the hub of the spider in such a manner that it may oscillate slightly. The lower end of the shaft is formed with an eccentric bushing which engages an eccentric ring. The latter carries a bevel gear, which meshes with a bevel pinion on the driving shaft. As the driving shaft is rotated, the eccentric serves to impart a gyratory motion to the shaft. The crushing head, which is supported on this shaft, is conical in form with a corrugated surface, as indicated. The head operates in an inverted conical shell faced with 54 plates of steel, arranged in three rings. These plates are technically known as "concaves." The rock slides through the hopper and lodges between the crushing head and the concaves. The gyratory motion of the head produces a powerful crushing motion, which breaks up the rock, and the latter when reduced to proper fineness drops between the crushing head and the concaves into the lower shell of the machine, where it is guided by an inclined diaphragm to the discharge spout. The rock may be crushed to a smaller size by providing the lower tier of concaves with corrugated surfaces. The interlocking corrugations tend to break up flat pieces which would ordinarily slip through. Further regulation may be made by adjusting the conical head upward. This may be done by means of a nut, which is threaded to the upper end of the vertical shaft and rests on the bearing sleeve. The eccentric of the machine operates in a reservoir of oil, so as to reduce friction and wear of the parts to a minimum.

The top shell of this crusher was made in two pieces, because its size exceeds the limits of railroad transportation. Each half with its concaves weighs 57,000 pounds. The lower shell is a single casting and weighs 73,000 pounds, while the bottom plate, with the bushing gear and eccentric, weighs 38,000 pounds. The weight of the entire machine is 425,000 pounds. The crusher was designed to develop a crushing pressure near the bottom of the head of 1,500,000 pounds. Tests at South Pittsburg showed that 29 horse-power are required to run the machine empty, and the load when crushing varies between 56 and 153 horse-power. Granites and trap rock would probably take twice this power when reducing to 6-inch size. Manganese steel concaves and a self-tightening manganese steel mantle for the crusher head would be used to adapt the machine to crush granite, quartz, trap rock, and hard abrasive limestones. We are indebted to the Power and Mining Machinery Company, of Milwaukee, Wis., for our information on this machine.

Relation of Government Fuel Investigation to the Solution of the Smoke Problem.

Statistics collected by the government indicate that the nation has consumed about seven billion tons of coal up to the present time. Last year the consumption was more than four hundred million tons. During the past ten years, nearly as much coal was used as had been used during the preceding century. This increase in the use of coal during the past century has been so great, that it is concluded that if the consumption continues to increase at the same rate, the coal fields of this country will be exhausted before the end of the next century. However, if by some means the increase in the use of coal can be checked, and the output of the mines kept down to the present figures, there will be no occasion to worry about the coal supply. But the increased demand for coal will probably continue, and we may reasonably look for a gradual rise in the price of coal as it becomes more difficult to mine it. Only the best and most profitable seams are being mined at the present time, the inferior coal being left in the ground. As used at present for heat, light, and power, the losses are so great that, of the total heating value of the coal, less than five per cent is converted into useful work in the ordinary manufacturing plant, and even some of the largest and best power plants are able to utilize only about ten per cent of the energy in the coal. In railroad operation only from three to five per cent of the coal value is realized for pulling the train. It is estimated that only one-seventh of one per cent of the fuel value is actually converted into light in an incandescent lamp. Nearly two million horse-power in the form of gas is allowed to escape from the blast furnaces of the country. This condition is rapidly being changed by the installation of gas engines to develop the power. There is also a great fuel waste in the manufacture of coke, besides the loss of many valuable by-products. It is estimated that these losses amount to fifty million dollars annually.

A Problem for Inventors to Solve.

The great success that has attended the operation of high-pressure fire systems which are in use in New York and Philadelphia, and are soon to be installed in San Francisco and other large American cities, is marred by one important shortcoming, which furnishes an interesting problem to inventors. This is a suitable reducing valve for controlling the nozzle pressure on any single line of hose, so that the stream may be held and directed by one or two firemen unaided by any mechanical contrivance—a pressure of 50 pounds at the nozzle being the limit for such work. As it is the tendency to remove the fire engines as fast as the high-pressure equipment is provided (in fact, in the new system for the built-up districts of San Francisco, it is proposed to do without fire engines entirely), this need is really quite pressing. While the high pressure will deal effectively with a large fire or conflagration, for a small, ordinary fire it must be handled most carefully in order to prevent damage by water. This latter item may be considerable; and there is a tendency upon the part of insurance companies in writing policies for a high-pressure district to increase the amount on the building, but to decrease that on the contents, on account of the water damage. Now in a high-pressure system, on an order of the fire chief or commanding officer at a fire, the pumps are started, and a certain pressure at the pumps is maintained by an automatic regulating valve at any point between say 100 and 300 pounds, and this pressure with the slight loss due to friction is maintained throughout the distribution system. Hydrants are placed on the mains at intervals, and each hydrant has four outlets to which lines of hose may be attached, each outlet being controlled by an independent valve. It is evident that even at a fairly large fire the same pressure and volume of water is not required from every line of hose, while at a small fire a small stream well and quickly directed will extinguish the blaze most effectively, so that the obvious place for regulating the pressure, so as to get the same flexibility and adaptability possessed by the fire engine, is at the hydrant, where some portable form of reducing valve, that can be readily carried on the hose wagon and speedily attached, is demanded. The essential features of such a valve as outlined by Capt. Greely S. Curtis, an independent consulting fire engineer, in a recent report on the New York Fire Department, are that it must allow an ample and unobstructed flow of water when desired, that it should maintain any desired pressure on the hose, that it should afford immediate relief on shutting off the valve, and limit the pressure in the line to 40 or 50 pounds when the flow is stopped at the nozzle, that it should possess a double pressure gage showing the pressure both on the hydrant and the line sides of the valve, and finally that it should be durable. Not only is this an engineer's opinion, but it is that of the practical firemen now working with the high pressure. While a number of arrangements have been proposed, the inventor who produces a satisfactory and practical device to meet these conditions will without doubt earn a substantial reward.

Distributing Cold Through Pipes.

The first international congress on refrigeration has just met in Paris. Its object is to awaken interest in the industrial and domestic applications of refrigeration. Artificial refrigeration originated in France but it has reached its greatest development in America. Cold is actually distributed to private houses in Boston, New York, St. Louis, Atlantic City, Baltimore, Norfolk, Los Angeles, Denver, and Kansas City, through systems of pipes which vary in length from 1 to 18 miles. The financial results show a still greater variance. The business is very profitable in some places and unremunerative in others. The Denver company, for example, has been forced to suspend operations.

In general it has been found advantageous to concentrate the production of cold in large establishments and to employ the ammonia process. There are two methods of distribution: by chilled brine and by liquefied ammonia, which is allowed to expand at the place where the refrigeration is desired. The latter method is preferred, and is used exclusively in the newer installations, although it requires a triple system of pipes. Both methods are in use in Boston and New York. In the method in which ammonia is distributed the tightness of all joints is very important, as leakage may entail losses that would make the enterprise unprofitable. Some companies use joints welded with the aid of thermite and insert expansion joints at intervals. The iron pipes through which the ammonia flows are inclosed in tile pipes which rest on concrete foundations. It is rumored that a French company will establish a system of distribution of cold in Cairo, Egypt. The project includes a central station for the condensation of ammonia, 3 miles of pipes for the distribution of the liquid ammonia to a number of substations, where it will be used to refrigerate brine, and 20 miles of pipes for the distribution of the cold brine to consumers.

Expansion of Valves at High Temperatures.

The results of experiments to determine the expansion of valves and fittings in service involving high temperature are given by the Valve World. Three flanges were taken, one of cast iron, one of ferro steel, and one of steel. They were exposed to varying degrees of heat for a period of 130 hours, the temperature being less than 500 deg. for 18 hours, 500 to 700 deg. for 97 hours, 710 to 800 deg. for 12 hours, and over 800 deg. for 3 hours. The average for 130 hours was 583 deg. The view previously put forth by the Valve World was that cast iron subjected to continued temperatures of approximately 500 to 600 deg. takes a permanent expansion and does not return to its original volume when cooled. The results of the above mentioned experiments are stated as follows: Cast steel flange—no change. Cast iron flange—outside diameter increased 19-1,000 inch, inside diameter increased 7-1,000 inch. Ferro-steel flange—outside diameter increased 33-1,000 inch, inside diameter increased 17-1,000 inch.

The Current Supplement.

SUPPLEMENT No. 1714 opens with an article by Percival A. Hislam on the new Russian armored cruiser "Rurik." Allerton S. Cushman contributes a splendid paper on electrolysis and corrosion, in which he develops his theory that rusting is an electrolytic effect. John J. Macfarlane summarizes the foreign trade in automobiles, and shows how remarkable has been the development of the industry. The well-known British fuel and gas expert Prof. Vivian B. Lewes contributes an article on the comparative thermal value of various fuels. Lubrication and lubricants are discussed by Dr. P. Martens. The anatomy of the "Mauretania" is the subject of a picture which represents a longitudinal section through the most modern of transatlantic liners. Francis Ward shows how the markings and colorings of fish protect them from their enemies. How plants may be forced by warm baths is told by Prof. Hans Molisch. The English correspondent of the SCIENTIFIC AMERICAN shows what the working cost of the Renard road train is per day. There are few natural phenomena so impressive to spectators as the total eclipse of the sun. For this reason eclipses have affected mankind strangely. Samuel Jennings shows what the relation of solar eclipses to ancient history has been.

The Death of Samuel D. Burr.

Samuel Devere Burr died at Plainfield, N. J., on October 28. He was born January 23, 1855. He received the degree of Civil Engineering from Rutgers College, and later the degrees of Bachelor and Master of Arts. For three years he was connected with the Engineering News, and was a valued member of the SCIENTIFIC AMERICAN'S staff for six years. He left the SCIENTIFIC AMERICAN to fill a position on the staff of the Iron Age, where he remained for sixteen years. At the time of his decease he was connected with Metal Industry.

During these years he assisted his father with two volumes on the Centennial Exposition, wrote "Bicycle Repairing" and "Tunneling Under the Hudson," also "Rapid Transit in New York City and in Other Great Cities" for the Chamber of Commerce.

The Pennsylvania Railroad forestry department has just completed its forestry planting for this year. It is stated by Railroad Men that 625,000 trees were planted. This makes a total of 2,425,000 trees set out by the Pennsylvania Railroad up to the present time. The object is to create an adequate supply of timber for ties required in years to come. The Pennsylvania Railroad evidently is taking active steps in regard to the preservation of natural resources. The true way of preserving our forests is not necessarily not to use them, but to replant them.

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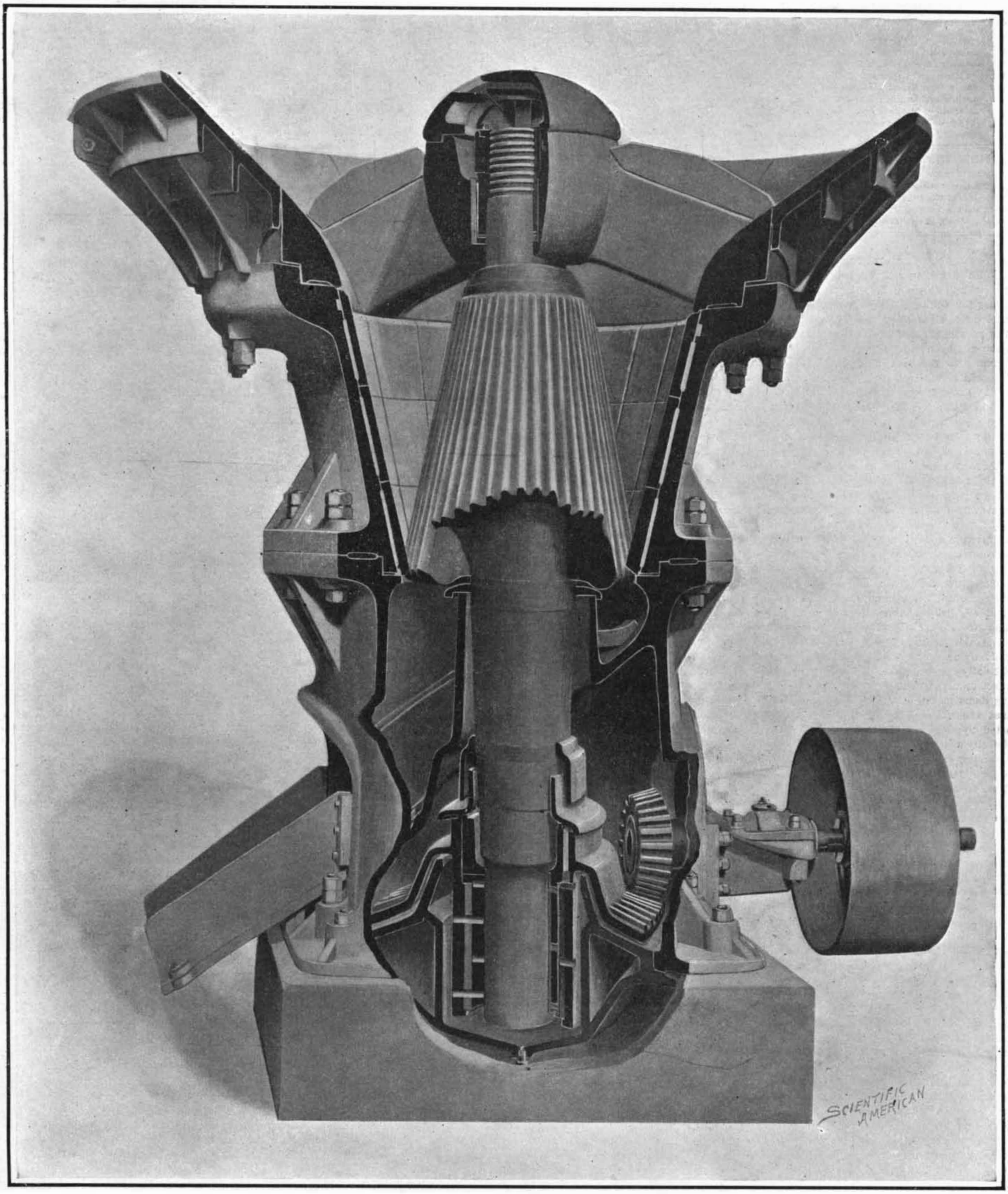

This huge crusher will take rocks as large as 3 x 5 x 10 feet, reducing them to 6-inch size at the rate of 800 tons per hour. Diameter of hopper, 20 feet; height of machine, 18 feet 11 inches; total weight, 425,000 pounds.

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