quires renewing. Water alone is also harmless in contact with iron, and if the ordinary water of commerce were evaporated in a vessel properly arranged to allow the escape of the air driven from the heated water, and then condensed before being allowed to enter the steam generator, corrosion would be almost completely retarded. This is, of course, assuming that the water was free from all injurious ingredients liable to deposit. But even with water highly chargad with suspended matter in solution, it would be well purified by the preliminary evaporation and condensation.

Spontaneous Combustion of Charcoal.—Among the substances subject to spontaneous combustion, according to the *Fireman's Journal*, pulverized charcoal is said to be one of the most remarkable. Incidental to this phenomenon a story is told that a load of charcoal was delivered in an outhouse of a clergyman in Leipsic, and showed no signs of burning until the door by accident was left open, when the wind blew sprinklings of snow on the charcoal. The rapid absorption of oxygen from the melting snow caused the charcoal to ignite, and as the day was windy the whole range of buildings was burned to ashes. In this connection a fruitful and unsuspected source of fire suggests itself to those of our American housekeepers who burn wood as fuel, and who store the ashes in boxes or barrels. The accidental disturbing of such ashes, even after years, will cause them to ignite, provided the air is damp or foggy. The phosphuret of potash from decayed wood renders wood ashes highly inflammable, and mysterious cellar fires in the rural districts are, no doubt, in some cases, caused by this form of spontaneous combustion.

Wire Rope Transmission.—Among the recent improvements in the way of transmitting power for long distances, is the substitution of belts by endless wire ropes running at a high speed. Just where the belt becomes too long for economy there the rope steps in. In place of a flat-faced pulley a narrow sheave, with a deep, flaring groove, is used, the groove being filled out, or lined rather with leather, oakum, India rubber, or some other soft substanee, to save the rope. The essential points are a large sheave, running at a considerable velocity, and a light rope. When the distance exceeds 400 ft., a double-grooved wheel is used, and a second endless rope transmits the power 400 ft. further, and so on. The loss by friction is said to be only 8 per mile. If it is required to transmit 300 horse power by means of a wire rope, the size of rope required will be one inch in diameter, running 4,920 ft. per minute over a wheel 14½ ft. in diameter, making 180 revolutions per minute. One is thus enabled, at a small expense, to transmit power in any direction.

A Novel Railway Device.—M. Haureg, a French inventor, proposes a method of boarding railway cars without stopping the train. A "waiting carriage," fitted with a steam engine with special gear, and space for passengers and luggage, is placed on a siding at the station, and picked up by the train as it goes past. The latter, by means of a hook on its last carriage, catches a ring supported on a post, and connected with a cable wound on a drum in the waiting carriage. Thereupon the drum begins to unwind, and in doing so compresses a system of springs, while the carriage is moved at a rate gradually increasing to that of the train. The engine of the carriage then winds in the cable, the train and carriage are connected, passengers are transferred from the joined carriage to the train, and *vice versa;* then the two are disconnected, and the engine of the carriage, working on the wheels, brings it back to the station whence it was taken.

High-Speed Machinery.—The speed of a cutting machine should be regulated by the number of feet per minute travelled over by the cutting face and the quality of the material cut From 15 to 18 ft. per minute may be allowed for wrought or cast iron, and twice that speed for gun metal, whilst for steel the speed must be reduced in proportion to its hardness. As a rule, these speeds are seldom approximated to, and thus it becomes a matter of serious loss to the engineering manufacturer that a certain cost of plant is not producing its full equivalent of work in a given time. In the same way, with reference to the prime movers or engines, their development of power is exactly proportionate to their speed; indicated horse power being the product of the gross pressure multiplied into the number of feet per minute, through which the resistance is overcome. About 300 ft. piston speed per minute is the average speed for which most commercial engines are designed.

A Glue for ready use is made by adding to any quantity of glue common whisky instead of water. Put both together in a bottle, cork it tight and set for three or four days, when it will be fit for use without the application of heat. Glue thus prepared will keep for years, and is at all times fit for use, except in very cold weather, when it should be set in warm water before using. To obviate the difficulty of the stopper getting tight by the glue drying in the mouth of the vessel, use a tin vessel with the cover fitting tight on the outside to prevent the escape of the spirit by evaporation. A strong solution of isinglass made in the same manner is an excellent cement for leather.—*Builder and Wood-Worker.*

The Basin of the Gulf of Mexico, and the Coral Reefs of Yucatan and Florida Banks.—At the session of the National Academy of Sciences, held recently in the lecture-hall of Columbia College, New York, Professor J. E. Hilgard illustrated his paper on the basin of the Gulf of Mexico by a sectional drawing and a model showing the bed of the gulf. The model, formed from data furnished by the United States Geodetic Survey, was constructed to a scale of forty miles to the inch. The area of the gulf is estimated at 600,000 square miles, one half of which has a depth of 100 fathoms. The deep basin, more than 55,000 miles in area, has a depth of 12,000 feet. In a paper read at the same session, by Professor Alexander Agassiz, on the origin of the coral reefs of the Yucatan and Florida banks, it was asserted that Darwin's theory of subsidence would not fully account for the great reefs. There are no traces of subsidence on so vast a scale; indeed, the signs are those of elevations, for which subterranean disturbances furnish the best explanation. The old coral reefs enable us to infer with tolerable accuracy the ancient courses of the ocean. The theory of subsidence does not account for the immense accumulations of matter on the gulf plateau, since the coral deposits are going on where there are no signs of subsidence.

Coal Deposits in Natal, South Africa.—Mr. Frederick W. North, mining engineer, who set out from England some time ago to explore the coal-fields of Natal for the Colonial Government, estimates that within the colony of Natal he has already inspected 200,000,000 tons, suitable for house, steam-locomotive, marine, or gas purposes. The best workable coal, as far as known as present, begins between Helpmakaar and Dundee, and very important coals, from 6 to 10 feet thick, extend over many miles of almost uninhabited country up to Newcastle. The coal, lying in nearly horizontal strata, is believed to correlate with the Permian and New Red Sandstone of Great Britain. It is bituminous, semi-bituminous, or fat-caking coal. Mr. North thinks the deposits surveyed by him will be of no service until about 150 miles of railroad are constructed. Coal at present brings £4 per ton at Pietermaritzburg, and at Durban, £3; while these coals could be put on the banks or into waggons at 10s. per ton. Mr. North describes this coal as "the only deposit, together with iron ore, with which nature has endowed Natal."

Why a Pump will not Lift Hot Water.—The suction pump depends for its action on atmospheric pressure. When the piston of such a pump is raised, a vacuum is formed beneath it, and the water from the well or reservoir is forced to follow the piston up to the top of its stroke, by the atmospheric pressure on the water surface with which the pump is connected. When the attempt is made to lift very hot water, however, the rise of the piston causes an abundant evolution of steam or vapor from the water surface, which fills the space beneath the piston. This steam or vapor has considerable tension, and exerts a sufficient back pressure to counterbalance and equalize the atmospheric pressure. On this account, the lifting of hot water, save for very small lifts, is impossible. When hot liquids are to be pumped, therefore, the point of supply should not be below the pump, but rather a little above it, so that the liquid may flow into it.

The Tay Bridge.—We commend to Mr. Haskin, of Hudson River tunnel notoriety, and to the coroner's jury who "sat upon" the victims of the disaster connected with it, the report of the experts employed to ascertain the cause of the Tay Bridge calamity. The bridge, says the experts, was bad in design and construction, and was badly maintained, and tumbled down because of defects of structure that were apparent and were merely patched up before the happening of the casualty. Sir Thomas Bouch, the designer and constructor of the bridge, is charged with the initial blunders. General Hutchinson, the Board of Trade Inspector, bears the blame of allowing the bridge to be used when he had full knowledge of its dangerous condition.