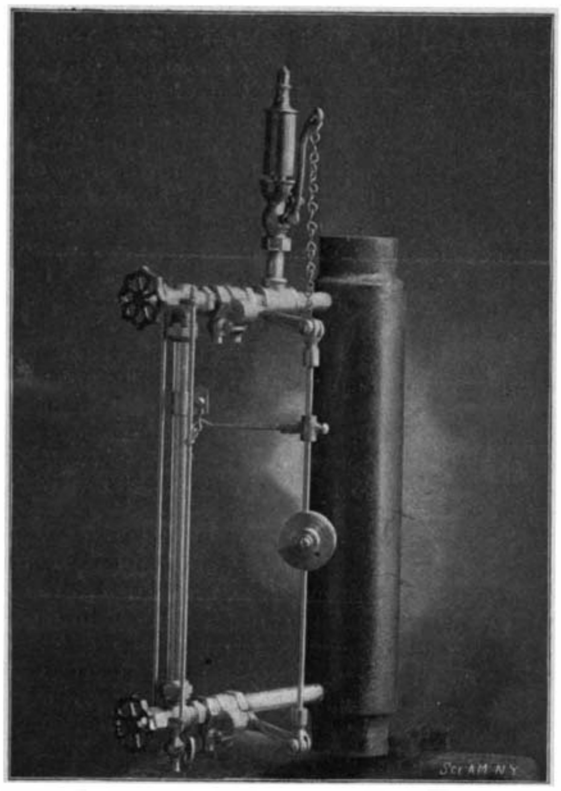
A SAFETY ATTACHMENT FOR WATER-GAGES.

Our illustration represents an automatic shut-off and alarm which is designed to cut off the water and steam should the gage-glass break, and to blow a whistle in order to call the engineer's attention to the accident. The device is the invention of William M. McLeish, of New Albany, Ind. The water-gage to which the improvement is applied comprises the usual water and steam inlet pipes connected by a glass. In the pipes are cut-off gate-valves whose stems are provided with arms connected with each other by a rod carrying an adjustable weight. On the rod a bar is adjustably secured by a set-screw. The free end of the bar rests on a support which embraces the glass. When the bar is thus supported the cut-off valves of the water and steam inlet pipes are normally held in open position. If the glass be broken, the support falls, and the weight on the rod connecting the arms of the cut-off valves moves down to close both valves so that the water and steam are shut off. The arm of the upper cut-off valve is connected by a chain with a whistle, so that when the weighted rod moves downward, the whistle will be blown to attract the attention of the engineer.



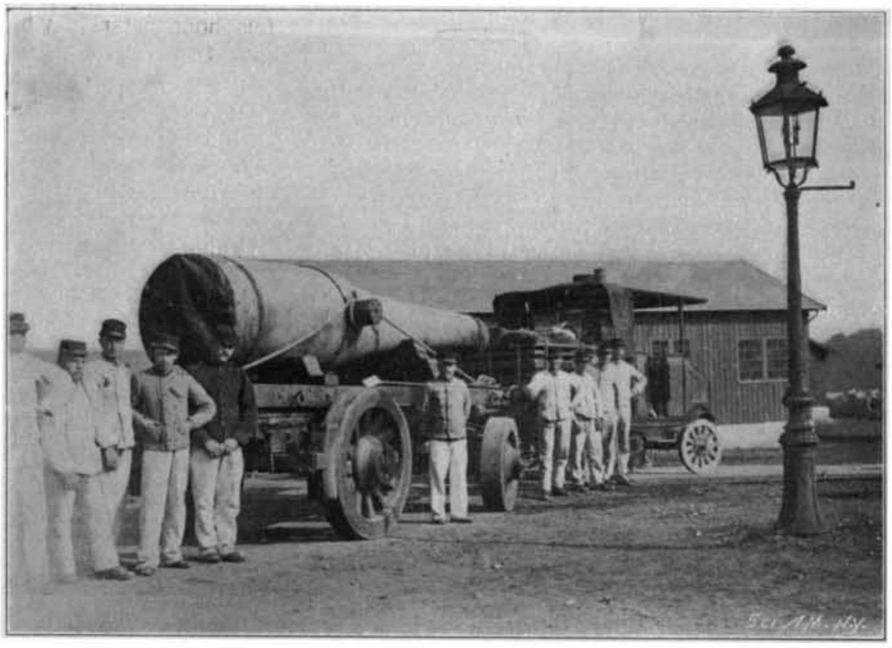
AN AUTOMATIC SAFETY ATTACHMENT FOR WATER-GAGES.

SCOTTE TRACTION ENGINE—TYPE SHOWN AT THE PARIS EXPOSITION.

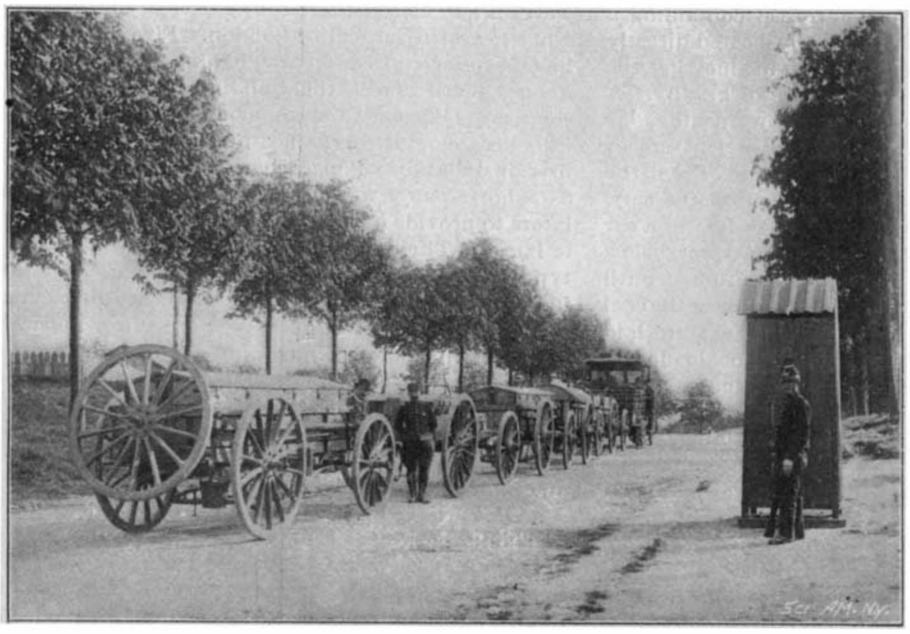
The exhibit of military automobiles at the Army and Marine Palace shows the great progress which has been made in this direction of late. In France especially, where the automobile industry is now so well developed, it is natural that the Etat Major, which is always on the lookout for the latest improvements, should have given the subject considerable study; and the leading automobile manufacturers have been encouraged in the construction of types of machines especially adapted for army use. Thus the different machines at the Exposition include private vehicles for the officers, moto-cycles for carrying dispatches, mail and telegraph wagons, ambulances, and heavy traction engines. Among the latter the Scotte traction engine deserves special mention, as it is the type which has been used by the army for some time past and has been adopted after a very thorough series of tests. The illustration shows a general view of this machine, taken at the Versailles military station. The machine serves as a tractor or carrier, as it will carry in the rear a load of four tons, but in most cases it draws a train of heavy trucks or army wagons, and can transport from 10 to 12 tons useful load with an average speed of 4 to 4½ miles an hour on ordinary roads, while on good roads this speed may be increased considerably. The engine has a capacity of 27 horse power nominally, but this may easily be raised to 40 at starting or in hard places. A series of tests of this machine has been made at the Versailles headquarters from 1897 to the middle of 1899 under the direction of the superior officers of the artillery and engineering corps. The tests were made in as thorough a manner as possible, as it was desired to establish conclusively the relative advantages of steam and horse traction and obtain a series of data which would serve for future work. The tractors were accordingly put through a series of evolutions according to a carefully studied programme, and the data thus obtained are of great value, considering the high authority of the experts and thoroughness of the tests. The results leave no doubt as to the superiority of steam traction for the army, and it is likely to become an important factor in future operations. The first road locomotives used in the French army date from 1875, and were of English make; later on, a series of French machines of 18 and 12 tons were used. These, while they gave considerable service in hauling heavy material for the new forts and batteries, presented a great many disadvantages; according to the official reports, they were not powerful enough, presented great defects in maneuvering and direction, and were excessively heavy, so that they were of but little value in mounting grades, and besides they injured the road considerably. From this experience the Etat Major did not look very favorably upon steam traction; but since the tests made with the new machines they have quite changed their opinion, and the reports show that they are now very much in favor of the system, and consider that it will solve many important problems. It may be of interest to cite a part of the official report: "The traction engine, whose weight is not more than six tons, can pass over all of the classed roads in France without deteriorating them, and can enter into fortified places; when drawing a train of wagons, it can make turns of an interior radius of 11 feet and describes with facility all the desired curves. It has the great advantage that the existing rolling material may be drawn by horses or by the tractor without any change whatever; all the types of military vehicles may be thus drawn by the use of hitching devices adapted for the purpose." The photographs show the various purposes to which steam traction is applicable, one decided advantage being that of drawing long trains of wagons; this is shown in the view of the train of ammunition wagons, which is being drawn up an 8 per cent grade, the total weight being in this case 18 tons. In another view is a train of five provision wagons, showing the method of supplying an army in the field. A third view shows the transportation of a 10-inch siege gun to one of the large forts; the weight is here 25 tons.

The reports have established some interesting data as to the advantages of steam over animal traction for army use. Suppose, for instance, that it is desired to transport 250 tons of material over a distance of 36 miles. Horses, drawing heavily loaded vehicles, can make at most 18 miles in one stage, and thus two sets will be needed to cover the 36 miles, making a relay in the center necessary. The tractor can, of course, cover the entire distance when supplied with fuel and water. In the case of horse traction, if each vehicle is loaded with 3 tons and drawn by 6 horses, as is usual

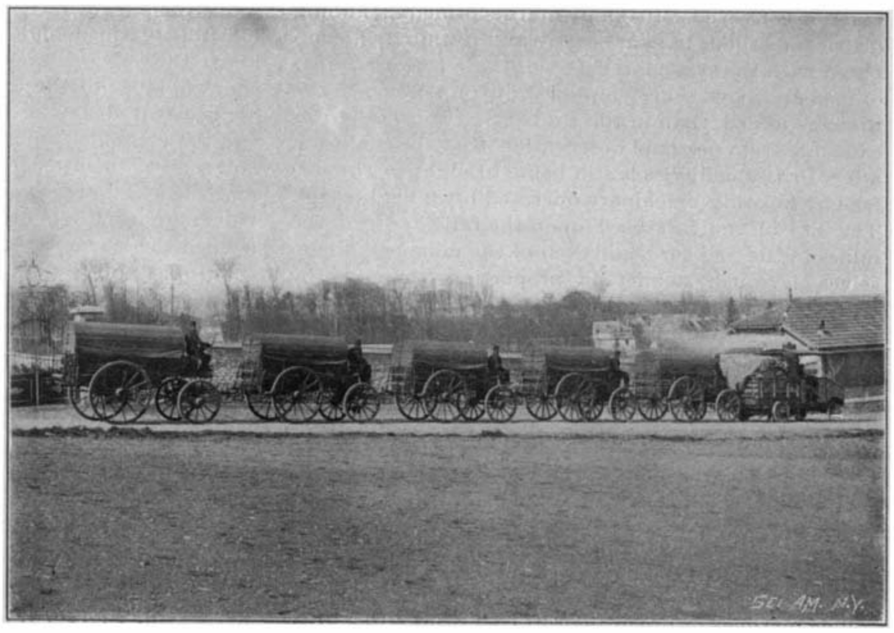
SCOTTE TRACTION ENGINE AT THE VERSAILLES ARMY HEADQUARTERS.



10-INCH SIEGE GUN, WEIGHING 55,000 POUNDS, DRAWN BY SCOTTE ENGINE.



AMMUNITION WAGONS ON 8 PER CENT GRADE—TOTAL WEIGHT, 18 TONS.



PROVISION TRAIN DRAWN BY SCOTTE ENGINE.

in army transports, 80 vehicles would be needed for the 250 tons considered, with 480 horses for one stage, or 960 horses for the two stages of the route. As to the personnel, the least number allowed requires one chief of the whole train, one officer or adjutant for each section of twenty vehicles, and four men per vehicle, making 325 men in all. As to the length of the train, allowing 60 feet to each vehicle, including the distance to the next, the line of vehicles will cover 4,800 feet of road. To feed the horses (counting 35 cents per day in France) will require an expenditure of $336, not counting the extra horses which always accompany a train of this kind. In the case of steam traction, 4 tons of useful load may be carried on the back part of the machine, and it will draw two vehicles loaded with 3 tons each, making 10 tons per train ; thus to carry the 250 tons would require twenty-five similar trains, this being well within the limit, as the machine will take 12 to 14 tons. As to the personnel, each train requires one engineer, one fireman, and two men, and for the ensemble are needed one chief of expedition, two foremen mechanics and twenty men under them, making 150 men in all. The length of each train is about 90 feet, spacing them 30 feet apart, making a total of 2,250 feet. Each tractor consumes, for the 36 miles, $6 in combustible, etc., making the cost of transportation $150 for the whole. By comparing these figures with those for animal traction, there results an economy in personnel of 275 men, in length of train 2,550 feet, and in cost, $186. The advantage is thus decidedly in favor of steam traction. The Versailles commission conclude their report as follows: "This system may render great service in army transports of all kinds. In time of peace it reduces the expenses of haulage between military establishments and docks which are outside of the railroad system. In case of mobilization, when horses will be wanting, owing to the substitution of mechanical for horse traction in all the large cities, the tractors will be valuable for the various army transports."

MODERN SOFT-COAL MINING AND HANDLING IN THE UNITED STATES.

BY HENRY HALE.

Although the total shipments of soft coal in cargoes from the United States to foreign ports during the present year will probably not exceed six per cent of the total bituminous output in this country, the increase in export trade has attracted much attention, since the shipment is fully four times as great as that of 1898. It is calculated that the total soft coal production of the United States for 1900 will range between 170,000,000 and 175,000,000 tons.

The success of American coal exporters has been due to the prices which they have quoted, being less than those of European dealers. Several causes have contributed to the success of American competition, one of which has been the labor difficulties in Great Britain and on the Continent, which have largely curtailed the production. It is generally admitted, however, that the principal reason is the economical methods of mining and shipping the product, and the extent and richness of the American deposits. While the mines in Great Britain and Germany, for example, have been worked for centuries, many deposits in the United States have been opened but a few years. One of the principal items of expense abroad is in the construction of shafts and the elevation of the coal to the surface. Pits which extend vertically 1,000 feet to the mine workings are quite common in Lancashire, Staffordshire, and South Wales. As the beds of fuel have been worked out, shafts have been driven in some cases to a depth of nearly 2,000 feet. The construction of the shafts requires a large amount of timber to prevent caving in and the installation of power plants, operated principally by steam, for raising and lowering the men and material. The system of ventilation in such mines is also very expensive, owing to the distance which air must be conveyed. In many of the principal mining districts methods used are costly and antiquated, compared with the system in this country, a larger number of men and boys being employed, in proportion to the tonnage mined, than in the United States. The writer can state from personal observation that the coal from a few British collieries is still being brought to the surface by hoisting machinery operated by animal power. The size of the cars used upon the railways from the mines to the seaboard, and even of the mine cars themselves, is much smaller in proportion than in the United States, and the locomotives employed have less power ; consequently more trains must be made up to transport a certain tonnage, at an increased cost for train crews and other service. The methods of transferring coal from the mines to the cars, and again at the shipping docks, or at the points of consumption, require more manual labor than in this country. As yet, mining by machinery is in its infancy in Great Britain, the majority of the work being done with the pick and hand-drill; consequently the number of miners in proportion to the output is far greater than on this side of the Atlantic.

The methods of procuring soft coal utilize, to a great extent, electricity and compressed air. A power station is built at a suitable point, to generate the electric current for operating the mining machines proper, driving the ventilating fans, furnishing current for the trolley mine locomotives, and supplying light in the various galleries and rooms. As fast as a mine is opened, tracks for the cars are laid in connection with the trolley system, and incandescent lamps placed in the "chambers," thus avoiding the danger of fire by other means of illumination. Many of the companies build houses for their employes, supplying them with light, baths, and other conveniences from the power station, and installing a system of waterworks and sewerage. Usually the power house and dwellings are constructed before mining proper begins. Then the main tunnel or entry is excavated to the face of the coal, its size and direction already being located by the company's engineers. The tunnel is large enough for a double-track railway and terminates in another tunnel or gallery, which extends parallel with the face of the coal seam. From it are cut short passages which terminate in the mining "chambers" or "rooms." These passages are, of course, cut through the coal and are what are termed "double entries," consisting of two passages separated by a partition of the mineral.

If the mining is done by hand, special drills are used, one miner and helper taking a contract to remove the contents of a room from 20 to 25 feet in width and about 20 feet in length.

In machine mining two miners will take a contract to clear out three chambers. The machines, operated by pneumatic or electric power, are carried to the face of the vein, and the framework is fastened in position by being screwed against the roof and sides. The electric current is conveyed to the motor operating each electric machine through an insulated cable which is connected with the main power station. This cable works upon a reel, and can be lengthened or shortened as required. If compressed air is used, it is conveyed in the same manner through flexible piping. The principal mining machines consist of steel punchers or bits bolted to movable metal belts or chains working upon platforms which are also movable. When the compressed air or electric current is turned on, it revolves the chain and its cutters, and at the same time holds the platform supporting the chain firmly against the vein of the coal. A horizontal groove is made of a depth and width varying according to the size of the machine. A Jeffrey cutter will make an incision 6 feet in depth and 4 feet in length within five minutes in ordinary soft coal. The groove is made as near the bottom of the room as possible, in order to cut or undermine the vein at its lowest point.

In one day what is known as a punch machine will cut from 175 to 225 square feet. An electric machine will cut from 720 to 900 square feet. As the average miner and helper, working by hand, will take out with drill and pick but 4 or 5 tons in the same time, the saving effected by the machines in time and labor can be appreciated. It is estimated that the saving to a mining company ranges from 20 to 50 cents per ton, according to the district where the mine is located.

From the time the mine cars are loaded until the coal is in the vessel's hold, a variety of labor-saving appliances is used. The cars, which are run to the entrance of each room, are made up into trains or "trips" which carry as high as 200 tons. One locomotive will do the work of from 15 to 40 horses or mules, according to the power of the motor. It hauls the cars from the entrance of the mine to the tipple, if there is no incline by which the force of gravity can be used. To handle a train of 20 or 30 cars, only a motorman and a brakeman are required. The locomotives vary in power, being built to work on grades as steep as 4 per cent. As they range in weight from 10 to 20 tons, the rails required for the tram road are very light.

At the tipple the weighing, separating and loading of the cars or boats are done automatically. The tipple, which is merely a wooden trestle containing a movable platform and scales, is usually located directly above the railroad track, or at such an incline that the coal will fall into the cars by the force of gravity. A car is elevated at the tipple so that by opening one end the contents run out upon the separation screens and scales, which record the total tonnage. From the scales the coal according to its size falls into the cars, which are usually made up in trains. As fast as a car is filled the locomotive pulls the next empty car below the tipple, and thus the operation is continued until the train is loaded. If it is desired to separate the coal into the three commercial sizes, three tracks are laid below the tipple, and three trains can be loaded at once. In connection with a number of the mines in West Virginia and in the George's Creek and Cumberland region of Maryland, as well as in Alabama, are coke-oven plants, so constructed that the mine cars can be run from the entrance directly over the ovens, and their contents dumped through openings made especially for the purpose, without the necessity of any manual labor except to guide the cars.

The cost of coal mining by the modern process has been reduced to such a figure that the product has been sold at the tipple as low as 90 cents per ton, at a small profit to the coal company. The actual cost of the coal placed on the cars ready for shipment has been reduced as low as 75 cents per ton in the districts referred to. Of course, these figures are subject to slight fluctuations, but it is calculated that 90 cents per ton is the maximum cost of this production. Including the railroad and steamship tariff and the cost of transferring at the destination, American coal has been placed in French ports, for example, at $5.50 per ton at a profit to the shipper. But it is believed that steamships can be built especially for the coal trade which can carry a cargo to Mediterranean ports at less than $1 per ton freight, including wages, food for the crew, fuel and charges of every kind. This figure would enable coal of a superior quality to be sold abroad at less than $3 per ton, fully $2 less than the best Welsh product.

Electrical Notes.

It is stated that the Jungfrau Railway in its entirety is to be abandoned, but the section already built and under construction will undoubtedly be very popular.

All the Russian warships on the Chinese station are to be fitted with Popoff's system of wireless telegraphy. The experiments with this apparatus have been carried out up to distances of forty miles with perfect success.

The premises at 5 West Twenty-second Street, New York city, which were formerly occupied by Prof. S. F. B. Morse, were torn down for the erection of a business building. It is gratifying to note that Mr. McCutcheon has had the tablet which used to mark the house replaced. The addition to the original bronze reads, "This tablet removed from building formerly on this site and replaced A. D. 1900."

A suburban electric street car line in St. Louis has fitted one of its cars with a telephone, says The Railway Review. The instrument is placed in the rear of the car, the negative wire being connected permanently through the wheels to the rail, and the positive wire being fitted with a simple device resembling a jointed fishing pole by which connection is secured to a private overhead wire paralleling the trolley.

The second branch of the Metropolitan Underground Road at Paris was opened on September 29. It runs from the Triumphal Arch to the Trocadero. Another line running north and south will be opened next spring. The American engineers have been impressed with the rapidity with which the work is carried on, only sixteen months having elapsed in building the tunnel from Vincennes to the Bois de Boulogne.

Ever since telephonic communication has been established between London and Paris, it has been constantly rumored that attempts were being made by the English and Belgian governments to inaugurate a similar service between London and Brussels. It is announced that in February, Brussels will be connected with the English capital by the telephone. There have been several obstacles in the way which have prevented realization of this scheme. Great difficulty was encountered in obtaining the sanction of the two governments, but after prolonged negotiations the necessary permission was obtained. The electricians of the English Post Office had two alternative schemes. One was to lay a cable from the English to the Belgian coast ; and the other was to utilize the Anglo-French wire as far as Calais, and then to extend to Brussels over wires on land. According to present arrangements it appears that the latter plan is to be adopted, since it has been found impossible with existing instruments to transmit vocal communication through a submarine cable over a greater distance than twenty miles. This is the length of the cable in connection with the London to Paris telephone, and also the cable connecting England with Ireland.

Large refuse destructor and electricity generating works are to be constructed by the vestry of Hackney, a northeastern suburb of London. Five acres of land have been acquired on the banks of the River Lea upon which to erect the buildings. The present designs are sufficient to accommodate 6,000 horse power in boilers, engines, dynamos and switchgear, but the first installation of machinery will only amount to 3,000 horse power which will be sufficient with accumulators to provide a current for 50,000 eight-candle power lamps. The engines will be of the triple-expansion type, with a working pressure of 175 pounds per square inch. Two dynamos will be driven direct by each engine, and a common condenser and cooling apparatus will be supplied to each pair of engines. The refuse destructor will comprise twelve furnaces with a daily burning capacity of 150 tons. It is estimated that the total cost of the scheme will amount to $1,250,000, but it is anticipated that the vestry authorities will effect an economy of $20,000 per annum. According to the Act of Parliament, the vestry are enabled to levy a maximum tariff of 16 cents per unit, but they propose to encourage the more general utilization of electricity by charging 8 cents to private consumers ; 6 cents for public lighting ; and 4 cents for the supply of electric power.