tom and thence to the apparatus stored in the chamber within the projectile.

One of the diagrams illustrates the results of a trial to which the instrument was subjected, which was of a very exacting character. The shore apparatus was stationed at *A*. The propelling engines of the craft were set in motion, and it traveled in the direction indicated by the figure 1. Thence it was carried to a point immediately opposite the transmitting apparatus and brought back to the starting point as shown by the figure 2. It was then dispatched on the complicated journeys 3 and 4, and brought back once more to the shore instruments. Then to test the absolute and immediate subserviency of the craft to the manipulations of the transmitter, it was submitted to the series of circular sweeps marked 5. This was a very trying ordeal to the craft, but it performed the evolutions readily and perfectly. It was then dispatched seaward, traveling in a directly straight line to the point, *B*, where it described a circle, indicating that it had reached the limit to which the ether waves traveled, which in this instance was 200 yards. Of course, this distance can be indefinitely increased by improving the sensitiveness of the instruments and strengthening the potentiality of the current transmitted.

The value and possibilities of this invention are incalculable. It can be manipulated so easily, readily, and variously that it would be impossible for an enemy to locate its direction of travel. Then again it is impossible for it to miss its aim, whereas with the gyroscope the movement of the target nullifies completely the discharge of the torpedo, which is consequently lost. It is also much cheaper than the ordinary torpedo. The Whitehead torpedo costs $10,000, while the complete cost of a torpedo equipped with the Varicas instrument costs only $3,000. Of course, there is the cost of the shore apparatus, but this is only an initial expenditure. The instruments placed in the torpedo are approximate in weight to that of the gyroscope, which is an important consideration, since increase in weight would signify a proportionate increase of the power of the propelling machinery. The invention has been inspected by several military and naval experts from all countries, who have expressed the opinion that it is by means of wireless telegraphy that torpedoes will be controlled in the future. The Swedish government has already commenced the introduction of a similar means of steering torpedoes into the defenses of its country.

MANUFACTURE OF WATER-GAS AT THE FORTY-FOURTH STREET STATION, NEW YORK.—II.

In our issue of January 19, we described a portion of the Forty-fourth Street plant of the Consolidated Gas Company for the manufacture of water-gas. The article referred to described the Lowe apparatus, in which illuminating water-gas is produced, and also the Gasogene plant, for the manufacture of non-illuminating water-gas. It was shown that the products of these two plants are led to a relief holder, from which they are conducted to the condensers of an oil-gas plant. The oil-gas from this plant and the mixture of illuminating and non-illuminating water-gas, after being combined in these condensers, are passed through the successive stages of scrubbing, purifying, etc., and finally collected in the main gas-holder.

OIL-GAS PLANT.

The first element of the oil-gas plant consists of a row of eighteen benches, containing six retorts, in which the oil and steam are decomposed. Each bench contains six retorts arranged in tiers of three. The retorts are cylindrical in section, and extend entirely from the front to the back of the bench. They are set in fire-brick walls, and the whole of the masonry, including the arches, etc., is built of the best firebrick. The retorts are closed at each end by cast-iron mouthpieces provided with movable lids. Each bench of six retorts is heated by two furnaces, one on each side, into which a supply of oil is sprayed under air pressure. The liquid fuel consists chiefly of the tar, pitch and various oils which are collected in drip tanks to which they flow by gravity from the hydraulic mains, the scrubbers and the condensers. From the drip tanks the refuse oil is pumped to a general collecting tank, from which it flows to the burners at the retorts. Within each retort is a 6-inch, wrought-iron pipe, which is closed at one end and has a semi-circular section cut away from the upper half of the opposite end. To the closed end of each of these pipes is led a small supply pipe, by which the oil and steam are introduced. The mixture is vaporized and partially decomposed within the pipe, and the resulting gases, escaping from the opposite end of the pipe, flow back above it to finally leave the retort by means of a vertical standpipe. Our sectional view, taken through one tier of retorts, shows the front of the retorts with the long line of standpipes extending above it. The gases pass from the standpipes down into the hydraulic main, where the tar and heavy oils are condensed and collected. The standpipes terminate in what are known as dip pipes, which are carried down a few inches below the surface of tar and liquor, as shown in the engraving. The liquor is maintained at a predetermined level by means of an adjustable gate, and the gas, after passing through the liquor, is led to the bottom of the air condensers. Here it is joined by the mixed gases from the relief holder, already referred to. In passing through the retorts, the oil is decomposed into a fixed oil-gas which is practically the same as the Pintsch gas so largely used for the lighting of street and railway cars. The gas mains which lead from the relief holder and from the oil-gas retorts are provided with gates, which enable the operator to mix the two gases in the proper proportions to give an illuminating gas of the desired candle power. The air condenser consists of two wrought-iron bases, each section of which is 6 feet wide and 30 feet in length. From the base there extends a series of vertical rectangular sheet-steel pipes, each pair of which is connected by a bend at the top. The pipes are so arranged as to operate in sections of four, the route followed by the gases in passing through the condenser being such that a given volume, in passing from one end to the other, has to travel through a linear distance of 500 feet, and is exposed to a total cooling surface of 15,000 square feet. Here the gases are cooled from a temperature of 180 deg. to one of approximately 100 deg., the temperature of the issuing gases varying, of course, according to the temperature of the atmosphere and the amount of gas that passes through in a given time. In the process of cooling, any oil which may not have been thoroughly fixed in the retorts is deposited, and falls to the base, from which it drains off to a drip tank.

From the outlet of the condenser the mixed and cooled gas is led to the base of a tubular water condenser, where it passes up and down through a series of tubes that are surrounded with circulating water. Here the gas is cooled down to a temperature of 80 deg. F., and any unfixed oils that may remain are deposited. From the condensers the gas passes to the scrubbers, which are constructed on the same general principles as those already described, the cylinders in this case being divided by a vertical diaphragm, whose object is to cause the gases to travel up through one-half of the condenser and down through the other half. In these condensers care is taken to use only a limited amount of water on the already cooled gases, as an excessive amount would be liable to absorb a certain portion of the illuminants. The gas is drawn from the scrubbers by the suction of a powerful centrifugal exhauster, and forced through a big valve known as the center valve, from which there radiates a series of horizontal pipes, which lead to the base of the purifiers. The purifiers are large cast-iron boxes measuring 24 feet square and about 4 feet in depth. Each box is provided with a wrought-iron cover, which, when it is in place, is seated in a water seal that renders the purifier gas-tight. The interior of each of these huge boxes contains two sets of gratings or grids, upon which is thickly strewn a purifying material, which consists of wooden chips and shavings that have been thoroughly saturated in oxide of iron. The gas filters up through this material, and the action of the oxide of iron serves to remove the remaining impurities, which consist chiefly of sulphur in the form of sulphureted hydrogen. From the purifier the gas passes to two large station meters, where it is measured, and a record obtained of the actual amount that is being manufactured hour by hour. From the meters the gas is led to a large gas-holder, with a capacity of 2,000,000 cubic feet, and from the gas-holder it passes, under a pressure of from 3 to 7 inches of water, to the city mains.

Although the Forty-fourth Street station has a capacity of 8,000,000 cubic feet per day, it only requires an area of slightly over two acres to accommodate the plant, a fact which is favorably commented upon by the many foreign experts who have at various times visited the station. Thanks are due to Dr. Elliott, chief chemist of the Consolidated Gas Company, and to Mr. F. C. Crowell, the superintendent of the Forty-fourth Street station, for courtesies extended during the preparation of these articles.

To Determine the Height of Liquid in a Cask.

In order to ascertain how far the liquid reaches in a keg, says Deutsche Destillateuren Zeitung, the following simple method may be employed:

Take a glass tube, bent at right angles, whose long leg is equal to the height between the bunghole and the upper floor, while the shorter one need only be a few inches in length. The shorter end is now connected with the bung by a piece of rubber hose, the longer one is placed in a vertical position and the bung is opened. According to the law of communicating vessels, the liquid will rise in the tube to exactly the same height as in the cask, so that the level of the fluid can be ascertained with great accuracy.

Automobile News.

The Grand Palais of the Exposition is being utilized for a vast automobile and bicycle show, in which all the leading French and foreign makes are represented. The Exposition has been organized by the Automobile Club of France, under the direction of its commissioner-general, M. Rives. The exhibits have been divided into two classes: I. Automobiles of all kinds, motocycles, and vehicles using mechanical traction. II. Bicycles of all descriptions. A great number of accessories form part of the exhibits in each class. According to the regulations, each of the automobiles is required to make the trip from Paris to Versailles to show that it is really capable of working. A retrospective exhibit is one of the interesting features, as well as a hall set apart for explaining the working of the different systems to persons interested.

According to the Auto-Velo, the Automobile Club of France has not as yet formally announced its choice of the chauffeurs who are to defend its colors in the Gordon Bennett Cup race, but if certain indications, almost official, are to be believed, two of these have been already chosen. These are Charron, who won the cup race last year, and Levegh, the winner of the Paris-Toulouse race. For the third, a list of the most prominent conductors will be made, and the committee will decide by vote. Neither Charron nor Levegh has as yet received any notification as to the choice, but it is probable that neither will refuse the honor. As to the Belgian Club, it will likely send with Jenatzy a machine of quite a new variety, in which a combination of petroleum and electricity will be used. According to Jenatzy, this machine makes the unusual speed of 72 miles an hour, but even if 60 miles an hour is allowed, it will prove a formidable competitor. Fournier, the well-known motocyclist, who, mounted with Charron in the Gordon Bennett race, has tried this new machine, confirms its extraordinary speed.

Consul Hughes, of Coburg, writes as follows: Dr. M. Kallmann's report on the competition of electrically propelled vehicles in Berlin is highly instructive. The battery taking the first honors weighed only 121 pounds per kilowatt-hour, while the heaviest weighed 286 pounds per kilowatt-hour. The mean weight of the thirteen vehicles taking part in the competition was 165 pounds. Upon the assumption of a yearly total mileage of 9,500 miles, he calculates the annual maintenance cost of a battery at only 48d., or, say, a cent per mile. The smallest consumption of energy per ton mile at the mean speed amounted to 91 watt-hours for a passenger car, a far better performance than previous records are able to show. At the highest speed, the consumption increased to 135 watt-hours. However, in the majority of cases, the demand did not vary greatly with the speed, which leads to the conclusion that, in order to obtain the greatest commercial economy of energy, the electrically propelled car should be driven at the highest speed consistent with public safety. By the high speed the consumption of energy per car mile is not considerably increased, while the number of passengers which may be transported in a given time naturally increases with the speed. With regard to the motor best adapted for the weight to be propelled, the capacity should amount to approximately 1 kilowatt per ton of the rolling weight.

A number of interesting experiments have been recently made in the Italian Army with regard to the application of automobiles in military maneuvers. These tests have been carried out at Turin, under the direction of the officers of the Etat-Major. To this end, the government had previously ordered from a Paris firm a heavy steam automobile of 50 horse power, capable of transporting, besides the combustible and water necessary for a course of 20 miles, 4 tons of material at a mean speed of 6 to 8 miles an hour on level road. It has been found that with this load the automobile could easily mount grades of 8 and 10 per cent while making 4 to 5 miles an hour. In other cases, besides the 4 tons of load which it carried, it could draw 10 wagons, representing a total of 27 tons, on roads not exceeding 4 per cent grade. The experiments made by the Etat-Major have been carried out on a large scale, and the automobile carrying its full load has made several times the trips Turin-Pino Chieri, 22 miles; Turin-Orbassano, 21 miles; Turin-Suse, 32 miles; Turin-Suse-Mont Cenis, 42 miles, etc. From these trials it has been proved undeniably that steam automobiles will render great service for the transportation of heavy loads. As to the light machines, especially for the transportation of personnel, the officials have found that petroleum and electric vehicles will prove of great value in military operations, although the latter must be for the time excluded from the active service of the troops on account of the difficulty of finding charging stations along the route. These tests are being continued by the Etat-Major, and the results are quite favorable to the use of the automobile in the army.

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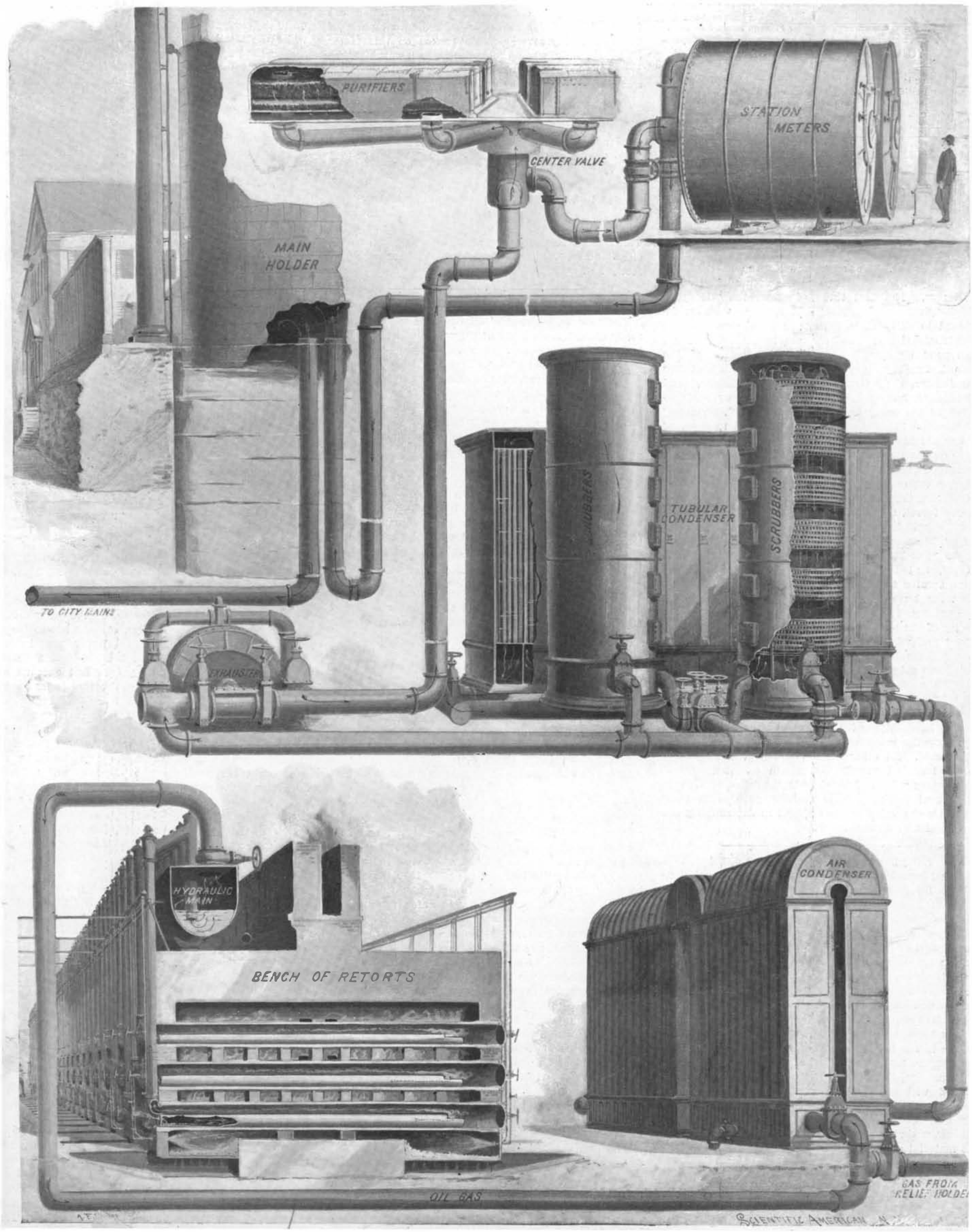

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