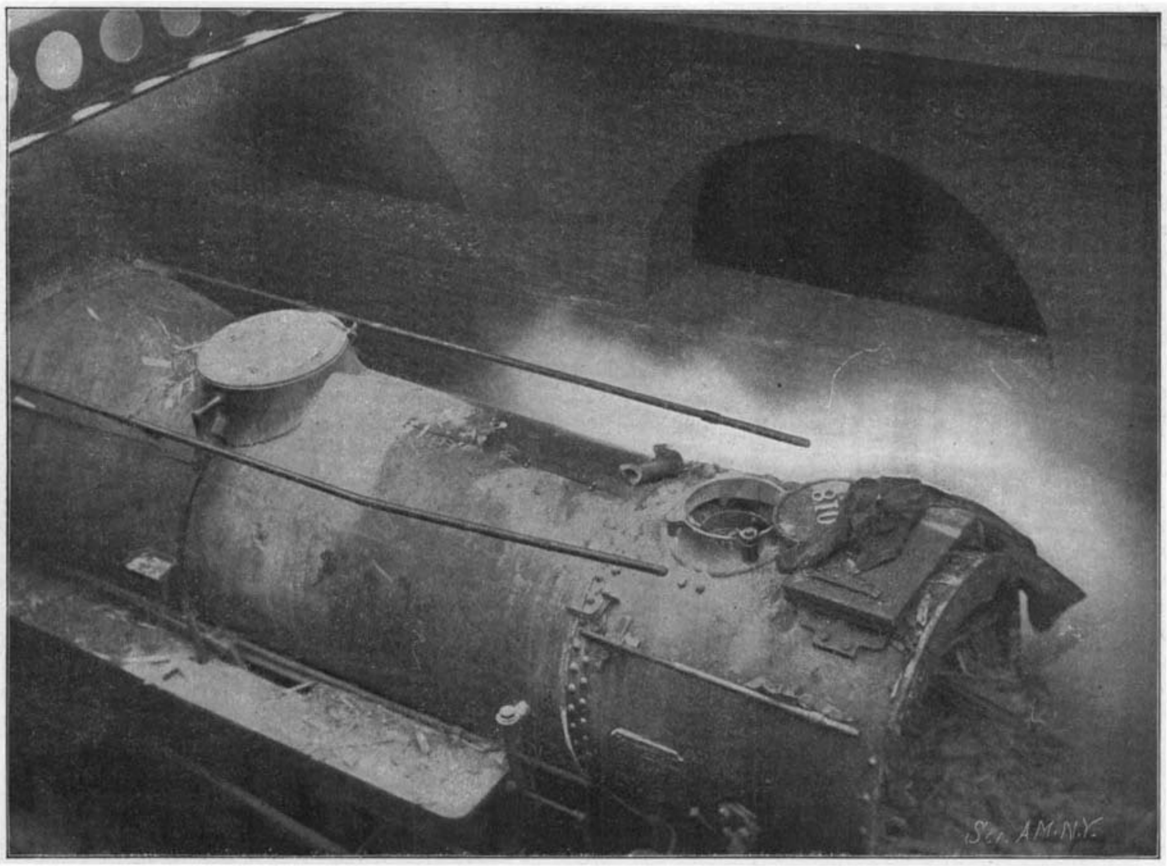
former to gain somewhat of the latter. Under the system adopted, it is a daily occurrence for crowded passenger trains to be stopped at the southern end of the tunnel under atmospheric conditions which render the visibility of the signals by a following train very uncertain.

Thanks to the eternal vigilance of the train hands, the impending and ever-present disaster, to the possibilities of which the public have been always keenly alive since the distressing tunnel accident in 1891, has been staved off for a whole decade—but it has come at last, and in truly heartrending magnitude and horror. Fifteen lost and twice as many seriously injured, are the results of a rear collision, which occurred under just such a conjunction of circumstances as everybody has feared. A crowded local train was stopped by signal before it was clear of the tunnel at the Forty-second Street end. Another local on the same track, whose engineer was endeavoring to maintain his credit with the company by making up lost time, was following as closely behind as the signals would allow. The engineer runs past the green signal which is set against him, and is holding his train at a speed which he judges consistent with his ability to stop at the red signal, when the red signal flashes out ahead, and with too much impetus to stop, he runs by it, over the torpedo set to warn him, past the rear flagman, and crashes into the ill-fated train.

As we go to press it is too early to say definitely where the blame should be placed. It is rumored that the engineer did not see the signals; but his fireman affirms that he saw both the green and red signals and notified the engineer accordingly as each was passed. The measure of accountability of the company will be determined by the question as to whether they have used every effort to minimize the great risks which undoubtedly exist at present. This statement suggests at once the question of abolishing the steam locomotive and substituting electric traction between Harlem and Forty-second Street. There is not the slightest doubt that electrifying the system would reduce the dangers of tunnel travel very materially. Signals would be much more clearly visible and audible signals more distinctly heard, while the brake-control of the trains would be somewhat increased. We would suggest, moreover, that there is room for an extra tunnel on each side of the present structure. If these were built, as was suggested, for the use of the Rapid Transit tunnel during some of the earlier discussions of the Rapid Transit route, the density of travel through the tunnel would be reduced fifty per cent. With electric traction installed, the objections to the construction of additional tunnels would be removed. Moreover, in granting the franchise to the New York Central for their construction, the city would have an opportunity to gather in some adequate recompense for the enormously valuable franchises that were practically given away to this system at an earlier day.

The accompanying photograph of the wrecked engine tells its own story. It crushed through the rear wall of the last car and embedded itself up to the cab windows within the car, while the remaining momentum of the engine was sufficient to telescope the forward half of the car into the car ahead, the unfortunate victims being literally ground between the nether and the upper millstone. The roof of the car stripped smokestack, bell and sandbox from the locomotive, burst in the smokebox door, and allowed the smokebox to become filled with wreckage and sawdust as shown in our illustration.



THE WRECKED NEW YORK CENTRAL ENGINE, AFTER IT HAD BACKED OUT OF THE NEW HAVEN PASSENGER CAR.

THE PERFECTING OF THE GASOLINE MOTOR.

The light high-speed type of gasoline motor, the invention of the Frenchman, Bouton, was a long stride forward toward developing and making more generally useful this ever-ready and instantaneously available form of power. Heretofore, gasoline motors were ponderous and clumsy, and were suitable only for stationary purposes, or for staunch, well-built launches and small boats. Their uncertainty of operation caused them to be viewed with disfavor and to be rarely used for business purposes.

In looking about for a suitable power for a motor machine, gasoline at once suggested itself to the above-named French engineer. He had had experience in the building of steam engines; and, after interesting Count De Dion in his project, began experimenting in 1881 with a gasoline motor he had designed for a tricycle. His motor had necessarily to be as light as possible in order to be used on so light a machine. Consequently, he designed it to run at a high rate of speed, which allowed of the parts being smaller and lighter than those formerly employed. The mechanism was simplified as much as possible by recourse to the high tension or jump spark system of ignition—a system that had been tried by Lenoir in the early days of gas engine invention and given up on account of the then apparently insuperable difficulty of maintaining the insulation of the sparking plug. By this method of ignition, the mechanical igniter with movable parts was dispensed with, and all necessary adjustments could readily be made outside of the cylinder. By a suitable apparatus for varying the time of the make and break of the primary circuit, the spark could be made to occur in the cylinder within a wide range of time, and thus the speed of the motor could be regulated with the greatest ease. The breaking down of the insulation of the sparking plug was largely avoided by adopting a vertical type of motor and employing splash lubrication. By placing a certain quantity of oil in the crank case, it was found that the motor would be lubricated thoroughly in every part without the oil getting on the plug, which was placed in a chamber at one side of the cylinder. In this chamber was situated also the inlet and exhaust valves. The former was opened by the suction of the motor, which left only the exhaust valve to be mechanically operated. After many experiments and practical experiences, an atomizing form of carbureter was adopted for supplying the motor with gas. At first the plan of cooling the motor by the air circulation caused by the progress of the vehicle was adopted, but this was found to work satisfactorily only with very small motors and in cold weather. In summer a tricycle equipped with such a motor would run only a few miles before the motor would rapidly fall off in power and soon cease to operate. This was ascertained to be due to the excessive heat of the cylinder head causing the incoming charge to expand before it could enter the cylinder. Water-jacketing was, therefore, found necessary to keep the head cool, and while in the De Dion-Bouton motor the whole cylinder is cooled by water, an American inventor has found that by cooling the head alone equally good results are obtained. The water is usually cooled by being pumped through flanged radiating coils. It has to be renewed once in a while, as it is gradually evaporated. A French inventor has recently made a radiator of copper tubes connected with the water jacket and hermetically sealed. The water is allowed to boil and to reach a pressure of two atmospheres, but is condensed again in the radiator. No water is lost and hence the care of replenishing it at intervals is avoided, while the temperature of the cylinder and head, even under the most adverse conditions, cannot exceed about 260 deg. F.

While all the other problems of the light gasoline motor have, therefore, practically been solved, the ignition problem still remains to give trouble. Electric ignition of any kind requires more or less attention, whether it is of the contact or jump spark type, and either batteries or dynamos are necessary to furnish the electric current. These are liable to be uncertain in operation unless carefully tested and watched, and even with the most perfect arrangements they will sometimes give trouble at very inopportune times.

Ignition by a hot platinum tube has been frequently tried by the French, but this necessitates a burner and fire to heat the tube, and deprives the gasoline motor of the element of safety it otherwise has by the presence of the burner flame.

What has been chiefly needed to make the explosive motor well-nigh perfect is an automatic sparking plug that can be operated without electricity, is not affected by oil or soot, and is durable and inexpensive. Such a plug, the invention of a French chemist and physicist, Monsieur A. Wydts, is described elsewhere in this issue. It is based on the well-known property that platinum has of becoming incandescent in the presence of oxygen mixed with hydrogen or other gases. Monsieur Wydts has made an alloy of some metals of the platinum group that has the same property in a greater degree than platinum and yet is much harder and more durable. This is practically the essence of his invention.

If the Wydts sparking plug continues to show in practice the results obtained in its first trial, we think the gasoline motor problem will be found completely solved. There will no longer be any uncertainties about the gasoline automobile, and this power will be put to many uses where certainty of operation is an absolute essential. The invention of a perfectly reliable sparking plug will also have much to do in advancing the perfecting of other types of explosive motors, such as the alcohol, the kerosene and the acetylene.

ELECTRO-OPTICAL PHENOMENA.

The electro-optical phenomena which have been recently discussed by Dr. Emile Bose, of Breslau, are interesting both from a theoretical and practical point of view. The experimenter finds that when a current of long duration is passed through a slightly acid solution, using gold electrodes, the anode becomes changed in appearance, and is covered with a layer of hydroxide. If the current is now stopped and the electrodes connected to a sensitive high-pressure galvanometer, the latter indicates a current whose intensity varies with the amount of light thrown on the plate covered with the layer of hydroxide. By using an arc lamp as a source of light, a difference of potential as high as 0.1 volt between the plates has been found. This depends upon the color as well as the intensity of the light. It is shown that a strong white light diminishes the potential. As to the different parts of the spectrum, violet light has the same action as white light; sodium rays and the yellow in general seem to have no appreciable effect, while the red, such as a lithum flame, increases the potential above the value which it has in the dark. The X-rays are found to have a decided action, resembling that of white light. This phenomenon is interesting from the fact that the different parts of the spectrum, red and violet, instead of differing in their action only in degree, here differ in direction and produce contrary effects. Dr. Bose is making experiments to show whether the effect is proportional to the intensity of light, and in this case the principle may prove to be of value in photometric work.

The Kansas City, Mexican and Orient Railroad has awarded a contract for steel rails to a European company, the rails to be furnished for the construction of the road in Mexico, and the contract payment is to be made with Mexican government subsidies, which are to be turned over to the company furnishing the rails, and the difference between the cost of the rails and the value of the subsidies, after all expenses have been paid, is to go to the construction company. The rails are to be of Belgian manufacture, and will be shipped in lots sufficient to lay sixty-two miles of track.