trance through the ash pit under the grate bars is cut off. The furnace becomes a retort, in which the coal is distilled and the carburetted hydrogen and other inflammable gases pass through the openings shown in the septum wall to meet a current of hot air and a fierce heat is the result. When the coal has become sufficiently heated then a moderate amount of air can enter the ashpit, working up through the coals, and the real process of burning goes on. To produce these results a mechanical draught is necessary, and this is brought about by a fan worked by a steam engine or by belt from a steadily working engine. If, however, the hot air and products of combustion were permitted to rush at this fan it would soon be burned out, and for a long time Mr, Mallett studied this part of his problem. He met it finally by injecting a spray of water into the flue through which the hot air was passing. The then moistened air readily gave up its heat to a coil of pipes through which the feed water of the boiler was passing and there was virtually produced a supplementary boiler in which both steam and water of an even temperature with that in the main boiler were produced.

Fig. No. 2 shows an ordinary stationary boiler. Below the furnace doors will be seen the row of grate bar pipes with the slide by which the supply of air passing into them may be regulated. It will be seen that the lever bar to the left works at one motion the slide over the grate bar openings as well as the slide in the ashpit door. There is no chance about it, but the amount of air for each boiler is carefully calculated and the levers set accordingly. The fireman has but to put on the coal and push the bar over to open the upper line of openings, permitting air to reach the combustion chamber, as shown in cut No. 1. When the fire has burned well up and rich gases are no longer given off the pushing of the lever over permits more air to pass in below and the complete combustion is secured. The fire is cleaned very easily by having a slot in the end of each grate pipe, and with a handle fitting them the fireman may give the bars a revolving motion, or, if need be a bar may be drawn out and a new one inserted without stopping the fires. In fact, once started a fire may be kept up indefinitely. The bars do not burn out, as there is at all times a strong current of air passing through them. To the right of the boilers, in Fig. No. 2 may be seen the cooling apparatus broken open to show the pipes within. The hot ultimate products of combustion, carbonic acid gas and nitrogen, come down from above and meet the small spray of water shower in the cut through the broken place in the flue. The pipe box, which is strongly made, has the hot air exhausted by the fan at the extreme right. The hot water pipe has a steam gauge upon it, as shown, and will have a safety valve as well, while between the pipe box and the boiler may be seen the connection by which the hot water and steam are respectively carried below and above the water line in the boiler. From the fan orifice comes out a torrent of carbonic acid gas mixed with nitrogen at a temperature of about 150 degrees. This may be allowed to go into the outer atmosphere at any point, and no chimney is required for it. The water spray keeps the gases at complete saturation, and this dew point is indicated by the dropping water from the small jet cock seen at the base of the superheater in cut No. 2.

The experimental furnace in East Eighteenth street having demonstrated that there was a real discovery, the Control Combustion Company was organized, and from February to August counsel were busy taking out patents the world over. The company is incorporated under the laws of the State of New Jersey with a capital of $2,000,000. The trustees and owners of all the stock are .— Hugh J. Jewett, G. R. Blanchard, of the Erie road; R. Suydam Grant, of the Grant Locomotive Works; E. J. Mallett, jr., the patentee; Thomas C. Platt, of the United States Express Company; Walter S. Gurnee, the banker, and H. E. Packer, of the Lehigh Valley Railroad. The company has an office in the Equitable Building and there the first application of the new style of boilers will be made. At present eight boilers are in use to supply the steam for heating the Equitable Building and running the elevator and dynamo machines, and the coal bill runs far up into the tens of thousands annually. Mr. Mallett is now changing two of the boilers and proposes to do with the other six boilers entirely for power. A few days more will witness the start of the new generators and then all who wish may see the smokeless chimneyless boilers in use.

THE SYSTEM ON THE RAILROADS.

A consolidated locomotive is being equipped for the Erie Railway, with the appliances for the new system. Cut No. 3 will give some idea of the form of the boiler. The smokestack disappears entirely and in its place is a man hole merely. The fan may be seen in the cut with the small engine to work it. The gases produced by the complete combustion will escape about the periphery of the extended boiler casing. A powerful draft can be maintained even when the locomotive is at rest. The engines of the locomotives are relieved from the back pressure caused by exhausting steam through the nozzles and the heavy resonant noise is avoided. The exhaust steam passes along the side of the locomotive through the pipe seen in the cut, to the tender, which is divided into three compartments. the upper one is for the fresh water, the middle one contains copper tubes connected with the external air in front and with a suction fan in the rear. The exhaust steam circulates around the copper tubes and becomes in part condensed, the resulting hot water falling into the lower compartments. The uncondensed steam that comes in contact with a spray of water falling from the upper compartment and the condensed water also enters the lower compartment, from whence hot water is pumped into the boiler. The air used to condense the steam is employed for heating and ventilating cars, being delivered through a conduit, which with coupling ends, passes along beneath the cars. Three registers in the floor of the car admit the air. This system does away with coal stoves or heaters, and supplies the car with fresh air and warm air without danger of fire in case of a smash up. When the locomotive now under way is completed it is proposed to make with it a transcontinental trial trip. Having a number of passenger coaches heated and ventilated from the boiler, cold weather will be chosen, in order to indicate the value of the car heating system, and on the way the poorest fuel will be burned. The Illinois soft coal, the Colorado coal and any sort of fuel which any railroad company along the route may care to provide will be taken and used in this boiler without any display of smoke. With such a boiler in the Fourth avenue tunnel the accident September 22 would not have happened through the inability of the engineer of the second train to see the lights of the preceding train. The taking away of the smokestack will also enable the engineer to have a clear view of the road before him.

SAVING FUEL AT SEA.

On steam vessels there will be a similar change. The objectionable heavy smokestack is replaced by the small porthole aperture at a suitable height above the water line from which the gases resulting from combustion will escape into the atmosphere. As it is only required to get rid of these products, but in no sense by means of a chimney or flue to produce draught, any convenient aperture can be used. The objection to smokestacks on river steamboats where bridges exist is thus overcome, and the hinged and telescopic stack can also be dispensed with, the latter especially on war vessels. At present the arrangements for generating power or steam on the transatlantic liners are far from satisfactory; smokestacks fifty feet above the main deck level and fourteen feet in diameter, belching out high volumes of smoke, are nuisances. Below decks are ten or a dozen great boilers, burning up nearly two hundred tons of coal per day. With the more rapid production of steam by the complete combustion the work may be done with four boilers and at a saving of about fifty per cent of coal. No smokestack is used, but from a porthole the results of the boiler fires escape in an invisible stream of carbonic acid gas and some nitrogen.

THE SYSTEM ABROAD.

In a few days an experimental boiler, now erected in London, will be opened to public inspection. The English patents are controlled by a syndicate consisting of Winthrop Gray, Allen Thorndike Rice, James Frederick Kernochan and Richard Irving, Jr.; the French patents by General F. Herron and F. Degnon, Mr. Mallett and his associates have been proceeding slowly but surely. They have sought no notoriety, as there was no stock to sell, but among the engineering fraternity there has been a great of unsatisfied curiosity excited. But now, with the project beyond the pale of experiment, the company invites the public in to see the new idea in combustion, wnich is in no wise a mere smoke burner, but instead a non-smoke producer; for when smoke appears Mr. Mallett takes it as an indication that the combustion is not perfect and that the supply of air is either too great or too small. During an interview with a *Herald* reporter, Mr. Mallett, with a per-