OIL FUEL ON SOUTHWESTERN RAILROADS.

BY DAY ALLEN WILLEY.

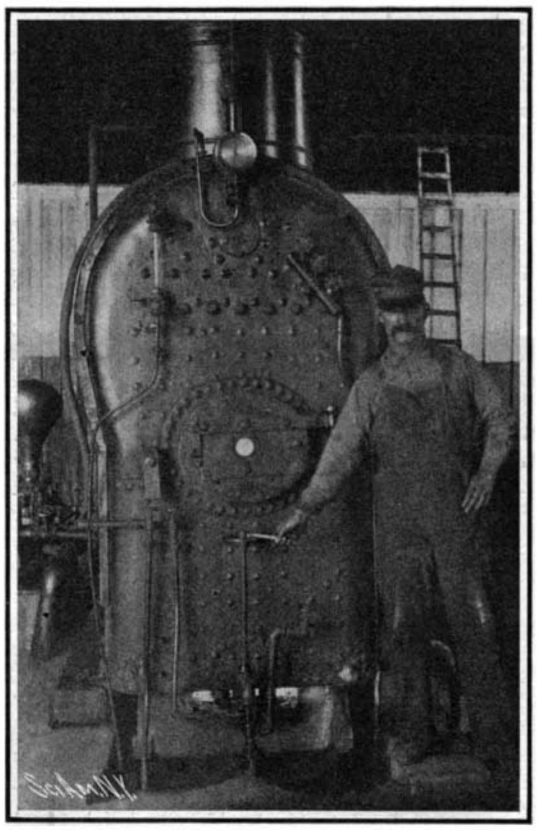
The series of illustrations recently given in the SCIENTIFIC AMERICAN showing the enormous production and consumption of petroleum, present an idea of its great value, especially for fuel. Perhaps no interests have been more benefited in this country by the abundance of fuel oil than those of the railroad companies especially in the West and Southwest. The substitution of liquid fuel for coal and wood on the Pacific coast is so extensive that nearly all of the freight and passenger locomotives of the principal systems, such as the Santa Fé and the Southern Pacific, burn petroleum exclusively. While many of the standard coal-burning engines have been equipped with oil-burning apparatus, and the space devoted to coal utilized for oil tanks, a large number of locomotives has been designed and built exclusively for the use of liquid fuel. The comparative tests that have been made of the best steam coal and of ordinary petroleum such as is produced from the California and Texas region prove beyond question that the latter is far more economical. Its use has passed well beyond the experimental stage.

One of the great advantages of petroleum is that fueling stations along the various systems can be supplied with it at a minimum cost and with little inconvenience, the oil being stored in reservoirs which are filled from trains of tank cars. The storage reservoirs are usually located adjacent to the water tanks, and the conduits serving the locomotives may be placed next to the water pipes, so that fuel and water tanks of an engine can be filled at the same time. In fueling a locomotive, a pipe similar to the ordinary pipe used for filling the water tank is employed, the upper end swinging on a flexible joint at right angles to the vertical pipe, which is connected to the supply reservoir either by an elevated or surface conduit. The connection is such that upon the opening of a valve the oil will flow into the engine tank by gravity. The accompanying illustrations show the method employed on the Santa Fé and the Southern Pacific systems.

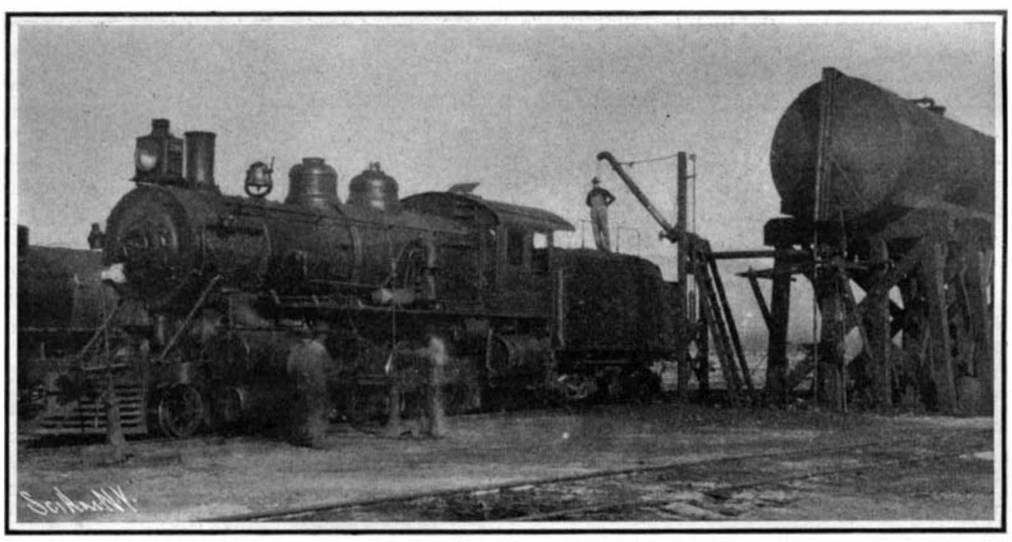
The cost of equipping a passenger or freight locomotive with oil-burning apparatus ranges between $100 and $150 to each engine, some of the systems being more expensive on account of the patents. The experience of the engineers with the liquid fuel is that they can make steam in about one-half the time required to get a coal-burning engine ready for service. By means of the ordinary burner the supply of oil can be regulated to a nicety, the flame being watched through a peep-hole in the furnace door. By noting the hue of the flame the fireman can tell at a glance whether the spray in which the fuel is forced into the fire-box contains too much or too little petroleum, and the proportion can be increased or diminished by merely turning a regulating valve. If the flame is white the combustion is practically complete. Engineers who have been utilizing petroleum claim that it becomes a smokeless fuel if the firing is properly done. This alone gives it a great advantage over coal, to say nothing of the reduced labor of the fireman.

The main difficulty experienced in the burning of liquid fuel is the formation of a deposit in the bottom of the firebox when the combustion is not perfect. This forms a mass so hard that it is necessary to break it up with an iron bar in order to remove it. When a layer of the carbon has formed it decreases the draft and makes it difficult to keep up the requisite steam pressure. Another difficulty which has been encountered is the tendency of the oil to clog the spraying conduits. Being secured from a wide area of territory the oil is not of uniform consistency, some kinds having higher specific gravity than others. If too much of the heavy oil is forced through the spraying apparatus, it may choke the feeding conduits, so that the feed ceases and the steam cannot be generated. A few instances have occurred on the southwestern lines where engines have been disabled from this cause, but they are only occasional.

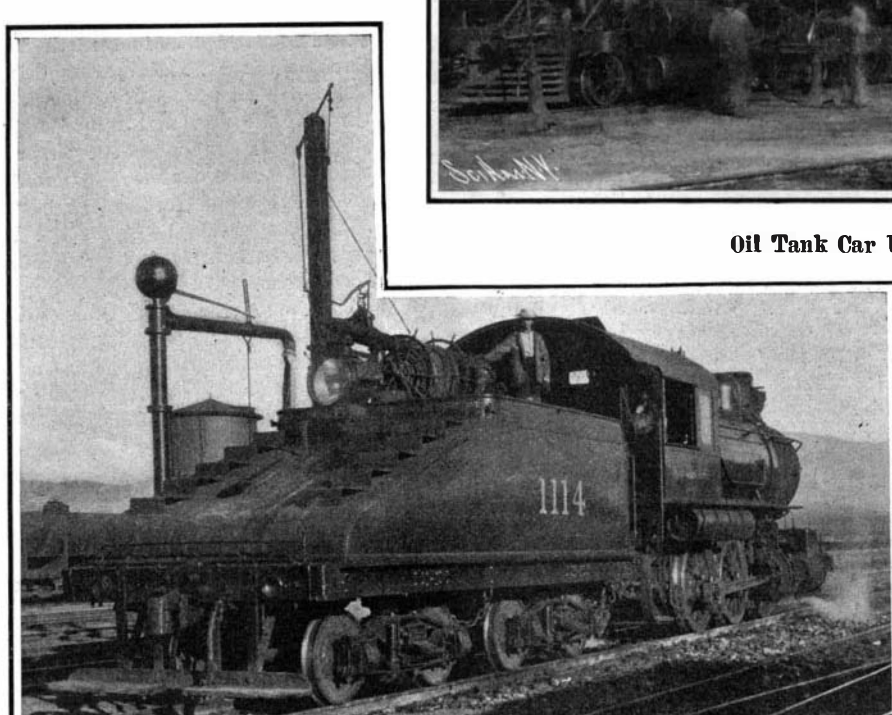
The use of petroleum fuel is of especial value in southeastern California and in Arizona, where the distance from the nearest coal deposits is so great that the expense of transporting coal to the several supply stations is a very important item. As three barrels of oil equal a ton of ordinary steam coal, a train of tank cars will carry a much larger supply of fuel than a coal train of the same tonnage. Going from station to station, enough cars are switched off at each to fill the reservoirs. This operation is usually performed by an ordinary steam pump, as the reservoir is placed on an elevated base so it can be emptied by gravity.



A Turn of the Lever Regulates the Supply. Intensity of Combustion is Indicated by the Color of the Flame.



Oil Tank Car Used as Fuel Station.



Locomotive Filling Oil and Water Tanks Simultaneously.

OIL FUEL ON SOUTHWESTERN RAILROADS.

There are over 7,000 parts in a well-known 24-horse-power motor car.

Temperature of the Sun.

The *savants* who have busied themselves with determining the temperature of the sun have given us very different figures. One of the first, Father Secchi, director of the observatory at Florence, says L'Illustration, by means of utilizing the height of the solar protuberances, attributed to the king of the stars a temperature of 10,800,000 deg. F. Some years ago Violle contented himself with a temperature between 3,632 deg. F. and 5,432 deg. F. His method was simple and ingenious: a thermometer is placed at the center of an opaque, hollow ball, allowing the solar heat to penetrate through a very small aperture. The diameter of the aperture and the heating of the thermometer permit the solution of the problem in a certain measure, by means of calculations based upon the diameter of the sun, its distance from the earth, and the law of radiation through the atmosphere. Other figures were further proposed—2,052 deg. F. to 3,092 deg. F. by Pouillet and Soret, 11,732 deg. F. by Wilson, etc.

The various methods employed, the article goes on to say, were vitiated by fundamental flaws which explain these divergencies. An infinitesimal error of observation results in an enormous number. On the other hand (whatever certain specialists pretend), we know nothing precise of the constitution of the atmosphere, or of what replaces it at a few kilometers above us; nothing, consequently, of the manner in which the calorific radiation acts in the mysterious heights.

M. Moissan, by an indirect process resting upon particularly reliable foundations, has just shed new light upon the solution of the problem. The great chemist (inventor of the electric furnace, thanks to which he has been able to volatilize the metals refractory to the action of the previous furnaces) has proved that there exists upon our planet no substance that cannot be liquefied and distilled by the heat of the voltaic arc, to which is universally given a maximum temperature of 6,000 to 7,000 deg. F.

Now, spectroscopic experiments teach us that the majority of the simple substances existing upon the earth are found in the sun. On the other hand, it is probable that, on account of the very quantity of heat that it radiates, the sun cannot be formed merely of gaseous materials that, overheated, could reach temperatures much higher than the temperature of distillation, but must contain a solid or liquid nucleus. Its temperature, therefore, should not exceed that at which the numerous substances common to it with the earth distill. Let us remark, however, that the distillations of M. Moissan were produced at the ordinary temperature. There may exist in the sun a pressure that raises this temperature; which, it seems, should be comprised between the number of Wilson, 11,732 deg., and that of Voille, 5,432 deg., but probably nearer the latter. So we are far from the 10,800,000 deg. of Father Secchi.

Comparison of Cost of Concrete and Stone Masonry.

The cost of concrete and stone masonry varies largely with the local conditions and the character of the work on which they are used; but there are very few places where concrete masonry is not only cheaper than stone masonry, but better, being much stronger and more suitable in many ways. This fact is becoming more generally recognized, and more than one quarry which in former years produced building stone is now producing crushed stone for concrete. The following figures give a general idea of the comparative cost of brick masonry and concrete, per cubic yard:

Brick.	
500 brick	$3.75
3/4 barrel cement	1.50
1/4 load sand	.50
Labor	2.25
Making a total	$8.00

Concrete.	
1 barrel Alpha cement	$2.00
1/4 load sand	.50
Broken stone	1.50
Labor and forms	1.50
Making a total	$5.50