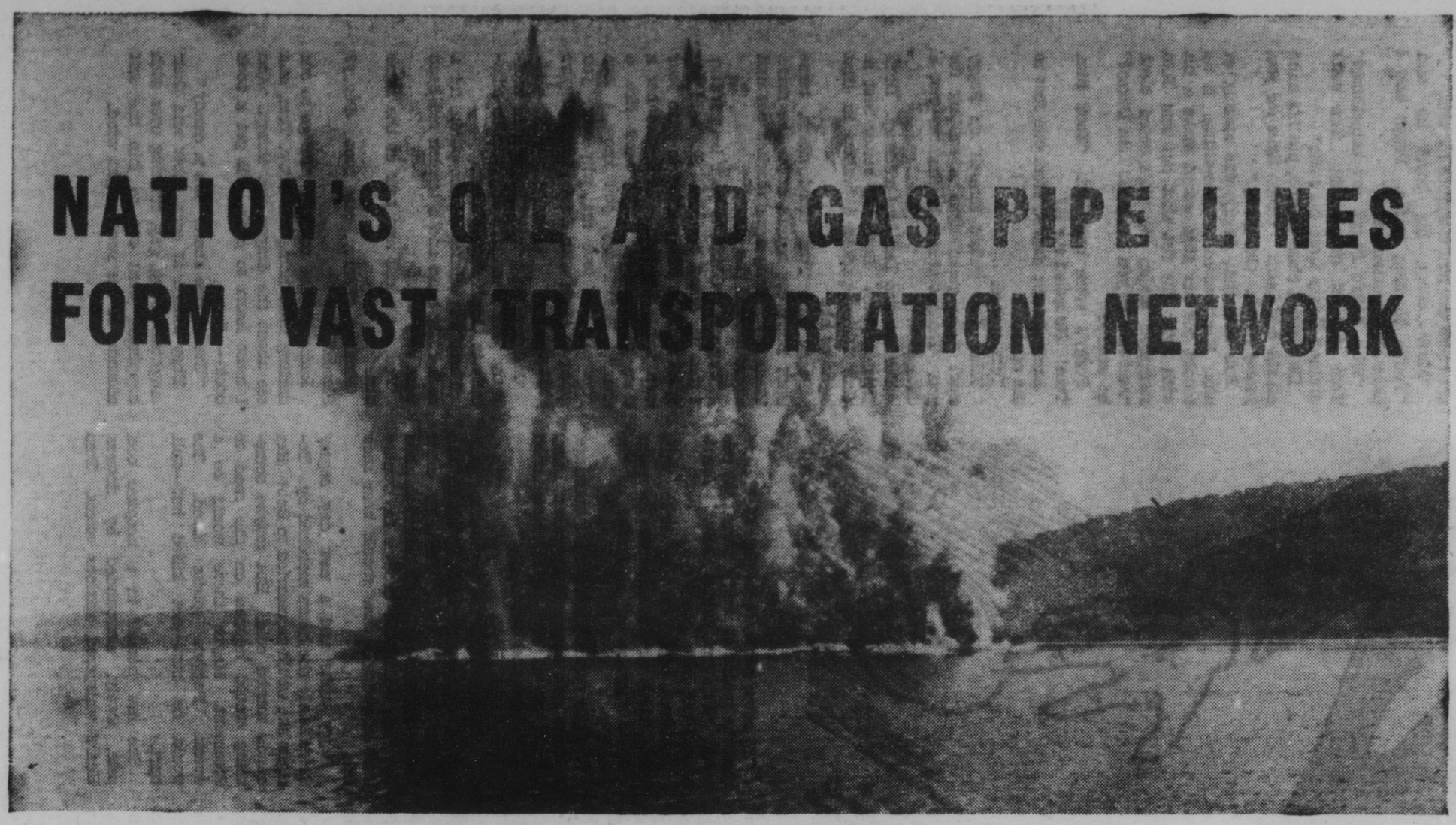
NATION'S OIL AND GAS PIPE LINES FORM VAST TRANSPORTATION NETWORK



Blasting a trench in the bed of the Susquehanna River, Pennsylvania, preparatory to laying a pipe line to carry gasoline and other petroleum products of The Atlantic Refining Company.

A map of the oil and natural gas pipe lines in the United States would show an enormous network of steel, forming one of the most important but least known of our present-day transportation systems. Petroleum and its products flow through pipes laid all the way from Texas to storage tanks on the outskirts of Manhattan. Factories in Detroit draw natural gas from pipes running to the Texas Panhandle. Thousands of people cross arteries of the great underground pipe line system every day without a thought for the traffic passing beneath them.

In addition to the trunk lines carrying oil and gas from the oil regions to industrial centers a thousand or more miles away, thousands of miles of pipe line connect seaboard terminals and refineries in or near the oil regions with the wells from which the supplies of crude petroleum are drawn. Another network of lines carries the products of refineries in other parts of the country to points throughout their marketing territory.

One of the largest pipe line construction jobs being carried on at the present time is a 225-mile extension being built from Williamsport, Pennsylvania, to Buffalo and Rochester, New York, by pipe line transportation subsidiaries of The Atlantic Refining Company. When the extension is completed it will be possible to pipe the products of the company's Philadelphia refinery across the State of Pennsylvania to the markets of western New York State. Eleven hundred miles of pipe lines of companies affiliated with The Atlantic Refining Company connect the oil fields of East, Southwest and West Texas, and New Mexico, with terminals on the Texas Gulf Coast, including the terminal at Atreco, near Port Arthur, where the company has recently completed a new refinery.

THE FIRST OIL PIPE LINE

The first oil pipe line in the United States was built in western Pennsylvania in 1865, six years after Colonel Edwin L. Drake drilled his first well and struck oil near Titusville. The line was laid down by M. E. Van Syckel and his associates. It consisted of a five and one-quarter mile stretch of two-inch pipe running from the Miller farm at Pithole, and had a capacity of 800 barrels a day. In 1874 J. J. Vandergrift and George W. Foreman completed a line from the Pennsylvania oil regions to Pittsburgh, capable of transporting 7500 barrels a day. Four years later work was started on a pipe line that crossed the Allegheny Mountains and carried oil from the western Pennsylvania fields to the Atlantic seaboard.

Within the next few years pipe lines began to multiply with amazing rapidity. As the producing areas of West Virginia and eastern Kentucky were developed, and as new fields were opened in Ohio, Indiana and Illinois, it was logical for the trunk pipe lines to build western extensions and, as new refineries were constructed, to build branch lines to these. When oil became plentiful in the Mid-Continent area, the lines were extended again. Lines were built in Louisiana and Texas to carry the oil to the refineries on the Gulf Coast. Pipe lines spread their network in the Rocky Mountain region and in California. At the present time, in addition to the enormous mileage of natural gas lines, there are well over 100,000 miles of petroleum pipe lines in the United States.

THE PIPE LINE CREW

Many of the operations involved in laying a pipe line demand a high degree of skill. To cite a single instance, a line-up gang must align the pipe with extreme care and accuracy prior to the tack-welding. An even spacing around the circumference of the joints is essential in order that the weld metal may penetrate down to the very root of the weld. In hot weather the attainment of this even spacing is sometimes extremely difficult. Great care must be taken to see that, in localities having a wide range of temperature, expansion problems are overcome so that the line will remain below the earth's surface at all times.

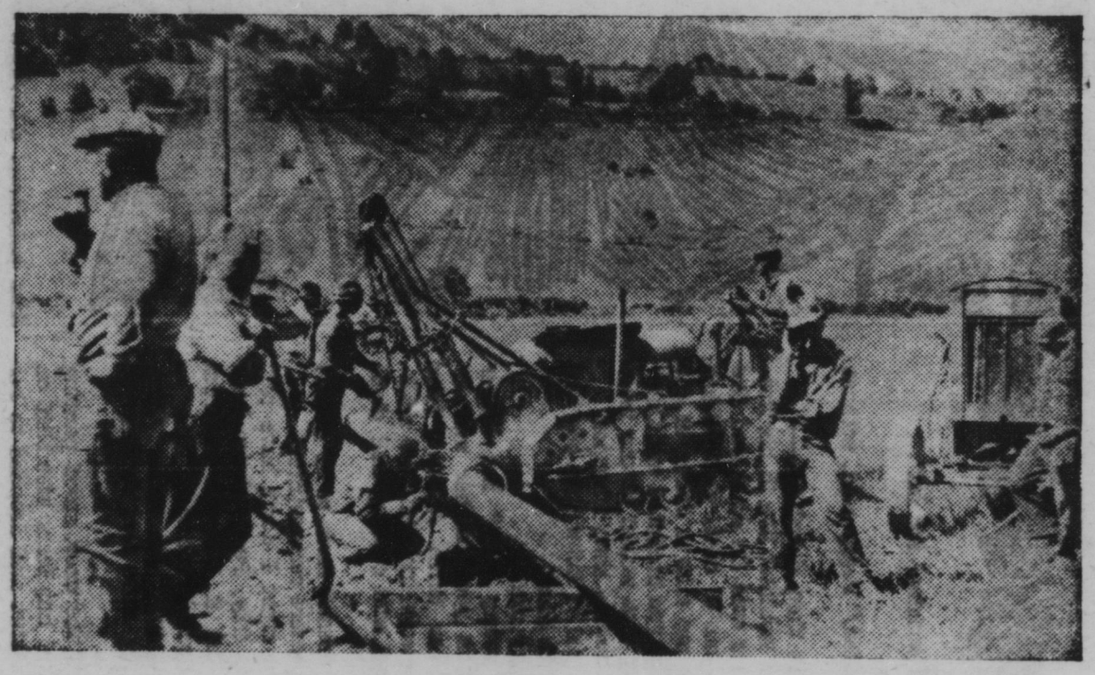
In practically all of the pipe line construction being carried on at the present time, the sections of pipe are welded together as they are placed in position beside the trench in which the pipe is to be laid. Pipe line construction is carried on in a systematic manner. After the pipe has been strung, along comes the line-up gang to align the pipe on skids and dollies, and tack-weld the joints sufficiently to retain alignment during the welding operation. The firing line or welding gang follows the line-up crew and welds the joints into sections from 80 feet to 1,000 feet in length. The tie-in or laying gang then pulls these sections together, welds them into position and places the pipe in the trench after bending it to fit the terrain. The pipe is then buried below interference with cultivation and, after the first tilling of the soil, forgotten by property owners and all except the pipe line company's operating staff.

OVERCOMING NATURE'S OBSTACLES

Heat, cold and the many other obstacles which nature offers are seldom sufficiently formidable to thwart the pipe line builders. Within the last few months a Canadian oil company has announced plans for the construction of a pipe line within the Arctic Circle. Last year the men pushing a line through the swamps of Louisiana worked up to their waists in muck and water. Pipe lines cross deserts, climb mountains, burrow under rivers and even run along the bed of the ocean to enable tankers to load their cargoes without docking.

Water crossings frequently provide tests of ingenuity and courage. When the tide is low, Nueces Bay, on the Texas Gulf Coast, becomes a vast expanse of black muck, but when the tide is high and a strong wind is blowing in from the Gulf of Mexico it becomes sufficiently deep and rough to be extremely hazardous.

The normally shallow water, and the fact that at times there is no water at all, merely a sticky mud, requires the use of shallow draught barges and heavy pulling and hoisting equipment. To meet these conditions, engineers in charge of a recent pipe line job devised a piece of equipment called "The Mud Hen," consisting of a barge having a tractor rear end connected with a gasoline engine. Heavy plates were welded paddle fashion to the axle shafts of the tractor and were extended to the outside of the barge hull. In this manner "The Mud Hen" was propelled through the muck and shallow water, drawing the barges containing the men and materials about the Bay.



Welder making a joint between sections of pipe

BATTLE AGAINST CORROSION

Corrosion is a destructive agent against which a constant battle has to be carried on after a pipe line has been laid. When the steel pipe is buried underground small electric currents are frequently set up on which the metal floats away. The steel pipe is the anode from which the iron ions run off into the soil. One ampere of current can carry off twenty pounds of steel a year.

Impressing a small voltage from some outside source, thus reversing the current, provides one of the many methods of preventing this electrolytic corrosion. The pipe then becomes the receiving end, the cathode. Any source of direct electric current power can be used for this cathodic protection, and one of the most widely used sources is a series of small, low-voltage generators driven by windmills.

Theft by tapping is another possible source of loss and every precaution is taken to guard against it. Line walkers patrol the route, always being on the alert watching for signs that betray the presence of a tap. A drop in the pressure due either to tapping or any other cause of leakage is revealed by delicate gauges in the pumping stations and terminals along the systems. Modern precautions against tapping have made the practice of stealing gasoline and other products from the pipe lines much less frequent and more hazardous than it used to be. In practically all attempted cases of tapping a line, the attempt is unsuccessful and the thieves are caught.

OPERATION OF THE PIPE LINES

In many respects the operation of a pipe line system is similar to the operation of a railroad, with its trunk lines, feeders, terminals, storage yards, switch systems, stations, dispatchers, telephone and teletype systems. Unlike the freight train, however, the pipe line does not have to transport itself as well as its load. The fluid is kept moving through the pipes by pumping stations, usually located about forty miles apart, although in hilly country, or for heavy and viscous oil, they may be placed at more frequent intervals.

Each station is equipped with pumps powerful enough to send the stream on to the next station, and is provided with storage tanks having a capacity ranging from 10,000 barrels to more than 50,000 barrels. Frequently three or four different "slugs," or batches, each consisting of from 40,000 barrels to 400,000 barrels, and each consigned to a different destination, will move through the same pipe line at the same time. Each "slug" may consist of a different grade of gasoline or other petroleum product.

Dye inserted in the constant stream of fluid at each point of contact between "slugs" is the signal that tells the pumping station operators where one consignment ends and another begins. The intercommunicating telephone, telegraph, teletype, or radio system enables the dispatchers to keep the station operators informed of the time when each batch will reach them, and to give the necessary instructions for shunting off the different consignments to the connecting lines that carry them to their different destinations.