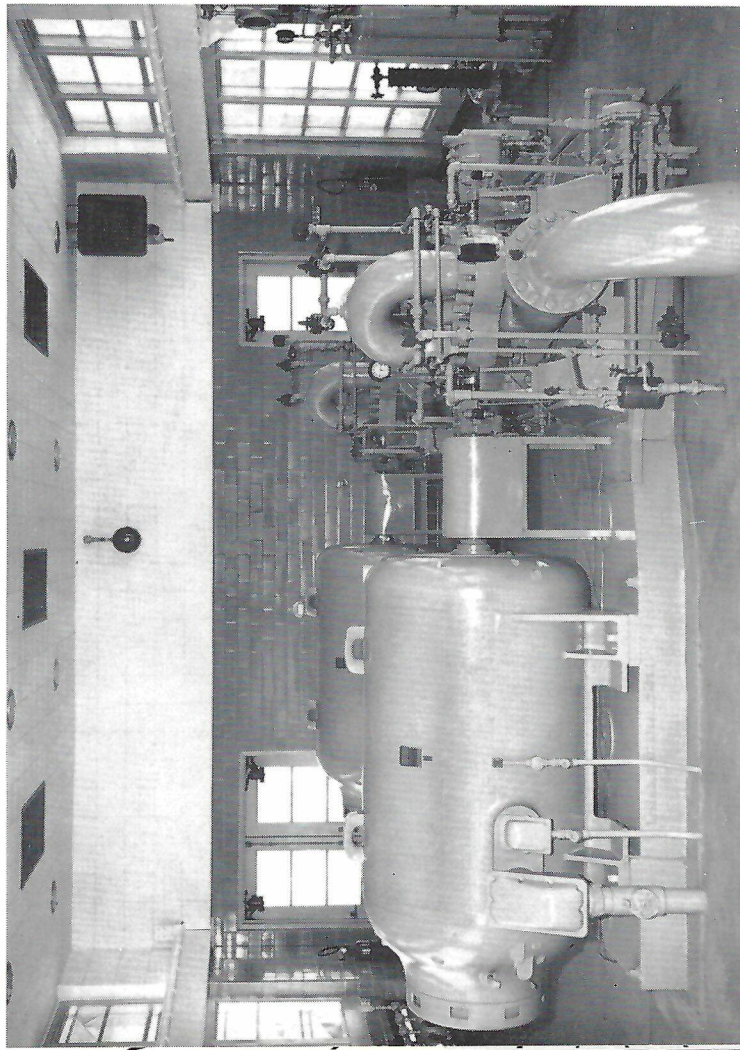
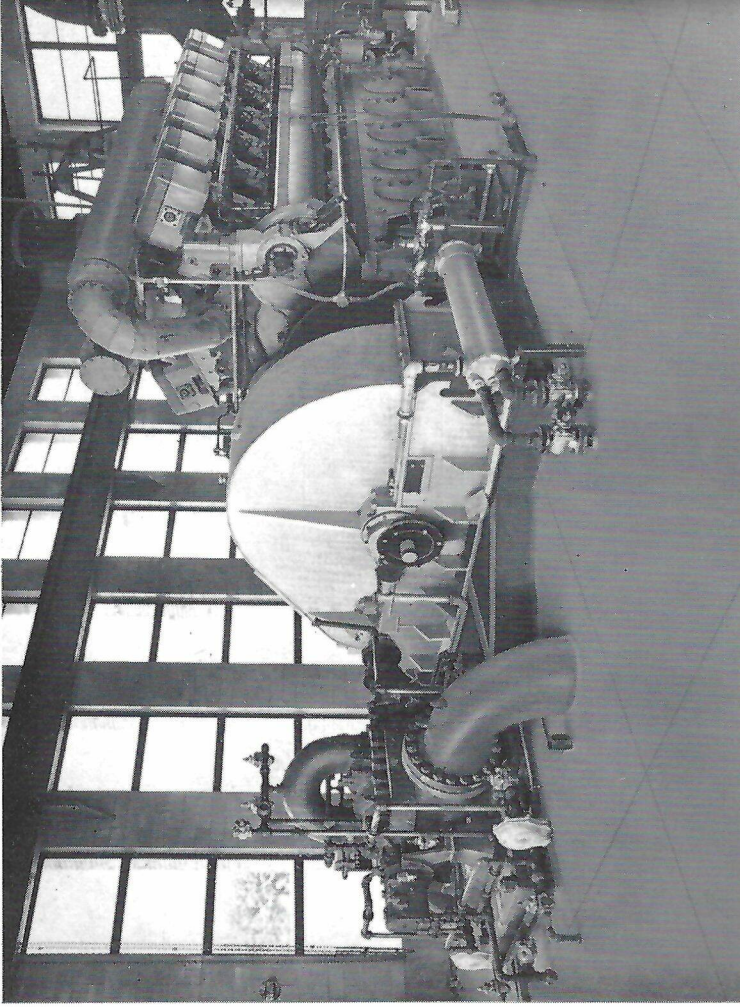
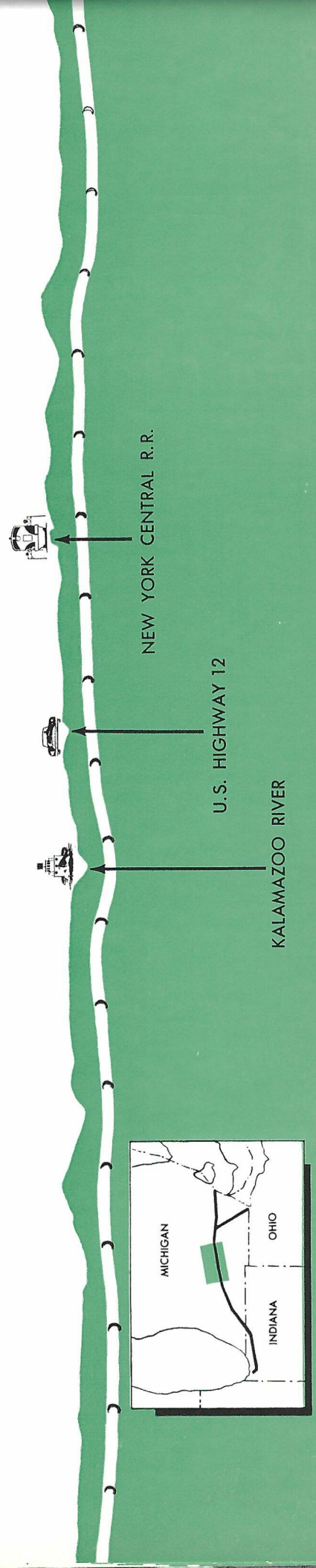




These two identical centrifugal pumps at the Kennedy station provide the initial pressure which starts the stream of products flowing through the pipe. The pumps may operate singly or in tandem, depending on the volume being moved. Each pump is driven by a 1,250 horsepower electric motor at a speed of 3,600 revolutions per minute.



This big 12-cylinder diesel engine at the Vicksburg pump station is the largest of its kind ever installed on a pipe line. It develops 2,500 horsepower and drives a single centrifugal pump, the same as those at Kennedy. At a top speed of 5,000 revolutions per minute this one pump develops as much pressure as the two pumps at Kennedy.

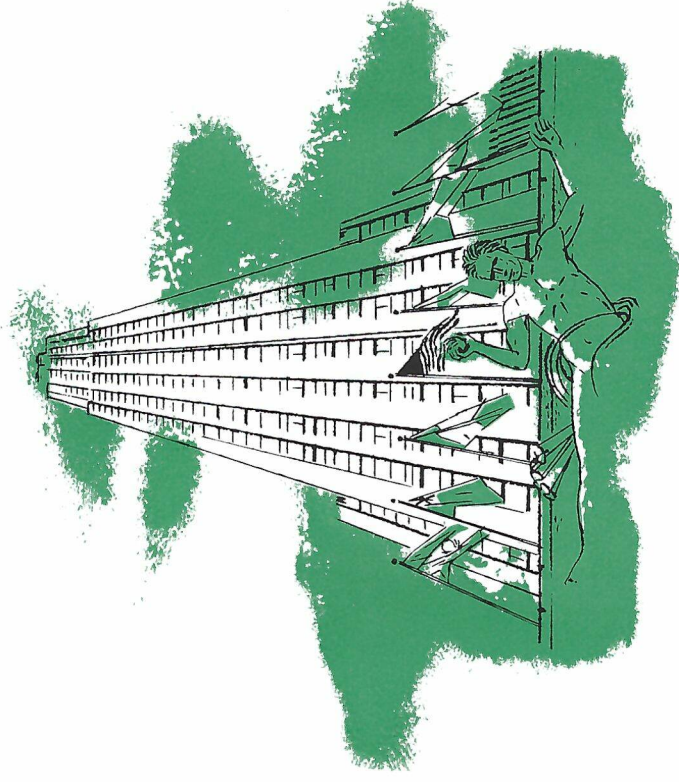


NERVE CENTER IN RADIO CITY

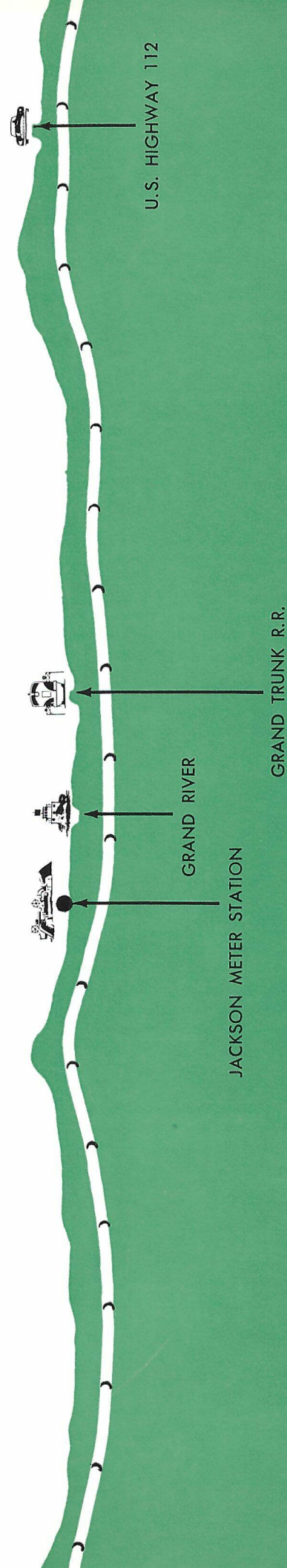
Surprisingly, over-all direction and scheduling of the movement of products originates hundreds of miles from the line. This scheduling of products and other routine Wolverine operations are carried on under contract by Shell's Products Pipe Line Department, which has its headquarters in Radio City, in New York. There, in a remarkable dispatching room, the dispatchers direct the movement of products in a pipe line half a continent away. They maintain around-the-clock supervision of the entire line with the aid of teleprinters, carefully planned pumping schedules and an ingenious dispatching board.

The key unit in following the pumping schedules is the dispatching board, a 17-foot counter-like device. This board serves as the dispatchers' crystal ball, giving them an up-to-the-minute picture of the line, telling them at a glance exactly how much of what product is where at any time.

The board is a diagrammatic representation of the line and



all its stations. Markers represent the various stations and delivery points, and lights show those operating at any time. The products in the line are represented by lengths of paper tape, scaled so that an inch represents a certain number of barrels of product, and colored to identify the various products.





Over-all direction of operations is maintained by means of this dispatching board, located in New York City. It gives the dispatchers an accurate, around-the-clock report of operating conditions on the line, showing which stations are on and off, and the exact location, volume, pressure and speed of various batches of products. (Inset) The dispatching room and all pump stations and delivery points are connected by a teleprinter system so that all receive information simultaneously. In addition, by dialing code numbers the Kennedy operator can start and stop the Vicksburg station equipment more than a hundred miles away.

Ingenious as it is, the board operates simply. Hourly reports flashed by teleprinter from Kennedy station tell the volume being pumped into the line. As a product enters the line, paper tape of appropriate length and color is fed onto the board. As the product flows along, the tape is moved forward, and when the product is withdrawn from the line at a delivery point, the equivalent amount of tape is removed at the indicated point on the dispatching board.

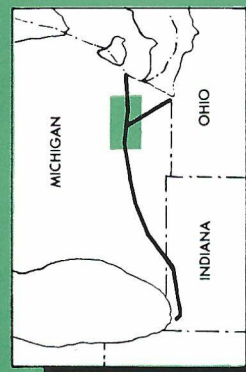
The dispatching board system is so accurate dispatchers are able to tell within minutes when a particular product will reach any point. For example, they can tell the deliveryman at a terminal to begin taking off 5,000 barrels of premium grade gasoline at 2:35 p.m., and he will find the batch arriving on the dot.

FREEDOM JUNCTION



NEW YORK CENTRAL R. R.

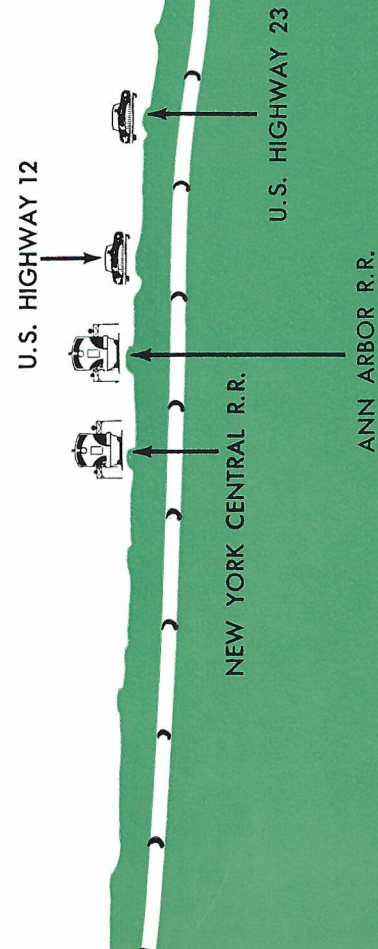
TO TOLEDO



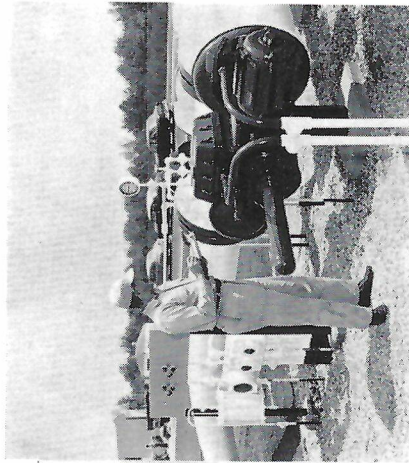
OPERATION OF THE LINE

Let's return to Kennedy station and follow a shipment through the line. Suppose a shipment of 50,000 barrels of kerosene is scheduled for 11 a.m. At that time the operator pushes the button starting the kerosene moving from the shipper's tanks through the feeder line and into the Wolverine Line. Although it has been tested by the shipper for quality and purity, it also passes through strainers and filters at Kennedy. The volume is measured by meters and the operator checks its specific gravity and temperature on instruments. (All shipments are measured and charged for on the basis of volume at 60 degrees Fahrenheit, so adjustments must be made for variation in temperature.)

As the stream flows along nothing separates adjacent products, but there is practically no mixing. Oddly, this is due to the fact that the stream whirls and churns through the pipe instead of flowing smoothly. This movement is called *turbulent* flow.



All shipments pass through strainers and excelsior-filled "hay tanks" as they enter the line at Kennedy station. Here the operator pushes a button to switch "hay tanks" for cleaning. The equipment below the panel consists of electrical safety devices which automatically take a unit out of service if an abnormal operating condition occurs.



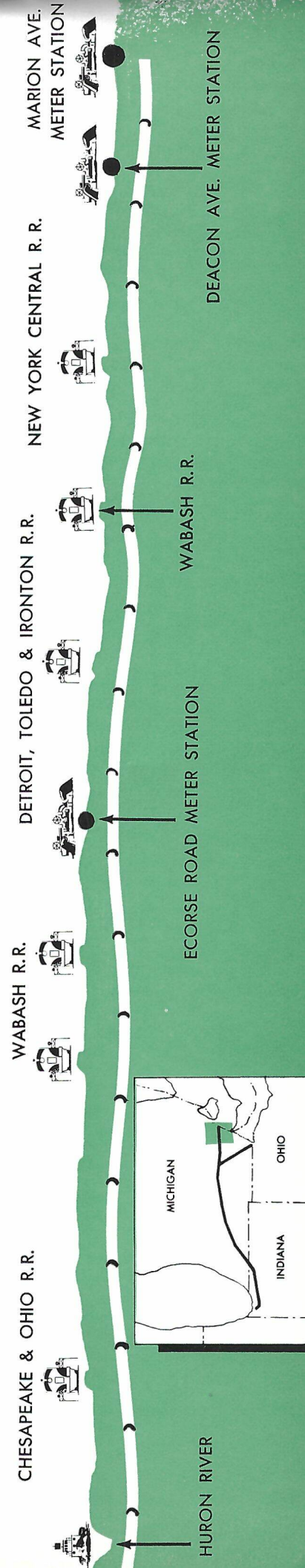
Here an operator takes a reading on the pressure gauge at the discharge valve at the Kennedy station. In the foreground, the equipment painted black is the electrical motor operator which turns the valve. As it opens and closes, the valve stem moves back and forth in the projecting cover.

Smooth movement is called *laminar* flow. In laminar flow, the liquid nearest the pipe wall is slowed down by friction so that the liquid in the center of the pipe moves faster. In turbulent flow, however, while the particles of fluid churn about chaotically, the mass all moves forward together. Under this condition, the difference in the specific gravities of adjacent products, even though slight, causes them to act as buffers against each other.

If the line is flowing at the rate of 4,000,000 gallons a day, the batch of kerosene flows at about four miles an hour and arrives at Detroit three days after entering the line at Kennedy. The deliveryman is notified as to time of arrival. He again measures the volume of the batch of kerosene and opens the proper valves for its delivery to the shipper's terminal.



All shipments are measured automatically by meters as they enter and leave the Wolverine line. Above is the metering manifold at Kennedy station, with strainers in the background.

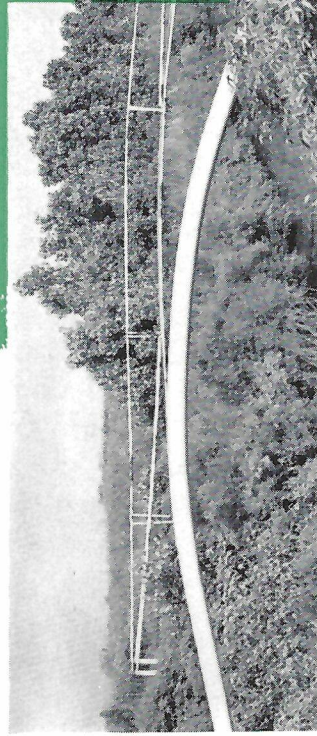


THE PIPE LINE, A LIFE LINE

The foregoing pages have given a general description and explanation of the equipment and operating methods of the Wolverine Pipe Line System. But still it is hard to visualize the line as a whole because it is mostly underground. To appreciate the continuity of the line, you must give your imagination free rein. You must picture mile after mile of pipe burrowing its way through meadows and corn fields, and under rivers, railroads and highways. You then must picture in that pipe the 15,000,000 gallons in-transit at all times and the 4,000,000 gallons of petroleum products the line can deliver daily — products destined for great factories in Detroit and Toledo, products for hundreds of tractors on farms in Michigan, Indiana and Ohio, for thousands of homes and for tens of thousands of automobiles. When you visualize all this, you can understand that the Wolverine Pipe Line System is truly one of the life lines of industry, agriculture, transportation and homelife in the Great Lakes area.



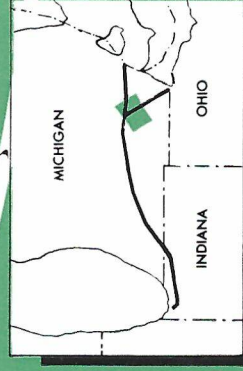
A land whose economy virtually moves on oil is seldom aware of the stream of energy flowing beneath its surface. The products pipe line tunnels under railroads, highways, fields and pastures, and is never seen except when it rises above ground at a pump station or leaps across a drainage ditch.

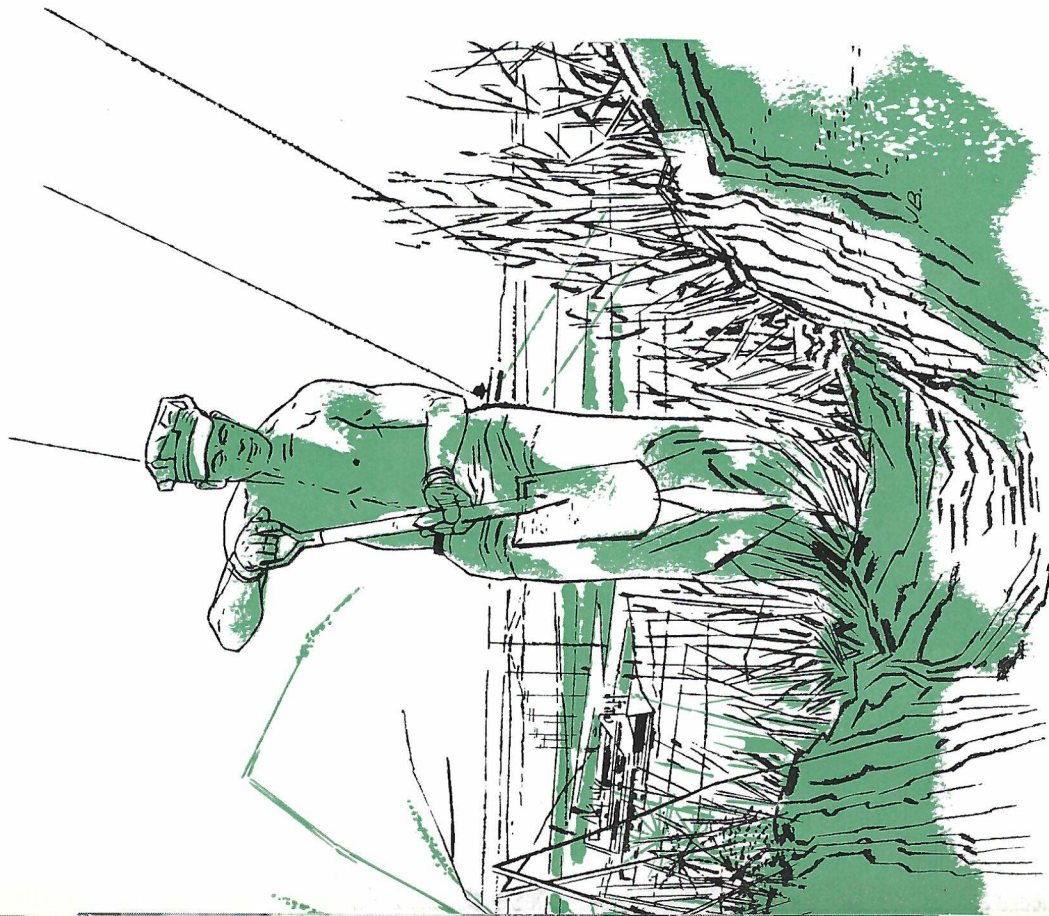


FREEDOM JUNCTION

NEW YORK CENTRAL R. R.

U.S. HIGHWAY 12





FACTS ABOUT THE WOLVERINE PIPE LINE

1. The Wolverine Pipe Line consists of 295 miles of 16-inch all-steel welded line.
2. Manufacture of the pipe required 45,000 tons of steel.
3. The line has an existing capacity of 4,000,000 gallons a day and a potential capacity of 7,350,000 gallons.
4. It has two pumping stations. Other surface installations include seven stations containing meters for measuring.
5. It takes 15,000,000 gallons of products, worth at retail prices, excluding taxes, about \$3,000,000, to keep the line filled.
6. The volume of products which can be delivered daily would fill 10 trains of 50 tank cars each.
7. Ingenious scheduling of shipments, high-pressure pumping and stop-watch precision in operations guarantee that the products of each shipper company remain distinct.

WABASH R.R.



U.S. HIGHWAY 50



RAISIN RIVER



NEW YORK CENTRAL R. R.



DETROIT, TOLEDO & IRONTON R.R.



MICHIGAN HIGHWAY 151



Good housekeeping is the hallmark of good pipe lining. Keeping the equipment and piping clean and freshly painted and the landscaped station grounds carefully trimmed.

