Chemical Laboratory Is Important Factor in Operating the Frisco Lines

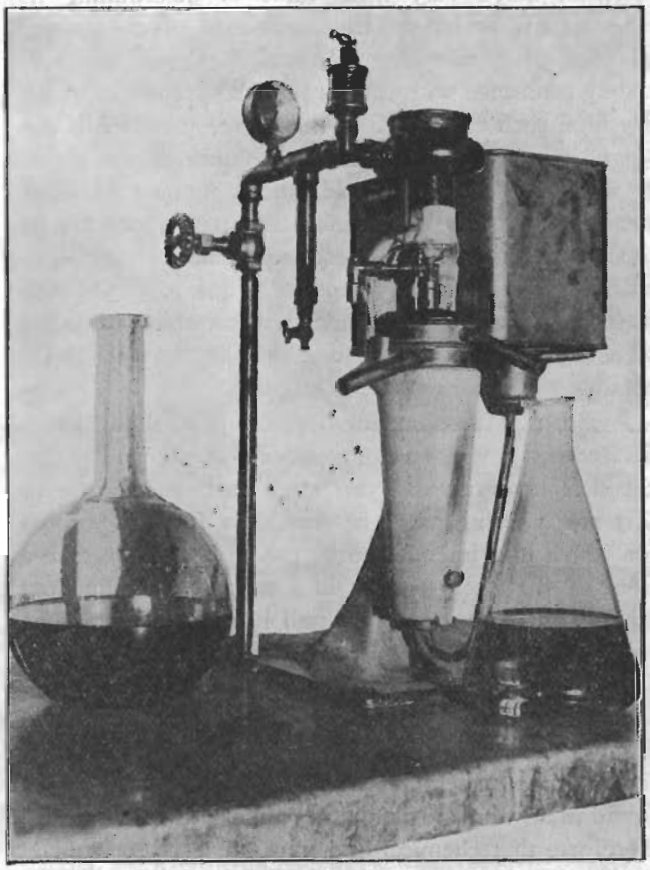
By M. A. HERZOG, Chief Chemist

"WHAT in the world does a railroad need a chemical laboratory for?" is the first question of the average individual when informed of the fact that the Frisco maintains at West Shops in Springfield a very completely equipped laboratory for the chemical and physical examination of materials. Thereupon we hold forth somewhat as follows:

A railroad is essentially a manufacturing enterprise —a company organized for the production of a single commodity—transportation. Into the production of efficient transportation, both passenger and freight, enters a multitude of raw materials of the most diversified nature. Steel—steel for locomotives, for bridges, for rails, for tools—for a thousand other uses. Oils for lubrication, for illumination and for fuel. Paints, varnishes, enamels—dozens of them. Brass, rubber hose, glass, cement, fire brick, leather, coal, turpentine —these are only a few of the hundreds of materials which the Frisco buys by the carload. The quality of these raw materials of transportation is of the greatest importance. Upon the strength of the steel in a locomotive depend human lives—an inferior grade of switch oil, resulting in an extinguished switch lamp, may be the direct cause of a disastrous wreck with its toll of life and enormous loss of money. And even where life is not at stake, the use of inferior material is a costly proposition, due to the frequent replacements required, and to idle equipment while repairs are being made.

The primary purpose of the Laboratory is to see that the Frisco gets the material best adapted to the particular purpose for which it is to be used. In order to facilitate this we have a series of specifications which set forth the quality of material desired for specific uses. Before a shipment of such material is made to the Frisco, a sample representing the shipment is taken by an inspector, forwarded to the Laboratory, and there subjected to tests to determine whether or not the material is of the quality called for by the specification covering that particular material. If the tests indicate the material to be of satisfactory grade, the shipment is accepted, if they do not, the shipment is rejected and the manufacturer is required to supply a grade of material which will meet the test requirements. In this manner the Frisco is protected against the use of material which will not give satisfactory service.

The Laboratory, however, handles a great deal more work than the routine testing of materials on order alone. When any department of the road considers the use of a new material of any kind it is first sent to the Laboratory and after a thorough investigation report is made as to its quality and suitability for use. When a freight shipment is damaged and a claim is pending, the Laboratory is often called upon to determine the nature and extent of the damage, and our decisions have saved the Frisco many thousands of dollars in unwarranted claims. Whenever any material



LABORATORY SUPERCENTRIFUGE

While this is not a cream separator, it could be readily used as one. It is used for the separation of moisture from oils and the clarification of various liquids when other means fail. The bowl of this machine makes forty thousand revolutions per minute at full speed. It is driven by compressed air.

fails to give satisfaction in service it is submitted to the Laboratory for investigation to determine the cause of failure. When information is required concerning any scientific subject, from the weight per cubic foot of steel to the best method of exterminating cockroaches, the Laboratory is called upon. Still another of our varied lines of work concerns the analysis of raw and treated boiler waters for our water engineer,

Mr. Elliott, whose inspectors submit a steady stream of water samples to the Laboratory for examination.

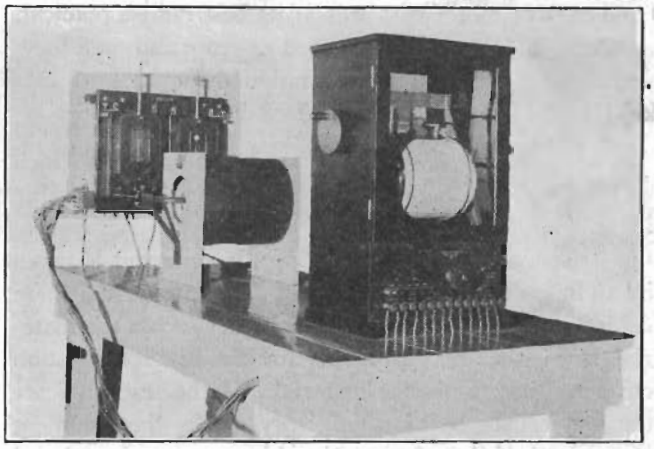
Although the Frisco Laboratory is usually referred to as "chemical," its activities very often lie entirely outside of the field of chemical work. In fact, one of the two large rooms of the Laboratory is entirely given up to the physical testing of materials. Although chemical tests are important and in many cases essential, they often do not tell the whole story. As an example of this we may take the case of varnishes and enamels. A chemical analysis of such a material, that is, determining the kinds and amounts of oils, gums, thinners and coloring matter which go to make up the material, is of very little value in determining its probable life under service conditions. The "lasting" qualities of a varnish or enamel, however, are intimately connected with certain physical properties of the dry film, such as elasticity—the degree to which it can "give" without cracking—the resistance to the action of water, both hot and cold, and a number of other such factors. By determining them it is possible to predict with considerable certainty what the varnish or enamel will do when it is applied to the job. On such material, therefore, the greater portion of our tests are of a physical nature, designed to imitate as closely as possible the conditions of actual use.

Again, it is possible for a piece of steel to have a perfectly satisfactory composition, as shown by the chemical analysis, and yet be so hard and brittle or soft and yielding as to be worthless for the purpose for which it is intended to be used. But if we take a piece of the steel, place it in a machine and find out how much force it takes to pull it apart, we can soon judge whether or not it is suited to the work in hand. This, however, works both ways. A steel may possess all the physical properties desired, and yet fly to pieces when attempt is made to forge it, due to excessive sulphur present in the steel, which could only be found in advance by a chemical analysis. It is evident, therefore, that chemical and physical tests go hand in hand.

With so many different materials to test, it may be imagined that a wide range of equipment and apparatus is necessary. The Frisco Laboratory has gradually expanded from its establishment some twelve years ago in a corner of the store building at West Shops, with a staff of one, until at the present time we compare favorably with many of the most modern commercial laboratories. The Frisco is a progressive road, and has readily seen the need of supplying up-to-date equipment for its test work in order to keep pace with the developments that are being constantly made in the science of testing materials. Among the apparatus which the Laboratory possesses might be mentioned microphotographic equipment for the investigation of the structure of iron, steel and other metals; apparatus for determining the correct heat treatment of steel; a source of artificial sunlight by means of which the fastness to light of the color of fabrics, paints, inks, and other materials may be determined in a few hours; an experimental paint mill, used in the preparation of standard samples of paints, and numerous others.

As indicated above, the tests which we make are varied and numerous, and it is not possible in an article of this length to even briefly summarize them. In every case attempt is made to avoid tests which have merely a theoretical value, and use instead those which have a direct, practical bearing upon the quality of the material and the use which is to be made of it. In order to do this it has been necessary for the Laboratory to evolve many original methods of test, and to design a number of testing machines and special pieces of apparatus to cope with the problems which have arisen.

The trend of the modern manufacturing industry is towards strict honesty in dealings with the consumer. The day of gross adulteration of manufactured products and of deliberate misrepresentation of material is passing. But there is still a multitude of manufacturers who ship a product slightly inferior to that called for, with the expectation of "getting by" with it. If they do—it means a loss to the Frisco. Or the manufacturer may make a mistake and ship inferior material unknowingly. But in either case the result is the same, if the material is placed in service. Therefore the Laboratory.



THERMAL TRANSFORMATION POINT APPARATUS

No, this is not the latest thing in radio equipment. It is an instrument for the study of the heat treatment of steels.

HOW MANY KNEW WE HAD A CHEMIST?

Mr. Herzog's article will prove educational and illuminative to more than one reader who failed to realize we had such a department.

Chief Signal Engineer Describes Installation and Work of New Block Signals

By I. A. UHR

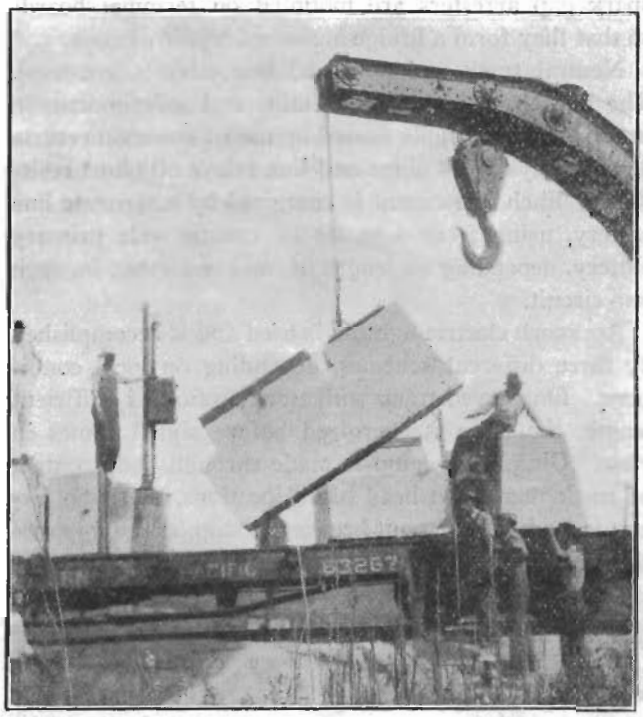
AN INSTALLATION of automatic block signals between Monett, Mo., and East Tulsa, Okla., is now in progress, covering a territory of 140 miles.

The first 5 miles west of Monett is double track at the termination of which is a junction of the South western and Northern Divisions. At Afton, Okla., 66 miles west of Monett, is another junction of the same divisions. Trains run over the track between Afton and East Tulsa from St. Louis and Kansas City to and from points in Oklahoma and Texas, which makes this a very busy line of single track railroad where track capacity increased by the automatic block signals will be of great benefit in train operation.

It was planned to first purchase sufficient material for installation of signals to Afton and have practically all material shipped direct to a central point for assembly and distributed by work train; but before this installation was completed, material was purchased sufficient to continue the installation to East Tulsa and arrangements made so that handling by the General Store and Signal Department forces was reduced to a minimum.

The handling of material in the most economical manner has always been a problem. The old scheme of making foundations in the field, then distributing signals, battery housings and other materials by use of hand cars or motor cars was at its best not economical, resulting in delays and increased expense and on a busy single-track railroad transportation difficulties of this kind would be greatly aggravated, due to the numerous times material would have to be unloaded and loaded up again to clear the track for trains. In order to avoid such conditions and conduct the handling in the most efficient manner, distribution of all material possible was made with the same work train which distributed the heavy units such as the combined signal foundations and battery boxes and signals complete.

The construction work is being performed by Frisco signal forces, separate construction gangs being organized from a skeleton organization which has not required the hiring of any experienced signalmen outside of our own department. Gangs were organized to handle the following classes of work: Concrete work, pole line, track bonding, underground wiring, case wiring and the clean-up squad. This has resulted in the men in each gang becoming very proficient in the class of work they are doing and made economy in labor as well as speeding up of the entire construction; just sufficient men were placed in each gang to keep up with their work in line with the general construction program.



Setting a Foundation at Its Permanent Location

The concrete work was started first, all being performed at a central point. The signal foundation and battery box is combined in one unit, the battery box having a capacity of 48 cells of caustic soda primary battery. Ten-cell battery boxes were made for track batteries where not located at signal locations.

After sufficient concrete work was completed, preparation was made to set the foundations and signals by work trains, care being taken in making the excavations to have them level and of proper depth to avoid expense so far as possible in leveling or changing their height. The top of each foundation is set level with top of rail.

The signals are style "S," three position, upper quadrant, semaphore type. Our previous standard provided that the semaphore blade be 25 feet above top of rail, while on this installation the blade is 15 feet above top of rail.

One-half of the track bonding is being done by a power drilling machine which averages 180 joints per day with machine run by one man. The other half is

performed by hand drilling machines and each driller averages 80 joints per day. Each joint is bonded with two No. 8 B. W. G. galvanized iron bond wires, 48 inches in length.

In addition to a carborundum type lightning arrester, which is placed on each wire from pole line and track, spark gap arresters are mounted on terminal boards so that they form a bridge across each pair of coils.

Neutral track and polarized line circuits are used. The line circuits are full metallic and independent, in order to avoid trouble caused by use of common return. Track relays are 4 ohms and line relays 50 ohms resistance. Each line circuit is energized by a separate line battery, using from 4 to 10-cell caustic soda primary battery, depending on length of, and resistance in, each line circuit.

Approach electric lighting is used and is accomplished by three different schemes, depending on local conditions. On curved track with track section of sufficient length, the lamp is energized before signal comes in view. Circuit for lamp is made through back contact of track relay. At head block locations, the lamp circuit is made with circuit breaker at stop on the opposite signal. At intermediate signals an 8-ohm D. N. L. relay is cut in series with the line control circuit for next

Location Complete and in Service

signal in rear and a back contact on this relay controls the light. The electric lamps are 3½ volt, mounted in Edison adapters, energized by 4-cell caustic soda primary battery.

All interlocking plants in this territory have been made modern with respect to the removal of detector bars and mechanical signals, changing them to electric and providing detector, approach and indication locking. The home signals were made a part of, and continuous with, the automatic block system. Call on arms provided to move trains through the interlocking plants in event electric home signal cannot be cleared on account of block being obstructed.

The line wire used is No. 12, copper-clad, weatherproof, double-braid, installed on Western Union pole line. In order to overcome the trouble of pulling cross arms out of line where line wires are dead-ended, as is the condition when line wire is dead-ended using standard pin and insulators, we have used insulated forks which are found to give excellent results.

Locations of signals were selected by Signal Department and checked after which the territory was covered by representatives of the Division Operating and Engineering Departments. Operating conditions were studied and it was found some changes and eliminations could be made in passing tracks without detrimental operation to trains which reflects a saving in the original installation of signals as well as cost of future maintenance and operation.

Extreme care was taken to insure that drainage is not obstructed by location of any signal apparatus.

The general scheme of signaling used is that known as the overlap sytem and when this installation is completed the Frisco Lines will have close to 1,000 miles of track signalled.

ON BEING CAREFUL

Rural Philosopher Speaks Some Homely Truths

"Say, folks," says Cy Perkins today, "you can't be too careful crossing a railroad track. The trouble is, before folks cross, people seem to be in a great sweat, but that sweating stuff don't get you a paper o' pins; in fact, this generation is going like thunder.

"I think they ought to call the lower front portion of the railroad engine an auto catcher instead of a cow catcher. Stop, Look and Listen."

On the Memphis Sub-Division

—And Engine Performance There

By L. M. WESTERHOUSE, Roundhouse Foreman, Memphis

HAVING just received a report of the September performance of the Memphis Subdivision through freight engines, and finding that it discloses a wonderful showing in this class of service, I believe it would interest readers of the magazine to know something about this subdivision.

The Memphis Subdivision, 144 miles of rock ballast, well-built railroad, operates between Thayer, Mo., and Memphis, Tenn., with Thayer as its northern terminal, Harvard, Ark., as the southern freight terminal and Memphis as its eastern passenger terminal.

A daylight trip over this subdivision presents some beautiful scenic vistas. Two miles out of Thayer, south, is the famous Mammoth Spring of Arkansas, recognized as the largest spring in the world. A large dam has been built there to check the waters of the spring, thus forming a lake. By taking a motor boat ride over this lake one gets a delightful view. The water at this point is very deep. Efforts to locate its depth proved futile when an anvil weighing 250 pounds was used for sounding.

Mammoth Spring is the head of the beautiful Spring River, followed by the Frisco for about 50 miles, a rugged country through which the road winds through cuts in the hills of solid rock, then through fertile valleys where corn and cotton abound. The beautiful Spring River furnishes Mammoth Spring, Thayer, Koshkonong, Brandsville and West Plains with power for electricity and yet has much to spare.

Fifty miles from Thayer, in a southerly direction, lies the navigable Black River. At Black Rock, Ark., the Frisco crosses over a drawbridge and a more level country is reached where one may find great cotton plantations and lumber camps. Hoxie, Jonesboro, Truman and Marked Tree are the principal cities. Further on is the levee and then the climb up the approach to the giant steel bridge, over the Father of Waters and thence into Memphis.

Over this division for the month of September there were no serious delays and no accidents or engine failures. A truly good railroad, and with good locomotives and equally good men to operate the trains.

In "through freight service" the 695 to 724 class engines are used. These are the pioneers of the Walschaer valve gear and piston valves on the Frisco and are a credit to the road. Although built in 1906, with some later improvements, they seem to grow better with age.

The engineers on these locomotives are handling more than 2,100 tons, south, and 1,550 tons, north, over the entire subdivision. The tonnage is based on their ability to overcome Bono Hill, going south, and "Forty-four" hill, going north. The average performance of the regularly assigned engines in "through freight service" for the month of September was 88 pounds per 1,000 G. T. M. If there is a better record anywhere on the Frisco it would be interesting to learn of it. The following is the September performance (the average weight of these trains was 1,668 tons, with an average of 6.4 hours per 100 miles. These engines burned 1,964 tons of coal and handled 44,837,000 G. T. M.:

Engine 724	81 lbs. per 1,000 G. T. M.
Engine 722	82 lbs. per 1,000 G. T. M.
Engine 721	85 lbs. per 1,000 G. T. M.
Engine 696	85 lbs. per 1,000 G. T. M.
Engine 719	86 lbs. per 1,000 G. T. M.
Engine 709	89 lbs. per 1,000 G. T. M.
Engine 716	89 lbs. per 1,000 G. T. M.
Engine 712	96 lbs. per 1,000 G. T. M.
Engine 698	98 lbs. per 1,000 G. T. M.

791 lbs., or an average of 88 lbs. per 1,000 G. T. M.

It Pays to Read the Safety First Articles

From one of the Frisco employes down in Texas comes this: "I once wondered whether 'safety first' articles were of real value. No longer do I wonder—I know now their value, for from reading carefully and following the advice given by Mr. Ball and others, I have learned to be more careful in my daily work and have gained, not only in precaution, as a result, but in efficiency as well, for the careful man is the accurate, efficient man. I have, indeed, found that it pays to be always careful."