

The Monthly BUSINESS REVIEW

Covering business and industrial conditions in the Fourth Federal Reserve District

FEDERAL RESERVE BANK of CLEVELAND

D. C. Wills, Chairman of the Board

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BUSINESS is regaining its equilibrium. Evidences are daily seen that business men are convinced that national prosperity lies only in a prompt return to a more solid and substantial footing. So far the movement has been orderly, and there is really nothing in the situation to create alarm if we are willing to read the signs of the times and make present and future plans to conform to the changed conditions.

Not all business men are willing to subscribe to the statement that there has really been a change in conditions. The disinclination of some to make more than a superficial study of the situation is disturbing, and it is hoped they will be able to see and heed the danger signal before they are brought up against the stone wall of reality.

Americans are essentially optimistic. This in itself is a virtue, rather than a fault, provided we do not permit our optimism to dim our perspective or warp our judgment. The assurance of some who insist that further expansion in business is both necessary and safe appeals to us as a case of "the wish being father to the thought." (The business semaphore is set at "Caution," and to refuse to observe it may be to invite disaster.)

The Federal reserve system was inaugurated in time to be the important factor in financing the most costly war of all time, and has proven its capacity to expand to meet business requirements which were undreamed of at the time the bill was enacted. The expansion of the past four years has taken up a large part of the slack which our elastic system affords, and it is now to be put to the test of contraction.

It would be very difficult, indeed, if not entirely impossible, for the Federal Reserve banks alone and unaided to undertake to compel such contraction as is necessary without increasing discount rates to the point where further loans would be prohibitive. Nor should the task of deflation be that of the Federal banks alone. It is true that our present extended condition has been brought about since the system was established, but the Federal Reserve banks have been merely the medium through which expansion has been possible, and not the *cause* of the inflation itself.

Business has taken advantage of the opportunity which war financing offered to inflate, and must now assume its proper share of responsibility in a conscientious effort to establish a more sound credit situation. Speculation, whether it be in stocks, real estate, raw or finished materials, must be stopped; non-essential credits, for whatever purpose used, must be eliminated; existing loans, wherever possible, should be reduced. Business must have recourse more to its own funds and less to the banks. Never has there been a time when reliance should be placed more upon one's own funds, and resort to the credit reservoir should be had only on occasions of the greatest emergency.

Economy in business is just as essential as elsewhere. With the demand for money or credit so great, and the supply so short, its wasteful uses in business extravagances cannot be too strongly condemned. Instances without number have been cited of reckless corporate expenditures, all of which have added to the credit strain as well as increasing the already too high cost of living.

In ordinary times, the early months of the year are periods of easy money. Never in the recent history of American finance has the demand for credit been so tense as during that period of the present year, except perhaps during financial flurries. The reserve position of the twelve federal banks reached the lowest point on May 14 since the establishment of the system—42.2 per cent, at the time when efforts should be made toward building up the necessary reserve credit for crop-moving purposes, the demand for which will soon be upon us. Within thirty days harvesting will be in full swing in the wheat belt, and the necessary funds must be forthcoming. It is absolutely vital that credit be conserved with this end in view.

At the present time the United States is maintaining the only free gold market in the world. As the international gold equilibrium is restored, which eventually it will be, this will result in a further depletion of our gold reserves, with a consequent reduction of our credit possibilities.

The abuse of credit is not the only fly in the industrial ointment. For years business has been operat-

ing in a more or less "off ag'in—on ag'in" style by reason of the activities of a few radical labor leaders, who have taken advantage of every opportunity to hamper and harass commerce and industry by demands, which, when granted, seem to have served merely as the basis for new demands. Strike after strike has followed in rapid succession, each in turn contributing to inconvenience, if not disorganization and actual suffering.

We are now in the throes of an unauthorized strike of the railway switchmen—a strike not even sanctioned by their leaders—and its influence has been far-reaching. Transportation at various points in the district is moving at from 25 to 75 per cent of normal, with the inevitable result that goods are piling up on shipping platforms in immense quantities—in some cases beyond the ability of the producer to finance it. This of necessity increases the credit strain, and will eventually result in the closing of plants, or at least a curtailment of operations. An unfortunate feature is that the harmful effects of such disorders do not pass away with their settlement. It will be months before traffic operations are restored to pre-strike conditions, even should the switchmen return to work at once.

Too many of us are inclined to the belief that an interruption of our transportation system is something with which we are not intimately concerned, and which we therefore view rather complacently. Nothing could be further from the facts. The distribution of goods is just as important an economic

factor as production, for without means of interchange of commodities we should find ourselves in the unenviable position of our forefathers—dependent largely upon what we individually produced.

It is a sad commentary on our industrial development that no satisfactory plan has been offered to secure a better understanding between the two most necessary forces to a prosperous and progressive America—labor and capital. Each is dependent upon the other, and yet each has been led to believe that they are each other's worst enemies. Labor is not entirely to blame—capital is not entirely to blame. There is a great middle ground upon which this problem may be worked out—a vast expanse now regarded as a sort of "No Man's Land" upon which neither may tread without arousing the suspicion of the other. Civil courts have been established for the settlement of disputes between individuals; international courts are provided for settling difference between nations; and it would seem that we should be capable of sufficient intelligence to establish some workable plan whereby industrial disputes could be adjusted equitably, and without the use of coercive measures to accomplish any desired result.

Business conditions are fundamentally sound. With a better realization of present conditions, coupled with reasonable efforts to control the situation so that confidence may be maintained, a satisfactory future for American business is assured.

Demand for Loans Heavy; Acceptance Market Somewhat Dull

Money is tight. The demand for credit is insistent, is aggravated to a great extent by large and expensive inventories and finished goods which cannot be moved, and requires the utmost vigilance on the part of the bankers to see that proper use is made of what loans are absolutely necessary for essential industries. Too much stress cannot be laid upon this point. Our credit possibilities are not unlimited, and the granting of loans to non-essential industries in the present situation must be at the expense of some more necessary production and cannot be condoned.

It may be hard for some bankers to grasp the situation, but most of them see the evil possibilities of further credit expansion and are acting accordingly.

The return of the general selling rate of acceptances to a 6 per cent basis has not stimulated business to the level of last month, although institutions and individuals that have not formerly been in the market are slowly being drawn into purchasing this form of security. The turn in the volume of bills sold is considerably less than in any month since the first of the year. The continued tightening of money, as shown by the upward trend of call rates and the

firm tone of the time money market, has largely been responsible in retarding the demand. The country banks, that have been the important source of absorption, are now feeling the weight of their local requirements for money, and are buying bills in much smaller amounts. The crop-planting season and the inability to move commodities has caused unusually large demands for money, and has been directly reflected in the acceptance market.

The offering of first mortgage railroad bonds of long maturity at exceptionally attractive yields has to a great extent kept corporations, savings banks and other institutions out of the market. Although these institutions are not as yet the equalizing factor in the market that they might be, their failure to demand even a small volume of bills is more seriously felt than at any other period.

In order to protect the market and foster its development, questionnaires have been sent out broadcast to banks and acceptance dealers, asking for detailed information concerning the bill market. It is expected that the returns will give the Federal Reserve Board much valuable information, and will probably result in developing a broader market.

***Railroad Situation Dominates Steel Trade; Credit Situation Becomes
Increasingly Important; New Buying Restricted;
Foreign Buying of Pig Iron Increases***

Transportation conditions continue to dominate the iron and steel industry. The past month by reason of the curtailed movement both of incoming raw material, and outgoing finished material due to the stubborn persistence of the switchmen's strike has been one of constant struggle on the part of the mills and furnaces to maintain operations. Many plants have been forced to shut down entirely or to greatly reduce their output by reason of these two main influences. After passing through several weeks of uncertainty, wherein conditions have been changing almost daily between some improvement and less favorable outlook, the situation at the present time is a little more hopeful. At the same time embargoes still are in force at many points with little possibility of their being lifted for some time. Mill and furnace yards are piled high with unshipped product and production is on a greatly reduced scale, so that the restoration of normal conditions probably will be a matter of protracted date of the indefinite future. The tie-up that has obtained in some of the large producing districts, such as in the Pittsburgh zone, in the Mahoning and Shenango Valleys, Cleveland and elsewhere, has been practically without parallel, owing to the density of the plants and industrial operations in that territory. Operations have been dependent largely upon the moving of materials by full train loads, but this necessarily has been restricted and thousands of tons of rolled steel and pig iron awaiting delivery have been added to the already considerable stocks in the yards of the manufacturers. The effect of the general freight blockade has been one of cumulative force upon the consumers of iron and steel, who necessarily are dependent in their operations on an uninterrupted supply of incoming material.

Many of these manufacturers have been forced to suspend or to reduce their production to low speed because of the lack of material. This has caused the throwing out of employment of a large number of men, which has had a tendency to relieve the shortage of labor in other directions. Furthermore the credit factor represented in the increased accumulations of unshipped products has become one of increasing importance and has been the source of deep and thoughtful study with respect to its ultimate development. The position of many manufacturing consumers of iron and steel has become very serious and it promises to remain so for some little time.

Production figures for the month of April furnish some measure of the extent to which output has been curtailed by the enforced slowing down of many plants. The April output of pig iron as compiled by The Iron Trade Review was 2,752,314 tons, a reduction of 623,454 tons from March, when the furnaces were turning out iron at the highest rate since

December, 1918. The net loss of the number of stacks at the end of April was 37, the total standing 278 against 315 on the corresponding date in March. The loss of steel ingot production in April was something like 750,000 to 800,000 tons, according to the statistics presented by the American Iron and Steel Institute. The April production was at the annual rate of 37,190,000 tons as compared with a rate of about 44,750,000 tons in March.

One of the most disquieting phases of a transportation situation has been the interference with the lake coal and iron ore traffic. Many vessels have been held in lower lake ports because of the lack of fuel and cargo coal, the latter of which they should be handling vigorously for the northwest at this time. The situation has been complicated by the strike of dock handlers at the head of the lakes which now has been adjusted. It is estimated that at the present time about 60 per cent of the total ore vessel capacity of the lakes is in action. The result of these conditions promises to be a material cutting down of the expected season's movement of iron ore and a shortage of coal at the northern points. The effect has been felt already in the Lake Superior mining regions, where some curtailment of operations has been forced. Where a 60,000,000 ton ore movement for 1920 has been predicted, ore operators now have dropped their estimates to 55,000,000 tons, and this probably will have to be revised lower as the loss of cargoes is continued. During April the lake ore movement amounted to 230,854 tons as compared with 1,412,239 tons for the corresponding month in 1919.

Market conditions have reflected the influence of the tying up of shipments and new buying has been considerably restricted. While there has been some increase in the irregularity of prices, due to the upset conditions, the latter in the main have remained strong. Few suspensions or cancellations of iron and steel orders have been reported, consumers in the main still manifesting a keen desire to obtain tonnage just as soon as physical obstacles are removed. There has been a fair amount of spot buying of pig iron where consumers were able to take in shipments on a slightly higher basis price. Export sales for future delivery have run in fair volume. An interesting feature has been the increased buying of iron and steel in this country by Great Britain, due to the shortage of supply prevailing there. Some round tonnages of various products have been sold on the American domestic level of prices and large inquiries are pending, including conspicuously a heavy lot of foundry pig iron for Scotland. Before the war Scotland never was a buyer of American iron and frequently was an exporter to this country.

Lake Shipping Backward Owing to Inability of Railroads to Handle Ore and Coal; Upper Lake Region will Suffer from Shortage of Fuel

The outlook in the lake trade is no brighter than it was a month ago. Many of the freighters have not started and the indications are that more vessels will be added to the idle list, owing to the scarcity of fuel and the fact that the railroads can only handle a small portion of the ore that has been lined up for direct shipment to the furnaces. That there will be a shortage of coal in the Northwest and that some of the furnaces in the interior will not be able to operate in full next winter is pretty certain, as under the most favorable conditions the demand in both trades cannot be supplied.

Sales of ore indicated that the requirements of the furnaces would be about 61,000,000 tons. Shipments for April were only 230,854 tons compared with 1,412,239 tons in April, 1919. The loss on June 1st will be much greater and as the car supply was short in the lake trade before the strike the railroads will not be in shape to handle the business after the labor trouble is settled even if the boats could operate at top speed. With only a part of the fleet in commission, ore is being delivered at Lake Erie ports faster

than the railroads can take it forward, and loaded cars are on the lines between the Lake Erie ports and the furnace yards. The railroads in some cases cannot handle solid trains that require little switching and ore carriers are waiting at all the Lake Erie receiving ports. The crews of a large number of vessels that were ready to go have been paid off and sent home.

Coal shipments for last month were only 307,000 tons and in April, 1919, the fleet loaded 1,082,183 tons. The requirements of the Northwest will be much greater than they were in 1919, as very little coal was carried over, and the demand in that district will not be supplied. The lake shippers will pool the coal in order to increase the movement, but getting the coal forward is a railroad proposition as there will be little delay in fleeting the coal if it is brought to the lake front. The steamers that are in commission are delayed in getting bunker coal, and fuel prices range all the way from \$7.00 to \$10.00 a ton—the highest on record in the lake trade.

Rail Strike Interferes with all Manufacturing; Declines Noted in Many Trades

Manufacturing, in common with other branches of industry, has been hard hit by the railroad strike. The lack of fuel is beginning to make itself felt, as many companies had about depleted their surplus piles before spring and have been unable so far to replenish them. Many plants are now operating with reduced forces, and in both these and others a complete suspension is indicated unless prompt relief is had.

The labor situation has been relieved to some extent by what unemployment has been forced through manufacturing suspensions, as those plants who are so situated that they will still operate at capacity are now able to secure the necessary help. One large employer of labor in the district reports that more men are presenting themselves for employment than has been the case for five years.

Cincinnati machinists have been on strike, but makers appear for the most part indifferent, as it is practically impossible to move goods. Local strikes for recognition of the open shop have been inaugurated at several points throughout central Ohio, with indifferent success as we go to press.

New building is being postponed in many cases, except where such progress has been made that it is deemed inadvisable to discontinue.

The automobile industry continues to hold its own, although complaints are becoming more numerous of difficulty in securing shipments of materials. The manufacturers of trucks are in more fortunate position than others in this regard as they are able to haul immense quantities of material, in many cases these hauls being hundreds of miles long. Passenger car makers also enjoy a freedom of movement in

being able to deliver the finished product under its own power.

Pottery makers report that the demand is just as great as it has been during the past year. Unfilled orders on hand are now at their peak, according to reports.

Tool makers report a decrease in business for the past month, due to inability to ship finished goods. The decrease would unquestionably have been larger but for the fact that many of the individual pieces composing tool manufacturers' products are small, and need not be transported by freight.

Hardware manufacturers are handicapped by a shortage of supplies. Jobbers of the metals have extremely low stocks on hand, and dependence must be placed upon what shipments are able to be made from the mills.

Tin can makers state that business with them has been considerably reduced owing to lack of material shipments. Orders are being received in smaller volume, and would seem to point to a scarcity of containers at canning time.

Stove and range manufacturers are optimistic. A number of plants have orders booked for the entire 1920 output, and are refusing to accept orders for delivery beyond January 1, 1921.

There has been a decided slump in the shoe business, and prices have started to decline. Manufacturers have been receiving large numbers of cancellations, and conditions in the shoe trade are very much disturbed.

Lumber dealers report a hesitancy on the part of manufacturers to buy further stocks of hardwood.

Rubber factories have curtailed production, owing to inability to make shipments.

Uncertainty Prevails in Textile Trade; Retailers May Face Losses in Women's Wear

More or less confusion exists in the textile trade, which is operating under many difficulties. Demands have been made by the Amalgamated Textile Union for a wage increase of 17½ per cent to take effect May 31. A meeting of the larger textile interests was held at Boston very recently to determine upon a policy with reference to meeting or fighting this demand. The unions had desired to make their agreement with the Wool Association as representing all manufacturers, thus establishing the precedent of collective bargaining between employers and workers. The unions have been notified, we are informed, that the matter of fixing wages was a

matter for settlement between manufacturers and their employees.

The price of wool is not strong and seems inclined to weaken even more. The cost of the raw wool entering into the making of cloth is, however, but a small part of the cost of finished goods.

Suit and cloak makers report business as healthy, but feel some apprehension as to the situation in the retail trade so far as their lines are concerned. Salesmen report large stocks which will have to be carried over or sold at much reduced prices, owing to changes of style in women's wear.

Uncertainty Prevails in Wholesale and Retail Trade; Volume of Retail Trade Decreases; Lower Prices Expected; Collections Slowing Up

Some uncertainty characterized the month of April in wholesale and retail trade. Indications seem to point to a tendency to reduce stocks held, and orders for the future are made with more caution than has been the rule during previous months. Dealers generally welcome this turn of events, and declare that they will be glad of a return to conditions when the buyer will have something to say in the matter of making contracts for merchandise to be delivered.

Cool weather has resulted in a slowing up of spring goods, which may force some liquidation before the season passes. The effect of the "overall" and "old clothes" movements cannot yet be measured, but there can no longer be any question of the psychological effect on the people.

Shoe dealers, in particular, are not placing orders for fall goods, believing that a generous price reduction is imminent.

The belief of merchants in general is that the peak of prices has largely been reached, and that a general decline is more probable than an increase.

Collections have slowed up somewhat, but in the main are still satisfactory.

Merchants are advertising sales more generally, which would appear to indicate that the buying demand had slackened somewhat.

Figures on retail trade sales show a considerable slowing up as compared with increases shown during the early months of the year. The composite report of retail stores for the District is given below:

| | |
|--|-------|
| Percentage increase in net sales during April over net sales during same period last year.. | 17.1 |
| Percentage increase in net sales from Jan. 1 to April 30 over net sales during same period last year | 30.3 |
| Percentage increase of stocks at close of April, 1920, over stocks at close of same month last year | 57.8 |
| Percentage increase of stocks at close of April, 1920, over stocks at close of March, 1920.... | 6.7 |
| Percentage of average stocks at close of each month from January 1 to average monthly net sales during same period | 373.5 |
| Percentage of outstanding orders at close of April to total purchases during calendar year, 1919 | 13.1 |

Mining Operations at Stand-Still; Coke Production Much Reduced; Oil Production "Neck and Neck" with Consumption

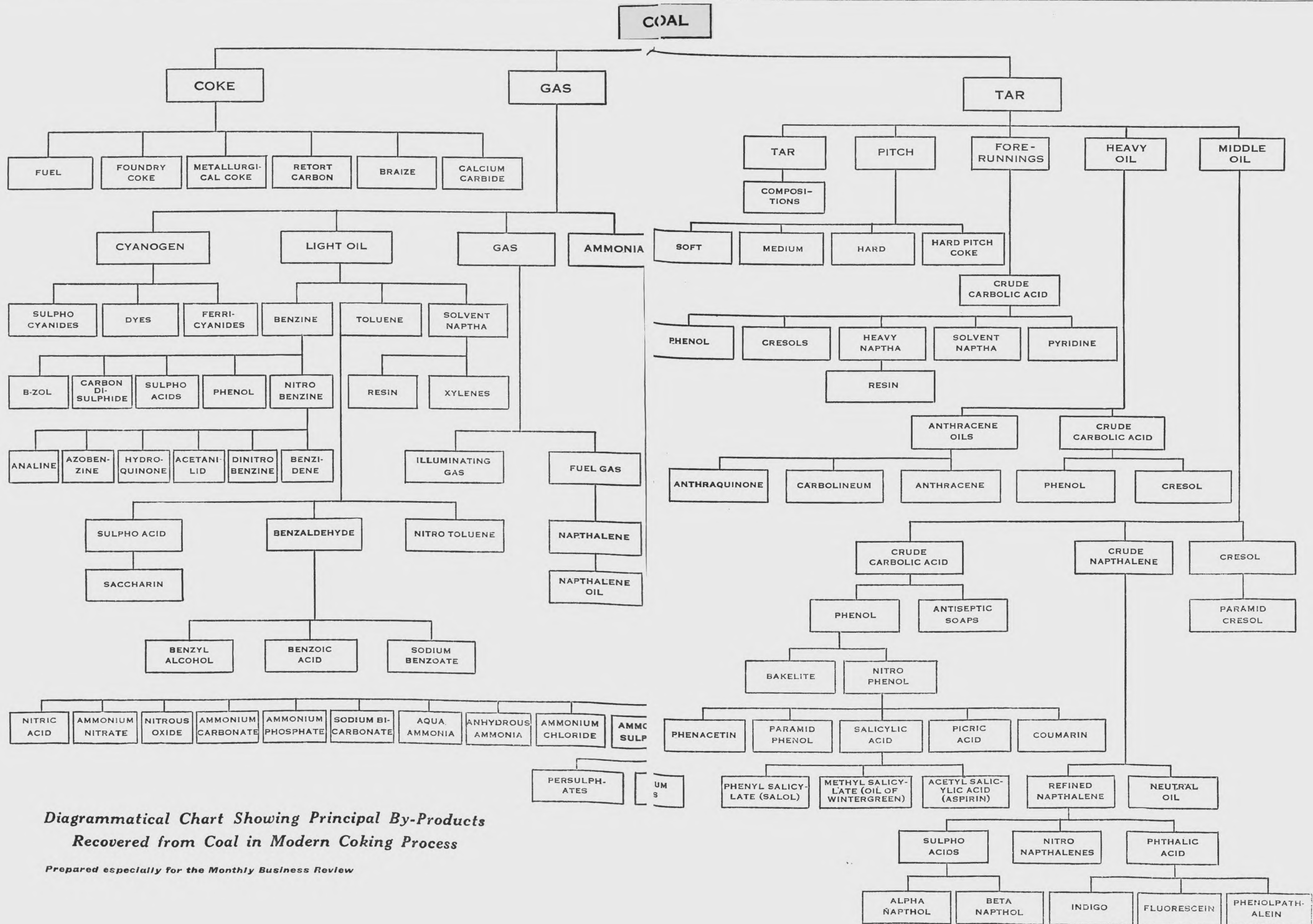
Mining operations, so far as rail shipments are concerned, are practically at a stand-still. Immense quantities of coal are now being transported down the Ohio River. Stocks of coal are running low, and it is almost certain that the fuel situation next winter will be more critical than during the past season.

Coke production, which was just beginning to approach normal, has again been given a set back. Some of the companies who depend upon river ship-

ments are more fortunate, in that the railroad strike has not so seriously affected them, except insofar as it interferes with shipments of domestic coke.

Oil production continues large, but the demand is steadily increasing. Stocks above ground are not large, and do not appear to be increasing, as the demand now is fully equal to the supply.

Oil prices still show a tendency to harden, and have recently established new highs.



Diagrammatical Chart Showing Principal By-Products Recovered from Coal in Modern Coking Process

Prepared especially for the Monthly Business Review

Transportation Conditions Chaotic; Car Shortages Reducing Shipments; Railroads Pay High Rates of Interest for Funds

Transportation conditions could hardly be expected to be otherwise than chaotic in the present situation. Railroads throughout the entire district are suffering from the effects of the switchmen's strike, which does not appear so hopeful as it did thirty days ago. Chambers of Commerce throughout the United States have been asked by the Cleveland Chamber to urge their members to send into the railroad yards such employes as have had switching experience, in an effort to relieve congestion and keep goods moving. It is yet too early to determine what effect this will have on the general situation.

In addition to the handicap of labor difficulties, the railroads are hampered by the inability to secure funds to make necessary repairs and replacements except at the rate of 7 per cent or better. Immense sums are necessary to rehabilitate the railroads, which must be maintained at a high degree of efficiency if they are to handle the immense amount of shipping which now awaits them.

General complaint is heard throughout the District of inability to secure cars for shipments, while freight embargos have been placed at certain points.

Bad Weather Delays Farm Work; Condition of Winter Wheat Unchanged; Oats Backward; Fruit Prospects Good

Unseasonable weather has added to the present difficult agricultural situation in this District. In practically all of this territory spring plowing has been delayed by reason of the cold, rainy weather. During the month of April over 20 days were too wet to permit work in the fields, as compared with the normal average of 5 to 10 days.

Wheat generally has made but fair growth, and the condition on May 1 has not changed from the April report of 68 per cent.

The preparation of corn land in the north-east section of the District is especially backward, being but about one-fourth finished on May 8. The seeding of oats has been rushed and the crop is now about three-fourths in. Germination in the eastern part of Ohio was not very good, and a considerable acreage has been resown.

Estimates of the damage to clover through winter-killing place the loss at one-third of the crop.

The fruit outlook continues promising, many trees being in bloom, and so far very little damage from frost has been reported.

Farm labor conditions remain about the same. Help is very scarce and high priced. The situation appears to be worst around the industrial centers.

During the 1920 season, according to an estimate made by the U. S. Department of Agriculture, 427,426 gallons of maple sirup and 41,622 pounds of maple sugar were made in the State of Ohio—a decrease of 43 per cent. The small output this year was largely due to the short, unfavorable season, the total number of trees tapped being only 5 per cent less than last year. The average price received for this year's output was about \$2.50 per gallon.

Building Operations Much Reduced; Material Supplies Very Low

Building plans are upset as the result of changes in sentiment regarding future conditions, and the inability to secure material. Considerable unemployment exists in the building trades. The market is practically bare of some supplies, cement more particularly, and the situation grows more acute daily.

Some contractors have adopted the expediency of trucking needed materials, even going so far as the factories where the materials are made.

A tabulated statement of building permits issued at the larger points in the District appear elsewhere in this *Review*.

Special Report on Coke Industry in Fourth Federal Reserve District

The early history of coke making in the Fourth District is rather hazy. It would appear that some coke was made in bee-hive ovens as early as 1833, but it was some years before it developed to the point where it might be called a commercial venture, which point was reached sometime in the early forties. It is said that the first big shipment produced was sent by boat to Pittsburgh, where the product was not known and no market could be found for it. The trip down the river was continued, and not until Cincinnati was reached was a foundryman located who would purchase the load, which is said to have been sold for about 9 cents a bushel. Once the virtues of the new fuel were discovered an immediate demand was created, which at that time could be met

only with great difficulty. The immense increase in the iron and steel industry is responsible for the gigantic development of the coke business, which supplies the ideal fuel for blast furnace and foundry purposes and has added hundreds of millions to the national wealth.

From the single oven first built for the commercial production of coke, the industry has developed to include in this District about 38,000 bee-hive ovens and approximately 3,500 by-product ovens, which produce annually about 35,000,000 tons of coke and millions of dollars worth of the various by-products which are recovered from the gases.

During the year 1919, the coke production of the entire country is estimated to have been 44,821,000

net tons. About three-fourths of this amount was produced in this Federal Reserve District. It is interesting to know that during the past year, for the first time, the output of the by-product ovens exceeded that of the bee-hives.

The first requisite for coke making is a satisfactory grade of coal. Not all coal is suitable for this purpose. The best coking coal in the United States is found in the Connellsville section and is known as the Pittsburgh No. 8 seam. This particular coal is especially desirable by reason of its high volatile matter content. Approximately 35 per cent of the weight of coal charged into the ovens passes off in the form of gases; hence, about 3 tons of coal are required to produce 2 tons of coke. This ratio varies somewhat with the quality of the coal and the length of the coking process.

The ideal coal for coking purposes is one which contains few impurities, especially those which cause trouble for the blast furnace operator or foundryman, who consumes the bulk of the product. A satisfactory metal cannot be produced with the use of coke which contains excessive amounts of mineral impurities. In recent years efforts have been made to develop means of purifying coal which would otherwise be unfit, in order that it may be used for coke making, and resort is now had to "dry" and "wet" cleaning processes for that purpose. The dry process consists of running the coal through what is known as a Bradford breaker (a revolving screen) in which the coal, being softer, is crushed and passes through the screen, while the impurities of slate, etc., as they are harder, remain on it and are thrown out. The wet process accomplishes much the same result, but with greater waste, by placing the coal on pulsating jigs, in water, the jigs being so regulated that the good coal is floated and the impurities sink. Of the two processes the "dry" method is the most economical, the cost of washed coal being increased about 25 cents a ton. Much good coal is lost with the impurities in this method, also, the loss being variously estimated at from 15 to 50 per cent.

Much study and investigation of fuels for coking purposes has shown that a satisfactory coking coal may be obtained by blending different grades, and a large amount of by-product coke is made from these blended fuels.

Three methods are employed in producing coke. The first is known as the "open-air" method, which, by reason of its extreme wastefulness, is rapidly passing out of use. The amount of coke so produced is negligible, and the process will be but briefly described. Coal is piled in large "ricks" through which run vertical and longitudinal flues, which are filled with wood to start combustion. The pile is smothered with coal dust and the rick allowed to coke. The product is then quenched and is ready for market.

The second process, which supplied our coke wants until the development of the by-product ovens, is known as the "bee-hive oven" method. There is some variation in the manner in which these ovens are built, but for the most part they are constructed in batteries two ovens deep, built back to back. Some are built in single rows at the foot of hills, while

others are built in what is known as the single block style; i. e., in batteries one deep. In the double blocks ovens, the space between the two ovens is filled with clay or loam; in the single block style it is necessary to build a retaining wall, the space between it and the oven being similarly filled. In the case of ovens built against hillsides, no such filling, of course, is required.

The ovens are built of fire-brick and stone, and are for the most part about 12 feet in bottom diameter and 8 feet high at the center. In the top of each oven is a round hole about 18 inches in diameter, called the "trunnel head," through which the charge of coal is delivered to the oven. The only other aperture is the door through which the leveling is accomplished, and the finished product removed.

Coal is loaded from coal chutes into larry cars, which run on tracks on top of the ovens, and the coal is charged directly from the larrys through the trunnel head into the oven. Just before charging the door is bricked up about half way, and when the coal has been placed in the oven is leveled either by a mechanical levelling device or a large scraper in the hands of a laborer. The oven door is then bricked up until practically closed. The coking process is regulated largely by the admission of air through this small aperture.

As a general thing, sufficient heat is retained by the ovens after coke has been removed to start combustion in the new charge. The degree of heat necessary is surprisingly low, as it is possible for a man to stand without discomfort in an oven sufficiently hot to "fire" a fresh charge.

The coking process, in bee-hive ovens, takes from 48 to 96 hours, depending upon convenience and the size of the charge. There is practically no difference in the qualities of the cokes. The usual charges are as follows:

| | |
|--------------------|-------------|
| 48 hours | 160 bushels |
| 72 hours | 180 bushels |
| 96 hours | 200 bushels |

After the coking process is completed, the coke is "watered out" (quenched) and is then drawn either mechanically or by hand and loaded for shipment.

A battery of coke ovens in operation presents a very spectacular sight, especially at night. When combustion starts, a dense, yellow smoke rolls from the trunnel head, sulphurous and choking, and increasing in volume; the gases ignite, and the smoke changes instantly to a dense black; the coal now presents the appearance, almost, of a liquid; the gases become less and less, the smoke disappears entirely; the charge is drenched, causing vast clouds of steam, and is then drawn from the ovens.

The bee-hive method of producing coal is wasteful in the extreme, but many "modified" plants are now utilizing part of the gas which hitherto has gone to waste. However, in fairness to bee-hive producers, it should be said that during the period of cheap coal the immense capital investment necessary to install by-product ovens was not justified. Coal selling at several times its past worth has brought about

a different situation, and it is freely stated in coke circles that the bee-hive process will soon be but a recollection.

The recovery of the various by-products heretofore lost in the coking process has been a development (in this country) of comparatively recent years. The first by-product coke was made in the United States in 1893, in the state of New York. Refinements and improvements have been made from time to time until the producers, like the packers who are said to save "everything but the squeal," are able to recover approximately 150 useful by-products, many of them common articles in our every-day life. Elsewhere in this issue will be found a graphic chart showing the principal recoveries. There is also appended to this article a list of some of the many uses to which these by-products are put.

On an average, the yield in the by-product process is as follows:

- 65 to 75 per cent its weight, in coke, per ton of coal.
- 10,000 cubic feet of gas, per ton of coal.
- 5 to 12 gallons of tar, per ton of coal.
- 20 to 25 pounds of ammonium sulphate, per ton of coal.
- 1 to 3.8 gallons of benzol, per ton of coal.

Multiplying these amounts by the coal tonnage used in coke production in our country during the past 80 years will give an idea of the immense waste of valuable materials during that time.

Opinions differ somewhat as to the relative values of bee-hive and by-product cokes as metallurgical fuels, although it appears now to have been fully demonstrated that the latter is fully equal to the former. Some plants, in fact, are convinced of the superiority of the by-product coke, claiming increased pig iron production on a lower coke consumption.

In the preparation of coal for use in by-product ovens, perhaps more attention is paid to screening the coal to secure the maximum density in the ovens. It is passed over screens of the size determined upon as best, the larger pieces being passed to rollers, or crushers, where they are reduced to proper size. The coal is then carried by conveyor belts to the coal bunkers, where it is dumped into larries, which in turn discharge through four openings in the tops of the ovens into the ovens. The coal is then leveled with a mechanical leveler, the lids are replaced, and the coking process starts.

By-product ovens are built in batteries and are 37 feet long, 9 feet 10 inches in height, and 19 inches wide. The capacity is approximately 500 cubic feet, and the coal charge is approximately 13.4 tons. The oven is filled, after levelling, to within 10 inches of the top. They are heated by gas through the medium of gas burners between the ovens.

The coking of the coal is completed in 19 hours, when the finished product is pushed out by a gigantic pushing machine into cars on the opposite side of the ovens. It is then hauled to a quenching station and quenched for 45 seconds. Six thousand gallons of water per quench are required, 1,000 gallons of which are evaporated. The coke is then allowed to drain one minute, dropped to a wharf and screened. Three

and "fines"—the latter being used largely in supplying fuel for operations at the plant.

The gases, from which the by-products are recovered, coming from the ovens enter a collecting main through ascension pipes at a temperature of approximately 400 degrees centigrade and leave the main at approximately 200 deg. C. The heavy tars are quickly condensed and drop out in the collecting mains. In order to prevent this pitchy tar from building up and stopping the mains, they are flooded with what is known as flushing tar—a mixture of 50 per cent tar and 50 per cent ammonia liquor. This carries the heavy tar and such pitch as is formed to the end of the main, where the hard pitch is screened out and removed.

From these mains the gas is conducted to coolers. During their passage, the temperature has been reduced to 75 deg. C. During the cooling, 70 per cent of the tar is condensed in the collecting mains before the primary coolers are reached; 20 per cent is condensed in the suction mains, and approximately 8 per cent of the lighter tars, and most of the water vapors, are condensed in the primary coolers. The temperature at the outlet from the primary coolers is 28 deg. C.

The liquor and tar are now combined and the mixture flows to a circulating drain tank from which it is pumped to the tar separating tank.

The gas is then passed on to the tar extractors, where the last traces of tar vapor are eliminated by mechanical means; i. e., forcing the gas through finely perforated plates and allowing it to impinge upon a flat surface which breaks up the tarry mist into globules.

The gas, thus freed from the tar, is preheated to a temperature of 60 deg. C. and then passed through lead-lined saturators containing a 5 per cent sulphuric acid solution. The gas coming in contact with sulphuric acid gives up all its ammonia to form ammonium sulphate. After this acid bath becomes saturated, the crystals of ammonium sulphate fall to the bottom and are ejected with an air syphon ejector and thrown upon a draining table. The mother liquor is returned to the saturator and the ammonia salt is dried in a whirling dryer for 15 minutes. The salt is then scraped onto a conveyor belt and carried to heated drum-dryers where the moisture is reduced from 2 per cent to less than $\frac{1}{4}$ of 1 per cent.

After the gas passes the ammonia saturators, it is passed through final coolers where it is brought into direct contact with water spray and cooled from 60 deg. C. to 25 deg. C., at which temperature it is passed through the oil scrubbers.

These oil scrubbers, arranged three in a series, are 16 feet in diameter and 100 feet high, filled up with wooden grids for 80 feet in such a manner that the oil which is trickling down through the grids from a series of 24 sprays at the top comes into intimate contact with the gas. The wash oil, as it is called, absorbs the benzol vapors from the gas. These scrubbers are so designed that it takes the gas 60 seconds to pass through the set of three. In this manner from 90 to 96 per cent of all the benzol vapors are extracted from the gas, and the oil will have a saturation of $2\frac{1}{2}$ to 3 per cent of benzol and its homologues.

The gas, after debenzolization, is passed on to 100,000 cubic foot regulators, from which about 45 per cent is sent back to furnish fuel for the coke ovens, the surplus being available for disposal as conditions permit.

The wash oil, saturated with benzol vapors, is pumped to the wash oil stills, where it is heated to 150 deg. C. through superheaters, and then led into the wash oil stills where it is brought into contact with live steam and the benzol vapors are driven out. These are condensed and separated from the water, and form what is called "light oil." The wash oil, thus debenzolized to a point where it contains less than 0.3 per cent light oil, is cooled through pipe coolers and returned to the scrubbers to take up another load of benzol.

The oils coming through the light oil stills contain approximately 8 per cent of wash oil and naphthalene. These are removed by distillation; thus approximately 92 per cent of the benzol and its homologues are distilled off. The benzol then passes through wash stills, where it is washed with acid. It is then washed with water, and neutralized with a 10 per cent solution of caustic soda. The water and soda are then drawn off and the product pumped to the pure stills. This benzol is finding great favor as a motor fuel.

When the tar and liquor mixture reaches the separating tanks, it is separated by gravity, and the "weak liquor," as it is known, is put through

ammonia stills where it is brought into contact with a solution of lime water and live steam. The lime combines with the ammonium chloride, forming calcium chloride. The ammonia is driven off as a gas and conducted into gas mains before the saturators, thus all being converted into sulphate of ammonia.

The tar, after being allowed to settle and the ammonia liquor is separated, is loaded into tank cars of 10,000 gallons capacity, and shipped to the open-hearth and heating furnaces, where it is burned in connection with coke-oven gas as a fuel for the production of open-hearth steel, and the remainder is disposed of to various tar using industries.

Coke by-products are used in the manufacture of the following articles or in connection with the processes named below:

Auto fuel, illuminating gas, engine fuel, paint solvent, dyes (over 500 shades), electrical insulation, paints, varnishes, sizing for wall paper, roofing material, linoleum, antiseptics, explosives, sugar substitutes, food preservatives, medicines, tobacco seasoning, perfumes, photo developer, washing soda, baking soda, rubber solvent, insecticides, artificial silks, gold and silver recovery, electro and silver plating, smelting, wood preservative, fireproofing, anesthetics, wool scouring, baking powder, fertilizers, batteries, galvanizing, refrigeration, buttons, electrical switches, pipestems, combs, disc records, greases, pipe covering, road surfacing, denaturants, smelling salts, and many others.

The following is a list of by-product coke ovens in the Fourth District, showing number of ovens and annual capacity in coal and coke tonnage.

| OWNER OR OPERATOR | NO. OVENS | ANNUAL CAPACITY IN NET TONS | |
|---|-----------|-----------------------------|-----------|
| | | COAL | COKE |
| American Steel & Wire Co., Cleveland, Ohio | 180 | 1,080,000 | 750,000 |
| Brier Hill Steel Co., Youngstown, Ohio | 84 | 520,000 | 379,000 |
| Carnegie Steel Co., Farrell, Pa. | 212 | 830,000 | 581,000 |
| Carnegie Steel Co., Clairton, Pa. | 768 | 4,800,000 | 3,360,000 |
| Cleveland Furnace Co., Cleveland, Ohio | 100 | 450,000 | 337,500 |
| Dover Products Co., Dover, Ohio | 24 | 144,000 | 100,000 |
| Hamilton Otto Coke Co., Hamilton, Ohio | 100 | 240,000 | 168,000 |
| Ironton Solvay Coke Co., Ironton, Ohio | 60 | 432,000 | 311,000 |
| Jones & Laughlin Steel Co., Pittsburgh, Pa. | 240 | 1,600,000 | 1,040,000 |
| Kentucky Solvay Coke Co., Ashland, Ky. | 100 | 800,000 | 600,000 |
| LaBelle Iron Works, Steubenville, Ohio | 94 | 610,000 | 445,000 |
| McKinney Steel Co., Cleveland, Ohio | 204 | 1,300,000 | 960,000 |
| National Tube Co., Benwood, W. Va. | 120 | 270,000 | 189,000 |
| National Tube Co., Lorain, Ohio | 208 | 1,200,000 | 850,000 |
| Portsmouth Solvay Co., Portsmouth, Ohio | 108 | 770,000 | 559,000 |
| Republic Iron and Steel Co., Youngstown, Ohio | 143 | 1,020,000 | 744,600 |
| Semet-Solvay Co., Dunbar, Pa. | 110 | 248,000 | 173,000 |
| Toledo Furnace Co., Toledo, Ohio | 94 | 560,000 | 408,800 |
| United Furnace Co., Canton, Ohio | 47 | 280,000 | 204,400 |
| Youngstown Sheet & Tube Co., Youngstown, O. | 306 | 2,050,000 | 1,425,000 |

Building Operations for Month of April

| | Permits Issued | | | | New Construction | | | | Increase of | | Percent of Increase |
|--------------|------------------|--------------|--------------|--------------|-------------------|------------------|------------------|------------------|-------------------|--------------|---------------------|
| | New Construction | | Alterations | | New Construction | | Alterations | | Total Valuation | | |
| | 1920 | 1919 | 1920 | 1919 | 1920 | 1919 | 1920 | 1919 | 1920 over 1919 | | |
| Akron | 508 | 685 | 149 | 126 | 2,274,846 | 2,468,000 | 1,016,415 | 122,775 | 700,486 | 27.0 | |
| Cincinnati | 262 | 178 | 607 | 510 | 623,580 | 205,955 | 357,160 | 229,895 | 544,890 | 125.0 | |
| Cleveland | 227 | 323 | 1,065 | 951 | 11,486,700 | 2,204,100 | 710,525 | 333,260 | 9,659,865 | 380.7 | |
| Columbus | 241 | 280 | 133 | 122 | 487,810 | 462,225 | 547,210 | 122,980 | 449,815 | 76.9 | |
| Dayton | 175 | 268 | 96 | 67 | 977,172 | 551,784 | 118,561 | 99,295 | 444,654 | 68.3 | |
| Erie | 87 | 134 | 98 | 97 | 170,230 | 163,138 | 188,782 | 65,921 | 129,953 | 56.7 | |
| Lexington | 30 | 25 | 99 | 83 | 325,000 | 105,000 | 74,490 | 28,168 | 266,322 | 200.0 | |
| Pittsburgh | 363 | 412 | 131 | 126 | 2,733,863 | 480,931 | 247,299 | 532,452 | 1,967,779 | 194.2 | |
| Springfield | 28 | 44 | 18 | 18 | 52,040 | 41,230 | 14,225 | 11,650 | 13,385 | 25.3 | |
| Toledo | 233 | 253 | 154 | 180 | 572,810 | 482,237 | 106,019 | 114,743 | 81,849 | 13.7 | |
| Wheeling | 75 | 26 | 41 | 39 | 191,794 | 11,319 | 6,546 | 13,993 | 173,028 | 683.6 | |
| Youngstown | 166 | 158 | 32 | 29 | 368,340 | 312,112 | 25,350 | 15,195 | 66,383 | 20.3 | |
| Total | 2,395 | 2,786 | 2,623 | 2,348 | 20,264,185 | 7,488,031 | 3,412,582 | 1,690,327 | 14,498,409 | 158.0 | |

Total Debts by Banks to Individual Accounts

| | Week ending | | Increase | Per cent of Increase |
|--------------|--------------|--------------------|--------------------|----------------------|
| | May 12, 1920 | May 14, 1919 | | |
| Akron | - | 29,968,000 | 9,541,000 | 46.7 |
| Cincinnati | - | 58,550,000 | 8,805,000 | 17.7 |
| Cleveland | - | 159,309,000 | 29,359,000 | 22.6 |
| Columbus | - | 26,722,000 | 2,028,000 | 8.2 |
| Dayton | - | 12,286,000 | 1,472,000 | 13.6 |
| Erie | - | 7,732,000 | 1,480,000 | 23.7 |
| Greensburg | - | 3,710,000 | 1,135,000 | 44.1 |
| Lexington | - | 5,496,000 | 566,000 | 11.5 |
| Oil City | - | 3,223,000 | 195,000 | 6.4 |
| Pittsburgh | - | 193,550,000 | 43,026,000 | 28.6 |
| Springfield | - | 3,645,000 | 704,000 | 23.9 |
| Toledo | - | 33,264,000 | 6,692,000 | 25.2 |
| Wheeling | - | 8,839,000 | 845,000 | 10.6 |
| Youngstown | - | 13,524,000 | 1,100,000 | 8.9 |
| Total | - | 559,818,000 | 106,948,000 | 23.6 |

Clearings

| | April 16 to May 15 | | Increase | Percent Inc. or Dec. |
|--------------|--------------------|----------------------|--------------------|----------------------|
| | 1920 | 1919 | | |
| Akron | - | 50,693,000 | 13,715,000 | 37.1 |
| Cincinnati | - | 291,749,906 | 61,711,495 | 26.8 |
| Cleveland | - | 560,095,672 | 179,446,365 | 47.1 |
| Columbus | - | 58,615,900 | 8,988,600 | 18.1 |
| Dayton | - | 20,742,756 | 4,117,607 | 24.8 |
| Erie | - | 11,898,149 | 3,021,974 | 34.0 |
| Greensburg | - | 5,422,784 | 1,374,248 | 33.9 |
| Lexington | - | 7,357,385 | 1,246,504 | 20.4 |
| Pittsburgh | - | 703,506,278 | 137,298,776 | 24.2 |
| Springfield | - | 6,958,303 | 1,466,568 | 26.7 |
| Toledo | - | 65,996,082 | 12,130,257 | 22.5 |
| Wheeling | - | 25,605,854 | 8,145,278 | 46.6 |
| Youngstown | - | 17,751,124 | 254,677 | 1.4 |
| Total | - | 1,826,393,193 | 432,407,995 | 31.0 |