Electric Railway Journal

Consolidation of Street Railway Journal and Electric Railway Review

HENRY W. BLAKE and HAROLD V. BOZELL, Editors HENRY H. NORRIS, Managing Editor
HARRY L.BROWN,Western Editor N.A.BOWERS,Pacific Coast Editor H.S.KNOWLTON,New England Editor C.W.SQUIER,Associate Editor C.W.STOCKS, Associate Editor
G.J.MACMURRAY,News Editor DONALD F.HINE,Editorial Representative
L.W.W.MORROW,Special Editorial Representative

Volume 58 New York, Saturday, August 20, 1921 *Number* 8

Most Power Plants Afford Some Opportunity for Saving

EVERY worth-while power engineer is keen to find and eliminate some energy or labor loss. This is his real job, even if he is mainly an operator rather than a designer. And there are losses enough in the best of power plants, some inevitable, many otherwise. Here is where the engineer who deals with dynamics, with motion, has an advantage over the one whose work lies principally with statics; that is, stresses in structures such as buildings and bridges. The power expert can see immediate effects of his work, say in reduction in rate of fuel consumption. On the other hand, while good work in bridge design, for example, is reflected in construction cost, the structure, once built, loses interest for the designer. He cannot be constantly at work improving it. Power plant work is, therefore, a peculiarly fascinating branch of engineering.

That there are so many chances to save in the power plant is due to several causes that do not necessarily reflect discredit upon the engineers of the past. Great improvements have recently been made in all elements of power-plant equipment. This is particularly true with those which have been the most notorious energy wasters, the prime movers. Moreover, the power plant has come to be considered more intelligently as a unit, all parts being expected to contribute to the general efficiency. For example: energy necessarily wasted in auxiliaries has been reclaimed in other parts of the plant, thus maintaining "heat balance." And again, the economies of the power plant have been upset, due to relative changes in costs of construction materials, fuel, money and labor among themselves and to the diminishing rates of cost of producing a unit of energy to its selling price. This last-named item is in effect the same whether the utility sells the energy generated or uses it in furnishing transportation service. These three factors in combination make possible such savings as were chronicled in the article in the Aug. 13 issue and which were made in the power plant of the Philadelphia & Wilmington Traction Company.

This performance suggests a brief review of the problems which confront the power-saving engineer. His first task is to trace the heat losses to their sources, in the flue gases, in the condenser circulating water, in radiation, in leakages, etc. Out of every pound of coal burned he finds the first taking possibly 25 per cent, the second 60 per cent and the others variously dividing among them, say, 5 per cent of the remaining 15 per cent of the heat in the coal. His first question is as to the reasonableness of these several losses. If one looks large compared with that in similar plants he knows he has "found the scent."

The next step is to locate the possibilities of loss reduction. If the flue gas losses are too great the gases are too hot, too voluminous or of wrong composition, possibly all of these. This means better design and operating practice in the boiler room. If the rejection of heat from the prime movers is excessive there is something wrong in the turbine or condenser design, in the circulating water, in the pumps or in the operating practice. The remedy may be so drastic here as the purchase of a new unit. The smaller losses are not so important as those mentioned. But lagging to control radiation, lubrication to minimize friction and good joinery and packing to eliminate leakage, all play their part. Moreover, radiation, friction and leakage all come out of the coal pile, no matter where they occur in the power plant. This point is emphasized since a heat-working auxiliary may be overlooked because it is obscure. Its remote location may lead to the inference that it produces insignificant losses, but the fallacy of this is self-evident.

So much for thermal, thermo-dynamic and dynamic losses. Now as to that more tangible loss, human energy. At present labor is mainly used in the power plant in handling materials, *i.e.*, coal, ashes, etc., and in lubricating, cleaning and overhauling machinery. The former work offers the principal opportunity for saving. In the past power plants generally have been overmanned. Some are overmanned today, in the sense that machines could be had to do their work. No power plant engineer can afford to overlook the progress that has been made in the past few years in the development of labor-saving machinery.

The upshot of this whole matter is that, in connection with every power plant organization, some one person should have the responsibility of studying constantly the opportunities for saving. He may be one of the staff or an outside consultant. Plans should be in hand for contemplated improvements even if these are in the distant future, so that each detail can be worked out in harmony with the ultimate aim. Only thus can the tearing out and replacement process be reduced to a minimum.

Must Operations Cease to Prove Essentiality?

DES MOINES' predicament in final analysis is about the same as that which prevailed at Bridgeport, Conn., a year or so ago when the citizens were compelled by the shutdown of the local lines of the Connecticut Company to choose between street cars and jitneys. But the present indications are that the people of Des Moines are going to take a longer time than did the citizens of Bridgeport to learn how much more serviceable to them are the street cars than the buses.

Conditions in Des Moines have been gravely aggravated by a malicious press and by a former city corporation counsel whose greatest ambition seem to be to harass the utilities and to exact the city's pound of flesh even to the destruction of the company. Having but recently bound itself to a 5-cent fare, the Des Moines City Railway has been particularly susceptible to the activities of this shrewd lawyer and to the continual harping of the papers that it was not living up

to its contract. The facts, however, fail to disclose that the company has been particularly remiss in this respect.

Among other things, the company agreed in the 1915 franchise to spend $1,500,000 in specified improvements in the next three years. Actually it spent $2,500,000, but on account of the great rise in cost of materials and equipment, even $1,000,000 in excess of the agreement was not sufficient to complete the program, and some promised new track apparently much wanted by the residents has not been built. Then, of course, the contract fare of 5 cents has not prevailed, but not by the grace of the city. The courts interfered and established a 6-cent fare, and later an 8-cent fare. Thus foiled in its demand, the city authorities sought recourse by opening wide the doors to jitney and bus competition. The invitation was promptly accepted to such an extent that 20,000 people a day, or 25 per cent of the total, were soon taken from the street cars. A further blow came when the court allowed the manufacturer to remove electrical equipment not paid for, thus shutting down three substations and a large generator at the power house and necessitating a 50 per cent cut in cars used. At this disadvantage, and with competition increasing, continuation of railway operation was of course impossible.

Thus far, then, the city has won its battle, but what of the future? The company will not start up again until the ruinous competition of the buses has been removed. If the buses cannot carry all of Des Moines' traffic, they can ruin the railway's ability to be self-supporting. If buses can supply all the transportation for a city of 126,000, which seems improbable without intolerable congestion on the streets and in the buses, though some of the characteristics of Des Moines are favorable to bus operation, it is quite certain that they cannot do it on a 5-cent fare. Evidently some solid doubts of this nature have been in the minds of the members of the City Council, for that body has not seemed to take very seriously the several propositions offered by the bus people, which is about the only creditable thing that can be said of its recent actions and inactions.

It will not take many weeks of the present congestion and grave shortage of transportation facilities to convince the great majority of the people that they want the street cars back. It may take some little time, however, for this feeling to be manifest with sufficient insistence to crystallize the indecision and lack of any plan on the part of the Council. Meanwhile, the city suffers immeasurable discomfort, inconvenience and financial loss.

It seems incredible that things should have to come to such a pass before public officials will comprehend the plain economics involved and what is really for the best interests of the people. Yet Toledo had to go through a cessation of car service before it could understand that the company was in earnest about its need for a fare increase; Bridgeport learned by the same process that it had to regulate the jitneys, and now Des Moines, with a very similar case in Bay City and Saginaw, Mich.

Are companies to be forced to these tactics in the many other cities where the patience of man and the endurance of the company have about been exhausted—New Orleans, Indianapolis, Akron, New York, Louisville, Chicago, Dallas, Detroit, Birmingham, etc.?

Serious as is the situation for the company and Des Moines, it nevertheless has placed the railway at an advantage in securing equitable conditions before resuming operations. There is no disposition to "stick" the city because of this position, but undoubtedly the city will have to agree to certain fundamental requirements of the company before the street cars will run again. Unfortunately, even with all requirements satisfied, it will take from two to three months before full service can be restored on account of the time required to finance and replace the electrical equipment that has been removed. It is certainly to be hoped that the officials of other cities will profit by the experience had in Des Moines and evolve a policy which will protect the public but at the same time enable the local railway company to continue uninterrupted its faithful and essential service. If the shutdown in Des Moines is a strategic move, it is so only incidentally, for the company could not have continued under the circumstances. And it cannot be expected that the beautiful weather, courtesy of private automobiles, the good nature engendered all around by the novelty of the experience and the exceedingly small amount of riding as compared to normal will continue long to lighten materially the task confronting the buses.

Boston's Prospects Much Better

BOSTON newspapers were all in accord in their comment on the report of the Boston Elevated Railway for the year closed recently. They see in the accumulated deficit of $4,980,000 a formidable barrier, precluding any immediate prospect of relief from the 10-cent fare, but they also see in the change for the year to a profit of $550,253 from a profit for the previous year of $17,079 a most encouraging sign for the future.

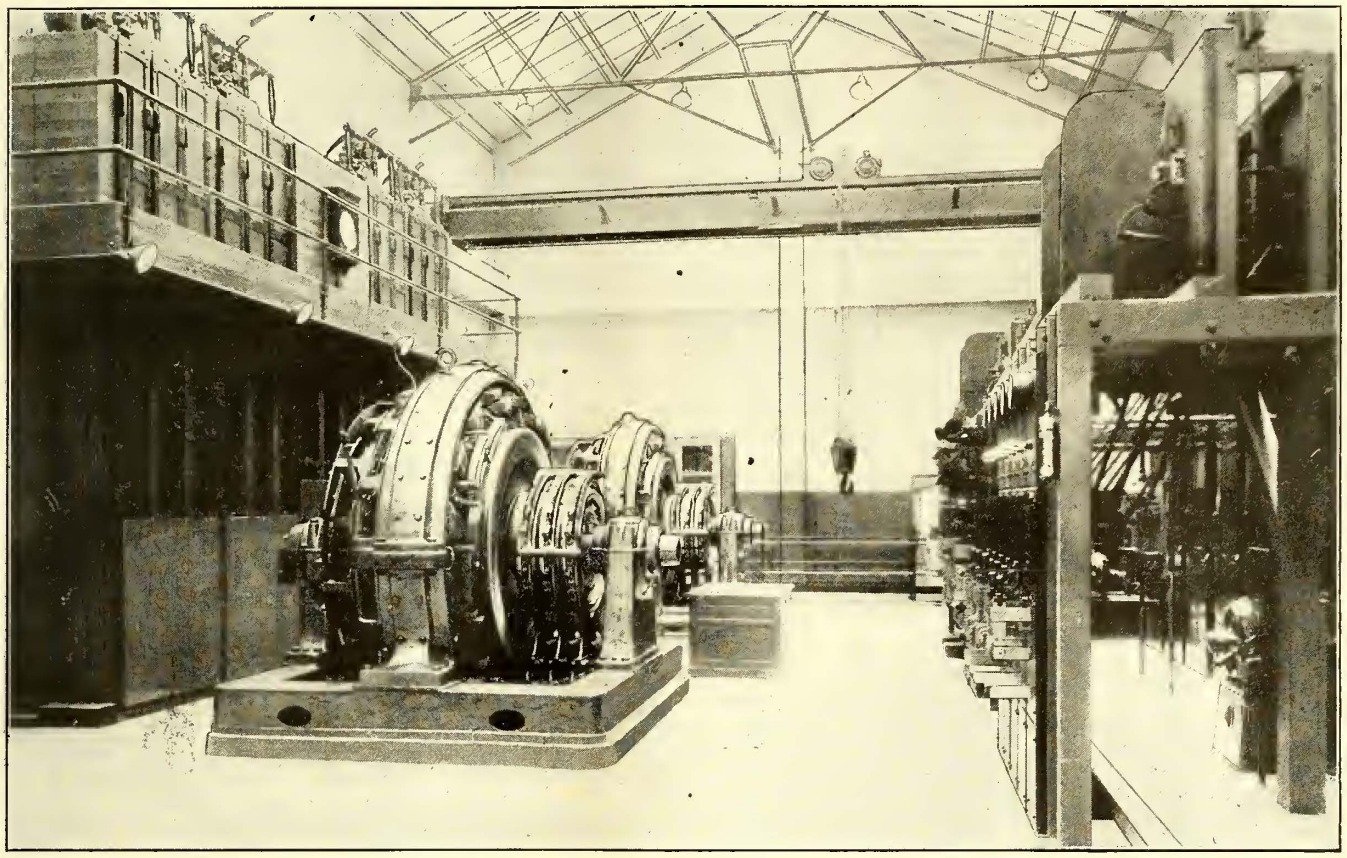
It was during the trying period in 1919 that the large deficit was accumulated. Since then the record has been progressively good. Ten cents seems large for a ride where 5 cents had prevailed, but the 5-cent, then the 7-cent and the 8-cent fare failed to prove adequate. It was the 10-cent fare that saved the situation. This the trustees are anxious to reduce. They labor under the necessity, before that can be brought about, of building up the reserve fund to $1,000,000 and of reimbursing the cities and towns in which the company operates to the tune of $3,980,000, advanced by the communities in the lean days of 1919. Just as the tide of rising costs in that year ran against the company and the communities, so the tide now is in the other direction. It is always dangerous to prophesy, but it is not unlikely that for the coming year the excellent showing for the period recently closed will be bettered materially.

One thing the statement of the trustees has done, it has made plain beyond the possibility of misconstruction the actuating ideas behind the extension by the company of the limited 5-cent fare service. The trustees have clearly in mind building up the property so that it will be of the greatest public service, but they state definitely that the 5-cent service cannot be continued if it interferes with or delays an otherwise possible reduction of the basic flat fare for travel throughout the system. Should a reasonable test prove that this service invades or seriously threatens an invasion of the net revenues of the railway, the trustees say they will be forced to advance the local 5-cent fare or else to abandon the experiment.

Downtown Substation in San Francisco

The Market Street Railway Has Constructed a New Substation for the Heavy Traffic District of San Francisco to Take Care of Excessive Voltage Drops During the Peak Hours

BY J. E. WOODBRIDGE
Resident Engineer Ford, Bacon & Davis, San Francisco



INTERIOR OF SUBSTATION WITH EQUIPMENT IN OPERATION

AS IN most large cities, the substations and 600-volt feeder system of the United Railroads of San Francisco grew out of old steam plants, poorly located for supplying the most congested portion of the load. The downtown district of San Francisco, including the heavy traffic of four tracks on lower Market Street, has been until recently supplied largely from the Bryant Street substation (originally a steam plant) situated some 20,000 ft. from the ferry.

In spite of a large tonnage of feeders, the voltage drop during the peak hour from 5 to 6 p.m. would run as high as 250 volts, giving a loss of approximately 2,000 kw. wasted in heating overhead copper and track return.

The United Railroads of San Francisco bought energy under a contract rate of $7.50 per thousand kilowatt-hours at 11,000 volts, with a guaranteed load factor of 60 per cent. As this load factor is not reached, the basis of the contract becomes power and not energy, the price being approximately $40 per kilowatt of peak demand per annum.

As 2,000 kw. of loss at this rate amounts to $80,000 per annum, it is obviously worth while to give careful consideration to any means by which this loss might be materially reduced.

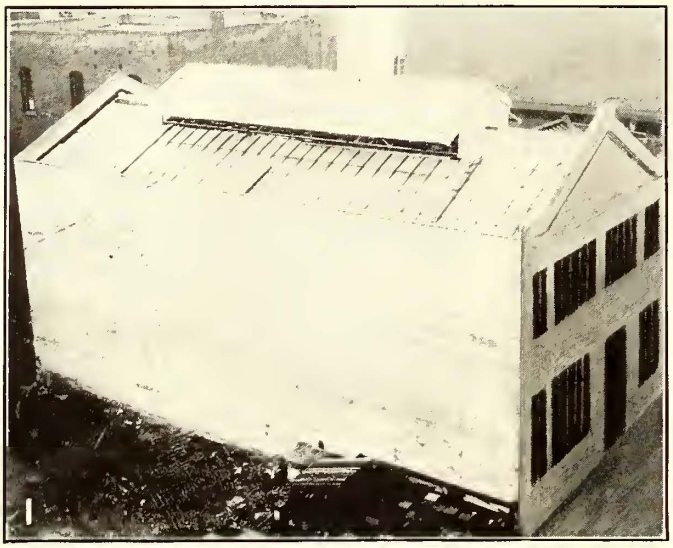
In spite of municipal competition, the traffic of the United Railroads of San Francisco (now the Market Street Railway) has been steadily growing, increasing the load on stations and feeders to the value reached during the Panama Pacific Exposition and requiring extensions to take care of future growth.

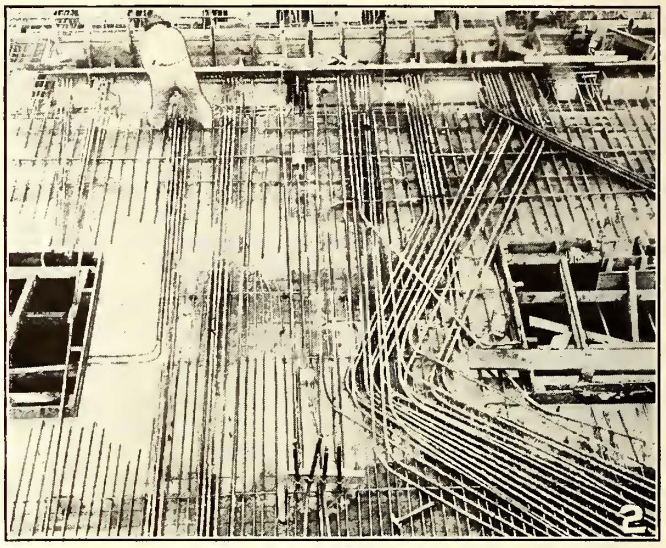
The writer estimated that the installation of a 4,000-kw. substation, suitably located in the downtown district, would reduce the feeder losses and, thereby, the peak demand by approximately 1,200 kw., besides releasing a large amount of copper. Such a substation has been built and, at this writing, has been in full operation less than one month, which is not a sufficient period to give an accurate comparison of new with old system peak demands, but there is every indication that the estimated saving will be exceeded.

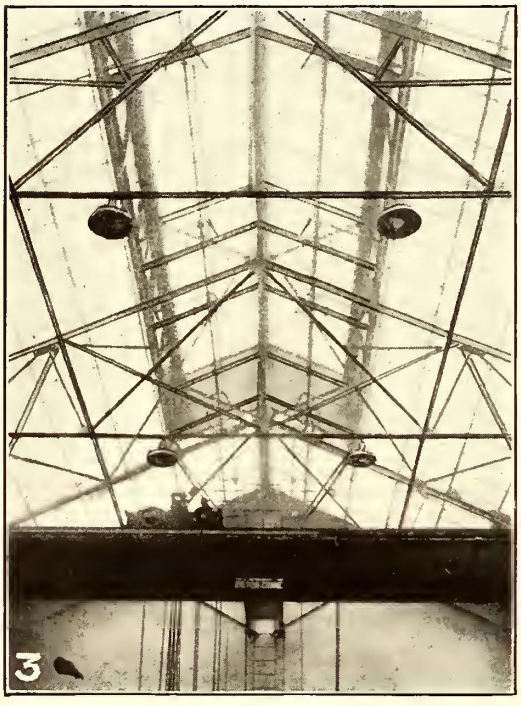
CONVERTERS PREFERRED TO MOTOR-GENERATORS

On account of lower first cost and higher efficiency, converters were chosen for this service instead of motor-generator sets as used in the older stations. The use of converters so close to heavy traction loads involves several serious difficulties, all due to the absence of direct-current feeder resistance to reduce the rush of short-circuit current in case of a broken trolley,

Construction Details and Equipment Arrangement for New Substation of the Market Street Railway in the Downtown District of San Francisco







No. 1—Exterior of substation as partly completed.

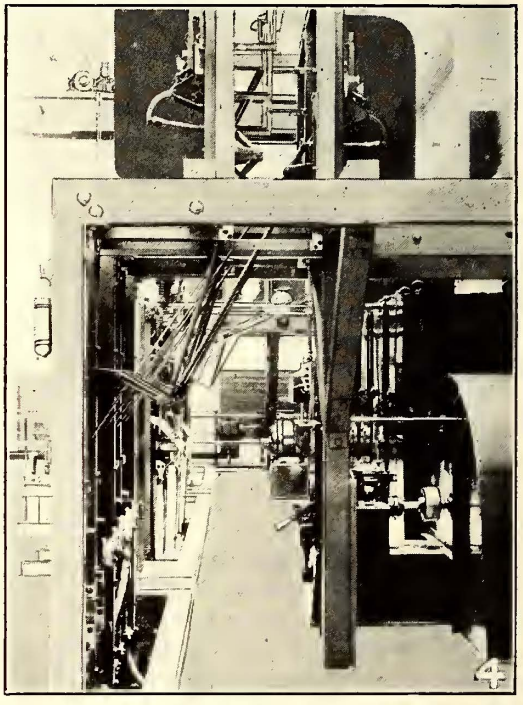
No. 2 — Installing conduits for small wiring in floor of station.

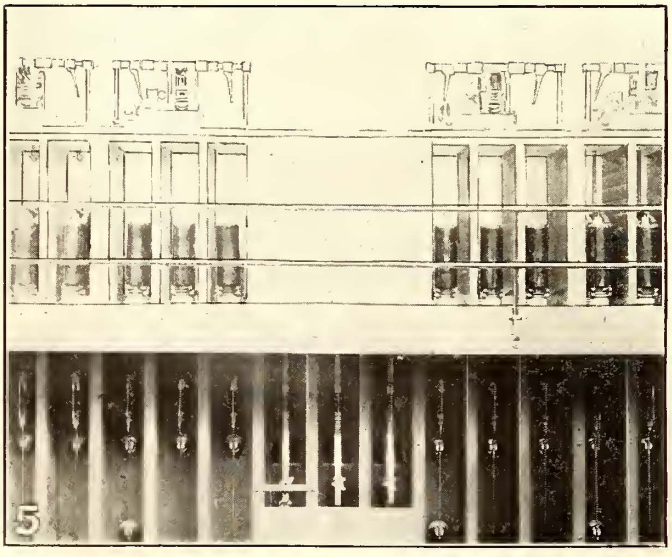
No. 3—Looking at the glass roof.

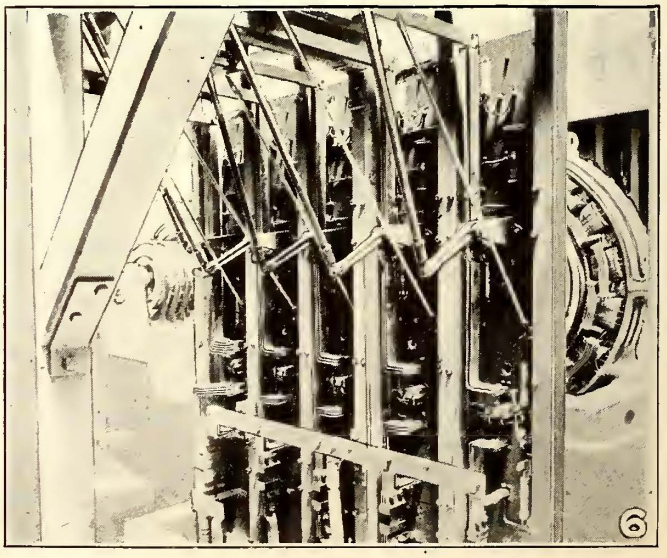
No. 4—General view back of the switchboards.

No. 5—Oil switches and disconnecting switch arrangement.

No. 6—Rear view of feeder switchboard.







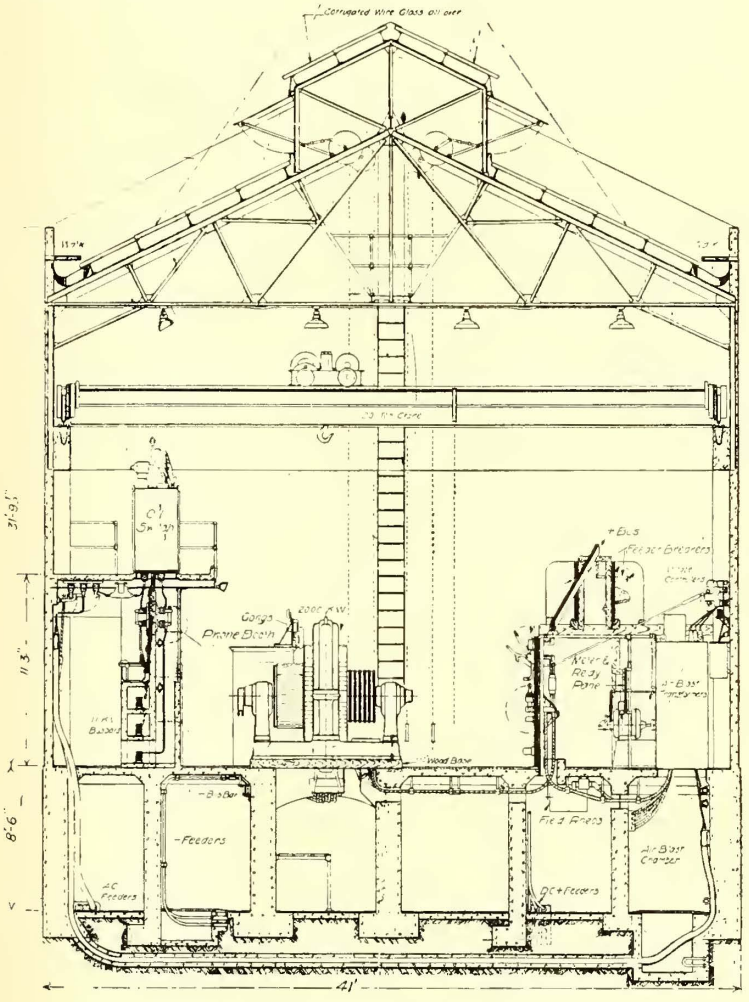
car-equipment failure or other fault from feeder network to ground. The old specification of no feeder taps nearer than 2,500 ft. to the station is not applicable where the heaviest load is 250 ft. away, and 2,500 ft. is about as far as the station feeds. The manufacturers' specification of sufficient feeder resistance to limit the short-circuit current of one feeder to three times full load of one machine is also not applicable where one feeder has a peak-hour average demand of 3,000 amp., which is approximately the rating of one converter. This would require a 30 per cent drop in this feeder or about a 500 kw. loss at $40 per kilowatt per annum. Precautions of various sorts, described below, were taken to protect the machines, operators and circuit-breakers, and the minimum resistance to any one point on the trolley network was made at 0.025 ohm, which would, obviously, limit the current to 20,000 amp. at 500 volts. This resistance was obtained, in most cases, by bringing the feeders out from underground to overhead as near the substation as possible and running the balance of the distance in weatherproof cable at a higher current density than can be used underground without danger of burn-outs. Added resistance was necessary in only two feeders, involving a loss of approximately 10 kw. in each at the peak. One of these resistances is used as an electrical furnace with air taken from the air blast chamber to warm the office.

Equipment Features Differ From Usual Practice

The converter fields are shunt wound, this departure from standard railroad practice having been taken for several reasons, as follows: First, to ease the severity of short circuits; second, to reduce the number of heavy windings and joints of large capacity in the machines; third, to eliminate the equalizer busbar, switches and connections and to simplify operation, and fourth, to improve the power factor on the assumption that the equipment will be loaded to its capacity on the basis of temperature rise, in which case improved power factor is a decided advantage. The commutating poles are of the high-reluctance design, their ampere turns being greater than those of the armature.

A somewhat unexpected advantage has resulted from the shunt characteristic. As the station output rises in the late afternoon, from approximately 6,000 to 9,000 amp., the voltage automatically falls off from 550 to 500 volts. As the peak is occasioned by congestion of cars on the downtown streets, which of itself necessitates slow running, the lower voltage undoubtedly results in less resistance loss in car equipments and improved system economy. The voltage drop is, however, so much less than with the old long feeds that better schedules are maintained, and a car will probably be dropped from each of several routes, without increase of headway.

The equipment is designed to make it possible to alter the voltage under load conditions without power-factor variation. This is accomplished by taps in the primary windings of the step-down transfomers, these taps being brought out to step-by-step circuit-breaking contactors, manually operated, with auto-preventive reactances for maintaining the connections while stepping from tap to tap. The transformer ratio is changed 1½ per cent for each of eight steps, giving a total ratio range of 12 per cent. The transformer primaries are star-connected and the taps for this purpose are brought out at the neutral end of each primary, giving minimum voltage between the taps of the three phases and from contactors to ground. The transformers are of the air-blast type and all taps for this purpose are brought out through the tops of the transformers to controllers located immediately above them, giving a convenient accessible location in plain view for these devices "isolated by elevation." The transformers are located behind the main switchboard, and the voltage control is actuated by means of mechanical shafting from hand cranks on the face of the board.



SECTION OF STATION

Voltage control was considered desirable in this case because of the convenience of such control in the motor-generator stations of the same system and the inconvenience of the fixed voltage of converters as ordinarily equipped. One of the chief advantages of voltage control is the ability it gives to transfer load to or from other stations at will on trackage fed from more than one station. While such advantages would not warrant the cost and added losses of induction regulators or booster converters, they are held to warrant the added cost of the step-by-step arrangement, which was $2,650 per machine, factory cost.

The location of the equipment in the substation differs somewhat from the usual design, which is intended to convey the power generally in one direction from incoming high-tension source to outgoing direct-current

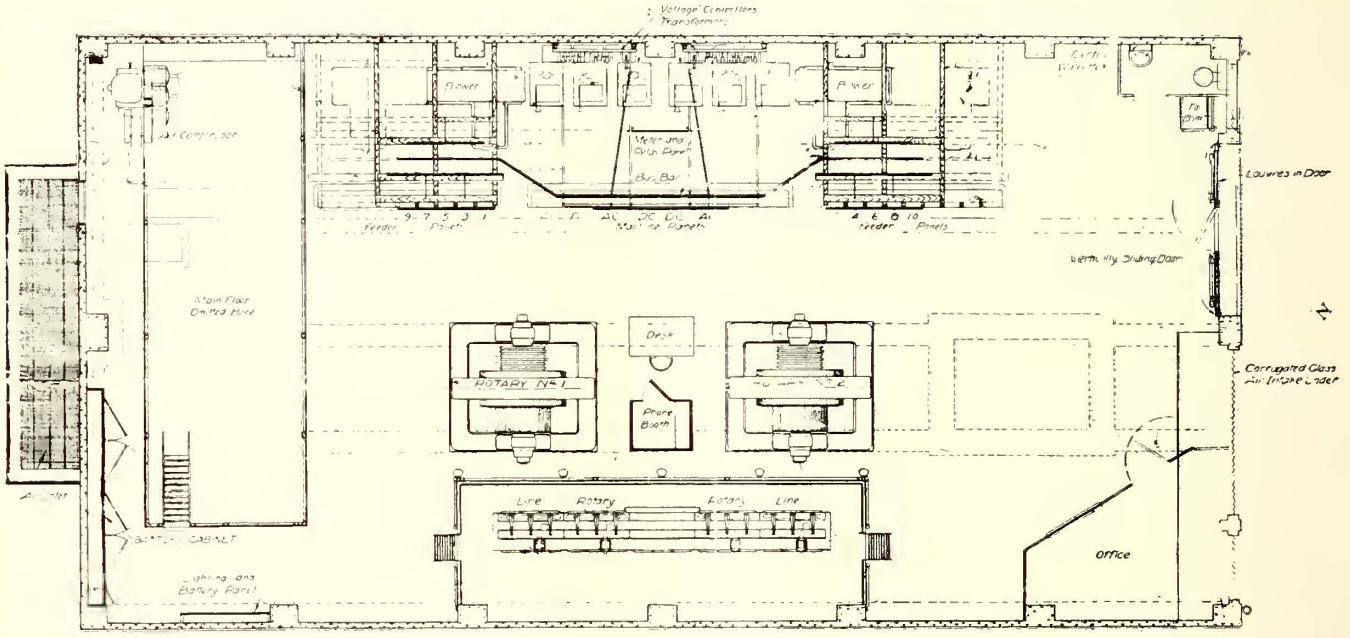
delivery. Such an arangement involves considerable running around by the operator—from high-tension switch control to starting switch, to field switch, to direct-current panel, etc., which slows down restoration of power in emergencies. The substation here described is designed for operation by one man per shift; for this reason all operations are centralized so far as possible and all control is collected in the immediate neighborhood of the telephone booth, which is treated as the operating center when operation must be made most expeditious, as in emergencies. All high-tension disconnecting switches between the busbars and the oil switches, commonly called "bus disconnects," including the busbar sectionalizing switches, are located within convenient reach from the main floor and in plain view from the operating position. No switches whatever are mounted on the machines. Negative switches are omitted as unnecessary and (the machines being shunt wound) no equalizing switches are required. The field switches are located with the alternating-current starting switches on the main switchboard. On account of the large number of cables to each starting switch (fifteen, each 2,000,000 circ.mil in size) it is, of course, advisable to have the starting switches between the transformers and the converters, which results in locating the transformers behind the board. Congestion on and around the main switchboard is avoided by careful lay-outs of cable runs and by the removal from the board of all devices, such as meters and relays, which do not require handling in emergencies.

The station is built for an ultimate capacity of four machines, of which two are now installed, the additional space being sufficient for two 3,000-kw. units, which would, if added, give a total capacity of 10,000 kw., sufficient for all probable downtown demand in San Francisco even with a subway under Market Street. In order to avoid an awkward location of the operating center, either with the initial or final equipment, the two machines first installed are located in the middle of the station with room for one additional at each end.

The converters face opposite to those in the usual design of substations, the collector ring end, instead of the commutator end, being toward the main working passageway and switchboard.

This is done to avoid risk to the operator and nervousness on his part from the danger of flashing under emergency conditions, such as cutting in machines on feeders which may be short circuited. The arrangement of the converters differs in another radical respect from the conventional, reverting to a practice abandoned for many years, in that the bed plates are set on timbers and insulated from ground. This has been done to eliminate the short-circuiting effect of flash-overs from positive brush rigging to pedestals or other portions of the frame and to cut out the severe burning that would otherwise occur in case of a breakdown from armature conductors to core. Each frame is grounded through an indicating lamp and suitable resistance to give notice in case of insulation failure. Risk of shock to operators from live frames is eliminated by the use of an insulating floor as described later.

Unusually convenient access to the lower half of the brush rigging is obtained by mounting the negative busbar in another location, by the omission of all shunts and by keeping all cables out of the way. A removable bench is provided to give a safe, convenient working platform under the commutators. The negative busbar is so assembled that it can be increased in section or extended in length without slacking off its connections.



PLAN OF STATION AND ARRANGEMENT OF APPARATUS

The site selected for the station is a piece of property 41 ft. front by 80 ft. deep on a narrow back street, immediately next to Market Street. This site was owned by the United Railroads of San Francisco, being the location of an old horse-car stable of the Sutter Street line previous to the San Francisco fire. The building is reinforced concrete with no structural steel below the roof trusses. The problem of adequate lighting, always difficult on a site surrounded by private properties on three sides with a narrow street on the fourth, has been solved by making the whole of the roof of glass. Corrugated, wired glass was used for this purpose, set on one-quarter pitch with 2-in. slope lap, and has proved eminently satisfactory in every respect. There is no leakage in downpours or driving storms even though some sheets were cracked due to being set on non-parallel purlins and overloaded by weight of men working on them before the bad supporting conditions

were noted. The roof does not sweat or let in too much heat under San Francisco climatic conditions. Direct sunlight is so diffused that there is no objectionable glare and the lighting on dark days is infinitely superior to that of any building with side windows or even with the ordinary skylights.

Ventilation is another feature requiring careful attention in a substation of this character, since the manufacturers refuse to design rotary converters with forced ventilation, leaving this as about the only class of electrical machinery to "stew in its own juice." The heated air is allowed to escape from this station through the sides of a monitor of the usual design, and cool air enters through louvers provided at both ends to admit air both above and below the main floor. This suffices for the two machines, but mechanically assisted draft will apparently be necessary for four.

The main door is made large enough to admit a converter assembled and the machines were shipped that way. To avoid waste of space with hinged doors and the cost of jack-knife or roller doors, the main door is mounted on vertical slides and is arranged to be lifted by the crane. No door latch or lock is required.

The air-blast pressure under the transformers is one ounce per square inch or about 150 lb. on the area of a door. A small air lock is provided with spring-hinged wickets in the inner and outer doors. The blower dampers are automatic.

An adjacent building was 2 in. away and it was considered advisable to leave no forms in the 2-in. space for fear of a complaint on the score of noise. The forms were ingeniously designed to allow their removal, which worked out successfully.

The location of the telephone booth in the operating center between the two machines necessitated special soundproofing. The booth is of single wall construction, lined with 1 in. of hair felt with an inner lining of wallboard. The inner windows are celluloids, the joint of the door is weather-stripped, the booth is mounted on rubber posts and the floor covered with a rubber mat. The result is almost absolute quiet.

The main floor is finished with 1 in. of Trinidad Lake asphalt mastic, which was preferred to concrete as less slippery, less dusty and softer under foot. The writer has taken 11,000 volts from hand to ground standing on this floor without sensation except when taking hold of and letting go the circuit.

The high-tension bus structure with all barriers is concrete cast in one pouring. Its longitudinal wall runs up between the line and bus terminals of the motor-operated oil switches, thus keeping any fireworks on the line side from spreading to the bus side. The oil-switch cells have removable doors back and front to provide for easier maintenance and quick cleaning up after breaking heavy loads.

The outside disconnecting switches are double throw with triple-pole, rod-operated short-circuiting and grounding switches that can only be closed on the back throw when the line is disconnected from the house. This does away with the need of the usual dangerous grounding wire.

All outgoing direct-current feeder panels and circuit-breaking equipment are mounted on timber frame work of mill construction in place of the conventional grounded steel frames. This has been done to avoid the chance of short circuit from positive busbar or bare copper connections to the steel frame when working on live circuits. Since the feeders in a downtown district must always be energized and can never be shut down even during the midnight hours on account of "owl-car" service, this precaution is a decided safety-first advantage. On account of the severe circuit-breaker duty occasioned by low feeder resistance to the trolley network, the circuit breakers are not mounted as usual on the feeder panels, where they would be immediately above the head of the man operating them. They are located in two rows above and behind the feeder switchboards, the double row allowing the breakers to be located on 32-in. centers with the panels on the usual 16-in. centers. Transite barriers are mounted between the breakers, thus isolating each breaker in a cubicle or cell somewhat similar to the cells provided for high-tension oil switches, but open at the top, front and bottom. In case repairs are required or burned-out breakers must be replaced, the operator can work in such a cell with its timber frame, slate and transite walls in comparative safety and is not endangered by accidental grounds or arcing from adjacent breakers.

In addition to the usual 600-volt main busbar, the feeder panels are equipped with what is termed a "hospital bus" supplied from the main busbar through a spare circuit breaker. Each feeder switch is double throw so that any feeder can be connected via the hospital bar to the spare breaker. All feeders can be interconnected through the hospital bus at times of light loads when the station is shut down, thus allowing the main 600-volt busbar to be de-energized for work on same or on the circuit breakers. Each feeder is equipped with a pilot lamp and suitable resistance to indicate approximate voltage delivered via multiple connections from other stations. This detail was specified in place of the usual voltmeter plug, as it was found that operators will not take the time to plug in a voltmeter on a cut-out feeder, but will cut in in a hurry to catch the cars before they slow down, with serious results at times.

In order to ring a gong when the breaker opens, each feeder breaker is equipped with an auxiliary switch, serially connected to another auxiliary switch actuated by the corresponding feeder switch which stops the gong when the latter switch is opened. All switches and breakers have laminated studs.

The direct-current feeders are $\frac{5}{32}$-in. paper-lead cables varying in size from one of 750,000 circ.mils to three cables per feeder each of 1,500,000 circ.mils. Total positive outgoing copper is 17,250,000 circ.mils and negative current is returned by eight 2,000,000-circ.mil bare cables drawn into fiber ducts.

Switchboard Details Simplified

The line and converter switchboard has been simplified by the omission of several items often used but found unnecessary. No direct-current starting equipment has been provided, since with the variable voltage alternating-current starting is always reliable. Instruments have been kept to a minimum. Each incoming line has pilot lamps and an ammeter only. Each converter has a reactive factor indicator on the low-tension side and a direct-current ammeter only. The main direct-current voltmeter has a suppressed zero to give an open scale. A 200-volt center-zero voltmeter is provided to show polarity and can be switched from either converter to positive busbar to serve as a paralleling voltmeter to avoid plugging a voltmeter from bus to machine and vice versa. Lamps are connected from the voltmeter bus to the battery to give a check test on

polarity or to serve if the polarity indicator is out of commission.

All connections between transformers, converters and switchboards are made with 2,000,000 circ.mil cables, two per phase and four per direct-current terminal, making twenty such cables to each converter. The cable racks are hardwood, held to steel straps by studs and malleable washers. The studs between phases of the alternating-current conductors are brass, all others including those between cables of the same phase, steel. All cable lugs were sweated on the ends of the cables, standing up in position.

The cost of the development, including transmission lines paid for by the company, was as follows:

Building	$51,000
Equipment, f.o.b. factory	76,000
Freight and installation	21,000
Conduits and manholes	33,500
Cables, positive, installed	32,000
Cables, negative, installed	7,500
Transmission lines supplying	75,000
Engineering and overhead	40,000
Total	$336,000

Automatic protective features are as follows:

The machine circuit breakers are equipped with alternating-current low-voltage release attachments connected to centrifugal speed-limit switches and direct-current, reverse-current relays. The alternating-current converter switches are equipped with inverse time-limit overload and instantaneous low-voltage relays, the incoming lines with reverse-power relays.

Plug switches are provided by means of which the winding of any relay may be energized from toy transformers with an overload current capable of adjustment, and in the case of the incoming lines with the proper phase and polarity. Thus the complete test of any relay may be made a routine operation.

The watt-hour meters are connected to triple-pole, double-throw switches for testing purposes, which accomplish the following results: First, the current transformer secondaries are cut off from the meters without opening the circuits of the current transformers, but leaving the current coils of the watt-hour meters open. The potential coils of the two torque elements of the meter are connected in multiple and the current coils in series. As a result, either with meter in service or out of service, the meter tester may, from the front of the board, make all necessary connections for the supply of and delivery from a phantom load, for testing each torque element of the meter and for making a check test on the two torque elements in series. The switch may then be sealed in the running position. An indicating lamp is connected across each potential coil of each meter to give notice of the blowing of any fuse, either primary or secondary.

Current for lighting the station is taken from the direct-current busbars as being the most continuously energized part of the network. At night the station is closed down and all alternating-current equipment is disconnected for a general clean-up by the night shift. All direct-current lighting circuits consist of four 115-volt lamps in series charging the control storage battery. No other charging equipment is required. A low-voltage release is so connected as automatically to light from the battery a sufficient number of lamps to illuminate the control center when direct-current power fails at night.

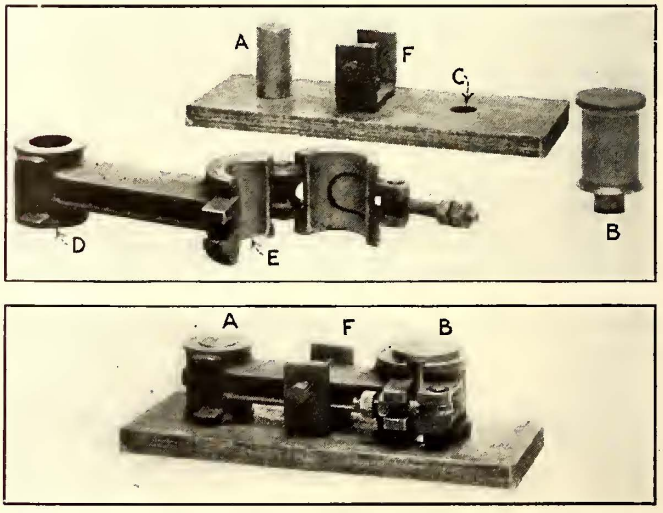
The converters, transformers and direct-current switchboards are of Westinghouse manufacture. The high-tension switching equipment is General Electric.

The station was designed for the United Railroads of San Francisco by Ford, Bacon & Davis, consulting engineers, who also superintended the construction of the building and of the conduit system required therewith and the installation of all equipment, cables, etc.

Jig for Rebabbitting Compressor Connecting Rods

The Babbitting of Compressor Connecting Rods Is Facilitated and Proper Alignment and Fit Are Assured by the Use of a Simple Jig

ACCOMPANYING illustrations show a form of jig used by the Ohio Electric Railway for rebabbitting the connecting rods of its compressors. The jig consists of a base on which is mounted a pin, *A*, a clamp, *F*, and a socket hole, *C*, for holding the pin *B*. In babbitting a connecting rod, it should first be fitted with a suitable bushing at the closed end *D*, so as to provide a close fit on the piston wrist pin. This closed end is then placed over the pin *A* as shown. Next the pin *B* is set in its socket hole at *C* and the open end of the connecting rod is adjusted by means of the clamp *F* until the pin *B* comes centrally with the hole to be rebabbitted. Cardboard fillers are used between the halves of housing to prevent the two halves from being cast in one piece, and also to prevent the babbitt from running out. Fire clay is used to stop up the bottom and thus insure all openings being properly closed to prevent any babbitt running out. The pin *B* should be a rather loose fit in the hole of the socket *C*, as it is necessary to lift this pin out of its socket in order to remove the connecting rod after babbitting, and the heat from the babbitt will



TOP VIEW, JIG WITH CONNECTING ROD AFTER BEING BABBITTED. BOTTOM VIEW, CONNECTING ROD IN POSITION READY FOR THE POURING OF THE BABBITT

expand this somewhat. The oil groove shown in the connecting rod of the accompanying illustration was cut by hand, but this can be readily cast by having a suitable raised form on the pin *B*, in which case some kind of a dowel or key should be put on the stem *B* to insure that the oil groove comes in the right place each time.

The use of this jig in the shop of the Ohio Electric Railway has considerably reduced the time necessary for babbitting connecting rods, and accurate fits have increased the time necessary between rebabbitting.

Springs for Easy Riding Cars

The Ratio of the Dead Load to the Live Load and that of Maximum Load to Average Load Are Factors that Give Great Difficulty in Designing Springs with Easy Riding Qualities

BY L. F. SEELAR
Chief Engineer St. Louis Car Company

THE selection of springs is one of the most difficult tasks which confronts the designer of trucks for street and interurban cars. On the heavier coaches used in railway service, the proportion of live or passenger load is so small, compared with the total weight of the equipment, that this difference plays but a small part in the selection of the spring. It is not unusual to find that the weight imposed upon the bolster spring by the light body amounts to but one-sixth of the capacity of the spring, and that the passenger or live load will amount to less than one-eighth of the light weight of the body. Under such conditions, it is a matter of no great difficulty to select springs that will give easy riding and have long life.

When we enter the field of street car design, we meet a totally different condition. The day has long passed since weight in car bodies was a matter of minor importance. For the past ten years it has steadily been impressed upon the car builder and designer, by the operating officials, that weights should be kept to a minimum. This reduction of weight probably reached its climax in the bringing forth of the safety car, in which the relation between the weight of the car body and that of the passenger load is equal one to the other. In this car the seated passenger load is equivalent to one-third the weight of the car body, and as it is not unusual for street cars to carry twice their seating capacity, it will readily be seen that the weight of car to passenger will often be as three is to two, and on occasions, no doubt, it is as one is to one. It is this condition, which reaches its maximum in the safety car (ratio of dead load to live load), that causes the greatest difficulty in designing springs that will give easy riding qualities, both when the car is only carrying the average load and when loaded to its maximum capacity.

It has become almost standard practice to design the bolster springs in double trucks for a height of 10½ in. under the weight of the body. Conditions imposed in maintaining step heights on street cars make it almost impossible to increase this dimension. At the same time, owing to the maintenance of clearance between the various parts of equipment, it is very difficult to obtain more than 2 in. of deflection of the car body between its height without load and with maximum load.

It is the usual practice to design truck parts so as to give a clearance of 3 in. with the car body light and 1 in. with car body and maximum load. This inch of clearance is often found to have entirely disappeared after cars have been in service from one to two years, due to wear of the various parts, and in exceptional cases this clearance has disappeared within six months. The spring designer must have a lively appreciation of the foregoing conditions, if he is to meet with success in providing a spring to carry minimum and maximum load and maintain comfort of the public.

For a long period of time I have assumed that a deflection of car body of 1 in. for each 10,000 lb. of load imposed would give easy riding, and insure a spring capacity tending to long life of truck parts. This rule cannot, however, be followed in many double-truck street cars that have recently been built. There are a number of cars now in service in which the body weight runs from 18,000 to 22,000 lb. and the maximum passenger load runs from 20,000 to 25,000 lb. As it is necessary to maintain at least ¾ in. between the bands of the springs with the fully-loaded car; and as the passenger load would, according to the foregoing rule, give a deflection of 2 to 2½ in., it is apparent that the deflection of the spring would be from 2¾ in. to 3¼ in., a condition that can very seldom be permitted. Where the rule of 1 in. deflection for each 10,000 lb. of load has been consistently followed, there have been very few complaints of cars riding hard and the springs have stood up remarkably well in service.

It has long been good practice to load bolster springs in double-truck cars and side springs in single-truck cars at two-thirds of their capacity; that is, with a car body weighing 20,000 lb., which is subjected to a maximum passenger load of 20,000 lb., the spring capacity is 60,000 lb.

As the average load carried by street cars is about one-half the seating capacity or one-sixth of the maximum load, which is imposed for a very short period of time (about two hours in eighteen), springs for street cars can be figured at higher limits than those mentioned, though it is never safe to go over 80 per cent of the capacity of the spring.

METHODS OF CONSTRUCTING SPRINGS FOR EASY RIDING

In order to maintain easy riding under the conditions outlined, four courses are open:

1. To put in plates of varying thicknesses. In cases of this kind it is customary to make the first and second plates heavier than the others. Where this is done there is a compound fiber stress set up which is hard to determine, and as the capacity of the spring is directly proportional to the square of the thickness of the plates, it is a difficult matter accurately to calculate deflections. This method should never be followed where any of the three others can possibly be used.

2. To place auxiliary plates within the main spring. When this is done the main spring is calculated to carry the weight of the car body and the seated passengers. The auxiliary spring is then designed to care for the standing passengers and road shocks. The two springs must be so proportioned that the deflection of the main spring with maximum load will never be exceeded. Therefore, to obtain this end it is necessary that the auxiliary spring be short and composed of very heavy plates.

3. To build up a spring of a large number of thin

plates. This spring is open to the objection of a large total deflection, though it gives the greatest flexibility and, therefore, is very easy riding.

4. To use a maximum fiber stress of 120,000 lb. instead of the 80,000 lb. formerly used.

For a great many years 80,000 lb. was considered as the elastic limit of spring steel. Modern heat treatment, however, has shown that this value can be increased, and it is possible by heat treating ordinary spring steel to obtain elastic limits of from 135,000 lb. to 250,000 lb. It is not unusual to find spring manufacturers demanding steels with an elastic limit of from 135,000 lb. to 150,000 lb. It is this ability to increase the elastic limit by heating treatment that enables us to design springs that are light in weight with deflection that will satisfy the mechanical limitations imposed, as by using a maximum fiber stress of 120,000 lb. instead of the 80,000 lb. formerly used, the weight of the spring is reduced and the deflection increased. This means that a few very thick plates will give the same riding qualities as were formerly obtained from a great many thin plates. It also makes it possible to reduce the size of the spring, as the strength of a spring is directly proportional to the square of the thickness of its plates, *i.e.*, a spring 30 in. long with four plates 3 in. x $\frac{1}{4}$ in. is only one-quarter as strong as a spring 30 in. long with four plates 3 in. x $\frac{1}{2}$ in., or stating it differently, one $\frac{1}{2}$-in. plate is equivalent to four $\frac{1}{4}$-in. plates. This gives a 50 per cent reduction in weight and volume. It is also true that the deflection of springs is proportional to the thickness of the plates so that the deflection of the $\frac{1}{2}$-in. plates is one-half that of the $\frac{1}{4}$-in. plate under the same load.

With the foregoing facts in mind, it is a comparatively simple matter to design a spring that will give nearly the same riding qualities as were formerly obtained and at the same time approximate the same factors of safety as used heretofore—and as will be shown by the following example:

Assuming a car body which will weigh 18,000 lb. and seat sixty persons at an average weight of 150 lb. each, we have a ratio of live to dead load of 1:2, and as this car will carry during rush hours from 100 to 120 persons, live load can very well equal or exceed the dead load. As the springs must be designed to meet the worst condition and as the total expected load would be 36,000 lb., the springs should have a capacity of 3 × 36,000 ÷ 2 or 54,000 lb. in order not to exceed the limit previously set as desirable.

By using the high fiber stress of 120,000 lb. and heat treating the spring to raise its elastic limit, we would only have a fiber stress of 80,000 lb. in the spring, due to load with maximum loading and have one-third of its capacity to absorb road shocks as at present. As the average load is less than one-half the seating capacity of the car, the fiber stress in the spring due to load would only be 42 per cent of the capacity of the spring. Cars usually operate eighteen hours per day, and are seldom worked to capacity for more than two hours per day, so that there is ample time to recover from any fatigue set up in the period of maximum loading.

The second consideration of design is that of deflection. As we are assuming a spring with plates of uniform thickness and having a limitation of 2-in. deflection from light to full load, this fixes the deflection from free to light load height as the deflection will be directly proportional to the load imposed.

Assuming the maximum passenger load at three times the seating capacity, we have a live load of 180 × 150 lb. or 27,000 lb., with a 2-in. deflection; this would mean a load of 13,000 lb. per inch. As the car body weighs 18,000 lb., the deflection under light load would be in the ratio—1:13,000 = X:18,000 or 1.384. Again assuming that the spring will stand 10½ in. high under light car body, we have a free height of 11$\frac{7}{8}$ in. or 12 in. As the capacity of the spring is 54,000 lb. and the deflection ratio is 13,000 lb. per inch, the total allowable deflection would be 54,000/13,000 = 4.154 in. and the distance between bands with light car would be 4.154 in. less 1.384 in. or 2.77 in.—say 2$\frac{3}{4}$ in. for deflection under live load and shock.

Determining Thickness of the Plates

We can now determine the total allowable thickness of the plates composing the spring by adding to the deflection for live load 2.77 in., the thickness of bands (usually $\frac{3}{8}$ in. each) 1½ in. and deducting the same from the light load height of 10½ in., which gives 10.5 in. less 2.77 in. + 1.5 in. or 6.23 in. for two halves or 3.12 for one side of the elliptic spring.

We are now ready to consider the third point of design—that of length. In order to gain easy riding a spring must have maximum deflection. Deflection is proportional to the square of the length so that a spring should have the greatest possible length, consistent with the maximum permissible deflection. As a rule, there are as many mechanical limitations to the length of the spring as there are to its height and they are ordinarily made from 28 in. to 36 in. long. Assuming a length of 31 in. with 3-in. bands, we have an effective length of spring of 28 in. The width of springs may be determined by available space or by requirements as to capacity. Car springs are usually 3 in. wide and we will use this width in the design of the assumed spring.

Having determined the limiting features of the spring, we are ready to begin its detail design:

1. It must have a capacity of 54,000 lb./4.
2. The deflection should not be more than 4.154 in.
3. Its effective length should be 28 in.
4. The total thickness of plates cannot exceed 3.12 in.
5. The width of spring is 3 in.

Since the capacity of the spring plates is proportional to the square of their thickness, and the stiffness of the spring is affected by the number of plates, it is necessary to find the greatest number of plates that can be used in order to give the required capacity in the space available.

By using a spring plate $\frac{1}{16}$ in. thick and 1 in. wide as a basis of comparison and considering the available space as occupied by a single plate we can obtain, first, the number of plates and, second, their thickness. "Machinery's Hand Book," page 421, gives the capacity of a spring 1 in. long, 1 in. wide and $\frac{1}{16}$ in. thick as 208 lb. with a fiber stress of 80,000 lb. With a fiber stress of 120,000 lb. its capacity would be 50 per cent greater or 312 lb. Since the length is 28 in. its capacity would be 312/28 or 11.14 lb.

The total thickness of all plates being 3.12 in. or 50/16 nearly the capacity of a single plate spring would be 50^2 × 11.14 or 27,850 lb. With spring plates 3 in. wide the capacity will be 27,850 × 3 or 83,550 lb.

Since the load (54,000 lb.) is distributed over four springs, each will sustain one-fourth of the total or

13,500 lb., and the total capacity of one spring plate divided by this sum will give the required number of plates—thus, 83,550/13,500 = 6.2, and dividing the allowable thickness, 3.12 by the number 6.2 will give the thickness of each plate—3.12 in./6.2 = 0.5 in. Again comparing capacity with the $\frac{1}{16}$-in. spring plate, we find that the capacity of the $\frac{1}{2}$-in. plate is as the square of 1 is to 8 and that the capacity of the spring is therefore 64 × 6 × 3 × 11.14 or 12,833 lb., which is within 5 per cent of the desired capacity and is as close a result as it is ordinarily possible to attain.

It now only remains to check the deflection. This can be done by the use of the formula $F = SL^2/2Eh$, in which S equals stress per square inch, L the effective length of spring in inches, E the modulus of elasticity, 30,000,000 lb., and h the thickness of the spring plate. Or by means of the table given on page 421 of "Machinery's Hand Book," which gives the deflection for $\frac{1}{2}$-in. plates as 0.00157 at 80,000 lb. fiber stress or 0.002355 for 120,000 lb. fiber stress. This constant multiplied by the square of the length (28 in.) will give the deflection for one-half of the spring—therefore, the deflection is equal to 2 × 784 × 0.00235 or 3.68 in. or a deflection within 3 per cent of that desired.

We can write a comparative specification showing qualities desired against those obtainable:

	Desired, In.	Obtainable In.
Number of plates	6	6
Width of plates	3	3
Thickness of plates	$\frac{1}{2}$	$\frac{1}{2}$
Length—center line of bolt	31	31
Width of band	3	3
Thickness of band	$\frac{3}{8}$	$\frac{3}{8}$
Capacity	13,500	12,833
Total deflection	4.15	3.68
Free height	$11\frac{7}{8}$	$11\frac{3}{4}$
Height with car body	$10\frac{1}{2}$	$10\frac{1}{2}$

The results obtainable are as close to those desired as it is possible to attain in manufacturing so that a spring can be made with a reasonable certainty of its satisfactory performance.

Results from Cadmium-Copper Trolley Wire

THE Eugene F. Phillips Electrical Works, Ltd., Montreal, Canada, has given out some results of a test of its cadmium-copper trolley wire on the lines of the Winnipeg Electric Railway. A curve with very heavy traffic was equipped for this test. One track was strung with copper trolley wire and the adjacent track with cadmium-copper wire, each being No. 00 and having a normal diameter of 365 mils. Both wires were installed on May 8, 1919.

On Dec. 21, 1919, after being in service 228 days, the maximum wear on the copper wire was 60 mils or 16.44 per cent, and on the cadmium-copper wire 20 mils or 5.48 per cent. The average wear on the copper wire was 20 mils or 5.48 per cent and on the cadmium-copper wire 5 mils or 1.3 per cent.

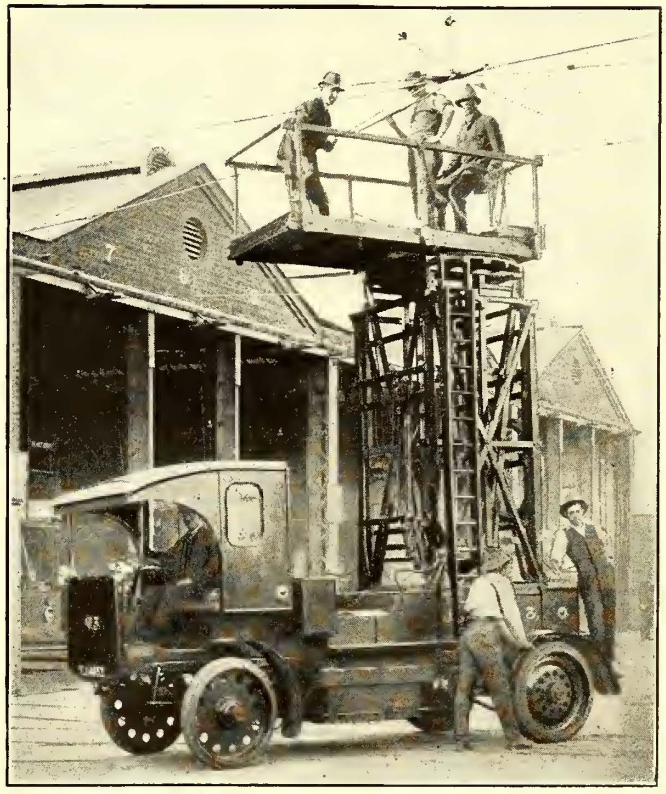
On May 8, 1920, after service of one year, the average wear on the copper wire was 45 mils or 12.3 per cent and on the cadmium-copper wire 15 mils or 4.1 per cent. On Dec. 29, 1920, after 602 days' service, the maximum wear on the copper wire was 115 mils or 31.5 per cent and on the cadmium-copper wire 30 mils or 8.2 per cent. On this basis the copper wire was considered as worn out and was removed and renewed with new copper wire. On May 8, 1921, the diameters were again measured, after 730 days' service of the cadmium-copper wire and 130 days' service of the replaced copper wire. The maximum wear on the cadmium-copper wire was 40 mils and on the replaced copper wire 20 mils, the averages being 30 and 12 mils respectively.

TEST ON CADMIUM-COPPER TROLLEY WIRE

Size B & S	Breaking Weight, Lb.	Tensile Strength Lb. per Sq.In.	Elongation in 10 In. Per Cent	Conductivity, Per Cent
0000	8,890	53,500	6 5	93 3
000	7,100	54,100	6 3	92 7
00	5,905	56,500	6 0	92 6
0	4,778	57,600	5 5	92 5

Results from these tests show that the cadmium-copper wire has superior wearing qualities, and its conductivity averages 92.7 per cent of the international annealed copper standard. Tests of tensile strength, elongation and conductivity are given in the accompanying table. These tests were made by McGill University. The results indicate that the tensile strength of the cadmium-copper wire is from 6 to 9 per cent higher than that of hard-drawn copper and the conductivity is $3\frac{1}{2}$ to $4\frac{1}{2}$ per cent lower.

Electric Tower Wagon



ELECTRIC TRUCK FITTED AS TOWER WAGON

THE accompanying illustration shows an Orwell electric truck fitted as tower wagon which is used by the Johannesburg, South Africa, municipality for electric railway work. The speed of this truck is about 20 m.p.h. and it has an operating range of about 50 miles. The distance which can be operated per charge has been sacrificed for speed, as the truck can be recharged whenever it is not in actual service. This truck is being tried somewhat in the nature of an experiment, as the municipality now uses gasoline-driven trucks, and if it proves entirely satisfactory it is contemplated to buy other electric trucks for the work.

Convenient Forms for Recording Inspection and Overhauling Work

BLANK COMPANY

DAILY INSPECTION SHEET

Car House _____ Date _____

Car No.	Circuit Breakers	Control Switches & Contactors	Reverser	Controllers	Motor Leads and Brushes	Governor Valves and Compressor	Lights and Fuse Boxes	Trolley Wheels Poles and Bases	Bells and Gongs	Axles and Axle Brgs.	Com. Cleaned	Brake Shoe Heads and Hangers	Brake Rods and Levers	Bolsters Hangers and Springs	Gears	Pinions	Motor Bolts	Center Plates and Side Brgs.	Journals	Hand Brakes	Wheels	Windows	Floors	Doors	Fenders	Register and Bell Cords	Sand Boxes	Steps

1 Each man will sign under parts inspected by him.

BLANK COMPANY

WHEEL CHANGERS REPORT

BUFFALO N Y _____

REMOVED								APPLIED			
Car No.	Wheel No.	Make	Cause of Removal	Applied	Mileage	Axle No.	Gear No.	From Car No.	Wheel No.	Make	Rd Rd or New

2 Foreman _____

BLANK COMPANY

SPECIFICATION OF ROLLING STOCK

CLASS NO. _____ PAGE NO. _____

GROUP NO. _____ DATE COMPILED _____

TYPE _____ COMPILED BY _____

NO. OF CAR _____ CHECKED BY _____

Car Body

1 Open or Closed
2 Date Purchased
3 Builder
4 Date Rebuilt
5 Weight Per Body

General Dimensions

6 Length of Body
7 Length Over all
8 Height Rail to Trolley Base
9 Width Over All

Framing

10 Side Sills
11 Corner Posts
12 End Sills
13 Center Posts
14 Platform Vestibule
15 Width of Opening
16 Dash
17 Sheathing, Sides _____ Ends _____
18 Roof, Type

Windows

19 Side Sash
20 End Sash
21 Monitor Side Sash
22 Monitor End Sash

Doors

23 Front
24 Rear
25 Center
26 Floor Material
27 Interior Woodwork Material

Seats

28 Longitudinal _____ Cushion L
29 Crosswise _____ Cushion L
30 Circular _____ Cushion L
31 Heaters
32 Trolleys
33 Curtains _____ Material
34 Steps
35 Signals
36 Trimmings
37 Lamps
38
39
40

Trucks

41 Single or Double _____ Type
42 Weight Per Truck
43 Wheels Dia.
44 Wheels Kind _____ Wt.
45 Axles Kind _____ Dia.
46 Axle Wt. Without Gear
47 Truck Centers
48 Wheel Base
49 Automatic Slack Adjusters

Electrical Equipment

50 Type of Control
51 No. of Controllers
52 Controllers Weight
53 Motors, No. _____ Type _____ H P.
54 Gear Ratio
55 Weight Per Motor
56 Inter. Door Control
57 Motormen's Signal Light
58 Circuit-Breaker Type

Brake Equipment

59 Hand Brakes _____ Type
60 Air Brakes _____ Type
61 Compressor Capacity
62 Governor Type
63 Air Brakes, Weight
64 TOTAL WEIGHT CAR COMPLETE

Accessories and Tools

65 Jack and Jack Handle
66 Fare Registers
67 Automotoneers
68 Trolley Catchers
69 Draw-Bar and Carrier
70 Signs, Side and End
71 Sand Boxes
72 Fenders
73 Window Guards
74 Motormen and Conductor Seats
75 Switch Iron
76 Broom
77 Take One Boxes
78 Shovel
79
80

3

ARMATURE CHANGED.

At _____ Date _____ 19

From Car No. _____ Truck No. _____ Motor No. _____

Armature No. _____ Type _____

Reason for Removal _____

No. Put In _____ Work Done by _____

Defect Found by Armature Room _____

4

BLANK COMPANY

CAR DEFECT REPORT

Car No. _____ Motorman No. _____

Date _____ Time _____ a. m. p. m.

Car Body

Air or Hand Brakes

Electrical

5

BLANK COMPANY

DAILY CAR HOUSE REPORT FOR 24 HOURS ENDING MIDNIGHT

CAR HOUSE _____ DATE _____ 19

NO. CARS INSPECTED _____ WEATHER _____

NO. REPAIR MEN ON DUTY—DAY _____ NO. CLEANERS ON DUTY—DAY _____ TOTAL _____

NO. REPAIR MEN ON DUTY—NIGHT _____ NO. CLEANERS ON DUTY—NIGHT _____ TOTAL _____

TOTAL NO. CARS ON HAND _____ EXTRA O K CARS 8 P M _____ EXTRA O K CARS 7 A M _____

CARS PULLED IN

CAR NO	TIME	MOTORMAN AND CONDUCTORS NUMBER	TROUBLE REPORTED	TROUBLE FOUND	REPAIRED BY	TIME O K.

CAR NO	TROUBLE ON BAD ORDER CARS 7 A M.	CAR NO.	TROUBLE ON BAD ORDER CARS 8 P M.

USE MORE THAN ONE LINE FOR DETAIL WHEN NECESSARY

CAR HOUSE FOREMAN _____

6

BLANK COMPANY

REPORT OF CARS TURNED IN

19

CAR HOUSE	NO 1 BARN	NO 2 BARN	NO 3 BARN	NO 4 BARN	NO 5 BARN	NO 6 BARN	NO 7 BARN	NO 8 BARN	NO 9 BARN	TOTAL
AVERAGE NUMBER OF CARS OPERATED DAILY										
PERCENTAGE CRIPPLES										
Air Compressor										
" Governor										
" Pipes, valves, etc										
Armature										
Automotoneer										
Bearings, armature										
Bearings, axle										
Bell Cord										
Brake Handle										
Brake Rigging										
Brakes Slack										
Brake Shoes										
Brakes Tight										
Broken axle										
" flange										
" motor case										
Brush Holder										
Car Body Handles, etc										
Charged										
Circuit Breaker										
Collisions										
Commutator										
Contactor										
Controller										
Curtains										
Derailments										
Dirty car										
Doors										
Door and Step Mechanism										
Fare Box										
Freeze-Ups										
Fender										
Fields										
Flat Wheel										
Floor rack										
Foot gong and Overhead bell										
Fuse										

CAR HOUSE	NO 1 BARN	NO 2 BARN	NO 3 BARN	NO 4 BARN	NO 5 BARN	NO 6 BARN	NO 7 BARN	NO 8 BARN	NO 9 BARN	TOTAL
Gear										
Gear Case										
Headlight										
Heaters										
Heater Motors										
Hot journal										
Journal Box										
Light Circuit										
Motor leads and cables										
Motor suspension										
Pinion										
Push Buttons										
Register equipment										
Release spring										
Resistance										
Roof										
Sand equipment										
Seats										
Sign										
Signal lamps										
Split switch										
Steps										
Switches										
Thin flange										
Trap doors										
Trolley										
" catcher										
Truck										
Vomit										
Windows broken										
TOTAL										
Previous										
Increase										
Decrease										

Inspected and found O.K. by barn men

7

1. Daily inspection sheet.
2. Report of wheels changed.
3. Specification of rolling stock.
4. Report of armature changes.
5. Car defect report.
6. Daily record of cars pulled in.
7. Summary of cars turned in.

Systematic Maintenance Good Investment

Methods Used and Results Obtained by One Large Railway Indicate that Careful Attention to Maintenance Details Produces Most Satisfactory Conditions—Concrete Example Discussed, Using Data Gathered from a Survey of the Shops and Records

By John S. Dean
Railway Motor Engineering Department, Westinghouse Electric & Manufacturing Company

IN ANY CAMPAIGN for increased revenues one important item which must not be overlooked is the possible economies which might be effected by certain changes or improvements in operating methods. To assist in pointing out some of the possibilities along this line a concrete example will be discussed, using data and figures gathered from a survey of the shops and records of one of the large railway operating companies with the following characteristics:

Service.—City of 500,000 population and interurban service to adjoining towns.

Miles of Track.—City, 230 miles; suburban and interurban, 204 miles.

Passengers carried per year, 227,000,000.

EQUIPMENT

Passenger	Motor cars	815 city (351 quadruple equipment; 468 double equipment)
		84 interurban—quadruple equipment
		23 suburban—quadruple equipment
		4 special (3 quadruple equipment; 1 double equipment)
	Trail cars	19 city
		4 suburban
Service	Motor cars	60 snowfighting equipments
		3 electric locomotives
		53 freight, track department, sand, etc.
	Trail cars	75 flat, dump, etc.

SHOP AND CARHOUSE EMPLOYEES

		Men
Main shops	Electrical department	45
	Mechanical department	29
	Air brake department	16
	Erecting department	22
	Wood-working department	78
	Painting department	25
	Reclamation department	22
	Total	237

		Cars	Men	Cars per Man
Carhouses	No. 1 Station	228	62	3.7
	No. 2 Station	93	22	4.2
	No. 3 Station	135	47	2.8
	No. 4 Station	60	16	3.7
	No. 5 Station	17	54	3.2
	No. 6 Station	101	29	3.4
	No. 7 Station	34	15	2.2
	No. 8 Station	67	24	3.7
	No. 9 Station	22	..	...
	Total	919	269	3.4 average cars per man

Very complete records of all work done at the main shops and at the carhouse are made and kept on file available at any time for ready reference. These records are used by the officials to make careful studies of equipment failures, and result in improvements to overcome these troubles. Further, from these records monthly reports are made to the management covering a general summary of trouble and work done on the equipment. The daily inspection sheets are each signed by the men doing this work and are used by the company's legal department as evidence in case of law suits. Some of the most important forms used in connection with the work are reproduced herewith. In addition to the above, tabulated blueprints are kept up to date showing important details of all passenger and service equipment, also car assignment sheets giving the most important details of all cars operating from the various carhouses.

The following system of inspection and general overhauling of equipment has been adopted and is being carried out on this property:

THE BELT RAIL IS BEING LEFT OFF THE CAR SIDE

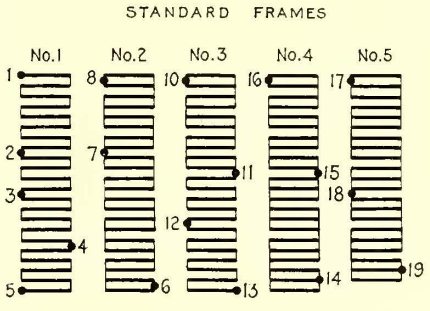
Daily inspection of cars with old style motors and brake rigging.

Light inspection every week.

Heavy overhaul every one and one-half to two years.

The daily and weekly inspections are made by the regular inspection force at the various carhouses, while for the general overhauling the cars are put into the main shops and the trucks and all equipment taken off and thoroughly overhauled. During this time the car bodies are very thoroughly cleaned and varnished or repainted.

The present working schedule of the shop for the general overhauling is from eight to ten cars each



RESISTANCE AND CURRENT CARRYING VALUES OF EACH OF ABOVE STEPS		
STEPS	OHMS	AMPERES
1 to 2	1.28	30.4
2 to 3	0.64	30.4
3 to 4	0.80	30.4
4 to 5	0.80	30.4
6 to 7	0.56	60.8
7 to 8	0.32	60.8
10 to 11	0.40	60.8
11 to 12	0.80	30.4
12 to 13	1.12	30.4
14 to 15	0.214	91.2
15 to 16	0.400	60.8
17 to 18	0.214	91.2
18 to 19	0.160	91.2

COMBINATION STANDARD LAYOUTS			
Based upon, weight of car, type of control, No. of motors, type and hp. of motor, gear ratio, size of wheel			
CLASS	STANDARD FRAMES	STEPS	TOTAL OHMS
A	1-1	4	5.76
B	1-2	4	4.40
C	3-4-5	6	2.18
D	3-4-4	6	3.14
E	2-2-2	4	2.64
F	4-4-4	5	1.838
G	2-5-4-5-5	7	2.610
H	3-2-5	6	3.574

STANDARD FRAMES OF GRID RESISTORS USING SINGLE THREE-POINT TYPE GRID

week. This will vary depending upon the amount and importance of repair and upon the new work going through the shop.

SHOP REARRANGEMENT TO FACILITATE MAINTENANCE

Within the past few years as the result of an investigation instituted by some of the officials of this company a number of important changes were made in the layout of the main shops and in the distribution of the work whereby the handling of the general overhauling of the equipment was greatly facilitated. In general the changes made were as follows: (1) The electrical department was moved into the main shops near the motor and truck floor; (2) the work in the motor, truck and carpenter shops was rearranged to permit the carpenters and electricians to work on the cars at the same time; (3) carhouses were provided with necessary tool equipment to do their light repair work, thus relieving the shop.

All carhouses are clean and comfortable with well-lighted and orderly arranged pits, in which are to be found the required wrenches and small tools necessary to handle all repair and inspection work on the equipment. These pits are also equipped with the necessary small machine tools and hoists to take care of all light repairs at a saving of time and money. The material used is handled on an exchange basis. Each house is assigned a definite amount of material, and to make a replacement at the main shops the old parts must be turned in and exchanged.

THIS TYPE OF HEADLIGHT HAS BEEN RECESSED INTO THE DASH

Each carhouse is in charge of a general foreman, who reports directly to the superintendent. In general, the force, which will vary with the number of cars parked in the carhouse, consists of a general foreman, an assistant foreman in charge of inspection, a light foreman, a general utility man, a controller inspector with helpers, an air inspector and helpers, a brake inspector and helpers, a motor inspector and helpers, an oiler, helpers and cleaners.

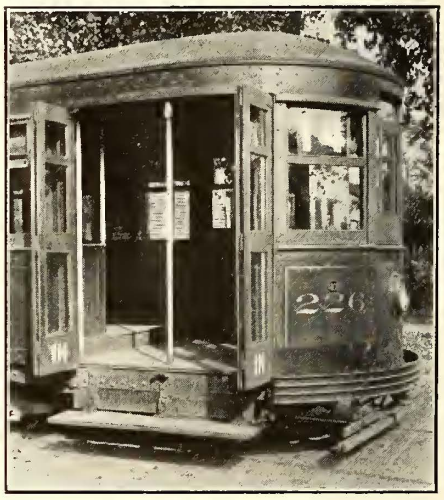
Some of the work done at the carhouses consists of daily inspection of cars with old style motors and brake rigging; weekly inspection of cars; sweeping of cars every night; washing outside of cars every four or five days; washing inside of cars every four weeks; changing wheels on cars, changing armatures and doing light repair work on crippled cars; submitting daily reports on all crippled and O.K. cars and reports on all cars inspected.

All carhouse foremen are furnished with a summary of the weekly records of crippled cars from all houses. This scheme has created a friendly competition among the various foremen which tends to bring out the very best efforts of the men to make a creditable showing for their respective houses.

To meet the severe operating conditions during the winter season ample equipment, consisting of sweepers, plows and other apparatus, is available, and a definite snowfighting program has been worked out and is put into effect.

The reclamation department, which was recently organized, has made an excellent showing during its short existence. The welding room is the most promising division of this department as it has made possible the salvaging from the scrap pile of a large number of motor and truck parts. This work is being done at a large saving and has greatly facilitated the overhauling work on equipment. Some of the results obtained in this department are shown by the figures taken from the records in the accompanying table.

An illustration on page 281 shows a pile of damaged and discarded gear cases in the background, while in the foreground are shown four similar cases that were reclaimed. Repairs are made by either the oxy-acetylene, electric or thermit process of welding, depending upon the size of the piece to be repaired and the final finish to be given the welded section. In doing this work much depends upon the skill of the operator, the welding metal and the flux used. A skilled workman by using the right combination of welding metal and flux can produce either a very hard or a comparatively soft welded joint.

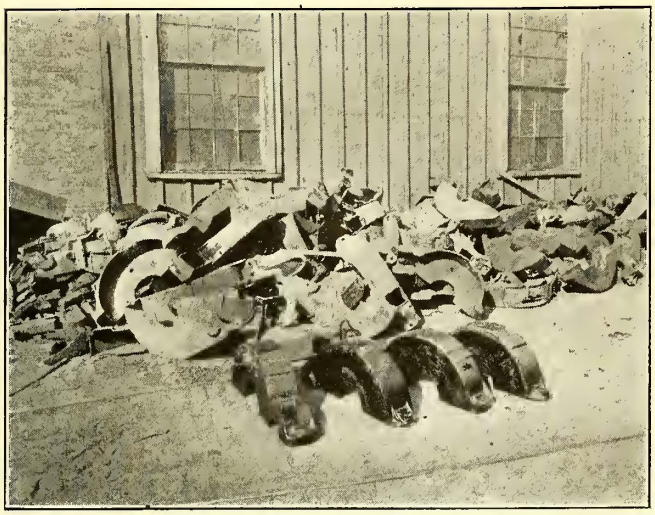


RECESSING THE HEADLIGHT INTO THE DASH ELIMINATES TROUBLE

Another illustration shows the babbitting department, which is fitted with two gas-heated pots, one used in burning off the grease and melting the babbitt from the old shells and the other to heat the clean metal used to reline the bearing shells. A high grade babbitt metal is used and great care is taken with each operation to produce reliable bearings. In order to make a good tinning job on the car journal brasses, a buffing wheel has been installed on which the surface to be tinned is thoroughly cleaned and polished. A further improvement considered for this department is the installation of an automatic temperature controlling device for the babbitting pots to maintain the correct working temperature of the metal.

Repaired Parts	Jan.	Feb.	March	April	May	June	July
Gear case halves	46	63	45	60	94	92	76
Motor frames	8	11	9	12	5	13	15
Trucks	..	..	20	12	19	20	14

With the great variety of equipments on this property, it was found that originally sixty-two different types of grid resistors were used. This required a large stock of individual castings and a great variety of assembled frames in order to make the necessary repairs



DAMAGED GEAR CASES AND SAMPLE RECLAIMED BY WELDING

when needed. This question was given careful thought and study, which finally resulted in adopting as a standard a single three-point type grid resistor which is now being applied to all equipments to replace the original sixty-two varieties. This single grid is built up into five standard frames which can be arranged in eight groups or classes suitable for all of the equipments. This arrangement when finally installed will be a big factor in facilitating repairs on the grid resistors.

METHODS OF WINDING, DIPPING AND BAKING

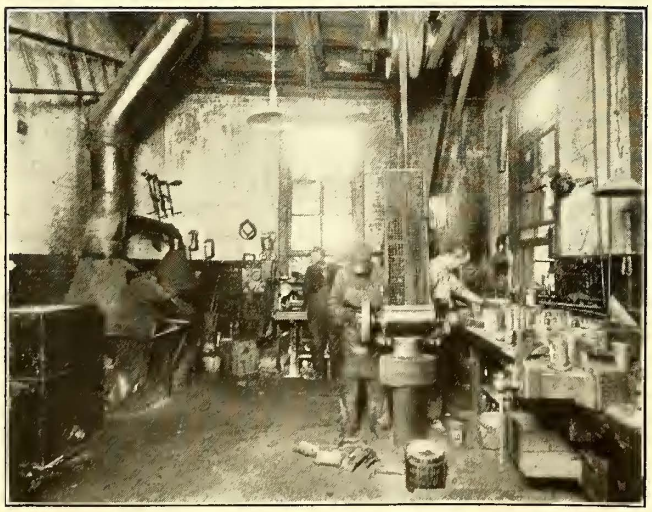
The winding department within the past few years was brought into the main shop nearer the motor and truck floor and this change has saved considerable time and money. In connection with the regular routine work in this department there are in use several schemes which are worth special mention.

Armature coils are heated in an electric oven, thus softening the insulation, making the coils more pliable and less likely to have insulation damaged while winding.

A complete outfit is in operation for impregnating field coils with insulating compound.

A dipping and baking plant has been installed to treat armature coils and completely wound armatures.

Armatures are inclosed in a flexible wood crate while being transferred between shop and carhouses. This carrier is readily applied and provides ample protection for the commutator and windings.

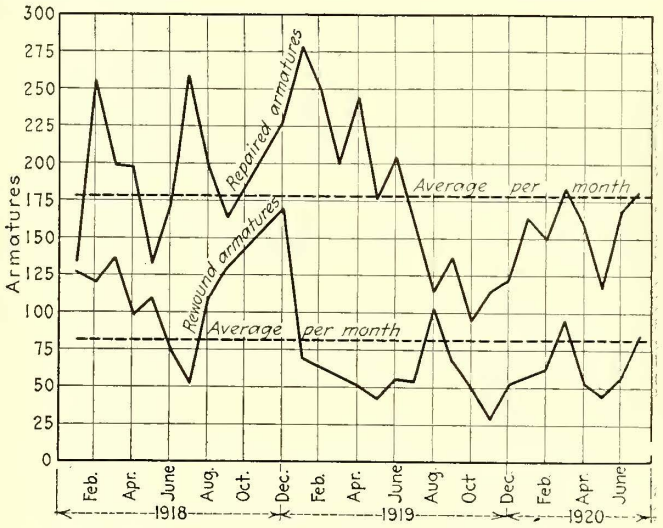


BABBITTING DEPARTMENT

The commutators on all machines have the mica undercut approximately $\frac{3}{64}$ in. All repaired armature windings are given an insulation test of 1,200 volts and new windings 2,000 volts to ground. This company has a definite program laid out covering the dipping and baking of all repaired and rewound armatures. This was put into effect more than a year ago and to date results have been very gratifying. In addition to the above all new field coils are impregnated.

The baking oven has natural ventilation, is heated by electricity and has automatic control to regulate the temperature. Schenectady black varnish is used and armatures are first heated about twelve hours, then dipped pinion end down except a few types of smaller sized motors, which are dipped commutator end down. Armatures remain in varnish until all bubbling ceases and then are baked for forty-eight hours at a temperature of 225 deg. F. The results obtained from treating armatures in this manner have been so satisfactory that this company is planning to put in additional equipment to dip and bake their completely wound motor frames.

An analysis of the pull-in reports showed an unusual number of broken motor cable leads especially on a certain class of cars. As a result of this investigation



CURVES SHOWING ARMATURES REPAIRED AND REWOUND

these cars during the overhauling period are having the car wiring put in conduits and motor cable leads securely cleated. All parts of the cleats are made a standard size and the motor leads are all brought out in the same relative position so as to make all parts on the trucks and car body interchangeable. All cables on the trucks are provided with two sets of quick break connectors so that the leads to individual motors as well as both sets of motor leads can be readily disconnected from the car body. When this work is completed it promises a further reduction of car pull-ins from motor lead troubles.

One detail in connection with the reconstruction work on trucks which has been given considerable attention by this company is that of providing hardened steel bushings at all wearing parts of the truck frames. This construction provides not only a longer life but also an easy means of repairing parts when they become badly worn.

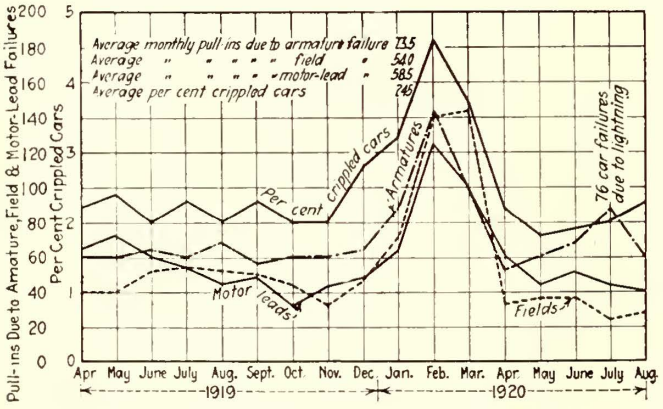
As a result of experience several changes have been made on standard car equipment which show what can be accomplished in the way of reduced maintenance by carefully going after mere details.

The belt rail is left off the sides of cars. This rail consisted of a wood strip running the entire length of the car on both sides about half way between the under side of the windows and the bottom of car body. This strip tended to catch water which would rust the side plates of the car body at this point, resulting in frequent repairs.

The fuse box on the same cars was located under the car at the side near the door and was either continually grounding due to drip water or being knocked off by passing automobiles. They are being removed and placed under the car just ahead of the main air reservoir.

By a comparison of the headlights shown in cars in accompanying illustrations it will be noted that one extends out very much farther than the other. The headlights extending out so far have been a source of continual trouble by being damaged and torn off by the trolley rope on the car ahead when operating in congested districts. All of these types of headlights are being reconstructed in the reclamation department and remounted as shown. This has eliminated much trouble.

On all single-end cars the apron on the front dash is left off as a matter of economy. This apron was originally placed over the dash at front and rear to keep small boys from finding a good foothold to ride on rear



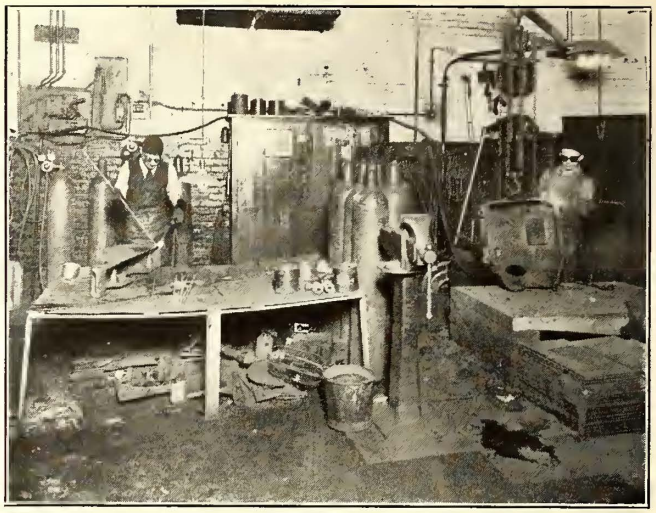
CURVES SHOWING CRIPPLED CARS AND PULL-INS

of cars and this protection is necessary and still maintained on double-end operated cars. However, on cars operated in one direction, this protection is not needed at both ends of the cars so the apron is left off at the front end, thus reducing maintenance costs.

At the main shop all assembled motors are given a no-load running test to check the bearings. Similar tests are made at the carhouses on all box frame motors when armatures are changed. The question of giving all repaired motors a running load test at the shop to weed out defective workmanship and material is now being considered by this company. When armatures or motors are changed on any cars at the shop or carhouses, each individual motor on the car is checked for correct connections by spinning the wheels. This is done in both directions to insure all motors working together. The car before being put in regular service is always given a trial run on a section of the main track to try and locate any possible trouble with the bearings or electrical equipment.

SOME LOW MAINTENANCE COSTS

In addition to trying to improve the maintenance methods this company gives very careful attention to operating costs on details as the management is a firm



WELDING ROOM

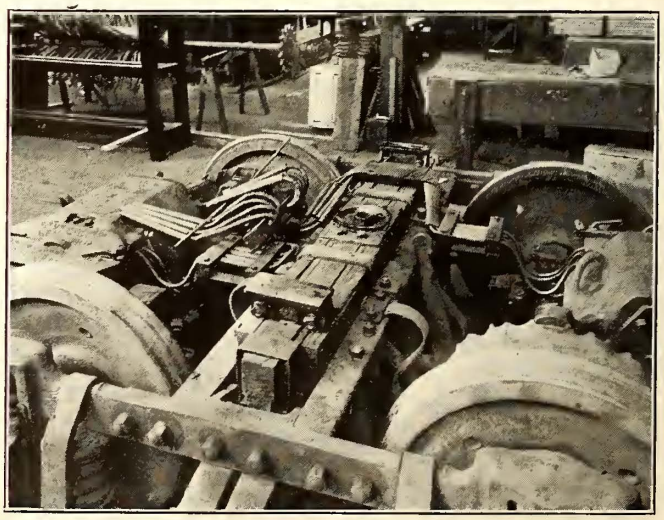
believer in looking after the small things on the property. The following cost figures show what has been accomplished along this line:

Carbon brushes per thousand car-miles	$0.09
Lubrication per thousand car-miles	0.219
Trolley wheels per thousand car-miles	0.29
Lamps per thousand car-miles	0.75
Brake shoes per thousand car-miles	0.90

The curves shown were plotted from values taken from the weekly report of pull-ins and in general they show that the peaks during the winter months are due to severe snow conditions. The armature curve was given an upward turn due to lightning trouble during the summer months and the general trend of motor lead and field troubles is downward. The percentages of crippled cars averages 2.4 per cent, which is a comparatively low figure.

The general tendency of both the repaired and rewound armature curves is downward, with an upward turn in the winter on account of snow conditions and again in summer due to severe electrical storms.

The high peak on all the curves occurred during February, 1920, and it will be recalled that this was a particularly severe period in regard to weather conditions. The peak in the armature curve for July, 1920, includes seventy-six failures which occurred as a result of a severe electrical storm.



MOTOR CABLE LEADS ARE SECURELY CLEATED IN POSITION

Des Moines Rides Buses and Walks

Public Calamity Being Enacted with Meager Public Concern — Dilapidated and Crude Buses Trying to Replace Street Cars, While Many Walk or Stay Home—No Great Effort Toward Solution Being Made

BY "OBSERVER"

DES MOINES, the capital city of Iowa, with a population of 126,000, has harassed its street railway company until it has been forced to cease operation, thereby imposing on the citizens what is little short of a public calamity, though but partially realized as yet at the end of the first week, when this is written. Every effort was made by the company to effect a settlement of the difficulties and warning was given of the necessity to shut down unless some solution were promptly found. The city authorities, the newspapers, and the people generally, seemed to believe this was only a bluff and refused to take the matter seriously. The shut-down followed at midnight on Aug. 3, at the order of Federal Judge Martin J. Wade, under whose direction the property had been operated under receivership since January, 1921. Operation of the lines having ceased, the bondholders have started foreclosure proceedings.

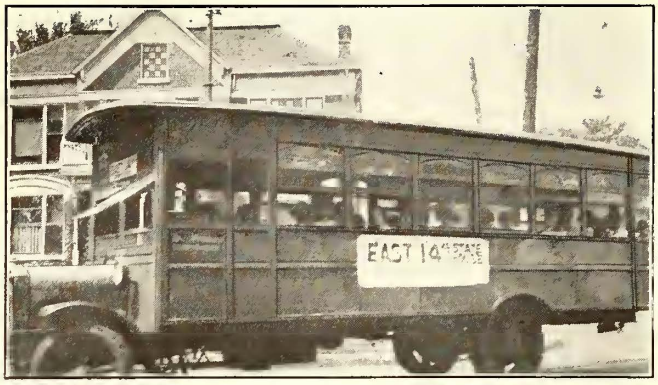
Now Des Moines is a free-for-all bus town, licenses being issued to all comers regardless of the type or condition of vehicle and with the simple requirement of a $25 license fee and a $5,000 indemnity bond. The $25,000 state bond for vehicles carrying over fifteen passengers is apparently not being enforced. At the end of the first week approximately sixty buses of all kinds and sizes brought in from Kansas City and St. Joe, Mo.; Hutchison, Kan.; Sioux City, Ia.; Minneapolis, Minn., etc., were doing their utmost in an unorganized and inexperienced way to make these few do the work that normally requires more than a hundred double-truck street cars. The results are pitiable indeed, yet the public officials seem to be complacently viewing the spectacle, while the people who must ride suffer a congestion and actual danger seldom witnessed. Even the downtown merchants, whom one would expect to be greatly concerned, are only passively interested as yet. They have been working in a way to set up a plan acceptable to company and city, but they have not displayed the determination one would expect of them to bring about a prompt settlement and return of the cars. Of a number of merchants interviewed, none was found who really felt keenly the absence of the cars, though a few seemed aware that a continuation would undoubtedly affect their business. Two complained that business had been so poor anyway that they guessed it could not be made any worse. Des Moines has been very hard hit in a business way because of its very large dependence on the farmers. The people riding the buses for the most part seem to be taking the situation somewhat as a "lark" and good naturedly making the most of the intolerable riding conditions. The private automobiles, of which Des Moines has a very large number (Iowa has one for every 6.7 inhabitants), come into the city loaded with friends and strangers in the morning. Practically all automobiles at this time of day are bound for the downtown business districts, though it is more difficult for the unfortunate pedestrian to intercept a ride going home in the evening, when the route of the private car cannot be foretold. However, many people wait thirty minutes and more for a lift in a private automobile. Others are walking six and seven blocks to board buses on their way to the downtown loop so that many of the buses are well loaded for the return trip when they arrive downtown. Great numbers of people are walking, and great numbers of women and non-necessity riders are staying at home rather than endure the discomforts, not to say embarrassments, of the Des Moines motor bus trip. The remark is frequently heard that a person is actually afraid to ride in the buses. This is not difficult to understand when one observes the crowding of thirty-five and forty people into buses seating twelve to eighteen. The low headroom, limited foot space and general *compression des voyageurs* makes a rush-hour ride one not to be readily forgotten. Passengers are so crowded in that in practically every bus they fill up the front end at the right of the driver so that he has no vision to the right at all. Indeed, in some buses passengers occupy the space at the front of the car on both sides of the driver so that he has no vision in either direction and can see only what is immediately in front of him. Therein lies the greatest danger, and it is only by the grace of God that a serious accident has not been recorded. Further danger lies in the fact that the buses in use were not designed for such extreme loads to begin with, and furthermore, most of them are in extremely poor condition.

Other evidences of the effect of the street car shutdown is afforded by action of an amusement park management and the State Fair Association. The management of the latter issued a statement to the effect that without street car transportation the Fair, which is scheduled to open Aug. 24, would produce a deficit of $150,000. Last year the Des Moines City Railway pro-

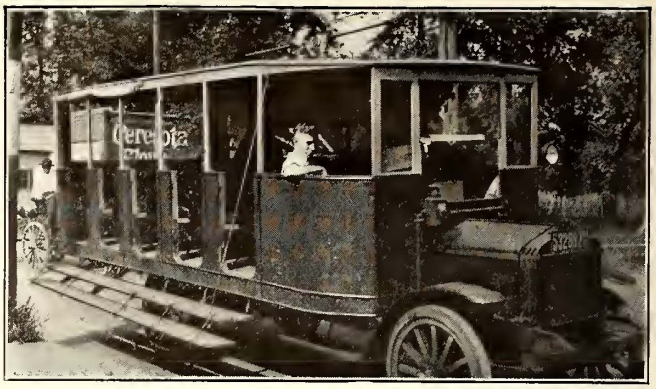
DAILY AVERAGE DATA OF 5-CENT BUS LINES IN DES MOINES

Line	1921 Days Covered by Check	Number of Buses	Number of Trips	Total Bus-Miles	Number of Passengers	Passengers per Bus per Day	Total Earnings	Earnings per Bus per Day	Earnings per Bus-Mile
Walker	4-18 to 4-20	3	99	371.97	1,074	331	$40.16	$16.46	14.3c.
Walker	5-16 to 5-18	5	165	620.79	1,735	347	86.73	17.35	13.9c.
University	3-12 to 3-26	10	402	1,310.04	4,836	487	249.55	25.00	18.0c.
University	4-25 to 4-30	10	362	1,176.63	4,123	412	206.15	20.62	16.5c.
Sixth Ave	2- 1 to 2- 2	5	219	742.36	2,600	532	133.00	26.00	17.7c.
Sixth Ave	3-28 to 4- 1	8	388	1,336.09	5,051	635	252.53	31.56	17.1c.
Sixth Ave	5- 9 to 5-14	8	357	1,228.65	4,327	624	249.50	30.77	20.2c.
Clark	2-16 to 2-18	2	78	243.2	1,071	536	53.57	26.78	20.5c.
Clark	4-11 to 4-16	5	162	500.6	2,096	465	104.80	23.26	20.5c.
Clark	5- 2 to 5- 7	5	196	607.1	2,397	497	119.84	24.83	19.7c.
Valley Junction*	4- 4 to 4- 9	4	104	601.76	1,664	459	124.81	34.61	20.9c.
Valley Junction*	4-25 to 4-30	4	108	625.2	1,637	609	122.74	30.70	19.5c.

* Charge 10-cent cash fare with reduced ticket rate, making average fare 7½ cents.



A GROCERY STORE ON WHEELS CONVERTED INTO A MORE PROFITABLE FORTY-SEAT BUS AND NAMED BY PATRONS "SAINT VITAS" BECAUSE OF ITS RIDING QUALITIES



A GREAT SCHEME FOR FAST LOADING AND UNLOADING BUT REQUIRING TWO MEN. THE STEPS FOLD UP WHEN THE DRIVER PULLS THE ROPE

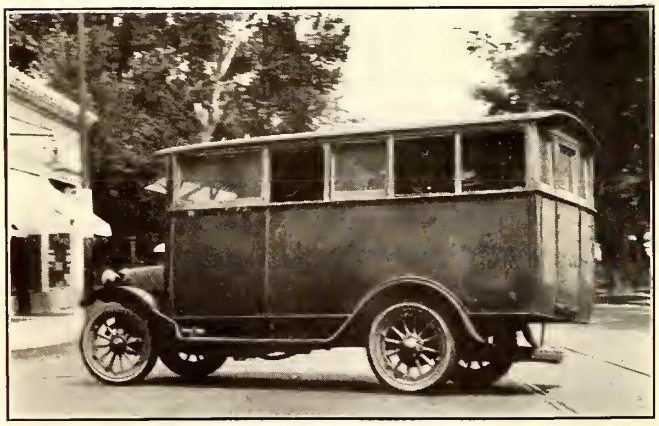
vided sixty cars to serve the State Fair, giving a forty-second headway all day up to 7 p.m. and hauling as many as 75,000 people in one day. One evening after a show at the fair grounds two full round trips of the sixty cars were required to haul all the people home. The manager of Riverview Park has announced that he will close the park on Sunday, Aug. 14, because of the falling off in admissions. At least 80 per cent of the 25,000 a week who patronize this park are car riders. To attend the park now, unless they live directly on the line of buses which is trying to serve the park, patrons must pay one fare to get into a jammed bus to ride downtown and then fight to get into another and pay another fare to proceed to the park. Naturally they stay at home rather than suffer this experience.

EXTENT OF BUS SERVICE

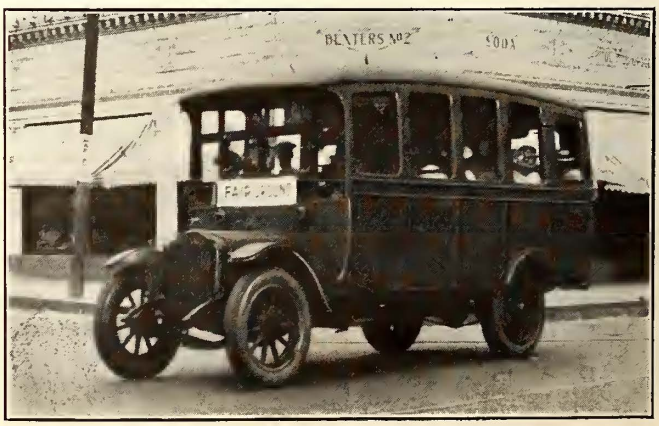
Prior to the shutting down of street railway service on May 23 there were twenty-five buses operating in competition with the company, on July 6 there were thirty-six and between this time and the day operation ceased, Aug. 3, not more than two or three additional buses were added to the competitive service. A check made on Aug. 5, the second day after the shutdown, showed there were fifty buses; on Aug. 6, fifty-six, and on Aug. 7, fifty-six maximum, including all cars hauling passengers whether bus or jitney touring cars. These figures were obtained through an accurate check made by the railway company and are considerably less than the number of buses claimed by the bus men's association to be in operation. The association claimed to have eighty-six buses in operation for the rush hour on Aug. 10, one week after railway operation ceased, but judging from figures given out previously it was estimated that there possibly were sixty-five buses.

During March, April and May of this year five different lines of buses paralleling street-car lines were operated. Buses were also operated spasmodically on other lines, presumably as a trial of the possibilities. Now an effort is being made to give some bus service along thirteen of the fourteen main car lines. Four of these, however, were being operated with but one bus, giving an average interval on the four lines of thirty minutes. Some of these bus lines are turned back about 1 mile short of the end of the car line, where the railway has turned back its tripper cars. The buses charge a 5-cent fare without transfer, whereas the railway fare was 8 cents cash, two tickets for 15 cents, with universal transfer and 2½-cent tickets for high school pupils and for children under 12 years of age. In April, May and June over 18 per cent of the total passengers carried by the railway used transfers. This week the buses put into effect a six-for-a-quarter ticket good between 9 and 4 to stimulate shopping. The tickets are sold on the buses.

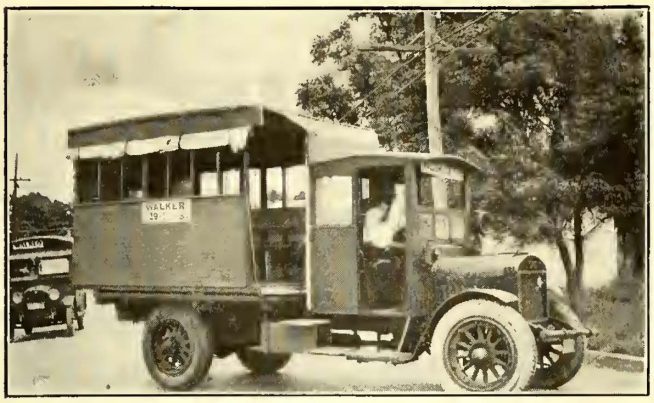
While the bus men have an association, comprising a majority of the individual owners, they are operating largely as individual enterprises and agreeing to a certain extent on schedule and other matters of service. Of course if a driver gets tired during the dull hours of the afternoon he drops out for one trip so that the interval is rather unreliable. A complete check made on Aug. 5 of the bus headway on each line between the hours of 7 and 10 a.m. and 2 and 7 p.m. disclosed a most erratic service, with intervals on the same line of from two minutes to forty-five minutes.



AN OLD TIMER BROUGHT BACK INTO SERVICE



ONE OF THE BEST BUSES IN DES MOINES



A FIELD REAL ESTATE OFFICE LIFTED ON THE TRUCK TO MAKE A BUS BODY. AFFECTIONATELY NAMED THE "GRAINARY"

THE "ICE WAGON," FOR THAT IS WHAT IT IS IN DES MOINES EXCEPT THAT SEATS (BOARD) HAVE BEEN ADDED

Of course, in fairness it should be said that the busmen cannot be expected to establish overnight a very complete or reliable service, or to equip themselves with first class buses. Through their association they have been endeavoring to secure a one-year franchise, upon receiving which they guarantee to spend a considerable sum of money for new buses, adequate to handle the city's traffic. Consequently, the buses that are now being supplied are such as could be purchased for comparatively small sums and financed on what little money the driver had available personally. The result is rather humorous, if one can forget the seriousness of the situation. The patrons have a good many of the buses named, as indicated in the captions under the accompanying pictures. They range in size from a seating capacity of eleven up to forty and employ old four-cylinder Cadillacs, GMC, Reo, White, Masters, Stewart, Republic and other chassis.

It is not thought that the number of buses in operation will be increased materially until the bus owners can be given some assurance by the City Council as to what their life will be. License fees for the buses now in operation expire on Sept. 1 and there is no desire upon the part of bus owners to pay the annual fee until some plan for future operation is worked out. It is said that ten buses from another city are waiting for shipment to Des Moines for the word that they will be given a lease on life by the Des Moines City Council.

BUS MEN WANT THE BUSINESS

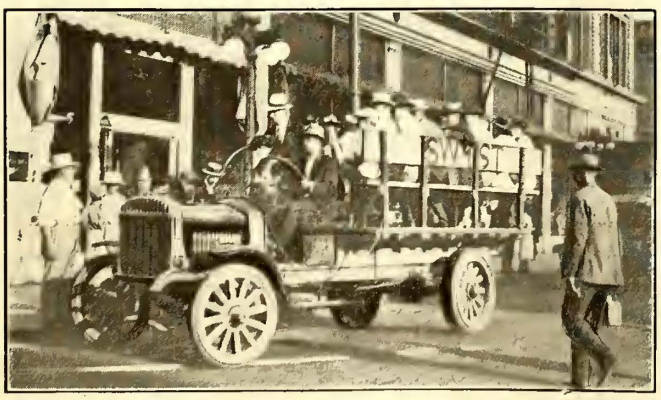
In addition to the efforts of the local bus men's association to secure a franchise, several other interests have been actively at work endeavoring to secure a franchise or promote a company to finance a system of buses to displace the street railway system. Typical of these propositions is the following made by T. J. Fay, president Fay Motor Bus Company, which has made quite a success of a 10-cent motor bus line in Rockford, Ill., and has started a system in Little Rock, Ark., and in one or two other places.

The Fay Motor Bus Company, co-operating with a number of substantial business men of Des Moines, hereby makes you a tentative offer to install and operate in the city of Des Moines a complete motor bus system, consisting of at least 154 buses of an average seating capacity of twenty passengers per bus.

After closely observing the intracity traffic of the present motor buses and traction lines now operating here, and estimating the amount of passengers that offer themselves for transportation, we find that the number is about 105,000 passengers in each day's operation at the present time, and as conditions improve, we will furnish all of the additional equipment necessary to give adequate transportation for the city of Des Moines at a fare of 5 cents from all outlying districts to the center of population as described on the accompanying map submitted to you, and issuing a transfer from transfer points at an additional charge of 2 cents, enabling a passenger to go from any part of the city to any other part of the city at a total fare of 7 cents. While we are basing these lines at the present time on general transportation lines now established, we stand ready to alter or to add additional lines as the necessity arises.

We also submit a survey of the operation, basing the costs of same on an experience acquired during the operation of over 7,000,000 miles.

Believing that the city should be recompensed for the use of such streets as the buses would operate over, and estimating the probable cost of the additional wear and tear on the pavements and streets of such routes, we would agree to recompense the city for such operations at the rate of $25,000 for each year of such operation. We also agree to clear the snow during the winter over our established routes sufficient to allow buses to operate during all weather conditions, and also agree to maintain a sufficient reserve to cover any just claims for personal injury or property damage that may accrue in our operation.



A SAMPLE OF BUS BODY NAMED APPROPRIATELY "STOCK CAR"

ANOTHER RELIC ENJOYING A NEW LIFE

Inasmuch as it is a very serious step for the city to enter into such a contract as we propose, and also a very large investment for those people interested in the installation of this system, we wish to have this considered a tentative proposition and would suggest that if you intend giving it your serious consideration, that we enter into the details, routes and other arrangements more definitely and perhaps work out a number of details in this problem to a more mutual conclusion, as we estimate the investment of this bus system to cost close to $750,000, including equipment necessary for the upkeep of such a large organization.

COMPARISON WITH RAILWAY SERVICE

The downtown district of Des Moines lies just about at the center of the 50 sq.m. included within the city limits. For this reason the mileage on practically all of the lines is unusually uniform, all lines radiating from the central district with no through lines and no cross-town lines. The average length of all the lines is 4 miles, giving an average round-trip distance of 8 miles. This characteristic of the city transportation system results in fairly short haul. The easy topography of the city, the fact that 85 per cent of the streets of Des Moines are paved and that the peak load is well distributed both morning and evening, also rather favor the possibility of providing the necessary transportation with buses. However, the handling properly of the rush-hour crowd presents a problem in a city of this size on which there is much well founded doubt that buses could possibly be adequate to the requirements. While the city authorities have apparently preferred to have transportation revolution rather than evolution, they have evidently been wise enough not to sign up any contract with a bus concern to supply the city's entire transportation needs. Of course such a franchise would have to be passed upon by the voters before becoming effective.

The normal base schedule of the Des Moines City Railway calls for seventy-nine cars, with fifty-three additional tripper cars during the rush hour. These 132 cars are so scheduled that 190 cars leave the downtown loop during the maximum hour. During this rush hour, on a certain day when the street cars and thirty-six buses were both operating, a total of 10,815 passengers were handled out of the loop. On the assumption that all of the passengers carried by both agencies had been carried on the street cars, the total square feet per passenger of street-car floor space provided was 4.2, each street car having 281 sq.ft. or a total for the 190 cars of 53,390. Assuming an average floor area of 74 sq.ft. for the buses in order to give an equivalent floor space of 4.2 sq.ft. per passenger with buses, it would have required 721 buses during the hour scheduled through the loop to handle the complete traffic of 10,815 passengers. This would mean that an equipment of 480 buses would be required, assuming a schedule speed and length of haul equal to that of the railway. When 132 street cars were provided to handle this load, they were not crowded, so that the comparison as indicating actual requirements that must be faced by the buses may be overdrawn. But even dividing the estimate by two, the result, 240 buses, would be a very long way from the estimate of 154 buses as made by Mr. Fay. The following additional data will be of interest in comparing the railway operation with the proposal of the bus men.

The average schedule speed of the railways including layovers, etc., was 9.5 m.p.h. In April of this year the operating expenses, including 3 per cent depreciation, were 34.62 cents per car-mile, and the passenger revenue, 35.01 cents. In June, because of greatly curtailed mileage on account of the partial shutdown of the power system, the operating expenses, including depreciation, were 42.21 cents per car-mile, and the passenger revenue, 47.09 cents. The revenue passengers per car-mile in January of this year were 5.60, in February 5.57, in March 5.05, in April 4.63, in May 4.91, and in June 6.16. These figures indicate very clearly the effect of the increasing jitney competition which began in January and the 60 per cent curtailment of car mileage which took place on May 23, due to power shutdown. For the first six months of the current year the revenue passengers per car-mile were 5.28 and the total passengers per car-mile 6.31.

A good idea of the earnings of the buses in Des Moines under competitive conditions; in other words, while the cars were running, may be had from the accompanying tables of data gathered from checks made on the days indicated this year.

The proposition of the bus company given heretofore might be compared with the statement of the engineers of another well known and competent truck manufacturer who appeared before the City Council and Chamber of Commerce and made the statement that if up-to-date bus service was provided with buses costing $8,500, the daily cost of operation for labor, maintenance and depreciation would be $41, and that on a 5-cent fare it would be necessary to haul forty persons each round trip for eighteen hours a day to earn this sum.

Several of the bus-owner drivers were talked to, and they seem to think they are making money now and

SURVEY OF BUS AND TRANSPORTATION PROBLEM AT DES MOINES, IOWA, SUBMITTED BY T. J. FAY

Average daily number of passengers carried on buses and traction lines		105,000
Number of buses necessary to carry 105,000 passengers per day at average of twenty-five passengers per round trip	140	
Additional equipment allowance of 10 per cent (replacing cars in repair shop)	14	
Total buses necessary		154
Note: (Due to the fact that there are portions of the day when the full equipment is not necessary, buses can be overhauled and repaired during this portion of the day, and the average operating efficiency should easily be at least 95 per cent.)		
Number of bus routes operating from center of city necessary to cover entire city		13
Average distance of each round trip		6 miles
Receipts per trip of twenty-passenger bus with average round trip load of twenty-five passengers		$1.25
Average revenue per bus-mile		20⅚c.
Number of trips per day necessary to carry 105,000 passengers at average of 25 passengers per round trip		4,200
Number of trips per bus per day		30
Average number of miles operated per day		25,200
Average number of miles per bus per day		180
Gross receipts per day carrying 105,000 passengers		$5,250
Transfers to be issued at additional price of 2 cents each, making cost of riding from one extreme limit of the city to the opposite city limit		7 cents
Ordinary fare from any part of city to center of city		5 cents
Estimating twenty-five passengers for each round trip, whereas seating capacity per round trip is forty (with additional 50 per cent standing room, or possible round trip capacity of sixty), it is possible with this equipment to carry an additional 25 per cent or a total of 130,000 passengers per day. This increase is allowed for periods of the day when there might be an unusual rush.		

SURVEY OF COSTS PER DAY FOR OPERATION OF 154 BUSES

Overhead (operating)	$856.80	
Depreciation (40 per cent a year)	767.12	
Insurance reserve (casualty)	154.00	
Total overhead		$1,777.92
7 per cent interest return on $700,000 investment		134.25
Maintenance:		
Gasoline	$587.16	
Oil	52.84	
Tires	690.00	
Shop repairs (labor)	65.52	
Parts, etc.	166.32	
Total maintenance		$1,561.84
Drivers' salaries		1,081.99
Total daily cost of operation		$4,556.00

RECAPITULATION

Gross receipts (105,000 passengers at 5 cents)	$5,250.00
Total operating cost per day: (154 buses making 4,200 trips per day at 6 miles per round trip or 25,000 miles at 18 cents per mile)	$4,556.00
Net profit per day	$714.00

plenty of it on a 5-cent fare, and will continue to do so even with the six-for-a-quarter ticket rate. They seem eager for the opportunity to demonstrate to the people of Des Moines that they can provide adequate service. Their most common remark is: "You give us a franchise and we will give you the service." Strange to say, they are asking only a one-year franchise, and on the strength of this declare themselves willing to purchase fine new buses and discard the present makeshift contraptions. Also, on the strength of such a franchise, they declare they had been assured of financing by one of the large manufacturers of trucks and farm implements. A franchise cannot be granted, however, without a vote of the people, which will require considerable time and there is much doubt that it would pass.

Causes of the Present Situation

The franchise under which the Des Moines City Railway has recently been operating is a twenty-five-year grant passed by the City Council Oct. 2, 1915, and approved by the voters on Nov. 22, 1915. The original franchise given to this company was dated Jan. 1, 1868, with a term of thirty years. From the date of this expiration in 1898 until the new franchise was started in 1915 the company was almost continually in the courts over a controversy as to whether the old franchise was actually limited to a period of thirty years or was in perpetuity. The supreme court of Iowa finally held that the franchise did expire on Jan. 1, 1898, and gave the company two years in which to secure a franchise or remove its tracks from the streets, but this legal battle and a belligerent attitude toward the people on the part of the old managements did much to develop an antipathy toward the company. It formed a good groundwork for the succeeding agitation of three of the four local newspapers and the politicians.

The new franchise entered into as late as 1915 rather surprisingly provides that:

> The maximum rate of fare for a single continuous ride within the limits of the city in one direction over any route of the company during the life of this franchise shall be 5 cents in cash. The company, in at least twenty-five convenient places within the city, shall sell to any person applying therefor six tickets for 25 cents. . . . The fare for children under twelve years of age shall be 2½ cents. On the payment of a 5-cent cash fare, the conductor will give the child a ticket which will be accepted as fare for another ride if presented by a child under twelve years of age. High school pupils on their way to and from school on actual school days between the hours of 7:30 a. m., and 4.30 p.m., shall be carried on tickets . . . sold in books at the rate of twenty for 50 cents. . . .

The franchise also provides that universal free transfer shall be issued, and a transfer upon a transfer. The company agreed to expend $1,500,000 for reconstruction, rehabilitation, new lines and extension, according to a specified itemization contained in the franchise, within a period of three years. In connection with the service to be rendered, the following clause quoted from the franchise is enlightening in analyzing the company's financial situation:

> As a guarantee of the service provided for in this section, it is agreed that no dividends on the outstanding stock of the company shall be considered or allowed in determining the quality, quantity or kind of service the company is bound and obligated to furnish under this ordinance; it being understood and agreed that subject to the payment of all costs of operation, including taxes and interest at not to exceed 5 per cent on the company's indebtedness represented by bonds, and not to exceed 6 per cent of the remainder of such indebtedness, and the setting aside of a depreciation fund as provided in Sec. 22 of this ordinance, the city is entitled to have and the company is bound to render the first class service as defined in this section.

The provision with regard to depreciation is that after the expiration of the first three years, the

> Company shall set aside and charge off a sufficient depreciation fund to cover replacement, renewals, new equipment and installations necessary to maintain the entire system and preserve the property of the company . . . in modern first class condition suitable for the carrying on of the business of the company.

There is a provision whereby the company agrees to arbitrate any difference which may arise between the company and the city or between the company and its employees. Another significant statement is that "the company, by the acceptance of this ordinance, agrees to continue to contract with its employees . . ."

The sale of stock and bonds is under the supervision of the city and "discounts upon bonds sold by the company shall not be added to the value of the property for any purpose." The company agreed to the purchase of the street railway property by the city upon six months' notice at any time during the life of the franchise. For this purpose it was agreed that the value of the property as of Aug. 1, 1915, was $5,000,000.

These few extracts from the franchise will be illuminating in reviewing the development during the last few years.

A common remark heard among business men and on the street in Des Moines is that the company has not lived up to its promises. This is possibly true as

DATA FOR SIX MONTHS ENDED JUNE 30, 1921, DES MOINES CITY RAILWAY

	Total	Per Car-Mile
Total passengers	17,561,809	6.31
Revenue passengers	14,649,652	5.28
Car-miles	2,781,734	1.00
Passenger revenue	1,110,267	39.91 cents
Operating expense, including depreciation	1,057,382	38.01 cents
Taxes	84,000	3.02 cents
Fixed charges	197,781	7.11 cents

REVENUE PASSENGERS PER DAY, DES MOINES CITY RAILWAY

Under Normal Service		Under Reduced Service	
Sun., May 8, 1921	62,646	Sun., July 24, 1921	50,390
Mon., May 9, 1921	74,962	Mon., July 25, 1921	54,565
Tues., May 10, 1921	79,248	Tues., July 26, 1921	55,683
Wed., May 11, 1921	77,975	Wed., July 27, 1921	52,857
Thurs., May 12, 1921	79,503	Thurs., July 28, 1921	50,689
Fri., May 13, 1921	74,526	Fri., July 29, 1921	54,779
Sat., May 14, 1921	92,595	Sat., July 30, 1921	55,884
	77,351		53,550

to work done, but not as to money expended. In fact the company has jeopardized its financial strength in attempting to carry out its promises. Instead of expending $1,500,000 in the first three years of the franchise for rehabilitation, extensions, etc., as agreed to in the franchise, the company actually expended $2,427,000, though failing, on account of the great increase in cost of equipment and materials, to carry out the full program of extensions and new lines by an amount which would now cost approximately $400,000 to complete. The company has also been unable to keep up with the paving requirements imposed upon it by the city by a considerable amount, though it has expended from $50,000 to $60,000 a year in paving maintenance alone. Then, as to the rate of fare, the company has also not lived up to its contract, but had it not been aided by the courts, the people of Des Moines would probably have been without transportation several months earlier.

The matter of wages has been very closely associated all along with the efforts made to secure an increase in fare, and aggravated by a very difficult labor situa-

tion. The present trouble first started when the company asked for an increase in fare to make possible the payment of increased wages awarded in arbitration. This went to a vote of the people in September, 1919, when a 6-cent fare was voted down. In January, 1920, the company went into receivership. A further wage arbitration awarded 70 cents an hour to the men, and as the company was unable to pay, the men struck. On the strength of a decision by the Iowa Supreme Court that a city had no right to fix the rate of fare, and in order to get the cars started, Federal Judge Wade ordered a 6-cent fare for adults to be put into effect on Aug. 23, 1920, the reduced rate for children and high-school students continuing as specified in the franchise. The additional revenue was to be applied to the payment of wages.

Finding itself unable to proceed longer on the 6-cent fare, the company applied to Judge Wade for a cut in service. A new schedule was drawn up and approved by the city supervisor and the date set to put it in effect. Corporation Counsel Byer then got an injunction against these schedules in the district courts. While there was some doubt as to the jurisdiction of this court, the company obeyed the injunction but again appealed to the Federal Court. The latter dissolved the injunction and ordered the district court to keep hands off. The reduced schedule was put into effect and the company ran along on this for several months until it became necessary to make a further cut in order to keep expenses within revenue. In December, 1920, Judge Wade appointed a master to make an investigation and recommend what would be a reasonable fare in order to put the company on its feet. After investigation the master recommended an 8-cent fare and an increase in the service by 1,800 car-hours per day. The company revised the schedule on that basis and on Dec. 23, at the order of Judge Wade, began the operation of 132 cars and the collection of an 8-cent fare with two tickets for 15 cents.

Then in January, 1921, having been defeated in its efforts to retain the 5-cent fare, the City Council opened the doors to jitney and bus competition, with the results related early in this article. The schedule of 132 cars remained in effect until May 23 of this year, when the court approved the petition of the General Electric Company to remove all equipment from three 500-kw. automatic substations and one 5,000-kw. generator, switching equipment, etc., from the power house, for which the manufacturer had not received payment. This made it necessary on that date to cut the service to sixty cars, which of course greatly aggravated the local transportation situation and served as a strong inducement for additional buses to start in business. The company continued operation on this basis, losing money rapidly, until midnight on Aug. 3, at which time all operation ceased as ordered by Judge Wade upon petition of the company. All through the difficulties numerous attempts were made and various plans proposed to bring about a settlement, but to no avail. Consequently, approximately 750 traction employees were thrown out of jobs, about 250 additional having been laid off when service was cut to sixty cars, and the city is without transportation save what can be supplied by an unorganized group of sixty or seventy heterogeneous buses. The railway company has discharged all employees, including trainmen, linemen, shopmen, barn forces, and sixteen out of thirty-four power house employees. The power plant has been continued in operation to supply energy for the Inter-Urban Railway and four small towns and mines and various other industries along the interurban right-of-way. The load on the power plant is now 17,000 kw. as against a normal load of 50,000-kw. Only the main department heads throughout the company have been retained on the payroll. In other words, the company is completely shut down, and some $8,000,000 worth of railway property is standing idle.

Economies from Use of Ball Bearings*

Mechanical Troubles Have Discouraged Electric Railway Men From the Use of Ball Bearings, but a Satisfactory Type Will Effect Large Savings

By J. T. PORTER
Master Mechanic Northern Texas Traction Company,

THE results from the use of ball bearings for the journal bearings of electric cars has been somewhat discouraging to the mechanical department of electric railway companies. Numerous mechanical troubles have developed, caused by poor workmanship, and the time and labor necessary for making wheel changes have been much greater than is necessary when friction type of journals is used. This latter condition is due somewhat to the truck design which is now employed.

COMPARATIVE COSTS OF OPERATION OF BIRNEY CARS EQUIPPED WITH BALL-BEARING AND FRICTION-BEARING JOURNALS, NORTHERN TEXAS TRACTION COMPANY, YEAR 1920

Cost to produce and deliver power to cars, per kilowatt-hour	$0.02
Using the test made at Beaumont as a basis of power consumed by both types of bearings, we arrive at the following conclusions:	
Cost per car-mile for power, ball-bearing journals	$0.0228
Cost per car-mile for power, friction-bearing journals	$0.0262
Mileage for Birney cars, year 1920	1,967,005
Cost of power used on Birney cars with ball-bearing journals	$44,847.714
Cost of power used on Birney cars if same were equipped with friction-bearing journals	$51,535.531
Actual saving in power during the year	$6,687.813
Saving per 1,000 car-miles	$3.40
Cost to remove, change bearings, change wheels and replace in car, inclusive	$8.71
Cost to replace worn or defective journal ball bearings, year 1920	$1,678.13
Cost per 1,000 car-miles to make changes of the seventy pairs of wheels changed in 1920, plus the cost to replace worn or defective bearings	$0.917
Saving per 1,000 car-miles, cost of wheel changes and bearing replacements deducted	$2.236

BALL BEARINGS VS. FRICTION BEARINGS FOR BIRNEY SAFETY CARS, BEAUMONT TEST

Power Consumption

Friction bearings, kilowatt-hours per car-mile	1.31
Ball bearings, kilowatt-hours per car-mile	1.14
Difference, kilowatt-hours per car-mile	0.17 or 14.9%

On a basis of 144 miles per day the ball bearings will save $89.35 a year. Considering the difference in price between ball bearings and friction bearing No. 218, the ball bearings would pay for themselves in two and one-half years.

Acceleration

Ball bearing, miles per hour per second	2.88
Friction bearing, miles per hour per second	2.58
Difference, miles per hour per second	0.30 or 11.62%

Free Running Speed

Ball bearing (maximum), miles per hour	25.2
Friction bearing (maximum), miles per hour	23 8
Difference, miles per hour	1.4 or 5.8%

Retardation from Maximum Speed

Friction bearing, miles per hour per second	3 13
Ball bearing, miles per hour per second	2.90
	0.23 or 7.93%

	Ball Bearings	Friction Bearings
Stop, seconds	8.20	7.43
Distance, feet	170.50	143.60
Retardation from 10 M.P.H.		
Stop, seconds	4.9	3.75
Stop, feet	52.38	35.88
Miles per hour per second	1.72	2.28

It is possible to obtain about 2 per cent higher schedule speed with ball bearings

The accompanying tables show the results of some tests made at Beaumont, Tex., on cars equipped with ball and friction type bearings and will serve to show the economies that can reasonably be expected.

*This is an abstract of the discussion presented by Mr. Porter at the interurban railway section of the Southwestern Electrical & Gas Association at its recent convention in Galveston.

Equipment and Its Maintenance

Short Descriptions and Details of New Apparatus of Interest to the Industry. Mechanical and Electrical Practices of All Departments

New Type Brake Slack Adjuster

Type of Slack Adjuster in Service for Several Years on European Railways Introduced to Railways of This Country in Connection with Safety Car Operation

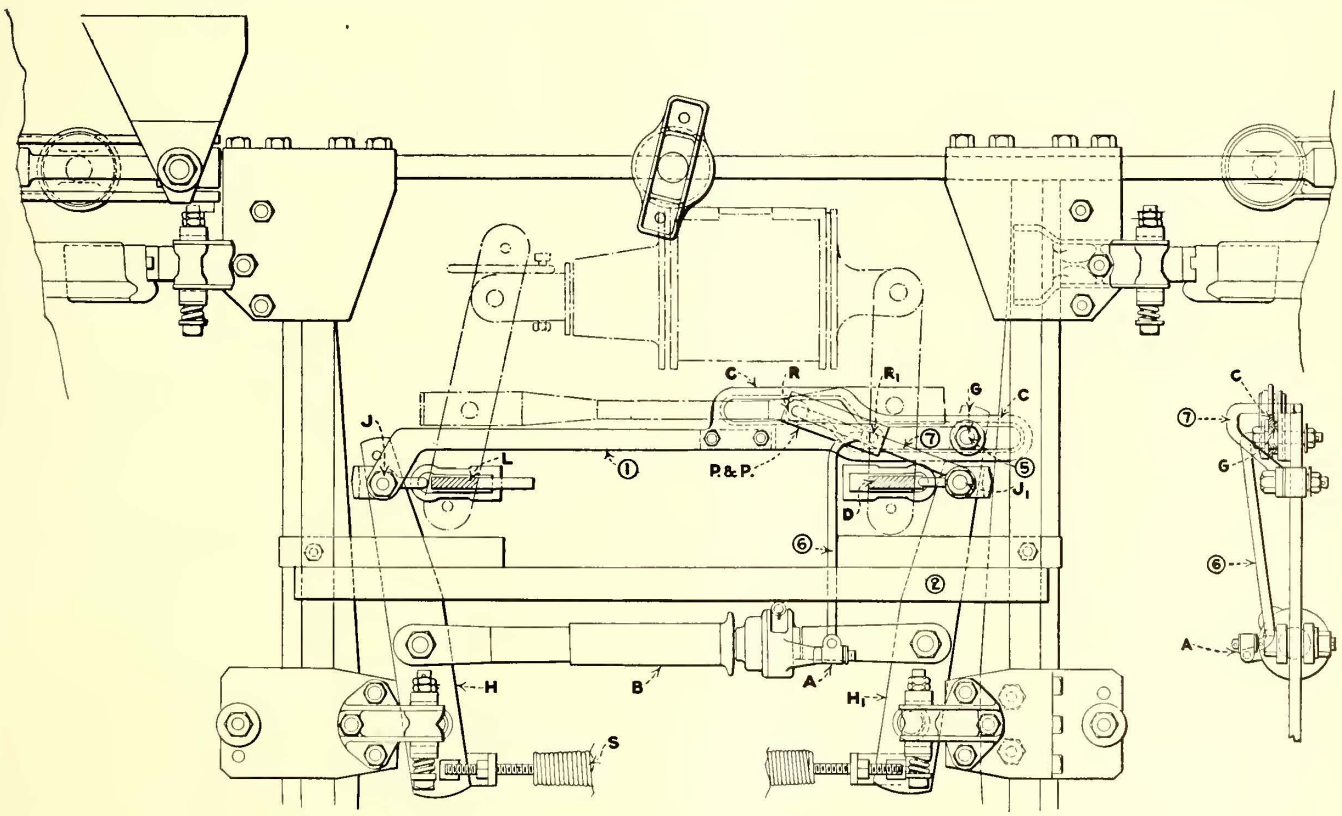
A TRIAL is being made on one of the safety cars of a large city electric railway system of a type of slack adjuster whose design and operation differ somewhat from others now in use in this country. This is known as the Durson slack adjuster and brake regulator. It has been used successfully on the railways of Sweden, Denmark, Holland and Switzerland, as well as on street railways of other European cities for several years.

The travel of the brake cylinder piston on cars equipped with air brakes may be considered as made up of three factors. First, the travel necessary to take up the shoe clearance and bring the brakeshoes into contact with the wheels if all adjustments are properly made; second, the travel necessary to take up any wear in the brake rigging or brakeshoes, and, third, the travel after the shoes are in contact with the wheels due to the elasticity of the brake lever system and the play in the journal boxes. The Durson slack adjuster differs in its operation from other types of slack adjusters now in use in that adjustment is automatically made for the second of these only; that is, the additional travel of the brake cylinder piston occasioned by wear in levers, fulcrum pins and brakeshoes, while no slack is automatically taken up for the travel necessary to take up the shoe clearance and to take care of the elasticity of the brake-lever system.

With the Durson brake regulator a certain predetermined minimum clearance between the brakeshoes and the wheels is fixed. Should there be any further slack due to wear of parts, wheels or shoes the adjuster comes into play and takes it up by the turning of a threaded shaft. When this point is reached the brake shoes touch the wheels at the same moment that the adjuster would otherwise begin to act and the friction moment in the screw thread due to tension in the brake rigging is then sufficient to overcome the frictional resistance in the adjuster clutch so that further working of the adjuster is stopped.

Installation and Operation of the Slack Adjuster

An accompanying illustration shows the Durson brake regulator connected in the brake rigging of a Birney safety car. The brake regulator *B* is placed between the horizontal brake levers *H* and *H*-1. Attached to these levers at *J* and *J*-1 is the bar 1, and to this is bolted



Slack Adjuster Connected in Safety Car Brake Rigging

the cam guide C, whose free end is held by means of a roller guide bolted to the horizontal lever H-1, which moves in the slot as the brake is applied and released. To the joint J-1 is attached the rod 7. The other end of this rod 7 passes through a roller R moving in the slot of the cam guide C. Two distance plates P and P-1, on either side of the cam guide C, transmit the motion to the roller R-1, which follows the motion of R and which in turn is connected by means of the rod 6 to the bracket arm A of the brake regulator. Upon the application of the brake, the rollers R and R-1 move along the slot of the cam guide C exactly as the distance between the joints J and J-1 is shortened. This motion is changed from longitudinal to transverse when the roller R-1 mounts the cam slot, and this operates the bracket arm A of the brake regulator.

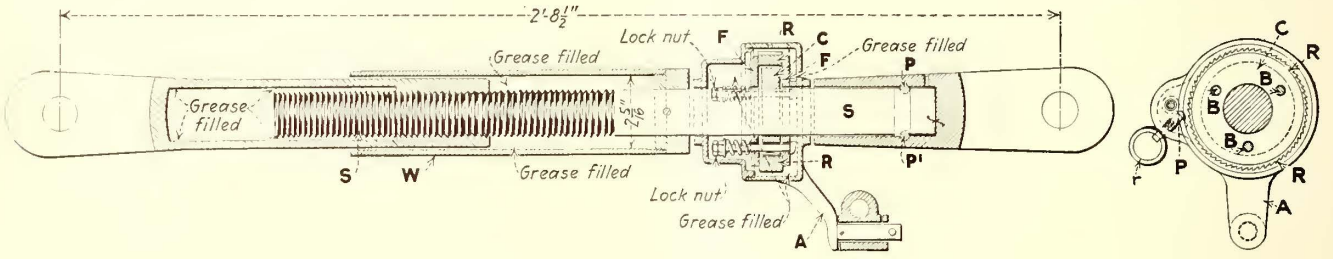
In order to obtain the proper uniform clearances and, therefore, the proper piston travel, the distance that the roller R-1 moves before it starts to mount the cam is regulated to come at the moment when the brakeshoes come into contact with the wheels. This immediately starts movement in the bracket arm A of the brake regulator and takes up the slack if any exists.

The brake regulator itself consists of a cold-rolled steel shaft S to which two end jaws are connected. These jaws are in turn bolted to the horizontal brake levers and form a connecting rod in the lever system. The shaft is attached to one jaw by means of two pins, P and P-1, engaging a groove in the shaft. As the thrust is taken up at the face f, which is finished, the only function performed by the pins is to prevent the jaw from dropping from the shaft when the apparatus is removed. The other end of the shaft has a triple left-handed thread, which screws into the other jaw. A collar C is welded to the shaft. On either side of the collar are two friction plates F, which are free to turn about the shaft. Three bolts B are set in holes which are drilled through the friction plates F and the collar C by means of which the motion of the friction plates F is transmitted to the collar C. Between the two friction plates F and revolving freely on the collar C is a circular ratchet R. Three springs, held in place by lock nuts, are adjusted to bring a desired degree of friction between the friction plates F and the ratchet R. Motion therefore of the ratchet R is transmitted through the friction plates F and the collar C to the shaft S unless the friction moment of the shaft S is greater than that between the friction plates and the ratchet R. In this case the ratchet R slides between the friction plates without imparting its motion to the shaft.

The ratchet, friction plates, collar and springs are inclosed in a grease-filled housing. The bracket arm A is a part of this housing and transmits the motion from the cam slot as already described. The pawl P is also connected to the housing as shown and engages the circular ratchet R when the bracket arm A is moved in a clockwise direction.

In operation, when the rod connecting the roller R-1 in the cam slot is moved in a transverse direction away from the regulator, it moves the bracket A in a clockwise direction. As noted, this motion is transmitted to the shaft and the revolution of the shaft in the female end of the hollow end jaw, which has a triple left-hand thread, causes the distance between the two jaws to be increased. This will take up any slack which may be present until the brakeshoes make contact with the wheels.

Tension then arises in the entire brake rigging, and when this occurs the friction moment between the screw shaft S and the female thread of the end jaw is greater than that between the friction plates F and the ratchet R. As a consequence further motion causes the slipping of the ratchet R between the friction plates F. A handle is used merely for the purpose of decreasing the length of the regulator when it is necessary to change brakeshoes. The pawl P is raised by means of the ring r, disengaging the friction clutch, and the regulator is easily screwed in to any desired length. The pipe W which is screwed and pinned to the handle 96 merely acts as a housing for the screw thread on the shafting. It slides along the hollow end jaw and has a clearance of but $\frac{1}{16}$ in. This hollow jaw, the pipe W and the center housing are all filled with a grease of such a consistency that it will neither melt in summer nor congeal in winter.



SECTION OF SLACK ADJUSTER

All moving parts of the Durson brake regulators are protected by grease-packed housings. They have been in use for years on the street railways of Copenhagen, Malmo and Stockholm, as well as on railway lines in the northern part of Europe. Conditions of snow and ice in these localities are very severe and prove the working qualities of the regulator under the most unfavorable circumstances.

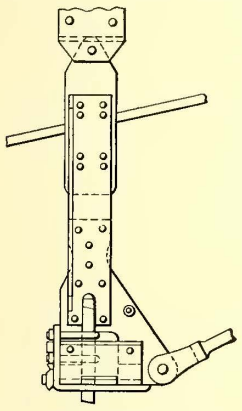
The only parts of the apparatus which are subject to wear are the friction plates and the circular ratchet. These surfaces are steel against steel. The construction of the regulator is such that even in case of an accident, it will continue to function as an adjustable turnbuckle until repairs can be made.

Spring Leaves Tempered Separately

In connection with the short article relating to the hardening of elliptic springs as published in the July 16 issue of the ELECTRIC RAILWAY JOURNAL, page 102, the statement was made that the sets of leaves were bunched together and heated in an oil-fired furnace. This is in error in that the leaves are tempered separately and then assembled and banded. Also the furnace is coke-fired instead of being oil-fired, as previously stated.

Cutting Device for Asphalt Pavement

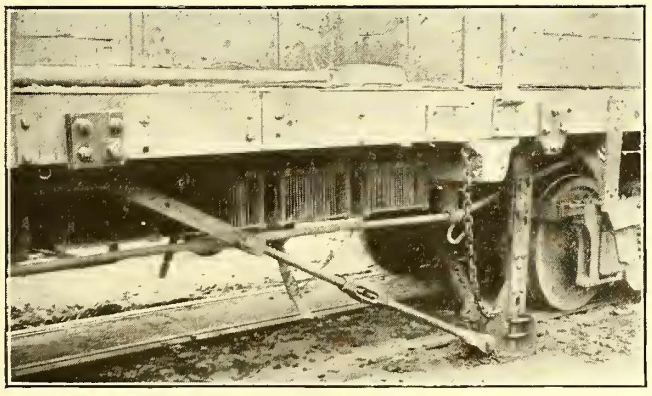
AN ATTACHMENT which can be put on any ordinary work car has been devised by the Market Street Railway of San Francisco for making a cut 1½ in. deep in asphalt pavement along the track. The cut can be made as the car moves along at a rate of 4 to 5 m.p.h. In addition to the saving in cost, a great advantage claimed for this device is its speed of operation. It has been used without interfering with the traffic on lines where service was being maintained on a three-minute headway. The method has been so successful that it has been adopted as standard throughout the system and no more pavement cuts along the track are being made by hand on reconstruction jobs.



FRAMEWORK FOR CUTTING TOOL

The cut is made by a tool which projects downward from a shoe carried by a work car and set to ride on the pavement at 18 in. or 24 in. from the rail head. The framework supporting the shoe consists of struts attached to the car at three points by means of pins and suitable mountings on the car body. The framework supporting the shoe can be attached to the mountings in about fifteen minutes. Once fastened in place, hinged joints make it possible to swing the device up out of the way under the car body, where it is held by hooks until the car arrives at the point where the work is to be done. The apparatus is so arranged that it can be used not only while the car is moving ahead in the usual direction of traffic, but also in the reverse direction by turning the apparatus around. This operation requires only about ten minutes

When ready to begin cutting it is only necessary to unhook the framework and swing it down so the shoe rests on the pavement. In this position the strut which thrusts the cutting tool down into the pavement is not yet vertical nor does it carry any weight. When the car moves forward a few inches, however, the hinge in the strut opens still wider, the strut takes a vertical



PAVEMENT CUTTING TOOL IN OPERATION

position and, as it tilts the car body 2 or 3 in. out of plumb, takes a considerable weight off the car springs and the cutting tool sinks into the asphalt. The car can then move forward at a rate of 4 to 5 m.p.h. leaving a clean cut in the pavement. The depth of the cut can be adjusted by changing the bolts which attach the tool to the shoe; the usual depth is 1½ in. and the width ¾ in.

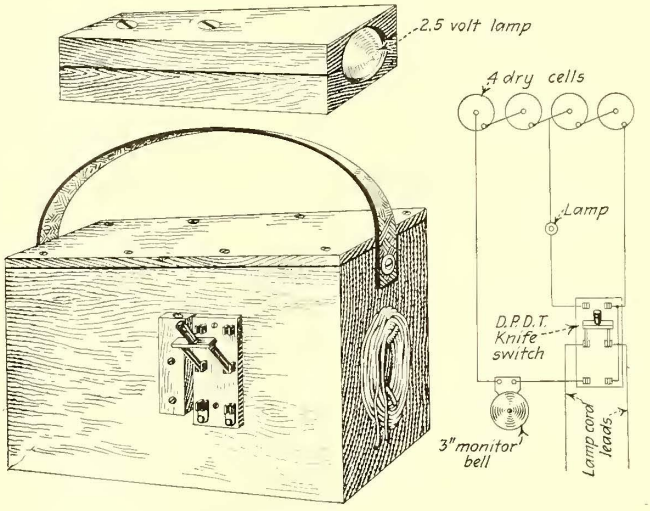
When cutting pavement in very cold winter weather it is sometimes necessary to put a load on the car to prevent the cutting tool from "riding" on the pavement surface. It was found that the best cutting tools were those forged from old carbon steel gads. These were superior to high-speed steel. The tool becomes dulled and requires to be replaced after cutting about 600 ft. in the summer time or 300 to 400 ft. in the winter time.

The design of the cutter was worked out by W. D. Chamberlin, principal assistant engineer. B. P. Legare is engineer of maintenance of way.

Convenient Test Box

MOST shop men are familiar with some form of bell box or test and inspection box, which they use for testing out connections, locating trouble and ringing out circuits. It is sometimes more convenient to use a light for indicating when the circuit is closed than to rely on the ringing of a bell or buzzer. The box illustrated which provides for both a light and a bell has been found very convenient for this work.

The box on which the various testing apparatus is



CONNECTIONS FOR TEST BOX

mounted and in which space is provided for four dry cells is made of ⅞-in. wood, and is 6½ in. x 9 in. x 11 in. in size. A cleat of sufficient size so that approximately 30 ft. of lamp cord can be conveniently wound up is fastened to one end of the box. The opposite end forms a convenient place for mounting the bell. A double pole double throw switch is necessary for cutting out either one or the other of the circuits which is not in use and the light can be located in a convenient position adjacent to the switch.

As test boxes are sometimes submitted to hard usage, it is desirable to protect the light in some manner. A satisfactory method has been found to mount the lamp in a block of wood about 1 in. square and 3 in. long, with a hole drilled in one end large enough to receive a small 2½-volt lamp. For convenience in mounting and connecting, the wooden block should be sawed in half and the wires from the lamp sockets can come out of two holes at the opposite end. By screwing the two halves together, all are protected. A leather handle for the top of the box is also a convenience for carrying. The accompanying illustration shows a form of box for this use, together with a wiring diagram for connecting four dry cells, so that all four will be used for ringing the bell and two of them for the lamp circuit.

News of the Electric Railways

FINANCIAL AND CORPORATE :: TRAFFIC AND TRANSPORTATION
PERSONAL MENTION

Another Park Planned

Philadelphia Rapid Transit Sees Money-Making Opportunity in Burd Home Tract

The Philadelphia (Pa.) Rapid Transit Company has made plain its purpose in purchasing the so-called Burd Home property in Delaware County. It is contemplated by the company to use the property as a public park and playground. The tract acquired consists of thirty-two acres lying west of the city limits. It was taken over in the interests of the Willow Grove Park Company, operating Willow Grove Park. The opinion of T. E. Mitten, president of the railway, is that the operation of the now proposed Burd Home Park will not lessen the attendance at Willow Grove because there are more people desirous of this kind of entertainment than both of these parks can supply.

New Park Has Many Advantages

The Burd Home Park will be operated through the Willow Grove Park Company, to which the Philadelphia Rapid Transit has advanced $340,000 to make a down payment upon the land at Burd Home Park. It is explained that this sum is expected to be repaid during 1922 from the sale of the street frontage of the Burd Home Park and from the earnings of Willow Grove Park.

The Willow Grove Park Company's further indebtedness consists of $75,000 due in 1924 and $239,500 due in 1925. Both of these amounts are secured by purchase money mortgage upon the Burd Home Park property and the opinion of the management is that they can easily be paid from the future earnings of Willow Grove Park.

Willow Grove Park Now Pays

This proposal by the company to start a new park naturally has directed attention to the activities of the company at famous Willow Grove Park. This latter park, known all over the country, was opened in 1896, and up to the time of the coming of the Mitten management in Philadelphia had always been a loser. In 1910 it was operated at a loss of more than $25,000. The former management of the railway in 1910 made new long-term contracts with concessionaires for the control of all of the principal attractions. The railway did not receive sufficient revenue from the amusements to pay the cost of the music, the policing and the administration of the park.

The Mitten management at once directed itself to making Willow Grove Park self-supporting by a more effective administration. This has been accomplished with such effect that Willow Grove Park during the ten years, 1911 to 1920, earned a net income of $444,117. At the beginning of the 1921 season the Willow Grove Park Company purchased for $125,000 from the Ryan Amusement Company all of its amusements and buildings representing an investment of $320,000, which the concessionaire had a right to remove under his contract expiring in 1920 and 1921. The operation of these purchased concessions will, it is estimated, produce $125,000 of net earnings for the year 1921.

Mr. Mitten anticipates that Willow Grove Park should in 1922 and thereafter earn a net income in excess of $200,000 per annum. He is frank to say, however, that Willow Grove Park as a revenue producer for the Philadelphia Rapid Transit by way of added passengers carried has always proved a disappointment because of the cost of operating the long lines over the extreme grades encountered on the York Road and Glenside routes. With its present 7-cent cash fare with four tickets for 25 cents, with the added zone outside the city limits, the company is, however, now earning sufficient on the York Road and Glenside lines for them not to be a burden on the rest of the system.

Indianapolis Company May Contract with City

Regulations under which the Indianapolis (Ind.) Street Railway shall operate, in the place of those specified in the franchise which the company surrendered several weeks ago, may yet be fixed by a contract between the city and the company.

Dr. Henry Jameson, chairman of the board of directors of the company, called on Mayor Jewett recently and before he left the City Hall he said the company had never taken the stand that it would not agree to a contract arrangement.

Samuel Ashby, Corporation Counsel for the city, and other city officials have understood since the last conference between the company officers and city officials that the company would not agree to the contract method of fixing the regulations.

Since the last conference, the jitney bus problem has become acute, and the company has asked the City Council to pass an ordinance regulating jitney bus competition. Some Council members, however, felt that the company should come to some agreement concerning regulation by the city before action was taken in regard to the jitney bus situation.

The city officials have felt that the contract method would be the best policy, both for the city and for the company.

Report Against Radials

Ontario Commission Reports Adversely Upon Great Transportation Project —Government Policy Fixed

An adverse report on the project for constructing and operating a number of electric railways by the Ontario Hydro-electric Commission, through an issue of bonds guaranteed by the government, has been made by the commission which was appointed by the provincial government to investigate the matter.

Decision against the construction of additional lines and development of the "radial" system is based on the present financial situation in the electric railroad industry generally, possible competition with the Canadian National Railways by paralleling lines and the desirability of testing the effect of highway development before undertaking a program of electric railway building.

The reasons that were cited were as follows:

> The financial condition of electric railways in Ontario and the United States has been precarious and unsatisfactory and the outlook discouraging; the evidence submitted indicates that the proposed electric railways would not be self-supporting. Their construction paralleling and competing with the Canadian National Railways system would be economically unsound, and a serious blow to the success of government ownership. Until the Chippawa power scheme, estimated to cost $60,000,000 or upward, is completed and shown to be self-supporting, the government would not be justified in endorsing the construction of an electric railway system at an initial estimated cost of $45,000,000.
>
> The endorsement of bonds by the province for systems of electric railways at the instance of the municipalities concerned is held highly dangerous and likely to lead the province into great financial difficulties, as it would give rise to demands for like accommodation from other localities which it would be hard to refuse. The expenditure of $25,000,000 on public highways in the province having been begun, it would be unwise to commence the construction of electric railways until the effect of highway improvement has been ascertained and the use of them by motor cars and trucks made clearly apparent. The rapidly increasing debts and financial commitments of the Dominion, Province and municipalities have aroused well-founded apprehension and are a cogent reason against the embarkation in the construction of the contemplated electric railways.

The report is signed by four of five members of the commission: Judge Sutherland, the chairman; General C. H. Mitchell, W. A. Amos and A. F. Macallum, C. E. The minority report by Frederick Bancroft, labor representative, controverts most of the conclusions arrived at in the majority report, recommending that the government should adopt the principle of publicly owned and operated electric railways. He states that unemployment conditions should be taken seriously into account and that the hydro-radial development would bring considerable relief.

It is anticipated that the report has determined the policy of the Drury Government with respect to the project.

Interurban Objects to Relocating Tracks

The Columbus, Delaware & Marion Electric Company, Columbus, Ohio, has filed in the Ohio Supreme Court its answer to the orders of the state highway commissioner and the county commissioners of Franklin County requiring it to move its tracks from the right-hand side of the road to the opposite side while the stretch of highway between the north corporation line of Columbus and the village of Worthington is being improved. The ouster petition was entered by the Attorney-General..

The company charges that the Ohio state highway commissioner, among others, ignored the proposal of the state board of administration to furnish prison-made paving brick at $33.50 per thousand and awarded a contract for brick to a private concern at an increase in price of 30 per cent.

Claims are also set up that the commissioner failed to award the contract for the improvement of the highway within the ten-day period allowed by law; that the improvement was contracted for by the commissioner without the approval of the state highway advisory board—since abolished under the Ohio reorganization code, which became operative July 1—and that the commissioner had been enjoined from proceeding with the improvement through injunction proceedings brought before the Franklin County Common Pleas Court and allowed by that tribunal.

The stretch of road to be improved is one of the most important arteries of travel leading to and from Columbus and is located north of Columbus. The Attorney General's suit was brought to compel the railway to move its tracks temporarily in order to permit the improvement to be made.

Engineer's Supplemental Report Presented

Mr. Ballard, the valuation expert for the city of New Orleans, La., in connection with the negotiations between the city and the New Orleans Railway & Light Company, presented his supplemental report on Aug. 13. Neither he nor the Commission Council would disclose the contents of his findings. Mr. Ballard intimated, however, that the recommendations made by him are in line with terms the Council believes the railway will accept. The Council was to confer on the report on Aug. 15.

The Council at its meeting on Aug. 9 appointed Wylie M. Barrow, special counsel in the injunction proceedings instituted by the receiver of the New Orleans Railway & Light Company. The suit was brought against the city, in the federal court, to restrain it from interfering with the collection of an 8-cent fare by the railway.

The appointment was made at the request of City Attorney Kittredge, who stated that the appointment of some one well versed in public utility matters as an aid to him in the conduct of the case was urgently needed, and that Mr. Barrow, as assistant to the Attorney General of the States and now acting as counsel for the State Railroad Commission, would be of service in the litigation pending before Special Maste Chaffe, recently appointed by Judge Foster to hear the evidence in the suit.

10 Per Cent Wage Cut in Dallas

The Dallas (Tex.) Railway has announced a reduction of 10 per cent in the pay of all motormen and conductors and employees in the mechanical and track departments of the company. Richard Meriwether, vice-president and general manager, declares that the reduction was made necessary through failure of the company to get a 7-cent fare from the city and the falling off of about $800 a day in revenues of the company. The reduction affects about 1,000 men and will clip something like $8,000 a month from the company's payroll.

The action was decided on after conferences with the employees, in the course of which the employees agreed to accept the reduction without protest. Platform men who have been receiving from 46 to 50 cents an hour, on two-man cars, and 50 to 54 cents an hour on the one-man cars, will get 5 cents an hour less under the new scale. Salaries of office employees who are paid by the month will also be reduced 10 per cent.

Wage Cut Negotiated in Denver

Negotiations between the receiver of the Denver (Col.) Tramway and the representatives of the employees looking toward a wage readjustment were concluded on Aug. 9, when the latter accepted the proposition submitted to them. The new scale became effective on Aug. 16 and is to continue for a period of nine months: The former rates and the new platform wage scale in cents per hour follow:

	Old Rate	New Rate
First three months	53	45
Next nine months	56	47
Second year	58	50
Third year and thereafter	—	52

Present trainmen in the employ of the company for less than three months will receive, after the effective date, the second year rate or 50 cents an hour until the expiration of their respective three-months' period and thereafter the maximum rate of 52 cents an hour.

All other trainmen now in the service of the company will receive, after the effective date, the maximum rate or 52 cents an hour.

Trainmen entering service on or after Aug. 16 will receive the lowest rate in the wage scale.

A bonus system, based upon performance, is to be worked out by the employees, representatives and the management under which trainmen will be able to increase their monthly wage somewhat.

Reductions in the wage scales of all other hourly paid employees, corresponding to the reduction in the trainmen's scale, were also made effective on Aug. 16.

12 Per Cent Wage Cut in Haverhill

The pay of the 300 employes of the Massachusetts Northeastern Electric Railway, Haverhill, Mass., will be reduced 12 per cent, under the decision of the Arbitration Board filed Aug. 11.

When the wage agreement expired on May 1, the employees sought a continuation of the old rate of 60 cents an hour, and the street railway officials, through President David A. Belden, requested a cut of 10 cents.

P. F. Sullivan, ex-president of the Bay State Street Railway, Thomas H. Mahoney of Boston and James H. Vahey were appointed as arbitrators. The finding is signed by Messrs. Mahoney and Sullivan, with a dissenting opinion by Mr. Vahey.

The new scale is retroactive to May 1, and the new 54 4-5 cents per hour will continue in effect until May 1, next.

Arthur G. Wadleigh, one of the public trustees of the Eastern Massachusetts Street Railway, appeared as counsel for the Massachusetts Northeastern.

Columbus Company Struggling Against Opposition

The troubles of the Columbus Railway, Power & Light Company, Columbus, Ohio, in its efforts to comply with the orders of the City Council to extend its lines to the suburb of Shepard are not yet over. Condemnation proceedings brought by the railway in the probate court of Franklin County, following unsuccessful negotiations with the Columbus, New Albany & Johnstown Traction Company to buy that company's line, extending from Columbus to Shepard, a distance of 1½ miles, have been held up by suit brought by the interurban railway, attacking the jurisdiction of the probate court.

The Franklin County Appellate Court, in which the injunction proceedings were brought by the Columbus, New Albany & Johnstown Traction Company decided against that line and in favor of the probate court, and the defeated traction company now seeks admission to the Supreme Court.

Its petition filed in the Ohio high court a few days ago attacks the judgment of the Appellate Court, and holds that the State Public Utilities Commission alone has jurisdiction.

Before and After—In Chicago

What Chicago was fifty years ago in the days of horse-drawn rigs and what she is today with all the conveniences and luxuries which electricity can supply, is told in a recent pamphlet published by the Illinois Committee on Public Utility Information. "Chicago's Genii, The Public Utilities," reviews some historical data concerning the growth of the electric light, power and gas service in this great city. One of the best examples of Chicago's Half Century Miracle is the electric railway system which ranks first in the number of miles of tracks, number of cars and the number of passengers carried.

Developments Being Awaited

Detroit United Railway Makes No Moves to Comply With Recent Ouster Ordinance

Although important developments have been expected in Detroit relative to the railway situation since the ordinance was passed by the City Council, requiring the Detroit United Railway to remove its tracks from Fort Street and Woodward Avenue, no move has been made by the company toward complying with the ouster, and the company's contention still stands that the price named by the city for these lines will not be accepted.

Construction Work Going Ahead

Construction work on the municipal ownership lines is being carried out according to schedule, and the Charlevoix-Mack-Buchanan crosstown line has been extended about 2 miles and ten cars added. Other sections of the municipal lines will soon be in operation, according to Joseph S. Goodwin, general manager of the system. The extension of the crosstown line is the first since crossings were installed at intersections with the Detroit United Railway tracks and other railroads according to the plans authorized by the Michigan State Public Utilities Commission.

It was announced by the city officials that the extension of the municipal crosstown line increased the receipts from the system about 25 per cent. A statement of receipts and expenditures of the municipal lines for the first six months in 1921 is to be issued by the City Controller's office as soon as all power bills for the operation of the lines are received.

Mayor Couzens is negotiating with the Ontario Hydro-Electric Power Commission for electric power from the commission's Niagara development to operate the municipal lines in Detroit. Niagara power is already being used across the Detroit River in Windsor.

Ouster Ordinance Attacked

The starting of petitions calling for a referendum on the ouster ordinance has been intimated as the first move in a plan to terminate the Fort Street and Woodward Avenue ouster and to have the existing municipal lines operated by a private company. The plan is backed by a number of business men, many of them located on the two lines in question. The plan provides for the submission of two questions to the voters.

It is cited that under the referendum clause of the city charter, an ordinance passed by the City Council, such as the ouster ordinance, must be submitted to a vote of the people on presentation of a petition signed by 10 per cent of the voters. The other proposed action is an initiative ordinance repealing the municipal street railway ordinance, approved by the voters on April 5, 1920. The lease of the lines to a private company is proposed.

The reasons given by the proponents of the plan include the belief that the city's interest can best be served by halting the expenditure of city money for street railway purposes and by providing some feasible solution of the traction problem. In event of the filing of a petition providing for the referendum of the ouster ordinance, the ordinance, it is cited, will be automatically suspended until the city clerk has certified as to the number of signatures on the petition. If sufficient signatures have been obtained the ouster ordinance cannot become effective until after the ordinance has been ratified by the voters.

Montreal Cut Put Into Effect

Developments in the Montreal (Que.) Tramways wage situation have followed a quiet course. On Aug. 16 the company put into effect its announced reduction of 12½ per cent. This cut it substituted for the 20 per cent reduction first proposed, against which the union representatives protested, contending for a reduction of only 10 per cent. The employees, of course, will not feel the effect of the cut until they receive their half-monthly pay checks on Aug. 31.

The company having failed to nominate a representative on the board of arbitration for which the employees applied to the Federal Department of Labor, the Department has appointed A. P. Frigon, a Montreal bond dealer, to act for the company. The men's representative, A. Brossard, a Montreal lawyer, will confer with Mr. Frigon with a view to choosing a third arbitrator, and if they cannot agree upon a nomination, the Department of Labor will select the third man.

The employees will remain at work under the reduced scale, pending the outcome of the arbitration. Under the Canadian legislation covering industrial disputes affecting public utilities, neither party is obliged to accept the award of an arbitration board, but the delay secured is a check upon rash action, and public opinion, based upon the presentation of both sides of the case before a properly-constituted tribunal, is generally a strong factor in bringing about ultimately an amicable settlement.

Wages Reduced 6 Cents an Hour

A new wage agreement with the platform men of the San Francisco-Oakland Terminal Railways, Oakland, Cal., went into effect on Aug. 1. The new scale follows:

Traction Division — First three months, 46 cents an hour. Next nine months, 49 cents an hour. Second year and thereafter, 53 cents an hour.

Key Division—First three months, 48 cents an hour. Next nine months, 51 cents an hour. Second year and thereafter, 55 cents an hour.

This scale was incorrectly given in the ELECTRIC RAILWAY JOURNAL, issue of July 30.

News Notes

Suburban Strike Settled.—The strike on the Syracuse & Suburban Railroad, Syracuse, N. Y., which has been in force two weeks, was ended on Aug. 16, and C. Loomis Allen, general manager of the road, accepted the offer of the men to return to work at a wage schedule of 45 cents an hour. The men struck when they quarreled with officials over terms of an impending arbitration agreement.

No Wage Cut at Present.—Officials of the Indiana Service Corporation, Fort Wayne, Ind., will not take up the matter of a wage cut on the city lines before the middle of September. President Feustel has announced that although the matter of a cut had been considered, a promise had been made to the employees that no such action would be taken definitely until the middle of September and the company has stated that it will hold to its promise.

City Won't Appropriate Money.—The new transit commission of New York City is unable to carry out its plan for the completion of transportation facilities owing to the city's holding up thirty-one contracts. At a recent meeting of the Board of Estimate the Mayor refused to have read the commission's request for approval of the urgently needed improvement. It was stated at the transit commission's office that the construction could not be started now until next spring as the Board of Estimate had adjourned its regular sessions until Sept. 30.

Compromise in Macon.—Trainmen of the Macon Railway & Light Company, Macon, Ga., have agreed to a wage cut of 4 cents an hour. The company wanted to cut the wages 6 cents an hour but agreed to compromise on 4 cents. The new scale ranges from 36 cents an hour for beginners to 49 cents for those who have been in the service for more than a year. The new agreement was signed by the men on Aug. 3. It will be binding for one year. The company's business has decreased 20 per cent during the past year compared with the previous year.

Vacation Issue Advanced Again.—In the wage adjustment of the platform men of the Community Traction Company, Toledo, Ohio, the two weeks' vacation with pay was given up by the men. After the election of a new business agent of the union, however, the men asked for re-opening of the vacation issue. The new agent claims that the men didn't understand what they were voting for when they approved the contract which eliminated the vacations. It is doubtful whether anything can be done at this date on the vacation issue. The contracts are signed and the action taken was carried out in accordance with the union rules.

Financial and Corporate

Merger in Indiana

Utilities Serving Seventeen Counties to Be Brought Together Under One Head

Seven Indiana utilities propose to consolidate as the Indiana Electric Corporation. Authority to carry out the plan is asked in a petition which was filed with the Indiana Public Service Commission. There will be a public hearing before the Public Service Commission to give the commission information concerning the proposed merger. Articles of incorporation for the corporation, capitalized nominally at $10,000 have been filed in the office of the Secretary of State

The companies involved in the merger are the Merchants' Heat & Light Company, Indianapolis; the Indiana Railways & Light Company, Kokomo; the Elkhart Gas & Fuel Company; the Valparaiso Lighting Company; the Wabash Valley Electric Company, Clinton; the Putnam Electric Company, Greencastle, and the Cayuga Electric Company. The companies serve seventeen counties.

It is the ultimate intention of the men backing the enterprise to locate a power house on the Wabash River in Vigo County, probably north of Terre Haute, at an expenditure of several millions of dollars and to connect it with a system of transmission wires which will deliver electric current from the Indiana coal fields to many parts of the state. A triangular transmission line 300 miles long would distribute the current, one line extending from the central plant to Kokomo, another to Indianapolis and the third from Kokomo to Indianapolis.

The incorporators of the Indiana Electric Corporation are Joseph H. Brewer, Grand Rapids, Mich., president of the Merchants' Heat & Light Company; Charles O'Brien Murphy, vice-president and general manager of the Merchants' Heat & Light Company; Paul D. Birdsall, secretary of the Merchants company; Lex J. Kirkpatrick, Kokomo, vice-president of the Indiana Railways & Light Company; Marshall V. Robb, Clinton, secretary of the Wabash Valley Electric Company. The board of directors is made up of the incorporators. Mr. Brewer is president of the board of directors, Mr. Murphy is vice-president and treasurer, Mr. Kirkpatrick is a vice-president, and Mr. Birdsall is secretary.

The plan of financing embraces the acquisition of the various properties by issuing $4,000,000 in common stock and $1,850,000 in 8 per cent preferred stock; by issuing $3,250,000 in 7.5 per cent fifteen-year first and refunding bonds; by issuing $2,250,000 in 7.5 per cent seriel bonds maturing within fifteen years; by issuing $750,000 in one-year 8 per cent notes.

The bankers concerned in underwriting the securities of the new company are Halsey, Stuart & Company, the Harris Trust Company, and Paine, Webber & Company, all of Chicago.

It is planned to have the Indiana Electric Corporation acquire all the properties of the merged companies free from all liens. The petition for authority to complete the merger plan sets out that a sum of $600,000 will supply sufficient capital necessary for the efficient and economical operation of the utilities owned by the various corporations.

Ohio Electric Segregation Approved

Federal Judge John M. Killits at Toledo has issued an order returning auxiliary lines operated by the Ohio Electric Railway to independent control and absolved the Ohio Electric of all liens, demands and claims for rental by the subsidiary companies.

The order was issued after an agreement had been executed by the receivers for the Indiana, Columbus & Eastern Traction Company, The Columbus, Newark & Zanesville Electric Railway, and the Fort Wayne, Van Wert & Lima Traction Company.

B. J. Jones was appointed receiver for the Ohio Electric on Jan. 26. He asked for separation of the companies on June 15.

Judge Killits also approved a contract entered into by J. Harvey McClure, receiver for the Indiana, Columbus & Eastern Traction Company, with Day & Zimmerman, Inc., Philadelphia, who will operate the road. The engineering company will receive $1,000 a month and expenses as compensation.

Adrian Lines May Suspend

Discontinuance of service on the Adrian (Mich.) Street Railway, a Doherty property, is threatened on account of a boost in the price of electric current by the Toledo & Western Railway effective on Aug. 20.

The railway officials claim that the Adrian lines have been losing money for some time. An increase in fare from 5 to 10 cents about a year ago failed to make up for the loss of patronage by the growth of automobile travel.

The city lines have always paid about $2 a car per day for power service from the Toledo & Western, but this line is in the hands of receivers and has raised the price of energy.

It is said that the Adrian property, if junked, would net owners about $30,000. This is the price asked for the line.

There is a possibility of the city buying the line.

Financial Authority Points Out D. U. R.'s Weak Spots

Lack of a comprehensive financing plan and "absentee ownership" are pointed out by the *Wall Street Journal* as the weak spots in the financial structure of the Detroit United Railway. The article, critical of the Detroit United Railway, appeared in the issue for Aug. 16.

An official of the Street Railway Commission is quoted as estimating that the Detroit United will be eliminated as a city transportation medium in Detroit within five years.

The *Wall Street Journal* considers the company's interurban lines "the largest and, perhaps, the most strategically stiuated in the country." It apparently sees in them the hope of the company for the future, for it says that "freed of political bickerings and expensive local campaigns the company, it is expected, will be in a more satisfactory position as a strictly interurban carrier."

Despite the arbitrary attitude of Mayor Couzens with respect to the very low price which he has fixed for the Woodward and Fort Street lines of the company the *Wall Street Journal* is of the opinion that "payment for lines taken over will finally of necessity be based on a just estimate of their value." In conclusion the paper says:

> There have been two weak points in Detroit United's financial structure—lack of a comprehensive financing plan and "absentee ownership." Practically all stock is held outside Detroit, much of it in Canada. It is not impossible that after the present political trouble is settled the company may find it advantageous to offer stock to Detroiters. The 7 per cent notes are due in 1923 and other obligations mature up to 1932. It is understood that a definite program is being worked out to provide for this situation.

Monongahela Stock Sells Well

The sale of preferred stock of the Monongahela Power & Railway Company, Fairmont, W. Va., which was started on May 16, 1921, has greatly exceeded expectations. To date the company has sold 18,746 shares, the par value of which is nearly $470,000. The shares which have been sold to old stockholders number 11,583 and there have been 7,163 new stockholders since the sale began.

The stockholders who bought their shares before June 25 have had their quarterly dividend checks mailed to them. The dividend is at the rate of 6 per cent per annum on the par value of the stock or nearly 8 per cent on the amount paid for the stock.

The additional stock has been sold largely throughout the territory where the company operates, that is to say, in Fairmont, Mannington, Clarksburg, Weston, Shinnston, Philippi also in Parkersburg and other places in that vicinity.

The company attributes the splendid success of this sale to the fact that it is the first opportunity that local people have had to become shareholders in the company. Under an arrangement which makes the acquisition of shares particularly attractive.

Suspension and Receivership in Saginaw

Failure to Curb Jitneys and to Grant Fare Relief Throws Line Into Bankruptcy

Since midnight of Aug. 10 citizens of Saginaw and Bay City, Mich., have been forced to rely entirely upon jitneys for their transportation, for at that time the cars of the Saginaw-Bay City Railway were put into the carhouses. On that day the company asked for a receiver and placed itself in bankruptcy. The proceedings took place in Bay City before George A. Marsten, referee in bankruptcy for the United States district court of the Eastern District of Michigan, Judge Arthur L. Tuttle of this court being out of the district. Otto Schupp, president of the Bank of Saginaw, was named receiver to conserve the property pending the appointment of a trustee.

THE petition in bankruptcy was filed by the Commonwealth Power, Railway & Light Company as the heaviest creditor, Booth & Boyd Lumber Company, Saginaw, and the Jennison Hardware Company, Bay City. The Commonwealth Company is also the owner of the bankrupt corporation.

The railway owes the Commonwealth Company $1,415,509 for money advanced as loans to pay for improvements, interest and operating expenses and thus keep the property going. The Commonwealth Company could not continue to put money into a steadily losing property.

The railway's total liabilities in bonds, notes and accounts payable and the loans from the Commonwealth, but exclusive of stock, are given as $3,588,851, with assets in excess of $5,000,000.

Following the decision of the creditors to file a petition in bankruptcy, the board of directors of the Saginaw-Bay City Railway, with all members present, adopted resolutions expresing willingness to have the company adjudged a bankrupt, as the only possible recourse.

John A. Cleveland, vice-president and general manager of the Saginaw-Bay City Railway, said:

> This action is deplorable, but as our people commonly know, it was inevitable. We had no other recourse. We could get no more money from the Commonwealth Company to carry us while struggling in a vain hope of being allowed to charge fares that would enable us to pay our own way. We have been trying for several years to make ends meet on inadequate fares and to get fares that would be reasonable and fair. We had hoped that the last two propositions submitted to our two cities would carry and save us from this fate, but the proposed new franchise in Saginaw and the proposed amendment to our franchise in Bay City, relieving us of paving, were decisively defeated. That was the climax and we are out of business as a consequence. Despite the fact that the people by their action said they wanted jitneys, I do not believe that either Saginaw or Bay City is a jitney town or wants to be known abroad as such.

More than 300 men are thrown out of employment in Saginaw and Bay City as a result of the bankruptcy.

Following default of interest due on Aug. 1 on Saginaw Valley Traction Company first mortgage 5 per cent bonds (a lien on the company's property in Saginaw and the interurban line to Bay City), petition was filed by the Commonwealth Power Railway & Light Company, which is the heaviest creditor and also owner of the entire capital stock of the Saginaw-Bay City Railway.

B. C. Cobb, vice-president of the Commonwealth Company, stated in part:

> The officials of the Commonwealth Power, Railway & Light Company, owners of all of the stock of the Saginaw-Bay City Railway, regret exceedingly, and I believe more than anyone else possibly can, the conditions that have made necessary the cessation of street railway service in Saginaw and Bay City. The Commonwealth company and the Saginaw-Bay City Railway have done everything in their power to keep the street cars running and they did keep them running and serving the people until the voters of both cities made it impossible to continue.
>
> The street railway situation in Saginaw and Bay City has been most unfortunate for the last three years. The street cars have been kept running, not only without any return on the investment, but with actual and large deficits.
>
> INCREASE INSUFFICIENT
>
> The majority of the city authorities in both cities have all along disregarded the fact that a public utility, like any other business, can continue to serve only as it is allowed to earn. Although our rates of fare were increased to some extent, the increase was never sufficient to enable us to cope with the increased cost of operation and, furthermore, we were forced to meet the unregulated and unfair jitney competition which city authorities not only allowed, but encouraged. The present results, therefore, were inevitable.
>
> During the last two years there have been several strikes and consequent interruptions in the street railway service in these two cities, owing to the company's inability to increase the wages of its men because it was not permitted to charge fares that would make it possible so to do.
>
> In June of this year the authorities of these two cities were plainly told by the company's officials that unless they gave relief in the way of increased fares, abandonment of the burdensome paving charges and the elimination of jitneys, the company could not continue to serve and would be forced into bankruptcy.
>
> The majority of the authorities in both cities positively refused to grant us this relief, but they did finally adopt and submit ordinances to the voters covering the fare and paving provisions promised, if the ordinances carried to regulate the jitneys. These ordinances were defeated in both cities.
>
> In addition to its original investment in the property upon which it received a return for only a short time, the Commonwealth company is a creditor of the Saginaw-Bay City Railway to a large amount for cash loaned it to pay the cost of improvements, interest and operating expenses. When the voters by their ballots said that the service rendered was no longer desired, there was nothing left for the Commonwealth company to do but stop putting up money, regardless of its faith in the future of the two cities and its belief that they are not jitney towns, and there was nothing that the Saginaw-Bay City Railway could do but quit.
>
> In addition to its loss on its original investment, the Commonwealth company is a common, unsecured creditor to the amount of $1,415,509. It is therefore a big loser and I am pleased to add, a good loser.
>
> FUTURE UP TO CITIES
>
> I repeat what the people of these cities know, that these companies have done everything in their power to continue service and avert this calamity not only to the companies, but to both cities and to every man, woman and child in both cities. It is a calamity to business. It is a calamity to labor, to every interest and phase of life and we deplore it.
>
> The future is up to these two cities. No reasonable street railway service can be maintained unless jitney competition is eliminated, reasonable fares charged and the company relieved of the heavy expense of paving.
>
> I do not believe in municipal ownership and operation of public utilities, but it may be considered that the present situation presents to Saginaw and Bay City an opportunity to acquire the railway property at a reasonable price; but having made the operation of the railway property impossible, they cannot obtain it for less than a reasonable price. So far as the Commonwealth Company is concerned, its net earnings will be more without these properties than with them operating at a loss.

It is understood that steps are being taken toward the formation of protective committees for the purpose of conserving interests of the bondholders.

The plight of the company has been pointed out repeatedly in the past. Things kept going from bad to worse, with the service tied up four times from March 23, 1919, to the time of the suspension. Some hope to the company was held out early in the present year by a series of conferences with city officials looking toward operation at service at cost. These conferences grew out of a tie up of the system last fall for twenty-four days. When the proposed new grant went before the people on July 19 it was voted down. Toward the close of the franchise negotiations on June 2, Mr. Cobb pointed out in unmistakable terms that the railway had reached the end of the rope so far as continuing to give service at a loss to itself was concerned. His warning then was:

> We want to continue giving Saginaw and Bay City street car service if we can, but we can't under existing circumstances. If we don't get the relief we have asked there is only one thing ahead—bankruptcy. This is no bluff—no "ifs" or "ands" about it—it is purely a business proposition. The company is at the end of its rope and unable to go any further unless it has help on all the things enumerated in this letter.

The City Council of Saginaw was to meet on the evening of Aug. 16. It was expected that an inquiry would be ordered to compel the company to resume service or at least to determine the binding effect of the franchise. Thus the Council, led by George Phoenix, finds itself in a hole. So long as the street cars were running that body had something to rail at, but it failed to realize that that was where it was strong and that its power for evil would end when the company went bankrupt and the cars were withdrawn. The members all realize it now, Pheonix more than any of the others. He now finds himself under the irksome necessity of providing a better, more adequate system of transportation than the city had when the cars were in operation. In other words, he is confronted by the impossible.

For a time the Mayor followed along with Phœnix and the others. Toward the last of the long controversy he did stand for a serious solution of the railway problem and against the jitneys. He is, therefore, in a position now to sit back and laugh at Phœnix and the others and to say: "I told you so."

All that the city now has at its command for transportation is a motly collection of nondescript cars and boxes, going by the name of buses and driven by irresponsibles. Some of these rattletraps are filled to the doors during rush

hours, with people hanging on and standing.

Saginaw and Bay City are, of course, very dead towns at present. Industry is down; not more than 25 per cent of labor is employed and in this clear, pleasant weather people are not riding as they otherwise would. That may give the jitneys a chance to plug along for a while, but at that, the better element of people are not patronizing the autos as they did the street cars, and the Mayor says he is already getting letters from the people demanding street car service. Merchants are not yet saying much, though some of them admit some falling off in trade even now.

The railway carried about 6,000,000 passengers in Saginaw in a normal year and 4,500,000 in Bay City. With forty jitneys, seating sixteen passengers in regular service and ten on the sidelines for emergencies, as they say, it is not difficult to imagine how adequately Saginaw is being served. Bay City has still fewer buses operating and needs fewer, for if ever a town was dead and silent, it is.

Mr. Seaman Still at It

John W. Seaman, a small stockholder who has filed many suits against the United Railways, St. Louis, Mo., only to be defeated in all the cases that have been decided, is seeking again to have Receiver Rolla Wells removed under the Adler suit appointment. The latest phase in much involved litigation came on Aug. 9, when Richard McCulloch and officers of the corporation asked the revocation of Federal Judge Wade's order which, if it stands, would give Mr. Seaman another day in court.

Judge Wade, acting in the absence of Judge Faris, who is on vacation, dismissed Mr. Seaman's petition for the appointment of a new receiver, but granted leave to renew the motion when Judge Faris returns. On Aug. 9 the defendant, the corporation, filed a motion to have Judge Wade rescind this grant, the corporation denying that there was any danger of a foreclosure on the bonds of the St. Louis & Suburban Railway, one of the constituent lines, or that Receiver Wells is being hampered in financing the receivership on account of doubt of the validity of his position under the Adler Bill, as alleged by Mr. Seaman.

Judge Wade in his ruling stated that he could see no emergency and that the litigation could wait upon the return of Judge Faris.

$28,935,656 Lost by New Haven on Rhode Island Trolleys

The annual report of the New York, New Haven & Hartford Railroad for the year ended Dec. 31, 1920, states that during the year the Rhode Island trolley properties were disposed of by the trustees appointed by the federal courts. The loss sustained by the New Haven Company amounted to $28,935,-656. This is written down in the profit and loss statement for the year. The income accounts for the remaining trolley properties are shown in the accompanying table. The results of the year's operations were unsatisfactory, but at present there are signs that the situation is improving.

The period of advancing costs continued into the year 1920 and increases in the rate of wages was made necessary on all of these electric roads. Efforts to obtain increases in revenue to offset the mounting costs were only partly successful, but toward the close of the year the economies that had been previously inaugurated together with the increased revenue accruing from passenger traffic due to more reasonable regulation in the operations of motor buses had turned the scale in favor of improved net revenues.

Weather conditions prevailing in the months of January, February and March, 1920, also made heavy inroads into the net revenues of all properties. Energetic efforts have been made to acquaint the public with the facts as to the financial condition of the company.

Note was also made of the appeal to the Connecticut Legislature for relief from burdensome obligations and for effective control of motor bus operation, and there is every belief that constructive legislation will soon be passed, in which the financial relief to be obtained, coupled with the increased revenue under the present rates of fare, should result in an improved financial showing for the ensuing year. This relief legislation has since been passed.

$350,358 Net Despite Strike and Auto Competition

The first full year's report of the Brooklyn (N. Y.) City Railroad, which operates 217 miles of track, has been issued for the year ended June 30, 1921. Notwithstanding the strike of August, 1920, which cost the company, including direct expenses and loss of revenue, approximately $1,000,-000, and competition from city controlled motor buses, the deficit after payment of operating expenses, taxes and income deductions covering fixed charges and rentals of tracks and cars was $350,858.

The report states that revenue from transportation shows a considerable increase over the corresponding period of the year previous, and with the reduction in wages, effective on Aug. 5, 1921, as well as the marked reduction in cost of materials there is a favorable outlook during the current year.

Passenger revenue amounted to $10,-179,968, which together with revenue from miscellaneous sources, made the total operating revenue for the year $10,457,171; operating expenses were $9,715,667. The net after taxes assignable to railway operation, which totaled $500,515, was $240,989. Fixed charges were $362,269 and rent of tracks, cars, etc., $321,421. Non-operating income amounted to $91,843.

Traffic handled during the year amounted to 218,145,000 passengers, divided as follows: Revenue passengers, 205,002,000; transfer passengers, 11,205,000; free passengers, 1,938,000. The car-miles run were 23,600,000.

The report also refers to the service over the Williamsburgh Bridge, which the city authorities have announced they were to take over. At present through service as well as local service is operated. In case the city takes over this operation the railway company plans to discontinue all bridge service. This will result in an increased cost and inconvenience to all riders to Manhattan inasmuch as the bridge ride will cost an extra fare. The profit from the bridge locals, on which the fare is 2 cents, or three tickets for a nickel, were only $25,483, much less than the extra cost incurred in routing all lines entering the Williamsburgh Plaza to the Manhattan end of the bridge.

INCOME ACCOUNTS—TROLLEY LINES CONTROLLED BY NEW YORK, NEW HAVEN & HARTFORD RAILROAD

	Berkshire St. Ry.		The Connecticut Co.		New York & Stamford Railway		The Westchester Street Railroad*		N. Y. Westchester & Boston Railway	
	Actual	Per Cent Change Over 1919	Actual	Per Cent Change Over 1919	Actual	Per Cent Change Over 1919	Actual	Per Cent Change Over 1919	Actual	Per Cent Change Over 1919
Operating revenues	$1,050,545	18.18	$13,089,317	18.52	$494,443	13.92	$239,039	19.98	$912,265	21.22
Operating expenses	1,037,645	19.52	12,417,141	34.78	457,324	17.60	276,006	*18.09*	829,765	25.22
Net operating revenue	$12,900	*4.98*	$672,176	*63.40*	$37,119	*17.80*	*$36,967*	3.41	$82,500	*8.04*
Taxes	45,205	*2.98*	725,767	17.12	24,260	2.46	12,081	1.37	170,234	15.18
Operating income	*$33,305*	*13.21*	*$53,591*	*104.20*	$12,859	*40.20*	*$49,048*	2.27	*$87,734*	*51.20*
Non-operating income	5,715	237.50	11,340	*94.60*	2,156	254.50	665	*24.30*	13,511	71.40
Gross income	*$26,590*	*117.80*	*$42,251*	*102.80*	$15,015	*32.10*	*$48,383*	1.88	*$74,223*	*47.80*
Deductions from gross income	(a) 319,013	0.51	1,393,840	4.13	(b) 100,962	3.60	(c) 34,751	*2.42*	(d) 1,732,959	3.59
Net income for year	*$345,603*	*4.85*	*$1,436,091*	*1,431.00*	*$85,947*	*14.08*	*$83,134*	2.15	*$1,807,182*	*4.87*
Profit and loss account at end of year	*$2,099,977*	*16.00*	$1,051,763	*60.4*	*$418,839*	*29.00*	*$439,282*	*23.80*	*$13,673,636*	17.20

*This company is entirely separate from the New York, Westchester & Boston Railway. Figures include receiver's account for the 29th of February and ten months ended Dec. 31, 1920.

Includes interest accruing to the N. Y., N. H. & H. R.R., but not included in the income account of that company: (*a*) $213,550, (*b*) $42,533; (*c*) $26,784; (*d*) $815,979.

Cuban Electric Road Sued

The Cienfuegos, Palmira & Cruces Electric Railway & Power Company, Cuba, is made defendant in a suit filed in the Common Pleas Court at Cincinnati, Ohio, by the Davidson Sulphate & Phosphate Company, Baltimore, Md., which seeks to recover $1,959,571 for breach of contract.

The Davidson company also attaches six electric cars under construction at the plant of the Cincinnati Car Company, which are the property of the defendant company.

The petition charges that the defendant failed to carry out a contract whereby railroad lines were to be constructed from the wharf at Cienfuegos to Caonao; from this point to Cumanayagua, and a branch line to a point in Cuba known as the Davidson Terminal. Under this agreement the plaintiffs were to have facilities for shipping 100,000 tons of material mined at its Cuban mines each year and were to have certain electric power facilities. As the result of the failure to carry out this agreement the phosphate company charges that it has been obliged to pay demurrage charges at Cuban ports due to delays in collecting its product for shipment. Filing of the suit in Cincinnati was due to the fact that the cars attached are being built there.

Financial News Notes

Rehabilitation Plan Fails. — The Geist plan to rehabilitate the railway at Lafayette, Ind., has been abandoned following a meeting of the citizens' committee named about two weeks ago to offer $100,000 in preferred stock to local citizens. The prospects are that the present owners will abandon the line in the near future.

Gold Notes Offered.—Halsey, Stuart & Company and the National City Company are offering at 89½ and interest $500,000 fifteen-year 7 per cent secured sinking fund gold notes of the Chicago, North Shore & Milwaukee Railroad, Highwood, Ill. The notes known as Series "B" are dated June 15, 1921, and are due June 15, 1936.

Abilene Line to Resume.—The Abilene (Tex.) Street Railway, which was taken over by the American Public Service Company, will be put in operation again on Sept. 10. New cars will be put in use and current for operating the lines will be furnished from the American Public Service Company's new $1,000,000 power station soon to be put in operation. There are now 5 miles of track. An extension will be built at once to the new McMurray Methodist College, now under construction.

Franchise Tax in Dispute. — The Southern Indiana Gas & Electric Company, operating the city railway lines at Evansville, Ind., and the line between Princeton and Evansville, will not pay its franchise tax to the city of Evansville unless required to do so by the courts. Frank J. Haas, general manager of the company, maintains that the company is not operating under a franchise at the present time and should not pay the tax. The company surrendered its franchise in 1917, but continued to pay the franchise tax until 1920. It is believed the case will be taken to the courts for settlement.

Exception Taken to Separate Foreclosure.—The Guaranty Trust Company has filed a bill in the United States Court taking exception to the decision of Judge Orr in which he rules that the Southern Traction Company, one of three underlying companies of the Pittsburgh (Pa.) Railways, may foreclose on mortgage and operate its West End lines independently. It is contended that any such action might delay the proposed reorganization of the Pittsburgh Railways and would mean protracted litigation, as the Guaranty Trust Company would appeal to a higher court. It is also stated that the value of Pittsburgh Railways as a unified system will be impaired if broken up.

Short Dallas Line Abandoned.—The Dallas (Tex.) Railway has been authorized by the City Commission to abandon its Nettie Street line. The application of the company for authority to abandon this line set forth that it was eight blocks in length and extended to Commerce Street, but did not connect with the tracks on that street. Receipts of the line during the last few months have averaged about $120 a month, while the cost of operation has been $575 a month. Continued operation would require the expenditure of $2,500 on track improvements. Investigation by the Supervisor of Public Utilities shows that $7,428 was lost by the company through operation of this line during the fiscal year ended June 30, and that an average of 138 persons ride this line a day.

Abandonment Planned in Spokane.—The Washington Water Power Company, Spokane, Wash., has applied to the city for permission to cancel certain of its franchises. The idea of the company is to abandon some of its lines. According to the city officials, some of the company's principal lines outside of the business district are operated without franchise rights. W. E. Coman, second vice-president and general manager of the company, is reported to have said that the company was aware that some of its franchises had expired, but that it had no intention of applying for a renewal at this time. No part of the regular service will be disturbed by the discontinuance of the two lines included in the pending petition of the company. It was expected that the whole matter would be considered at a public hearing to be held on Aug. 16. A review of the fare and the jitney situations in Spokane is published on page 300 of this issue.

Disappointing Outlook in Brazil.—At the annual meeting of the Brazilian Traction, Light & Power Company in Toronto, Ont., on July 20, Vice-president Miller Lash told the shareholders that at the present rate of exchange, earnings for the first half of the present year were just about sufficient to provide for bond interest, sinking fund and preferred dividend with no substantial provision for capital expenditure. It was impossible to sell securities at the present time and to provide working capital. Mr. Lash pointed out that conditions were improving except for the drop in milreis, which had declined from 27½ cents in 1919, by over 50 per cent, to 10½ cents. He intimated that dividends would return with a 20-cent milreis. He pointed out, however, that in the last half of last year coal had cost $2,500,000 or $29.70 a ton. In the first half of this year it had dropped to $615,000 or $12.09 a ton. The drop in exchange, however, had almost wiped out this difference.

Woonsocket Lines Sold.—The Woonsocket properties of the Rhode Island Company, which include all the remaining property of the Rhode Island Company, Providence, R. I., were sold by Arthur A. Thomas, special master, on Aug. 6 to C. H. Mandeville, who announced he was bidding for the United Electric Railways. There will be $300,000 paid in cash, but there are a number of other obligations that Mr. Mandeville must meet or at least see that the new traction company meets. On Aug. 12 the Superior Court confirmed the sale. This approval of the sale by the court has the effect of bringing under the control of the United Electric Railways substantially all of the railway properties in the State, formerly operated by the Rhode Island Company. Furthermore, the transfer practically winds up the affairs of the Rhode Island Company, inasmuch as the new owners of the Woonsocket lines have agreed to assume, with reservations, the obligations of that company.

Barcelona Net Up 14 Per Cent.—According to the sixth annual report of the board of directors of the Barcelona Traction, Light & Power Company, Ltd., for the year ended Dec. 31, 1920, the net income from all sources including that derived on the Barcelona tramways was $2,731,769 as against $2,194,353 in the previous year, an increase of nearly 25 per cent. Interest on bonds for the year amounted to $1,963,485. Depreciation reserves were also made by the chief operating company. The railway itself set aside $293,364. The operating results of the Barcelona Tramway Company showed an increase in gross earnings of nearly 25 per cent over those of the previous year, but owing to a large increase in operating costs the increase in net earnings was only 14 per cent.

Traffic and Transportation

One-Man Operation Attacked

New Cars Being Used to Make Political Capital in Milwaukee—Standard Cars In Use

Alleging that one-man safety car operation was unsafe, Alderman Carl Dietz of Milwaukee recently introduced a resolution in the Milwaukee Common Council calling upon the City Attorney to petition the Wisconsin Railroad Commission for an order prohibiting one-man cars from operating in the city of Milwaukee.

Company Explains Position

One-man operation was introduced in Milwaukee city service on the Thirty-fifth Street crosstown line about two months ago. On Aug. 1 it was extended by the Milwaukee Electric Railway & Light Company to the Twenty-seventh Street crosstown line. It is expected that it will be further extended to the other crosstown and light traffic lines of the company.

The matter was thrashed out on Aug. 5. 1921 at a hearing on the subject before the committee on railroads of the Council. Alderman Dietz, the introducer of the attacking resolution, urged its adoption almost entirely on safety grounds. He was supported by two or three other witnesses, but what opposition appeared seemed due to lack of familiarity with the safety equipment of the car rather than with the quality and quantity of service rendered by this type of equipment.

The company was represented at the hearing by its President, John I. Beggs, H. A. Mullett, assistant general manager, and W. A. Jackson, general attorney. The company's position as expressed by its representatives, was that due to the present state of unemployment, shorter hours which permit people to walk to and from work, and automobile competition, its railway revenues this year were smaller than during the previous year. The deficit would have to be made up either by increasing the rate of fare, lowering wages, reducing service, or effecting economies in operation.

While it was uncertain whether any one of these means would be sufficient to meet the situation alone, the company was first attempting to effect as many economies as possible, and for that reason had started one-man car operation.

Recommended by City's Utility Expert

Attention was called by representatives of the company to the recommendation made some time ago by the city's public utility expert that one-man car operation be inaugurated for the sake of effecting economies. The inauguration of one-man car operation was also urged in the report just issued by the Public Utilities Acquisiton Committee of Milwaukee, which was signed, among others, by three of the leading members of its Common Council. The representatives of the company pointed out that one-man safety cars were in use all over the country and that they were apparently favored by municipally-owned railway utilities such as those of Detroit and Seattle.

H. A. Mullett, assistant general manager of the company, described the safety equipment of the cars which are being used in one-man service. This is the Standard Safety Car Devices Corporation equipment for one-man cars. The cars themselves are a number of a lot of 100 which the company has recently acquired. They were especially designed for use in Milwaukee and may be utilized either for two-man or one-man operation. These cars seat fifty-three persons, are unusually light, comfortable and good looking, and have produced a distinctly favorable impression on the patrons of the railway company.

Testifies for One-Man Car

Testimony in favor of the one-man safety car operation was given by E. J. Steinberg, resident engineer in Milwaukee for the Wisconsin Railroad Commission, who said that this type of service had been approved by the commission for the Thirty-fifth and the Twenty-seventh Street crosstown lines. He pointed out that the company was voluntarily giving better service on these lines with one-man cars than that required by commission standards of loading. Another witness who testified in favor of one-man operation also stressed the fact that the service on the Thirty-fifth Street line had been distinctly improved since the installation of one-man operation thereon. The point was made by this witness that if certain practices on the part of one-man car operators were deemed unsafe, these should be corrected, but that this was no reason why one-man car operation should be entirely prohibited.

At the end of the hearing further consideration of the matter was postponed for a period of thirty days in order that the new service may be tried out for a somewhat longer period of time before final judgment was passed on the matter. It is expected that the Common Council will uphold the company in its use of one-man safety cars in Milwaukee city service.

In an advertisement primarily intended to further the sale of its securities the company made the following comment on the attack upon its use of safety cars in city service:

> Strict economy from top to bottom of the organization with its more than 5,000 employes is the only means of assuring regular payment to our thousands of home investors of their income from the business, in times like these. Nobody has to be told we can't spend what we don't earn; that we can't hire more men than we have work for, nor pay excessive salaries, nor in any other way give out more than we can take in. This Company has paid every debt on the due date, in full, since it was organized twenty-five years ago; it has paid regular dividends to its shareholders for over twenty years, and it intends to continue doing so. To do this in a season of hard times means avoidance of waste and it means utilizing every practical means for saving. This is especially true of the street railway end of the business. It can be made to serve better and at less cost by using one-man safety cars instead of heavy two-man cars on some of the streets; so the Company, following the example of other cities where the change has pleased the public by giving more frequent service with equal safety, is gradually introducing this economy into its business.
>
> Some folks who have no knowledge of the business, and no stake in it, criticise such economies, in order to make political capital. It isn't a political matter at all. It is question of providing most and best service at least cost to the public that pays the bills—and this is a job for the company's engineers co-operating with the city's and the state's engineers. *We are not going to risk the safety of our customers.* You can bank on that. But we are going so far as possible, to introduce whatever tried and proved new methods will improve the service and reduce its cost.

Fare Advance Refused

A recent ruling of the State Corporation Commission continues in effect the 5-cent fare on the lines of the Lynchburg Traction & Light Company, Lynchburg, Va., for six months, at the end of which time the commission will again review the situation. In its petition the company asked for an 8-cent fare between the city and points outside. The opinion was written by Alexander Forward and was unanimously approved by the commission.

Some months ago the company gave notice that it would on May 11 apply to the commission for authority to publish and file, effective June 1, revised tariffs for railway service providing a uniform fare of 6 cents, with an alternative proposal that in the event permission for such 6-cent fare within the city limits of Lynchburg was not granted by the City Council, then application would be made for authority to charge an 8-cent fare applicable between points in the counties of Campbell and Bedford and also between points in those counties and points in the city.

The commission thereupon fixed the same date, May 11, for hearing the proposed fare advances of the company. A hearing was accordingly had on that day and upon motion of opponents a further hearing was given on June 2, when the evidence and argument having been fully presented, the entire matter was submitted to the commission.

Prior to the first hearing the City Council of Lynchburg, which is admitted by the company to have jurisdiction over railway fares within the city limits, refused to grant the increase to 6 cents, so that the company's application to the commission was based upon a proposed increase in fares between the city and outside and between points outside, of 8 cents per passenger.

In its finding the commission stated that in a period of declining costs a reduction in operating expenses could be anticipated and that this is a transition period and no one can foretell future price levels.

Taylor Franchise Upheld

The franchise ordinance drafted by A. Merritt Taylor and recently submitted to the City Council of Norfolk, Va., for adoption has been vigorously defended by Messrs. Kerr, Wright and Doherty, leading business men of Norfolk and former members of the Public Utilities Commission, in a special report on the franchise made to the City Council on Aug. 3.

In their report these gentlemen refer to the severe criticism of the Taylor franchise, but point out that no constructive suggestions have been advanced as a substitute. They can see no better remedy than the one suggested by Mr. Taylor, a practical utilities operator, and acknowledge with indebtedness his comprehensive recommendations with respect to re-routing, improvement of present service and a new franchise.

The high points in the franchise ordinance drafted by Mr. Taylor which have caused much discussion were reviewed in the ELECTRIC RAILWAY JOURNAL, issue of Aug. 6.

Commission Orders Amended Tariffs

The Public Utilities Commission of Utah has decided that the Utah Railway must amend its coal carrying tariffs, effective not later than Aug. 8, so as to prevent any discrimination against the Salt Lake & Utah, an electric interurban operating between Salt Lake City and Payson, Utah, and in favor of either the Denver & Rio Grande or the Los Angeles & Salt Lake railroad. The system of the electric railway comprises 75 miles of road.

The order came in the case brought by the Salt Lake & Utah, commonly known as the "Orem Line," against the Utah railway. It was complained that the Utah railway carries in its tariffs, with reference to joint rates on coal routed from mines on the Utah railway to and through Salt Lake, the proviso that the rates shall be applicable "only to traffic for delivery on team tracks of the Salt Lake & Utah Railroad, or industries served by it, when so routed by shipper."

The effect of this was that if the Salt Lake & Utah were to undertake to haul coal for shippers who were on the Denver & Rio Grande or the Los Angeles & Salt Lake (Salt Lake Route) tracks, additional switching charges had to be made, which the interurban had to absorb or else lose the traffic.

The Salt Lake Route intervened in the case by claiming that it had made a large joint investment with the Utah railway at the latter's Provo terminals, and also that the two rail lines owned 2,000 steel gondola coal cars in common.

These joint investments, it was contended, made the rails from the Utah railway mines to Salt Lake practically one complete railroad, and the intervenor claimed that it was entitled to consideration as such. The case was referred to in the ELECTRIC RAILWAY JOURNAL for July 16.

Spokane Jitneys Run Wild

City Shows Its Contempt for Utility Commission by Permitting Competition With Railway

Jitneys have been in operation in Spokane, Wash., since the latter part of June with the result that the gross revenues of the electric railways there have been reduced and the service on these lines materially curtailed. The Washington Public Service Department in May issued an order granting the appeal of the two Spokane railways, the Washington Water Power Company and the Spokane & Eastern Railway & Power Company, for an increase in fare from 6 cents to 8 cents.

The City Commissioners through Mayor Fleming had previously announced that in the event of such decision by the state, the city would release the jitneys in competition with the railways.

Losing their fight before the commission to prevent an increase in fare, the city officials prepared to put their threat into operation. Every effort was made to get them to reconsider this decision, but without avail. The state officials in their written opinion and decision on the case, expressed the hope that the city was not in earnest in such a determination and pointed out the ultimate harm that it would bring to Spokane.

RAILWAY OFFERS COMPROMISE

The Chamber of Commerce roused itself and a committee of representative citizens, headed by Ben C. Holt, attempted to bring about a settlement and compromise. This committee secured from the railways a promise of a 7-cent fare dependent on the purchase of tickets, five for 35 cents. This compromise offer was curtly rejected and the jitneys released.

Every sort of a car was pressed into service in the first days of the jitney service. These are now giving way to buses which carry from ten to twenty passengers. A railway official estimated early this month that the two companies have suffered a loss of 21,000 fares daily or about one third of the normal patronage. Of this number it is the opinion that the jitneys are carrying about half, while the others are walking, being carried by friends in their cars or using their own machines.

This official said that so far as his company was concerned, the loss of patronage had been fully offset by the taking off of the tripper service. The tripper cars on this line are all two-man cars, so that with the increase in fare, the decrease in the payroll, the decrease in other costs and the sale of the juice for commercial use, this man figures that his company is just where it was before.

The fact remains, however, that with the jitneys in operation less than two months, they have made serious inroads on the railway business and forced considerable curtailment of service with the abandonment of certain unimportant lines already contemplated and asked for by the two companies.

The more conservative and far seeing of the citizens recognize the danger to real estate values in outlying districts and the inconvenience to those resident in them and strongly oppose the licensing of jitneys by the City Council. Spokane is a city with widely scattered residence districts, many of which frequented by the working class have no paved arteries. In winter and the wet weather of spring and fall, jitney service to these districts will be next to impossible. However, there is much sentiment favorable to the jitney and people are riding in them and suffering crowding and inconvenience cheerfully that they would not tolerate as a regular thing on the electric railway.

Neither the city officials nor the street railway officials give any indication of quitting the fight. Some of the railway employees incline to the opinion, however, that the only way to bring the matter to a speedy conclusion for the benefit of all concerned is to put the cars in the carhouses and demonstrate the inadequacy of the jitney service. More conservative counsel has so far prevailed and the companies are simply cutting down the service as rapidly as the jitney makes a line unprofitable.

Floats Teach Safety

According to W. F. Hanna of the Safety Committee, No Accident Week in Maryland and especially in Baltimore, accomplished some fine results. No fatalities due to traffic accidents were recorded, although some accidents occurred.

From Sunday, July 17, through Friday, July 22, an intensive safety campaign was waged, bringing home to the residents of the city some graphic lessons on the need of safety. Each day contributed some special feature in a striking manner. One day was known as "Wagon and Truck Day," and another as "Children's Day." The slogan, "Don't Get Hurt," appeared on large white streamers attached to the front and rear bumpers of every trolley car. July 20, "Walk Right Day," featured a hospital scene called "The Jay Walkers' Ward."

Another interesting tableau was prepared at the Carroll Park Shops of the United Railways & Electric Company which showed on a flat car a wrecked automobile with a specter of death in front of it. The car operated through the streets of the city while mournful tunes were played by a school band.

The United Railways & Electric Company gave its hearty co-operation to the success of the drive. Mr. Cullen, assistant to the president of the Baltimore property, said that the campaign was a great success and that the lesson of the week would have a lasting effect.

Fares Advanced Again in Toledo

Street Railway Commissioner W. E. Cann at Toledo, Ohio, has announced that on Aug. 20 fares will be jumped another notch by the Community Traction Company when ticket sales are changed from eight for 50 cents to six for 40 cents with the 7-cent cash fare and 1-cent transfer remaining. The commissioner says he believes this change will be the last necessary to bring back the stabilizing fund to normal. The last raise in fare was put into effect by the railway company on Aug. 1.

Only 25 per cent of the passengers are paying cash at the present time. This makes the average fare only a little more than 6¼ cents. On a straight 6-cent fare the railway system showed a deficit of approximately 1 cent per passenger.

As rapidly as economies of operation have been put into effect the car riding has decreased. The first twenty-five days of July brought in $12,638 less revenue than the same period in June. This ratio of decrease has been constant all summer. In February when the service-at-cost ordinance went into effect the revenues were averaging $12,000 daily. That figure at present is about $8,000.

Connecticut Jitney Case Argued

Judges Martin T. Manton, Edwin S. Thomas and John C. Knox, in the court room of the Federal Building at New Haven, Conn., on Aug. 16, heard the application of the jitneymen of New Haven for an injunction against the enforcement of the new jitney law by the state authorities. It is expected that a decision will be rendered by Aug. 22. While the application was presented by local jitneymen at New Haven the decision of the court will affect the entire state.

Attorney Woodruff for the jitneymen claimed that the jitney operators by reason of the application of the law had suffered substantial loss while being prevented from using their machines to earn a living and that their constitutional rights had been denied them. He said that service furnished by the buses was demanded by public convenience and necessity. He attacked the arbitrary attitude of the commission, but Judge Manton said that the court had nothing to do with that. The question it must consider was whether or not the Legislature had the power to enact the present law.

Judge Walter C. Noyes, trustee of the Connecticut Company, argued against the granting of an injunction. He showed where the state has power to regulate traffic over its highways and to control it. The new statute of Connecticut, he pointed out, is similar to the statutes of other states which have been upheld already by the supreme courts of those states.

Attorney General Healy said that the plaintiff had an inadequate conception of the right and public policy of the state.

Transportation News Notes

Tokens in Use.—The Vicksburg Light & Traction Company, Vicksburg, Miss., has replaced its paper tickets with metal tokens.

Ticket Fare Cut.—In Gadsden the Alabama Power Company has made a cut of 10 cents in the price of books of 16 tickets, selling them for 90 cents instead of $1.

Children's Fares Reduced.—The Alton, Granite & St. Louis Traction Company, Alton, Ill., has announced the use of metal tokens instead of tickets. A reduction in children's fares from 5 cents to 4 cents will be put into effect.

Protests High Fare.—A petition has been signed by many residents of Pottsville, Pa., and sent to the Public Service Commission requesting that body to require the Eastern Pennsylvania Railway to lower its fare between Pottsville and St. Clair. The petition declares that the distance is only 3 miles and that a 10-cent fare is not warranted in view of a cent-a-mile commutation rate on some railroads.

Awards for Safety Records.—In an effort to minimize accidents on the municipally-owned cars of St. Petersburg, Fla., R. E. Ludwig, director of utilities, has put into effect a bonus system under which motormen will receive cash awards or vacations for working for a stipulated period without accidents. Mr. Ludwig believes that this plan will not only lessen the number of accidents but will encourage the careful handling of the cars.

Petitions for One-Man Cars.—The Peoria Railway, a subsidiary of the Illinois Traction System, has presented to the Council an ordinance giving it the right to operate one-man cars in the city of Peoria. The company has furnished the Council with a list of cities where one-man operation of cars has been successful. The company further states that it wishes to extend its service but cannot do so as long as two men are required to operate cars.

City's Expert Preparing Data.—Harold M. Olmstead of the Delos F. Wilcox staff is going over the books of the Minneapolis (Minn.) Street Railway preparing for the city's argument at the hearing before the State Railroad & Warehouse Commission on Aug. 23, in which the city will combat a request of the railway for an emergency rate of 7 cents with four rides for 25 cents. A similar hearing is set for the same day in the case of the St. Paul City Railway, the two lines being component parts of the Twin City Rapid Transit Company, and their interests being similar as to rates of fare.

Change in Fare Announced.—The Grays Harbor Railway & Light Company, Aberdeen, Wash., has announced a change of fare in Aberdeen and Hoquiam from 6 cents within each of the cities, and a 12-cent fare between them, to a straight 10-cent fare. The change is announced as the result of recent jitney competition in the two cities and between them. The City Council of Aberdeen has instructed City Attorney A. E. Cross to protest the new fare before the Public Service Commission. According to a recent ruling of the State Department of Public Works, the company is allowed to charge a 10-cent cash fare, or an 8⅓-cent token fare. School rates remain unchanged.

New Publications

Roadway and Track

By W. F. Rench. Published by the Simmons Boardman Publishing Company, New York. 242 pages. Cloth.

This book is not one essentially on location, as are so many books on track, but partly on construction and more particularly on maintenance, care and protection of track. As such it should be very useful to the maintenance-of-way engineer. The writer was formerly supervisor of the Pennsylvania Railroad. The practice described is in a large measure that of that company.

Proceedings of Society for the Promotion of Engineering Education

Proceedings of the twenty-eighth annual meeting of the society. F. I. Bishop, editor. University of Pittsburgh, Pittsburgh, Pa.

This volume covers the meeting held at the University of Michigan, June 29 to July 2, 1920, and includes a number of articles of interest to engineers engaged in electric railway work. Special attention was devoted at the meeting to the relation to technical schools of the utilities and the engineering industry.

The Business Library

By Louise B. Krause, Librarian with H. M. Byllesby & Company, Chicago. 124 pages; illustrated. *Journal of Electricity and Western Industry*, San Francisco, Cal.

This is the second edition of this book. The first was published two years ago. Additions have been made to bring up to date the list of articles of value on the subject of business libraries. Some of the subjects covered are the organization of the library, the service expected to be rendered, how to file periodicals, government documents, trade catalogs, photographs and lantern slides. The methods advocated for the classification and cataloguing of the particles filed, the mechanical equipment needed and the qualifications essential for the business libraries are also covered in detail.

Personal Mention

Mr. Brewer, Promoter

Grand Rapids Operator and Manager Putting Through Important Merger in Indiana

Joseph A. Brewer, Grand Rapids, Mich., president of the American Public Utilities Company, is the moving spirit in another consolidation of utilities. This time the properties concerned are all in Indiana. They operate in seventeen counties. The plans being advanced propose a considerable extension of the activities of the companies which it is intended to bring together under one head, and contemplate a power development scheme which will involve an expenditure of several millions of dollars in the erection of a plant in the Indiana coal field with transmission lines to Kokomo and Indianapolis. The new company will be known as the Indiana Electric Corporation. Mr. Brewer will be its president. Among the companies which will be taken over is the Indiana Railways & Light Company, of Kokomo.

"Joe" Brewer is a Michigander. He is not in "Who's Who," but that is a reflection on "Who's Who" rather than on "Joe." All the Central West knows Mr. Brewer intimately, and the East knows him by his work even if it has had only a small share heretofore in assisting him in his financial operations. With Mr. Brewer it is another case of truth being stranger than fiction. The annals of American business are, of course, replete with examples of men who have risen to prominence from humble beginnings, but there are angles to the achievements of Mr. Brewer that differentiate him from others.

Not all stenographers become public utility owners. Not all railroad clerks become railroad presidents or rise to prominence in the railroad world. This is mostly the fault of the stenographers and clerks. Mr. Brewer at fourteen was both stenographer and clerk at Grand Rapids. He learned the ropes rapidly but the position lacked the element of contact that Mr. Brewer craved. He decided to take a chance. Hieing himself off to Detroit he set up shop as a public stenographer. If there is any place in which to come into contact with persons of mercurial temperament it is as a public stenographer. Your customers range from the prima donna of the traveling theatrical company to —well, most anybody. You are supposed to react to the state of mind of your client. You learn a lot about human nature.

Having established this point of contact with the dear public, Mr. Brewer returned to Grand Rapids where soon he became a real caterer to the public by purchasing an interest in the Holland Gas Company. Thus is the mystery solved of where all the money went that was earned by one public stenographer. The public is usually ungrateful and gives grudgingly to the utility manager, but there seems to be something irresistible about the urge onward of the business. Thus it was only a short time until Mr. Brewer took over the Winona Gas Light & Coke Company, Winona, Minn. A little later he and Charles B. Kelsey, another utility operator, realized that they could do more by joining forces than by operating separately, so the firm of Kelsey, Brewer & Company was formed.

So far the talk about Mr. Brewer has been nothing but business. Mr. Brewer, however, plays as hard as he works. Northeast of Plainfield Village, Mich., Mr. Brewer has a farm of 360 acres. Here he does his playing by supervising one of the most complete establishments of its kind in the State. This is the man's principal hobby. Despite the demands made upon his time by his utility and banking connections, Mr. Brewer has served as president of the West Michigan State Fair, an enterprise of no mean proportions.

The financial manuals list Mr. Brewer as president of the American Public Utilities Company, president of the Jackson (Miss.) Public Service Company, president of the Wisconsin-Minnesota Light & Power Company and president of the Eastern Wisconsin Electric Company, to note just a few. Forty-five finds Mr. Brewer still going strong in the field of public service, as is attested by the plans being matured for the $18,000,000 consolidation in Indiana.

H. C. DeCamp Leaves Sales Work to Become Operator

H. C. DeCamp, for the past eleven years a representative of the railway department, Westinghouse Electric & Manufacturing Company, Cincinnati office, has been appointed assistant general manager of the City Railway, Dayton, Ohio. Mr. DeCamp is very well known in railway circles, particularly in the Middle West, where he has for many years been active in the affairs of the Central Electric Railway Association, which he has served in various capacities from member of numerous committees to "parson" on the annual cruise this last summer. For many years he has had a hobby of the ways and means of promoting a better spirit and better salesmanship on the part of trainmen. He has felt that the trainmen have received less attention than they deserved, and at one time wrote a series of "Letters of a Retired Motorman to His Son," which were published in *Aera*. In his new position, with the full co-operation of the officers of the company, he expects to work out these ideas and endeavor to make the city railway one of the best operated companies in the country.

Mr. DeCamp has had a fund of both railway operating and selling experience. He first became interested in street railway matters in 1889, when he went to work for the General Electric Company. Subsequently he was connected with the old Utica & Mohawk Valley Railway, the Brooklyn Rapid Transit system, and the Third Avenue Railroad, thereafter entering the sales field. While engaged in selling, however, he has always kept up his interest in the operating field, particularly along the lines of efficient management and operation.

Transit Engineer Will Study Foreign Methods

Robert Ridgway, chief engineer of the New York Transit Commission, sailed recently on the Olympic for a five weeks' stay abroad, where he will study methods of construction and operation of subways, rapid transit lines and urban transportation generally. Mr. Ridgway is expected to make a special study of the underground systems of London, Paris and Berlin, to obtain information that will help him in laying out new lines in this city and to solve the traction problem in New York. He went by direction of the commission. Clifford M. Holland, chief engineer of the New York and New Jersey Tunnel Commission, accompanied him.

Harry S. Williams Joins Detroit Municipal Railway

Harry S. Williams has been made assistant superintendent of equipment of the Detroit municipal street railway system. Since 1914 he has been engaged in building work in Detroit, but prior to that was for many years in electric railway work. He started his railway experience in the construction department of the Lima-Honeoye Electric Railway, and became assistant superintendent when the construction of the line was completed. After three years he became connected with the construction work of the Oneida (N. Y.) Railway, and upon completion of this was transferred to Utica, N. Y., serving for a time in the power department and later in the mechanical department. At this time he had charge of the shops and carhouses of the Utica & Mohawk Valley Railway Company, now a part of the New York State Railways. Following the electrification of the West Shore Railroad from Utica to Syracuse, he was made electrical engineer of that property, with supervision of the power houses, overhead and third-rail, in addition to the car equipment. In 1910 he became chief engineer of the Peter Smith Heater Company, Detroit, serving in this capacity until 1914.

Walter J. Devine is now the secretary of the Ohio River Electric Railway & Power Company, Pomeroy, Ohio. The position until recently was held by J. K. Trimble.

Herbert Ware has severed his connection with the Public Service Railway, at Camden, N. J., after a service of more than twenty-five years. For more than ten years he served as starter at the Pennsylvania terminal, at Camden, N. J. He was at one time assistant to the superintendent of employment at Camden. He started with the company as a motorman.

Walter Jackson, consulting engineer, has returned from a three months' study of transport conditions in Europe. In technical matters he paid particular attention to trackless trolley development and the amazing growth of motor-bus operation both in city and country service. Visits were made to London, Paris, Vienna and Berlin in connection with changes in rates of fare, service-at-cost contracts and public ownership.

George C. Graham has been appointed superintendent of rolling stock and shop of the Windsor, Essex & Lake Shore Rapid Railway, Kingsville, Ont. Prior to his present appointment he was engaged in commercial business in Hamilton, Ont., and before that he was for six years superintendent of rolling stock of the International Railway, Buffalo, N. Y. Until January, 1910, Mr. Graham was master mechanic of the United Traction Company, Albany, N. Y., when he resigned to become superintendent of car equipment and shops of the Los Angeles Pacific Company, Los Angeles, Cal.

Obituary

R. H. Taylor, Jr., manager of the Sault Ste. (Mich.) Traction Company, died very suddenly on Aug. 4 of heart failure. Mr. Taylor had held the position of manager of the Sault Ste. property since the reorganization of the road many years ago. During the World War he served as sergeant in the 160th depot brigade and is said to have had a splendid record.

W. C. Connor, former mayor of Dallas, Tex., and builder of the first street car line in the city died at Long Beach, Cal, recently, after an acute illness of only a few days, although he had been in failing health since 1906. Mr. Connor was prominently identified with the building of Dallas since 1870, having been four times Mayor, organizer of the first volunteer fire department, builder of the first electric light plant in Texas, the first ice factory, the first street car lines and a pioneer in many other lines of industry. The first street car line he built employed mule cars and the line ran up Main Street and out Ervay Street to Browder Springs. When the electric lines superseded the mule cars, Mr. Connor retained his interest in the lines and served for many years as vice-president of the Dallas Consolidated Street Railway until this property was conveyed to Stone & Webster.

Manufactures and the Markets

DISCUSSIONS OF MARKET AND TRADE CONDITIONS FOR THE MANUFACTURER, SALESMAN AND PURCHASING AGENT

ROLLING STOCK PURCHASES BUSINESS ANNOUNCEMENTS

Good Time to Build

Important Engineering Firm Bases This Opinion on Survey of the Field

Dwight P. Robinson & Company, New York, have recently compiled and issued a chart showing price tendencies in nine groups of commodities from 1914 to July 1, 1921, based on the Bureau of Labor statistics. Commenting on these curves the company says in part:

It is now evident that price recessions in many industries have been arrested. During a recent week more price increases than decreases were noted, the reverse of a situation which had existed for fifty-six consecutive weeks.

Particular attention may be called to the curve for lumber and building materials, which has begun to straighten out. Building materials have taken a deflation of 139 points from their peak, as contrasted with the average deflation for all industries of 124 points, in spite of a more than normal demand for construction material. For the month of January contracts awarded were 6 per cent behind the January five-year average. For the period January to July 1 they were 9½ per cent ahead of the January to July 1 five-year average.

There is not very much industrial construction going forward. When the large volume of this class of work starts, the increased demand will undoubtedly have a tendency to push building costs up, for the same laws of supply and demand obtain in the construction industry as in other lines and it is not reasonable to suppose that in the face of such activity there will be an appreciably greater deflation.

The railroads are now practically assured of government aid and accordingly may soon be in the market for the equipment and materials they have so long needed. Heavy railroad purchases will act as a strong tonic to the business situation and will undoubtedly affect general prices.

Activities of Trade Associations

An official statement having to do with the activities of trade associations will be issued the latter part of August. A promise to this effect was made by Commerce Secretary Hoover after a conference on the subject between Mr. Hoover and members of his staff with the Attorney-General and members of the Department of Justice staff. Pending the issuance of the statement, Mr. Hoover declines to comment. The Attorney-General stated that there are a great number of trade associations which are of much benefit to business and that the activities of the great majority of these organizations are not being questioned. He said the Department of Justice simply is trying to find if there are not some cases in which illegal activities are being carried forward under the guise of trade associations.

The probabilities are that the official statement which is to be issued will not go very far toward illuminating the twilight zone which covers a part of the field of some of the existing associations. Since the Supreme Court of the United States is expected to hand down, during the October term, an opinion in the hardwood lumber case, which may define some of the limits of the fields of the trade associations, it is not probable that any executive department is going to declare any very definite policy before the rendition of that opinion.

The Department of Commerce has ascertained that there are more than 5,800 trade and industrial organizations in the country.

French Railway Orders Equipment

An order for electrical equipment amounting to $1,200,000 has been received by the Westinghouse Electric International Company from the Midi Railway of France. The order includes transformers, synchronous converters, lightning arresters and other substation equipment. The Midi Railway operates an extensive system starting from Bordeaux, running through Toulouse to Cette, with many branches. The section on which the Westinghouse equipment will be used extends from Pau to Toulouse in the Pyrenees Mountains near the Spanish border. The line passes through Tarbes and St. Gaudens, and has a total length of more than 100 miles.

Large Turbine Generators Tested

The capacity of the testing room of the South Philadelphia works of the Westinghouse Electric & Manufacturing Company was taxed to capacity recently when 169,000 kw. of steam turbine generators were on the test floor at the same time. Nearly 150,000 kw. of this amount was made up of five turbines for some of the largest railway and power companies in the United States. These included a 35,000-kw. turbine for the Hellgate station of the United Electric Light & Power Company of New York, a 25,000-kw. turbine generator for the Gold Street Station of the Brooklyn Edison Company, a 25,000-kw. turbine for the Virginia Power Company, Cabin Creek, Va.; a 35,000-kw. turbine for the Calumet station of the Commonwealth Edison Company, Chicago; a 25,000-kw. turbine for the United Electric Light Company, Springfield, Mass., and a 10,000-kw. turbine for the American Rolling Mills, Middletown, Ohio.

Electrification Data Needed

A technical commission in Portugal (No. 35,284) desires to be placed in communication with firms in the United States engaged in undertakings such as the electrification of railways and transmission of electrical power and to secure literature and catalogs from manufacturers of material and accessories pertaining thereto.

Rolling Stock

The Hydro-Electric Railway, Windsor, Ont., intends to rehabilitate its present rolling stock and buy twenty new cars.

The New York, New Haven and Hartford Railroad, New Haven, Conn., mentioned in the July 30 issue as having placed an order with the Osgood-Bradley Car Company for eight steel motor cars and for fourteen trailer cars of the same type, has given the following data on these cars:

Number of cars ordered (motor)	8
Date of order	Dec., 1920
Date of delivery	Dec., 1921
Builder of car body	Osgood-Bradley Car Company
Type of car	Motor-passenger
Seating capacity	84
Weight—	
Car body	68,500 lb.
Trucks with motors	69,700 lb.
Equipment	32,000 lb.
Total	170,200 lb.
Bolster centers, length	47 ft. 7½ in.
Length over all	72 ft. 7¼ in.
Truck wheelbase	8 ft. 1 in.
Width over all	9 ft. 8 5/16 in.
Height to top of roof	13 ft. 3⅝ in.
Body	All steel
Interior trim	Steel and agasote
Headlining	Agasote
Roof	Monitor
Air brakes	Westinghouse AMU-2-16
Armature bearings	Brass
Axles	O. H. Steel
Car signal system	Westinghouse Air
Car lighting	Adams & Westlake or Safety Company
Center bearings	M. C. B.
Side bearings	Creco roller
Conduits and junction boxes	Osgood-Bradley pressed steel boxes
Control	Westinghouse multiple unit
Couplers	National Malleable Castings Company—extended horn
Curtain fixtures	National—cam type
Curtain material	Pantasote
Gears and pinions	Nuttall BP
Heater equipment	Consolidated—52 Truss plank—26 seat
Headlights	Golden glow—12-in. reflector
Journal bearings	Brass
Journal boxes	Cast steel 6½ in. x 11 in.
Lightning arresters	Westinghouse 379-s 3-time element relay with 392 overload trip
Motors	6 cars—4 Westinghouse 409-D 2 cars—4 Westinghouse 417
Sash fixtures	National
Seats	Heywood Brothers & Wakefield
Seating material	Pantasote
Slack adjuster	American type L
Springs	Triple elliptic
Step treads	Feralun
Trucks	Standard Motor Truck Company
Ventilators	Osgood-Bradley
Wheels	Steel-tired 42-in.
Draft gear	Radial for operation on loop at lower level of Grand Central Terminal
Current collector	Railroad Company's Standard A.C. pantagraph and D.C. third-rail shoes

The body design of the trail cars is identical with that of the motor cars. The trail cars, weighing 104,000 pounds, are equipped with Westinghouse ATU-1-16 air brakes. The wheelbase of the truck is 1 in. shorter than that of the motor cars. The journal boxes are 5 in. x 9 in., while the wheels are 36-in. forged steel instead of 42-in. steel-tired. The American type J slack adjuster is used instead of the type L used on the motor cars.

Franchises

Shawnee-Tecumseh (Okla.) Traction Company, is resetting its tracks in Tecumseh. When the franchise was granted the company it provided for a double-track line which was never built. The line was built to one side of the street and it is now being removed to the center of the street preparatory to paving the road. The company has also replaced the wooden structure across the North Canadian River with a new steel girder bridge.

Fort Worth-Lake Worth (Tex.) Interurban, has been granted a permit by the County Commissioner's Court of Tarrant County sitting at Fort Worth, Tex., for the construction of an interurban line from Fort Worth to Lake Worth, a distance of about ten miles. The permit was granted to A. P. Barrett, W. P. Welty and J. H. Jackson, and it is proposed to build the line from the terminus of the Rosen Heights Street car line to the Municipal Bathing Beach on Lake Worth. The lake is the outdoor resort not only for the City of Fort Worth but for all the country within a hundred miles of the city. The cost of the line, according to Mr. Barrett, is estimated at $350,000.

Track and Roadway

The Columbus (Ga.) Railroad is rebuilding its track on the North Highland line using heavier rails and additional switches. This was found necessary in order to operate an increased schedule. A loop is also being constructed at the end of the line.

United Railways & Electric Company, Baltimore, Md., will extend its line one mile from Carney, Md.

Winnipeg (Man.) Electric Railway, is tearing up its old tracks on Main Street between Sutherland and Selkirk Avenue and replacing them by new 85-lb. heavy type standard rail. The ties are also being renewed, and special intersections put in at Dufferin and Main, Euclid and Main, and Selkirk and Main. Work on improving the tracks on Sherbrooke street and Sargent Avenue is also proceeding.

Public Service Railway, Newark, N. J., will remove its tracks in the middle of Valleybrook Avenue, Lyndhurst, N. J., and install a double track system in that thoroughfare.

Phillipsburg (N. J.) Transit Company, has been directed by the city commission to make improvements between the tracks on Lewis, Heckman and South Main Streets, Phillipsburg.

Oklahoma Railway, Oklahoma City, Okla., has met with the approval of the citizens at a hearing before the corporation commission in its plan to spend $100,000 in improvements and extensions, with the exception of the proposal of the company to abandon a section of track on Twenty-eighth Street. Other changes will be approved, including the consolidation of the Capitol and Culbertson lines, in a way to improve the service.

Trenton, Bristol & Philadelphia Street Railway, Philadelphia, Pa., is making a number of improvements to the bridge spanning the Neshaminy Creek at Croyden, Pa. and the bridge is now closed to traffic.

Wichita Falls (Tex.) Traction Company, will at once begin construction on the new Ninth Street line, from Floral Heights into the business district of the city. Permit for this line was granted by the City Council recently. The new line will traverse Ninth Street from Broad Street and will eliminate a loop of about twenty blocks, thus effecting a material saving in the operation of cars to the Floral Heights section. The company also announces that a new line will be built to serve the southern part of the city which has been developed since the Southland line was built several years ago.

Dallas-Terrell (Tex.) Interurban Railway will enter Dallas via Forney Avenue, Stonewall Street and Parry Avenue, according to Richard Meriwether, vice-president and general manager of the Dallas Railway and also vice-president of the interurban company. Application will soon be made to the City Commission of Dallas for trackage rights. Work of grading for the line between Dallas and Terrell is going forward, Mr. Meriwether said, but several small stretches of right-of-way must be secured before the grading work can be completed.

Charlottesville & Albemarle Railway, Charlottesville, Va., will enlarge Jefferson Park.

Power Houses, Shops and Buildings

Pacific Gas & Electric Company, Sacramento, Cal., has installed a new 12,500-kw. steam turbo-generator at Station "C," Oakland. It is a General Electric machine.

Interstate Public Service Company, Indianapolis, Ind., has selected a tentative site for the construction of a dam on Fourteen Mile Creek, near Charlestown, Ind., with which to provide power for an extension of the company's lines from Charlestown through New Washington, Madison, and thence to Aurora, connecting with the line to Cincinnati.

Dominion Power & Transmission Company, Hamilton, Ont., suffered a loss of more than $75,000 when its substation on Victoria Avenue, North Hamilton, was struck by lightning during a recent storm. Repair work is well under way.

Trade Notes

The Michigan Railroad Company, Jackson, Mich., has equipped fifty-four of its cars with the new Root spring lifeguard manufactured by the Root Spring Scraper Company, Kalamazoo, Mich.

J. E. Slimp, after a two months' association with the E. T. Chapin Company, as manager of sales, located at Chicago, has resigned. The E. T. Chapin Company is a producer of Western red cedar poles and piling and has its home office at Spokane, Wash.

The Belden Manufacturing Company, Chicago, Ill., is now supplying standard magnet wire in even quantities of ¼, ½ and 1 lb. on small substantial fiber spools, the charge for which is very small. This makes the method of handling quite convenient where small quantities are used.

The Webster & Perks Tool Company, Springfield, Ohio, announces that the grinding and polishing stand and accessory department of its business has been sold in its entirety to the Hill-Curtis Company, Kalamazoo, Mich., which will continue this business. The Webster & Perks Tool Company will hereafter concentrate upon the exclusive manufacture and sale of the W&P line of universal and plain cylindrical grinding machinery.

The Globe Ticket Company, Philadelphia, Pa., celebrated its thirtieth anniversary of incorporation on June 25 by an excursion of its employees, numbering about 450, to Atlantic City. All were entertained as guests of W. E. Hering, president of the company. This company has just enlarged its factory space by almost 20 per cent, so that it now occupies eight floors of its building at 112-114 North Twelfth Street, Philadelphia.

The Root Spring Scraper Company, Kalamazoo, Mich., manufacturers of spring snow scrapers and lifeguards, reports that shipment was recently made of four hundred scrapers for the new cars now being built for the Detroit Municipal Railway. The scrapers were delivered to the manufacturers of the cars who will install them. Several smaller orders from old users of the equipment have also been filled.

Albert Taylor, manager North Atlantic District, the Electric Storage Battery Company, Philadelphia, died suddenly in New York on July 6. Mr. Taylor, who was a graduate of Princeton University, joined the Electric Storage Battery Company in 1898 as a salesman in its New York office, having previously been with the Edison General Electric Company, the United States Electric Company (absorbed by Westinghouse), and the Stanley Electric Manufacturing Company. In January, 1900, he was made assistant manager of the company's New York office and two months later became manager. In February, 1920, Mr. Taylor was selected as manager for the North Atlantic District, embracing branches in New York, Rochester and Boston, and covering the states of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York and part of New Jersey.

New Advertising Literature

The Ward Leonard Electric Company, Mount Vernon, N. Y., has issued a booklet describing its "vitrohm" (vitreous enameled) resistor units.

The Delta-Star Electric Company, Chicago, Ill., is distributing bulletin No. 36, devoted to its high-tension air-brake switch and outdoor substation equipment. This bulletin contains forty-eight pages and will be mailed upon request.

The William B. Scaife & Sons Company, Oakmont, Pa., has issued a booklet entitled "Facts About Water Purification for Steam Generation." This treats of the various substances to be found in water used for steam generation and describes method of softening and purifying the water to prevent scale and corrosion in the boiler.

The Thompson Electric Company, Cleveland, Ohio, has issued a folder describing its safety disconnecting hangers, which enable high lamps to be lowered away from the electric circuit for cleaning and renewals. The use of these hangers makes reflector and lamp cleaning easy and safe and much more likely to be done since they bring this maintenance work down to the ground instead of requiring some one to climb to it.