REPAIR SHOP PRACTICE IN COLUMBUS, OHIO

The Columbus Railway & Light Company, of Columbus, Ohio, has a very complete repair shop, which takes care of practically all its own repair work, and it also engages in the manufacture of material and repair parts much more extensively than the majority of companies. The shops are located in a group of three buildings, adjoining the Rose Avenue car

FIG. 2.—AIR HOISTS AND CIRCULAR CRANES

houses. An exterior view of the shop buildings and master mechanic's office is shown in Fig. 1. The pits and truck room are located in the front wing, which measures 55 ft. x 95 ft. The machine shop occupies the ground floor of a three-story building, formerly an old horse-car barn. The second floor of this building contains the armature and field coil rooms and a

hoists on circular cranes in the rear of the shop and one 4-in. hoist in the armature room. A Christensen direct-connected compressor, supplying 150 ft. of air per minute, discharges into a 42-in. x 10-ft. reservoir, which supplies the hoists and is used for other purposes. The car hoists have stirrup-shaped attachments, and in hoisting a car a timber is placed under each end of the car and through the stirrups. It is possible to hoist a car in half a minute. The circular cranes are used in handling



FIG. 3.—BRASS FOUNDRY

motors, armatures and trucks. Together they cover the entire width of the shop, the diameter of each circle being 24 ft. Each crane has two arms extending from the center to the circumference, these arms being pivoted at the center, with travelers at the outer ends. On the arms are also travelers from which the air hoists are suspended. The outfits were built

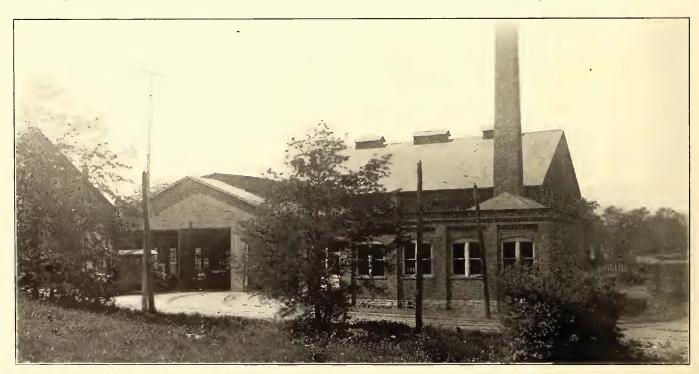


FIG. 1.—EXTERIOR OF REPAIR SHOPS, COLUMBUS RAILWAY & LIGHT COMPANY

stock room, 65 ft. x 65 ft., while the third floor is used for . storage. The carpenter shop is in a wing, 48 ft. x 100 ft., at the rear of the main building. The paint shop, foundry and blacksmith shop are in separate buildings, a short distance from the main buildings.

Air hoists are used extensively in the truck room. For hoisting cars there are eight 9-in. hoists, each capable of lifting 3 tons, covering three pit tracks. There are also two 6-in. air

in the company's own shop, and cost \$240 each complete, including air hoist and connections. The circles were made from 8-in. I-beams, which were bent into proper shape on a wheel press. They were laid out with a templet, and steel-faced blocks were used in the wheel press. The I-beams were moved about 9 ins. at a time, and they went over the circle three times to insure accuracy. The outfit gives two cranes without any posts in the center of the room, and at a saving in cost of 200

per cent over the ordinary type of crane. The cranes were of great advantage this spring when the company changed motors on nearly 100 pairs of trucks used under box cars and placed them on trucks used under summer cars, and it was possible to change from six to seven cars per day with seven men in the shop. The Columbus system is broad gage (5 ft. 2½ ins.), and the company uses maximum traction trucks with a 20-in. pony

wheel on the box cars and an 18-in. wheel on the summer cars. The closed cars have seventeen-tooth pinion and sixty-seven-tooth gear, while the summer cars have nineteen-tooth pinion and sixty-nine tooth gear, hence separate trucks were required.

For car lubrication the company

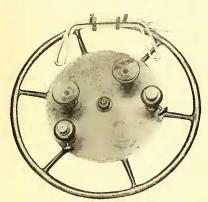


FIG. 6.—FORM FOR WINDING G. E.-800 ARMATURE COILS

tions and drawn together by a large bolt and nut, as shown in Fig. 5, with a commutator segment inserted. The men have slotted, set up and turned commutators ready to go into armatures in 1½ hours, and the average time is less than 2 hours.

For winding G. E. 800-armature coils the company uses a specially designed form, which consists of a large brass hand wheel provided with spools having ridges suitably arranged for



FIG. 7.—INTERIOR OF STOCK ROOM

uses Galena car oil. On motor bearings wick-feed armature cups are employed, of the type recently illustrated in the Street Ratlway Journal as having been originated by this company. The journal boxes are packed with Perfection packing waste,

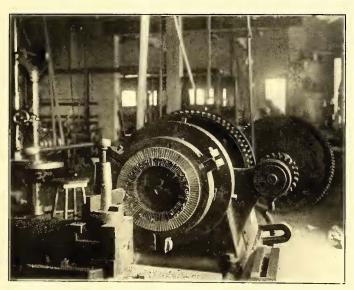


FIG. 4.—TURNING COMMUTATORS

the same as a freight car. The cost of lubrication on this system does not exceed 12 cents per 1000 miles.

The G. E. 67 motor is used as standard, and besides doing all its own armature work, the company builds all its own commutators.

Billings & Spencer drop-forged commutator bars are employed, with Chicago Mica Company's mica bars as segments. These bars are assembled in a three-part clamp, as shown in Fig. 5, and faced and slotted in a lathe, as shown in Fig. 4. The commutator is held in place while being turned and banded on the outside by a core, which is cast in two sec-

this particular coil (see Fig. 6). Two of the spools have release plugs which slip out for removing the coil. All armature and field coil winding is done by one girl in a winding room, which is located on the second floor. Taping is done by hand,

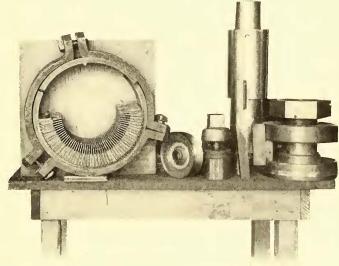


FIG. 5.—CLAMP AND COMMUTATOR SEGMENTS, ARBOR FOR TROLLEY WHEEL, TOOL FOR TURNING TROLLEY WHEEL, EXPANDING MANDREL AND COMMUTATOR CORE

as it is claimed it can be done more accurately than by machine. Coils are first taped with white braid, and then dipped in armalac, and the portions which fit into the armature slots are taped with Star friction tape. The coil is then taped the second time with linen tape, and then dipped in Massachusetts Chemical Company's armalac insulating varnish.

A small but well equipped brass foundry takes care of a remarkably large amount of work. One man, at \$2.50 per day, does all the work in this department, including making of cores and babbitting. The company produces practically all the brass castings required in the operation of the system, in-

cluding rail-bonds, line ears, trolley wheels, controller parts, journal bearings, etc. As an example of the intricate work produced it might be stated that the company recently turned out a set of switchboard equalizing bars with sixteen double connections. The furnaces were home-made, and consist of two old boiler shells, which were lined with firebrick and provided with suitable castings at top and bottom. Natural draft

THE COL	UMBUS	RAILWAY	COMPANY.
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Туре,		MOTOR No. 1.		MOTOR No. 2.
Arm. out.				
Arm. in,				
P. Brasses,	Out	in	Out	In
C. Brasses,	Out	In	Out	ln .
Axle Brasses,	Out	In	Out	In
Fruck Brasses,	Out	In	Out	In
Pinion,	Off	On	Off	On
Gear.	Off	On	Off	On
Whyels,	Off	On	Off	On
Wheels.	Off	On	Off	On
ield Coils—Top,	Out	In	Out	ln
Field Coils—Bottom,	Out	la .	Out	<u>In</u>
Miscellaneous Repairs,				
Remarks :				

FIG. 8.—TRUCK-ROOM REPORT ON CARS TURNED IN TO MASTER MECHANIC WHEN WORK IS COMPLETE

is used with a good grade of coke for fuel. But one furnace is used at a time, giving each one heat per day. The composition used in trolley wheels is nine parts of copper and one of tin.

THE COLUMBUS RAILWAY COMPANY, CAR REPAIRS.

Car No.	-	_ 190 _
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* Arms, • 2 7		
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" Fronts,		
" Panels,		
Dashes,		-
Miscellaneous Repairs		
	Total, and an analysis of	

FIG. 9.—CARPENTER SHOP REPORT ON CAR REPAIRS

It is claimed that in preparing the metal it should be melted and run into pigs and then melted the second time. When put into the lathe it should cut very tough and free from grit, and the shavings should turn a red color. In turning wheels a single tool is used, which is provided with ears, which trims the sides as well as turning the center, and they are able to finish forty wheels an hour by this method. The tool and arbor used are shown in Fig. 5. G. E. graphite bushings are used, and the wheel has a reservoir which is filled with oil. The 4-in. wheels cost 42 cents, and they have averaged 6567 miles over a period of several years. The company makes all its own babbitt and bearing material. The babbitt used is a com-

position of 83 1-3 per cent tin, 8 1-3 per cent copper, and 8 1-3 per cent antimony. In making rail-bonds the company uses scrap wire of 9-gage, 10-gage or 11-gage. Seven strands are usually employed. A tin clamp holds them in place and a pure copper lug is cast on. As shown in view of the foundry, Fig. 3, the rail-bond molds are designed to produce five bonds at a time. The lugs are then turned and expanded on a lathe. The Columbus Railway Company

TO C. E. HOTT:		
	Car House,	190_
Name of Conductor	Molorman,	
No. of Car,Time,	Where occurred,	
Give detail description of troubl	le and damage resulting:	
		Motor Inspector.
NOTE.—This report must be made out p	promptly by Motor Inspector, reporting any trouble which may cause or any damage car may receive	e car to be removed from service
	or any damage car may receive	
	F CAR TROUBLES MADE BY	
FIG. 10.—REPORT OF	F CAR TROUBLES MADE BY	
FIG. 10.—REPORT OF	F CAR TROUBLES MADE BY TO MASTER MECHANIC	BARN FOREMA
FIG. 10.—REPORT OF	F CAR TROUBLES MADE BY	BARN FOREMA
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No. 13—12-17-03-5000 The Column MR. HOTT:	F CAR TROUBLES MADE BY TO MASTER MECHANIC mbus Railway & Light Cor	BARN FOREMA mpany
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No. 13—12-17-03-5000 The Column MR. HOTT:	F CAR TROUBLES MADE BY TO MASTER MECHANIC mbus Railway & Light Cor	BARN FOREMA mpany. //90 Division
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PANTITY	ARTICLE.		COST.	
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FIG. 12.—FORM FOR CREDITING RETURNED MATERIAL

Bonds are produced at the rate of 120 per day, and they cost about 16 cents, figuring material, labor and all foundry expenses. Trolley ears, 14 ins. long, cost 16½ cents each. Armature bearings have a composition of 80 per cent copper, 15 per cent lead and 5 per cent pig tin, and have shown a life of 58,000 miles and over. Controller cylinder segments are cast in rings and turned out, using an expanding mandrel to get inside. The company has a complete line of expanding mandrels, which were made in the shops. The company is also making its own register fittings, and hangs the register pulleys from the hand-strap pole, using eighteen on a car. For the corner pulley a 4-in. wheel with wide groove is employed. A

5-16 round leather belt is used, and practically all trouble from breaking of register cord has been eliminated. In fact, there has been only one replacement during a year after cars were equipped. Span-wire insulators are made from steel strips, cut into suitable lengths, using porcelain knobs and bolts.

The stock room, measuring 65 ft. x 65 ft., is located on the second floor of the main building, and is reached by dumb waiters and speaking tubes from the various departments below. The master mechanic has a photograph album, containing photographs of every piece of material produced in the shop

S. 26-2-24-03-3000 The Columbus Railway Company.

TYPE		NUMBER	
9852	Fuld	# 318	
4	7,0	HOURS	
fite	1 Insulation	mpaned	

FIG. 13.—SPECIMEN OF DAILY REPORT FROM ELECTRICAL DEPARTMENT

and carried in stock. These have numbers corresponding to the pattern numbers, and the work of ordering material is greatly facilitated by this method.

The use of pumice stone and sand-paper in rubbing down and finishing woodwork and car bodies has been entirely dispensed with. Instead, the company uses a fine silica sand, which is rubbed on wet with a sponge or cloth. This material

The Columbus Railway & Light Company.

Name	å	No.	No	
			CHARGE	
			•	
			_	
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FIG. 14.—DAILY TIME CHECK MADE OUT BY EVERY SHOP MAN

cleans mouldings and crevices and gets into corners in a manner impossible with sand paper. The sand is bought by the wagon load, and costs \$4 per ton, as compared with pumice at 7 cents per pound. In cleaning dirty woodwork the company first uses a preparation of soft soap, made by dissolving Star laundry soap in hot water, which is then rubbed thoroughly with the silica sand. The cleaning is done thoroughly, and the woodwork is not scratched in the least. The saving in time by this method is enormous. In painting cars the company does not use any rough stuff, and prefers the less glossy finish. All cars are touched up and revarnished once a year. Rusty steel dashes are burned off, treated with a coat of boiled linseed oil, applied hot, and brought up to a color with lead surface. The Columbus cars have considerable fancy lettering and striping, but it is figured that this costs practically nothing, because it is done entirely by the foreman, who is not expected to assist in the ordinary work.

This spring all summer cars were fitted with eaves troughs.

vanized iron, worked in a molding, and there is down-spout of 3/4-in. gas pipe at each corner post. The scheme cost about \$9 per car, but it is figured

that it will save the car by taking the water off from the woodwork, joints and curtains and prevents it from blowing onto the seats, and it is also an innovation that is greatly appreciated by the conductors, being in line with the company's well-known policy of taking an unusual interest in the men. It will

be remembered, as here-

inbefore outlined in the

STREET RAILWAY JOUR-

These are made of gal-THE COLUMBUS RAILWAY & LIGHT CO. REQUISITION FOR MATERIAL. To be ordered of

FIG. 15. ORDER ON THE MAIN OFFICE FOR MATERIAL

NAL, the Columbus company gives every employee an annual dividend, figured on the basis of his earnings.

A very complete system of records is kept. The company keeps mileage records on cars, trucks, car bodies and motors; also on wheels, armatures, commutators, pinions, brasses, axles, gears, trolley wheels, etc., and monthly and annual reports are prepared covering all these details. The master mechanic receives a daily report from car house as to car mileage; the cars average about 150 miles per day. From the shop foreman he receives daily reports as to repair work done and replacements made, the reports covering both the time of the men employed on the work and the car on which the work was performed.

The master mechanic maintains in his office a card rack, showing the numbers of the cars in service on each division. The cards show the type of car, size, motor, truck and other details. If a car is disabled the card is reversed and shows up a red face indicating that the car is out of service.

The shops of the company are in charge of C. E. Hott, master mechanic, who has occupied this position since the horse-car days. He is responsible for nearly all the innovations introduced.

The sink hole on the Urbana, Bellefontaine & Northern Railway near Round Prairie, Ohio, is proving a most expensive obstacle. Reference to this hole was made some months ago, when it was thought it was being filled up. At present, however, the situation seems to be worse than ever. The hole is only 50 ft. across, but the many thousands of feet of cinders, rock and gravel, besides large quantities of timber, which the company has dumped into the hole have disappeared in a few hours. Quite recently the company made another determined effort to complete the fill. It dumped more than thirty train loads of earth, and came near losing some of its cars, which had been allowed to stand on the track over the hole for a few minutes. The Cleveland & Southwestern Traction Company had such a hole on its line two years ago, but after persistent efforts it was finally filled up. C. A. Alderman, chief engineer of the Appleyard system, is offering a prize to any one who will tell him how to fill the hole.