FOR PERSONAL INFORMATION ONLY — Must Not Be Published Before Presentation at the Annual Meeting.

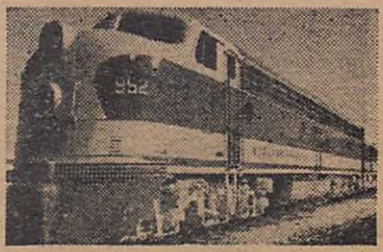
1963 PRE-CONVENTION REPORT

★

25th Annual Meeting

— of —

Locomotive Maintenance Officers Association



Oct. 14, 15, 16, 1963 — McCORMICK PLACE, Chicago, Ill.

(Lodging only Hotel Morrison)

Surrette

MULTIPLATE BATTERIES

With Rezistox Plates and Quadruplicate Insulation Including Dynel

—FOR—

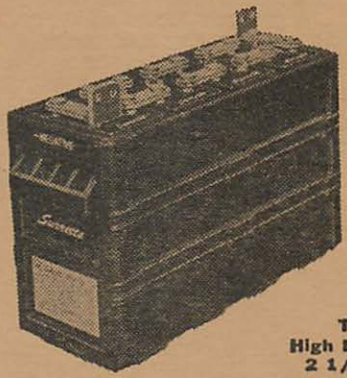
DIESEL LOCOMOTIVES

Plate edges sealed with Polyethylene all sides.

Heavy plate feet protrude through die-cut rubber insulators on bottom of plates.

Insulated all sides.

No shorts possible.



Higher Sustained Voltage When Cranking Means Faster Cranking

48 Railroads have purchased Surrette Batteries

Type G-T-N-S
High Electrolyte Level
2 1/2" Over Plates

1. Lower current density per plate made possible by the greater number of plates and greater effective plate area. 2. Reduces water consumption. 3. Reduces positive plate oxidization. 4. Anticipated service life increased by months. 5. Requires up to 50% less watering and attention through their greater service life.

Exclusive REZISTOX GRID CONSTRUCTION makes possible 40% more plate surface each cell. Costs no more than other recognized brands. Proven in tests and field service over a 20-year period. The extra capacity, lower current density per plate, REZISTOX plates, Quadruplicate insulation with Dynel is a bonus which reduces maintenance and adds months of longer trouble-free life.

Higher cranking voltage and lower operating cost.

Rubber Monobloc Containers also available for Low Compartments.

The **Surrette** STORAGE BATTERY CO., Inc.

Jefferson Ave., Salem, Mass.

ATTENTION EVERYONE COMING TO THE MEETING!

REGISTRATION FEE AT ANNUAL MEETING $3.00 PER MEMBER!

LADIES FREE

1. TO SAVE **YOUR** TIME, WE HAVE A "REGISTER AT THE MEETING SYSTEM." This is described on page 8 of this book. (USE IT **TODAY!**)

2. **SUPPLY COMPANY MEMBERS: SPECIAL ATTENTION!** Your membership card and registration fee of $3.00 paid at **our** desk **will entitle you to attend any and all regular meeting room sessions. IT WILL NOT ADMIT YOU TO THE EXHIBITS and ENTERTAINMENT:** they are owned, financed, and operated by the Railway Supply Assn., Inc., 332 South Michigan Ave., Chicago, Ill., in which we recommend membership, which may be arranged if you desire at their desk at the meeting, or by mail to the above address.

3. **IF YOU LIVE IN THE CHICAGO AREA:** Our registration desk will be open Sunday, October 13, beginning at 2:00 p. m. Come in Sunday afternoon, register, and enjoy this special opportunity to visit with our officers and your other friends. THIS WILL SAVE YOU VALUABLE TIME ON MONDAY MORNING: KEEP YOU OUT OF THE REGISTRATION RUSH.

4. **BRING YOUR WIFE WITH YOU:** She will enjoy the special entertainment planned for her!

5. BE SURE **NOW** YOU HAVE YOUR 1963 MEMBERSHIP CARD. (If you can't find it, ask for another **TODAY, please don't wait to get one at the meeting. There will be no facilities there to issue one to you. This delays too many other members waiting behind you in line.)**

SPECIAL INSTRUCTIONS: TAKE NOTE

6. **STUDY these reports closely.**
7. **SEND written questions to the Chairmen.**
8. **READ registration instructions on page 8.**
9. **BRING THIS BOOK TO EVERY SESSION OF THE ANNUAL MEETING! There are no extra copies.**
10. **SAVE YOUR TIME: Prepare your Registration Form on page 8, BRING IT WITH YOU!**
11. **Come to McCormick Place to Register for a Convention Badge.**

1963 Advertisers Index

This space dedicated to the firms listed below for their cooperation and assistance in making possible the publication of our Twenty-Fifth Annual Pre-Convention Report in the year 1963.

INDEX

MONDAY, OCTOBER 14, 1963

TUESDAY, OCTOBER 15, 1963

WEDNESDAY, OCTOBER 16, 1963

SPECIAL EDITORIAL: ATTENTION ALL MEMBERS!

Clear The Track For Railroad Mergers!

Today's major transportation problem is seen most clearly as one of too many carriers and too much transport capacity, combined with too little traffic. It's as though a roominghouse dinnertable were set for five people, and seven or eight showed up to eat: Someone, obviously, is going to go hungry!

The cause of this dilemma lies mainly in ever-expanding government development programs for road, air and water facilities, which this year will entail spending by all units of government of some $15 billion. Our taxes, in effect, are being used to wring our necks.

Railroad mergers are a natural reaction to this basic economic problem. They enable management to streamline plant and cut costs to meet today's rough-and-tumble competitive conditions. Mergers help railroads offer the public better services. They are a main key to a more prosperous industry offering more secure employment.

The public benefits through the merging of railroad systems not only from lower transportation prices resulting from increased economies, but also through improved services due to the stronger competitive position of the consolidated railroads. Mergers have the added virtue of reducing excessive transport capacity and permitting railroads to channel additional capital into modernization programs.

As for the crucial matter of jobs, railroads strengthened by soundly conceived mergers offer promise of more stable employment in the future. Traffic expansion could even lead in the long run to more, not fewer, jobs. Meanwhile, workers who may be affected by mergers have the extraordinary liberal protection required by law, which is unparalleled in scope and benefits in general industry.

The current railroad merger movement basically must be viewed as an end-product of revolutionary changes in technology, rising competition and governmental policy inequities. What is needed is not another study of the railroads nor a moratorium on mergers but a policy of encouraging sound mergers, together with maximum freedom to pass the resulting economies on to the public in the form of improved services and reduced prices. Here lies the route to the super-transportation service of the American future.

Association of American Railroads
Washington, D. C.

ADM CHEMICALS / FOCUS ON FUNCTION

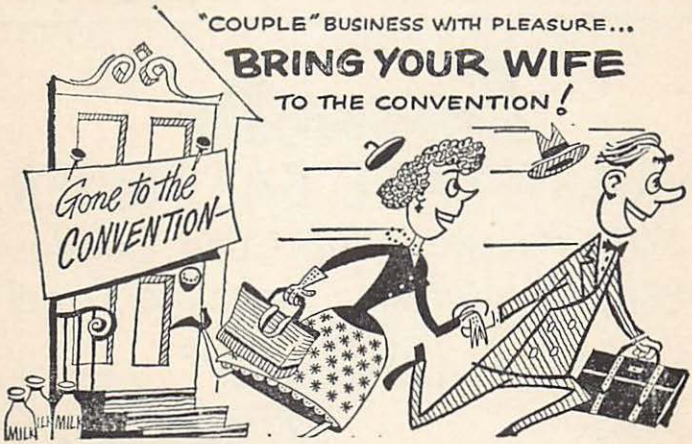
TUFF FAST-DRY ENAMEL— One-day application, automotive-type beauty and durability. Prime, topcoat and stencil a car in 4 to 6 hours.

TUFF EPOXY SYSTEM— Major breakthrough in chemical-resistant coatings. Tuff offers durability plus high gloss and color retention.

ADM *Freight Liner* PRODUCTS

ADM CHEMICALS

ARCHER DANIELS MIDLAND COMPANY 700 INVESTORS BUILDING MINNEAPOLIS 40, MINNESOTA



Just look at that cut; guess the fellow who made it never had a wife!

OF COURSE YOUR WIFE IS COMING TO THIS ANNUAL MEETING;

She Wouldn't Miss It For Anything!

We Just Hope That SHE Brings YOU With Her!

SUPPLY MEMBERS: SPECIAL ATTENTION!

Your Membership Card and Registration Fee paid to us will entitle you to a "Meetings Only" convention badge that will entitle you to attend all our meeting sessions.

It will NOT permit you to enter the Exhibit Hall or Entertainment Hall: These two features are owned and operated by the Railway Supply Association, Inc. They pick up the check for both; naturally they will confine admission to these two events to their own members and guests.

If you are not a member of the Railway Supply Association, Inc., we urge you to join today, writing their Secretary-Treasurer, 332 South Michigan Avenue, Chicago, Illinois, for application.

If for any reason you don't care to or cannot join the Railway Supply Association: Please understand that your membership with us will permit you to attend all our annual meeting sessions: BUT WILL NOT PERMIT YOU TO ENTER THE EXHIBIT HALL OR ENTERTAINMENT!

Please understand and appreciate the correctness of the above arrangement, help us avoid the one or two misunderstandings that arise on this issue each year. THANKS!

ATTENTION ALL MEMBERS COMING TO THE ANNUAL MEETING

SPECIAL CONVENTION REGISTRATION INSTRUCTIONS

We WILL NOT "Register By Mail" This Year

(Development of the Sun. afternoon registration has made this unnecessary.)

Please DO NOT Send In Any Registrations By Mail

AT THE ANNUAL MEETING

1. Register **First** at Registration Desk in Lobby at McCormick Place; **then** come to L. M. O. A. Registration Desk in Lobby.
2. CLIP (don't staple) Three One Dollar Bills **RIGHT HERE.**
3. CLIP (don't staple) YOUR 1963 MEMBERSHIP CARD **RIGHT OVER THE MONEY.**
4. ☐ **I WANT A BADGE FOR MY WIFE** (CHECK BOX) (Supplymen get Wives Badges at Allied Booth.)

WE ARE NOT PERMITTED TO ISSUE GUEST BADGES FOR ANY SUPPLY COMPANY REPRESENTATIVES OR FOR ANY RAILROAD PEOPLE WHO SHOULD BELONG TO THE **TRAVELING ENGINEERS, CAR DEPARTMENT OFFICERS, and AIR BRAKE ASSOCIATIONS.** WE ARE NOT PERMITTED TO ISSUE ANY BADGES FOR WIVES OF SUPPLYMEN: THESE ARE ISSUED AT THE ALLIED RAILWAY SUPPLY ASSN. BOOTH.

5. TEAR OUT THIS PAGE (attach your card and money now) AND PRESENT IT TO REGISTRATION GIRL UNDER SIGN READING, "PAID UP MEMBERS REGISTER HERE."

6. THE REGISTRATION GIRL WILL KEEP YOUR CARD. (It will be mailed to you after the meeting.)

7. **IF YOU CAN'T FIND YOUR 1963 MEMBERSHIP CARD, CHECK THE BOX BELOW: RUSH TO THE SECRETARY TODAY.**

☐ I AM COMING TO THE CONVENTION, BUT CANNOT FIND MY CARD MAIL ME ANOTHER.

Name .....

Title .....

Company .....

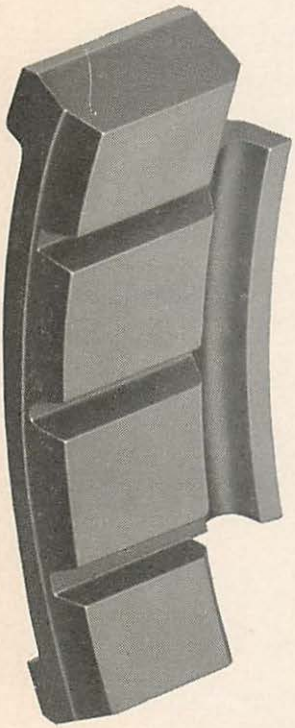
Address .....

Please don't come to the meeting without your card, the **other fellows** won't like standing in line behind you while **you** are getting one.

8. DO THE ABOVE **BEFORE** COMING TO THE CONVENTION; IT WILL SAVE TIME FOR **EVERYONE.**

ANCHOR®

COMPOSITION TREAD BRAKE SHOE



- *Longer Brake Life*
- *Longer Wheel Life*
- *Smoother, "Softer" Rides*

ANCHOR Shoes mean lower maintenance costs per train operation mile . . . substantially lower replacement costs . . . and stable friction at all speeds. Monetary savings quickly amortize conversion costs. The lower braking forces required cause less wear on pins and bushings—which means less brake rigging maintenance. Truck members can be lighter, less bulky . . . and less costly.

RPI MEMBER

GRIFFIN WHEEL COMPANY®

445 North Sacramento Boulevard • Chicago 12, Illinois

Chicago • Colton • Muncie • Tacoma

GRIFFIN STEEL FOUNDRIES LTD.

St. Hyacinthe, Quebec;
Transcona, Manitoba, Canada

ONE OF THE Amsted INDUSTRIES

ATTENTION ALL RAILROAD MEMBERS!

The ground rules of this Annual Meeting require:
"THAT ALL SUPPLY COMPANY HOSPITALITY SUITES MUST BE CLOSED TO AND OFF LIMITS TO **ALL RAILROAD PERSONNEL** WHILE THE MEETINGS ARE IN PROGRESS."

Please do not **embarrass** your Supply Company friends by calling at their suites while the meetings are in progress; it will cause them:

1. **To remind you of this ground rule.**

or

2. **To lose their reservation at this meeting, and to forfeit their right to attend future meetings.**

ALL SUPPLY COMPANY MEMBERS: Your strict observance of the above rule is absolutely necessary, will be greatly appreciated.

You are urged to attend the meetings because:

1. **Your** product might be discussed.
2. You might be in position to answer a question that is asked.
3. You need to know what **our** problems are, in some cases, they are **your** problems also.

★ ★ ★

ATTENTION ALL MEMBERS:

THIS IS A SINCERE WORD OF THANKS TO THE ORGANIZATIONS LISTED BELOW WHO HAVE CONTRIBUTED MUCH TO THE SUCCESS OF OUR 1962 PRE-CONVENTION PRESENTATION PROGRAM BY PROVIDING COMPLIMENTARY USE OF ROOMS FOR COMMITTEE MEETINGS AND FOR THE PRE-CONVENTION PRESENTATIONS THEMSELVES:

Albany Hotel, Denver, Colo.
American Legion Shawnee Post, Louisville, Ky.
Baker Hotel, Dallas, Texas
Claridge Hotel, Memphis, Tenn.
Hamilton Hotel, Chicago, Ill.
Fred Harvey's, King Louis IX Dining Room, Union Station, St. Louis, Mo.
Jefferson Hotel, Richmond, Va.
Mayflower Hotel, Jacksonville, Fla.
Patten Hotel, Chattanooga, Tenn.
Pomponios D-X Restaurant, 48th & Pecos Sts., Denver, Colo.
Sherman House, Chicago, Ill.
Texas State Hotel, Houston, Texas
York Hotel, St. Louis, Mo.

There were no obligations for the use of these facilities, but we are quite sure that these establishments would appreciate the opportunity to serve you if and when you are in their vicinity.

OUR OFFICERS FOR 1963

C. A. LOVE
President
Chief Mechanical Officer
Louisville & Nashville R.R. Co.
Louisville, Ky.

F. A. UPTON
Fourth Vice President
General Membership Chairman
Chief Mechanical Officer
C. M. St. P. & P. R.R.
Milwaukee, Wisc.

MEMBERSHIP GROWTH THRU THE YEARS

	Advertisers	*Associate*	*Active*	*Total*
1939	0	27	60	87
1940	34	48	162	244
1941	38	48	210	296
(Annual Conventions were discontinued during the war after the 1941 meeting)				
1942	31	29	82	142
1943	36	23	57	116
1944	70	58	164	292
1945	76	76	214	366
1946	103	187	676	963
1947	101	284	937	1321
1948	113	295	1183	1591
1949	134	595	1789	2521
1950	123	595	2101	2822
1951	125	626	2912	3663
1952	135	510	2747	3392
1953	118	597	3288	4003
1954	118	545	2943	3606
1955	81	434	3235	3750
1956	110	419	3257	3786
1957	100	423	2678	3201
1958	82	350	2320	2752
1959	90	387	2395	2872
1960	98	393	2302	2793
1961	101	348	2201	2650
1962	118	316	2291	2725

1963 GOAL — 3063 BY SEPT. 21 3063

Many thanks for the grand job done in 1962, which helped us retain our top position as the largest such Association in existence.

1963 — "Do All You Can With What You Have" is the slogan for this year. **GET A NEW MEMBER TODAY!**

OUR OFFICERS FOR 1963

H. N. CHASTAIN
First Vice President
Program Chairman
General Asst. Mech. Dept.
A. T. & S. F. Ry. System
Topeka, Kans.

J. J. EKIN
Second Vice President
Advertising Chairman
Supt. Special Equipment
B. & O. R.R.
Baltimore 1, Md.

T. MURRAY
Third Vice President
Meeting Procedure Chairman
Master Mechanic
St. L. - S. F. Ry.
Springfield, Mo.

G. M. BEISCHER
Fifth Vice President
Co-ordination Chairman
C. M. O.
B. & O. R.R.
Baltimore 1, Md.

OUR OFFICERS FOR 1963

C. M. LIPSCOMB
Secretary-Treasurer
Gen. Clerk to Terminal M.M.
Missouri Pacific R.R.
1721 Parker St.
North Little Rock, Ark.

C. L. COMBES
Publicity Chairman
Editor
Railway Locomotives & Cars
30 Church Street
New York 7, N. Y.

OUR OFFICERS FOR 1963

ADVISORY BOARD

R. E. FRANKLIN
Chief Mechanical Officer
Pennsylvania R.R.
Philadelphia 4, Penn.

F. E. RUSSELL
Chief Mech. Officer — System
Southern Pacific Co.
San Francisco 5, Calif.

OUR OFFICERS FOR 1963

ADVISORY BOARD

C. E. POND
Gen. Supt. Motive Power
Norfolk & Western Ry.
Roanoke 17, Va.

K. T. REED
Gen. Mgr. M. P. & E.
C. & O. - B. & O.
Huntington 19, W. Va.

J. A. WELSCH
Gen. Supt. Motive Power
Illinois Central R.R.
Chicago, Ill.

OUR OFFICERS FOR 1963

ADVISORY BOARD

J. G. MOORE
Asst. Vice President — Mechanical
Southern Railway
Washington 13, D. C.

W. D. DICKIE
Chief of M. P. & R. S.
Canadian Pacific Ry.
Montreal, Que., Canada

J. H. HERON
Vice President Equipment
New York Central R.R.
New York 17, N. Y.

J. G. GERMAN
Chief Mechanical Officer
Missouri Pacific R.R. Co.
St. Louis, Mo.

OUR OFFICERS FOR 1963

ADVISORY BOARD

E. A. KUHN
Retired Chief Mechanical Officer
Baltimore & Ohio R.R.
107 Palmetto Lane
Harbor Bluffs, Largo, Fla.

E. F. TUCK
Retired C. M. O.
St. Louis-San Francisco Ry.
819 East Kingsbury
Springfield, Mo.

D. S. NEUHART
Gen. Supt. Motive Power
and Machinery
Union Pacific Railroad Co.
Omaha, Neb.

OUR OFFICERS FOR 1963

PAST PRESIDENTS

1939 and 1940

F. B. DOWNEY
(Past President)
Asst. to Shop Supt.
Chesapeake & Ohio Ry.
Huntington, W. Va.
(Deceased)

1941

J. C. MILLER
(Past President)
Master Mechanic (Retired)
N. Y. C. & St. L. R.R. Co.
419 Liberty Street
Conneaut, Ohio
(Deceased)

1942 to 1946 Incl.

J. E. GOODWIN
(Past President)
Exec. Vice President (Retired)
Chicago & Northwestern Ry. Sys.
4 River Ridge Road
Little Rock, Ark.

1947

S. O. RENTSCHLER
(Past President)
Supt. Motive Power
Bessemer & Lake Erie R.R.
Greenville, Penn.

OUR OFFICERS FOR 1963

PAST PRESIDENTS

1948

C. D. ALLEN
(Past President)
Supt. Motive Power
Chesapeake & Ohio Ry. Co.
Richmond 10, Va.

1949

J. W. HAWTHORNE
(Past President)
General Supt. M. P. & E.
Atlantic Coast Line R.R. Co.
Jacksonville, Fla.

1950

G. E. BENNETT
(Past President)
Vice Pres. - Gen. Purchasing Agent
Chicago & East Ill. Ry. Co.
Chicago Heights, Ill.

1951

P. H. VERD
(Past President)
Vice President — Personnel
E. J. & E. Ry.
Chicago 4, Ill.

OUR OFFICERS FOR 1963

PAST PRESIDENTS

1952

H. H. MAGILL
(Past President)
Retired Master Mechanic
Chicago & Northwestern Ry. Sys.
Route 2, Box 465
Avon Park, Fla.

1953

S. M. HOUSTON
(Past President)
Gen. Supt. Mech. Dept. (Retired)
Southern Pacific Company
568 Superior Ave.
San Leandro, Calif.

1954 and 1955

F. D. SINEATH
(Past President)
Asst. Gen. Supt. M. P.
Atlantic Coast Line R.R. Co.
Jacksonville, Fla.

1956

T. T. BLICKLE
(Past President)
General Mgr. — Mechanical
A. T. & Santa Fe Sys.
Chicago 4, Ill.

OUR OFFICERS FOR 1963

PAST PRESIDENTS

1957

J. T. DALEY
(Past President)
Chief Mechanical Officer
Alton and Southern R.R.
East St. Louis, Ill.

1958

F. E. MOLLOY
(Past President)
Retired Supt. Motive Power
Southern Pacific Co.
3018 Hullin Way
Sacramento, Calif.
Deceased 7-16-63

1958

F. R. DENNEY
(Past President)
Mechanical Superintendent
New Orleans Union Pass. Term.
New Orleans, La.

1959

E. V. MYERS
(Past President)
Retired Supt. Mech. Dept.
St. Louis - Southwestern Ry.
2500 Howard Drive
Pine Bluff, Ark.

OUR OFFICERS FOR 1963

PAST PRESIDENTS

1960

W. E. LEHR
(Past President)
Supt. Motive Power
Lehigh Valley R.R.
Sayre, Penn.

1961

O. L. HOPE
(Past President)
Asst. Chief Mechanical Officer
Missouri Pacific Railroad
St. Louis, Mo.

CHAIRMAN — BOARD OF DIRECTORS

R. E. HARRISON
(Past President)
Mgr., Maint. Planning & Control
Southern Pacific Company
San Francisco 5, Calif.

OFFICERS AND EXECUTIVE COMMITTEE

SOUTHERN REGIONAL EXECUTIVE

S. C. SNOW
Supt. Motive Power
Louisville & Nashville R.R.
Louisville, Ky.

SOUTHERN
REGIONAL EXECUTIVE COMMITTEE

Atlanta & West Point — Geo. A. Joiner, Gen. Diesel Supvr., Montgomery, Ala.

Atlantic Coast Line R.R. — F. D. Sineath, Asst. Gen. Supt. M. P., Wilmington, N. C.

Central of Georgia Ry. — J. W. Mason, Asst. S. M. P. & E., Macon, Ga.

Chesapeake & Ohio Ry. — F. A. Murphy, Gen. Fmn., Handley, W. Va.

Florida East Coast Ry. — S. D. Smith, Gen. Diesel Supvr., St. Augustine, Fla.

Georgia R.R. — R. A. Parrish, M. M., Augusta, Ga.

Gulf Mobile & Ohio R.R. — C. W. Esch, C. M. O., Mobile, Ala.

Illinois Central R.R. — R. J. Chinn, Mech. & Shop Engr., Chicago, Ill.

Louisville & Nashville R.R. — S. C. Snow, Supt. M. P. - Maint., Louisville, Ky.

Norfolk & Western Ry. — W. S. Garrett, Asst. S. M. P., Roanoke, Va.
Richmond, Fred. & Potomac R.R. — J. A. W. Smith, Supvr. Diesel Eqpt., Richmond, Va.

Seaboard Air Line R.R. — R. W. Murray, Gen. Diesel Supvr., Hamlet, N. C.
Southern Ry. — T. C. Gilbert, Diesel Engr., Chattanooga, Tenn.

OFFICERS AND EXECUTIVE COMMITTEE

CENTRAL WESTERN REGIONAL EXECUTIVE

W. L. HUEBNER
Asst. to Gen. Mgr. — Mech.
A. T. & Santa Fe Ry.
Chicago 4, Ill.

CENTRAL WESTERN
REGIONAL EXECUTIVE COMMITTEE

Atchison, Topeka & Santa Fe Ry. — W. L. Huebner, Asst to Gen. Mgr. — Mechanical, Chicago 4, Ill.

Chicago, Burlington & Quincy R.R. — J. D. Schroeder, Asst. Gen. Supt. M. P., Chicago, Ill.

Chicago, Rock Island & Pacific R.R. — W. H. Waltman, Engr. Shop Plants & Machinery, Chicago, Ill.

Denver & Rio Grande Western R.R. — P. D. Starr, M. M., Denver, Colo.

OFFICERS AND EXECUTIVE COMMITTEE

SOUTHWESTERN REGIONAL EXECUTIVE

T. W. BELLHOUSE
Supt. Mech. Dept.
St. Louis-Southwestern Ry.
Pine Bluff, Ark.

SOUTHWESTERN
REGIONAL EXECUTIVE COMMITTEE

Gulf, Colo. & Santa Fe Ry. — C. W. Cramer, Gen. Diesel Fmn., Cleburne, Tex.

Kansas City Southern Ry. — W. H. Bruening, Master Mech., Shreveport, La.

Mo.-Kansas & Texas Line — H. G. Doyle, Mech. Engr., Parsons, Kans.

Missouri Pacific R.R. — E. E. Dent, Mech. Supt., Houston, Texas

New Orleans Pass. Term. — F. R. Denney, Mech. Supt., New Orleans 13, La.

St. Louis - San Francisco Ry. — Thomas Murray, M. M., Springfield, Mo.

St. Louis - Southwestern Ry. — J. C. Renfrow, Jr., Mech. Engr., Pine Bluff, Ark.

Texas & Pacific Ry. — W. Combs, Supt. of Shop, Marshall, Tex.

OFFICERS AND EXECUTIVE COMMITTEE

CENTRAL REGIONAL EXECUTIVE

G. F. BACHMAN
Chief Mechanical Officer
Elgin, Joliet & Eastern Ry.
Joliet, Ill.

CENTRAL (CHICAGO)
REGIONAL EXECUTIVE COMMITTEE

Alton & Southern R.R. — Lester Van Pelt, Loco. Shop Fmn., East St. Louis, Ill.

Belt Railway of Chicago — R. M. Campbell, Diesel Fmn., Chicago 38, Ill.

Chicago & Eastern Illinois R.R. — M. H. Kuhn, M. M., Danville, Ill.

Chicago & Illinois Midland Ry. — A. B. Lichtenberger, Asst. M. M., Springfield, Ill.

Elgin, Joliet & Eastern R.R. — H. W. Hartshorne, Asst. to Supt. M. P. & E., Joliet, Ill.

Indiana Harbor Belt R.R. — S. A. Papa, Gen. Fmn., Chicago 9, Ill.

Monon R.R. — C. D. Haner, Gen. Loco Fmn., Lafayette, Ind.

Terminal R.R. Assn. of St. Louis — O. J. Laubenthal, Gen. Fmn., St. Louis 3, Mo.

OFFICERS AND EXECUTIVE COMMITTEE

EASTERN & NEW ENGLAND REGIONAL EXECUTIVE

L. H. BOOTH
Gen. Master Mechanic
Chesapeake & Ohio Ry.
Huntington, W. Va.

EASTERN & NEW ENGLAND REGIONAL EXECUTIVE COMMITTEE

Akron, Canton & Youngstown R.R. — E. H. Davidson, Jr., Diesel, Supvr., Akron, Ohio

Baltimore & Ohio R.R. — A. M. Schuh, Train. & Meth. Engr., Baltimore 1, Md.

Bangor & Aroostook — N. E. Skogg, Diesel Supvr., Derby, Me.

Bessemer & L. E. R.R. — H. E. Mathay, Asst. Gen. Loco. Fmn., Greenville, Pa.

Boston & Maine — P. C. Dunn, Asst. Gen. Mech. Supt., Boston, Mass.

Central Ry. of N. J. — Bernard J. Doneski, Jr., Asst. to Supt. M. P. & R. E., Elizabeth, N. J.

Central Vermont R.R. — D. L. Shepard, Sut. Equip., St. Albans, Vt.

Long Island R.R. — C. P. Soffel, Supt. Shops, Jamaica 35, N. Y.

Maine Central R.R. — Harold Hook, Supt. Loco. Maint., Boston, Mass.

New Haven R.R. — T. W. Webster, Supvr. Loco. Maint., New Haven, Conn.

Reading R.R. — F. G. Fisher, C. M. O., Reading, Penn.

Western Maryland R.R. — H. J. Koch, Asst. Mech. Engr., Hagerstown, Md.

OFFICERS AND EXECUTIVE COMMITTEE

NORTHWESTERN REGIONAL EXECUTIVE

C. P. STENDAHL
Asst. Supt. Motive Power
Great Northern Ry.
St. Paul 1, Minn.

NORTHWESTERN

REGIONAL EXECUTIVE COMMITTEE

Chicago & NW Ry. — M. H. Crandall, Diesel Supvr. - Sys., Chicago, Ill.

Chicago Great Western Ry. — B. T. Nelson, Supt. M. P. & Eqpt., Oelwein, Iowa

Chicago, Milw. St. P. & Pac. R.R. — R. H. Maas, Gen. Supvr. Loco. Maint., Milwaukee, Wis.

Duluth, Missabe & Iron Range Ry. — H. R. Seitz, Asst. S. M. P., Proctor, Minn.

Great Northern Ry. — R. G. Tausch, Asst. to C. M. O., St. Paul 1, Minn.

Green Bay & Western R.R. — A. S. Johnson, Mech. Inspr., Green Bay, Wis.

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MASTER BOILERMAKERS' ASSOCIATION

ON MARCH 10, 1955, The Master Boilermakers' Association accepted our invitation to join the Locomotive Maintenance Officers Association. We were honored and pleased to have them accept this invitation on the same date it was extended to them.

F. R. MILLIGAN, President
Master Boilermakers' Association
Gen. Boiler Inspr., Can. Pac. Rys.
(Retired)
541 Leon St.
Kelowna, B. C., Canada

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J. J. DWYER, *Chairman*
Committee on
What's Your Problem?
Chemical Engineer
C. & O. Ry. - B. & O. R.R.
Huntington, W. Va.

Monday Morning, October 14, 1963

10:00 A. M.
PRESIDENT'S ADDRESS

C. A. LOVE
President
Chief Mechanical Officer
Louisville & Nashville R.R. Co.
Louisville, Ky.

10:50 A. M.

Special Address

In

Joint Session

With All

Associations

In

Airie Crown Theatre

McCormick Place

★

BRING YOUR WIFE AND ALL YOUR GUESTS TO THIS MEETING. WE WANT THE LARGEST CROWD POSSIBLE.

SPECIAL ATTENTION — ALL MEMBERS

LET'S ALL BE IN THE BANQUET ROOM AT 9:55 A. M.
SO WE CAN START PROMPTLY AT 10:00 A. M.

YOU DO NOT NEED A BADGE TO ATTEND ANY OF THE MONDAY MORNING MEETINGS. This special arrangement has been made so everyone can be in the Grand Ballroom for the opening session at 10:00 a. m. sharp.

If anyone attempts to stop you for a Badge Monday morning, show him this page and come on in the meeting room ON TIME.

BADGES WILL BE REQUIRED AFTER LUNCH MONDAY,
REGISTER DURING THE NOON HOUR SURE!
DO THESE TWO THINGS TODAY

A. GET A NEW SUPPLY MEMBER AT THIS MEETING.

B. TURN TO PAGE TWO (2) OF THIS 1963 PRE-CONVENTION REPORT

1. **THANK these Advertisers as you visit their room and exhibit. (Where consistent.)**
2. **INVITE those NOT LISTED AS ADVERTISERS to participate as Advertisers in the 1963 Annual Proceedings. (Where consistent.)**

O. L. HOPE, President
Asst. Chief Mechanical Officer
Missouri Pacific R.R.
St. Louis, Mo.

SOUTHWESTERN RAILWAY DIESEL CLUB

Pre-Convention Presentation of Committee on Diesel Engine. 1963 topic, "Mechanical Maintenance – Higher Horsepower Locomotives."

Mr. T. W. Bellhouse, Superintendent Mechanical Department, St. Louis Southwestern Ry. Co., and member of the Southwestern Railway Diesel Club, presented his preliminary report of Locomotive Maintenance Officers Association Committee at Houston, Texas, April 18, 1963.

The report was well received and was followed by a very interesting discussion.

Regular meetings – 1963 – Third Thursday in January at Dallas, Texas; April at Houston, Texas; September 26 at Fort Worth, Texas.

JOIN THE SOUTHWESTERN RAILWAY DIESEL CLUB TODAY!

TED SPROTT, Secretary-Treasurer
P. O. Box 391, Cleburne, Texas

Please accept my application for membership ($6.00 Associate) ($3.00 Ry. Employee) for annual dues is enclosed.

Name _____ Position _____

Company Name _____

Mailing Address _____
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Recommended by _____ Signature _____

Monday Afternoon, October 14, 1963

2:00 P. M.

REPORT OF THE COMMITTEE ON

DIESEL MECHANICAL MAINTENANCE — OTHER THAN ENGINE

Pre-Convention Presentation: SOUTHWESTERN RAILWAY DIESEL CLUB

1:30 P. M.
APRIL 18, 1963
Texas State Hotel
Houston, Texas

CHAIRMAN: L. M. ALLISON
Master Mechanic
St. Louis-San Francisco Ry.
Springfield, Mo.

Vice Chairman

W. H. Bruening, Master Mechanic, Kansas City Southern Ry., Shreveport, La.

Committee Members

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Ed Heaton, Electrical Draftsman, Missouri Pacific Ry., St. Louis, Mo.
J. B. Fister, Division Master Mechanic, Reading Ry., Reading, Pa.
W. R. Leonard, Asst. Supvr. Diesel Engs., A. T. & S. F. Ry. Co., Chicago 4, Ill.
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D. W. Glosh, Supvr. Diesel & Motor Equip., N. Y., C. & St. L. Ry., Cleveland 1, Ohio
W. F. Scoble, Asst. Master Mechanic, Southern Pacific Co., Los Angeles 39, Calif.
T. F. Kelly, Chief Mech. Inspr., C., R. I. & P. Ry., Chicago 5, Ill.

ATTENTION ALL MEMBERS: We are pleased to announce that Committee Chairman T. W. Bellhouse was promoted to our Executive Committee, and that Mr. L. M. Allison was appointed Chairman of this Committee on June 1, 1963. Our sincere thanks go to Mr. Bellhouse for the fine report that he and his committee completed, and to Mr. Allison for his special assistance to Mr. Bellhouse, and for the special discussion arrangements for this session.

★

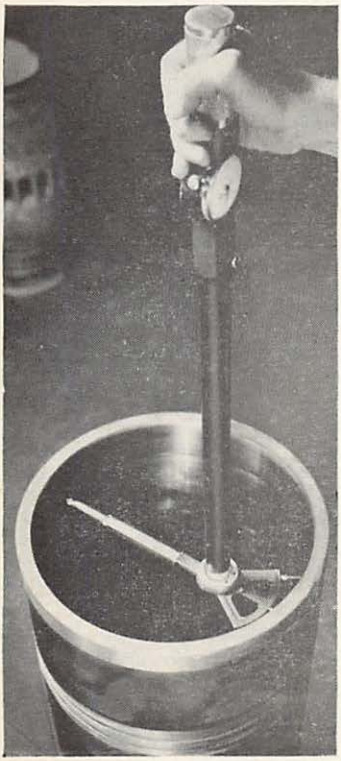
1963 TOPIC:

"MECHANICAL MAINTENANCE — HIGHER HORSEPOWER LOCOMOTIVES"

1. INTRODUCTION: Your committee on Diesel Mechanical — Other was asked to take as its theme a general discussion of "higher horsepower locomotives" to serve as a background for discussion of fellow L.M.O.A. committees on more specific subjects dealing with the diesel engine, electrical maintenance, etc. This report will deal with such subjects as the economic justification for the purchase of higher horsepower locomotives, the disposition of existing units when higher horsepower units are purchased and the changes in operation and maintenance made necessary by the acquisition of higher horsepower locomotives. It is our aim to point out the bad with the good — the disadvantages with the advantages.

We make this study and report with the thought that problems existed when 1350 horsepower was considered "higher horsepower." With blood, sweat and tears on the part of railroad mechanical departments and the builders, most of these problems were beaten. We feel that today's higher horsepower problems can be solved, too. *First they must be recognized as problems and laid on the table for all to see. That is one important purpose of this and other L.M.O.A. committees.*

2. DEFINITION OF HIGHER HORSEPOWER LOCOMOTIVES has to be reached before a discussion of them can be started. This can be approached from several viewpoints. Horsepower per single diesel engine can be used as a criterion. So can horsepower per cylinder. The line can also be drawn between normally aspirated and turbocharged engines. After considering all factors your committee decided that the horsepower *per locomotive unit* is the important thing to be considered and that, *for the purpose of this paper, 1750 horsepower should be considered the*



lower limit for higher horsepower locomotives. We realize that our 1750 *and* 1800 *horsepower units will be with us to maintain for several more years.*

3. DESIGN REQUIREMENTS FOR HIGHER HORSEPOWER LOCOMOTIVES: Meeting design requirements for higher horsepower locomotives is the responsibility of the *locomotive manufacturers*, but it is our *responsibility* to see that the *manufacturers understand* our *requirements* and *meet* them. *The initiative in design of units to meet operational requirements has for too long been in the hands of the manufacturers. The railroads have common problems and common requirements for our motive power units.* Your committee has agreed upon several of these requirements. They are listed below and commented upon briefly:

A. *A* 90 *day minimum maintenance period.* Suggestions to make this possible are:

(a.) *More adequate oil filtration capacity.*

(b.) *Oil bath, rotonamic or other improved engine air intake filter.*

(c.) *More adequately sealed and improved gear cases.*

(d.) *Increased capacity fuel filter.*

(e.) *Improved traction motor and traction motor brush design to extend brush life.*

(f.) *Increased capacity of oil reservoir for air compressor.*

B. *Increased fuel capacity for* 24 *hour operation between fuelings.*

C. *Improved air filtration (pressurized cabinets, etc.).*

D. *Ability to start, maintain, and regain maximum* 70 *m.p.h. train speeds without the necessity of adding additional units with increased dead weight.*

E. *Greater availability.*

F. *Toleration for fuel and lube oil mixtures.*

G. *Lower maintenance costs per horsepower mile.*

H. *Increased component life.*

I. *Greater reliability from failure in service (more important with high horsepower per unit).*

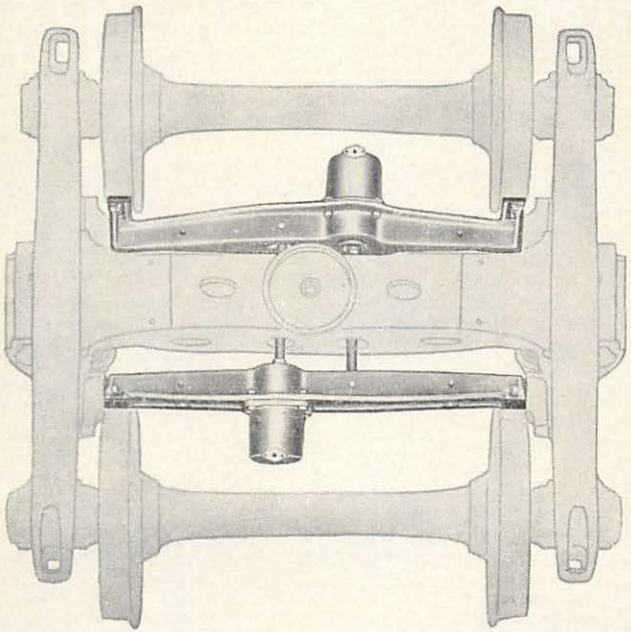
J. *Higher output per ton of locomotive weight.*

K. *Improved utilization.* This means a unit with a flexibility in performance characteristics to meet the most diverse conditions, both *low speed heavy tonnage* and *high speed accelerated freight service.*

4. DISCUSSION OF AVAILABLE AND PROPOSED HIGHER HORSEPOWER LOCOMOTIVE: *The picture concerning available and proposed higher horsepower replacement units is in a state of change. This is a healthy state only so long as it changes toward the ultimate needs of the railroads.* This direction will be affected directly by our constructive criticism of available units and our encouragement of units which are proposed and more nearly meet our needs. The makes and models presently rated as major contenders for the replacement market are listed below with committee comments on each:

A. *Electro-Motive GP-35 Diesel Electric* (existing). This unit has a nominal rating of 2500 h.p. for traction at speeds above 12 m.p.h. and reduced tractive horsepower at lower speeds. It appears that Electro-Motive intends to market this design for some years to come. Older designs of General Motors' units may be used in conversion to GP-35 with resultant trade-in allowance.

B. *Electro-Motive DD-35 Diesel Electric* (existing). This design is an Electro-Motive answer to installing more horsepower in



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one unit. It consists of two turbo-charged Model 567 D-3A diesel engines with separate generators each driving a new design truck through traction motors. The nominal horsepower for traction is 5000 at speed above 12 m.p.h. *There is no control cab on this unit and it is used only as added power in a consist.* This would, of course, require that this unit be used in multiple operation. *This unit has the advantage of utilizing existing components in purchasing, but has the disadvantages inherent in "slave" units of inability to operate as an individual unit.*

C. *General Electric U-25B Diesel Electric* (existing). This unit is rated at a nominal 2500 h.p. for traction but is derated to 2000 h.p. at speeds below 16 m.p.h. This unit appears to be the current diesel-electric design with the greatest performance potential and represents the maximum performance available from a single engine diesel-electric design at the present time.

D. *General Electric GE-40 Diesel Electric* (proposed). This unit would be a two engine diesel-electric design having 4000 h.p. available for traction. The unit would incorporate two 12-cylinder GE engines and existing Model 752 traction motors on six wheel trucks similar to those used under electric locomotives. The motors would be arranged in tandem to improve power distribution and rail adhesion. The unit would be equipped with a steeple type cab in the center to conserve space and would have dual controls for operation in either direction.

D (a). *General Electric U-50* (proposed) rated at 5,000 h.p. This unit will be powered by two General Electric V-16 diesel en-

gines and equipped with four two-axle trucks. Fully loaded it will weigh 272 tons, with an overall length of 83 feet 6 inches, and height 16 feet 5 inches. This will be an operating unit with the cab on one end, incorporating all the present features of the U-25-B, including maximum speed of 70 m.p.h.

E. *Alco Century* 420 *Diesel Electric* (existing). This unit is equipped with a 12-cylinder Alco 251 diesel engine and is rated at 2000 h.p. for traction from four axles and four traction motors. This unit has the advantage of utilizing components from existing Alco units to reduce capital costs.

F. *Alco Century* 424 *Diesel Electric* (existing). This unit is the same as the Century 240 except that it is equipped with a 16-cylinder 251 diesel engine and has a nominal rating at 2400 h.p. for traction from four axles.

G. *Alco Century* 628 *Diesel Electric* (existing). This unit is powered by a 16-cylinder Alco 251 diesel engine and is rated at 2750 h.p. for traction through six axles and six traction motors.

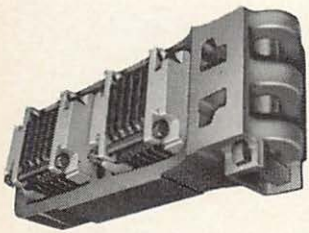
H. *Alco RDH-1 Diesel Hydraulic* (proposed). This is a two engine diesel hydraulic unit of domestic manufacture and is rated 4300 h.p. but is currently limited to 3600 h.p. for traction. This unit utilizes Voith transmissions driven by domestic diesel engines with standard control system and components wherever possible. Three of these units are presently under construction.

H (a). *Alco Century* 855 (proposed), rated at 5,500 h.p. This unit will be powered by two 16-cylinder Alco Model 215-C diesel engines, and will have eight traction motors on eight axles, with truck design unreported. Fully

Standards of the Railroad Industry

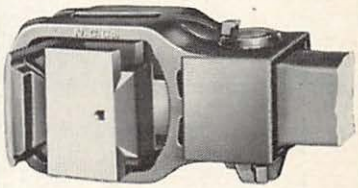
National Rubber Cushioned Draft Gears for Diesel and Electric Locomotives

NATIONAL MS-485-5A



Multi-pad gear used where structural or other considerations prevent use of National M-380-A gear. Recommended for application to switch locomotives in multiple unit service. Other designs available for applications where continuous tractive effort is below 100,000 pounds.

NATIONAL M-380A



For heavy diesel passenger locomotives and diesel and electric freight locomotives. Especially recommended where total continuous tractive effort exceeds 100,000 pounds, either in single locomotive or multiple unit service.

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A-7102A

loaded this unit will weigh approximately 544,000 pounds, with length of 86 feet, and height 16 feet 10 inches. This will be an operating unit incorporating all the improvements now existing in the present Alco Century series.

I. *Krauss-Maffei KM-4 Diesel Hydraulic* (existing). Six of these units are in service in the United States presently, three of them on the Denver and Rio Grande Western and three of them on the Southern Pacific. They are powered by two Maybach high speed, light weight diesel engines with 3500 h.p. available for traction. These units use the Voith three torque converter and drive through all six axles.

J. The eleven designs mentioned above appear to be the major contenders at the present time for consideration as replacement in upgrading our locomotive fleets.

5. ECONOMIC JUSTIFICATION FOR PURCHASE OF HIGHER HORSEPOWER LOCOMOTIVES: On January 1, 1962, the American railroads were 97.7% dieselized. We in the railroad industry began to feel sorry for our friends in the locomotive supply business. We were prone to think in terms of the 30 years life of the steam locomotive. We failed to reckon with the fact that economic pressures can and do accelerate change. In this case, the economic pressures were, in part, created by the investments in plants and machinery of the locomotive builders. They had to keep on selling new locomotives. The first diesels were sold on the basis of economic justification of doing more work with fewer units and of decreased maintenance and servicing costs as compared with the locomotive of the day, steam power. Locomotive builders have to use the same

argument today to sell replacement locomotives. *It is up to us in the railroad industry to do everything we can to encourage the locomotive builders to keep looking for any and all changes in design that will help us do more with less, both in number of units and in reduced maintenance on the fewer units. It is up to us in the mechanical department, with the support of our managements, to see that these promises of "reduced maintenance" are not just sales pitch but rather a hard, mile after mile reality.*

The major areas of justification for the purchase of higher horsepower units are:

A. *Reduction in the number of units owned.*

B. *Reduction in the overall maintenance costs.*

C. *Reduction in overall servicing costs.*

These three areas will be discussed in the paragraphs that follow:

A. *The reduction in total units* in the fleet which can be accomplished with the purchase of higher horsepower units can be figured in several ways. *Builders normally consider and compare on the basis of horsepower available for traction. This is a convenient unit of comparison and gives an approximately correct answer. A more accurate method of determining equivalent units has been developed and is described in a study on engineering and performance factors of locomotives prepared by the Southern Pacific mechanical department.*

In this concept a locomotive is considered as a "block of power" available for handling tonnage. The "block of power" has three significant dimensions:

1. *Horsepower available for traction per ton of locomotive weight.*

2. *Acceleration index based on the number of units required to accelerate a trailing load of* 3700 *tons from* 20 *to* 50 *miles per hour within a predetermined time.* This index is based on using units of the *same type and capacity* on level tangent track.

3. *Simulated Train Operation.* This dimension is related to the simulation of train operation over a given section of railroad on a prescribed schedule *using locomotive units of the various types.* This information is derived from data processed on the IBM 650 computer according to the train simulation method developed by the Pennsylvania Railroad. This dimension represents the trailing tons that one unit of the various types of equipment could handle over a given section of railroad within a prescribed running time.

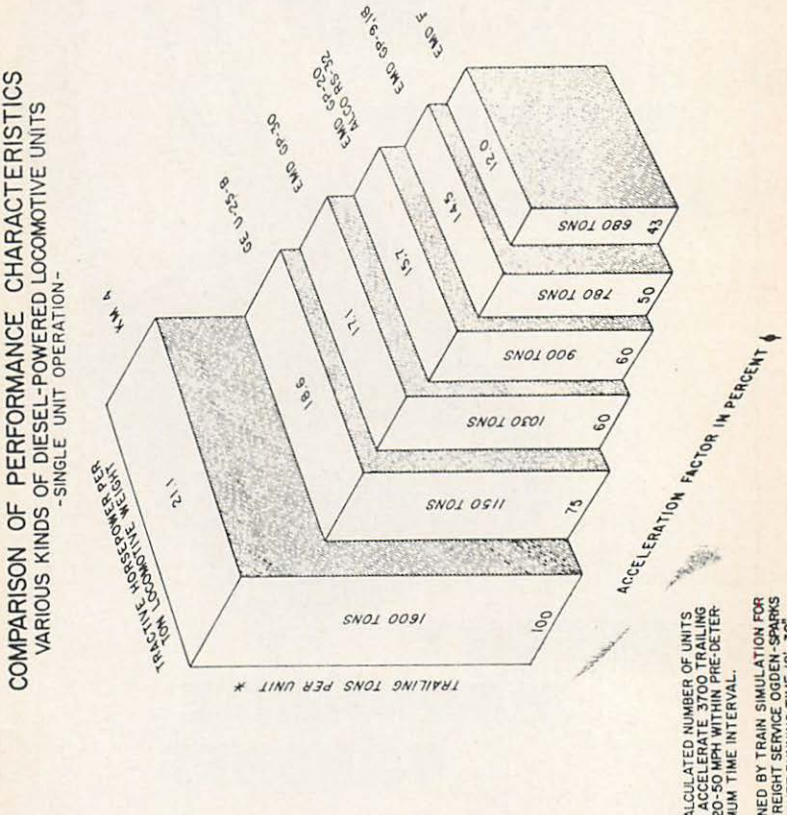

FIGURE-1

By combining the three dimensions graphically, a visual capability comparison of various types of units can be obtained. Each of the dimensions increases as the characteristics become more favorable so that the larger the "block" in physical size the greater the performance and operating value of the unit.

Figure No. 1 shows a "block of power" comparison of performance characteristics of various kinds of diesel powered locomotive units in single unit operation. This chart was developed in the Southern Pacific study and the train simulation is for expedited freight service from Ogden, Utah, to Sparks, Nevada.

A summary of the reduction in fleet units which can be realized by buying higher horsepower replacement units can be made by showing the number of various type units which will give the nearest equivalent performance.

Mfr.	Type of Unit	Status	No. of Units Reqd. for Nearest Equivalent Performance	Total Input HP for Traction	Drive
EMD	F-7	Existing	7	10500	Electric
EMD	GP-30	Existing	5	11250	Electric
Alco	DL-640	Existing	5	12000	Electric
G. E.	U-25B	Existing	4	10000	Electric
K. M.	KM-4	Existing	3	10500	Hydraulic
EMD	(2 GP-30's & 2 RB-3600's)	Proposed	4	11700	Electric
G. E.	GE-40	Proposed	3	12000	Electric
Alco	RDH-1	Proposed	3	10800	Hydraulic

Using the F-7 as the basic unit, it may be seen that to handle a number of given assignments in main line freight service 70% as many GP-30's or DL-640's, 56% as many U-25B's or GP-30's and RB-3600's combined in pairs, and 42% as many KM-4's, GE-40's or RDH-1's would be required.

B. *The reduction in overall maintenance costs* is brought about by refinements in design and by elimination of repeat maintenance items such as car-body filters. *One of the most helpful design refinements is the pressurized engine compartment on the Alco Century series and the G. E. U-25B. Improved lube oil filtering systems also play an important part in reducing maintenance. An engine that can be kept on a diet of clean air, clean fuel and clean lube oil gives us greatly reduced maintenance problems.*

Manufacturers claim a 35-60% reduction in maintenance costs. It should be pointed out that these figures are based primarily on *scheduled* maintenance *and in most cases do not include the unscheduled maintenance costs that come from both the failures of our maintenance forces and from the faulty design of the engines. Warranty and, in epidemic cases, the integrity of the builders protect us to some extent, but eventually the baby winds up sitting in our lap.*

Accurate, factual maintenance cost figures on the different makes, types and models of diesel units in our service are something we must have. The units being offered as replacements are very similar to units already in service. Our actual cost figures for similar units, reduced slightly for design improvement should give us realistic figures for maintenance of the replacement units. Similarly, our cost figures tell us

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which classes of unit should be replaced because of high cost. These two cost figures make it possible to make realistic and accurate forecasts of the savings we can expect in reduced maintenance when we purchase replacement power. *These cost figures are still more meaningful when adjusted to a per horsepower mile.* Comparison should, of course, be made on power in the same or similar service and with the same or similar maintenance facilities and personnel.

C. *Reductions in overall servicing costs* are realized primarily from less frequent servicing. This permits elimination of intermediate servicing terminals. Fuel tanks of up to 3500 gallons capacity are available. With large fuel tanks the locomotive consists can be left on the train through intermediate terminals, eliminating hostling costs and other attendant costs at these terminals.

6. DISPOSITION OF EXISTING UNITS AS HIGHER HORSEPOWER UNITS ARE ACQUIRED: Keeping of cost records on fleet units is quickly justified in deciding what units will be retired as new power is bought. This decision determines whether our unit fleet is actually upgraded or just swapped. Our committee had various solutions to this question all of which suited their particular situation.

One best way to handle the replacement of power emerges from all these individual solutions. *The best way is to keep accurate cost figures on existing fleet units and then plan ahead to get rid of the most costly first. This will usually result in getting rid of the oldest and smallest switch power first and downgrading freight power such as GP-9 and Alco 1600 to switch and local work.*

One problem that lies in the future and which again calls for accurate cost figures is that of replacing this small power, which we must continue to have for switch, local and light transfer work. *The consensus of opinion of our committee is that there should be one most desirable horsepower for this smaller power and that would appear to be* 1500 *h.p. These units are small enough for switch jobs, large enough for most locals and can be used in multiple for heavy transfer or can multiple in to the maintenance points from outside points as a useful member of the consist.*

In any event, all railroads should make up their minds definitely as to the size of switch-local unit that best meets their needs. This will guide the builders in their plans for the future.

7. CHANGES IN OPERATION WITH HIGHER HORSEPOWER UNITS: Higher horsepower units with the attributes of greater dependability and availability and increased mileage between maintenance and servicing intervals cause a marked change in our locomotive operation.

In the first place, we have more money and more horsepower tied up in one unit. *High utilization becomes increasingly important.* Instead of furnishing a fresh consist of power at the terminals where it was formerly necessary to service thru freight units, the entire consist can now be run through such terminals until servicing is finally needed. *This eliminates unit detention and increases the miles per day per unit.*

An increase in miles per day per unit simply means that we are getting more work done for our investment dollar and are thus justifying the cost of buying new power to upgrade our fleet.

Another effect of higher horsepower units on our operation is that fewer units will be used for

a given train on a given schedule. While this is a good thing from some viewpoints *it definitely puts the manufacturers of locomotives and our maintenance forces on the spot.* As an example, in consists of 9000 horsepower, four GP-30's would be required as compared with six F-7's. *A unit failure of an F-7* would decrease the available horsepower *only* 16% as compared *with* 25% for one *GP-30. This stresses the importance of designing trouble-free operation into the locomotives we are buying to upgrade our fleet. It also stresses the importance of quality control in our own maintenance shops.*

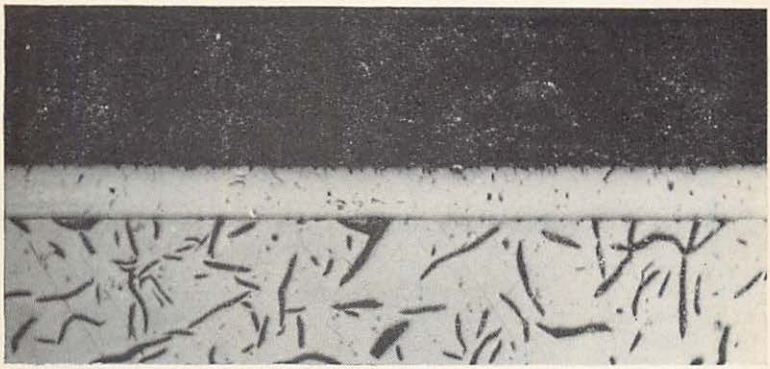
One of the things that we are finding and which was discussed at length in this committee's meetings is the frequency of shopping higher horsepower units for unscheduled maintenance. We, in the mechanical department, are vitally interested in reducing costs. We feel that this can be done by upgrading our fleets, extending maintenance mileage, and by having fewer units to maintain. A large part of the justification for upgrading our fleets is found in our reduced maintenance budgets. *There is no fat in these budgets to cover up unscheduled maintenance whether caused by poor design, poor workmanship in manufacture, or poor maintenance by our forces. Our committee feels that we, on the railroads, will take the responsibility for and correct, at our expense, any faulty workmanship that is causing this unscheduled maintenance. We feel strongly that manufacturers should more fully accept their responsibility in cases of design or manufacture faults. In many cases manufacturers have done this, but in too many cases the service department and the engineering department of the*

manufacturer seems to be working for entirely different people. We believe that this is primarily caused by failure of the engineering departments to accept their full responsibility for designs that fail in service. We feel that unscheduled maintenance caused by design failures should be paid for from the manufacturers' research and development budget rather than from our maintenance budgets.

Operation of higher horsepower units over extended miles makes a *close laboratory control even more essential.* With a well equipped laboratory samples can be analyzed in a matter of minutes and at a cost as low as $1.41 per sample. Results of the oil analysis often gives information that pinpoints troubles that can be corrected before serious failures occur.

Maintenance scheduling, scheduling of specific units into specific maintenance points, becomes more critical with the acquisition of higher horsepower units. *Each unit represents a larger percentage of the fleet horsepower* than with small units. For this reason, a minimum number can be tied up at any one time. Unscheduled maintenance disrupts scheduled maintenance programs. *In many cases units have to be run past due maintenance because of units tied up for unscheduled maintenance.* This, in turn, breeds more unscheduled maintenance and further disrupts attempts to set up an orderly scheduled maintenance program. *This is another reason why our committee has strong feelings about the manufacturers responsibility for design and manufacturing defects. We spend too much time and deficit money fighting brush fires that we didn't set.*

8. EFFECT OF HIGHER HORSEPOWER UNITS ON



Photomicrograph (1000X) shows perfect adhesion of Porus-Krome to basis metal.

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MAINTENANCE TERMINALS: As our fleets are gradually upgraded with higher horsepower units, we will have fewer units to maintain. These units will be making their miles faster but, being designed for higher mileage between maintenance intervals, will require fewer scheduled maintenances than our present fleet. An upgraded fleet will require less shop room than an equivalent horsepower fleet of small units. *Your committee feels that maintenance of the upgraded fleet should be performed at a reduced number of maintenance points located to minimize detention. These shops should be adequately tooled and manned to do highest class work at times of scheduled maintenance.*

Centralization of shops also makes the control of work quality a much simpler problem. Centralization and modernization of maintenance points also cut unit detention time for scheduled maintenance.

9. SUMMATION: Following is a summary of your committee's findings on the general subject of "Higher Horsepower Locomotives."

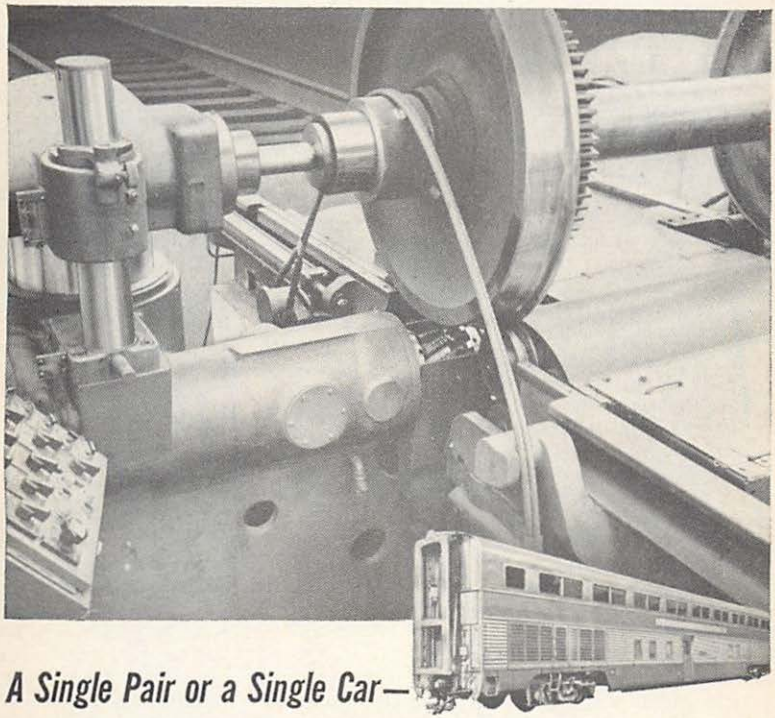
1. *Higher horsepower locomotives, properly designed, manufactured and maintained are a valuable tool in reducing the overall budgets of our railroads.*

2. *The units we buy now as replacements will be ours to operate and maintain for the next 15 years. It is, therefore, our responsibility to encourage the builders, by any available means to manufacture locomotives now that will serve our purpose during the life of the locomotive.*

3. *Accurate cost figures on our existing fleet serve two purposes:*

(a) *Pinpoint the most costly classes for first priority in replacement.*

(b) *Give factual basis for eco-*



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nomic justification in replacement purchases.

4. *Higher horsepower units should have certain design characteristics:*

(a) *A 90 day minimum maintenance period.*

(b) *Increased fuel capacity for 24 hour operation between servicings.*

(c) *Improved air filtration.*

(d) *Ability to start, maintain and regain 70 mile per hour freight train speeds without the necessity of adding additional units with increased dead weight.*

(e) *Greater availability.*

(f) *Toleration for fuel oil and lube oil mixtures.*

(g) *Lower maintenance costs per horsepower mile.*

(h) *Increased component life.*

(i) *Greater reliability from service failures.*

(j) *Higher output per ton of locomotive weight.*

(k) *Improved utilization — a unit with flexibility in performance characteristics.*

5. *Operation of a fleet of higher horsepower units demands:*

(a) *More exacting utilization scheduling to obtain highest possible miles per day.*

(b) *More exacting scheduling of maintenance to minimize out of service and assure maintenance on schedule.*

(c) *More exacting quality control of schedule maintenance work to eliminate unscheduled maintenance.*

(d) *More exacting designing and manufacturing by the builders to eliminate unscheduled maintenance.*

(e) *Close laboratory control becomes even more important in preventing unscheduled maintenance.*

(f) *Maintenance terminals for upgraded fleets will be fewer but better equipped to decrease detention time and increase the quality of work. Maintenance terminals should be geographically located to make units available for maintenance with a minimum of detention.*

10. CONCLUSION: Your committee would like to express appreciation to our respective managements for the opportunity of serving on this committee this year. We have enjoyed working together to bring you this paper. *Our exchange of views and ideas makes us realize that the mechanical departments of our railroads have many problems in common and that we have one main goal in common, furnishing dependable power for our trains at the lowest possible cost.*

J. K. ARNISH, President
R. F. of E. Trainmaster
C. & I. M. R.R.
Springfield, Ill.

ST. LOUIS RAILROAD DIESEL CLUB

Pre-Convention Presentation of "Effects of Higher Horsepower on Electrical Equipment," by Mr. J. R. Mitchell, Assistant Electrical Engineer, Illinois Central Railroad, Chicago, Ill.

Mr. Mitchell, Chairman of L. M. O. A. Committee on Diesel Electrical, made an excellent presentation of his subject, and it was very educational and interesting. He was assisted by many members of his committee in answering questions from the audience.

Registered attendance for the meeting was 125. The members of our Club sincerely thank the Locomotive Maintenance Officers Association and Mr. Mitchell and his committee for the splendid program presented May 6, 1963.

St. Louis Railroad Diesel Club regular meetings are on the first Monday of January, March, May, November, and second Monday of September, in Fred Harvey's King Louis IX Dining Room, Union Station, St. Louis, Mo. Dinner, 7:00 p. m. Meeting at 8:00 p. m. Christmas Party early part of December. When in St. Louis on those dates pay us a visit. F. C. Whitlock, Secretary-Treasurer, 612 North 23rd St., East St. Louis, Ill.

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Monday Afternoon, October 14, 1963

3:00 P. M.

REPORT OF THE COMMITTEE ON

DIESEL ELECTRICAL MAINTENANCE

Pre-Convention
Presentation:
ST. LOUIS
RAILROAD DIESEL
CLUB

CHAIRMAN: J. R. MITCHELL
Asst. Electrical Engr. Equipment
Illinois Central R.R.
Chicago, Ill.

6:00 P. M.
MAY 6, 1963
King Louis IX Room
Union Station
St. Louis, Mo.

Vice Chairman

B. J. Maguire, Supvr. Diesel Elec. Maint., C. M. St. P. & P. R.R., Milwaukee, Wis.

Committee Members

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R. H. Stocksdale, Engr. Elec. Equipment, Western Maryland R.R., Hagerstown, Md.
H. J. Betts, Chief Electrical Engr., Canadian National Rys., Montreal, Canada
F. M. Nelson, Engr. Turbine Loco. Design, Union Pacific R.R., Omaha, Neb.
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J. E. Lackey, Supvr. of Elec. Equip., Missouri Pacific R.R., St. Louis, Mo.
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W. Leys, Mech. Officer - M. P., Grand Trunk Western R.R., Battle Creek, Mich.
J. C. Renfrow, Mechanical Engineer, St. L. Sw. Ry. Lines, Pine Bluff, Ark.
R. B. Thielen, Supvr. Diesel Loco. - Maint., Southern Pacific Co., San Francisco, Calif.

★

1963 TOPIC:

"EFFECTS OF HIGHER HORSEPOWER ON ELECTRICAL EQUIPMENT"

This report is based on data made available by members of this committee, information received from a survey outline questionnaire sent to responsible locomotive manufacturer and supplier representatives, and others.

PART 1

For the purpose of this report all diesel locomotives rated 1,750 horsepower and over shall be considered "higher horsepower." With few exceptions higher horsepower locomotives have become a reality year by year primarily by application of new found materials and techniques to existing standard or semi-standardized major components. *These components often are "strained to their utmost" to cope with their new environment. However, standardization of components has been an economic boom to both user and manufacturer alike.* It appears that through our new found knowledge and techniques that we have tended to drive our equipment closer and closer to the safety factor dividing line.

It has been said that making the most of what we have is the shortest distance to useful results. There are other ways and a good many times better ways, but to insist on finding them before moving on often delays rather than speeds. *In other words, making the most of what we have is not the worst definition of success.* If we are to get the most out of our electrical or any other components in higher horsepower service, we must put the same type of "higher horsepower" thinking to work in tightening up on procedures and quality control. If we don't, we will lost part of our hard fought gains in increased unscheduled maintenance.

1. TRACTION MOTORS—GENERAL: In reviewing previous reports, questions, and com-

ments as railroad men gather at various meetings and informal sessions the number one item of electrical expense is still the maintenance, basic overhaul, rebuild, and upgrading of traction motors. The higher horsepower units are demanding that more and more closer mechanical, electrical, thermal and magnetic tolerances plus increased quality control be upgraded into each traction motor. We find that some who had become complacent with their experiences based on traction motors used in lower horsepower service have suddenly been made painfully aware of the higher failure rate and increased commutation difficulties caused by their use in higher horsepower units without properly upgrading them.

One of the most important, difficult, and potentially expensive electrical decisions the railroads must make in regards to the effects of higher horsepower units is what to do with their pool of existing traction motors of all vintages. It certainly is not economical to wholesale upgrade older serviceable traction motors without first analyzing which ones can be basic overhauled or downgraded for economical use in existing units that are not projected to be candidates for upgrading within a traction motor overhaul period. The upgrading of existing units to higher horsepower does provide an opportunity to weed out and send in the "dogs." We have learned to be wary of the "hard sell" to wholesale upgrade our traction motor fleet into one of the latest version of traction motor. Consider the railroads that converted large quantities of traction motors (including D-37's) into D-27 type as a standard traction motor for their railroad then had to quickly revalue their decision when faced with large blocks of GP-30 units and now GP-35 units. Also

consider the railroads who were urged to convert D-27's into D-37's then had to reconvert the D-37's into D-47's within a short period of time because of design failures in the D-37 traction motors.

2. TRACTION MOTOR MECHANICAL CONSIDERATIONS: In the past traction motor frames were machined and interpole and main fields were applied with tolerances that were an overall compromise for the intended horsepower range. Today under some of the higher horsepower units these tolerances are unacceptable. In addition to correction of original machining tolerances, the traction motor frames distort from vibration, wear, and from support bearing and other failures. To rebuild and upgrade these frames, for example, to projected D-57, D-67, or 752E5 (E6) service we have to determine proper condemning limits of wear and distortion by use of proper gauging, welding and machining to a standard that will be good for the next two or three basic overhaul periods under higher horsepower units. Increased bearing, gear case, field and interpole, flashover and commutation failures will result due to frame and related parts distortion and poor field and interpole coil alignment.

3. TRACTION MOTOR AXLE CAP WEAR: There appears to be no major changes designed to reduce axle cap to frame wear except the use of rubber-bonded-to-steel type of nose suspension. One railroad has increased the axle cap bolt torque value to 40,000 pounds per square inch. Close tolerances to determine if proper mating fit of axle caps to their specific motor frame and proper cap to spline interference must be maintained.

4. TRACTION MOTOR RUB-

BER NOSE SUSPENSION: Since last year's annual report, several thousand rubber traction motor nose suspensions for traction motors have been placed in service. *Due to high volume usage, the cost per unit has dropped to where a rubber nose suspension unit can be purchased for practically the same cost as a renewal set of four steel coil springs. Enthusiastic reports from various railroads using these rubber nose supports tend to substantiate earlier test results that this is a big step forward in traction motor vibration and shock control for all types of traction motors.* One railroad reports reduction in wheel slip, 180 degree commutator bar burning due to broken armature coils, and other vibration induced failures by use of rubber suspension nose supports with other conditions being held as constant as possible for comparison purposes. One locomotive maufacturer reports that the use of rubber nose supports has materially reduced brush holder component part failures. The use of these rubber mounts should help the EMD old style D-57 dual finger type constant pressure traction motor brush holders which still appear to be more prone to failures caused by the same vibration values than the D-27 type brush holders having the heavier brush box castings. However, in our conversion to rubber mounts, don't forget to give them a chance by proper maintenance on the spring holders, wear plates, pinkeeper, pins, nuts and bolts which are reuseable. For longer life the manganese steel nose support wear plate should be used in lieu of the old type carbon steel plate.

One D-27 traction motor with rubber nose support incurred force levels at several mixed frequencies measured on top of frame at 50 miles-per-hour train

speed in main line service as follows:

Across track direction — 4.5 g
Perpendicular to ground—4.5 g
Direction of train motion — insignificant.

(g is the acceleration due to gravity and is approximately 32.2 ft. per second.)

5. TRACTION MOTOR MAIN FIELD AND INTERPOLE VIBRATION SNUBBERS: Some manufacturers and railroads are applying additional neoprene dampening pads and tie downs on both the epoxy-mica and silicone rubber type main and interpole coil leads and connections to prevent breakage due to vibration.

Additional tie down staples and vibration snubbers must be applied to solid or flexible type lead connections of epoxied EMD main field coils to prevent them from breaking in traction motors used in high speed main line service. The failures are apparently due to fatigue under cyclic vibrations. Tests indicate that neoprene snubbers do not change the frequency response of the connections but decrease the amplitude of the strain thereby lowering the stress. The effect of increased speed on vibration and stresses in coil connections is considerably higher than the effect of increased load due to higher horsepower.

6. TRACTION MOTOR ARMATURE BEARINGS: As there has been no indication of changes designed to decrease the loading factor on traction motor armature bearings, our survey inquired if there has been or likely to be an increase in armature bearing failures resulting from higher bearing speed and loading. One manufacturer replied "Theoretically, yes, but the theoretical increase will not be noticeable since there are many factors other than speed and load which affect bearing life." One railroad

reports they have had no failure increase to date in G.E. 752E5 armature bearings used in traction motors rated at 733 horsepower in E-44 locomotives. Another railroad has had low mileage EMD-57 traction motor armature bearing failures on GP-30 units but indicates it to be a problem of quality control rather than a failure due to grease, high speed, or loading factor.

7. TRACTION MOTOR ARMATURE BEARING GREASE: The Cyprena RA or Andok BR type greases are not considered limiting at the present horsepower and armature speeds when used in either 752-E5 or D-57 and D-67 armature bearings. General Electric approves the use of Cyprena RA for use in their traction motors but has standardized on Andok BR in their output of new and rebuilt traction motors. EMD and the majority of the railroads are using the Cyprena RA grease in all types of EMD traction motors with good results when used in conjunction with the nylon anti-churning inserts. The D-67 traction motor has anti-churn nylon inserts in both commutator and pinion end bearing covers.

8. TRACTION MOTOR PINION AND RING GEAR WEAR EFFECTS: Some railroads are continuing to have what they consider to be excessive ring and pinion gear failures. A higher percentage of failures was reported on EMD in comparison to G.E. traction motors gearing. Proper gear heat treatment, control of material, and accuracy of machining are a necessity on the part of the manufacturer. The railroads must follow through with more rigid inspection and maintenance procedures. *The pronounced effect of ring gear profile wear on traction motor vibration force levels is now being more widely recognized by both manufacturers and railroads.* An accelerometer located on top of the commutator end bearing housing on a rubber support mounted traction motor in GP-30 high speed main line service recently indicated the following force levels and number of times registered:

Traction Motor Equipped With New Pinion Driving New Ring Gear

16 g — 5 times 18 g — 1 time
29 g — 0 time

Same Traction Motor Equipped With New Pinion But Driving Used Ring Gear Gauged Profile Wear Over .010" That Would Have Probably Passed A Visual Inspection

16 g — 9,050 times
18 g — 8,490 times
23 g — 2,600 times

The above points out the need for more railroads to gauge ring gear profile wear, and then do something about it. Preliminary consideration is being given to setting a profile wear condemning limit of .010". *One railroad has been reprofiling ring gears for some time now with apparent success.* It is surmised that EMD or some other manufacturer would be interested in reprofiling ring gears for those railroads who do not care to incur the expense or who are not willing to police quality control in reprofiling ring gears.

9. TRACTION MOTOR GEAR LUBRICANT: The grade of pinion and ring gear lubricant is considered to be of prime importance in higher horsepower applications. The use of "Jet type" lubricant is definitely recommended and a controlled lubricant level a necessity.

10. TRACTION MOTOR GEAR CASE: The new gear case designs have proven to be only partially effective in controlling ring gear and pinion lubrication. The basic problem is that, although the gear case is usually reasonably leak proof on its

initial application, excessive leakage develops after the gear case has been removed and applied several times. Tighter designs and more careful handling in railroad shops are necessities for use with the lower viscosity of the superior lubricants needed for present and future high horsepower locomotives. The EMD gear cases are particularly difficult to hold tight. Several railroads report that the modification of old EMD gear cases to the new return duct style is difficult and expensive. The railroads are having trouble in determining the amount of grease that is in the gear case in order to know how much to add. A prescribed amount of grease based on service experience is applied at intervals set up by each railroad. Many gear cases are being overfilled and grease wasted, and gear failures due to dry gear cases still plague railroads that have not tightened down enough on inspection procedures.

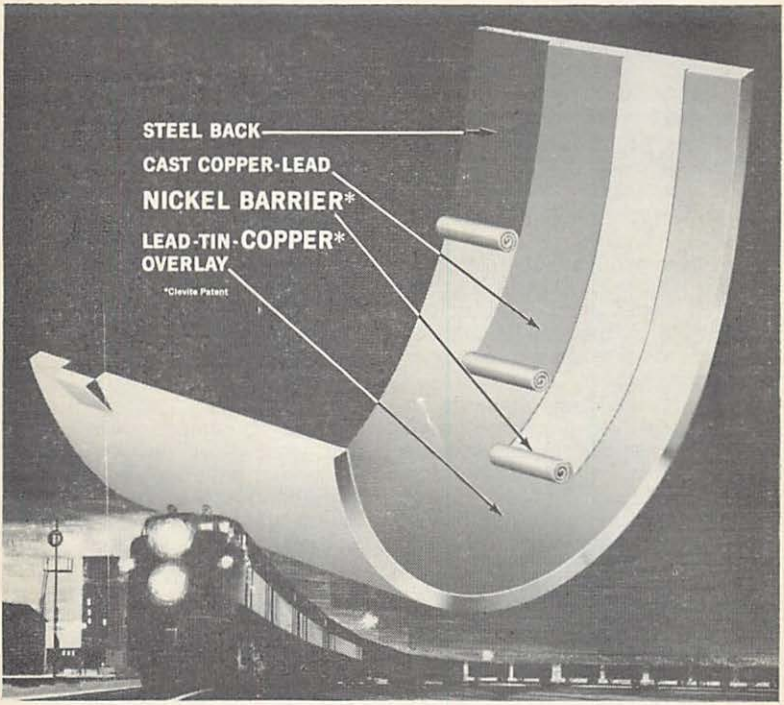
11. TRACTION MOTOR AXLE SUPPORT BEARINGS: Maintaining smooth finishes on rotating thrust surfaces and the use of cast dust guards integral with the commutator end bearings produced a reduction in thrust wear on axle bearings on traction motors. The use of felt oilers and proper maintenance of EMD felt seals are required in order to give longer bearing life.

12. TRACTION MOTOR MAGNETIC CONSIDERATIONS: No major changes have been reported in the armature core laminations, spider or quill on the D-57 traction motor. The welded end armature core laminations have been substituted for some time now on the 752-E5 in order to help prevent loose core stacking and resultant coil failures to ground. However, grounds at the core ends are still a problem. One railroad has suggested that each end of the armature core slots be undercut a depth of several thousandths of an inch for approximately 1/4 to 5/16" of laminations in order to insert an extra thickness of U slot insulation on G. E. armatures for added ground protection. The present EMD traction motor field can tolerate no more than 74-76% shunting before the circuit becomes unstable. Even this requires close field copper size, insulation and temperature control. The SD-9 and SD-24 units have the absolute maximum motor field shunting that can be tolerated.

13. TRACTION MOTOR THERMAL CONSIDERATIONS: One of the major stumbling blocks in the use of higher horsepower diesel electric locomotives is the thermal limitation of the traction motor armature and the main and interpole coil insulation system. The battle for higher horsepower traction motors is primarily the battle of limiting mechanical coil movement, commutation, and increasing heat resistant qualities and extraction from the coils. At present there is still divided opinion of both the railroads and the manufacturers on the relative immediate and long term merits of the integrated epoxy-mica versus the glass-silicone rubber systems of insulation for new and upgraded traction motors. Continuous and short time heat run tests now in progress on traction motors using these various systems should give us some indication.

14. TRACTION MOTOR FIELD AND INTERPOLE COILS: The EMD D-47 and D-57 glass-silicone rubber field and interpole coils are the same with only minor changes such as increased interpole and field lead insulation, divided stainless steel interpole washer, and coil sizing tolerances.

The G. E. 752-E5 main field



CLEVITE: New source for EMD bearing replacements

Cleveland Graphite Bronze, world's largest maker of large engine bearings, now offers its patented heavy-duty bearing for replacements of EMD main and rod bearings.

This type bearing is *proven*, produced for many years at the rate of four million a month. Yet, this is the first time this bearing has been available for use in EMD engines.

It has enjoyed wide acceptance as the original equipment choice for all types of heavy-duty applications – from diesel to piston aircraft. Only Cleveland Graphite Bronze can offer this improved four-layer bearing.

For complete information, contact *Cleveland Graphite Bronze, division of Clevite Corporation, 17000 St. Clair Avenue, Cleveland 10, Ohio. In Canada: Clevite Ltd., 1177 Talbot, St. Thomas, Ontario.* Also manufacturers and distributors of the Clevite Journal Bearing Cartridge.

CLEVITE

coils are glass-mica mat with modified silicone varnish for ground insulation. The interpoles are primarily bag moulded epoxy-glass and now have increased copper size.

15. TRACTION MOTOR ARMATURE: The G. E. 752-E5 armature insulation is primarily mica-mat and modified silicone varnish.

The wire wedged D-67 armature has Class H Type ML resin insulated split coil conductors designed to reduce eddy current loss and to give better thermal characteristics.

The D-57 armature depends on the stainless steel square wire wedging to provide increased air turbulence and heat dissipation to help produce a claimed 11 degree temperature advantage over the D-47 type armature. Several railroads have reported loose wire wedging causing loose and chafed coils and insulation failures from wire wedging not locked securely in core slots. Difficulty in properly tightening armature coils is also being experienced using stainless steel or aluminum wedges that are not trapezoidal in shape similar to the old phenolic wedges. These armatures are also being carefully watched for signs of looseness and mica powdering. The 200 degree centigrade glass-acrylic resin armature banding tape is arousing interest due to its reduction in cost, high temperature stability and strength retention as the band ages. The D-57 and D-67 commutator has an increased copper depth on the lower side of the commutator bar. Seasoning is now at 190-200 degrees centigrade and commutators ground at seasoning temperature and speeds.

Older commutators are being upgraded for D-57 service by spin seasoning at 190-200 degrees centigrade providing they pass all electrical tests and that final riser clean up thickness will be 5/8" or more.

16. TRACTION MOTOR COMMUTATOR TUNGSTEN INERT GAS (TIG) WELDING: Tungsten Inert Gas (TIG) welding of commutators on both G. E. and EMD armatures is increasing, particularly as a salvaging operation on armatures having high resistance in risers. G. E. has been TIG welding both new and old armatures for some time.

One railroad shop reports about one out of ten armatures requiring a basic repair will require welding. After heating and gravity dripping or centrifugal force sling out of as much old solder as possible, this shop uses a standard inert gas welding holder mounted so the electrode position can be indexed to the outside diameter of the riser section. Welding starts there and moves inward for a continuous weld. (Some shops prefer spot welding rather than continuous.) Oscillation of about 1/16" is provided by a signal light mechnism. A 1/8" (some shops prefer the 3/32") thorated tungsten electrode ground to a point is used with continuous high frequency arc imposed on welding current of 140-175 amperes d. c. depending upon riser thickness. The indexing is to every fourth bar to control heat buildup. Approximately 210 segments are done in 2 1/2 hours. Wire brushing is done occasionally to remove surface contamination from riser. On inspection 5% or more have to be rewelded. Penetration is about 1/32" but varies. Shielding is pure argon at 40 cubic ft. per hour flow (some shops use a helium-argon mixture). Although the service life of TIG welder armatures has not yet been determined, the resoldering of high resistant risers has proved to be a poor calculated risk.

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17. TRACTION MOTOR AMPERE RATING: The D-57 traction motor is rated at 980 amperes continuous only if supported by ambient air at 2,900 - 3,000 cubic feet per minute air flow such as produced in the GP-30 locomotive unit. The D-57 is derated to 950 amperes continuous when used in units such as the GP-9 and GP-18 which deliver hotter traction motor duct intake air at 2,400 - 2,500 cfm. The 625 horsepower D-67 traction motor is rated at 1,000 amperes at 357 kilowatts when used in GP-35 or DD-35 units.

18. TRACTION MOTOR AIR FILTERS: In an attempt to provide cleaner air, one railroad has made test evaluation of several traction motor air intake filters with the basic conclusion that the application of these particular clean air intake filters of same air intake area as the blower will reduce air flow from 33% to 46%. One filter reduced air flow to 63% by volume after 30 days of winter service on an F7 by manometer test. The general conclusion is that the filtered air intake area will have to be increased approximtaely four times present test size in order to hold air flow reduction to within 20% to 25% after 30 days of service. Recommendation has been made to discontinue the test for fear of overheating the traction motors in the hot summer weather or until larger air intake areas can be provided. Cleaner and cooler air intake for traction motors has been accomplished in both the GP-30 and U-25-B higher horsepower locomotives.

19. TRACTION MOTOR BRUSH HOLDER AND BRUSHES: Several railroads have extensively tested and have arrived at independent conclusions that the standard EMD traction motor carbon brush can perform satisfactorily in the constant pressure brush holder. *The special premium priced notched traction motor brush is not necessary on many railroads.* Naturally, there are variations in performance from railroad to railroad and each one should prove this for themselves. The standard brush when used in constant pressure brush holder equalizes the wear rate between the two halves. The trailing half of the notched brush in the D-57 dual finger constant pressure brush holder still normally wears faster than the leading half. The railroads still have to renew brushes based on the shortest half and not the average of the two halves.

The D-67 constant pressure brush holder has returned to the single wide finger construction exerting 10 pounds pressure on a new 2 3/8" length standard configurated brush. The brush holder front brush pocket opening has been lowered to permit installation of the 2 3/8" brush.

20. TRACTION MOTOR ELECTRICAL CHANGES: No improvements appear to have been made in the D-57 traction motor design to withstand the increase in voltage. The 752-E5 has increased the commutator mica segment width from 45 to 60 mils. Flashover ring protection is a standard feature on the 752-E5 motor. Some preliminary tests of flash rings on D-57 traction motors left this issue in doubt. However, it appears to be worth further investigation.

21. MAIN GENERATOR MECHANICAL CONSIDERATIONS: One of the serious problems that faced the railroads in the upgrading of the D-12 to the D-22 EMD main generator was the overheating, melted solder, and compensating field coil connections burning open due to broken top interpole leads. The interpoles and compensating coil insulation was changed from a

mica varnish to silicone rubber. The originating cause of these failures was due to the fracture of a top interpole coil lead caused by heavy engine and frame vibration which in turn caused the poorly supported interpole coil leads to fracture and break. The compensating bar insulation internally was also being damaged and developed grounds. A crash program had to be instituted to apply neoprene dampening pads and securely tie the interpole and compensating connector leads. The D-32 main generator has redesigned and silver brazed compensating, differential, start, and interpole connections eliminating all external bus bars and field leads. This should be a considerable improvement. The GP-30 and particularly the GP-18 units have three heavy distinct torsional vibration ranges that must be avoided for prolonged periods. There is one critical vibration range from 350-385 rpm, another from 405-435 rpm and the third from 580-595 rpm.

Several GP-30 main generators have had to be removed due to fans being cracked near the hub. Excessive vibration may have been a contributing factor.

22. MAIN GENERATOR BEARING AND HOUSING: The sealed grease bearing with Cyprena RA grease continues to give good account of itself in the EMD main generators. The life of the bearing housing appears to be short on several railroads. These railroads continue to have successful rebuild of main generator end housing by boring and shrinking a tempered steel ring to restore bearing housing tolerance.

23. MAIN GENERATOR MAINTENANCE: The G. E. main generator appears to have considerable more safety factor built into it from a maintenance point of view. There has been little experience to date on the EMD D-32 main generator.

24. MAIN GENERATOR MAGNETIC CHARACTERISTICS: No major changes are known to have been made in the magnetic characteristics of the EMD or G. E. main generator as used in the Alco for use in higher horsepower service.

25. MAIN GENERATOR THERMAL CHARACTERISTICS: The GP-30 and GP-35 and U-25-B units have made considerable improvements in the main generator cooling system to handle increased thermal loading by redesigning for increased capacity and cleaner air. If the traction motor armature stainless steel wedging proves successful, the next logical step would be the same type of wedging being applied to the D-32 main generator for increased horsepower output within limiting heat range.

26. MAIN GENERATOR ELECTRICAL CHARACTERISTICS: G. E. has increased the main generator voltage to 1,040 volts. The EMD D-32 main generator has been increased to 900 rpm in the GP-35 resulting in increased voltage. The D-32 main generator brushes have been increased in wafer thickness from 5/8" to 27/32" and individually held to the commutator with two constant pressure negator type springs. The angle of brush contact has been changed so the brushes will contact the commutator heel first instead of the toe first position used in previous EMD main generators.

27. CONTROL GENERAL: Major changes have been made in the electrical control system by all locomotive builders by use of static excitation systems, increased steps in motor field shunting, and unique approaches to controlling power applications and wheel slips or slides.

The electrical power and con-

trol systems on higher horsepower diesel electric locomotives are becoming more complicated with each model introduction. This is true in spite of the great progress made in eliminating many of the individual electro-pneumatic-mechanical devices by use of static components.

28. CONTROL MECHANICAL CONSIDERATIONS: The trend in our higher horsepower locomotives and also in upgrading existing units is to remove every piece of rotating or sliding equipment possible with its inherent high cost of maintenance and replace with static type of equipment with no moving parts.

On the later GP-30 locomotives all four traction motor armatures are connected in series across grids in dynamic braking so their voltage can be compared to detect wheel slide.

29. EXTENDED DYNAMIC BRAKING: One railroad is using extended dynamic braking on GP-30's which produces 700 amperes from any speed down to 3 to 4 miles per hour. Regular dynamic braking effort drops off fairly rapidly until there is only approximately 50 amperes at 3 to 4 miles per hour. The dynamic brake equipped GP-30 units are having the adhesion limit or power limit (PIR) resistor removed and replaced with a rectifier to produce a wider range and accuracy of regulation.

30. CONTROL POWER LIMIT: Several railroads report that the power limit relay (PLR) contacts on GP-30's have considerable arcing and pitting which may lead to high maintenance rate. The GP-30 starts power limiting control at 18 1/2 miles-per-hour and continues to gradually reduce horsepower as the speed drops. The GP-35 starts power limiting control at 18 1/2 miles-per-hour but never operates below 2,000 horsepower. The U-25-B power limits by reducing from 8th to 7th throttle position to operate at approximately 1,550 horsepower.

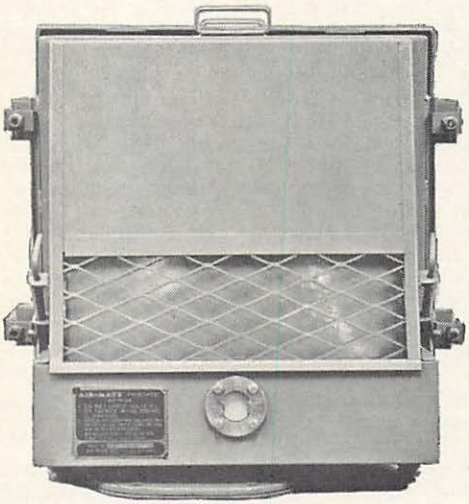
31. CONTROL THERMAL CONSIDERATIONS: Some static components have failed in service due to lack of engineering in providing adequate heat sinks for the environment in which they are located.

32. TRANSIENT VOLTAGE SPIKES: Locating and suppressing transient voltage peaks that destroy the over voltage sensitive semiconductor devices are still a problem on their applications in both higher and lower horsepower units.

We have found no better method of protecting each device having semiconductor components than to insist on it having a proper peak reverse voltage (PRV) bypass circuit incorporated into its input. On GP-30's there have been numerous failures of various control rectifiers that have been tracked down to voltage spikes originating in the radiator cooling fan and other circuits.

The Alco DL-640 controls have produced rectifier and resistor failures in the 17FM191D1 card panels. Some railroads are removing this panel and installing 17FM191H1 panels for improvement in reliability of controls.

33. WHEEL SLIP CONTROL: Wheel slip control is still a major problem on all the higher horsepower units. The G.E. U-25-B has had many wheel slip control modifications since first being introduced. The EMD GP-30 units delivered since January 15, 1963, use the Forward Transition Relay (FTR) in the highest step of transition to detect and correct simultaneous wheel slip at high speed. Older GP-30 units used the WS-24 relay until it was found that this relay, due to vibration, sometimes caused false



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operation of the wheel slip and sanding system.

Recently it has been found that the GP-30 wheel slip system was set too sensitive at the factory causing premature wheel creep (WCR) and wheel slip (WS) action in parallel. Several railroads have found that their GP-18 and GP-30 units were running with bad order silicon diodes in the wheel slip bridge circuits and did not have wheel slip protection at all.

34. EDUCATION OF RAILROAD PERSONNEL: *One of the important electrical problems the railroads are facing today is that of educating their personnel on the fundamentals and use of the new static power and control systems.* Several railroads have started a program of distributing treatises on fundamentals, simple experiments, and application functions of various semiconductor components and devices used on cars and locomotives. The railroads are appreciative of the vast amount of technical information available in the various trade publications and tests available by manufacturers and suppliers.

35. CONCLUSION: In the above considerations it is realized that there have been many omissions, some of which are due to lack of first-hand knowledge. Particular types of equipment are frequently mentioned due to the vast numbers on order or in existence. *We have concentrated in the areas that are giving us the most failures and economic damage not from a pessimistic attitude but because we must overcome them to reap the full benefits from the use of higher horsepower units. We have raised many questions we cannot as yet answer but hope to stimulate thinking.* The enumeration of the many virtues of higher horsepower equipment and the decision for going to higher horsepower units have mostly been left in the hands of those who specialize in this area.

PART 2

It was the consensus of the committee that the standardization, nomenclature, accumulation, tabulation, and reporting of traction motor performance and cost analysis suitable for either manual or computer system is long overdue. It is the committee's opinion that this project be prepared to the stage of recommendation to the proper A. A. R. Committee for their refinement and consideration toward adoption through regular A. A. R. channels. Comments from the railroad and manufacturers' representatives to guide our thinking on this subject will be appreciated.

W. C. GAGE, President
Chicago Railroad Diesel Club
Master Mechanic
C., M., St. P. & P. R.R.
Chicago, Ill.

CHICAGO RAILROAD DIESEL CLUB

The Pre-Convention Presentation of the Committee on Diesel Electrical Maintenance was presented before the CHICAGO RAILROAD DIESEL CLUB by the Chairman, C. A. Wilson, Gen. Supvr. Diesel Engs., A. T. & S. F., Chicago, Ill., at our April 9, 1963, meeting at the Hotel Hamilton.

This was one of the finest presentations given before our Club, as evidenced by the numerous requests for copies of our publication, and from so many distant points, indicating the publicity given this meeting by those who attended the meeting and who travel in their everyday progression of their vocation.

Our Club meets on the first Monday after the first Sunday of each month, except during the months of July and August. Our fiscal year is from June 16th to June 15th of the following year. Dues: Railroad Personnel, $3.00; Associate Members, $5.00. Wouldn't you like to be a member?

- -

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Monday Afternoon, October 14, 1963

4:00 P. M.

REPORT OF THE COMMITTEE ON

DIESEL FUEL AND LUBE OIL

Pre-Convention Presentation: CHICAGO RAILROAD DIESEL CLUB

6:30 P. M.
APRIL 9, 1963
Hamilton Hotel
Chicago, Ill.

CHAIRMAN: C. A. WILSON
Gen. Supvr. Diesel Engs.
A. T. & S. F. Ry.
Chicago, Ill.

Vice Chairman

R. R. Pooler, Physicist — Test Dept., A. T. & S. F. Ry. Sys., Topeka, Kans.

Committee Members

R. A. Bardwell, Engineer of Tests, Chicago & Eastern Illinois R.R., Danville, Ill.
T. A. Tennyson, Engineer of Tests, St. Louis-Southwestern Ry. Lines, Pine Bluff, Ark.
R. R. Holmes, Engineer of Tests, Western Maryland, Hagerstown, Md.
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1963 TOPIC:

"FUEL AND LUBE OIL REQUIREMENTS FOR HIGHER HORSEPOWER LOCOMOTIVES"

Higher horsepower locomotives covered in this report are those in which the diesel engines have had the horsepower per cylinder increased and not on engines whose total horsepower has been increased by the addition of more cylinders. Your committee has devoted most of its study to determining whether or not such engines will require anything different in the way of fuel or lubricating oils, as well as items on which study was started last year will be explored in the light of the increased popularity of the higher horsepower locomotives.

From our survey of experience thus far with fuel and lubricating oil required for good performance with the higher horsepower engines, as compared with the lower horsepower engines of the same design, we would foresee no material changes in the basic specifications for either fuel or lubricating oil. However, at this time we do feel that it is wise to use those lubricating oils which have passed the qualification tests established by the engine builders. Such lube oils will give a margin of safety for the higher horsepower units while experience is being gained and will be entirely suitable for the other engines. Basis for qualification of these oils is not something which can be easily written into a statement of physical characteristics such as might form the basis of a specification of the type normally used by railroads.

Cleanliness: While the new higher horsepower engines do not appear to require anything different in the way of new lubricating oil or fuel, *these engines do demand cleanliness in both the lube oil and fuel.* Abrasives, soot, resins and other oxidation products, water and other contaminants must be removed from the oil and kept at the lowest possible level. Laboratory control of both lube oil and fuel thus becomes of greater importance for the successful operation of the higher horsepower engines.

1. LUBRICATING OILS: The manufacturers recommend that an additive type heavy-duty lubricating oil having a high resistance to oxidation and a low tendency to the formation of carbon deposits be selected for use as listed below in the manufacturer's lube oil specifications:

A. LUBRICATING OIL PROPERTIES LIMITS

	EMD	ALCO	GE	FM
Viscosity				
1. Seconds at 100° F. Maximum	1300	1500	1500	1500
2. Seconds at 210° F. Minimum	74	70	70	70
Viscosity Index Minimum	35	40	40	40
Maximum	75			
Flash Point ° F. Minimum	420°	350°	400°	400°
Fire Point ° F. Minimum	475°	425°	450°	450°
Pour Point ° F. Maximum	40°	25°	25°	25°
Zinc Maximum	10 P.P.M.			
Viscosity Classification SAE #	40	40	40	40

EMD recommends that the lubricating oil shall be non-corrosive to copper-lead bearings at 230° F. and to silver metal at 285° F.

B. LUBRICATING OIL CHANGES: The recommended lubricating oil change intervals are based on average operating conditions in freight service on higher horsepower diesel engines as follows:

EMD — Three months or 30,000 miles on GP-18 and SD-18 locomotives. Four months or 60,000 miles on GP-20, GP-30 and SD-24 locomotives.

ALCO — Semi-annually or by laboratory examination.

G. E. — Full laboratory control or 30,000 miles.

F. M. — Full laboratory control.

C. LUBRICATING OIL FILTER CHANGES: Manufacturers recommend lube oil filter element change period in freight service:

EMD — 30 day on combination of five (5) pleated paper and two (2) cotton waste elements.

ALCO — 30 day on all pleated paper elements.

G. E. — 10,000 miles on all pleated paper elements.

F. M. — 30 days on all cotton waste elements.

D. FUEL DILUTION: All four builders recommend that dilution above 5% is considered serious and the high horsepower diesel engines should be shut down and the lubricating oil system drained and recharged with fresh oil.

2. COMPATIBILITY OF OILS WHEN MIXED IN HIGHER HORSEPOWER ENGINES: As an expedient to resolve various issues not pertinent to the maintenance of motive power, a number of railroads mix different brands of lubricating oil in storage as well as in crankcases of their diesel engines without apparent detriment to maintenance and operating schedules. However, engine builders do not recommend mixing of different brands of lubricating oil and a good many railroads insist on not mixing them in the higher horsepower engines. At best, there is a calculated risk involved and nothing to be gained as far as the health of the engine itself is concerned. When mixing is practiced, good laboratory control is essential.

It is quite difficult to tell exactly whether or not there is compatibility between two or more unused lubricating oils for all possible combinations and next to impossible to predict this for mixtures in which both new and used oils might exist in an infinite number of combinations. Compatibility of lube oils is often predicted by determining tendencies toward oxidation, development of a corrosive condition, frictional characteristics and additive stability of the individual oils and as many combinations as time will permit. In this case an attempt is made to evaluate these characteristics of the mixtures in the light of those for the individual oils. However, this is only a rough screening which does not account for the presence of used oils in the mixture or removal of deposits from old engines which can also play a decided part in the end results. In all types of diesel engines it is possible to obtain a lower engine cleanliness than when using the oil separately. Secondly, laboratory control of lubricating oils is more complicated when oils are mixed. Third, the oil supplier's responsibility for the performance of his oil is lessened when it is mixed with other products. It should also be pointed out that some cases of shorter life of lubricating oil and lubricating oil filters have been experienced as the result of mixing lubricating oils.

If mixing of lubricating oils is desired, the railroads involved should study their operation and lubricating oil performance as well as their maintenance practices and facilities to see what problems would be involved and if there would be any actual savings by going to the use of a blended lubricating oil.

3. HIGH VISCOSITY INDEX LUBRICATING OILS: The use of high viscosity index (80 or higher) lubricating oils is now being extended to the higher horsepower diesel engines with very good results and performance. These oils have a viscosity index up to 95 and contain var-

ious ash levels and different types of additives.

One high viscosity index lubricating oil being used in lower horsepower engines has an ash level of 0.25% and the inorganic portions of the additive was primarily Barium with a small amount of Calcium. This oil has been in operation for a number of years and no engine difficulties or lubrication problems have been experienced. The engines remain clean with the cotton linter filters being changed on a thirty (30) day schedule.

The performance of the higher viscosity index lubricating oils which are produced by refining procedures and not by the application of viscosity index improvers can and are being successfully used in the higher horsepower diesel engines with lower ring wear, longer oil life and cleaner engines being experienced. This type of oil is more stable to oxidation and high lube oil temperatures and the rate of change in viscosity is lower than with the medium viscosity index oils. In some cases reduced lubricating oil cost will result from the use of the higher viscosity index oils as the base stocks are less expensive and lube oil consumption will be reduced.

4. ASHLESS DETERGENT LUBRICATING OILS: The use of ashless detergent lubricating oils are being investigated by the railroads and a number of laboratory as well as field tests are being conducted with very promising results and to date it appears these oils will operate satisfactorily in the higher horsepower engine.

One oil under test has the following property limits:

Viscosity	
Seconds at 100° F.	1023
Seconds at 210° F.	78
Viscosity Index	65
Flash Point ° F.	470
Pour Point ° F.	—10
Carbon Residue %	0.02

The test oil has been in use in four locomotives for six months and this test appears to be progressing satisfactorily and the operation has been normal.

To date, there have been two assemblies changed on one locomotive and one assembly on another locomotive account scuffing at the lower portion of the piston skirt. All assemblies on this test were equipped with the double hook scraper and spring loaded oil rings. The spring loaded oil ring was placed in the second groove from the bottom of the piston on these engines and since their application, it is the standard practice to use the spring loaded oil ring in the bottom groove. It was felt that the location of the spring loaded oil ring might have a bearing on the scuffing experienced.

These engines have been inspected weekly in the presence of the oil company's representative and oil samples taken as directed. Each week the blotter tests are examined and an oil sample examined under the microscope. This microscopic inspection has been interpreted as satisfactory with this additive level still OK and still carrying the impurities in suspension throughout the oil. The test oil, of course, is blacker than the other oil, but by wiping your hand over the top deck or rocker arm there are no scummy deposits which adhere to the parts and is very easily wiped off.

The lube oil filters were first changed monthly for the first three months. They were then allowed to operate 90 days before changed but each intervening month the filters were removed and examined and the same filters replaced. At the end of 90 day period no material difference

could be seen in the filters than was in evidence at the end of the 30 day period.

The number 7 main bearing was inspected on two engines at the six month period. Both of these bearings were new when the locomotives were released from the shop at the beginning of the test and both bearings were found in excellent condition except for occasional scratches caused by grit.

Two locomotives are now operating on the fourth month with the same cotton linter elements and since these engines are easily controlled and are inspected weekly, the same lube oil filters will be run to see how long they can be actually operated.

These engines will be due their first annual inspection since the beginning of the test in July or August and a representative examination of the main bearings will be made, and at the same time the oil coolers will be removed, weighed and examined, as the oil cooler seems to be the first point at which sludge and contamination begin to deposit out after the oil has been saturated and can no longer carry additional contaminants in suspension.

This ashless detergent lubricating oil looks very promising at this time but more data is needed on its performance as well as engine conditions and wear rates before any recommendations can be made.

Evaluation of additive strength by decrease in the amount of metallic additive constituents cannot be practiced for ashless diesel lube oils but must rely solely upon the darkfield microscope and special chromatographic methods. These were discussed thoroughly in your committee's 1962 report.

5. USE OF SPECTOGRAPHIC DATA: The 1962 report of your committee contains a description of a number of laboratory tests which are needed in a good laboratory control program for diesel engine lubricating oil. The best method available today for determining the kind and amount of metallic contaminant being carried by the oil is the emission spectrograph and it is felt that a brief discussion of the use of this instrument is needed to round out our report of last year.

Basically, the emission spectrograph is an instrument for separating light into its component wave lengths by means of a prism or grating. It also includes some means of generating the light and of measuring and recording the intensity of each component wave length separated. This instrument is adapable to analysis for many different elements, each of which gives off a characteristic group of light wave lengths, or spectrum, under the proper conditions. For oil analysis, the light is generated by burning a sample of oil (or the ash from the oil in many laboratories) in a flame, in an arc generated by passing electricity across the gap between two carbon electrodes, or in electric spark. The arc is preferred because it gives more flexibility in the number of different metals which can be determined.

While the amounts of the various metals obtained by one railroad laboratory can check very closely with those from another, the significance of these amounts in relation to engine condition, oil condition, etc., becomes a matter of interpretation in the light of experience and must take into account the following factors which are not listed in the order of importance:

1. Age of engine.

2. Miles since bearings last changed or inspected.

3. Mechanical work recently done on the engine.
4. Miles since oil change.
5. Efficiency of oil filtration.
6. Past history of engine regarding fuel and water leaks.
7. Miles since oil cooler last cleaned.
8. Past spectrographic history of engine.
9. Properties of the oil itself such as viscosity, degree of oxidation, dispersancy, insolubles, etc.

During the many years which the spectrograph has been used in diesel crankcase oil examination on the American railroads there has been generally good agreement between railroad test departments as to what materials need to be watched. There has also been an area of agreement that these metals signify certain conditions when found in amounts greater than certain base values. Significant values which are used as a guide to predict internal trouble in diesel locomotive engines have been collected from a number of railroads and the table which follows represents an average of these values in parts per million.

Significant Values For Metals Found In Diesel Crankcase Oil
Results In Parts Per Million

Engine Builder	EMD	ALCO	BALDWIN	FAIRBANKS MORSE	GENERAL ELECTRIC
Iron	100	40	40	80	30
Chromium	20	15	30	40	4
Aluminum	25	10	15	10	3
Copper	40	20	30	30	3
Lead	40	20	20	15*	20
Silver	5				
Tin	15	10	5	5*	
Silicon	10	10	10	10	15
Magnesium	5	5	5	5	5
Boron **	40	40	40		50
Sodium ***	50	30	50		

*Fairbanks-Morse engines since 1952 have aluminum bearings.
**Boron is run when non-chromate water treatment of conventional railroad type is used instead of chromate water treatment.
***Sodium is not ordinarily run by users of emission spectrograph but it is used to predict water leaks with the flame spectrophotometer.

The above values are average concentrations and are not used strictly as "GO" and "NO-GO" rules in requesting corrective action by maintenance forces. Each individual railroad may find that it is necessary to make variations within the above picture which are applicable to its own conditions. Normally an engine will show wear products much lower than these limits.

As a general statement of the significance of the tabulated values shown previously, your committee offers the following summary.

1. *Iron*: With increase in soot carbon, high iron can indicate ring and/or liner wear. This will often be accompanied by a rise in copper and silver in EMD engines and by high chromium in engines with chrome plated liners. If soot carbon is normal, wear must be anticipated in other parts of the engine, such as accessory gear trains, crankshaft journals, cam follower wear, etc. High iron can also be the result of faulty air cleaning in which case silica, magnesium and aluminum should also be out of line.

2. *Chromium*: A sudden increase in chromium is indicative of a water leak if chromate type

water treatment is being used. If non-chromate water treatment is being used then chromium increases are due to wear and should be coupled with either iron or aluminum, or both in some engines, for interpretation. Wear might also be differentiated from water treatment residue by determining sodium content of the oil. A gradual increase along with higher soot carbon indicates wear of chrome plated rings and/or liners.

3. *Aluminum*: Rising aluminum is indicative of piston scuffing and/or wear for engines equipped with aluminum pistons. It can indicate bearing wear in samples from engines which have aluminum bearings. Aluminum in the oil can also be related to dirty air and dirty fuel. Wear of aluminum housings, due to misapplication of moving parts, can cause relatively high aluminum in the oil.

4. *Copper and Lead*: These two metals are best evaluated together. When an abrupt rise in lead occurs, followed by a rise in copper, bearing trouble is suspected. As previously stated, this may also be accompanied by a rise in other metals. Since both copper and lead can come from other locations in the engine, decisions in this respect must be based on considerable experience. Also, some engines, when new or after extensive bearing replacement, tend to run with very high amounts of lead in the oil until bearings have conformed.

5. *Silver*: Increasing silver indicates wear and/or corrosion of silver plated bushings in EMD engines. For older models these bushings were only in the wrist pin area but newer models also have other silver plated bearings.

6. *Tin*: The amount of tin can often be coupled with lead and

copper to properly assess indications of bearing wear.

7. *Magnesium*: This metal is introduced as a result of contamination of the air or fuel by dirt or of the fuel by cracking catalyst.

8. *Boron*: This metal is used to identify water leaks when conventional railroad non-chromate water treatment compositions are used.

9. *Sodium*: This metal is determined mainly by users of flame spectrophotometers to identify water leaks and it can be used with either chromate or non-chromate treatment.

Again, we would like to emphasize that the above brief description does not tell the whole story. In addition to the above, the spectrograph is quite valuable in following the metals which are in the lube oil additive and to check for such metals as zinc which are not permitted above very small amounts in oil for EMD engines.

Experience to date with spectrographic analysis of a relatively large number of samples of oil from EMD and Alco higher horsepower engines has shown considerably lower amounts of the wear and contaminant metals in the oil. As compared with earlier EMD engines, the GP-18, GP-20, GP-30, and SD-24 diesel engines show much lower metal levels in the oil. This has also been true of Alco 251 engines as compared with earlier models. This may be either good or bad and will require more experience for complete evaluation. One railroad reports several instances of broken compression rings which were found by air box inspection on GP-30's and at no time did the spectrograph detect any out-of-line condition. A recent gear train failure on one GP-30 locomotive, however, did show 20 ppm copper and 60 ppm iron to be present in the oil. The difficulty in correlation on the newer type of power may be bound up in the more efficient oil filtration system and it appears that a study of sampling methods is needed. In the meantime, we feel that higher horsepower engines which reach the conventional limits have indicated difficulty and the cause should certainly be investigated.

6. LUBRICATING OIL FILTERS: With introduction of the higher horsepower diesel engines it was found that full flow lube oil filtration was necessary. The builders are using larger filter bowls containing at least seven elements consisting of a combination of pleated paper and waste or all pleated paper elements and increasing the filter bowl by-pass valve setting to forty (40) pounds.

The external by-pass valve with the forty (40) pound springs is now recommended for all lube oil filter bowls. To make this conversion an inlet baffle should be applied to prevent the hot oil stream from eroding the cotton cover of the cageless element. It is also important that the filter elements used be designed for the forty (40) psi differential pressure to prevent the collapse of the center tubes.

7. TURBOCHARGER LUBE OIL FILTERS: EMD turbocharged engines use oil from the crankcase to lubricate the critical turbocharger bearings and this is another point where cleanliness of the oil is of prime importance. Recognizing that the heavily loaded turbocharger thrust bearing is susceptible to damage from dirt, special filtration of the lube oil which is supplied to the turbocharger is carried out by means of the turbocharger lube oil filter and the soak back filter. These filter elements adequately clean the oil if they are main-

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tained properly on a suitable schedule (recommended as one month between cleaning periods by engine builder). However, it should be pointed out that adequate filtration by any type of turbocharger filter element requires maintenance of proper oil filtration of the main engine lube oil supply. This also has a profound effect on the life of the turbocharger element.

Earlier models of EMD Type 567-D engines used metallic screen type filter elements which could be cleaned at regular intervals to keep them in service. However, these elements are somewhat delicate, expensive, and it is quite difficult to tell how clean they are even after recommended procedures have been followed. For this reason, pleated paper elements of the throw-away type have recently become available for the turbocharger oil filter. A kit is available for adapting these elements to the older turbocharged engines and your committee feels that conversion to the throw-away type filter is desirable. Use of the paper elements eliminates the doubt and difficulty in the cleaning process as well as the expense made necessary by replacement of damaged metal type elements.

As yet, no paper throw-away element has been made available for the soak back filter and this still must be cleaned in a good solvent type emulsion cleaner with plenty of agitation.

8. LUBRICATING OIL STRAINERS: The higher horsepower diesel engines are still equipped by the builders with the same type and design of lubricating oil strainers that were used years ago. *These strainers are obsolete and do not provide the necessary protection to the diesel engine. They are costly to*

clean, repair and have very short service life.

Improved strainers are now available which can be purchased for the EMD and Alco diesel engines which will provide longer engine protection, and lower maintenance costs. This strainer has a fluted configuration mounted between two perforated sheet metal shells which strengthen the unit and eliminate handling damage. In addition to this, a greater straining area is provided allowing for heavier dirt load to build up on the strainer with no decrease in oil flow.

9. FUEL OILS: The engine builders recommend that distillate fuel meeting the requirements of ASTM No. D-975 Grade No. 1 D or No. 2 D be used as listed below:

	EMD	ALCO	G. E.	F-M
Cetane Number (Min.)	40	40	40	45
Distillation Temperatures ° F. (90%) (Max.)	650°	675°	675°	675°
Flash Point ° F. (Min.)	150°	125°	150°	150°
Water & Sediment % (Max.)	0.05%	.10%	.10%	.10%
Carbon Residue (10% Bottoms) (Max.)	.15%	.35%	.35%	.35%
Ash % (Max.)		.02%	.01%	.02%
Viscosity SSU at 100° F.		32-45	32-50	32-50
Sulfur % (Max.)	0.75%	1.0%	1.0%	0.50%
Copper Strip Corrosion		No. 3		

It is recommended for cold weather operation that the cloud point and pour point shall be 10° F. below the prevailing ambient temperature, except where fuel oil heating facilities are provided.

Low atmosphere temperatures, as well as engines operating at very high altitudes, may require the use of fuels with higher cetane rating.

Alco Products, Incorporated, recommends that the gum content of the fuel shall be at a level consistent with satisfactory engine performance.

Electro-Motive Division recommends that solid matters such as rust, cracking catalyst and clay should not exceed a maximum of 5.0 milli-grams of ash residue per gallon of fuel when filtered through an 0.80 micron Millipore paper.

A. Fuel Oil Filter Changes:

Manufacturers' recommended fuel oil filter element change period in freight service on their higher horsepower engines:

EMD — 90 days on all fuel oil filter elements.

ALCO—Semi-annually on primary filters. Annually on secondary filters. Adjustments may be necessary when adapting these schedules depending on the service requirements of the locomotives and type of fuel used.

G. E. — 30 days on primary filters. 90 days on secondary filters. With the incorporation of the new large capacity filter element it now appears that six months filter life on the primary and secondary filters is practical.

F-M — 30 days on all fuel oil filter elements.

The committee is pleased to note that all the builders of higher horsepower diesel engines are now using a primary filter with the large lube oil filter element of the cageless type as it provides long service life with a low pressure drop. In most cases the large filter element is mounted a few degrees from horizontal to facilitate draining and cleaning when the element is changed. *One manufacturer is now mounting this filter in a vertical position, which is not satisfactory as it presents problems in draining and cleaning and it is hoped they*

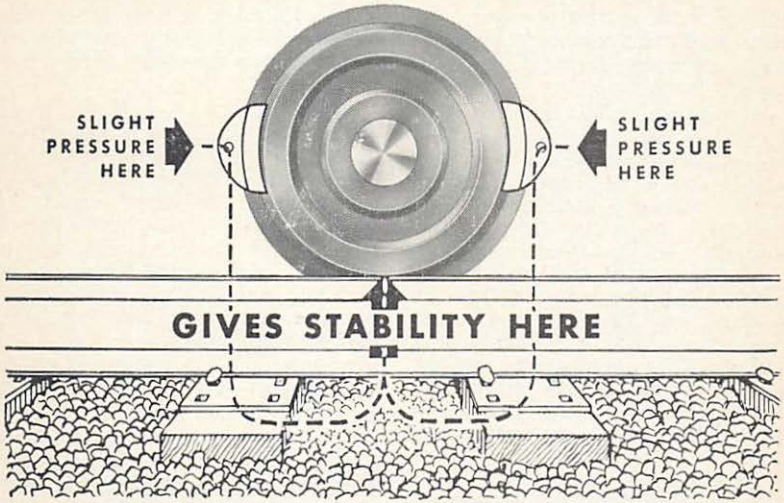
will go back to the old standard horizontal mounting.

Pleated paper filter elements are being successfully used in the large single element fuel filters and in some test applications where refined paper filter elements with a total filtering area of 11,172 square inches was used the filter operated one year or 150,000 miles before changing. Pleated paper filter elements will carry a very heavy dirt load for longer intervals with little or no pressure drop across the filter.

10. BACTERIA GROWTH: A few cases of bacterial growth has been reported and the growth has been controlled by the use of organic boron which is soluble in fuel. The use of the boron compound has extended the filter life considerably as well as reducing rust and fuel tank corrosion.

11. CATALYST FINES: The committee feels that catalyst fines is not a problem but if any indications are found, the best approach is to make the supplier police his product. The problem of indentifying fines in the average railroad laboratory is enormous. An electron microscope can give an indication if particulate matter similar to catalyst fines in size and shape is in the fuel oil. However, it takes elaborate filtration equipment and probably a spectrograph to positively identify this material.

12. ENGINE SPARKING: The problem of engine sparking is



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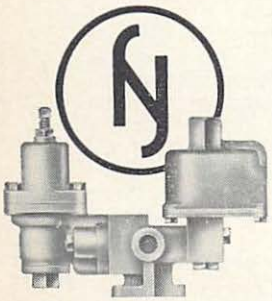

The Wheel Slip Controller and its associated devices can be applied to all existing air brake systems *with the minimum of modification.* Write for Circular 103 giving full information and installation diagrams.

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The Wheel Slip Controller responds to the existing wheel slip detection relays and within one-half second automatically applies a light brake application to the slipping locomotive unit. This corrects most slips and restores the slipping wheel to train speed *without reduction in power.*

The original road tests, covering thousands of miles, have been confirmed by service experience on 12 Major Domestic Railroads who have purchased hundreds of new locomotives which possess this feature. The benefits derived from the Wheel Slip Controller are stimulating its broader use on existing equipment.

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still with us and the committee feels that the use of metallic additives in the lubricating oil is one of the causes.

In many states the turbocharger is accepted as an effective spark arrestor and we had hoped that the higher horsepower turbocharged engines would, at least, be free of the problem. While this has been generally true of the 4-cycle engines with turbochargers, there is at least one possible source of trouble on EMD turbocharged engines. This involves the ejector for removing fumes from the crankcase and putting them into the exhaust stack just after the turbine. If this device is not maintained in accordance with engine builder's recommended practice, oily vapors can be carried into the stack where it can deposit on the stack walls, further oxidize, collect soot and otherwise grow in size until it can be ejected as a flaming particle. The remedy is simple and proper maintenance of oil separator and separator drains should be added to the list already published by your committee in 1962.

In our continued study of diesel engine sparking, laboratory and road tests have shown that the most practical way to eliminate this problem under all conditions on EMD normally aspirated engines is the application of the modified swirl type exhaust manifold, conformable oil control rings and needle valve injectors.

13. PROPERTIES OF FUEL & LUBE OIL: *Gravity* — ASTM D-287. An index of the weight of a measured volume. Applies to both fuel and lube oil.

a. *A. P. I. Gravity* — Arbitrary hydrometer scale generally used in petroleum transactions in the United States.

b. *Specific Gravity* — The ratio of the weight of a given volume of petroleum oil at 60° F. to the weight of an equal amount of distilled water at the same temperature.

Flash Point — A. S. T. M. D-93 — Flash point is the temperature to which the product must be heated under specified conditions to give off sufficient vapor to form a mixture with air that can be ignited momentarily by a specified flame. In the case of fuel oil a relatively high flash point is desired for safe handling and use of fuels.

In lube oils, the flash point is a measure of contamination by gasoline or fuel oil.

Cloud Point — A. S. T. M. D-97 — The cloud point is the temperature at which paraffin wax or other solid substances begin to crystallize or separate from solution. The cloud point is useful for determining the temperature at which filter plugging will occur because of wax separation. Not applicable to lube oil.

Pour Point — A. S. T. M. D-97 — The temperature, 5° F. above the temperature at which the petroleum product will not flow when held horizontally for 5 seconds. The pour point is useful in determining the lowest temperature a petroleum product will flow or can be pumped. It applies to both fuel and lube oils.

Viscosity — A. S. T. M. D-88 — Viscosity of an oil is a measure of its resistance to flow. In fuel oils it is important to specify a minimum viscosity to assure adequate lubrication of fuel pumps. For lubricating oils in general, viscosity is the most important controlling property. In a bearing that is operating properly with a fluid film between its surfaces, the viscosity of the oil at the operating temperature is the property which determines the bearing friction, heat generation and the rate of flow through the bearing. The viscosity of a lube

oil varies widely with temperature. Usually the viscosity is measured at 100° F. and at 210° F.

Viscosity Index — A. S. T. M. D-567 — A commonly used measure of a fluids change of viscosity with temperature. The higher its viscosity index the small the relative change in viscosity with temperature.

Water and Sediment — A. S. T. M. D-96 — Fuel Oil. This centrifuge method gives total water and sediment content by volume. This test is used primarily to determine the cleanliness of the diesel fuel oil purchased.

Water in Used Lube Oil — The fry test, wherein a sample of used lube oil is heated in a small pan and observed for spitting or popping, is used to find water in lube oil.

Carbon Residue — Ramsbottom Carbon Residue. A. S. T. M. D-524 — With fuel oil, it is customary to distill the oil to 10% residual and determine the carbon residue on the remainder. This residue is a measure of the carbonaceous depositing characteristics of the fuel oil.

Prior to the use of inorganic additives in lube oil, this test was regarded as indicative of the amount of carbon material a lube oil would deposit in the combustion chambers of an engine. However, the additives now used have a higher ash content than the carbon residue normally formed. Therefore, the carbon residue of most oils is higher and the test has lost much of its significance.

Ash — A. S. T. M. D-482 — The ash content of diesel fuel is usually nil. Ash forming constituents are important only when present in large enough quantities and of such a nature to cause unduly heavy deposits or excessive wear in the engine.

In lube oil, the A. S.T. M. D-874 is used to determine additive depletion. Higher ash levels and abnormally appearing ashes are indications of the contaminants in the lube oil.

Sulfur — A. S. T. M. D-129 or D-90 — High sulfur fuels will form sulfur oxides during combustion and cause corrosion. In lubricating oils, the sulfur content may be used as an indication of the presence of some additives.

Corrosion — A. S. T. M. D - 130 — This test is used on diesel fuels because it is a sensitive test for free sulfur and corrosive sulfur compounds.

Distillation Range — A. S. T. M. D-158 — The distillation range of a fuel is a measure of its volatility. The volatility requirements of an engine depend on its design and service. Most diesel engines used on the railroad will burn fuel oils having a distillation range between 400° F. and 700° F.

Cetane Number — A. S. T. M. D-613 — The cetane number of a diesel fuel is significant primarily because it is an indicator of the ignition quality of the fuel.

Neutralization Value — A. S. T. M. D-664 — The total acid and total base numbers are calculated from the end points as obtained from appropriate titration curves of potential versus milliliters of titrant. In modern diesel lube oil, the total base number of unused oil is relatively high and the total acid number is low. As the oil is used, the total base number, (TBN) becomes lower and the total acid number (TAN) rises. Each oil, depending on the way it is compounded, has its original values and rate of change. Any serious departure from these values indicates contamination or over heating of the oil and should be investigated.

Pentane and Benzene Insolubles — A. S. T. M. D-893-60T — Procedure B gives coagulated Pentane and Benzene Insolubles. The Pentane Insolubles contain oxidation products as well as carbon particles, dirt and other contaminants. The Benzene Insolubles consists of carbon particles, dirt and any contaminants not soluble in Benzene. Since Oxidation products are soluble in Benzene, they are removed in the Benzene wash and the difference between the Pentane and Benzene Insolubles is a measure of the oxidation of the lube oil. The Benzene Insolubles are a measure of the dirt load in the lube oil.

14. CONCLUSION: The fuel oil requirements for the higher horsepower diesel engines have created no problems but the committee feels that the engine builders and the oil suppliers should study the basic requirements of any good lubricating oil and design their products accordingly.

8:30 P. M.

Entertainment for Members, Wives and Guests

Check Convention Program

Special Notice: We have been challenged to "put more business" in our meeting; accordingly we have scheduled the **Tuesday Morning Session to start at 9:00 a. m.**

LET'S SHOW THE INDUSTRY WE ACCEPT THE CHALLENGE BY BEING IN THE BANQUET ROOM AT 9:00 A. M. READY TO GO TO WORK TUESDAY MORNING **WITHOUT FAIL. BE THERE!** THIS MEANS **EVERY** MEMBER. THIS MEANS **YOU!**

A. E. FOX, JR., President
Mid-South Air Brake and
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2738 Frisco St.
Memphis 14, Tenn.

MID-SOUTH AIR BRAKE AND RAILWAY DIESEL CLUB

Our club is now in its 19th year, being organized in 1944. Originally, our aim was patriotic in teaching Shop men and Operators more about the locomotives they repaired and handled, during World War Two.

Since the end of World War Two our purpose has been much the same as before, the education and enlightenment of those who work with Diesel Locomotives. With the continued help of men like Mr. J. F. Morton, W. W. Jolly, Past Presidents, and Mr. J. N. Fox, Master Mechanic we pledge to uphold these purposes.

Anyone desiring to affiliate with our club may do so on an associate basis by filling out the blank at the bottom of the page and sending it with one dollar to our Secretary.

Mr. Kenneth Wyatt, Secretary
Mid-South Air Brake & Railway Diesel Club
932 Sassafras, Memphis, Tenn.

Please enroll me as a member in your club.

Name _____ Title _____

Company _____

Address _____

Tuesday Morning, October 15, 1963

9:00 A. M.

REPORT OF THE COMMITTEE ON

DIESEL ENGINE MAINTENANCE

Pre-Convention Presentation: MID-SOUTH AIR BRAKE AND RAILWAY DIESEL CLUB

1:30 P. M.
MAY 22, 1963
Hotel Claridge
Memphis, Tenn.

CHAIRMAN: G. W. NIEMEYER
Mechanical Superintendent
Missouri Pacific R.R.
Little Rock, Ark.

Vice Chairman

J. P. Mac Gregor, Supt. Locomotives, Wabash Railroad Co., Decatur, Ill.

Committee Members

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J. E. Brennecke, Diesel Shop Foreman, T.R.R.A. of St. Louis, St. Louis, Mo.
N. A. Buskey, Production Control Supvr., Baltimore & Ohio R.R. Co., Cumberland, Md.
W. B. Harris, Supervisor, Diesel Eqpt., Western Maryland Ry., Hagerstown, Md.
E. R. Henkel, Mgr. Shoreham Shops, Soo Line R.R. Co., Minneapolis, Minn.
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C. V. Kalkbrenner, Mech. Fmn., St. L. S. W. Ry. Lines, Pine Bluff, Ark.
H. R. Kinney, General Master Mechanic, G. M. & O. R.R. Co., Bloomington, Ill.
J. A. McDonald, Mechanical Assistant, Canadian National Rys., Montreal, Quebec
W. E. Seagraves, Asst. Gen. Supvr. Diesel Engines, A. T. & S. F. Ry. Sys., Chicago, Ill.
T. H. Temple, Diesel Supt., St. L. & S. F. Ry., Springfield, Mo.

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1963 TOPIC:

"COMPARATIVE ANALYSIS OF

HIGHER HORSEPOWER ENGINE MAINTENANCE"

While the title of this committee's report may appear to be restrictive, it is our belief that it opens an avenue to mechanical maintenance men to hold up for a fair perspective, the operations, failures, and weaknesses of the higher horsepower units against the power offered for our maintenance.

In spite of the expressed desire of the manufacturers to design and build a higher horsepower unit for improved performance and reduced maintenance, *we are finding some "bugs" in the design which are actually causing increased maintenance over the former units.* By "comparative analysis" between the present high horsepower models and the former units which we have maintained for many years we have the opportunity to compare the present maintenance operation against the type of power which was originally offered by the builders years ago and by this comparison we can see the real reasons for changing our maintenance to improve our performance and lower costs.

There was a difference of opinion among the members of this committee as to the rating of the higher horsepower units that we should consider in this paper since we have heard of 2400 and up to 5000 horsepower per unit. But in all fairness to the members of this organization, we thought that we should still include the 1750 horsepower units since we have found all railroads reporting some of the problems indicating that the 1750 may still be a problem child.

You know the advertisements we all see on television, comparing the merits of cigarettes, and the slogan "It's what's up front that counts." This really holds true on the railroads of the United States, Canada and Mexico, but unfortunately we don't have a "filter tip" to remove the

broken rings, valve blows, piston failures, unequal injection, and other parts failures.

At the convention last year the interest shown in the reports on ring breakage, valve blows and seal failures makes it imperative that we open this year's report on these items in the hope that not only further information may be traded but that the mechanical personnel reading these reports may offer more and better solutions to the problems so that the railroads having these problems may have a solution they feel will be advantageous to all of us.

Fortunately, we have a wider range of information this year, and a study of microscopic pictures which better explain some of the problems we have been blindly groping around for without being able to lay a finger on the culprit.

1. BROKEN RINGS: One of the conditions which still exists and is being asked about is the problem of broken rings. While improvements have been made, we have to admit that this problem is still a long way from a satisfactory solution. *On this committee we feel that fuel injection is one of the prime factors in the broken ring problem.* We find that not only is there a tremendous difference in the delivery from the same type injectors but that the output of these injectors changes as they are used. We do know that a laboring piston is poor insurance against broken rings. Then, if the fuel delivery increases, higher cylinder pressure is applied to the ring in that cylinder until finally failures result.

2. EROSION 251 LINER SEATS AND CRACKS: The report last year indicated that the manufacturers had a remedy for the apparent erosion of the lower liner seat on the 251 engine by the application of a renewable insert which must have the lower deck bored and the insert pressed in to prevent leakage. We still have reports on 251 engines of the excessive cracking of the camshaft bearing housings and cracking of the deck plate where camshaft bearing support is welded to the side plate.

3. PISTON PROBLEM 251 ENGINE: *We have not found a remedy for the loss of the ring carrier on the banded aluminum piston.* We have reports this year of the loss of the ring carrier on the 251 banded piston which causes approximately the same damage as was found in the loss of the ring carrier on the 244 piston. *We on the committee feel that the manufacturers should experiment on a solid piston for this unit.* Other types of pistons than those recommended by the manufacturers have come out for these units and the testing of them is being done on railroads reporting to this committee. Tests are showing that the solid pistons appear to have some advantages, in either aluminum or ductile iron, with the ring belt area of high Brinell hardness. At least we have not had the numerous reports of the loss of the ring carrier. With the extended mileage the higher horsepower units are operating, the loss of one unit account of a ring band failure can cause the missing of connections on a high revenue train. *It should not be necessary for the railroads themselves to have to road test other types of pistons for their own protection.*

4. FUEL INJECTION 251 ENGINE: We have not had reports of broken ring troubles as severe on the 4-cycle 251 engines as we have had on the 2-cycle engines that are being used, but there is an increase in reports of weaknesses in the fuel injection equipment as reported last year.

The troubles being experienced

to date are eroded nozzle tips, fretting corrosion of the fuel delivery valve cage on the lapped faces, pump spring breakage, wear on the single drive lug of the fuel pump plunger caused by the new hardened control sleeve, wear on the control sleeve on pumps not equipped with hardened control sleeve.

Field tests are being made on a new design of plunger for 251 engines which incorporates a double drive lug and double slotted sleeve to accommodate this plunger. This is the approach for correction of wear on the single drive lug and new hardened control sleeve.

Thinking on the field test of the double lug plunger and double slotted sleeve was influenced by good performance of 244 engine pumps which have shown little or no wear on plunger lugs and double slotted sleeves.

Last year this committee reported on the fuel injection problems on these units due to inability to hold needle valve in nozzle to the proper opening pressure. *This problem is still prevalent and to date we have no information from manufacturers as to their experimentation or improvements in fuel injection equipment. Since this committee reported last year on the information received from a cross section of all railroads, we felt that some action would be taken to improve the fuel injection on these units, but we have a further report that the only testing being done at present is by the railroads themselves.* Last year we reported on excessive wear in the needle valve tip and nozzle, loss of pressure on the spring causing erratic action of the valve, and cracked nozzles, and we do not want to be repetitious. *Neither do we wish to continue*

to battle a piece of equipment that has proved it is not as efficient or satisfactory as it should be and the dependability of which is so low that monthly test must be made to insure that the equipment depending upon its satisfactory service is at least partially protected. The prevalence of fuel dilution on this type of power is terrific and can cause unexpected increased maintenance costs and failures unless policed with laboratory control constantly.

5. TURBO MAINTENANCE 251 ENGINE: *With the resulting poor injection on these high horsepower units in heavy freight service, the problems on the turbo maintenance are increasing.* Due to incomplete combustion we are having a build up of deposit in the turbo, making maintenance imperative, and any failure to remove and clean at least annually is an opportunity for a complete failure before attention is again given this piece of equipment. With the resultant failure of the turbo to produce sufficient combustible air for the engine, increased heat in the manifold is a by-product of this poor combustion and a death notice for the manifold. *We on the railroads are still pleading for an improvement in the exhaust manifold, which was hard to maintain on the 244 but with the monthly mileage we are making on the 251, is terrific. The renewal of the water inlet hose must be made every two years, or an engineering change should be made to eliminate this hose, since the complete cooling of this turbo is a must, and a cooling water failure results in a cracked turbo casing and an engine failure.* It is claimed by the manufacturer that suficient water cooling is not afforded with the original application of the water hose on the

251 turbo and a modification has been suggested that additional outlet lines be added going into the expansion tank to relieve the steam pressure which builds up in the housing and water jacket on the turbo, forcing out the circulating water causing hot spots and failure of the cast water jacket. *This is a must if you intend to load these units heavily on extended mileage.* The cooling of the parts and oil used in high horsepower units cannot be emphasized too strongly since we have all had problems with the cooling of the lesser horsepower units, and now with increased fuel consumption and higher operating temperatures, the close tolerance for maintenance of this equipment on high horsepower engines makes this an imperative maintenance problem.

6. WEAR ON OVERLOADED RINGS: Wear test rates, as conducted with radioactive rings to show the actual facts in the operation of a ring in a unit, indicated that a cylinder with a 10% overload will cause an increase of wear rate of two and one-half times normal rate. While reports indicate that ring problems are not too severe on the 2400 horsepower units, the ring breakage problems on the 1800 horsepower units still continue to increase where cylinder firing pressures to 1500 pounds are apparently normal and no other units where unequal injection is experienced.

7. FUEL INJECTION EMD UNITS: The delicately balanced fuel injection problem of the 2-cycle engine is something that is being watched by all maintenance men. The interest displayed last year prompted this committee to make further and more extensive studies of this problem.

There have been many tests run on fuel injection and many varied results have been obtained. While we all believe that better atomization is obtained from needle valve injectors, further tests have indicated that the two to six per cent savings indicated on load test with new equipment and weighed fuel oil did not remain constant, and a reduction from one to two percent in a month was found to occur on needle valve equipment until the results approximated the spherical injector.

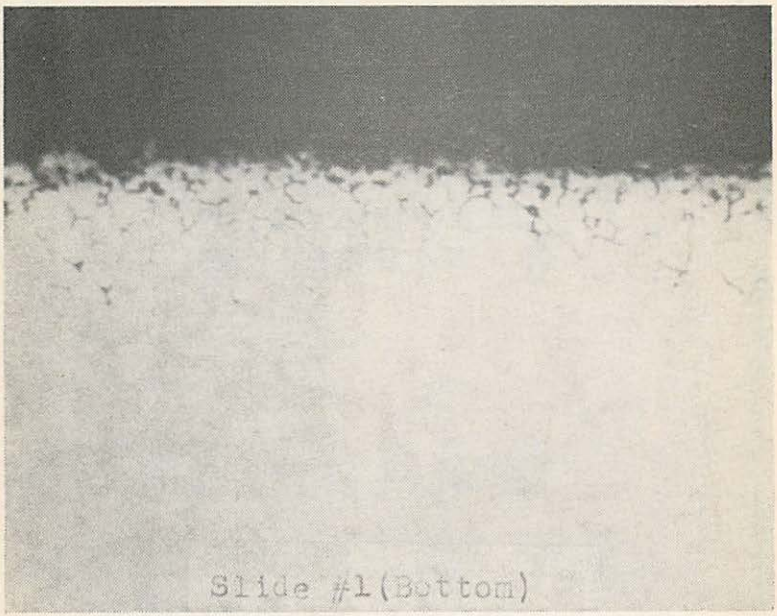
The most interesting thing noted in reports from railroads and from visual inspection of shops was the fact that each shop is attempting to help itself in regard to the problem of balanced fuel injection. We have seen factory made test machines and shop made test machines, all for the purpose of balancing out the injectors placed in the units for operation. The calibration of these injectors was averaged on the shop made machines to comply with new injectors received from the manufacturer, and on the factory built test stands the calibration was held to the manufacturer's recommendation.

We found that the injectors were grouped as to delivery. That is, the actual delivery was marked in oil-resistant paint on the side of the injector body below the hold down crab, so that if an assembly developed broken rings, water leaks or a parts failure, the injector that was placed back in the engine would have the same delivery as the one removed, so that the engine would be held as nearly in balance as possible with the test equipment available.

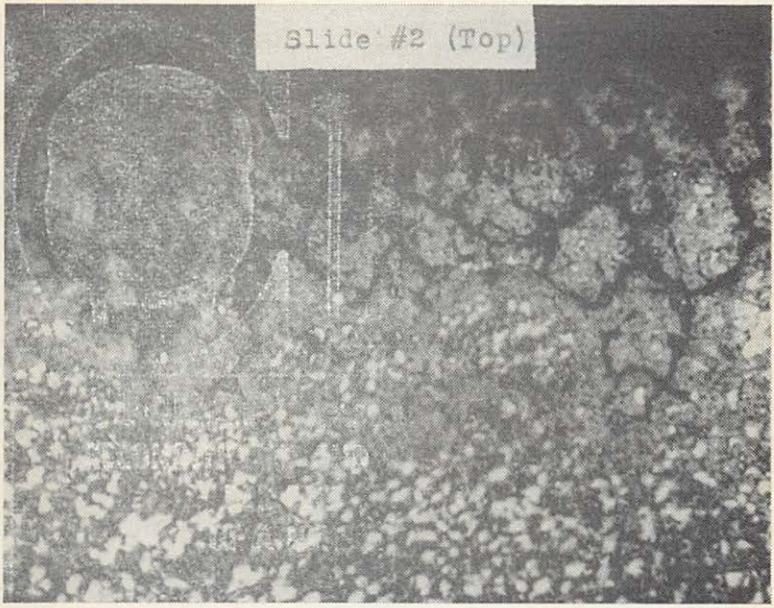
Railroads testing their own injectors have resorted to the use of an adjustable fuel rack that replaces the No. 5226496 rack, or an adjustable rack gear that can change the position of the helix on the plunger due to its being offset on the flat to the gear

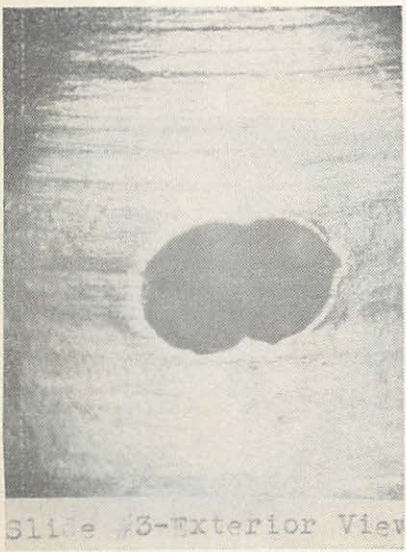
teeth. The gear is marked with a dot or a minus, depending upon the desire of the operator to increase or decrease the delivery of the injector.

However, several railroads have followed up on a series of tests of these calibrated injectors after periods of service and found they did not maintain a constant pre-use calibration. There seemed to be a steady increase in injector output and further tests and examinations were necessary to determine the cause for this increase.



The figure shown on Slide No. 1 is a photomicrograph of the surface network typical of an unused nozzle, showing the surface enlarged 500 times. You can see the subsurface fissures which allow the surface to slough off. This changes the orifice size, allowing more fuel to be discharged from an enlarged opening, affecting calibration. It also distorts the spray pattern and reduces atomization. You will notice the intergranular constituent which outlines the former austenitic grains. It is believed that this intergranular network resulted from the absorption and diffusion of posibly some carbon, nitrogen or hydrogen from the furnace atmosphere by the steel while at an elevated temperature during the heat treating operation. The depth of penetration is approximately .001 to .00125 in depth and the shallow depth of penetration indicates it was not intentional.





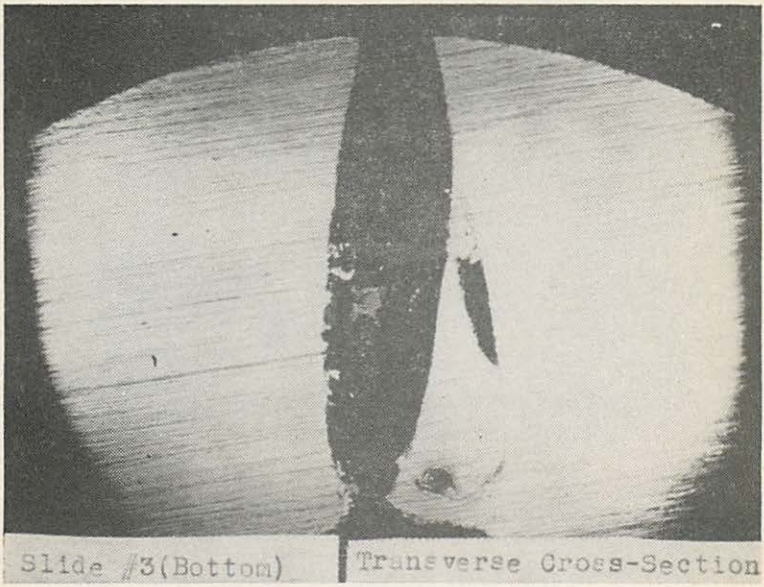
Slide No. 2 is an enlargement of another nozzle, showing the surface structure of a new nozzle, enlarged 1200 times, showing the surface network and underlying carbide particles (showing in white). You can readily see the loose surface structure of the finished nozzle which is not conducive to a steady and predetermined delivery of the tip.

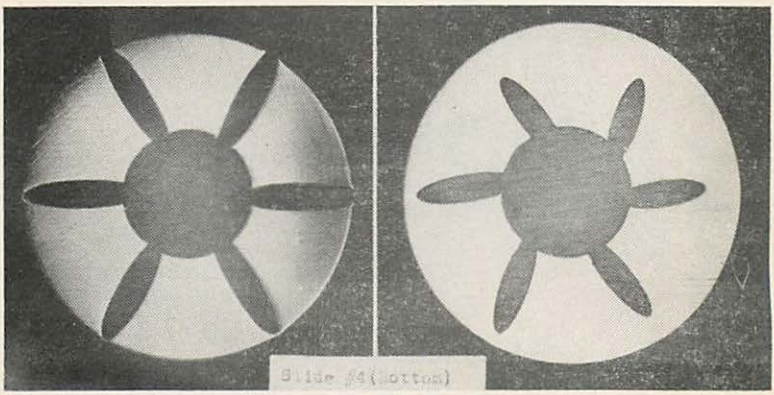
Slides No. 3 are photos, enlarged 100 times, of a new nozzle with a misdrilled hole that has been plugged. The two pictures are of the same nozzle and show the outside surface of the tip and the actual drilled passage and the plug that was applied through the first hole. From the evidence of the flutes as indicated, it is possible that the plug could be the broken drill that was first used on the tip.

While we are talking of drilled holes I want to show Slide No. 4

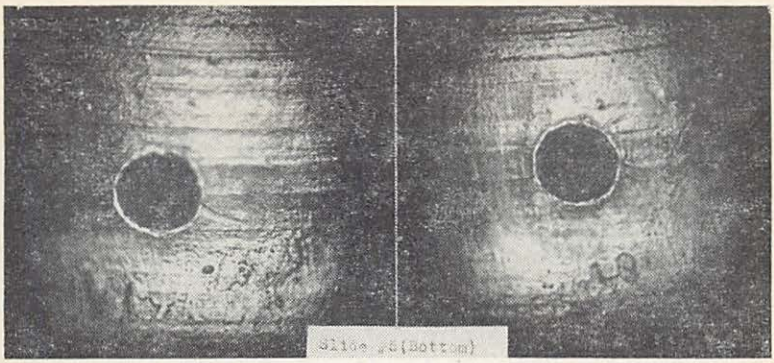
which shows the irregular pattern of the drilled tip. We are trying to get a regular spray patten that we have been told should be readily visible on the top of a piston.

In trying to develop the increase in the delivery of nozzles the study was started in new nozzles before use on certain railroads. One of these is shown on Slide No. 5 which shows the



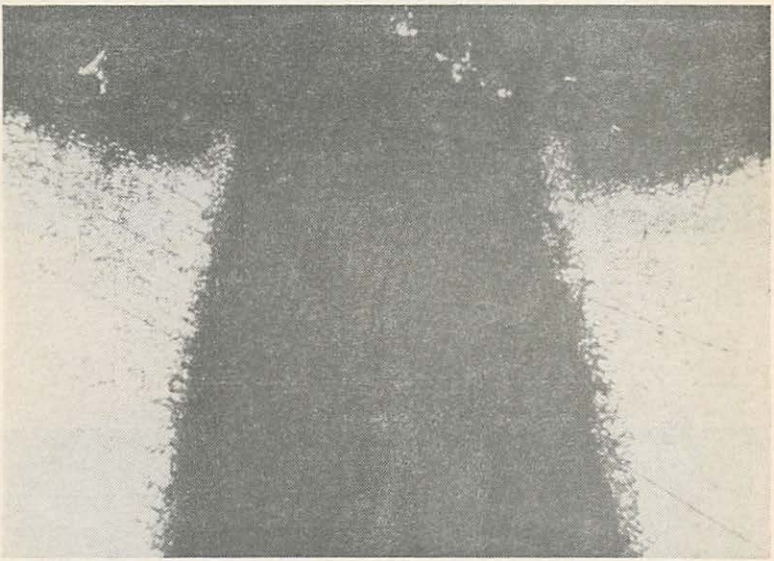


appearance of a raised surface around the entire circumference of the orifice opening. This nozzle was placed in service, and after being in service with an increase of fuel delivery, the picture on Slide No. 6 was made. This shows the raised surface indicated on



Slide No. 5 completely gone. While there is only a smooth hole and all indication of a raised surface is gone, it does show an elongated orifice or opening.

Slide No. 7 shows the exterior edge of the hole on the needle valve side of the tip, showing the surface network and also a raised burr on the inside surface of the tip which restricts the orifice and by its removal would not only increase this orifice but the fuel delivery possible through this opening.



Slide # 7 (Bottom)

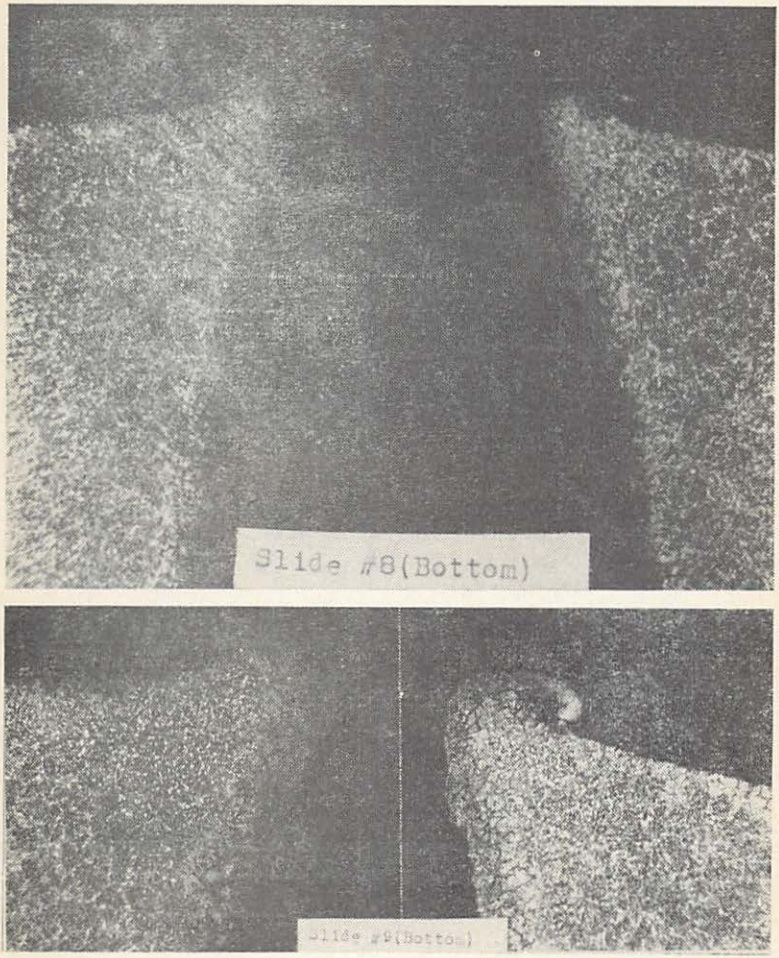
Slide No. 8 shows the exterior end of the tip hole with the burred and raised circumference magnified 200 times. This shows the outside surface of the tip on the discharge side and again shows the restriction of the outside edge of the orifice and the apparent raised burr.

Slide No. 9 shows another tip, magnified 500 times, which shows again the severe network surface and the raised burr on the outside of the tip which is burned and washed away in operating, causing the different rates of delivery.

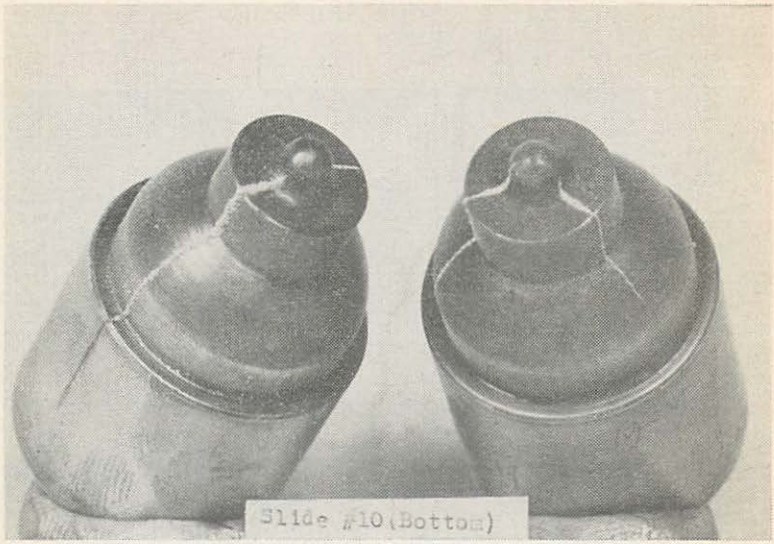
Last year at LMOA, as railroad representatives we asked that further study be made of the fuel injection problem to try to help maintenance personnel protect their operation of high horsepower units against these fuel injection irregularities and increases. We also brought out the necessity of a predetermined flow through the nozzle tip to prevent a severe overload on the possibility of power assembly failure. Worn tips with elongated holes are a prime cause of valve blow, valve breakage and severe carbonization which will cause sparking.

These pictures that you have seen should call to your attention the fact that it is necessary to clean the spark arrestors we depend on to protect us against sparking at least on an annual inspection, since the moist carbon formed by maladjusted or poor-

performing injectors is the worst cause of diesel locomotive sparking. The spark arrestor does not compensate for poor mechanical operation but only protects an efficient operating machine.



Slide No. 10 is an enlargement of a used tip that was found cracked on inspection and pop testing. Many of these have been witnessed by members of this committee and this is something to which very close attention must be given. We have had called to our attention that there are a great many cases of bubbles in the sight glass caused by blow back from the high compression through the injectors and the return fuel line causing a poor operating engine and that it has taken the change-out of almost



a complete set of injectors to find the one giving trouble. *There has been a piece of equipment made on one railroad which has eliminated the costly change-out of the injector and the resulting retiming of the injector and lashes by taking a fuel line from the manifold to the injector and adding a fuel sight glass bowl such as is found on the fuel line of your automobile so that the bubbles will be readily visible passing through this bowl.* This can be made for all types of the EMD injectors, both B and C fuel lines. When bubbles appear in the sight glass the engine is checked to determine if possible which side of the return lines indicates the most heat. If this cannot be determined, then the test fixture is applied to the fuel lines of each injector until the bad order injector is found by showing bubbles in the bowl on the return fuel line. *This operation is much faster than changing out injectors until the indication of bubbles stops due to getting the right injector, since only the fuel lines have to be changed and not the entire injector.* (A print of this piece of equipment is shown as Print No. One.)

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DO THESE TWO THINGS TODAY

A. GET A NEW SUPPLY MEMBER AT THIS MEETING.

B. TURN TO PAGE TWO (2) OF THIS 1963 PRE-CONVENTION REPORT

1. THANK these Advertisers as you visit their room. (Where consistent.)
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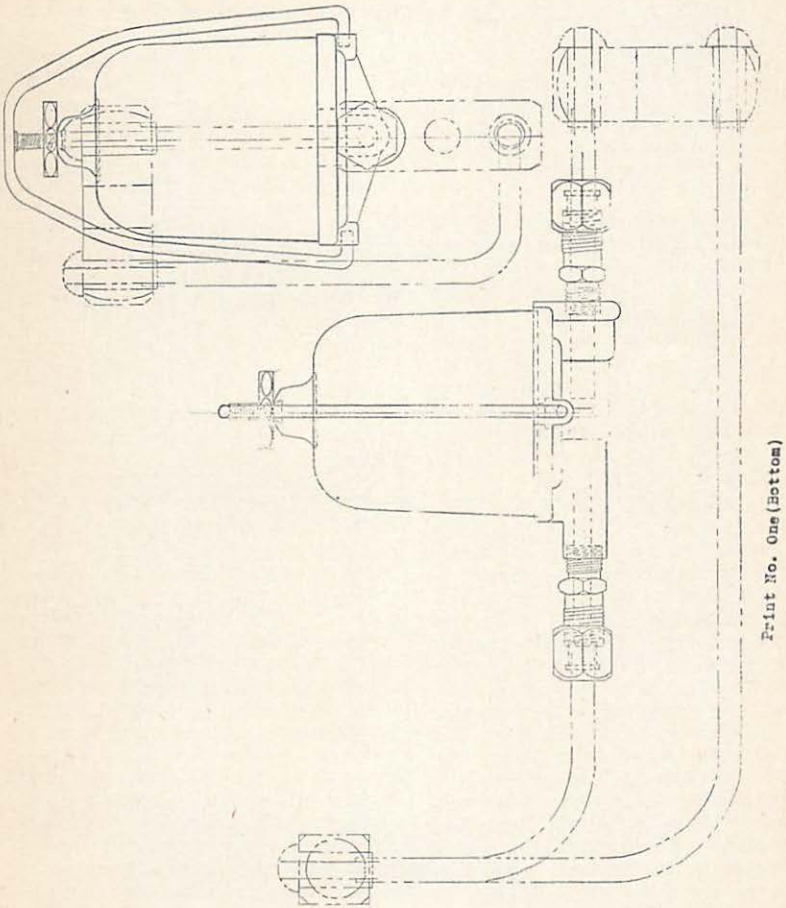


8. GP-20 AND GP-30 REPORT: The reports received by the committee on the GP-20s and GP-30s indicated that very good results are being obtained from the operation of the GP-20 except the trouble experienced on account of fuel injection and the cracking of some of the pistons. The problem with the turbocharger, while it is still with railroads operating these units, has shown beneficial results from the modification made by EMD.

We are now advised by EMD that they have an improved piston which has been reinforced in the stress areas and is capable of better cooling to eliminate this problem. Because of the ring set with which these pistons are equipped, piston No. 8320396 is for chrome liners and piston No. 8320393 is for cast iron liners.

We still receive reports of trouble on the GP-30 account of wrist pin bearing problems and

water leaks on new units before 50,000 miles.

There has also been an injector problem resulting from stuck racks and leaky needle valves. There have been several reports of valve breakage on new units and turbocharger damage and failures.

We have reports of the GP-30 units with Ventura type exhaust stacks pulling a vacuum on the crankcase showing much better oil and engine condition.

It has been reported that there appears to be a problem of cracked cylinder heads showing up again on the GP-30 and GP-18 units. The cause has not been determined but it is a costly maintenance item.

9. WATER LEAKS — EMD: *This committee feels that the railroads have a reason for complaining about some of the conditions that occur. We are still plagued with water leaks on these units and a great cause for this is the weakness of the grommet on the head to liner seal. With the removal several years ago of the brass ferrule from the water opening in the liners the entire pressure of the water system has been placed on this small grommet, and railroads have had repeated failures from them and damage to the pistons and rods due to water in the cylinder.*

The committee reported on this last year, and yet we see no improvement in this section of the engine, and railroads all over the country are complaining about it and must begin an experimental campaign on their own for a remedy.

We see by these examples why there is the possibility of not only broken rings but valve blows and scored pistons from these defects shown.

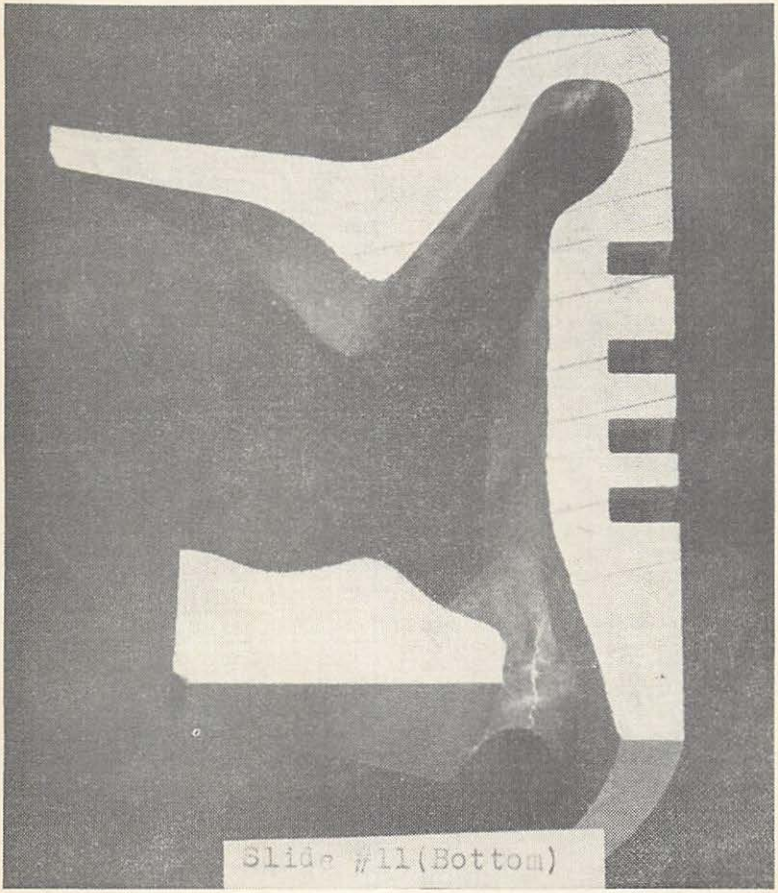
10. PISTON AND CARRIER PROBLEMS: On Slide No. 11 we have another item that must be watched closely on the "C" and "D" pistons on EMD engines — the beginning of the failure of the piston platform in the piston for the carrier piston.

A great deal was said last year regarding the "C" piston pin and carrier due to smearing of the nickle silver pin on the steel carrier bore. We on this committee recommended the change-out of this equipment as quickly as possible to the insert bearing as found in the "D" engines, which we believe to be much improved over the old "C" type. The "C" carrier and pin have been removed from the latest EMD catalogue.

11. EXTENDED MILEAGE AND MAINTENANCE OF EMD UNITS: With increased horsepower came increased fuel tank capacity which allowed operation in longer pool service and lower cost per mile of operation. With improved filtration of lube oil and fuel oil, the down time in the shops has been reduced on periodic maintenance and extended on mileage maintenance due to reduced maintenance at low mileage intervals. This allows a higher utilization of power and reduces the number of units necessary for maintenance since they are hauling heavier trains faster and further than before.

12. DIESEL HYDRAULIC: The committee received very few reports on operation and maintenance from users of the diesel hydraulic engines. However, the reports received were very encouraging regarding the operation of these units and we were advised that more were on order and a program was set up for the manufacture of a prototype to be made in the U. S. A.

13. U25B: We contacted the railroads operating the U25B for information as to some of the problems they have experienced



and have reports that the power plants in these units cannot be considered trouble-free and leave much to be desired by maintenance men depending on these prime movers for availability and trouble-free service on extended mileage with a minimum of maintenance.

We are in receipt of letters from railroads operating these units reporting oil troubles on these units, such as excessive oil contamination by suspended matter, the extremely short life of lube oil filters, and the necessity of numerous oil changes on these units. However, the railroads reporting also advise that the builder is now experimenting with a piston and ring combination to try to overcome this problem.

There have also been numerous reports of road failure from low oil alarm believed to be false low oil condition. The builder is now changing out the 100 mesh lube strainers by furnishing 40 mesh strainers to allow more oil flow. The pressure of the switches is being changed. The

idle shut down has been set at from 6 to 9 pounds and 35-42 pounds in 8th throttle. The by-pass valve on the main header has been raised to 75 pounds and higher.

We have reports of loose valve seats in the cylinder heads, reported both loose and cracked, which caused damage to the engine and the possibility of a turbocharger failure.

With the problem already mentioned with the 251 exhaust manifold, the U25B has a manifold problem also, caused by failed manifold in the elbow section and bellows.

We had the report of the wrist pin bushing failures last year, and continue to get this information this year. But we have reports of improvement with the new wrist pin bushing and the micro finish on the pin.

We now have information concerning the failure of the articulated connecting rod bearing, and that connecting rod bearings on the crankshift journal have been found shelled. While this may not be classed as an epidemic, it is something that must be watched by all mechanical personnel operating these units.

We also have information on broken camshaft fuel lobes on the U25B locomotives. These camshafts are cracking or breaking in the keyway slot of the lobes and the builder is experimenting with integral lobe cams to try to remedy this problem.

This committee, dealing with a comparative cost of the operation of higher horsepower units, admits that the manufacturers are experimenting with fixes for the problems we are experiencing, but we do feel that some of these problems were inherent in the older units and that before adding an additional load to a bad seal, poor ring or injector, and a weak exhaust system, a more thorough engineering job should have been done. A closer laboratory control should be maintained over the parts we purchase from the manufacturers and which are built into the power. With the failure of parts offered by the manufacturers, it is necessary for mechanical men on the railroads to purchase other than manufacturers' parts in an effort to protect their operation.

Again, we would like to request a power plant that is trouble-free, with a minimum of maintenance, as publicized by the manufacturers, and which would only need fuel, water and oil to haul the nations' freight over the rails with a minimun of mechanical delays or failures.

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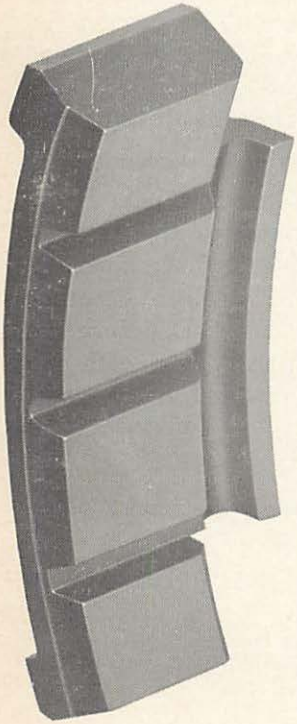

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Pre-Convention Presentation of Report of the Committee on Shop Equipment in co-operation with the Mile High Railway Club.

On April 29, 1963, the Mile High Railway Club was host to the Locomotive Maintenance Officers Association. Mr. C. P. Stendahl of the L. M. O. A. Executive Committee presented Mr. J. D. Schroeder, Chairman of the Committee on Shop Equipment, who with the able assistance of his committee members presented a very good program.

The members showed a very keen interest in the report "*Shop Equipment for Higher Horsepower Locomotives*" and following the presentation of the report there was a lively discussion and questions were presented which were ably answered by Mr. Schroeder and his committee.

We wish to thank the L. M. O. A., Mr. Stendahl, Mr. Schroeder and his committee for the fine presentation. We extend to all members of the various Diesel Clubs throughout the country a cordial invitation to meet with us and enjoy our meetings and discussions. Regular meetings are on the last Monday of each month except June, July, August and December, at Pomponios DX Restaurant and Lounge, Denver, Colo. Dinner, 6:30 p. m. Meeting at 7:30 p. m.

Tuesday Morning, October 15, 1963

10:30 A. M.

REPORT OF THE COMMITTEE ON

SHOP EQUIPMENT

Pre-Convention
Presentation:
MILE HIGH
RAILWAY CLUB
6:30 P. M.
APRIL 29, 1963

Pomponios D-X
RESTAURANT
48th & Pecos Sts.
Denver, Colo.

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Asst. Gen. Supt. M. P.
C. B. & Q. R.R.
Chicago, Ill.

Vice Chairman

J. J. Carroll, Shop Supt., Union Pacific R.R., Salt Lake City, Utah

Committee Members

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J. D. Speier, Master Mechanic, K. I. & T. R.R., Louisville, Ky.
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W. J. Presho, Industrial Engr., Southern Pacific Co., San Francisco, Calif.
R. B. Martin, Asst. Master Mechanic, Western Maryland Ry., Cumberland, Md.

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1963 TOPIC:

"FACILITIES REQUIRED FOR

HIGHER HORSEPOWER LOCOMOTIVES"

1. HIGHER HORSEPOWER: In studying the assigned subject matter for this year; this committee has taken the liberty of expanding the scope of the study to include additionally the ever-important terminology "efficient and economical." We found it quite a challenge to actually arrive at a suitable definition of the term "higher horsepower" locomotives, so we have assumed that we are to think in the terms of locomotive units commonly offered on the market today developing in the range of 2000 to 2500 horsepower. However, units developing up to 10,000 horsepower are currently being tested in service and single units developing 5,000 horsepower will be commonly offered by the time this report goes to press. Locomotive builders have well publicized the claimed economics inherent in these larger "packages" of motive power and much has been said about the economies of maintaining a lesser number of units in a fleet to accomplish a given work load, so it logically follows that we must make every effort to streamline our maintenance and repair operations to permit having the full advantage of the total fleet horsepower contained in a lesser number of units.

The answers to our inquiries generally have indicated that no extensive basic changes in maintenance facilities have been required for handling the latest type units and components, but further study has brought out some interesting detailed aspects of the matter that seem worthy of serious consideration.

2. THE MOST MODERN DESIGNS AND SUGGESTED OPERATIONAL PROCEDURES for locomotive repair shops have been extensively reported in the recent past and we feel it timely to advise that presently installed and operative versions of such facilities are generally serving their purposes very well and have proven adaptable, if not a requisite, for the efficient maintenance of the higher horsepower units. We would be premature in attempting to advise you in any way relative to the possible reduction in size of the running repair facilities which may be feasible due to the actual lesser number of units that may be required to handle the transportation requirements. It is felt that the current trend toward building of single units of much greater horsepower should be studied carefully and planning for running repair shops of the future should be adjusted in line with this apparent trend.

3. HEAVY REPAIR SHOPS: It appears that, in a general way, the heavy repair shop facilities will need continue very much in line with the past. This would refer particularly to the departments of such shops devoted to the repairing of locomotive components, in fact, *we may safely assume that most component repair work involved in the maintenance of the higher horsepower units will not be reduced in proportion to the actual number of units maintained and may be more properly measured on the basis of horsepower developed, which leaves us with a constant continued work load in this area.*

4. NEW SHOP FACILITIES: In the planning of new shop facilities and maintaining equipment in older facilities, we would direct attention to the importance of considering the weights and dimensions of the latest types of units, as well as units of the future as they affect jacking and hoisting facilities in a shop. *We are now dealing with units in the weight range of 175 tons each. The larger units to be offered will have total weight of 250 tons*

and upward, and individual trucks will weigh approximately 40 tons. The new units will be approximately 88 feet long with truck lengths of 28 feet. In many shops the installed lifting equipment is now being taxed to its full rated capacity with resultant need for extreme care in maintaining the machinery, as the wear factor is found to greatly increase as equipment of this type is used to its full rated capacity. There are some existing drop table and body supports that will not be adequate for the higher horsepower locomotives and it is necessary to replace the support bar with a high tensile steel bar and to reinforce the side and bottom plates of the body support beams at points of high stresses, for the heavier locomotives.

Most certainly, in planning for new shops, we should contemplate the need for lifting equipment of rated capacities and physical dimensions that will be a requisite for handling the locomotive units of the future and in cases where retirement of shop facilities are presently being contemplated, it will be well to consider that high capacity cranes that have seen little use in the recent past may again be needed in the near future. Installation of second cranes may provide the needed capacity in some instances where installed cranes are of insufficient capacity.

5. PRECISION TOOLS: In the maintenance of the higher horsepower units more precise workmanship has become a prime requisite in the repairing and adjustment of the mechanical and electrical equipment. Such attention necessitates shops being provided with all the tools and equipment needed to carry on this type of work.

6. LOAD TEST STANDS: Frequent load testing of locomotive power plants on many properties

was deemed of little value and was neglected to a great degree on older units. *We now find that the full and proper functioning of the latest units necessitates having a complete knowledge of unit output and load test stands of ample capacity must be provided and used regularly. Many load test stands already installed are of insufficient capacity to serve for testing the higher output of the later type units.* In some cases the capacity of the devices can be increased at reasonable cost and complete load testing facilities should be provided where they are not presently available.

7. PORTABLE LOAD TEST STAND: We have reports of some economical and satisfactory load test stands having been installed by using two complete dynamic brake grid hatches salvaged from obsolete units. The maintenance cost of perpetuating such equipment over many years remains a moot question, and may prove to be uneconomical installation, but appears to offer, at least, a very satisfactory and economical installation that will suffice until more expensive equipment can be afforded and justified.

A very interesting innovation consists of mounting these resistor banks on a four-wheeled rubber-tired trailer that permits ready transportation of the equipment to the locomotive; thus avoiding the necessity for moving units to designated tracks for load testing and permits readily transferring the operation from one location to another as may be desirable from time to time.

8. GOVERNOR TEST STAND: The engine governor has always played a very important role in a properly functioning unit. *In the higher horsepower units it has been found that the governor setting must be very precise and many of the latest type governors cannot be adjusted on the engine;* therefore, a suitable governor test stand must be available and used for proper checking and adjusting of the governors of the later type units. Actually the governor test stand that has been satisfactorily serving for the handling of prior models of the governor can usually be readily and economically modified for adjusting the so-called rebalancing type of governor.

9. MODIFICATION OF EXISTING GOVERNOR TEST STANDS requires the addition of an accurately controlled source of compressed air with accurate measuring instruments included. A 60-inch mercury manometer in the air line serves very well for measuring the air input and suitable fittings for ready connection of the air supply to the fuel limiter portion of the governor should be provided. It has been found that on some earlier models of the governor test stand that the drive motors were inadequate to properly test the latest governors. In such cases the drive motor brackets must be adapted and a motor having proper torque and speed characteristics provided.

10. FUEL INJECTION EQUIPMENT: *It has become obvious that proper maintenance of the later type units demands precise attention to be given to the testing and repair of fuel injecion equipment to achieve the necessary in this area. It is important that the best of shop facilities be dedicated to the repair and testing of the equipment* and the more frequent precise attention required dictates that most efficient shop practices should prevail. We would refer you to some very fine plans for equipping and operating injector repair departments that have been well pub-

licized in recent years. *It has been found that the well-equipped and properly operated shop will pay for itself in a very short time and continue to reflect considerable savings not only in the direct cost of testing and repairing the equipment, but in the reflected economies of locomotives having the benefit of well maintained fuel injection equipment*

11. PORTABLE INJECTOR TESTER: Of particular interest are the portable devices that have been developed for testing of injectors individually in the engine, which obviates the need for removing all the injectors to permit locating one that is malfunctioning. We have been favored with some fine slides showing some modern well-equipped shops and at the conclusion of this report we would like you to see these pictures and hear the running commentary that will be offered by two of our committee members who happen to be thoroughly acquainted with the installations.

12. TRACTION MOTOR REWORKING: Developments pertaining to the extreme care required in the re-working of traction motors in the high horsepower units is being reported by your Diesel Electrical Committee. *Of particular interest to this committee is the obvious need for equipment and tooling that will permit more efficient machining, gauging and assembling of the traction motor components to the closer tolerances required* in the repair procedures on the present day traction motors. However, we were not able to gather information on this subject in time to include it in this report, but we understand the motor builders can furnish some very helpful information on this subject.

13. TRUCKS: It has been interesting to note the results of transmission of higher horsepower from locomotive to the rail

as it affects locomotive truck wear and a need for more precise maintenance policies in connection with truck repair work is indicated.

14. PORTABLE TRUCK PEDESTAL JAW MILLING MACHINE: *We are very much impressed with the economies being effected through the use of a portable milling machine being used for milling of truck pedestal jaws.* Previous to the acquisition of this machine, jaw faces were ground with the use of a hand grinder. This method provided an unsatisfactory finish and it was impossible to actually control dimensional tolerances. *It was found that when a truck leaves the shop after having had the jaw faces milled to close tolerances that the time required before re-shopping for jaw work was extended at least 50%, thus presenting a one-third less work load. The more accurate jaw alignment obtained actually resulted in the most attractive savings. The initial immediate savings plus the savings due to work load decrease means an ultimate saving of one-half over the grinding method costs in addition to the increased liner box and wheel wear that can be anticipated along with the increased efficiency and safety resultant from the use of this improved method of pedestal jaw machine.* We understand that the earlier versions of these portable milling machines that were offered have proved to be a little light for the work presented *but a machine of heavier construction is now being offered, which is felt will prove to be entirely satisfactory.*

15. TORQUE CONTROL IMPACT WRENCHES & POWER TOOLS: With utmost sincerity, we were hoping to be able to report and recommend to you the application of suitable, reliable torque control impact wrenches or power tools to diesel locomotive maintenance work. *We do have reports of very limited use of these important labor-saving devices and are advised that such tools currently available are reliable on specialized work. An example would be use of one of the tools used in applying EMD cylinder heads to liners in preassembling these components on a production line basis.* Generally, we have not found such equipment offered in the wide range or adaptable to the wide range of work, that would offer the greatest potential economies. It is understood that further research and development is being carried on by the tool companies and *we would urge you to encourage the people in the tool industry to rapidly complete the development work.*

16. ACTUAL TIME STUDIES of many of the various common chores about the diesel engine where accurate control of torque is required should readily point up the savings potential of mechanized method versus the manual method. *Undoubtedly properly developed information will, in most cases, readily point up the need for a line of power wrenches, with accurate control of torque inherent that will serve the wide range of bolted applications of components on the locomotives.*

17. MAIN BEARING TOOLS: *We have belatedly learned of the need for revised versions of the commonly used main bearing tools for use on engines of the higher horsepower units.* Few details of such tools are available at this writing, but you will want to fully investigate the adaptability of such tools before making expenditures for new equipment of this type.

18. CLEANING LOCOMOTIVES AND COMPONENTS:

This committee was faced with numerous requests to furnish information on up-to-date methods of cleaning locomotives and their components. It is not our intent to deviate from the assigned subject matter so we have attempted to look at particular cleaning problems that have arisen with the advent of the higher horsepower units.

19. PISTON UNDER CROWN DEPOSITS: Response to our inquiries point up two definite areas where cleaning problems have come along with the higher horsepower units. The first deals with the necessity for complete removal of piston undercrown deposits and the second deals with a more urgent need to satisfactorily clean the car body exteriors without increasing labor costs.

You are well acquainted with, or will learn of, necessity for maintaining maximum cooling to the pistons of the high horsepower units to dissipate the higher temperatures encountered. *This makes mandatory the removal of piston undercrown deposits when pistons are in shop.* This problem seems to have been most successfully solved by blasting of the usual abrasives used for such work and it is recommended that advantage be taken of automatic equipment, available from many sources, for doing this job. The equipment used should be provided with conveyors, set up as a part of the piston reconditioning department, to insure a minimum of manual handling and to avoid disrupting of a production line type of operation in the department.

20. CAR BODY CLEANING: *We have been living through a gradual transition from locomotives of car body type to those of hood type and have noted our exterior cleaning costs rise steadily through that period.* The cur-

rent models of higher horsepower units are of the hood type and locomotive fleets are readily becoming saturated with units of that type, and it is timely that we consider the possibilities of satisfactorily and economically washing these units. The systems which have been installed vary from one with several very simple U-shaped spray pipes with nozzles, one to spray on detergent and the other to rinse off the locomotive, to an elaborate wash arrangement with side brushes, multiple sprays and fully automatic operation.

21. FIVE STAGE SPRAY SYSTEM: *One recently installed washer features a five stage spray system, controlled by push buttons, to clean the locomotive at it moves through at an average speed of one MPH, or approximately* 90 *FPM.* The locomotive unit travels progressively through a pre-wet spray, then a body acid spray, an alkaline spray and then a final rinse. The final spray is supplied by a booster pump furnishing heated water at 250 PSI for effective removal of detergents and dirt. Additional sprays are provided to clean the trucks, wheel plates and underframes during the progress of the locomotive through the cleaning area.

22. REVOLVING SIDE BRUSH SYSTEM: A more elaborate system on another railroad includes the use of revolving side brushes for car body locomotives as well as for cleaning side panels and cabs of hood type locomotives. This particular washer occupies 170 ft. of track space with concrete platforms sloped for drainage. The locomotive unit is moved through the washer by a motor driven puller with a rabbit, at a constant speed of 45 FPM. The first or pre-wet spray operates with city water pressure to cool the locomotive, eliminating the possibility of the detergent drying on a hot day. Thirty feet further along detergent is sprayed on trucks, underframe, etc. Side brushes on a 45° angle are installed 30 feet after the underframe rinse to loosen dirt. The final high pressure spray stand following the brush stand floods the entire body with approximately 200 gpm of cold water at 250 PSI. *Operation of the above system, except for occasional mixing of detergent, is fully automatic.* After the puller rabbit has been moved into position contacting the traction motor frame, the start button is pressed. As the locomotive moves along the wash track the wheel treads operate track type limit switches to start and stop detergent and booster pumps, open and close solenoid valves and operate the brushes automatically. When the locomotive unit reaches the end of the wash track, a limit switch stops the puller, with the entire system shut down. Manually operated push buttons are provided for all functions for test.

23. PULLER SYSTEM: A similar arrangement at another location has a puller operating at 11 FPM reducing the overall length to approximately 45 feet. Such an arrangement provides the necessary action time for the detergent and reduces the amount of platform and drainage required. *Cleaning operations are fully as effective as the arrangement outlined above.* The puller system for moving the locomotive through the spray system has proven very satisfactory. Adequate cleaning is dependent upon sufficient time for the detergents to act on the soil, as well as a slow operating speed through the brushes and rinse sprays. It is difficult to maintain the desired speed through the cleaning ar-

rangement other than by a winch or puller system.

24. SPRAY SYSTEM: *Most answers to our inquiries relative to car body type washing indicated that adequate cleaning could not be obtained using sprays alone regardless of the number of spray stands, type of cleaning materials, or pressures used; however, we do have a report from one large railroad which has only very recently been successful in developing a spray arrangement that does a satisfactory job. This committee feels that on many properties, the cost of installation of the elaborate equipment needed to provide power brushing of hood type units would be prohibitive and we feel that eventually a satisfactory job can be done through the use of the much less expensive spraying procedures.* Undoubtedly much of the success of such an operation will need come from the development of cleaning agents designed specifically for such procedures and continued research in this field will undoubtedly provide the necessary materials. *The successful installation* referred to above provides for spray stands applying acid type materials followed at a 28-ft. interval with an alkaline type solution. The high pressure water rinse nozzles are situated 30 feet from the alkaline sprays. Very high water pressures at the rinse nozzles are apparently imperative and the above installation provides 285 lbs. per square inch water pressure at the nozzles. Other installations reportedly are making use of water pressure up to 800 lbs. per square inch with very fine results. In this instalation the above procedures are followed by a clear water flushing rinse, but the need for this flushing can be readily determined by on-the-site testing.

Locomotives are moved through this installation at approximately 2 MPH. *This operation can readily and effectively be automated if it is felt feasible to do so.*

25. CLEANING VAT SLUDGE CONVEYOR: Although deviating entirely from the assigned subject matter, we would like to direct your attention to interesting development recently coming to our attention that has resulted in considerable economies in cleaning costs in shops where equipment consisting essentially of a conveyor arrangement custom built for installation in cleaning vats or tanks and serves to remove the accumulated sludge from the tanks. *Savings resulting from use of this equipment came about from obviating the need for manual cleaning of the sludge from these vats and tanks and results in minimum of cleaning agents added to maintain solutions at desired strength. Reportedly the cost of some installations have been fully amortized within the first year. The use of this equipment appears to offer a very interesting field for further economies in our cleaning operations.*

26. SUMMARY: *The current trend toward individual locomotive units of greatly increased horsepower rating is in its infancy and it is difficult to envision just what the ultimate commonly used units may offer as locomotive power packages.* Further the basic physical characteristics of locomotives to be offered may be at considerable variance with today's locomotives, particularly in the areas of body types, general dimensions, truck types and arrangements, total weights, accessibility of components, etc. *Therefore, it is not timely to attempt a prescribed standardization of general maintenance facilities, but*

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You can have your cylinder heads picked up and delivered free in orders of 32 or more, anywhere, anytime.

Every head is stripped, preheated, welded, machined, new parts installed, finished, painted, tested, inspected and returned to your shop.

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The world is moving ahead with progress. We must also move ahead developing and accepting new money saving ideas.

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With rising costs of everything it is important to look for ways to save.

Be wise — Productionize. Better yet — take the load off your back — leave it to J & J Production by Volume. — Quality by Progress.

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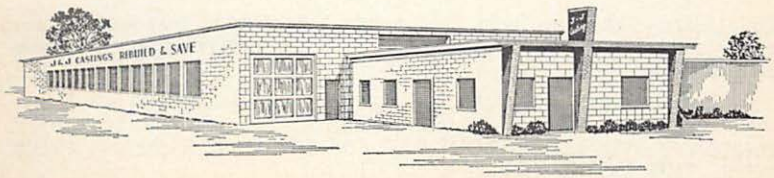
Hibbing, Minnesota

P. S. A good process has been developed and proven successfully for welding cracked EMD-567 A, B, C, & D, Alco-244, 539, 251, and Baldwin-V. O., 606.



good planning today should look toward facilities that are highly flexible in arrangement so they may be readily adapted to future locomotives while continuing to serve the current models as well as the models of the recent past.

The resultant reduction of number of units available for train handling assignments further dictates a need for efficient maintenance layouts that permit most rapid completion of locomotive maintenance requirements, not only to economize in labor costs, but to avoid jeopardizing the unit availability and utilization ratios.

Locomotive heavy repair shops may be considered in the same light as are the running repair shops and for the same reasons.

Many time and cost saving methods result from use of specialized tools and equipment and quite generally the people of the supply industry have readily available, for our benefit, details of suggested methods and procedures that present great potential in improved locomotive maintenance practices. Likewise our friends of the various trade publications are very helpful in widely disseminating helpful ideas on a current basis. *We emphasize the importance of looking at all the progressive developments with an open mind and availing ourselves of these developments to the fullest extent feasible. Certainly we must be appreciative of the cooperative spirit inherent in our industry and we all look forward to hearing of your problems and learning of suitable solutions, and through the efforts devoted to this association and other organizations we can all expect to keep abreast of progress as it develops in the area of our responsibility for the maintenance of the higher horsepower locomotives.*

★ ★ ★

DO THESE THINGS TODAY!

A. GET A NEW SUPPLY MEMBER AT THIS MEETING.

B. TURN TO PAGE TWO (2) OF THIS 1963 PRE-CONVENTION REPORT.

1. **THANK** these Advertisers as you visit their room. (Where consistent.)
2. INVITE those NOT LISTED AS ADVERTISERS to participate as Advertisers in the 1963 Annual Proceedings. (Where consistent.)

★ ★ ★

Special Notice: We have been challenged to "put more business" in our meeting; accordingly we have scheduled the **Wednesday Morning Session** to start at 9:00 A. M.

LET'S SHOW THE INDUSTRY WE ACCEPT THE CHALLENGE BY BEING IN THE BANQUET ROOM AT 9:00 A. M. READY TO GO TO WORK WEDNESDAY MORNING **WITHOUT FAIL. BE THERE!** THIS MEANS **EVERY** MEMBER. **THIS MEANS YOU!**

Tuesday, October 15, 1963

12:00 Noon

Coordinated Mechanical Associations'

LUNCHEON

Honoring All Railroad Presidents

PRINCIPAL SPEAKER

W. H. KENDALL
President
Louisville & Nashville R.R. Co.
Louisville 1, Ky.

2:00 P. M.

Entire Afternoon

Reserved for Review of

American Railway Progress Exposition — Combined Railway Suppliers Exhibit

Featuring:

$40,000,000.00 Display of Railroad Equipment On Track and in Exhibition Hall

Presented By:

300 RAILROAD SUPPLIERS Expected to be seen by 30,000 people!

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C. A. LOVE, President
C. M. O.
Louisville & Nashville Ry.
Louisville, Ky.

THE SOUTHERN AND SOUTHWESTERN RAILWAY CLUB, INC.

At the April 18th meeting in Jacksonville, Fla., a very large and attentive audience listened to a very fine presentation by Mr. W. F. Dadd.

Mr. Dadd and members of his Committee delivered their program on "Mechanical Department Responsibility for Locomotive Maintenance Cost Control System". In this paper the Committee presented the many problems which confront the Mechanical Dept. in their endeavors to control the ever rising costs in the Mechanical Dept. on maintenance features.

After the meeting a very active discussion period followed, and the members and guests brought out many important features for the consideration of the committee.

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I hereby make application for (ACTIVE) (ASSOCIATE) membership in the SOUTHERN AND SOUTHWESTERN RAILWAY CLUB, INC.

I further agree to abide by the Rules of said Club, and attach herewith ($7.50) ($15.00) in payment of first years dues, which is to be returned in case my application is not accepted, and I agree to pay ($7.50) ($15.00) per year in advance each year thereafter until my resignation is presented in writing.

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Mail to H. W. Brewer, Sec'y., P. O. Box 7211, Jacksonville 10, Fla.

Reporter _____ Meeting.

Wednesday Morning, October 16, 1963

9:00 A. M.

REPORT OF THE COMMITTEE ON

NEW DEVELOPMENTS IN MOTIVE POWER MAINTENANCE

Pre-Convention Presentation: SOUTHERN AND SOUTHWESTERN RAILWAY CLUB

9:30 A. M.
APRIL 18, 1963
Mayflower Hotel
Jacksonville, Fla.

CHAIRMAN: W. F. DADD
Gen. Supt. Motive Power — Sys.
Baltimore & Ohio R.R.
Baltimore, Md.

Vice Chairman

W. H. Miller, Master Mechanic, Pennsylvania R.R., Philadelphia, Pa.

Committee Members

C. M. Slavin, Supt. Costs, C. & O. Ry., Huntington, W. Va.
J. W. Adams, Mgr. Planning & Production, L. & N. R.R., Louisville, Ky.
J. J. Gregory, Supvr. Cost Control, N. Y. C. R.R., Collinwood, Ohio
Carl Godfrey, Asst. to Shop Supt., Atlantic Coast Line, Waycross, Ga.
R. H. Maas, Chief Draftsman, C. M. St. P. & P., Milwaukee, Wis.
F. G. Fisher, Asst. Supt. M. P. & R. E. and Mech. Engr., Reading Co., Reading, Pa.
A. L. Novak, Industrial Engr., E. J. & E. Ry., Chicago, Ill.
V. L. Smith, Supt. Motive Power, Belt R.R., Chicago, Ill.
J. C. Wroten, Jr., Diesel Supvr., Seaboard Air Line R.R., Hamlet, N. C.
D. L. Stanley, Supt. Loco. Dept., Bessemer & Lake Erie R.R., Greenville, Pa.
C. N. Cawlfield, Supvr. Planning & Sched., Frisco R.R., Springfield, Mo.
E. F. Hatton, Chief Accountant, B. & L. E. R.R., Greenville, Pa.
G. H. Barker, Special Representative, Southern Pacific, San Francisco, Calif.
Herman Thornton, General Foreman, Missouri Pacific R.R., North Little Rock, Ark.
J. T. Wade, Asst. Supvr. Diesel Engs., A. T. & S. F. Ry., Chicago, Ill.
T. J. Bradley, Master Mechanic, D. & H. R.R., Watervliet, N. Y.
W. D. McNeilly, Chief Industrial Engr., B. & L. E. R.R., Greenville, Pa.

★

1963 TOPIC:

"MECHANICAL DEPARTMENT RESPONSIBILITY FOR LOCOMOTIVE MAINTENANCE COST CONTROL SYSTEMS"

1. COST DETERMINATION: Our subject is a continuation of similar presentations in 1961 and 1962 which had outlined the need for improved methods as a tool for controlling and lowering locomotive maintenance costs. The continued study of this subject is bringing into focus the identity of true maintenance costs and their relationship to the many factors that contribute to the total cost of operating a railroad. Deferred maintenance, taxes, and changes in depreciation allowances are being recognized, for example, as important factors in the determination of costs.

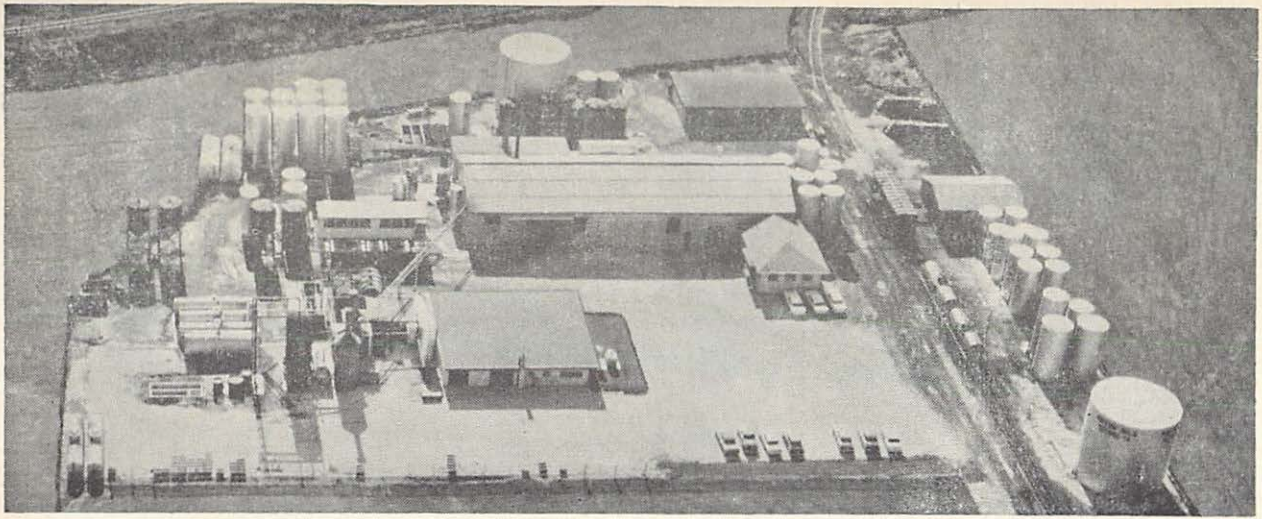
2. RESPONSIBILITY FOR SETTING UP AN APPROPRIATE MAINTENANCE CONTROL SYSTEM falls upon every Mechanical Department managerial staff who must be able to accept the responsibility for repair and maintenance of motive power and in addition, to justify its efficiency and handling of this responsibility. Our previous year's paper dealt mainly with cost control and accurate reporting of work performed. This was recommended to be applied at the job level beginning with each gang foreman who is in the best position to report the labor expended by his people and the job production from these people. This can be adequately controlled by a daily group labor report, daily production report and guide sheet listing standard hours for the maximum number of jobs to be performed. When this type of cost and work production control is properly reported to a headquarters point, where total labor expended by individual shops is analyzed with the budgeted expenditures for that shop and for the total of all shops, a practical level of cost control has been achieved.

3. THIS PERMITS MAXIMUM

CONTROL OF THE NUMBER OF MEN being used for the work actually being performed. The next problem to be answered is with respect to the necessity for each job of work being performed by properly qualifying the particular type job through the prescribed maintenance assignment or by a recognized part change incident expected at a recognized interval on a specific type of locomotive.

4. IN RECOGNIZING AND ACCEPTING A BASIC MAINTENANCE PROCEDURE ON A PARTICULAR TYPE OF POWER, the Mechanical Department officers must be ever mindful of their responsibility to furnish reasonably trouble-free motive power for Transportation Department use. In conjunction with this, the Transportation Department must strive for improved locomotive utilization to minimize the number of units to be maintained. *This particular factor requires maximum cooperation between locomotive maintenance supervision and transportation officers with respect to meeting Maintenance Department shopping schedule dates accurately,* which schedules when being made should give maximum consideration to Transportation Department needs.

5. CENTRALIZATION: The trend on many roads over the past several years has been a centralization of maintenance facilities. This has generally contributed to lower maintenance costs. *Studies which evaluate availability and utilization of locomotive units indicate, however, the desirability of performing maintenance work during normal lay-over time.* Where sufficient unused unit hours are available at an end-of-line point, for example, the performance of



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simple monthly maintenance and form requirements at such point may well contribute to a greater overall economy of operation, through improved availability of power for utilization. While units might be formed in this manner for straight monthly work, they would still be scheduled to a centralized point on a quarterly basis in order to control heavier work and the maximum number of parts changes.

6. A CENTRAL REPORTING POINT should be staffed with supervision properly trained to receive and evaluate reports of work done at all points with accurate reporting of specific parts changed such as fuel pumps, injectors, heads, pistons, cylinder liners and other components. This information must be recorded in a manner to permit easy and frequent analysis of the maintenance being required on any specific unit, also analysis of the regularity of change of any specific part. Central control in this manner will result in awareness of conditions resulting in too frequent replacement of any component. It will also make possible an evaluation of service life to permit the extension of assigned change periods for a specific item. Both of these evaluations will be based on the failure rate of the part in question or its condition which required change.

7. ANALYSIS: Many of us in the past have made a spot check analysis of diesel unit performance either because of excessive troubles being experienced or a desire to re-evaluate and change progressive maintenance systems or shopping schedules. The centralized system being proposed should be analyzed at a regular interval with reports being made on the result of the analysis to indicate the efficiencies with respect to assigned maintenance policies. The performance of the parts being considered should be evaluated not only on a service time basis but also considering mileage and if available, by fuel consumption.

8. APPLICATION: Let's consider one method of applying and controlling centralized records with a regular analysis to produce usable information and thereby improve efficiency. It does us little good to keep records such as have been under discussion if the information therein is not readily available and/or if the clerical work to post on these records costs more money than the losses we are trying to prevent! Certainly, in today's modern world of computers and automation, we must think beyond the "pencil pusher" stage. Most American railroads have by now gone into many facets of computer use and have undoubtedly been able to save tremendous sums on many types of applications. However, at the same time, many have also discovered that their use must be carefully controlled, as they are not a cure-all for all problems that arise. This is particularly true when considerations of decentralization, ready availability, and availability at the source are factors.

9. KEYSORT: In the area of locomotive maintenance cost control systems, railroad "X" has incorporated a method of control which uses the "pencil-pusher" at one end of the spectrum and a computer at the other. Joining the two is a very efficient manual method known as Keysort, furnished by Royal McBee Corporation, which does quite a good job of filling the void between the "pencil-pusher" and the computer. Other similar manual card systems may also meet requirements. Attached are two cards presently in use by railroad "X", the Diesel Electric Locomotive

28 27 26 25 24 23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1
YEAR BUILT

EXHIBIT C

DIESEL ELECTRIC LOCOMOTIVE APPARATUS RENEWAL CARD

UNIT NUMBER

No. 1 TRAC. MTR.		No. 2 TRAC. MTR.		No. 3 TRAC. MTR.		No. 4 TRAC. MTR.		No. 5 TRAC. MTR.		No. 6 TRAC. MTR.	
DATE	SERIAL NO.	DATE	SERIAL NO.	DATE	SERIAL NO.	DATE	SERIAL NO.	DATE	SERIAL NO.	DATE	SERIAL NO.

1 2 3 4 5 6 7 8 9 10 BUILDER

1 2 3 4 5 6 WRECK DAMAGE

16 15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 FAILURE OF COMPONENTS

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 FAILURES REGIONS & DIVISIONS

1 2 3 4 5 6 7 8 9 10

K-32278-XI

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 | 1 2 3 4 5 6 7 8 9 10

← FAILURES – REGIONS & DIVISIONS →

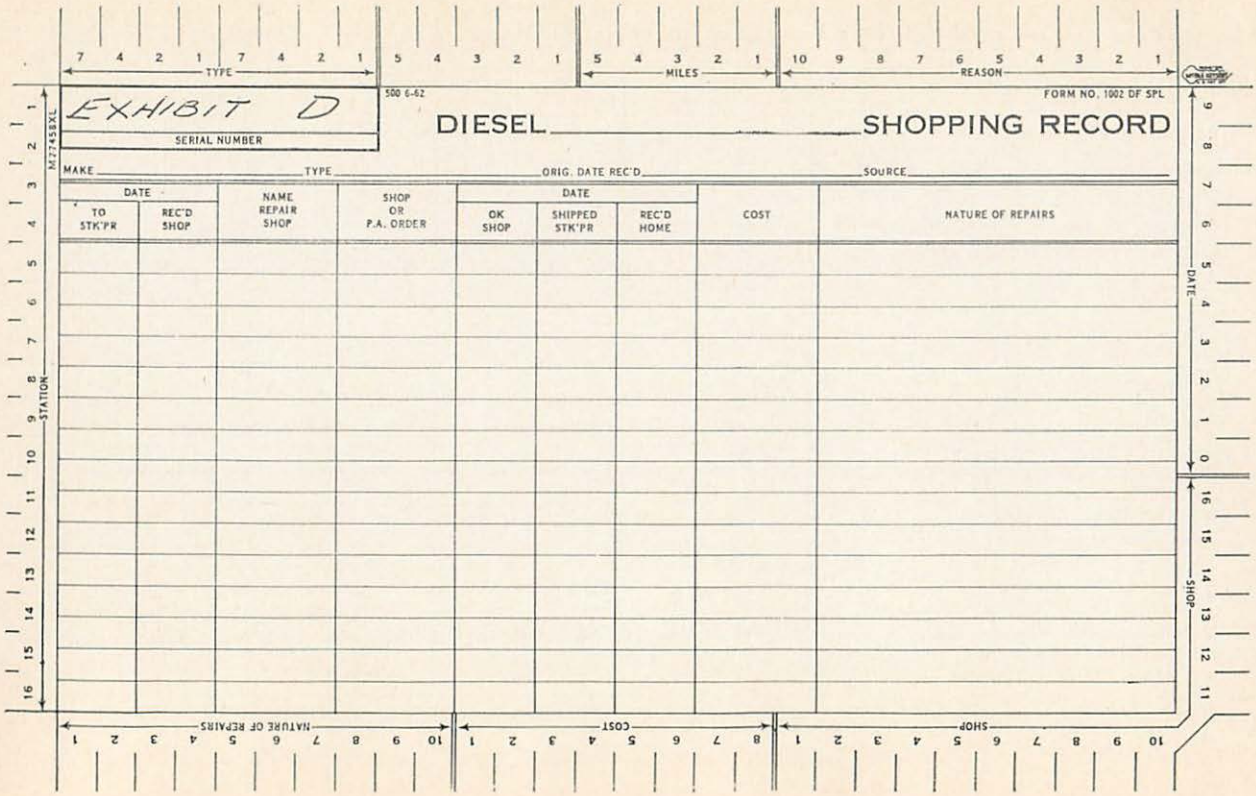
← WRECK DAMAGE → 1 2 3 4 5 6

ENGINE		MAIN GEN.		AUX. GEN.		T.M. BLOWER		RADIATOR FAN		RADIATOR FAN	
DATE	SERIAL NO.	DATE	SERIAL NO.	DATE	SERIAL NO.	DATE	SERIAL NO.	DATE	SERIAL NO.	DATE	SERIAL NO.
ENGINE		MAIN GEN.		AUX. GEN.		T.M. BLOWER		RADIATOR FAN		RADIATOR FAN	
TURBOCHARGER		STEAM GEN.		PAINT				WRECK DAMAGE			

← BUILDER → 1 2 3 4 5 6 7 8 9 10

← FAILURE OF COMPONENTS → 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

← YEAR BUILT → 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28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500 6-62
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DIESEL SHOPPING RECORD
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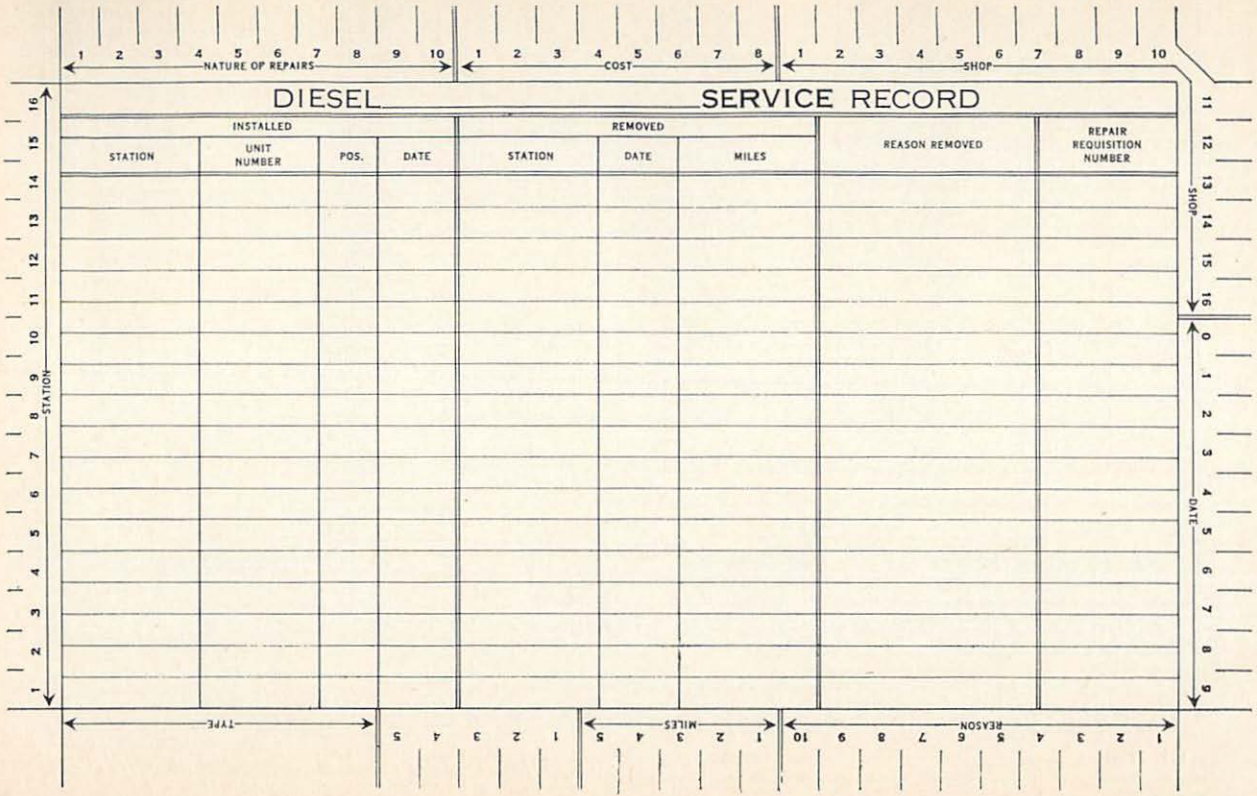

NATURE OF REPAIRS
COST
SHOP
DIESEL SERVICE RECORD
INSTALLED
REMOVED
STATION
UNIT NUMBER
POS.
DATE
STATION
DATE
MILES
REASON REMOVED
REPAIR REQUISITION NUMBER
STATION
SHOP
DATE
TYPE
MILES
REASON

EXHIBIT A

LOCOMOTIVE UNIT RECORD

MP&E 481

MAINTENANCE STATION _____ CLASS _____ UNIT NUMBER _____

ENG. SER. Nº - TYPE	DATE OVERHAUL-TYPE	SHOP OVERHAULED	ACC. END DATE	GEAR TRAIN DATE	CRANK-SHAFT Nº - COND.

MAIN GENERATOR			TURBO or BLOWER			GOVERNOR			STEAM GENERATOR		
SER. Nº	TYPE	DATE APP.	SER. Nº	TYPE	DATE APP.	SER. Nº	TYPE	DATE APP.	SER. Nº	TYPE	DATE APP.
			R								
			L								
			R								
AUX. GENERATOR			L			COMPRESSOR			CENTER CAST. INSP. DATE		
SER. Nº	TYPE	DATE APP.	R			SER. Nº	TYPE	DATE APP.			
			L								
			R								
			L								

MAIN BEARINGS

Nº	UPPER			LOWER		
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

ROD

Nº	UPPER			LOWER		
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						

CYLINDER PRESSURE READINGS

CYL. No.																
1	R 1	I														
		F														
2	L 1	I														
		F														
3	R 2	I														
		F														
4	L 2	I														
		F														
5	R 3	I														
		F														
6	L 3	I														
		F														
7	R 4	I														
		F														
8	L 4	I														
		F														
9	R 5	I														
		F														
10	L 5	I														
		F														
11	R 6	I														
		F														
12	L 6	I														
		F														
13		I														
		F														
14		I														
		F														
15		I														
		F														
16		I														
		F														

REMARKS —:

Exhibit A

POWER ASSEMBLY REPLACEMENTS

CYL. NO																		
1	R 1																	
2	L 1																	
3	R 2																	
4	L 2																	
5	R 3																	
6	L 3																	
7	R 4																	
8	L 4																	
9	R 5																	
10	L 5																	
11	R 6																	
12	L 6																	
13																		
14																		
15																		
16																		

CODE —:

CH - CRACKED HEAD
BV - BROKEN VALVE
G - GROMMET
UHS - UPPER HEAD SEAL
LHS - LOWER HEAD SEAL

BP - BROKEN PISTON
HP - HOLE IN PISTON
BR - BROKEN RING (1-2-3)
SR - SMOOTH RING (1-2-3)
SL - SCORED LINER
BL - BROKEN LINER

ULS - UPPER LINER SEAL
LLS - LOWER LINER SEAL
VPL - VENT PIPE LEAK
JPL - JUMPER PIPE LEAK
( ) - PISTON SIZE

CYL. No.		FUEL PUMP – NOZZLE – INJECTOR															
		PUMP	N – I	PUMP	N – I	PUMP	N – I	PUMP	N – I	PUMP	N – I	PUMP	N – I	PUMP	N – I	PUMP	N – I
1	R 1																
2	L 1																
3	R 2																
4	L 2																
5	R 3																
6	L 3																
7	R 4																
8	L 4																
9	R 5																
10	L 5																
11	R 6																
12	L 6																
13																	
14																	
15																	
16																	

LUBRICATING OIL CHANGE

ENG. Nº	DATE	STATION	REASON	GAL. ADD	ENG. Nº	DATE	STATION	REASON	GAL. ADD	ENG. Nº	DATE	STATION	REASON	GAL. ADD.

SUP. 481 PARTS CHANGE RECORD UNIT NO.

WHEELS								ELLIPTIC SPRINGS			COIL SPRINGS			EQUALIZERS			SWING HANGERS		
STA.	DATE	1	2	3	4	5	6	STA.	DATE	POS	STA.	DATE	POS	STA.	DATE	POS.	STA.	DATE	POS

WHEEL CODE

EXHIBIT "B"

REPORT OF DIESEL UNIT COMPONENT CHANGE 1

Name of Part	Serial Number
Part Type	Manufacturer Reclaimed or New
Removed From Applied to Loco. Unit	Position

Date Applied	Date Removed	Mileage

Reason for Removal — FAILED — INSPECTOR — MILEAGE

Station	Date	Foreman

SEND TO CENTRAL RECORD BUREAU

REPORT OF DIESEL UNIT COMPONENT CHANGE 2

Name of Part	Serial Number
Part Type	Manufacturer Reclaimed or New
Removed From Applied to Loco. Unit	Position

Date Applied	Date Removed	Mileage

Reason for Removal

Station	Date	Foreman

ORIGINAL SENT TO CENTRAL RECORD BUREAU
SEND TO STATION ASSIGNED UNIT _____

REPORT OF DIESEL UNIT COMPONENT CHANGE 3

Name of Part	Serial Number
Part Type	Manufacturer Reclaimed or New
Removed From Applied to Loco. Unit	Position

Date Applied	Date Removed	Mileage

Reason for Removal

Station	Date	Foreman

ORIGINAL SENT TO CENTRAL RECORD BUREAU
FILE IN DATE ORDER AT STATION CHANGING PART

Note: The above should be a unitized carbonized form for easy record transmission.

Apparatus Renewal Card (Exhibit "C") and the Diesel Shopping Record (Exhibit "D"). Although they are presently being revised, they have been in use for several years and have performed well.

10. KEYSORTER: The technique of Keysort involves the use of holes around the edge of the card. Each hole is assigned a meaning or characteristic and when that characteristic does apply to the particular item represented by the card, it is indicated so by slotting out the area between the hole and the edge of card. Therefore, a deck of cards may be searched by merely inserting a stylus called a Keysorter (which looks somewhat like an icepick) into the hole representing the characteristic desired and lifting. By the simple technique of gravity, those cards which have been slotted fall off the Keysorter and those not slotted stay on, thus permitting rapid separation at the rate of about 60,000 cards per hour. Different coding patterns permit amazing capacity and also permit sorting the cards back into proper sequence after they have been used.

11. LOCOMOTIVE UNIT RECORD: In the railroad "X" plan, the form 481 (Exhibit "A") is used and retained by the "pencil-pushing" technique at the various station locations plus certain key (area) stations. This gives the men directly responsible a complete detailed record at their finger tips with the benefits outlined earlier.

12. IN THE CENTRAL RECORD BUREAU, the two Keysort cards are maintained and posted from the information received on their copy of Exhibit "B". Information here is limited to major considerations, such as cylinder repull causes, bearing inspection or renewals, main generator repairs, air compressor overhauls and so on. The important information relating to any one locomotive is posted on Exhibit "C" and additional details relating to the separately controllable components (such as engine, main generator, engine blower, etc.) are posted on Exhibit "D".

13. THE KEYSORT CARDS, therefore, are available for simplified analysis on a completely controlled daily basis, permiting determination of similar problems wherever they may occur, as well as other considerations necessary in the central location as indicated before. You will notice codes for failures, failure of components, year built, builder, and wreck damage on Exhibit "C" and for station, nature of repairs, cost, shop, date, reason, miles and type on Exhibit "D".

14. COMPUTER: We have not, however, ignored the computer in this arrangement, for the Keysort cards serve as the Source Document for feeding information to the computers once every six months for a complete printed report. We feel that this combination of control methods does meet the criteria for any good information system — the best possible balance between maximum available information and control and lowest cost (considering all three factors of forms, manpower, and equipment). *Use of a similar system is recommended to the American railroads.*

15. CENTRAL RECORD BUREAU: In considering the location for a Central Record Bureau, it is obvious that on some properties, one major point with the greatest number of units assigned should be the location for the maintenance of system records. This will keep to a practical minimum the transmission of records and the clerical help needed for

the maintenance of such records. *Properly instructing and qualifying supervision to make maximum use of such record system can result in early recognition of problems being experienced with particular units or groups of units and thereby lead next to the investigation of the problem for correction.*

16. EXHIBIT "A" IS A SIMPLE FORM FOR RECORDING THE INFORMATION on a specific unit with respect to parts change. This will permit easy review by the record analyst. Many railroads have simple recording systems at least similar to this exhibit. However, this suggested form offers simplicity by being compact and easier to analyze than numerous other record systems requiring evaluation of several different cards. *It will be noted that this form is a simple record of the frequency of doing work rather than the detailed record of specific parts.*

EXHIBIT "B" IS A RECOMMENDED PARTS CHANGE REPORT to be used by stations reporting to the Central Record Bureau. This is in triplicate and carbonized to simplify recording. One portion is mailed to the Central Record Bureau, one portion to the assigned maintenance point for the unit and the other portion to be retained and filed for ready reference at the reporting station. Here again many roads have similar systems for reporting parts change. Exhibit "B" is being offered for consideration of the roads now maintaining many individual record points who might wish to consolidate into fewer points through centralized records. *After considering our general proposal, it is hoped much advantage can be gained by reporting to one centralized point in this manner.*

17. IN INAUGURATING OR MODIFYING ANY SYSTEM, an immediate analysis of performance based on past history will either support present shopping schedules and maintenance program or point out the areas for *consideration, investigation* and *change*. Many railroads are currently operating with some degree of deferred maintenance. This deferred maintenance, however, is based on past experience and should certainly be subject to re-evaluation at regular intervals. This should, of course, be coupled with activity to perform scheduled repair to at least some selected minimum number of units to progressively eliminate the majority of deferred maintenance.

18. ACCURATE EVALUATION OF THE PARTS CHANGE INCIDENTS and/or failure rate through centralized record should assist considerably in establishing a new period for scheduled repair.

19. COST CONTROL: *Since our ultimate aim is to control and reduce costs,* it is important that in each case of trouble being investigated and corrections being considered, the effect of these changes on any other cost be recognized. By the same token, changes for other costs may affect the ultimate cost of the item in question. For example, in the case of diesel engine piston rings, it may be considered that a higher cost top ring is being purchased to minimize ring probems. In which case, some reduction in cylinder repull should be recognized. However, cylinder changes for all other causes will require replacement of rings. Therefore, the increased cost of the top ring must be pro-rated to all cylinder changes rather than to only those made due to ring condition. This same reason must be applied to each item of material considered for change

when it is part of an assembly affecting other parts.

20. COMPARISON: By using methods similar to that recommended above, one railroad made comparison of several types of units in two specifically different types of service with the following result:

GP-7 — Units in both areas were used in similar service and had nearly the same cost experience.

GP-9 — Units in low mileage service of approximately 4,000 miles per month experienced cost of 28.0c per mile as compared with similar units making approximately 14,000 miles per month which averaged cost of 9.0c per mile. The approximate cost per unit per month was reasonably the same being in the area of $1,125 to $1,150 per unit per month. It would appear the cost difference on GP-9 units in these two different services should be thoroughly analyzed to determine if unnecessary inspections and/or maintenance are being performed on the low mileage units. In addition, the periodic or scheduled repairs for replacement of all cylinders, etc., should be reviewed on these two groups to assign a frequency of repair which matches the use of the power rather than assign one period of repair to be used on these units regardless of service.

Further review of this condition developed low mileage units had 38% of assemblies changed over the same period of time in which the high mileage units had 70% of assemblies changed. This further supports the fact that there was some considerable difference in work being performed by these two groups of units.

Comparison on this road of other types of units indicated failure rate of parts other than cylinders warranted investigation and more specific control to improve performance. One particular item was traction motors with high mileage, after being given minimum service cleaning, were applied to high speed and/or high H.P. units for which this type of motor was intended, resulted in early failures. Consideration of this fact resulted in instructions being issued to put low mileage or recently overhauled traction motors in the critical power, using older motors to a maximum degree in switching power and low mileage service road power.

21. THE LIFE SPAN OF LOCOMOTIVES will vary on individual railroads due to the nature of operation or financial conditions. It is presently possible on some properties to consider a road freight unit life of fourteen to sixteen years based on tax structure and not entirely on the technical consideration of the unit life as considered on other properties. An accurate recording of maintenance costs by type of units when properly graphed will clearly show the effect of maintenance programs and the ultimate increased maintenance cost as the unit age increases. Maximum consideration of these factors will ultimately result in a reasonably accurate determination of a diesel unit's economic life.

22. NEW ERA: While we recommend the foregoing as a necessity to properly support our other systems of cost control for reasons indicated above, *we feel that American railroads are on the threshold of an era during which we will see many new locomotive developments.* This era will provide additional values that can direct trends and times to support locomotive rebuilding and/or replacement plans if a properly controlled centralized record is sufficiently complete and currently analyzed. This can

be effected individually. *However, if such systems are in general use, railroads operating newer types of units can cooperatively aid each other by the interchange of performance record analysis to direct decisions with respect to engineering, rebuilding, or replacement.*

23. MATERIAL RECLAMATION: *One further step which is recommended deals with the policy of material reclamation.* It is important that we be certain service life of reclaimed parts is accurately reported in order to properly evaluate policies of reclamation. Service life of such pieces can be accurately followed with the afore-recommended method of reporting to Central Record Bureau provided, of course, any pieces reclaimed are properly identified at time of application or removal from the unit and so indicated in the central record system. The specific control of parts reclamation can be adequately covered under recommendation of our 1962 proposal with labor and production reports being used indicating:

1. Item.
2. Cost of new item.
3. Number items turned over for reclamation.
4. Number items reclaimed.
5. Labor cost per item reclaimed.
6. Material cost per item reclaimed.
7. Total cost item reclaimed.

The changing scene makes it imperative that performance of improved parts and components, new or rebuilt locomotives and transportation demands constantly be evaluated. These evaluations should deal with not only pieces but components and locomotives to insure maximum control of our costs and assist our railroad managements in building a stronger, more competitive position in the transportation field against all competition.

Your committee hopes that the foregoing recommendations will assist at least some of you in considering methods for improving operations and reducing costs.

J. F. SAPP, President
Mechanical Engineer
Louisville & Nashville R.R.
Louisville, Ky.

☆ ☆ ☆

LOUISVILLE RAILROAD CLUB

☆ ☆ ☆

The Louisville Railroad Club, formerly known as the Louisville Diesel Club, was formed in 1952 and has approximately 250 active and associate members.

The membership is composed of Journeymen and Supervisors of the B. & O., Southern, Pennsylvania, I. C., Monon, New York Central, K. & I. T., and L. & N. Railroads, and representatives of various railroad supply companies.

The L. M. O. A. Committee on Diesel Material Inventory and Control presented their 1963 Pre-Convention Report at our meeting on May 8, 1963, which was attended by 100 members and guests.

The Club meets on the 2nd Wednesday of January, May, August and October at Shawnee Post Legion Hall, 28th and Main Streets.

Wednesday Morning, October 16, 1963

10:00 A. M.

REPORT OF THE COMMITTEE ON

DIESEL MATERIAL INVENTORY AND CONTROL

Pre-Convention Presentation: LOUISVILLE RAILROAD CLUB 6:30 P. M. MAY 8, 1963

American Legion Shawnee Post 28th and Main Louisville, Ky.

CHAIRMAN: G. R. HARROD
Process Engineer
Southern Railway
Chattanooga, Tenn.

Vice Chairman

A. M. Amos, Assistant Shop Superintendent, S. A. L. R.R., Jacksonville, Fla.

Committee Members

H. B. Herrin, Asst. Master Mechanic, Illinois Central R.R., Memphis, Tenn.
P. D. Falkenstein, Asst. Supvr. Diesel Engines, A. T. & S. F. Ry., Chicago, Ill.
J. F. Finnegan, Supvr. Loco. Maint. Practices, B. & O. Ry., Baltimore, Md.
W. H. Rumbaugh, Mtl. Supervisor, C. & O. Ry., Huntington, W. Va.
W. E. True, Asst. Supt., B. & M. Ry., Greenfield, Mass.
J. D. Edmunds, Mech. Asst., Reclamation, Canadian National, Montreal, Canada
F. S. Ross, District Mtl. Supervisor, C. R. I. & P. R.R., Silvis, Ill.
O. E. Smith, Staff Asst. — Scheduling, Louisville & Nashville Ry., Louisville, Ky.
R. E. Larkan, General Foreman, Missouri Pacific Ry., Houston, Texas
J. F. McDonough, Traveling Storekeeper, N. Y. C.
R. W. Hooper, Asst. Mech. Supt. Loco. Maint., N. Y. N. H. & Hartford Ry., New Haven, Conn.
M. M. Early, Shop Engineer, N. & W. Ry., Roanoke, Va.
H. R. Gilzow, Asst. Mgr. Purchases & Stores, St. L. S. F. Ry., Springfield, Mo.
W. W. Atkinson, Mech. Prod. Planner, Southern Pacific Ry., Sacramento, Calif.
H. B. Trace, Sys. Welding Supvr., Erie-Lackawanna Ry., Cleveland, Ohio

★

1963 TOPIC:

"ORGANIZATION AND RESPONSIBILITY OF LOCOMOTIVE AND STORES DEPARTMENTS"

1. THE FAILURE OF RAILROADS TO BE COMPETITIVE in the transportation industry must not be contributed completely to governmental restrictions and regulations. We must not entirely depend on our railroads to be competitive through favorable legislation resulting from the President's transportation message to Congress. *Survival of railroads and their being the leading competitor in transportation with a much improved economic status must be accomplished by lower costs in addition to removal of regulations and restrictions.*

2. LOCOMOTIVE REPAIR AND MAINTENANCE COSTS are a large part of the costs which railroads must reduce and control so that rates and fares can be reduced to bring transportation of material and people back to the rails. *The purpose of this association is to assist in the reduction of all locomotive costs by publicizing cost reducing methods and procedures. Material cost, the interest of this committee, represents approximately forty percent of locomotive maintenance and repair cost.*

3. THE PURCHASE OF MATERIAL IS NOT THE ONLY COST INVOLVED WITH MATERIAL. Even after material is purchased and paid for, it still remains expensive. Material must be handled, moved from place to place, stored and cared for in a safe manner. The lack of material and poor storage procedures result in even more expense attributable to material. *Time wasted and lost in looking for material which is either not available or not readily accesible in the shop is a needless waste. Expense and waste is also caused by the procuring of material which fails to meet specifications and not of the correct quality. Much money is wasted also by the purchasing of material which is never used. This is brought about by a failure to properly plan and schedule work.*

4. THE AREA OF MATERIAL PROCUREMENT is an area in which many savings can be realized, and each department of each of our railroads has a responsibility to reduce cost. Better methods to move material, to store material, to inventory material, and to purchase material must constantly be searched for and developed. Savings can be realized by having a well organized material procuring program and having definite lines of responsibility. There should be a clear cut definition and pinpointing of responsibilities along this line.

5. THE ORGANIZATION AND RESPONSIBILITY OF THE LOCOMOTIVE AND STORES DEPARTMENT refers to the organization and responsibility of these two departments with respect to each other as well as to the organization and responsibility of each individual department. The Locomotive Department has certain responsibilities with respect to the Stores Department. Likewise the Stores Department has certain responsibilities with respect to the Locomotive Department. Since the Locomotive Department is charged with the primary responsibility for maintaining equipment, the Stores Department must be thought of as a service department which is called upon by the Locomotive Department to purchase and store materials as directed.

6. DELEGATING RESPONSIBILITY: No doubt many different ways of organizing and delegating responsibility are represented here today. We could probably find almost as many different organizational setups as we have railroads represented.

We could not possibly hit upon, nor would we want to hit upon, all the different organizational setups represented. *We do want to set forth, however, one way to accomplish a good organization and reduce costs and at the same time produce a quality product.*

7. ORGANIZATION: First of all, your attention is directed to the organization of these respective departments with special emphasis placed on organization with respect to each other. Our first concern will be with the local organization of these respective departments. Our scene is set in a large diesel shop in which all classes of repairs are performed, including monthly maintenance, engine change-out, main generator change-outs, truck change-outs, and other heavy repairs. In this diesel shop the spot system of monthly maintenance is used. *This, of course, makes it necessary to have the proper material and tools at specific locations for specific jobs to do certain pre-determined work at pre-determined spots. The material is stored on the job site.*

8. MATERIAL STORAGE: Perhaps it would be advantageous to elaborate briefly on this method of material storage. *Local suppliers make their deliveries to a specific delivery point from where the material is placed directly in the parts bin. In the case of materials shipped in by freight or any other means, this material is moved from the freight car and placed directly in the parts bin. The only material storage existing is that which is placed directly in the parts bin in the shop and at the mechanic's elbow. The mechanic goes to the shelf and gets the material. There is no storehouse with an issuing window to issue materials to the mechanic. The storehouse only works one shift a day five days*

a week. This is sufficient for them to inventory the material and place material in stock.

9. LIAISON OFFICER: With this kind of maintenance set-up, definite channels are needed through which to order, set up, and store material. An officer to span the gap between the Stores Department and Mechanical Department is needed. *The duties of this mechanical officer would incompass the processing of all orders for materials and tools to the Stores Department.* Limiting the placing of orders with the Storehouse to a single man has many advantages, one of which is accuracy in ordering and in furnishing the correct ordering information. This allows for the correct quantity and quality to be ordered. This mechanical officer works with the foreman and men in the shop. His duties include the following—to:

A. *Scrutinize their orders,* look up correct part numbers, condense, organize, and write up the orders legibly and orderly.

B. *Act to control material inventory* by determining maximum figures.

C. *Set up the quality of material* through knowledge of use and demand of material.

D. *Report inferior quality* and assist with corrective action or change of supplier.

E. *Supply drawings* and technical information on special material.

F. *Direct and revise material storage areas* in the shop since all material is stored in the shop on the job, and to design material containers where required.

10. GENERAL FOREMEN: The Stores Department in this location probably has a car shop and other facilities for which to purchase material. This means that more than likely a division storekeeper will head the Stores Department at this location. The Stores Department could have three general foremen under the storekeeper. *One general foreman is over Car Department material, the second in charge of Shipping, Receiving and Movement of material from receiving point to storage areas, and movement of material from storage areas within the shop to the shipping platform, and the third general foreman is in charge of Diesel Shop material.*

11. COOPERATION: The Mechanical Department officer and the Storehouse general foreman work closely together and cooperate in every respect. They call each other's attention to material stock which is low, and to apparent cases where the maximum and minimum is not correctly set. They direct each other's attention to material which suddenly stops moving. This allows the Mechanical Department man to determine whether or not the material is still needed. They direct each other's attention to waste of or abuse of material. They direct attention also to the need for additional material such as relay covers, etc. Most of the above conditions will in time be brought to the mechanical man's attention through usage of the material, but if this situation can be prevented, it is good. The Mechanical and Stores Department man cooperate in storing difficult to store material. Special racks are designed on which to store pancake engine cooling fans, power contactors, brush holders, cab seats and carbon brushes to mention a few. These special racks serve two purposes. *They make it possible to store needed material on the job and conserve much needed space in a limited area. The result of this cooperation is that the correct material is on hand in the correct location, in the necessary*

quantity, of correct quality, and stored properly and safely.

12. STORAGE: The responsibilities of the Locomotive and Stores Department are many and varied. *One of the primary responsibilities is the storage of material in the shop at the point of use.* The Locomotive Department must designate and provide if necessary a place for the storage of material. The Stores Department must stock designated material in this location. The Mechanical Department must provide and designate locations for the shop people to place bad order material. Areas must also be designated for scrap and rag containers. *The old adage of a place for everything and everything in its place must be strictly adhered to.*

13. MATERIAL ORDERING: *Basically the responsibility of the Mechanical Department is to determine what materials are needed, and what quantities, and, in some cases, the quality needed, and where the material is needed.* The Mechanical Department must then inform the Stores Department of their needs in a clear, concise and legible manner. *The Stores Department must purchase material at the best available price to be consistent with quantity and time requirements and quality. They must receive this material and store it where directed by the Mechanical Department.*

14. IN STORING MATERIAL ON THE JOB in the Diesel Shop, small tags are employed to identify the material as to part number and storehouse sheet and line and also to designate a specific location for that material. *To check these tags and balance the amount of material on hand against the maximum and minimum, the storehouse employs men whom we shall call checkers. The men also place material on the shelves as it is received. In making their stock check, the quantity necessary to order for*

the purpose of restoring the quantity to maximum is ordered by the checker through the storehouse ordering clerk. Material of this nature is not handled by the Mechanical Department man since it is on a maximum and minimum and the source of supply has been determined.

15. IN STOCKING OF MATERIAL IN THE SHOP, THOUGHT MUST BE GIVEN TO THE LOCATING OF MATERIAL SO IT CAN BE FOUND BY SHOP CRAFTSMEN. For example, all electrical component parts such as resistors, rectifiers, coils, contact tips, shunts, and interlock blocks should be stocked in a definite area. Likewise, complete electrical parts such as power contactors, relays, and magnet valves should be stocked in a definite location. Larger electrical components such as engine cooling fans, dynamic brake grid blower motors, and traction motor blower motors should be stocked in a specific area. *Grouping material according to its application pinpoints an area for similar materials and makes them easier to find. This grouping of material also extends to engine parts, car body parts, and truck parts.*

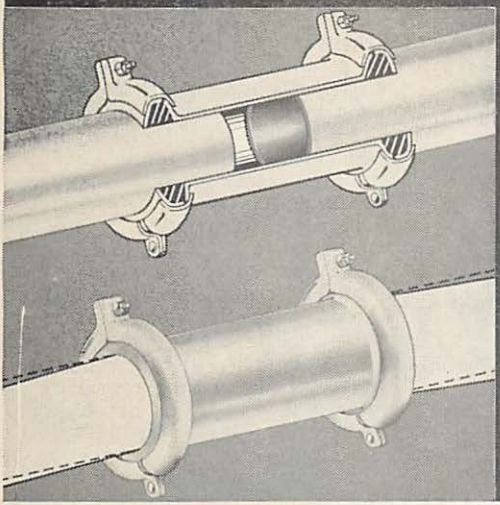
16. STORING OF SIMILAR MATERIALS IN A DEFINITE AREA has several advantages. *One of these advantages is that it eliminates searching all over the shop for a piece of material.* If resistors, for example, are stored in several different locations, an electrician has an excuse for searching all of these locations. If the resistors are all stored in one location, and *this should be in the area where this type of work is performed on the locomotive,* the electrician has only this one area in which to look for the resistor. *If the desired resistor is not in this location there is no point in searching elsewhere.* The resistor would not be stocked. *This also relieves the electrician or his foreman of the responsibility of looking up a part number for the resistor.* The desired resistor can quickly and easily be matched by a quick search of the shelves. This same principle certainly applies to other items of material such as rectifiers, interlock blocks, contact tips, etc.

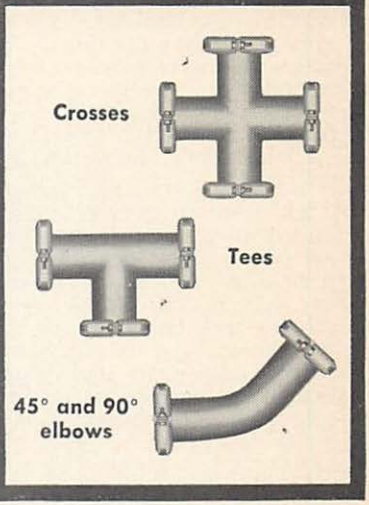
17. NUMERICAL ORDER STOCKING: A past practice with most storehouses has been to stock material in numerical order. *This makes it easy for the storehouse to check their stock, but results in difficulty in finding material. For example, two resistors might be used side by side in a bank of resistors. These resistors might have widely spaced part numbers; consequently, with this method of storage they would be stored far apart. This would result in wasted time in searching for the two resistors.* By having all resistors stored in the same area, they can quickly and easily be found.

18. MATERIAL DELAY REPORT: In order to point out material and tools which are needed but not available, a material delay report is utilized. This report is filled out by the foreman and submitted to the Mechanical Department officer. This form is a mimeographed form calling for such information as name of the material, part number, if available, where needed, and unit number for which the material was needed. With this information, the Mechanical Department man can investigate the material need and order the material as the situation dictates.

19. THE LOCOMOTIVE AND STORES DEPARTMENT HAS A DEFINITE RESPONSIBILITY IN THE POLICING OF PARTS BINS. Mechanics in the shop

Cut Diesel Maintenance Costs With FLEXMASTER Pipe Couplings





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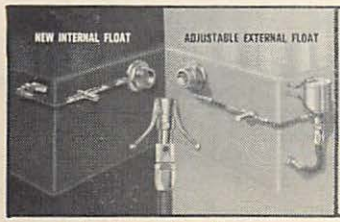

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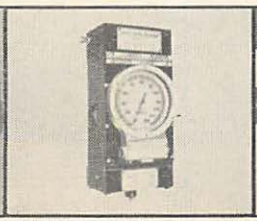
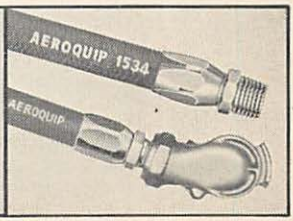


Barco Railroad Diesel Speed Recorder



Air brake, hot water, lube and fuel oil lines

must keep foreign objects such as rags, oil cans, nuts, bolts, etc., out of the parts bins. The Stores Department must keep the parts bins neat, cleaned out, and orderly. The Mechanical Department must cooperate in this by educating their employees to keep everything in its designated place. They must do this in order to determine what materials are on hand and quantities to be ordered.

20. SHOP REPAIRED ITEMS: Many items used on locomotives are repaired by our railroads in their own shops. Many items such as relays, contactors, traction motors, and other various electrical parts are in this category. Mechanical parts such as power assemblies, governors, water and lube oil pumps and radiators also enter into this category. The location of shops in which these repairs are made is various. This shop or shops could be under the same roof with the diesel shop, or in adjoining buildings, or in a distant city. In any event, it is the Stores Department's responsibility to handle and shop material of this type whether it be inter-building or inter-city handling. This, of course, calls for efficient material handling techniques. The Mechanical Department should designate and provide if necessary a place to store material of this nature. The quantity to keep on hand must also be determined. With material of this nature, it is a help to use a check sheet listing each part stocked to check the amount on hand and the amount needed. After the material has been inventoried, the check sheet is sent to the repair shop which provides the quantities needed.

21. SPECIAL CONTAINERS & RACKS: This type of material lends itself to the use of special containers. For example, four-wheeled dollies can be used for storing power assemblies, water pumps, and air compressor heads and cylinders. Four of these four-wheeled dollies can be carried on a fork truck. *The dollies are stored in the area where repairs of this nature are performed. When a power assembly is needed, the craftsman rolls the four-wheeled dolly to the locomotive. This is especially advantageous in a shop which has ramps level with the locomotive engine room. This makes it possible for the craftsman to carry the power assembly parts into the locomotive and eliminates the need for any kind of crane handling.* The craftsman uses the good power assembly and places the old power assembly on the same dolly. The dolly is then rolled to a designated area and from here moved by the storehouse to the repair shop. Special racks can also be designed for the storage of power contactors, traction motor and main generator brush holders, engine cooling fans, and many other items. Storing material on racks allows for easy and quick inventory. A quick glance at the rack will determine if sufficient material is on hand.

22. PALLATIZED LOADS: In this connection, the use of pallatized loads can be utilized. For example, racks could be designed to hold a certain number of train control receivers, and the racks could be made portable so they can be transported from building to building. When the receivers on one rack are used, or nearly so, a rack of repaired receivers is brought in and the rack of used receivers carried to the repair shop. *This method necessitates a large number of spare parts in the repair pool.* If a sufficient number of spare parts are available, this system would work very well.

23. QUANITY AND QUALITY CONTROL: The Mechanical De-

partment at the repair shops must set up their respective repair processes so as to produce *sufficient quantity*. A close check must also be kept for *quality*. Each part should be thoroughly inspected, and if possible, tested on a test rack before being sent to the using point. Experience must dictate probably more than anything else the quantities of overhauled parts to keep on hand. The majority of parts of this nature are changed out on a failure basis. In most cases a level of parts to have in the repair pool will be determined by experience. *Quantities must be such so as to allow for parts available on the shelf, parts in transit between shops, and parts being repaired. This requires very close cooperation between the using point and the supply point.* Care must be exercised so as not to become overstocked with any one item.

24. SCHEDULED CHANGE-OUTS: Parts which are changed out on a scheduled basis can be scheduled into the shop. *The parts required can be determined in advance.* In most cases the need for engines, trucks, main generators, and air compressors can be determined somewhat in advance of the actual need. *However, the need cannot always be determined in advance; therefore, it is necessary to have these items on hand at all times because they are subject to failure.* This points out a primary responsibility of the Locomotive Department; and that is determining which parts are needed frequently enough to keep in stock. It is necessary, of course, to have capital tied up in repair parts. Experience, probably more than anything else, dictates the parts which justify the investment of capital necessary to keep them lying on our parts shelves. From time to time, certain parts are needed which are not stocked; in which case, an emergency order must be placed. *Occasionally, it is necessary to sustain locomotive out of service time waiting on material with which to repair the locomotive. This is necessary because of the impracticability and expense of stocking every part of every locomotive on our railroads.* The discussion thus far has been limited to a large diesel shop; however, the organization and basic concepts also apply, and probably even more so, to repair shops. Usually at the repair shops, the scope of the operation is more limited and the variety of material not as great.

25. PURCHASING: *The Stores and Purchasing Departments should do all of the purchasing.* When a decision is made by the Mechanical Department to purchase any material in quantity and with frequency, this information should be turned over to the Stores Department. The local Stores Department should forward this to the general purchasing agent, or consult with his office about purchasing the material. The material may be standard material sold by the locomotive builder only, in which case purchasing from the locomotive builder is mandatory. The general purchasing agent should have many avenues for shopping for the best available price. When the best available market has been determined, the local Stores Department is informed and the material can be purchased in a routine manner afterwards. After the initial set up, the item purchased should be scrutinized occasionally for price and quality. *The Stores Department should constantly search for better prices on all items.*

26: LOCAL PURCHASES: Also, on local requests to purchase items costing in excess of a certain amount, say fifty dollars,

the local Stores Department should submit this request to the general purchasing agent, who again shops for the best available price. In doing this, consideration must be given to shipping time and shipping cost. Perhaps the item can be purchased locally at the best price. *Situations will arise where material is needed on an emergency basis and provisions should be made for bypassing this procedure.*

27. PRICE COMPARISON: The Stores Department should attempt to attain for as many items as possible more than one price. *A comparison of prices should constantly be made.* The price of a part from the locomotive builder should be compared to the price for the same part from an outside supplier. With some parts it is not possible to obtain any price other than that given by the locomotive builder. However, many parts, such as pipe clamps, locomotive steps, car body panels, pilots, etc., can be manufactured by concerns other than the locomotive builder and lend themselves to competitive prices. *It is well worth while to search for these competitive prices, for in many cases savings can be realized.*

28. QUALITY: *In shopping for the best prices, we should not lose sight of the vitally important aspect of quality. Materials which we purchase must be of sufficient quality to do the job for which they are bought.* Should a purchasing agent buy pricewise only, he is not doing a good job, although figures may prove he is. The same is true of a mechanical officer who does not look at prices and at the same time insists that his pet commodity be used. He can also prove by his operating figures that he is doing a good job. *John Ruskin, the eminent philosopher, once wrote, "It is unwise to pay too much but worse to pay too little. When you pay too much, you lose a little money; that is all. When you pay too little, you sometimes lost all, because the thing you bought was incapable of doing the thing it was bought sometimes lose all, because the*

29. MACHINE SHOPS: In a great many diesel shops around the country there is a not too noticeable absence of machine shops. *In this day of tailor-made replacement parts, the need for an elaborate machine shop no longer exists. However, the need for machine shop work sometimes arises in our shops.* A machine shop must be contracted for repairing shop equipment and in some cases for repairing and fitting locomotive parts. Many items other than machine shop items are contracted to outside concerns. Work of this nature should certainly be subjected to competitive bidding. Much money can be saved by putting this type of work on a competitive basis.

30. WARRANTY CLAIMS: *Some return, and consequently savings, can be realized by the proper handling of warranty material.* Locomotive builders guarantee most of their repair parts for a period of one year. *In order to receive any warranty adjustment on a failed item, it is necessary to furnish the locomotive builder with the unit number on which the part failed, the date removed, accumulated mileage on the failed part, and why the part was removed. Keeping inaccurate records is the greatest deterrant to realizing any return on warranty items. The keeping of such records would present substantial expense, which could not probably be offset by the return of warranty material. This is especially true of smaller, inexpensive items. Certainly accurate records should be kept and are kept on larger, more ex-*

pensive, new or rebuilt or unit exchange items such as engines, main generators, traction motors, and governors. These items are expensive and certainly should be closely watched for any warranty adjustment which might be possible.

31. COMMUNICATIONS: To reiterate some of the things we have been discussing, *proper inventory control, organization, and responsibility must be equally shared by all departments, including the Using, Stores, and Purchasing.* First of great importance is good communications between all concerned. *The best informed do the best job in any department.* The cooperative effort of helping each other, giving advice and counsel, and holding meetings when vital information affects all departments will result in a smoother and more efficient operation. *Good liaison efforts must exist between all departments.*

32. IN SUMMATION: *It is the responsibility of every officer present, and of every railroad employee, to constantly be alert for savings procedures. To remain competitive, and become even more competitive, we must constantly and diligently search for better prices and improved methods for performing our operation. In the area of material procurement and material storage and handling, many savings can be realized. All of us must strive to improve overall railroad economy by saving all we possibly can in our own shops and on our respective assignments.*

★ ★

EXTRA SPECIAL: SOMETHING NEW HAS BEEN ADDED!

IT IS VERY IMPORTANT THAT EVERY MEMBER STAY FOR THE 11:00 A. M. SESSION WEDNESDAY MORNING!

In addition to Chairman J. J. Dwyer and his committee members, we will also have on hand the Chairman and Members of all the other seven Technical Committees. WE EXPECT TO BE ABLE TO ANSWER ANY QUESTION YOU ASK. WE WANT TO KNOW OF ANY AND ALL NEW DEVELOPMENTS ON YOUR RAILROAD.

Wednesday Morning October 16, 1963

11:00 A. M.

ANNUAL MEETING PANEL ON:

"What Is YOUR Problem?"

J. J. DWYER, Chairman
What Is Your Problem Panel
Chemical Engineer
C. & O. Ry. - B. & O. R.R.
P. O. Box 907
Huntington, W. Va.

Here is a really new feature on our program:

Chairman J. J. Dwyer and his panel of the seven Technical Committee Chairmen shown below will, at the Annual Meeting ONLY, ANSWER ANY AND ALL DIESEL MAINTENANCE QUESTIONS (not covered by the 1963 Topics).

★

Mail Mr. Dwyer your "REALLY TOUGH PROBLEMS"

★

(There was no Pre-Convention Presentation of this Annual Meeting feature.)

WHAT IS YOUR PROBLEM PANEL MEMBERS

L. M. Allison, *Chairman Committee on Diesel Mechanical—Other Than Engine*, Master Mechanic, St. Louis-San Francisco Ry., Springfield, Mo.
W. F. Dadd, *Chairman Committee on New Developments in Motive Power Maintenance*, Gen. Supt. Motive Power—Sys., Baltimore & Ohio R.R., Baltimore, Md.
G. R. Harrod, *Chairman Committee on Diesel Material Inventory and Control*, Process Engineer, Southern Railway, Chattanooga, Tenn.
G. W. Niemeyer, *Chairman Committee on Diesel Engine Maintenance*, Mechanical Superintendent, Missouri Pacific R.R., Little Rock, Ark.
J. R. Mitchell, *Chairman Committee on Diesel Electrical Maintenance*, Asst. Electrical Engr. Equipment, Illinois Central R.R., Chicago, Ill.
J. D. Schroeder, *Chairman Committee on Shop Equipment*, Asst. Gen. Supt. M. P., C. B. & Q. R.R., Chicago, Ill.
C. A. Wilson, *Chairman Committee on Fuel and Lube Oil*, Gen. Supvr. Diesel Engs., A. T. & S. F. Ry., Chicago, Ill.

★ ★ ★

2:00 P. M.

ENTIRE AFTERNOON RESERVED FOR REVIEW OF

AMERICAN RAILWAY PROGRESS EXPOSITION — COMBINED RAILWAY SUPPLIERS EXHIBIT

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☆ **Presented by:** ☆

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SPECIAL ATTENTION ALL MEMBERS:

FEEL FREE TO GET INTO THE FLOOR DISCUSSIONS!

Be assured that **every** remark **you** make will be sent back to **you** for **your correction, before** it is printed in the Annual Proceedings.

NOW WE NEED YOUR HELP. We are **paying premium rates** to get this discussion transcript to you at the earliest possible date after the meeting.

These premium rates are just wasted money, if just **one** speaker delays and fails to return **his** transcript **immediately.**

Your remarks are very valuable to the officers in setting up next year's program,

— SO —

PLEASE CORRECT AND RETURN YOUR ANNUAL MEETING TRANSCRIPT **TO THE REPORTING COMPANY IMMEDIATELY** UPON RECEIVING IT.

1. **Important** Things To Do **Now.**
   - A. Write your boss a report on the things of value you learned at this meeting. Remember, he already has a copy of the 1963 Pre-Convention Report.
   - B. Get a New Member **TODAY.**
   - C. Secure an Advertiser where consistent to do so. (Any Supply Firm **NOT** listed on page two (2) of this 1963 Pre-Convention Report is a prospective Advertiser. Those listed are already in as advertisers, of course.)
   - D. Write or call your Congressman to support and fight for fair and equal treatment of the railroads.

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