LOCOMOTIVE TERMINALS

A DISCUSSION OF THE ARRANGEMENT, DESIGN, CONSTRUCTION AND OPERATION OF LOCOMOTIVE TERMINAL FACILITIES TO OBTAIN THE GREATEST EFFICIENCY.

PART III.

Reporting Work.

Ordinary running repairs at practically all terminals are made on the basis of the written reports of the engineer who has brought the locomotive in, and of the inspectors who have inspected it. These reports, for obvious reasons, should be written, and the proper form of blank be filled out, to accomplish the best results.

When locomotives were smaller and less complicated the reports for repairs were usually made on what practically amounted to a blank pad on which was written a memorandum of what needed attention. Under modern conditions, however, it often happens that a report of this form would be of considerable length, covering several sheets, which would be difficult to record and file, to say nothing of the difficulty of deciphering some of the handwriting. It is the custom on some roads to have a printed sheet where practically all of the items that might possibly need reporting are given and it is necessary for the engineer or inspector to simply make an X after the item that requires attention.

One of the illustrations shows the front and back of a sheet of this kind, in use on the New York Central & Hudson River Railroad, which answers the purpose very well. The instructions printed on the back of this sheet show how it is used.

In connection with the description of the inspection pit and instructions to inspectors on the Pennsylvania Railroad given in the previous issue, the form MP-62 used by both the inspectors and engineers was illustrated. This blank answers the purpose under the conditions described very well, since each report covers only a very small part of the locomotive and there are five or six separate reports sent in at once, none of which could be very extensive. At points, however, where but one inspector is used and the engineer is required to very carefully go over the whole locomotive himself such a form would not be large enough.

In the Pennsylvania scheme the MP-62 reports, on arrival at the engine house, are removed from their carriers by the work clerk, who in all cases is a thoroughly practical mechanic, and the items thereon are transferred to other blanks, each separate job, or a number of minor jobs, being put on a single card. These cards are given to the work distributor, who in turn delivers them to the foreman in charge of each class of work. One of the forms used for this purpose in the engine house is illustrated. The piece work card differs from this very slightly. The column on the extreme right is for use in case a man is temporarily taken off from a piece of work on which he is engaged. Under such conditions the time is noted when he was taken off the job and he surrenders his card to his foreman, receiving in return another card. At no time may a workman have more than one card and that referring only to the work upon which he is engaged. On the other hand, the cards retained by the foreman always show the work that is not assigned and that which has been temporarily suspended. When the job is completed and has been inspected, the card is returned to the work clerk in the office, who checks it and fills in the total amount and files it in a case kept for that purpose.

In order to prevent the necessity of writing out each item by the work clerk, an experimental card is being tried at some of the engine houses on the Pennsylvania, where piece work is in force, on which the separate items are printed in a column so arranged that a punch mark can be made opposite each. In using the card the work clerk simply punches the items requiring attention, as given by the MP-62 report, instead of writing them out. The subforemen also possess punches for indicating the jobs that develop while the work is being done. The piece work prices are printed on this card, and when it is returned, the record is complete and requires very little labor for recording. The illustration shows the face of one of these cards as a sample of the method. The back of the card has a double column of items similar to the single column on the face. There is a different card for each different class of work.

It will be noticed that in all of these cases the foreman is required to sign his name to the card and a record is kept of the

SYNOPSIS.

M. P. 142 B

PENNSYLVANIA RAILROAD COMPANY

PHILADELPHIA, BALTIMORE & WASHINGTON RAILROAD COMPANY
NORTHERN CENTRAL RAILWAY COMPANY
WEST JERSEY & SEASHORE RAILROAD COMPANY

DAY WORK CARD

7 19 1909
N 8 x 3

SERIAL No. OF CARD _____ ISSUED MO. ____ DAY ____

No. OF SHOP _____ COMPLETED MO. ____ DAY ____

ISSUED TO _____ NUMBER OF OPERATOR _____

CHARGE	PIECES	OPERATIONS	Rate per Hour	AMOUNT		TIME	
						1st ON	
						1st OFF	
						2d ON	
						2d OFF	
						3d ON	
						3d OFF	
		CORRECT _____ FOREMAN _____ TOTALS					

WORK DISTRIBUTION CARD—PENNSYLVANIA RAILROAD.

NAME	NO. OF OPERATOR	DATE AND HOUR	TOTAL HOURS	Rate Per Hour	AMOUNT

CORRECT _____ Foreman TOTALS

BACK OF WORK DISTRIBUTION CARD—PENNSYLVANIA RAILROAD.

M. P. EXPERIMENTAL 4-9

PENNSYLVANIA RAILROAD COMPANY

PHILADELPHIA, BALTIMORE & WASHINGTON RAILROAD COMPANY
NORTHERN CENTRAL RAILWAY COMPANY
WEST JERSEY & SEASHORE RAILROAD COMPANY

SERIAL No. OF CARD _____ ISSUED _____

No. OF SHOP _____ CHARGE _____ CLASS _____ DIV. COMPLETED _____

NAME	No.	Rate Per Hour	DATE	1st	2d	3d	4th	5th	TOTAL HOURS	AMOUNT	
			ON								
			OFF								
			ON								
			OFF								
			ON								
			OFF								

CORRECT _____ Foreman INSPECTED / NOT INSPECTED _____ Gang Leader TOTALS

PIECE WORK PRICES
ARE PRINTED IN THESE COLUMNS.

OPERATIONS

CROSSHEADS
ARM, S.R. (with, ha. _____
BLOCK, PER SIDE _____
CROSSHEAD FIT TO GUIDE _____
CROSSHEAD WHEN DISC FROM PISTON ROD _____
GIB FIT TO SHOE _____
GIB FIT TO SHOE AND LINED _____
GIB FIT TO SHOE AND LINED, NEW GIB _____
KEY, NEW FIT _____
KEY, OLD FIT _____
KEY, OUT AND IN _____
KEY, SAFETY PIN REMOVED _____
KEY TIGHTENED _____
LINED, INC. SIDE PLATE OFF AND ON _____
PIN, PISTON, PUT IN _____
PIN, SAFETY, PUT IN _____
PIN, WHEEL, PUT IN _____
PIN TIGHTENED _____
PIN TURNED BY HAND _____
PISTON ROD CUT & COUP AT CROSSHEAD _____
SHOE BOLT _____
SHOE BOLT TIGHTENED _____
SHOE BOLT FILED AND FIT BY HAND _____
SHOE BOLT HOLE REAMED FIT BY HAND _____
SHOE OFF & ON CENTER, NOT INC. BOLTS _____
SHOE OIL CELLAR OR CUP SPUNGED _____
SIDE PLATE _____
SIDE PLATE FIT OR NEW _____
SIDE PLATE LINER RIVETED ON _____
SIDE PLATE STUD _____
SIDE PLATE STUD DRILLED OUT, ORS _____
SHAKE, EACH ADDITIONAL _____

CYLINDERS
COCK _____
COCK BACKED OUT WHEN BROKEN OFF _____
COCK CLEANED OUT _____
COCK DRILLED OUT _____
COCK HOLE RETAPPED _____
COCK REACH ROD BACK SECTION _____
COCK REACH ROD BELL CRANK _____
COCK REACH ROD COLUMN _____
COCK REACH ROD FRONT SECTION _____
COCK REACH ROD LEVER _____
COCK REACH ROD LEVER GUARD _____
COCK ROD OR SLIDE PER SIDE _____
COCK ROD STRAIGHTENED & SET, PER SIDE _____
COCK SHAFT BEAM & FILED & FIT TO FRAME _____
COCK SHAFT BEARING THICK, BOTH SIDES _____
COCK SHAFT STRAIGHTENED OR RESET _____
COCK THAWED OUT PER SIDE _____
COCK TIGHTENED _____
COCK VALVE _____
CYLINDER BORED OUT FIRST CUT _____
CYLINDER BORED OUT EACH ADDIT. CUT _____
CYLINDER HEADING COUPLER ROOT _____
CYLINDER 3-PIECE, INC. HOLES REAMED, COMPLETE _____
HEAD, BACK AFTER GUIDES ARE DOWN, SB, D16 E, F, G, H4-9 _____
HEAD, BACK AFTER GUIDES ARE DOWN, ALL OTHER CLASSES _____
HEAD, BACK BUSHING _____
HEAD, BACK CASING _____
HEAD, BACK CASING FIT TO CYLINDER _____
HEAD, BACK CASING TIGHTENED _____
HEAD, BACK, STUD _____
HEAD, BACK, STUD DRILLED & RETAPPED _____
HEAD, BACK, STUD TIGHTENED COMPLETE _____
HEAD, BACK, TIGHTENED COMPLETE _____
HEAD, FRONT, SB, D16, E, F, G, H4-9 _____

EXPERIMENTAL WORK DISTRIBUTION CARD—PENNSYLVANIA RAILROAD

workman who performs the work. The files are usually made under engine number heads, so that it is a very simple matter to trace the workmanship to the workman.

The scheme for reporting, recording, distributing, and filing the work reports on the Lake Shore & Michigan Southern Railway was very fully described in the article on "Organization," which appeared in the December, 1908, issue of this journal and the following description is reprinted from that article:

When an engineer comes in off his run he verbally reports the work which is necessary on the engine to a clerk at the work report office. The clerk writes the report in a work report book and the engineer reads it, and if correct, signs it. In this way

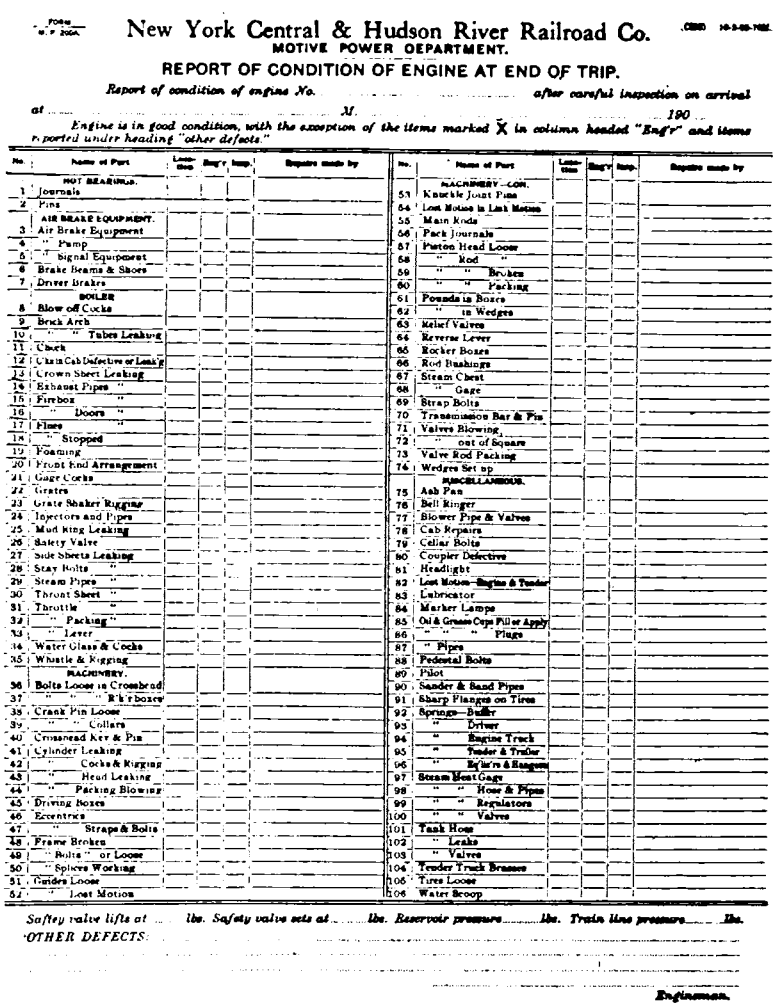
the reports are always kept clean and legible. The clerk makes out the work slips from the report book on a form about 3 x 5 in., similar to the one shown in the illustration; a separate slip is made out for each job. When the work cards have been made out, the clerk marks the work report in the book O. K., with the figure 1 or 2 underneath, showing that the items have been copied on work slips; 1 indicates that the cards have been made out by the day clerk and 2 by the night clerk.

The cards are placed on the engine foreman's desk along with all incomplete work reports (work reported but not done when engine was last in the house) for that particular engine; these latter cards are taken from the incomplete pigeon-hole, of the engine in question, in the file case.*

The passenger work cards are turned over to the passenger engine foreman and the freight and switch engine work cards are given to the freight engine foreman. These in turn distribute them to the various gang foremen or workmen, as the case may be, and when the work is completed, or at the close of the work period, receive them back. The engine foremen distribute and receive the cards so that they may have an exact knowledge of all of the work reported and in order that they may promptly report the engines for service when the work is completed.

If any of the inspectors or foremen discover unreported work, a report is made out and handed to the clerk, who copies it in the work report book, and the card is handled the same as engineers' cards.

As soon as the work has been completed the workman signs and dates the cards on the face, in a place provided for that purpose, and returns them to the gang foreman. If, for any reason such as lack of material, too short time, or the engine not dumped, the work reported cannot be attended to before the engine goes out, the foreman having the work card will make a note on the back of it to that effect, signing his name and date. This incomplete work card is then filed in the incomplete pigeon-hole, under the number of the engine. When the engine returns to the engine house the incomplete cards are taken from the pigeon-hole and handled as new cards. If the work has been done at the other end of the run the card is signed and handled in the usual manner.



New York Central & Hudson River Railroad Co.
MOTIVE POWER DEPARTMENT.
REPORT OF CONDITION OF ENGINE AT END OF TRIP.

Report of condition of engine No. ..... after careful inspection on arrival at ..... M. ..... 190 ..

Engine is in good condition, with the exception of the items marked X in column headed "Eng'r" and items reported under heading "other defects."

No.	Name of Part	Location	Eng'r	Insp.	Repairs made by
	HOT BEARINGS.				
1	Journals				
2	Pins				
	AIR BRAKE EQUIPMENT.				
3	Air Brake Equipment				
4	" Pump				
5	" Signal Equipment				
6	Brake Beams & Shoes				
7	Driver Brakes				
	BOILER				
8	Blow off Cocks				
9	Brick Arch				
10	" " Tubes Leaking				
11	Check				
12	Chain Cab Defective or Lost				
13	Crown Sheet Leaking				
14	Exhaust Pipes "				
15	Firebox "				
16	" Doors "				
17	Flues "				
18	" Stopped				
19	Foaming				
20	Front End Arrangement				
21	Gage Cocks				
22	Grates				
23	Grate Shaker Rigging				
24	Injectors and Pipes				
25	Mud Ring Leaking				
26	Safety Valve				
27	Side Sheets Leaking				
28	Stay Bolts "				
29	Steam Pipes "				
30	Throat Sheet "				
31	Throttle "				
32	" Packing "				
33	" Lever				
34	Water Glass & Cocks				
35	Whistle & Rigging				
	MACHINERY.				
36	Bolts Loose in Crosshead				
37	" " " Rk'r boxes				
38	Crank Pin Loose				
39	" " Collars				
40	Crosshead Key & Pin				
41	Cylinder Leaking				
42	" Cocks & Rigging				
43	" Head Leaking				
44	" Packing Blowing				
45	Driving Boxes				
46	Eccentrics				
47	" Straps & Bolts				
48	Frame Broken				
49	" Bolts " or Loose				
50	" Splices Working				
51	Guides Loose				
52	" Lost Motion				

No.	Name of Part	Location	Eng'r	Insp.	Repairs made by
	MACHINERY—CON.				
53	Knuckle Joint Pins				
54	Lost Motion in Link Motion				
55	Main Rods				
56	Pack Journals				
57	Piston Head Loose				
58	" Rod "				
59	" " Broken				
60	" " Packing				
61	Pounds in Boxes				
62	" in Wedges				
63	Relief Valves				
64	Reverse Lever				
65	Rocker Boxes				
66	Rod Bushings				
67	Steam Chest				
68	" Gage				
69	Strap Bolts				
70	Transmission Bar & Pin				
71	Valves Blowing				
72	" out of Square				
73	Valve Rod Packing				
74	Wedges Set up				
	MISCELLANEOUS.				
75	Ash Pan				
76	Bell Ringer				
77	Blower Pipe & Valves				
78	Cab Repairs				
79	Cellar Bolts				
80	Coupler Defective				
81	Headlight				
82	Lost Motion Engine & Tender				
83	Lubricator				
84	Marker Lamps				
85	Oil & Grease Cups Fill or Apply				
86	" " Plugs				
87	" Pipes				
88	Pedestal Bolts				
89	Pilot				
90	Sander & Sand Pipes				
91	Sharp Flanges on Tires				
92	Springs—Buffer				
93	" Driver				
94	" Engine Truck				
95	" Tender & Trailer				
96	" Eq'm'r & Hangers				
97	Steam Heat Gage				
98	" " Hose & Pipes				
99	" " Regulators				
100	" " Valves				
101	Tank Hose				
102	" Leaks				
103	" " Valves				
104	Tender Truck Brasses				
105	Tires Loose				
106	Water Scoop				

Safety valve lifts at ..... lbs. Safety valve sets at ..... lbs. Reservoir pressure ..... lbs. Train line pressure ..... lbs.

OTHER DEFECTS.

Engineman.

FACE OF ENGINEER'S AND INSPECTOR'S REPORT CARD—NEW YORK CENTRAL & HUDSON RIVER RAILROAD.

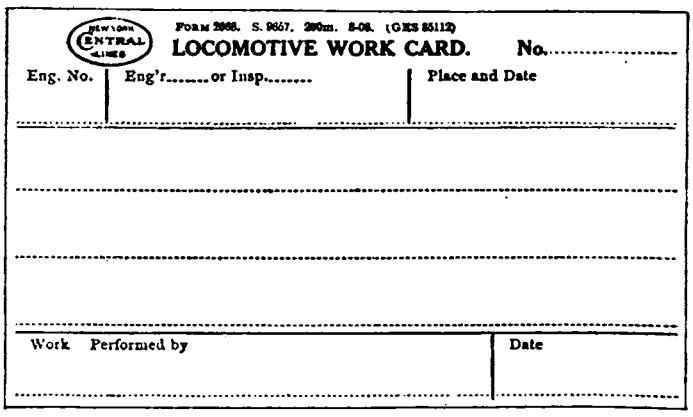
A distinction should be made between cards for work, which upon inspection by the gang foreman is found to be in good condition, and cards for work, which, although necessary to be done, was not finished before the engine was allowed to leave this point. Cards of the first class refer to work which in the judgment of the engine foreman is in good condition and need not be done. Such cards should be signed on the face by the engine foreman, giving the date and stating that the work reported is not necessary. These cards are then ready to be filed as "finished" work.

Cards of the second class are for work to be attended to on the return of the engine; such cards should be signed and dated on the back along with a brief explanation why the work could not be done before the engine left the house. These cards are "unfinished" work reports and should be so filed. The gang foreman returns all completed cards to the office as soon as the work is finished and the incomplete cards at the close of the work periods, or when the engine leaves the house. If the engine is still in the house at the close of the work period, all incomplete cards for work which may not be done are turned over to the incoming gang foreman. The report clerk should file all finished cards as soon as possible and hold over the unfinished ones.

At the close of each month all finished cards are taken from file all finished and hold-over or unfinished cards as soon as possible.

Supervision.

In practically all of the systems for assigning work by means of cards it is required that the foreman of the gang doing the work shall sign the card, before it is turned in, as a record that he has inspected the finished work and found it satisfactory. Of course, there is much work done around a roundhouse that it would be impossible to inspect, but inasmuch as the workman's name is also on the card it is easy to soon discover an unreliable man.



NEW YORK CENTRAL LINES
Form 2668. S. 9657. 200m. 8-08. (GES 85112)
LOCOMOTIVE WORK CARD. No.....

Eng. No.	Eng'r.....or Insp.....	Place and Date

Work Performed by	Date

ENGINE HOUSE WORK REPORT CARD—L. S. & M. S. RY.

* These file cases consist of pigeon holes 3⅛ in. wide and 8 in. high, one for each engine, sub-divided by tin slides so that the upper section, ¾ in. high, may be used for incomplete work cards, while the lower part, 2¼ in. high, is used for finished work reports.

These files are in the office of the clerk, in which no one is allowed to enter but the clerk and the engine-house foreman. The engineers' reports are dictated through a window. The hostler reports the engine numbers as soon as the engines are placed in the house or on storage track, so that the clerk can immediately place the incomplete work reports, if there are any, on the foreman's table.

Enginemen must carefully inspect their locomotives before turned over to engine house force, or at the end of each day's work. Enginemen will be held responsible for reporting on this form all defects which can be seen by them from the outside, or observed on the road. Enginemen must make report on one of these forms whether the engine requires repairs or not, and must always fill in items "Safety Valve lifts at....," "Safety Valve sets at....," "Reservoir Pressure....." and "Train Line Pressure....." No attention will be paid to verbal reports or reports not signed by enginemen.

Items numbers 6, 13, 24, 34, 35, 40, 42, 47, 70, 77, 90, 95, 96 and 98 contain two or three items each; when reporting any of the items for any of these numbers for repairs, draw a line through the item which is in good condition and which is NOT in need of repairs.

The Engineman, to report an item in need of repairs, should place an X after the item in column headed "Eng'r," and the Inspector, to report an item in need of repairs, should place an X after the item in column headed "Insp.," thus:

No.	Name of Part	Location	Eng'r	Insp.	Repairs made by
1	Hot journal	R. M. D.	X		
93	Springs—Driving	L. F.		X	

would indicate that the Engineman had reported the right main driving journal as running hot and that the Inspector had reported the left forward driving spring in need of repairs.

When repairs have been made the Foreman or the man in charge of the work must draw a circle around the X which indicates that the repairs have been made, thus:

No.	Name of Part	Location	Eng'r	Insp.	Repairs made by
1	Hot journal	R. M. D.	⊗		John Smith
93	Springs—Driving	L. F.		⊗	W. Jones

would indicate that the hot driving journal reported by the Engineman had been repaired by John Smith, and the left forward driving spring reported by the Inspector had been repaired by W. Jones.

The following items reported under the heading "Other Defects" have been repaired:

ITEM REPORTED	REPAIRS MADE BY

When items are reported as in need of repairs and the repairs are not made, the Foreman or the the man in charge of the work must give the reasons for not making the repairs in column headed "Repairs Made By."

Reservoir Pressure____lbs. } as found. Reservoir Pressure____lbs. } as corrected.
Train Line Pressure____lbs. } Train Line Pressure____lbs. }

Repaired at _____

Repairs completed_____ 190__ at_____M.

Repairs made by_____
Name of workman in charge of work

Inspected by_____
Engine Inspector.

Air Brakes Inspected by_____
Air Brake Inspector

Approved by_____
Engine House Foreman.

NOTE.—The workman in charge of the work, Engine Inspector and Air Brake Inspector will sign this report and hand it to the Engine House Foreman, who will approve same and forward to the Master Mechanic, or the Division Superintendent of Motive Power.

BACK OF ENGINEER'S AND INSPECTOR'S REPORT CARD—NEW YORK CENTRAL & HUDSON RIVER RAILROAD.

It is the custom in some engine houses where piece work is in force to have a certain number of day workers and to use them for all work which cannot be thoroughly inspected, the piece work jobs being only those that are not concealed.

Ample supervision of engine house forces is of an importance equal to that of ample facilities. The work at this point does not generally attract the highest class of workmen, and it is often necessary to use men that are not thoroughly trained and who need considerable instruction. Unexpected difficulties and annoyances are very numerous, in all of which cases, if there is some one available who has authority and time, the work will proceed with much greater smoothness and rapidity. It is a great mistake to have too few foremen in an engine house. While they appear on the payrolls as non-productive labor, they are really the most productive class of men employed and even in indirect ways are often enabled to save the company the amount of their monthly salaries in a day or even in a few hours. In selecting engine house subforemen it is very advisable that men who have been trained in engine house work be selected. It is, of course, well that they should have had other experience, but the peculiar conditions of the handling of running repairs need special training in that line.

REMARKS—Why Not Done	Foreman	Date

BACK OF ENGINE HOUSE WORK REPORT CARD—L. S. & M. S. RY.

Work to Be Done.

It is impossible to formulate a rigid rule for what work shall be done in engine houses and what shall not. It is profitable at some points to make fairly heavy repairs in an engine house, work which will sometimes occupy as much as a week or ten days. Again, some engine houses are not permitted to do any heavy repairing and are not equipped for doing much machine work. Where the house is a long way from a repair shop and is handling a large amount of power it must be to a considerable extent self-supporting. Again, where it is located adjacent to a heavy repair shop it is usually considered that it should depend upon the shop for all the heavy work. The advisability of the latter arrangement is open to question.

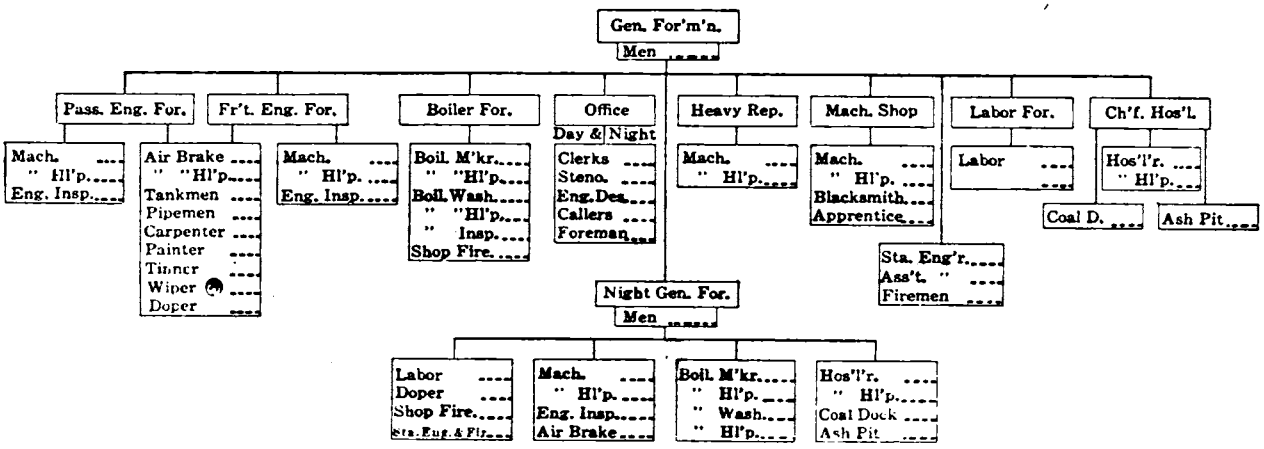
Under average conditions it may be said in general that facilities should be provided for taking care of all work that does not require the actual renewal of some major part which would require machining and fitting. It probably is not advisable, as a general thing, to arrange for the renewing of tubes in an engine house, although this is sometimes done. All boiler repairs which require the renewal of any large part will under ordinary conditions keep the locomotive out of service a sufficient length of time to make it advisable to send it to the shop where other repairs that may not be immediately necessary can be made while it is laid up. Engine houses should be provided with facilities for removing the wheels, for turning the tires—unless standard wheel centers are in use when they can be changed instead of turned—for facing shoes and wedges, refitting driving boxes, renewing rod brasses, renewing cross head gibs, patching or welding frames as a temporary repair, doing all required repairs to the brake rigging, renewing bushings on the valve gear, renewing eccentric straps, facing off valve seats and all work of this character.

Where the locomotives are thoroughly standardized it is possible to supply the engine houses with parts which are already finished to standard dimensions and in such cases much more extensive repairs can be made in the engine house than would be otherwise advisable.

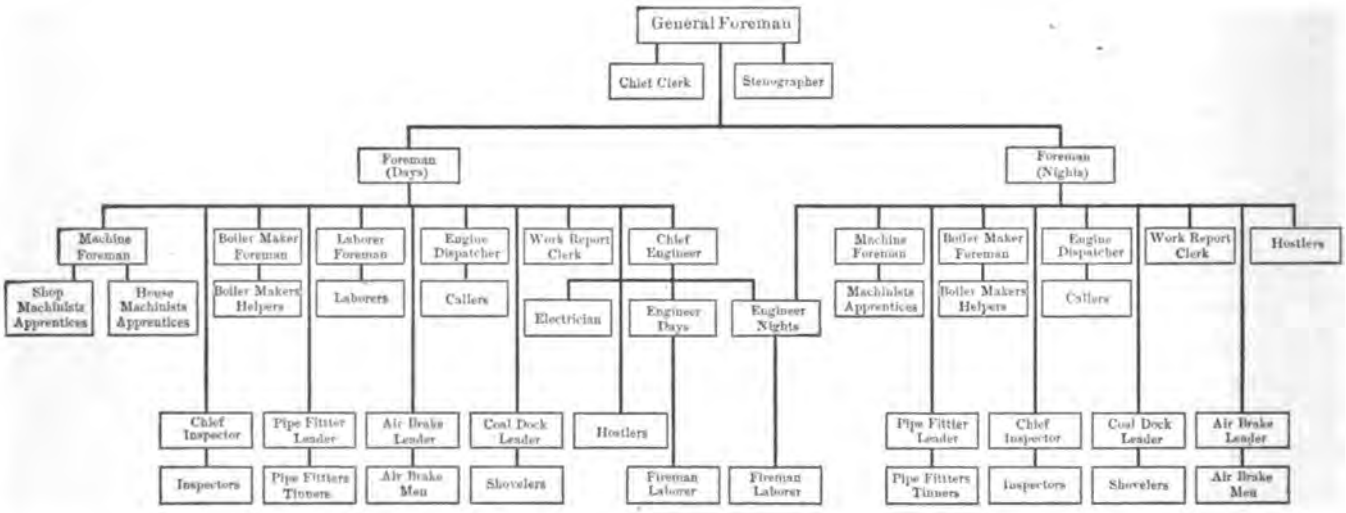
All the engine houses built in the last 8 or 10 years are provided with drop pits or drop tables for removing wheels and in the case of the Ashtabula engine house of the Lake Shore Railway, at least, an overhead crane of a capacity sufficient to lift a locomotive is provided. At this place all of the wheels can be removed and the locomotive be placed on blocks in a convenient position for making other repairs in about five minutes after the rods and pedestal binders have been removed.

Machine Shop.

At all terminals turning more than 100 locomotives per day and in some cases at those turning less than this, a complete machine shop should be provided. This does not mean that it necessarily should be extensive or that all of the tools that are found in a repair shop should be included, but means that there should be at least one of each class of machine that work of this character might require. A driving wheel lathe of a capacity to take the largest wheels is very essential if standard centers are not in use, when it will probably be advisable to turn all tires at the



ORGANIZATION CHART FOR A LARGE LOCOMOTIVE TERMINAL—LAKE SHORE & MICHIGAN SOUTHERN RAILWAY.



ORGANIZATION OF FORCES IN A LARGE ENGINE HOUSE.

main repair shop. A planer of a size sufficient to take in a large frame brace and also suitable for shoes and wedges will be required; a lathe large enough to swing a rocker arm and probably two other sizes of lathes, one being intended for bolt work and the other of possibly 18-in. swing for general work will answer the requirements for that equipment; a medium size shaper and one radial drill; a vertical drill, a bolt cutter, pipe threading machine and cut-off saw will complete the usual tool equipment with the exception of a boring mill, which is probably one of the most important tools to place in an engine house. An hydraulic press of a size suitable for driving box brasses and a portable crank pin press should also be provided.

Jib cranes, air hoist trolleys, etc., for convenient handling of parts that require machining, will, of course, prove as valuable here as in a larger shop. The tool room should have a very complete equipment so far as various sizes of tools are concerned. It is sometimes surprising to discover how much money is lost through the inability to use a locomotive on account of the absence of a certain size of drill or reamer that is required, or by an engine failure on the road due to makeshift methods that have been compulsory on the part of the roundhouse force for the same reason. A locomotive broken down on the road will very soon lose enough money to provide a complete outfit of drills and reamers for the engine house.

A forge shop equipped with at least one good-size power hammer and a number of open forges will, of course, be found necessary. Under normal conditions no regular carpenter shop would be provided or required.

In a number of the later engine houses a narrow gauge industrial track has been set into the concrete floor all around the outer circle beyond the engine stops. This track is provided with turntables and switches, so that it extends into the various shops, store house and the scrap bin, and in some cases alongside the drop pits. Small push cars are operated upon this track and all heavy transporting is done by means of it.

Organization.

In no single way, or in fact in no combination of ways, can the cost of maintaining the locomotives in service be reduced as much as by means of a sound and thoroughly efficient organization. This feature is really very little understood on some railroads and the wonderful results that will follow its introduction are realized only by those who have discovered it by experience.

Of course, organization is a very broad term and many of the features that have been mentioned throughout these articles are part of this subject, but one of the most important features is the classification of the forces and the distribution of responsibility for results, so that, first, there is no confusion in any man's mind as to what his duties are, and, second, that his duties are within his capability. The old method where a roundhouse foreman had 100 or more workmen under him, all on the same grade, he being the only man who could sign requisitions, assign work, or clear up difficulties, was an enormously expensive one.

The accompanying illustration shows the arrangement of the forces at a large engine house where this subject has been given the closest attention, and while this exact arrangement probably is not suitable for all points, it illustrates the basic idea of the

FORM M.P. 297-A. C.E.S. 11-12-09-100M.

New York Central & Hudson River Railroad Co.

EMPLOYMENT AND CONDITION OF ENGINES.

Engine House, 8 A.M. ..... 19....

	Total
Through Passenger	
Local Passenger	
Through Freight	
Local Freight	
Switching	
Grade or Pushing	
Work Train	
Reserve	
For Sale or to be Demolished	
Stored	
Loaned	

IN ENGINE HOUSE UNDER REPAIRS.

Eng. No.	Service	Hours Work Required	Eng. No.	Service	Hours Work Required	Eng. No.	Service	Hours Work Required	Eng. No.	Service	Hours Work Required	
Ready for Service												
												Total

Engine House Foreman.

All engines giving out on the road or that have been in collision during the past 24 hours should be reported under

REMARKS:.....

(SEE INSTRUCTIONS ON BACK)

DAILY REPORT FORM, SHOWING CONDITION OF POWER—NEW YORK CENTRAL & HUDSON RIVER RAILROAD.

NOTICE ON BACK OF ABOVE FORM.

This form should be filled out and forwarded to the office of the Division Superintendent of Motive Power showing employment and condition of each engine assigned to the point reporting or coming under the engine house foreman. Report to be taken at 8 A. M., and to give individual engine numbers.

All engines that are assigned to regular runs, or that are in daily service, should be reported under the respective headings according to the service or class of work they are performing.

Engines to be reported as "RESERVE" are such engines as are not regularly assigned to runs or other daily service, but are being held at the engine house to be used in case of an extra, or to take the place of an engine that is disabled, or is out of service for boiler washing or inspection.

Engines to be reported as "READY FOR SERVICE" are such engines as are in regular freight or switching service, and have had the fire cleaned, have been loaded with coal and water, inspected, and have had all necessary repairs made, and are waiting call for train, or other service.

it is not in any manner official. In this log are jotted down such items as one foreman thinks the other may wish to have information upon. Much of this information is, of course, recorded in the dispatcher's book. No attempt is made to make this record complete in the matter of everything that happens; only such things as may come up later are noted. The log is kept in two parts, one being the engine situation, showing what engines are ready for service, what ones are held for repairs and what engines have been put into service, where they went and with what crew. The other is items of general information. Extracts from this part of the log, kept by the night foreman, are given below.

FRIDAY, JANUARY 7, 1910.

1910—Gone on No. 37—3523 off acc't flues leaking.
1151—Helping 37 with Burns and Davis.
2031—Gone on helper 43 with Makey and Devine.
3518—In on 49 returned on No. 28.
3520—In on 34—3501 returned on 70—3520 dumped, flues leaking.
3525—In on 35—3520 returned in place on No. 32.
3535—Gone to Albany light with Fox and Jones.
3506—Came up on 69—3539 in place on No. 36.
3535—Came down on Sec. 18 with Smith and Johnson.
1151—Thomas and Tobin came in on help 32.
3514—3552—Dumped acc't flues leaking.
1152—1909—3522—Coming on Pullman trains. Sec's of No. 3 can get no definite information.
2515—Gone on 1 A. M. switcher with Ripley.
2507—Gone on ice train place of 2542 that is out of service.
2524—Gone on Westfield Sus. with Kenyon.
3641—Gone on local east place of 3635 that is being held here acc't flat tender wheels.
2504—Still at Palmer. Dispt. will have eng. towed in by some helper; none out during night.
1914—Came up with Eng'r Parsons. Suppose this eng. should be held for her regular crew as their clothes and tools are locked up on eng. All the regular fast freight crews went last night except Attridge and Ward.
1905—Came up with W. White and is here for NH2.
1908—Here for B. A. 2. 1906 has not arrived yet.
Potter and Lempke are here for spare time, commences 4:30 A. M.
3506—Here for No. 6—3525 for 26—3514 for 361—1917 O. K. 3532 for 15.
3527—O. K. except left check pipe burst. 3523—Ready for a fire. Ren's wired office last night that 2624 has very bad tender wheels, flat and shelled.
You will have to notify James and Holden that Supt. wants them at 10 A. M. to-day at his office.
Clancy will call up in a few minutes and let you know about Pullman trains coming.
2602—Has steam heat working. They will want this engine for Pullman train I think.
New fireman that you left here is here yet. Still waiting; had no freight job for him during the night. He is now in rest room.

The form used on the New York Central Lines for reporting the condition of power to the division superintendent of motive power is shown in another of the illustrations. This form is official and is forwarded each morning from all engine houses.

distribution of responsibility through many channels which are all combined under one supreme head. This is a straight "line" organization of the simplest kind and if properly subdivided will probably prove to be the most efficient.

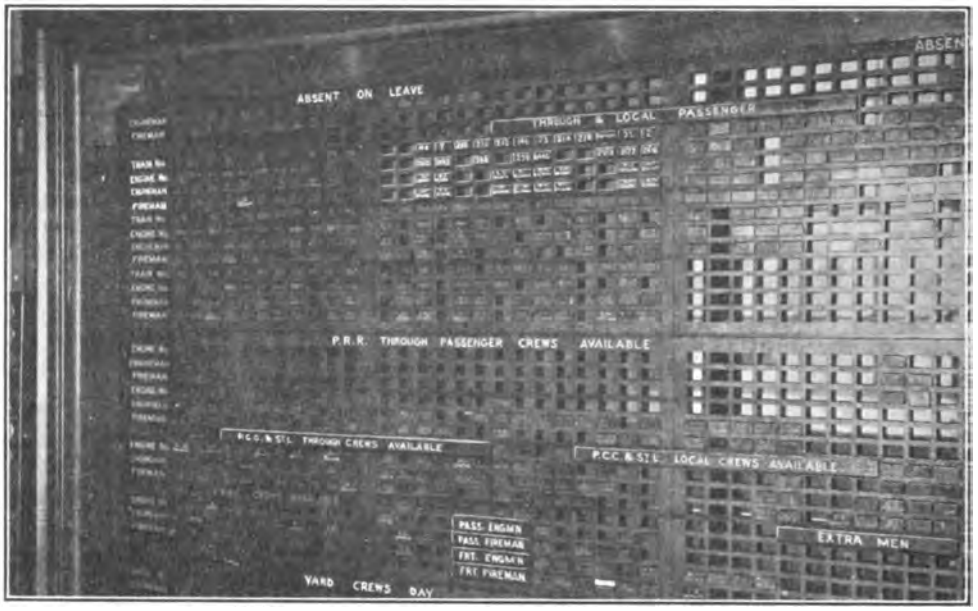
Another illustration is given of the organization of a larger terminal. This is taken from the article on the "Organization of the Lake Shore & Michigan Southern Railway" which is mentioned above. It shows an almost ideal arrangement which has proven to be thoroughly practical in every way.

Miscellaneous.

In the West Springfield engine house of the Boston & Albany Railroad has been instituted what amounts to a running log. This is maintained by the day and night foremen simply for their own information and record, and while it is filed for reference

Posting of Blue Prints.—It is the custom on some roads to post in the engineers' room at the engine house a blue print showing all the tracks, switches and signals at that terminal. This print includes the identification mark of each tower, signal post, etc., and is found to be very valuable, especially in connection with orders that may be issued by the superintendent for the guidance of engineers in the use of certain tracks.

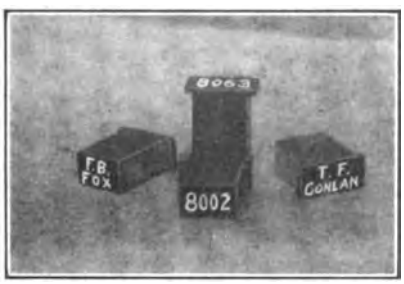
Dispatching Board.—A very successful type of dispatching board, which is in use at the Pittsburgh engine house of the Pennsylvania Railroad, is shown in the accompanying illustrations. This is placed behind glass in the partition separating the engine dispatcher's office from the enginemen's room. It is made up of a number of units of convenient size put into one frame and is thus capable of ready expansion as required. Each



DISPATCHING BOARD, PENNSYLVANIA RAILROAD AT PITTSBURGH.

of the units is made up of 5-plies of ¼-in. oak glued together with grain crossed to prevent warping. Rectangular holes, 1¼ x¾ in., are cut through the board and plugs, having flanges at one end to prevent their being pushed through too far, are inserted in the holes. These plugs bear the engine number or engineer's name as needed. The names on the plugs are large enough to be read by the dispatcher without getting up from his desk and a 12-section board has been found of sufficient size to care for the dispatching of from 150 to 200 engines per day. The titles are made up on strips which have plugs on their back, so that changes can be made readily without the scraping off of old and painting on of new titles. The illustration shows the construction of the board and plugs.

Another type of board, that has been found very convenient, is arranged in a circular frame and set behind a window in the partition between the dispatcher's office and the enginemen's room. The drum is made of sheet iron, painted, and mounted



PLUGS USED IN DISPATCHING BOARD ON PENNSYLVANIA RAILROAD AT PITTSBURGH.

so as to be easily revolved and the engine numbers and names of the crew are on tags which are hung on hooks in the proper location under the different runs. The board is provided with a circular handle at the bottom which extends through an opening into the enginemen's room and thus can be revolved to bring in view any particular run that anyone wishes to see. It can in the same manner be revolved by the engine dispatcher who marks up crews without leaving his desk.

Cans for Waste.—In a number of the better maintained houses large galvanized iron cans, about 3 ft. in diameter and 4 ft. high, are set alongside the posts between every 5th and 6th pit for the receiving of pieces of waste, sweepings from the floor and other scrap of this nature. Nothing of any value is put in these cans, which are emptied periodically on to the scrap car. Their presence to a large extent prevents the collection of miscellaneous waste material in the bottom of the pits and exerts a decided influence in keeping the house in a cleanly condition.

Soda Ash Solution.—Where soda ash is used generally it has been found that the best method is to dissolve it in large tanks, having the solution of the proper density, which is put into the tenders by means of buckets. This insures the proper amount of soda being put into each tender and is much more satisfactory than to put in the soda as a powder.

Hydrostatic Tests.—The injector for making hydrostatic boiler tests can be easily mounted upon a cart and be connected to the steam and water line connection between the pits. The boilers can in this way be tested with very little difficulty or expense.

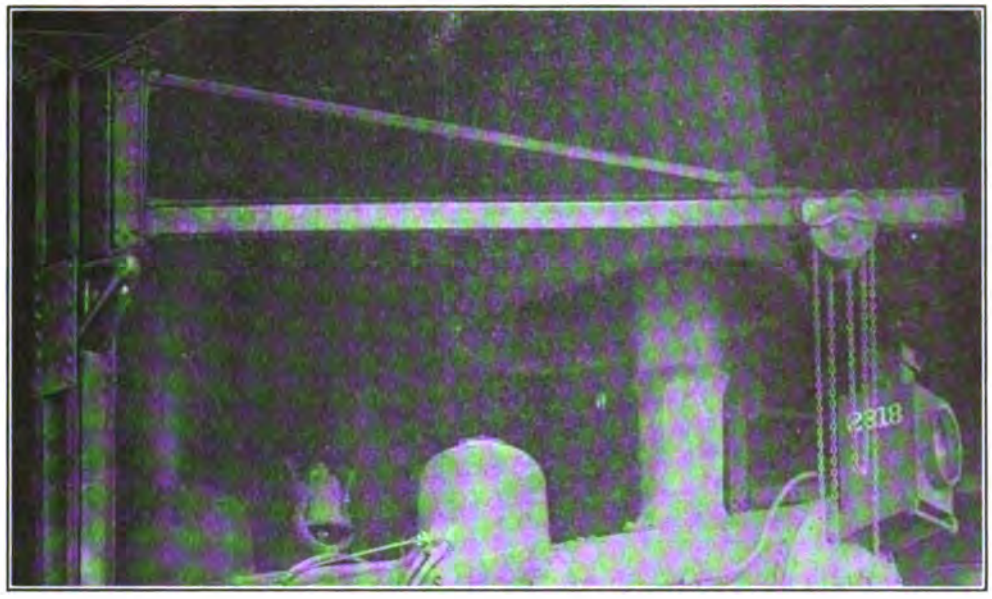
Cleaning Gang.—Three or four men, whose regular duty it is to go over the whole house the first thing every morning, picking up everything that is lying around the floors or in the pits, piling it upon a cart and afterwards salvaging the serviceable material and putting it into its proper place and dumping the refuse, will keep an engine house looking neat and clean at a slight expense. In fact, the good material which they are able to salvage, that would otherwise be lost, probably more than pays their wages.

Lamp Guards.—The guards for incandescent lamps, particularly the portables, should be very substantially made of heavy galvanized wire and provided with a strong hook by means of which they can be hung up on rods and other places around locomotives. The bottom of the guard should be flat and large enough so that the lamp can be set up on a flat surface without any danger of it being easily tipped over. Removable cross wires, forming a protection on the bottom, should be provided.

Clothes Lockers.—If the clothes lockers are in the main engine house instead of a separate building they should not be of the expanded metal type, as these permit the smoke, gases and soot to easily get inside the lockers, and soil everything therein. In such cases, of course, ventilation should be provided, but not openings large enough to allow the dirt to get inside. By far the better way is to use expanded metal lockers and have them in a separate building in connection with the toilet facilities, etc.

Crane on Incoming Track.—For the purpose of removing air pumps or other heavy parts, that may be shipped upon the tender of passenger locomotives, an air hoist on a jib crane extending over the incoming track leading to the turntable, or some other convenient location, has been found most convenient. The same crane, of course, can be used for loading the heavy parts that are to be shipped to the shop or other points.

Permanent Jib Crane.—No expense of time or money was spared in making the East Altoona engine house of the Pennsylvania Railroad as near perfect as possible and, among other ex-



PERMANENT JIB CRANE ON OUTER LINE OF POSTS. ONE OF THESE CRANES BETWEEN EACH TWO PITS AT EAST ALTOONA ENGINE HOUSE—PENNSYLVANIA RAILROAD.

cellent features, there are installed on each of the outer row of posts between the pits a swinging jib crane made up of I-beams and carrying a triplex chain hoist on the roller carriage supported by the flanges of the arm. These arms are long enough so that any of the heavy parts near the front end of the locomotive can be easily handled by properly locating the engine. They have been found to be one of the handiest things for an engine house. Front end rings, smokestacks, bells, steam chest

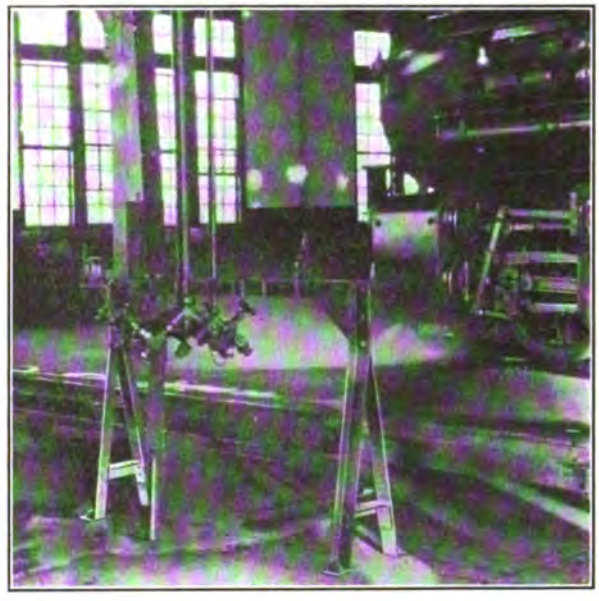
HOT WATER WASHOUT SYSTEM, MANIFOLD PIPE LINES IN CONDUIT.

covers, bumper beams, headlights, etc., are easily and quickly handled with it.

Washout System.

It can be said without fear of contradiction that every engine house in which large boilers are washed should be provided with a hot water wash out system. The saving in the time that a locomotive is kept out of service for boiler washing makes such a system very profitable to say nothing of the increase in the life and improvement in the condition of the boilers themselves.

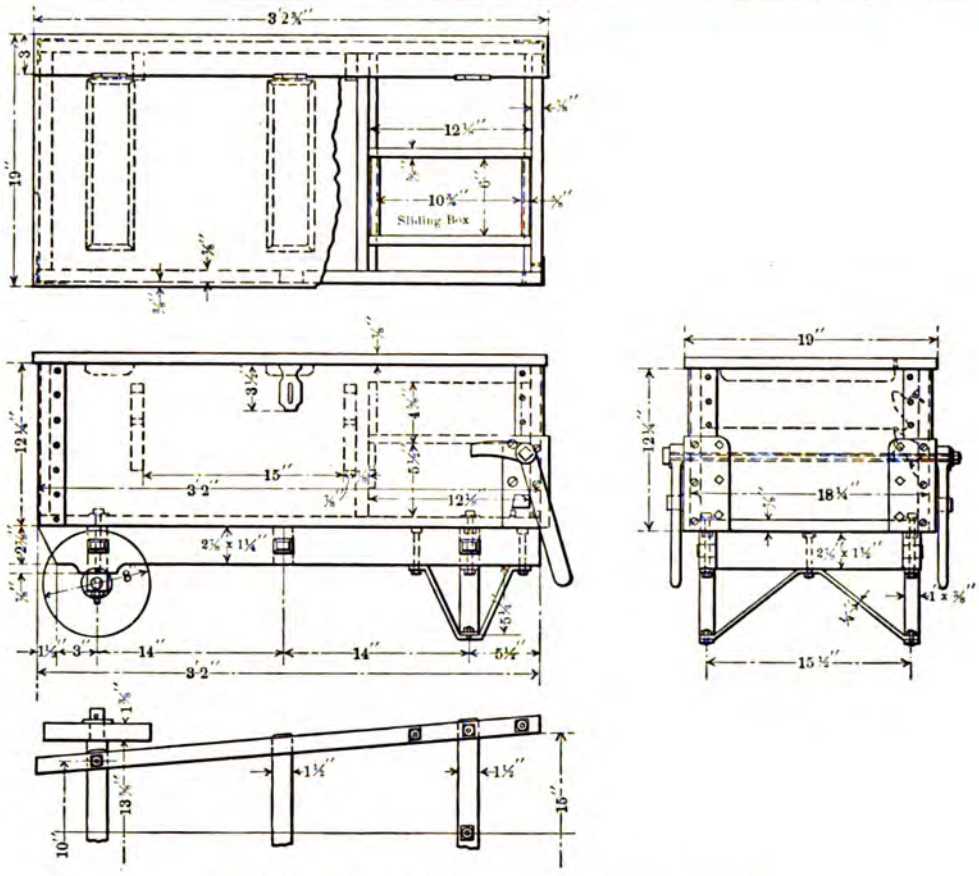
The most successful systems provide a plant consisting of the necessary drums and pumps located in a separate section of the house from which are carried the various pipe lines terminating in connections between every second pit. In some cases these pipes are carried in conduits near the outer or inner circle and have connections extending beneath the floor, which are brought up to manifolds on the posts between the pits. The conduits are covered with iron gratings so that repairs can be easily made. In these cases there is also a line carried around the roof of the house for a connection to the blow-offs on the dome which



FRAME HOLDING CONNECTIONS TO PIPE LINES OF ALL KINDS—WEST SPRINGFIELD—BOSTON & ALBANY RAILROAD.

has a connection to the same manifold. One of the illustrations shows an arrangement of this kind, which includes a large blower pipe brought up from below, a hot and cold water line and a connection on either side for the attachment of the hose.

In some other cases the pipe lines are all carried from the roof timbers at the top of the house, connections being brought down at the posts in a similar manner. The advantage of the manifold in a case of this kind is that a mixture of hot and cold water, or of steam and water, can be made so that the proper temperature is easily obtained. The disadvantage lies in the



PORTABLE MACHINIST'S TOOL BOX FOR ENGINE HOUSES.

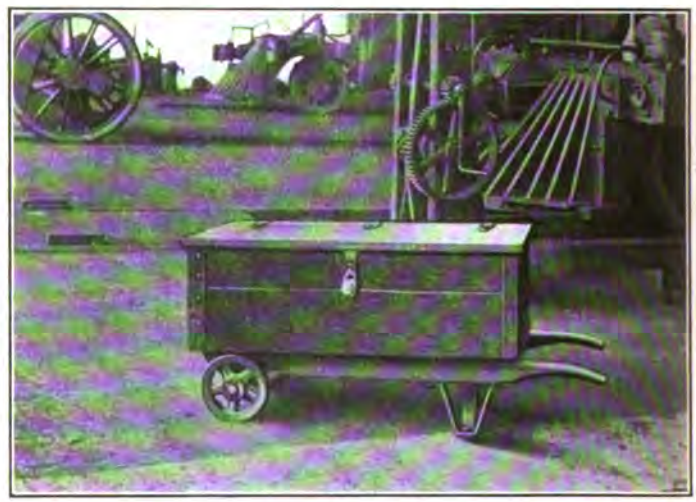
fact that the wash out water can be cooled down below the most satisfactory temperature by the man doing the washing, who finds it more convenient to handle the hose when it is not so hot. One of the illustrations shows a rack for holding the pipe terminals from the overhead line that is in use at the West Springfield engine house, where the location of the posts are inconvenient for this purpose. At the time the photograph was taken the overhead wash out system was not installed, but the places where the various pipes go on the rack are indicated. In this case no manifold is used, each pipe terminating in a Y, to which is connected two valves. The lines shown in the illustration are steam, water and air. In addition to these there has since been installed the blowing off line, the hot water wash out line and the hot water line for filling boilers. This makes a very neat and satisfactory arrangement of piping.

On account of the large amount of space required a description of several of the hot water washout systems will be delayed until a later number.

HANDY DEVICES.

Portable Machinist Tool Box.—A roundhouse machinist under modern conditions of piece work or bonus payment finds it necessary to have available a large supply of tools, more than it is possible for one man to carry in his hand from place to place. In fact, in houses where the highest efficiency is being maintained, it has been found to be good practice to equip each machinist with wrenches, jacks, etc., that in most houses are common property and stowed away in one place. In order to make it possible for a man always to have his supply of tools available and easily transportable, a tool box, which in effect is mounted on a two-wheel baggage truck, is used. This box is long enough and large enough to take in any tools that would be ordinarily required and is fitted with a substantial hasp and lock. The complete equipment of these tools is charged against each machinist, and he is held responsible for their safe keeping. Two designs of this type of tool box are shown in the illustrations, one having an ordinary wooden handle and the other fitted with iron handles, which drop down out of the way when not in use. These boxes are sometimes made of sheet metal instead of wood, although the latter is perfectly satisfactory. These boxes are also convenient for use as benches to stand upon.

Cleaning Waste.—While waste that is used by wipers is usually considered a negligible expense, and after it has become too dirty for further wiping is used to kindle fires at most places, still at points where this subject has been carefully investigated it has been found that it is well worth while to collect the waste that is discarded by the wipers, thoroughly wash it, and put it



PORTABLE MACHINIST'S TOOL BOX—LAKE SHORE & MICHIGAN SOUTHERN RAILWAY.

again into use. At such points fires are kindled with crude oil either poured directly on the fuel, or by means of a special firing-up machine.

The waste discarded by the wipers is put into special galvanized iron receptacles distributed throughout the house and is collected and thrown into a large vat of crude oil, where it is