



**DISPLAYED  
STEAM LOCOMOTIVES**

**Their Care and Maintenance**



STEAM LOCOMOTIVES

ON DISPLAY

(Their care and Maintenance)

J. David Conrad,  
Superintendent of Motive Power

Illinois Railway Museum

Artwork by  
Steven Diederich

March 1974

Provided as an Educational Service by the

Illinois Railway Museum

No rights reserved, reproduce at will.



## FOREWORD

In the period following the Second World War, as the railroad industry in the United States was making the transition from steam locomotives to diesel electrics, many towns and cities throughout the land felt a sense of loss at the passing of the age of steam. To commemorate the steam age and to pass on some notion of it to succeeding generations, steam locomotives were obtained and placed on display in parks. They brought back memories of a happier, less complex time. Parents and grandparents took the children to look at these relics and to relate what it was like to see one actually operating; the whistle down the tracks, the smoke and steam, the flash of the side rods and wheels, the sights, sounds, and smells of what the steam locomotive was all about.

Today, in the United States, there are fewer than 3000 steam locomotives left in existence of probably better than 75,000 in 1945. Of these, only a handful still operate at museums and as tourist attractions. The majority of the locomotives today are in parks and fairgrounds, on courthouse lawns and next to the depot. They are, with precious few exceptions, outside, exposed to the elements, and to vandals. This is, of course, quite understandable. Due to the size of a locomotive, inside shelter is not practical. But even a huge piece of steel needs attention and maintenance if it is to survive and look presentable. It is to this end that this pamphlet strives: the maintenance and preservation of steam locomotives on display.



This booklet's creation was prompted by several factors. First, a majority of the steam locomotives on display in our country are in very poor physical shape. Second, when something like this becomes an eyesore, oftentimes no one really knows what to do about it. Third, when nothing is done, the locomotive is sometimes cut up for scrap. Our goal is to: offer tried and proved methods of display locomotive maintenance; offer suggestions for getting the work done cheaply; be available for consultation on jobs of this nature; and, as a last resort, to provide help in the disposition of display locomotives.

Many, if not most, steam locomotives were not really prepared for display other than a fresh coat of paint. The following steps should be taken to insure the locomotives' survival and to put it into a state where it will not deteriorate further (refer to Figure 1, the location of some parts varies between different locomotives, also the quantities of some parts may vary. For instance, some locomotives may have two sand domes or two air pumps). Basically, the only enemy which a locomotive has is rust and corrosive action, so the engines' preservation is dependent upon: 1) Closing and sealing areas which admit water; 2) Removing anything that absorbs or holds water; 3) Cleaning and painting or greasing any part which comes in contact with the elements.

The preliminary work of visually restoring a locomotive involves cleaning out certain parts and sealing them from the elements. The entire



smoke box (see Figures 1 and 2) should be swept, shoveled out and hosed down. All soot and ash must be removed as it holds moisture and speeds up the rusting process. Care should be taken to clean all the way back to the boiler tubes. The smoke box drain should be left open. The door should be bolted shut and the smokestack should have a round plate welded over it to prevent rain from entering.

The sand dome should be emptied of sand, and the lid tack-welded on. The turbo-generator (dynamo) exhaust pipe should be capped. The cab roof hatches and tender tool boxes should be tack-welded shut. The firebox should be cleaned, firedoor could be tacked shut. The ashpan should be cleaned, ashpan hopper doors should be left open.

If the engine is a coal burner, the tender should be shoveled out and cleaned. If the tender floor has an opening with an Archimedes screw in it, this can be covered.

If the engine is an oil burner, the filler hatch should be bolted down. No welding/cutting should be done near the oil tank. Vents should be covered and the dip stick bolted down.

Inside the water compartment, the rust and scale on the floor should be shoveled out. If moisture is present inside the tender, it would be advisable to cut a few 2-inch diameter holes in the floor at the low spots. Tender drain valves should be opened. If the tender top has standing water, several small holes can be drilled or cut in the tender side at the deck line.



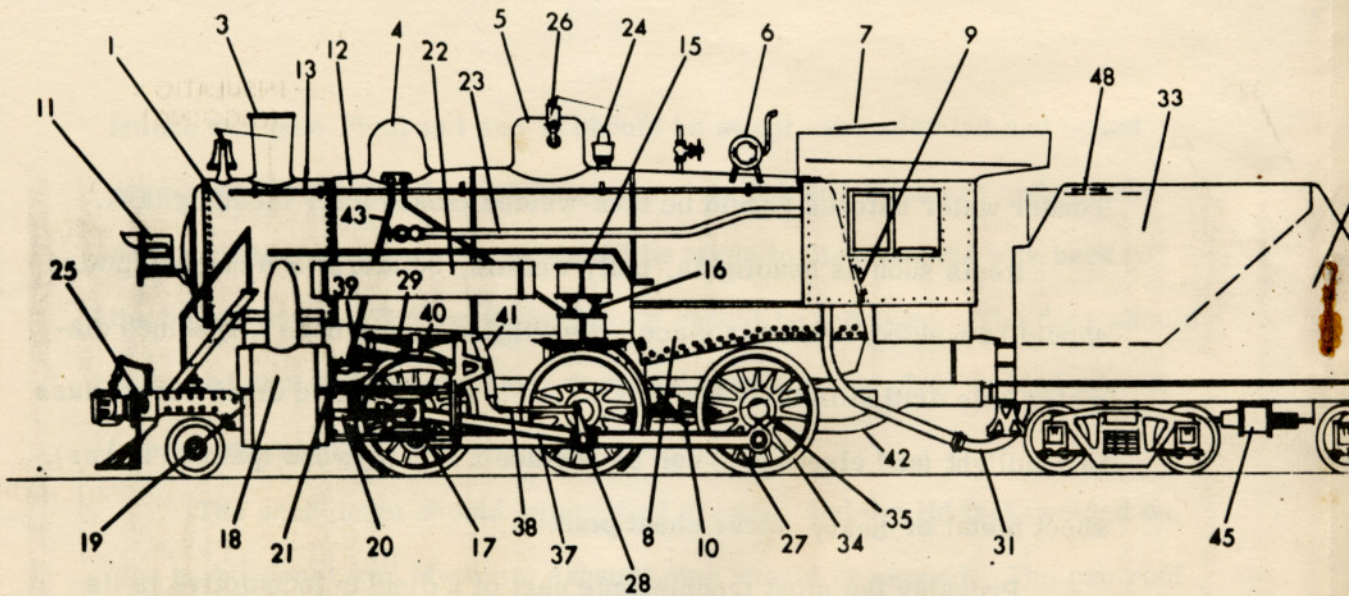
Tender water hatches should be tack-welded closed after cleaning tank.

Items such as headlights, bell, whistle, builders' and number plates should be welded/brazed in place. Headlights should have a 1/2-inch diameter hole drilled in their bottoms to allow rain water to drain out. Glass in headlight (and elsewhere) can be replaced with plywood (painted silver), sheet metal or heavy clear sheet plastic.

Probably the most troublesome part of a display locomotive is its boiler jacket and the insulating material underneath (magnesia) (See Figure 3). The major problem is moisture saturating the insulation. Since the insulation never completely dries out, the thin sheet metal jacket rusts away allowing the insulation to fall out or leaving large holes through which the insulation oozes out.

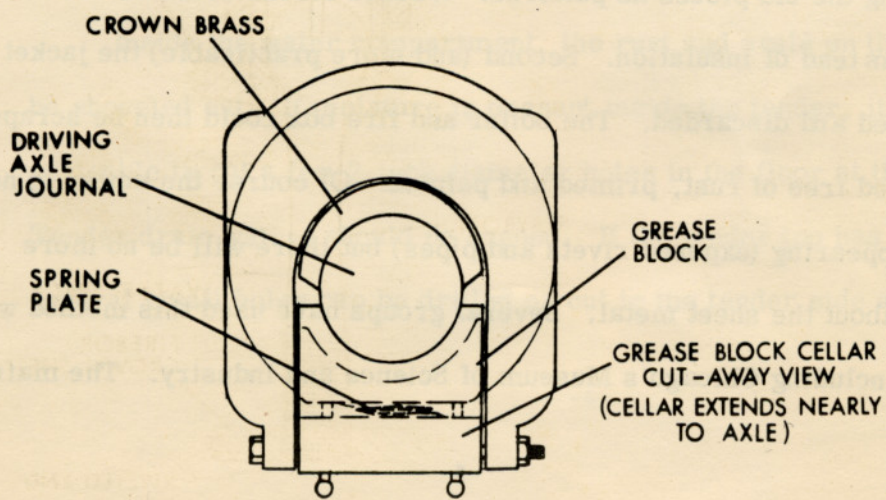
Obviously, if the locomotive is under cover this problem may never arise, but few engines are so lucky. There are two ways of solving the problem. First, the jacketing could be carefully removed and a new jacket made using the old pieces as patterns. Wooden blocks could be used as spacers instead of insulation. Second (and more practicable) the jacket could be removed and discarded. The boiler and fire box could then be scraped and chipped free of rust, primed and painted. Of course the boiler is not as neat appearing (exposed rivets and pipes) but there will be no more worries about the sheet metal. Several groups have used this method with success including Chicago's Museum of Science and Industry. The main



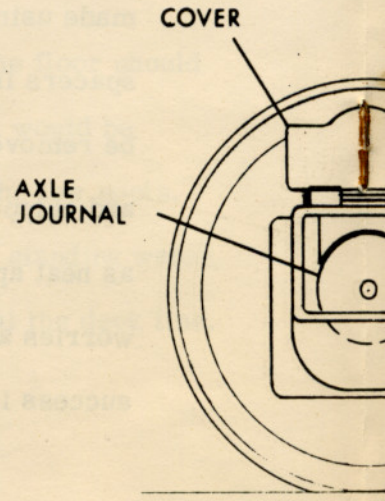


**Fig. 1**

- |                    |                           |                        |
|--------------------|---------------------------|------------------------|
| 1. SMOKEBOX        | 13. HANDRAILS             | 25. PILOT              |
| 2. BOILER TUBES    | 14. STEPS                 | 26. WHISTLE            |
| 3. STACK           | 15. AIR COMPRESSOR        | 27. SIDE ROD           |
| 4. SAND DOME       | 16. AIR COMPRESSOR PISTON | 28. ECCENTRIC CRANK    |
| 5. STEAM DOME      | 17. CROSSHEAD             | 29. SPRINGS            |
| 6. TURBO-GENERATOR | 18. STEAM CHEST           | 30. TENDER             |
| 7. CAB ROOF HATCH  | 19. CYLINDER              | 31. TANK HOSE          |
| 8. FIREBOX         | 20. PISTON ROD            | 32. WATER COMPARTMENT  |
| 9. FIREDOOR        | 21. VALVE STEM            | 33. COAL COMPARTMENT   |
| 10. ASHPAN         | 22. AIR TANK              | 34. DRIVER             |
| 11. HEADLIGHT      | 23. DELIVERY PIPE         | 35. DRIVING WHEEL AXLE |
| 12. BOILER JACKET  | 24. SAFETY VALVES         | 36. TENDER TRUCK       |



**Fig. 5 DRIVING BOX JOURNAL**



**Fig. 4 JOURNAL B**  
MOST LOCOMOTIVE  
PILOT WHEELS



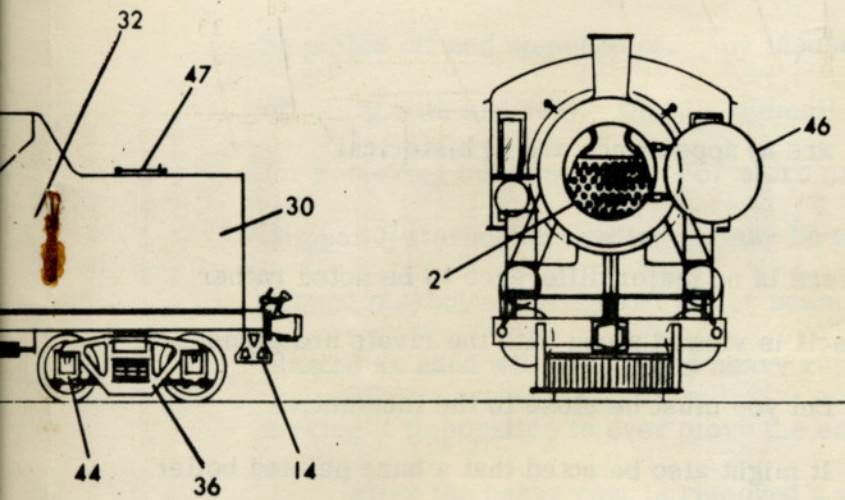
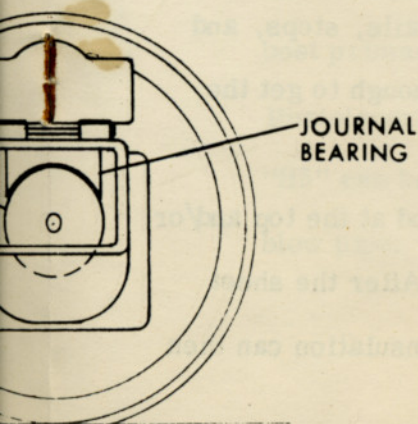


Fig. 2

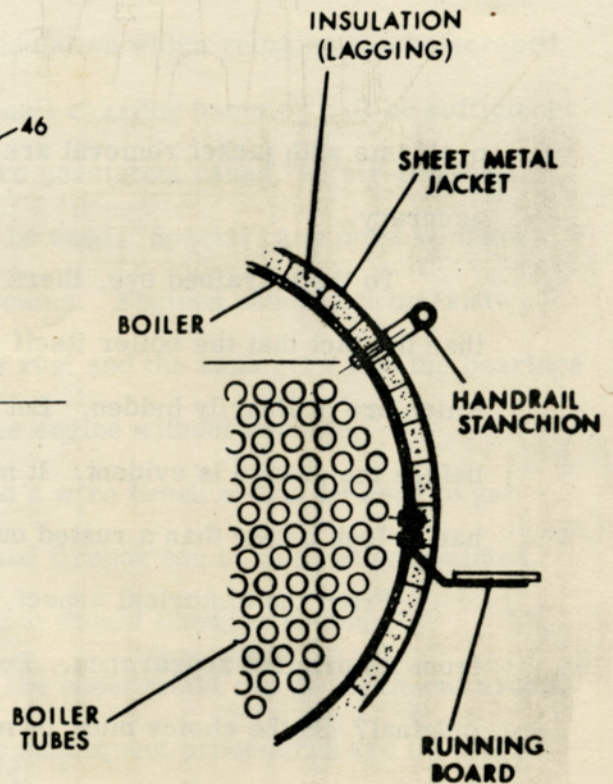
- 37. MAIN ROD
- 38. ECCENTRIC ROD
- 39. COMBINATION LEVER
- 40. RADIUS ROD
- 41. REVERSE LINK
- 42. FRAME
- 43. SAND PIPE
- 44. JOURNAL BOX
- 45. BRAKE CYLINDER
- 46. SMOKEBOX DOOR
- 47. WATER HATCH
- 48. HATCH TO OIL COMPARTMENT  
(USED WITH OIL FIRED LOCOMOTIVE)

MENT  
ENT  
AXLE



JOURNAL BOX (OUTSIDE BEARING)

LOCOMOTIVES HAVE INSIDE BEARINGS ON  
WHEELS



SECTION THRU BOILER  
Fig. 3

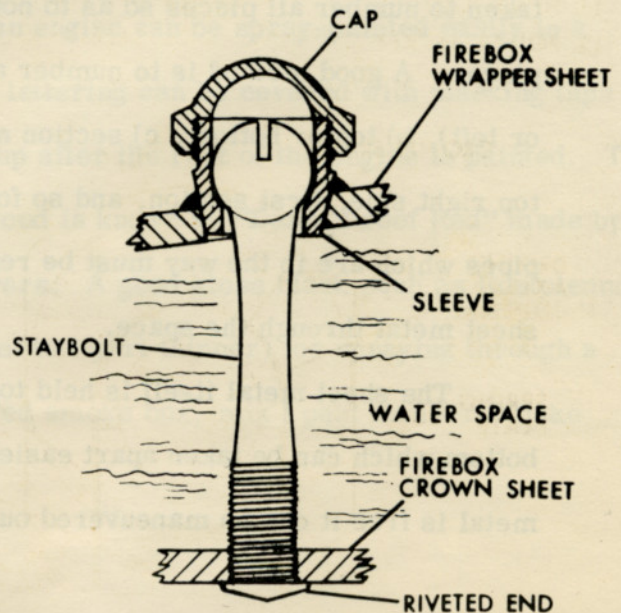
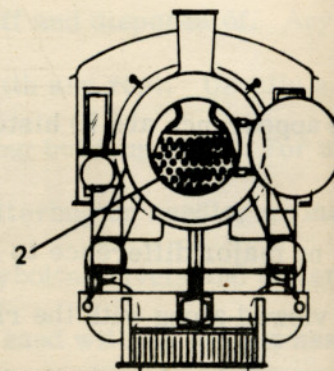
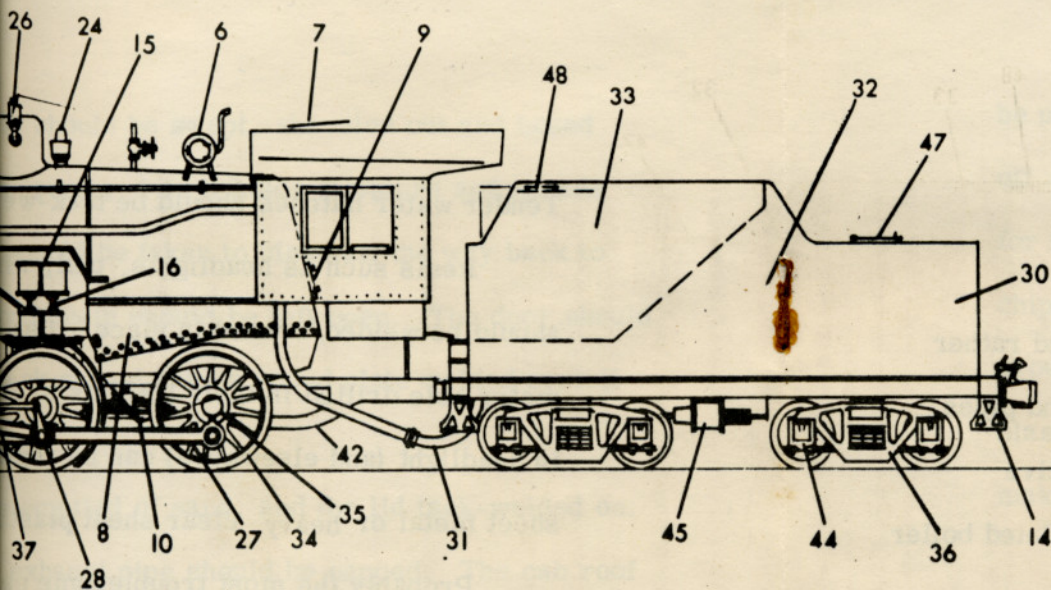


Fig. 6 FLEXIBLE TYPE STAY-BOLT  
USED IN FIREBOX





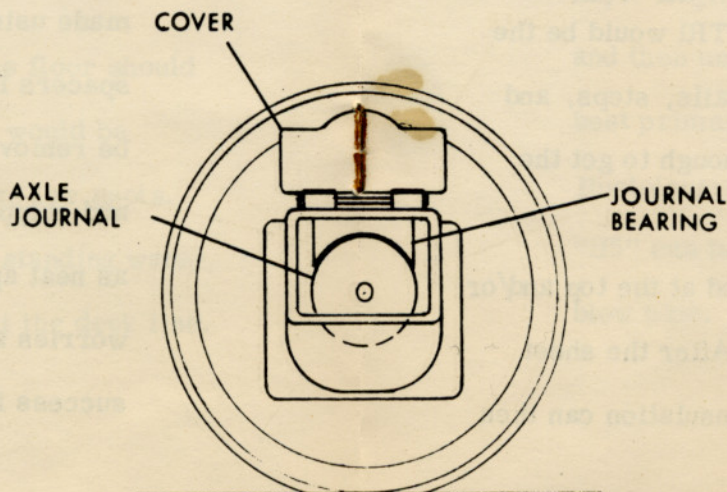
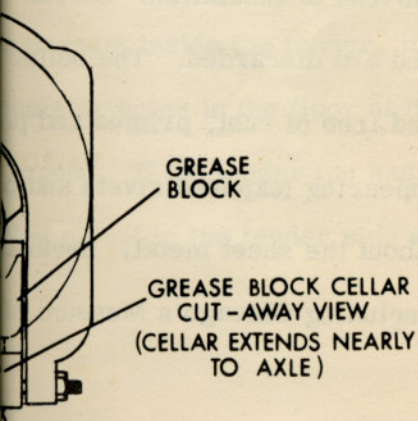
**Fig. 1**

**Fig. 2**

ANDRAILS  
 EPS  
 R COMPRESSOR  
 R COMPRESSOR PISTON  
 OSSHEAD  
 EAM CHEST  
 LINDER  
 STON ROD  
 ALVE STEM  
 R TANK  
 ELIVERY PIPE  
 AFETY VALVES

25. PILOT  
 26. WHISTLE  
 27. SIDE ROD  
 28. ECCENTRIC CRANK  
 29. SPRINGS  
 30. TENDER  
 31. TANK HOSE  
 32. WATER COMPARTMENT  
 33. COAL COMPARTMENT  
 34. DRIVER  
 35. DRIVING WHEEL AXLE  
 36. TENDER TRUCK

37. MAIN ROD  
 38. ECCENTRIC ROD  
 39. COMBINATION LEVER  
 40. RADIUS ROD  
 41. REVERSE LINK  
 42. FRAME  
 43. SAND PIPE  
 44. JOURNAL BOX  
 45. BRAKE CYLINDER  
 46. SMOKEBOX DOOR  
 47. WATER HATCH  
 48. HATCH TO OIL COMPARTMENT  
 (USED WITH OIL FIRED LOCOMOTIVE)



**JOURNAL**

**Fig. 4 JOURNAL BOX (OUTSIDE BEARING)**

MOST LOCOMOTIVES HAVE INSIDE BEARINGS ON PILOT WHEELS



problems with jacket removal are a) appearance and b) historical accuracy.

To the untrained eye, there is no major difference to be noted rather than the fact that the boiler itself is viewed along with the rivets and pipes which are ordinarily hidden. But you must be close to the locomotive before the change is evident. It might also be noted that a bare painted boiler has to look better than a rusted out jacketed boiler.

From the historical aspect, it is true that the engine has been altered from its original appearance. But once again, is a rusted out boiler jacket original? So the choice must be made between the two evils. The longer the jacket remains on, the greater the deterioration to the boiler. Although the boiler is constructed of 5/8 or 3/4-inch thick steel, it still rusts.

If it is desired that the old jacket be used as pattern, care must be taken to number all pieces so as to not lose track of the placement of the pieces. A good method is to number and initial all pieces by a) side (right or left), b) top or bottom, c) section number. Therefore, TR1 would be the top right side, first section, and so forth. Next, all handrails, steps, and pipes which are in the way must be removed or loosened enough to get the sheet metal through the space.

The sheet metal itself is held together by threaded rod at the top and/or bottom which can be taken apart easiest by cutting torch. After the sheet metal is free it can be maneuvered out and stacked. The insulation can then



be pulled off and disposed of. Any insulation which remains can be scraped off along with any rust. Usually a small chipping hammer will be sufficient for removing built-up rust. For more persistent cases, an air-powered chipper (jitterbug or needlegun) may be used. Special care must be taken around staybolts, rivets and boiler seams. Engines should not be sand-blasted as sand will not get the heavy rust and the sand gets into the bearings making it impossible to ever move the engine without damage.

After the heavy rust is removed a wire brush should be used to get the light rust after which the boiler and firebox can be primed and painted. Pipes which are covered with insulation should likewise be done.

If the boiler is to be left bare, the sheet metal can be torch-cut around handrails, etc., and discarded. The subsequent procedures are as noted above. This method is the most practical for most park engines. Once carried out, virtually all that need be done from then on is to paint the engine every so often.

Once properly prepared, an engine can be spray-painted easily in a day. Engine numbers and other lettering can be covered with masking tape and then uncovered and touched up after the rest of the engine is painted. The best primer for both steel and wood is known as "Damp Proof Red" made by Rustoleum and other manufacturers. A good gloss black such as Rustoleum "H5" can be thinned (3 parts paint to 1 part thinner) for spraying through a blow pipe. For a graphite colored smoke box, mix 1 part number 2 flake



graphite with 5 parts boiled linseed oil. This must be painted on by hand. All wood should be treated with "Penta" or "Bloxrot" liberally before painting. Paint wood by hand as it soaks up far more paint.

The machinery (moving parts) of a locomotive doesn't need much maintenance. Going through the following procedure should be sufficient. By so doing, the engines' mobility (should the need ever arise) will be assured.

Remove cotton waste or pads from all journal boxes (see Figure 4) on engine and tender. Smear grease on as much of the bearing surface of each axle as possible. On locomotives with hard grease lubrication on driving wheel axles (see Figure 5) the grease block must be pulled down by pulling on the hooks or chains from the spring plate. Grease can then be smeared along axle with a swab or a stick. Care must be taken to get grease to the back of axle.

All piston rods should be greased as well. This includes not only the main pistons but the valve stem (directly above the main piston), air pump and power reverse pistons. Crossheads should also be greased.

Cylinders should have several gallons of oil poured into them. All other machinery (rod cranks, valve gear, etc.) should be oiled freely. Oil cups should be filled and covered.

Drains on all pipes and appurtenances should be left open (air pumps, power reverse, hydrostatic lubricator, etc.).



Should the locomotive ever have to be moved, all axles should be emery-clothed free of rust before any movement is attempted. Cylinders should be kept well oiled as well as the other machinery. A knowledgeable railroad man should supervise this work.

There are many organizations which may be interested in the restoration of a locomotive as a volunteer activity. In addition to model railroad clubs, railfan groups and local railroad unions, groups such as Scouts, Junior Chambers of Commerce, Fraternities, Sororities, VFW, Lions, etc., may help in organizing a project like this. Another possibility might be operators of steam locomotives. Tourist railways and museums which operate steam locomotives have problems locating replacement parts as parts wear out. Operators might be interested in visually restoring a locomotive for the privilege of exchanging worn parts for usable parts.

It is hoped that this booklet has provided sufficient information for anyone to visually restore a display steam locomotive. Possibly a trend towards getting these engines looking decent again will begin due to this publication.

In the event that any locomotive must be disposed of, the Illinois Railway Museum will try to act as a clearing house in finding a new location for it. We will also try to recommend qualified help for restoration jobs and generally be available for consultation on any aspect of locomotive restoration.



## ABOUT THE ILLINOIS RAILWAY MUSEUM

The Illinois Railway Museum is a non-profit, educational corporation, incorporated under the laws of the State of Illinois. We are accepted as such by the State of Illinois and the Internal Revenue Service. The museum was founded in 1953 to preserve one electric interurban car. Today the museum comprises over 150 pieces of railway equipment including: 11 steam locomotives; 30 freight cars; 25 passenger cars; the entire Nebraska Zephyr Train; 14 street cars; and, 17 interurban cars, plus cabooses and work equipment.

The museum operates a one and one-half mile demonstration railway on which rides are given during most of the year. At the present time, the museum owns forty-six acres on which switch yards and buildings housing much of the equipment are located.

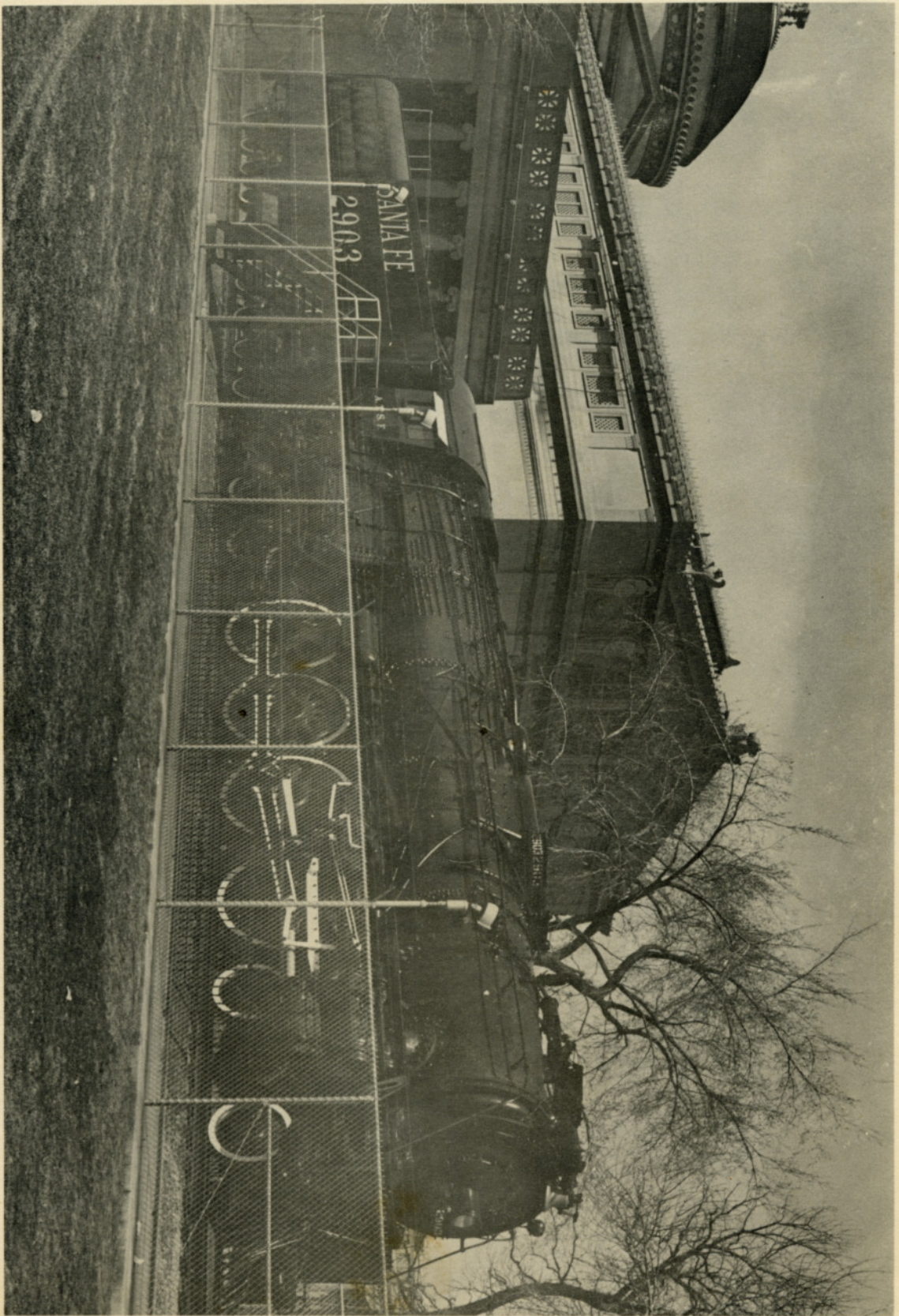
The museum is funded through the sale of rides and by contributions by individuals and corporations. It is not connected with the railway industry. All restoration, track work and operations are done by volunteer workers from all walks of life. Membership is open to anyone. Further information about the museum can be obtained by writing to

ILLINOIS RAILWAY MUSEUM

P. O. Box 431

Union, Illinois 60180







# ILLINOIS RAILWAY MUSEUM

A NOT FOR PROFIT EDUCATIONAL CORPORATION

P. O. BOX 165, UNION ILLINOIS 60180

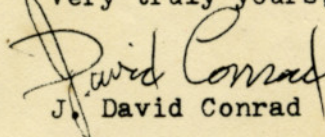
July 1974

Gentlemen:

Our records indicate that you have a steam locomotive on display. The enclosed booklet is provided free of charge as an educational service. It deals primarily with the care of locomotives on display. Please file it for future reference or forward it to the proper agency.

Thank you.

Very truly yours,

  
J. David Conrad

Supt. Motive Power