

JNR C62  
LIVE STEAM  
OPERATING & ASSEMBLY  
INSTRUCTIONS

## PREFACE

The JNR C62 4-6-4 type locomotives, the most famous JNR steam locomotives, were born of the redesign of D51 2-8-2-type locomotives, which were the best known JNR freight locomotives, too. The Mikado type, suitable for freight was modified to the Hudson type as the most suitable for express passenger trains, because the freight priority policy of the war period was changed to a passenger priority policy post war.

The C 62 class served on the main line of the JNR, such as the Tokaido (Tokyo-Osaka), Sanyo, etc. on express passenger trains; while the D51s were used mostly for freight service all over Japan. They recorded the maximum speed of 129 km/h. We, the Japanese, cannot forget their noble proportions, with the large drivers of 1,750 mm and a length 21.5 m, at the head of the famous express trains "TSUBAME"(Swallows) on the Tokaido line. They became the last express passenger locomotives of the JNR.

## SPECIFICATIONS

|                   |                                                                                                                                             |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| Scale/Gauge       | 1/30, 45 mm                                                                                                                                 |
| Sizes Length      | 726.5 mm                                                                                                                                    |
| Width             | 102 mm                                                                                                                                      |
| Height            | 132 mm                                                                                                                                      |
| Net Weight        | 7.2 kg.                                                                                                                                     |
| Wheel Arrangement | 2 C 2 (4-6-4, 232), Hudson                                                                                                                  |
| Drivers,          | Dia. 58 mm, Box Center Drivers made of stainless steel with ball bearings on axles and connecting rods. Equolizer spring action.            |
| Cylinders         | Two Cylinders, Bore 15 mm x Stroke 20 mm                                                                                                    |
| Valve Gears       | Walschaerts' with Reversing Lever                                                                                                           |
| Boiler Type       | Locomotive Type with 6 smoke tubes.                                                                                                         |
| Capacity          | 400 ml                                                                                                                                      |
| Fittings          | 2 x Safety Valves, Regulator, Blower Valve, Check Valve, Whistle Valve, Water Gauge, Pressure Gauge, Blowdown Valve.                        |
| Firebox Area      | 64 mm x 47 mm                                                                                                                               |
| Lubricator        | Axle Driven Mechanical Lubricator                                                                                                           |
| Fuel              | Hard Charcoal                                                                                                                               |
| Tender Water Tank | Capacity : 800 ml                                                                                                                           |
| Feed Pumps        | 1) Water Feed Hand Pump (Cylinder Bore 10 mm x Ram Stroke 16 mm)<br>2) Axle Driven Mechanical Pump (Bore 5 mm x Stroke 6 mm), By-Pass Valve |

\* Subject to change without notice.

PREPARATION

- 1) Tools for driving : A Kettle, Gloves, Watery rags, Measuring Cups, Shovel or Scoop, Electric Suction Fan, Rakes,
  - 2) Fuel : Hard Charcoal (to be broken into pieces the size of a finger nail)
  - 3) Water : Distilled water or city water without foreign materials.
  - 4) Lubricating Oil : Steam Cylinder Oil (Oil for a motor car is not sufficiently viscous but it can be a substitute.)
- PRECAUTION

As the locomotive burns charcoal and use lubricating oil, lay the track out of doors for fire prevention. A bucketful of water, watery rags, etc. should always be handy. When it is windy, never drive the locomotive.

DRIVING PROCEDURE

- 1) The track should be layed out as flat as possible. Whether the locomotive can run beautifully or not depends on the condition of the tracks. Especially, this locomotive, C62, has a strong tractive force, and can haul an adflat the back of the tender. The track should be firm enough for safe and smooth running.
  - 2) Apply oil to the moving parts such as cranks, rods, axles, bearings, etc.
  - 3) Fill the tender water tank with clean water and force water into the boiler by the pump till the water gauge indicates 2/3. Then, refill the tank with water to a proper level.
  - Note: If hot water is used, the fuel would be saved and steam would be raised more quickly.
  - 4) Fill the oil tank with steam cylinder oil. (The oil should be heavy with proper grade.)
  - 5) Close the regulator and blower valve. Set the reversing lever in mid gear (neutral position).
  - 6) Install the suction fan in the chimney and drive the fan. Put a paper or thin wooden sticks into the firebox and ignite fire. (Refer to Steam Raising by Locomotive Boiler.)
- When the pressure gauge indicates 1 kg/cm<sup>2</sup>, remove the fan and release the blower valve to raise steam further by its own blowing. As pressure goes up, the blowing sounds are becoming stronger. Adjust the blower valve by experience in order to save extra steam consumption.
- When the boiler pressure becomes 4 kg/cm<sup>2</sup>, start to drive.

- 7) As drain coks are not provided, push the locomotive forward to expell the condensed water in the cylinders (drain), adjusting the reverser.
- Note: The condensed water out of the chimney is hot and containing oil. Be careful not to splash the hot jet from the chimney over the bystandars and their clothes, the track and the engine.
- 8) Confirming the pressure is 4 kg/cm<sup>2</sup> by the gauge, open the regulator. Then, the locomotive start to run to the direction of the reversing lever.

- 9) With the By-Pass Valve closed, the axle driven mechanical pump can feed water automatically into the boiler during running. If the By-Pass Valve is properly adjusted, water in the boiler can be kept in constant or slowly decreasing.



- 10) When water is forced into the boiler by the hand pump, slowly pump water into the boiler with the regulator closed and the blower valve opened so that the pressure in the boiler will not be lower than  $1 \text{ kg/cm}^2$ .
- 11) Charcoal is to be supplied into the firebox occasionally when necessary, falling down the ashes.
- 12) The running direction can be switched by the reversing lever.
- 13) Whistling consumes a lot of steam. It would be better not to make whistling so often.

## MAINTENANCE

- As the locomotive after driving is stained with oil, water, dusts, ashes, etc., clean them out.
- 1) Blow down water in the barrel.
  - Open the blowdown valve and the regulator. Rotate the drivers.
  - 2) Water in the tender water tank should be poured out of the filling orifice.
  - 3) Oil in the oil tank is syphoned out.
  - 4) Open the smokebox door and clean the smoke tubes with the brush. Ashes in the firebox and smoke tubes should be cleaned.
  - 5) Check if there is any loosen screw or nut. If any, tighten them.
  - 6) After cleaning the dusts, oil, water, etc., apply oil to the moving parts.

## STEAM RAISING IN THE CHARCOAL BURNING LOCOMOTIVE BOILER

Aster Model JNR C62 is provided with the loco type boiler. A locomotive boiler can burn oil, and liquified gas, etc.. However, the interest in burning solid fuel such as coal and charcoal may excel that of the others by far. Even with the C62, of which the firebox is wide, the grate area is as small as  $64 \text{ mm} \times 47 \text{ mm}$ , and the diameter of firehole is only  $20 \text{ mm}$ . When low quality house coal is burnt in such a small firebox, the smoke tubes are very soon choked, and ember is formed on the fire grate. Thus, the fire becomes weak and the locomotive will not run. If good Welsh steam coal is not available, anthracite can be used or hard charcoal, called "Bincho" in Japan. With hard charcoal as the main fuel, the fire will burn adequately. If a little coal is added to the charcoal, you can enjoy the smoke and smell of coal.

The charcoal should be broken into pieces the size of a finger nail. Too small pieces will fall through the grate. For steam raising and driving, several tools are required, as illustrated. It is not easy to light the fire on very hard charcoal, Bincho, and there are several methods. First, there is the method using a blow lamp burner for marine boilers.

Place the charcoal evenly to about  $2 \text{ cm}$  height in the firebox. Ignite the blow lamp burner and put a suction fan in the chimney. Blow the underside of the charcoal as well as heating the boiler. Even though the surface of the charcoal becomes red, when the burner stops, the charcoal will become black again soon. Blow both the charcoal and the boiler till the pressure approaches about  $1 \text{ kg/cm}^2$ . Then shut the firehole door and open the blower valve. The red charcoal burns more strongly with the locomotive's blower. When new charcoal is added, it will crackle. The colour of the fire becomes yellow and combustion is excellent. The pointer of the pressure gauge moves up and the safety valves begin to release steam.

The firebox door should be shut except when stoking charcoal and checking the fire.

The intensity of fire with solid fuel is not constant as with liquid fuel such as alcohol. Just after stoking, the fire decreases, being covered by the new black charcoal. Once the new charcoal begins to burn, the fire improves. This cycle gives us the pleasure of cleaning the fire ashes from the ashpans, feeding the fire steam raising by the blower, refueling



always maintained in a ready-to-run condition. When the fire is put out, separate the engine from the tender. In case of an alcohol-fired engine, empty the water in the tank and then, put back the remaining alcohol into an alcohol bottle. In a solid fuel engine, first, put back the charcoal left unburnt and then, pour out the water. In the locomotive type boiler, turn the firegrate upside down to drop the remaining charcoal by inserting a rake through the firehole. Open the ashpan door and take out the charcoal for re-use. Open the smokebox door and clean the smokestacks and smokebox by a flue brush, as illustrated. Water in the barrel is poured out through the plug. As the driving parts are mostly made of steel, clean them with dry rags and coat them with oil, using oily rags to prevent rust. Check if screws are missing or loose, and if the pipe connections are in good order.

water, etc. as well as running the locomotive. In starting the fire without using a blow lamp burner, make an extension tube which fits the chimney liner, as illustrated, to which a belows is connected by a hose, since the Aster electric fan may not create a strong enough draught to start the solid fuel fire. Light the small pieces of charcoal on a cooking stove. Shovel the lighted charcoal into the firebox and work the bellows. Till steam is raised, use soft charcoal which burns easily, and then use the hard charcoal "Bincho". Experienced drivers can light the fire without using a cooking stove. They use chips of wood soaked with paraffin on top of the soft charcoal in the firebox with sufficient draught. Then follow with the hard charcoal once the steam is raised enough. After enjoying the driving, clean the engine and tighten any loose parts, so that the engine is

# P A R T S L I S T

| NO. | N A M E                     | Q'TY | NO. | N A M E                       | Q'TY   |
|-----|-----------------------------|------|-----|-------------------------------|--------|
| 1   | Main Frame (R)              | 1    | 38  | Leading Coupled Drivers       | 1 Pair |
| 2   | Main Frame (L)              | 1    | 39  | Main Coupled Drivers          | 1 Pair |
| 3   | Drag Beam                   | 2    | 40  | Trailing Coupled Drivers      | 1 Pair |
| 4   | Front Buffer Beam           | 1    | 41  | Horn Stay                     | 6      |
| 5   | Front Buffer Beam           | 1    | 42  | Coupling Rod (L)              | 1      |
| 6   | No.1 Stretcher              | 1    | 43  | Coupling Rod (R)              | 1      |
| 7   | No.2 Stretcher              | 1    | 44  | Return Crank                  | 2      |
| 8   | No.3 Stretcher              | 1    | 45  | Return Crank Retaining Screw  | 2      |
| 9   | Bogie Bolster               | 1    | 46  | Leading Crank Pin Collar      | 2      |
| 10  | Trailing Truck Bolster      | 1    | 47  | Ram Gudgeon Pin               | 1      |
| 11  | Equalizer                   | 4    | 48  | Steam Chest Cover             | 2      |
| 12  | Equalizer Bracket           | 4    | 49  | Steam Chest Packing           | 4      |
| 13  | Equalizer Pivot Pin         | 4    | 50  | Slide Valve Block             | 2      |
| 14  | Delivery Elbow              | 1    | 51  | Slide Valve                   | 2      |
| 15  | M6 Lock Nut                 | 3    | 52  | Steam Chest                   | 2      |
| 16  | 1/4 Stainless Steel Ball    | 6    | 53  | Valve Spindle                 | 2      |
| 17  | Axle Driven Pump Body       | 1    | 54  | Valve Spindle Gland Nipple    | 2      |
| 18  | Suction Elbow               | 1    | 55  | Valve Spindle Crosshead (L)   | 1      |
| 19  | 1/5 O Ring                  | 1    | 56  | Stud                          | 8      |
| 20  | Ram                         | 1    | 57  | Graphited Yarn                | 1      |
| 21  | Bogie Truck Center Pin      | 1    | 58  | Tail Rod                      | 2      |
| 22  | Leaf Spring Buckle          | 6    | 59  | Tail Rod Guide                | 2      |
| 23  | Leaf Spring (1)             | 12   | 60  | Front Cylinder Cover          | 2      |
| 24  | " "                         | 12   | 61  | Cylinder Packing              | 4      |
| 25  | " "                         | 12   | 62  | Cylinder Block                | 2      |
| 26  | " "                         | 12   | 63  | Rear Cylinder Cover           | 2      |
| 27  | " "                         | 12   | 64  | Rear Cylinder Cover           | 2      |
| 28  | " "                         | 12   | 65  | Piston Rod Gland Nipple       | 2      |
| 29  | " "                         | 12   | 66  | Crosshead (L)                 | 1      |
| 30  | Spring Hunger (1)           | 4    | 67  | Crosshead (R)                 | 1      |
| 31  | Spring Hunger (2)           | 8    | 68  | Crosshead Backplate           | 2      |
| 32  | Leaf Spring Center Reatiner | 6    | 69  | Sliding Plate                 | 4      |
| 33  | Spring Hunger Screw         | 12   | 70  | Valve Spindle Crosshead (R)   | 1      |
| 34  | Spring Hunger Pin           | 12   | 71  | Slide Bar                     | 2      |
| 35  | Spring Pin                  | 4    | 72  | Steam Chest Front Cover       | 2      |
| 36  | Coil Spring                 | 12   | 73  | Valve Spindle Crosshead Guide | 2      |
| 37  | Spring Pin Block            | 4    | 74  | Expansion Link (R)            | 1      |
|     |                             |      | 75  | Spacer                        | 4      |

| NO. | N A M E | Q'TY | NO. | N A M E | Q'TY |
|-----|---------|------|-----|---------|------|
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|    |        |   |     |                     |   |
|----|--------|---|-----|---------------------|---|
| 75 | Spacer | 4 | 115 | Smokebox Saddle (R) | 1 |
|----|--------|---|-----|---------------------|---|

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|----|-----------|---|-----|-------------------|---|
| 76 | Die Block | 2 | 116 | Eccentric Rod (L) | 1 |
|----|-----------|---|-----|-------------------|---|

|    |                                                       |   |     |                   |   |
|----|-------------------------------------------------------|---|-----|-------------------|---|
| 77 | Radius Rod,Combination Lever,<br>Union Link, Assembly | 2 | 117 | Eccentric Rod (R) | 1 |
|----|-------------------------------------------------------|---|-----|-------------------|---|

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|----|-----------------------|---|-----|------------------|---|
| 78 | Running Board Bracket | 1 | 118 | Return Crank Pin | 2 |
|----|-----------------------|---|-----|------------------|---|

|    |                             |   |     |                 |   |
|----|-----------------------------|---|-----|-----------------|---|
| 79 | Valve Spindle Crosshead Pin | 2 | 120 | Bogie Stretcher | 1 |
|----|-----------------------------|---|-----|-----------------|---|

|    |                  |   |     |             |   |
|----|------------------|---|-----|-------------|---|
| 80 | Motion Plate (L) | 1 | 121 | Bogie Frame | 2 |
|----|------------------|---|-----|-------------|---|

|    |                  |   |     |                |   |
|----|------------------|---|-----|----------------|---|
| 81 | Motion Plate (R) | 1 | 122 | Guard Iron (R) | 1 |
|----|------------------|---|-----|----------------|---|

|    |             |   |     |                |   |
|----|-------------|---|-----|----------------|---|
| 82 | Lifting Arm | 1 | 123 | Guard Iron (L) | 1 |
|----|-------------|---|-----|----------------|---|

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|----|------------------|---|-----|-----------|---|
| 83 | Lifting Link Pin | 6 | 124 | Pivot Pin | 1 |
|----|------------------|---|-----|-----------|---|

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|----|-----------------------|---|-----|---------------|---|
| 84 | Crosshead Gudgeon Pin | 2 | 125 | Spring Holder | 1 |
|----|-----------------------|---|-----|---------------|---|

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|----|--------------------|---|-----|--------------------------|---|
| 85 | Connecting Rod (R) | 1 | 126 | Side Control Leaf Spring | 2 |
|----|--------------------|---|-----|--------------------------|---|

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|----|----------------------------|---|-----|--------------------|---|
| 86 | Ball Bearing (ø7 x ø4 x 2) | 2 | 127 | Bogie Truck Spring | 1 |
|----|----------------------------|---|-----|--------------------|---|

|    |                    |   |     |                          |   |
|----|--------------------|---|-----|--------------------------|---|
| 87 | Connecting Rod (L) | 1 | 128 | Trailing Truck Frame (L) | 1 |
|----|--------------------|---|-----|--------------------------|---|

|    |                        |   |     |                                 |   |
|----|------------------------|---|-----|---------------------------------|---|
| 88 | Motion Plate Stretcher | 1 | 129 | Trailing Truck Inside Frame (L) | 1 |
|----|------------------------|---|-----|---------------------------------|---|

|    |                    |   |     |                          |   |
|----|--------------------|---|-----|--------------------------|---|
| 89 | Expansion Link (L) | 1 | 130 | Trailing Truck Frame (R) | 1 |
|----|--------------------|---|-----|--------------------------|---|

|    |                       |   |     |                                 |   |
|----|-----------------------|---|-----|---------------------------------|---|
| 90 | Running Board Bracket | 1 | 131 | Trailing Truck Inside Frame (R) | 1 |
|----|-----------------------|---|-----|---------------------------------|---|

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|----|------------------------------|---|-----|--------------------------------|---|
| 91 | Exhaust Extension Pipe Screw | 2 | 132 | Trailing Truck Leaf Spring Pin | 8 |
|----|------------------------------|---|-----|--------------------------------|---|

|    |             |    |     |                |   |
|----|-------------|----|-----|----------------|---|
| 92 | M5 Lock Nut | 13 | 133 | Spring Pin Nut | 8 |
|----|-------------|----|-----|----------------|---|

|    |                                |   |     |                         |   |
|----|--------------------------------|---|-----|-------------------------|---|
| 93 | Exhaust T Pipe Extension Screw | 1 | 134 | Trailing Truck Axle Box | 4 |
|----|--------------------------------|---|-----|-------------------------|---|

|    |                              |   |     |                      |   |
|----|------------------------------|---|-----|----------------------|---|
| 94 | Steam T Pipe extension Screw | 2 | 135 | Axle Box Coil Spring | 4 |
|----|------------------------------|---|-----|----------------------|---|

|    |                |   |     |                          |   |
|----|----------------|---|-----|--------------------------|---|
| 95 | Steam Manifold | 1 | 136 | Trailing Truck Horn Stay | 4 |
|----|----------------|---|-----|--------------------------|---|

|    |          |   |     |                       |        |
|----|----------|---|-----|-----------------------|--------|
| 96 | Oil Tank | 1 | 137 | Trailing Truck Wheels | 2 pair |
|----|----------|---|-----|-----------------------|--------|

|    |               |   |     |                              |   |
|----|---------------|---|-----|------------------------------|---|
| 97 | Pump Cylinder | 1 | 138 | Trailing Truck Rear End Beam | 1 |
|----|---------------|---|-----|------------------------------|---|

|    |              |   |     |                                |   |
|----|--------------|---|-----|--------------------------------|---|
| 98 | Oil Pump Ram | 1 | 139 | Trailing Truck Coil Spring Pin | 2 |
|----|--------------|---|-----|--------------------------------|---|

|    |            |   |     |                            |   |
|----|------------|---|-----|----------------------------|---|
| 99 | ø5 Packing | 9 | 140 | Trailing Truck Coil Spring | 3 |
|----|------------|---|-----|----------------------------|---|

|     |                      |   |     |                               |   |
|-----|----------------------|---|-----|-------------------------------|---|
| 100 | Oil Check Valve Body | 1 | 141 | Trailing Truck Front End Beam | 1 |
|-----|----------------------|---|-----|-------------------------------|---|

|     |                               |   |     |                          |   |
|-----|-------------------------------|---|-----|--------------------------|---|
| 101 | Tender Bogie Truck Center Pin | 2 | 142 | Trailing Truck Pivot Pin | 1 |
|-----|-------------------------------|---|-----|--------------------------|---|

|     |                   |   |     |                   |   |
|-----|-------------------|---|-----|-------------------|---|
| 102 | Ball Valve Spring | 1 | 143 | Locomotive Boiler | 1 |
|-----|-------------------|---|-----|-------------------|---|

|     |                  |   |     |                 |   |
|-----|------------------|---|-----|-----------------|---|
| 103 | Chccl Valve Plug | 1 | 144 | Manifold Header | 1 |
|-----|------------------|---|-----|-----------------|---|

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|-----|---------------------|---|-----|------------------|---|
| 104 | Crank Shaft Bearing | 1 | 145 | Manifold Packing | 1 |
|-----|---------------------|---|-----|------------------|---|

|     |              |   |     |                   |   |
|-----|--------------|---|-----|-------------------|---|
| 105 | Check Spring | 1 | 146 | Manifold End Plug | 1 |
|-----|--------------|---|-----|-------------------|---|

|     |            |   |     |             |   |
|-----|------------|---|-----|-------------|---|
| 106 | Crank Disk | 1 | 147 | M4 Lock Nut | 1 |
|-----|------------|---|-----|-------------|---|

|     |                   |   |     |                               |   |
|-----|-------------------|---|-----|-------------------------------|---|
| 107 | Eccentric Rod Pin | 2 | 148 | Whistle Valve Connecting Pipe | 1 |
|-----|-------------------|---|-----|-------------------------------|---|

|     |                |   |  |       |   |
|-----|----------------|---|--|-------|---|
| 108 | One Way Clutch | 1 |  | Screw | 1 |
|-----|----------------|---|--|-------|---|

|     |             |   |     |                      |   |
|-----|-------------|---|-----|----------------------|---|
| 109 | Driving Arm | 1 | 149 | Whistle Valve Spring | 1 |
|-----|-------------|---|-----|----------------------|---|

|     |             |   |     |                          |   |
|-----|-------------|---|-----|--------------------------|---|
| 110 | Crank Shaft | 1 | 150 | Regulator Flange Packing | 1 |
|-----|-------------|---|-----|--------------------------|---|

|     |                   |   |     |                    |   |
|-----|-------------------|---|-----|--------------------|---|
| 111 | Oil Tank Retainer | 1 | 151 | Whistle Valve Body | 1 |
|-----|-------------------|---|-----|--------------------|---|

|     |                |   |     |          |   |
|-----|----------------|---|-----|----------|---|
| 112 | Oil Pipe Union | 1 | 152 | Push Pin | 1 |
|-----|----------------|---|-----|----------|---|

|     |              |   |     |                          |   |
|-----|--------------|---|-----|--------------------------|---|
| 113 | Oil Tank Lid | 1 | 153 | Whistle Valve Push Lever | 1 |
|-----|--------------|---|-----|--------------------------|---|

|     |                     |   |     |                        |   |
|-----|---------------------|---|-----|------------------------|---|
| 114 | Smokebox Saddle (L) | 1 | 154 | Blower Connecting Pipe | 1 |
|-----|---------------------|---|-----|------------------------|---|



| NO. | N A M E | Q'TY | NO. | N A M E | Q'TY |
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|     |                           |    |     |                                |   |
|-----|---------------------------|----|-----|--------------------------------|---|
| 155 | Blower Valve Body         | 1  | 195 | Smokebox Front Plate           | 1 |
| 156 | Pressure Gauge Pipe       | 1  | 196 | Smokebox Door Handrail         | 1 |
| 157 | Pressure Gauge            | 1  | 197 | Smokebox Door Handrail         | 1 |
| 158 | Water Gauge Upper Fitting | 1  | 198 | Smokebox door                  | 1 |
| 159 | Water Gauge Cap           | 1  | 199 | Smokebox Door Retaining Screw  | 1 |
| 160 | ø7 Packing                | 2  | 200 | Smokebox Door Grip             | 1 |
| 161 | Gauge Glass Lock Nut      | 2  | 201 | Retaining Dummy Handle         | 1 |
| 162 | Gauge Glass               | 1  | 202 | Retaining Screw Wheel          | 1 |
| 163 | Blower Pipe Nozzle        | 1  | 203 | Number Plate                   | 1 |
| 164 | Water Gauge Lower Fitting | 1  | 204 | Firebox Cleading               | 1 |
| 165 | Check Valve               | 2  | 205 | Dummy Generator                | 1 |
| 166 | Firedoor                  | 1  | 206 | Dummy Strainer                 | 1 |
| 167 | Stay Nipple               | 2  | 207 | Dummy Boiler Cleaner           | 1 |
| 168 | Longitudinal Stay         | 1  | 208 | Handrail                       | 2 |
| 169 | Regulator Handle          | 1  | 209 | Ashpan                         | 1 |
| 170 | Regulator Gland Nut       | 1  | 210 | Firegrate                      | 1 |
| 171 | Regulator                 | 1  | 211 | Boiler Retaining Angle         | 1 |
| 172 | Super Heater Header       | 1  | 212 | Firebox Spacer Ring            | 1 |
| 173 | Steam Inlet               | 1  | 213 | Boiler Spacer Ring             | 2 |
| 174 | Super Heater              | 1  | 214 | Smokebox Spacer Ring           | 1 |
| 175 | Blower Needle Valve       | 1  | 215 | M6 Lock Nut                    | 1 |
| 176 | M6 union Nut              | 1  | 216 | By-pass Valve Union            | 1 |
| 177 | Firedoor Hinge Pin        | 1  | 217 | By-pass Valve Body             | 1 |
| 178 | Boiler Cleading           | 1  | 218 | M5 Gland Nut                   | 1 |
| 179 | Regulator Bell Crank      | 1  | 219 | By-pass Valve Handle           | 1 |
| 180 | Handrail Knob             | 18 | 220 | Axle Driven Pump Suction Pipe  | 1 |
| 181 | Steam Dome and Sandbox    | 1  | 221 | Axle Driven Pump Delivery Pipe | 1 |
| 182 | Dummy Whistle             | 1  | 222 | Whistle Retaining Plate        | 1 |
| 183 | Sandbox Lid               | 2  | 223 | Steam Whistle                  | 1 |
| 184 | Dummy Check Valve         | 1  | 224 | Whistle Steam Pipe (A)         | 1 |
| 185 | Step                      | 1  | 225 | Whistle Steam Pipe (B)         | 1 |
| 186 | Boiler Band               | 7  | 226 | Hand Pump Elbow                | 1 |
| 187 | Smokebox Crossbar         | 1  | 227 | Cab Retaining Plate            | 1 |
| 188 | Chimney                   | 1  | 228 | Cab Front Plate                | 1 |
| 189 | Chimney Base              | 1  | 229 | Reversing Lever                | 1 |
| 190 | Chimney Square Washer     | 1  | 230 | Spacer                         | 2 |
| 191 | Petticoat                 | 1  | 231 | Pin (ø1.2 x 6) Sprit Pin       | 1 |
| 192 | Smokebox                  | 1  | 232 | Lever Latch                    | 1 |
| 193 | Head Light                | 1  | 233 | Trigger (or Latch Handle)      | 1 |
| 194 | Smokebox Door Hinge Pin   | 2  | 234 | Latch Guide Screw              | 1 |

| NO. | N A M E                          | Q'TY | NO. | N A M E                                       | Q'TY |
|-----|----------------------------------|------|-----|-----------------------------------------------|------|
| 235 | Latch Spring                     | 1    | 275 | Uncoupling Shaft Bracket(R)                   | 1    |
| 236 | Stand                            | 1    | 276 | Uncoupling Shaft Bracket (L)                  | 1    |
| 237 | Lever Fulcrum                    | 1    | 277 | Uncoupling Shaft                              | 1    |
| 238 | Lever Quadrant (or Sector Plate) | 1    | 278 | Chain                                         | 1    |
| 239 | Reach Rod End Piece (A)          | 1    | 279 | Dummy Economizer                              | 1    |
| 240 | Reach Rod                        | 1    | 280 | Air Hose                                      | 1    |
| 241 | Reach Rod End Piece (B)          | 1    | 281 | Oil Pump Driving Rod                          | 1    |
| 242 | Reversing Arm Cover              | 1    | 282 | Brake Hanger Bracket                          | 6    |
| 243 | Running Board (L)                | 1    | 283 | Hanger Spacer (Long)                          | 2    |
| 244 | Running Board (R)                | 1    | 284 | Hanger Spacer (Short)                         | 4    |
| 245 | Running Board (on Cylinder)      | 2    | 285 | Brake Cross Rod                               | 3    |
| 246 | Front Deck                       | 1    | 286 | Brake Pull Rod                                | 2    |
| 247 | Cylinder Lagging                 | 2    | 287 | Brake Shoe & Hanger                           | 6    |
| 248 | Smoke Deflector (L)              | 1    | 288 | Water Feed Pump Cylinder                      | 1    |
| 249 | Smoke Deflector (R)              | 1    | 289 | Cylinder Packing                              | 1    |
| 250 | Step                             | 2    | 290 | Valve Box                                     | 1    |
| 251 | Lubricator Casing                | 1    | 291 | Valve Box Plug                                | 1    |
| 252 | Cooling Pipe (R)                 | 1    | 292 | Suction Valve                                 | 1    |
| 253 | Dummy Boiler Water Cleaner       | 1    | 293 | Link                                          | 2    |
| 254 | Dummy Water Feed Pump            | 1    | 294 | Ram                                           | 1    |
| 255 | Cab Step                         | 2    | 295 | ø10 O ring                                    | 1    |
| 256 | Air Reservoir (R)                | 1    | 296 | Lever                                         | 1    |
| 257 | Air Reservoir (L)                | 1    | 297 | Pin                                           | 3    |
| 258 | Dummy Power Reverse Gear         | 1    | 298 | Extension Handle                              | 1    |
| 259 | Cooling Pipe (L)                 | 1    | 299 | Tender Truck Frame                            | 4    |
| 260 | Compressor Retaining Plate       | 1    | 300 | Tender Wheels                                 | 4    |
| 261 | Dummy Compressor                 | 1    | 301 | End Beam                                      | 4    |
| 262 | Dummy Pressure Governor          | 1    | 302 | Center Bolster                                | 2    |
| 263 | ø2 Copper Wire                   | 1    | 303 | Bearing                                       | 8    |
| 264 | Safety Valve                     | 2    | 304 | Bearing Spring Pin                            | 8    |
| 265 | Blowdown Plug                    | 1    | 305 | Tender Water Tank                             | 1    |
| 266 | Cab                              | 1    | 306 | Pipe Nipple                                   | 3    |
| 267 | Number Plate                     | 3    | 307 | Delivery Union for Hand Pump                  | 1    |
| 268 | Separable Roof                   | 1    | 308 | Delivery & Suction Union for axle driven pump | 2    |
| 269 | Regulator Pull Rod               | 2    | 309 | Hand Pump Delivery Pipe                       | 1    |
| 270 | Drawbar                          | 1    | 310 | Return Tube                                   | 1    |
| 271 | Drawbar Pin                      | 1    | 311 | Return Tube Orifice                           | 1    |
| 272 | Coupler Drawhead                 | 1    | 312 | Orifice Holder                                | 1    |
| 273 | Coupler                          | 1    | 313 | Drawbar Pin                                   | 1    |
| 274 | Coupler Pin                      | 1    |     |                                               |      |

| NO. | N A M E              | Q'TY | NO. | N A M E                   | Q'TY |
|-----|----------------------|------|-----|---------------------------|------|
| 314 | Drawbar Pin Spring   | 1    | 324 | Coupler Drawhead          | 1    |
| 315 | Dummy Brake Cylinder | 1    | 325 | Coupler Pin               | 1    |
| 316 | Coal Gate            | 1    | 326 | Coupler                   | 1    |
| 317 | Coal Plate           | 1    | 327 | Tender Step (R)           | 1    |
| 318 | Coal Plate Packing   | 1    | 328 | Coupler Spring            | 2    |
| 319 | Water Filler         | 1    | 329 | Reinforce Coil Spring     | 1    |
| 320 | Filler Lid           | 1    | 330 | Delivery Hose Union Screw | 1    |
| 321 | Filler Hinge Pin     | 1    | 331 | Delivery Hose Union (1)   | 1    |
| 322 | Tender Handrail      | 1    | 332 | Delivery Hose Union (2)   | 1    |
| 323 | Tender Step          | 1    | 333 | Cilicone Tube             | 1    |

# TOOLS INCLUDED

|   |                                  |
|---|----------------------------------|
| 2 | (-) Screw Driver                 |
| 1 | Box Spanner <i>Hydraulic</i>     |
| 1 | Brush                            |
| 1 | Scoop (or Shovel)                |
| 1 | Spanners                         |
| 1 | Cylinder Oil                     |
| 1 | Packing Paste                    |
| 1 | Ornamental Rail <i>Edwile</i>    |
| 4 | Ornamental Sleeper <i>Edwile</i> |

# SCREWS & NUTS

## (1) Flat Head Screws

|     |           |
|-----|-----------|
| B2  | M1.7 x 3  |
| B4  | M2 x 4    |
| B5  | M2.6 x 4  |
| B7  | M1.7 x 6  |
| B9  | M2 x 8    |
| B10 | M2 x 6    |
| B17 | M2 x 10   |
| B29 | M2.3 x 6  |
| B30 | M2.3 x 14 |
| B31 | M2.3 x 12 |
| B23 | M2 x 3    |
| B27 | M2.3 x 8  |
| B28 | M2.3 x 16 |

## (2) Nut

|    |      |
|----|------|
| N1 | M2   |
| N2 | M2.3 |
| N3 | M2.6 |
| N4 | M3   |
| N5 | M4   |
| N6 | M1.7 |

## (3) E-Clip

|    |      |
|----|------|
| E1 | ø1.2 |
| E2 | ø4   |
| E3 | ø5   |
| E6 | ø1.5 |
| E7 | ø2.5 |
| E5 |      |

## MAIN FEATURES

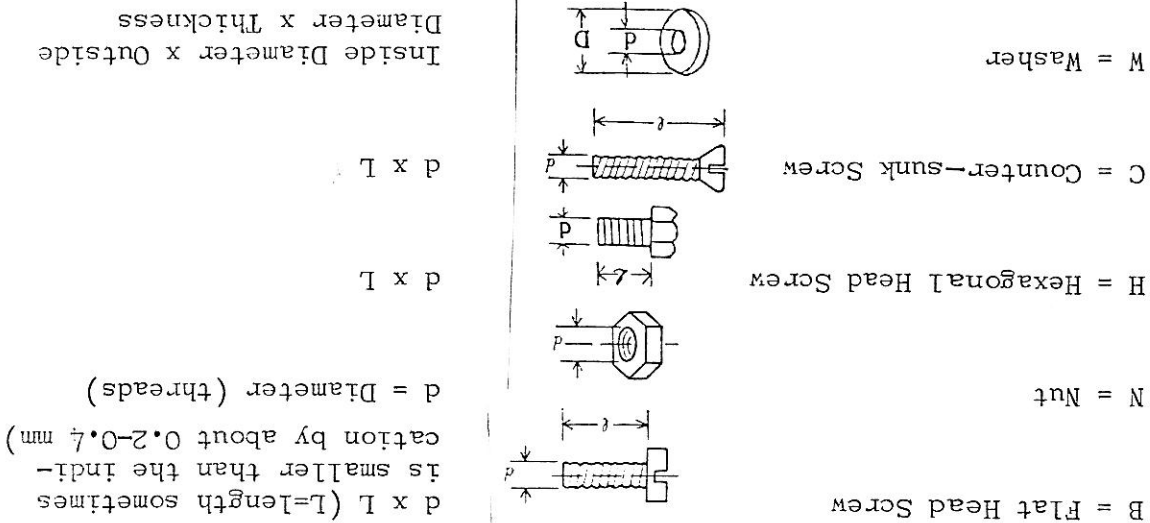
- \* Frames are made of brass casting. Drivers, connecting and coupling rods are made of stainless steel strong at wearing and rusting.
- \* Radial ball bearings are used on drivers axles, connecting and coupling rods. An adult may be hauled.
- \* Equolizer spring action drivers ensure smooth and safe running.
- \* Axle driven mechanical lubricator and feed water pump are provided.
- \* A feed water hand pump is installed in the tender, too.
- \* A reversing lever for ease of driving is in the cab.

- \* The boiler made of copper, silver-soldered through out, is locomotive type and is tested at  $10 \text{ kg/cm}^2$ . A blowdown plug is attached for ease of blowing off water and cleaning.
- \* A workable whistle is installed under the frame.

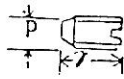
## NOTES BEFORE ASSEMBLY

- \* This instruction booklet is used together with the illustrations booklet.
- \* Screws and nuts are included in extra quantities. Extra ones to be kept for maintenance.
- \* Packing solution will become solid in a day, reacting to air. Water, steam, air should be passed after the packing solution become rubber-like.
- \* The assembly should be done in accordance with the instructions, block by block.

- \* Screws and nuts are indicated in the following manner;



Retaining Screw



- \* Necessary Tools are included in the kit form. However, the following tools would be useful, too.

Tweezers, Files (Round), Pliers, Scale, etc.



# I. MAIN FRAME

| PART NO. | Q'TY | NAME              | PART NO. | Q'TY | NAME                   |
|----------|------|-------------------|----------|------|------------------------|
| 1        | 1    | Main Frame (R)    | 10       | 1    | Trailing Truck Bolster |
| 2        | 1    | Main Frame (L)    | 11       | 4    | Equolizer              |
| 3        | 2    | Drag Beam         | 12       | 4    | Equolizer Bracket      |
| 4        | 1    | Rear Buffer Beam  | 13       | 4    | Equolizer Pivot Pin    |
| 5        | 1    | Front Buffer Beam | B27      | 8    | Flat Head Screws       |
| 6        | 1    | No.1 Stretcher    | B28      | 6    | " " "                  |
| 7        | 1    | No.2 Stretcher    | B29      | 10   | " " "                  |
| 8        | 1    | No.3 Stretcher    | C13      | 8    | Countersunk Screw      |
| 9        | 1    | Bogie Bolster     | C14      | 6    | " " "                  |
|          |      |                   |          | 8    | " " "                  |

\* There are various kinds of screws to be used in this assembly, be careful not to misuse the screws.

\* First, make the assembly of the main frame, using the part nos. 1 to 10, as illustrated, in loose. Then, adjust the frame till the bottom edges of the frames touch a flat surface the full length. Then, tighten the screws.

\* Insert equolizer pivot pin (13) into truck bolster (11) and then, screw in to the side holes of No.1 & 2 stretchers (7,8). Fit equolizer bracket (12) on pivot pin (13) and fasten with screws (C2) and (B28). B28 screws should not be screwed fully, since they are used on fastening brake collars later. Equolizers should swing lightly.

# II. AXLE DRIVEN PUMP AND LEAF SPRINGS

| PART NO. | Q'TY | NAME                    | PART NO. | Q'TY | NAME                        |
|----------|------|-------------------------|----------|------|-----------------------------|
| 14       | 1    | Delivery Elbow          | 29       | 12   | Leaf Spring (7)             |
| 15       | 2    | M6 Lock Nut             | 30       | 4    | Spring Hunger (1)           |
| 16       | 2    | ø4 Stainless Steel Ball | 31       | 8    | Spring Hunger (2)           |
| 17       | 1    | Axle Driven Pump Body   | 32       | 6    | Leaf Spring Center Retainer |
| 18       | 1    | Suction Elbow           | 33       | 12   | Spring Hunger Screw         |
| 19       | 1    | ø5 O Ring               | 34       | 12   | Spring Hunger Pin           |
| 20       | 1    | Ram                     | 35       | 4    | Spring Pin                  |
| 21       | 1    | Bogie Truck Center Pin  | 36       | 4    | Coil Spring                 |
| 22       | 6    | Leaf Spring Buckle      | 37       | 4    | Spring Pin Block            |
| 23       | 12   | Leaf Spring (1)         | N1       | 42   | Nut                         |
| 24       | 12   | " "                     | B9       | 4    | Flat Head Screw             |
| 25       | 12   | " "                     | N5       | 1    | Nut                         |
| 26       | 12   | " "                     | SW1      | 1    | Spring Washer               |
| 27       | 12   | " "                     | E6       | 6    | E-Ring                      |
| 28       | 12   | " "                     |          |      |                             |
| 29       | 12   | " "                     |          |      |                             |

\* Axle driven pump body is to be set with the stamped valve seat downward. Place steinless balls(16) on the upper valve seat of pump body (17) and suction elbow (18), and lightly tap the balls for easier fitting on the seat.

\* Put the balls (16) on both seats of pump body (17). Screw M6 nut (15) on- to suction elbow (18), applying packing compound on the threads, and fasten into the pump body (17) to the length as illustrated. Tighten the nut, then Note: Packing solution should not get in the pump body. Delivery elbow (17) should be fastened into the pump body, the same way.

\* Fit the assembled pump into No.3 stretcher (8) and fasten with screws (B9). Fit Ø50 ring (19) on the groove of ram (20) and insert into the pump body. \* Make six sets of the spring assemblies.

There are seven kinds of leaf springs, each two of which are used in one unit. Pile the leaf springs From No.23 to 29, in that order, as illustrated, and insert center retainer (32) into them from the bottom. Fasten them with buckle (22) and nut (N1) at the top, as illustrated.

\* Two sets of the spring assemblies to be used on main drivers' axle. Fit spring hangers (31) on both ends of the top leaf spring (23) and fasten with spring hunger screws (33) and nuts (N1), as illustrated. There must be a small clearance between the top leaf spring (23) and spring hunger (31). \* The rest, 4 sets, are to be used on leading and trailing drivers' axles. This time, fit spring hunger (31) on one end of the top spring (23) and spring hunger (30) on the other end, and fasten with hunger screws (33) and nuts (N1), the same way. Spring hunger (31) should be in outside when mounted on drivers' axles.

\* Clip E-rings (E6) on center retainers (32) when the assembly is mounted on main frame.

\* Put spring pin (35) into main frame and screw into spring pin block (37), using spring (36), as illustrated. Then, insert spring hunger pin (34) through spring hunger (30) and block (37) and retain with nut (N1) inside of the frame. See Fig. 1.

\* Another spring hunger (31) is to be connected to equalizer (11) with spring hunger pin (34). Note: The nuts (N1) should be locked by metal cemedine or the like.

\* Fasten bogie truck center pin (21) into bogie bolster (9) with spring washer (SW1) and nut (N5), as illustrated.

Longer threaded part of center pin should be put through the bolster.

### III. D R I V E R S

| PART NO. | Q'TY | NAME                     |
|----------|------|--------------------------|
| 38       | 1    | Leading Coupled Driver   |
| 39       | 1    | Main Coupled Drivers     |
| 40       | 1    | Trailing Coupled Drivers |
| 41       | 6    | Horn Stay                |
| PART NO. | Q'TY | NAME                     |

# IV. ENGINE

PART NO. Q'TY NAME

PART NO. Q'TY NAME

|    |   |                             |    |   |                               |
|----|---|-----------------------------|----|---|-------------------------------|
| 48 | 2 | Steam Chest Cover           | 61 | 4 | Cylinder Packing              |
| 49 | 4 | Steam Chest Packing         | 62 | 2 | Cylinder Block                |
| 50 | 2 | Slide Valve Block           | 63 | 2 | Piston                        |
| 51 | 2 | Slide Valve                 | 64 | 2 | Rear Cylinder Cover           |
| 52 | 2 | Steam Chest                 | 65 | 2 | Piston Rod Gland Nipple       |
| 53 | 2 | Valve Spindle               | 66 | 1 | Left Hand Crosshead           |
| 54 | 2 | Valve Spindle Gland Nipple  | 67 | 4 | Right Hand Crosshead          |
| 55 | 1 | Valve Spindle Crosshead (L) | 68 | 2 | Crosshead Back plate          |
| 56 | 8 | Stud                        | 69 | 4 | Sliding Plate                 |
| 57 | 1 | Graphited Yarn              | 70 | 1 | Valve Spindle Crosshead (R)   |
| 58 | 2 | Tail Rod                    | 71 | 2 | Slide Bar                     |
| 59 | 2 | Tail Rod Guide              | 72 | 2 | Steam Chest Front Cover       |
| 60 | 2 | Front Cylinder Cover        | 73 | 2 | Valve Spindle Crosshead Guide |

-13

\* On drivers' axles, ball bearings and bearing boxes are mounted. Fit the bearing into the box and install the drivers on the main frames, as illustrated. The hole of the box fits onto leaf spring center retainer (32). Confirm the bearing boxes are lightly sliding.

\* Fasten horn stays on main frame with screws (B4) after installing the drivers. Connect the eccentric sheave arm mounted on trailing drivers' axle to ram (20). After confirming that the arm and the ram are in a line, retain the eccentric with screws (P1) tightly.

Check if the ram is reciprocating in accordance with drivers' rotation. Note: Right hand crank pins are in advance of left hand ones by 90 degree. \* Fit right and left coupling rods (42, 43) on each side of crank pins, and check all the drivers are smoothly rotating. Then, retain crank pin of leading driver (38) and coupling rods together with crank pin collar and countersunk screw (C1) and crank pin of leading drivers (40) with nuts (N2). Temporarily fasten return crank (44) on main drivers' crank pin with return crank retaining screws (46).

Notes: 1) If the drivers are not rotating lightly, enlarge the holes of coupling rods, by slightly filing. If the drivers are properly coupled, they would automatically start to revolve on a slight slope.

2) Connecting rods and coupling rods are made of stainless steel. If they are polished by sand papers, they would look more beautiful.

PART NO. Q'TY NAME

PART NO. Q'TY NAME

|    |   |                                 |    |    |                   |
|----|---|---------------------------------|----|----|-------------------|
| 42 | 1 | Coupling Rod (L)                | 47 | 1  | Ran Gudgeon Pin   |
| 43 | 1 | Coupling Rod (R)                | C1 | 2  | Countersunk Screw |
| 44 | 2 | Return Crank                    | N2 | 2  | Nut               |
| 45 | 2 | Return Crank Retaining Screw B4 | 12 | 12 | Flat Head Screw   |
| 46 | 2 | Leading Crank Pin Collar        | P1 | 2  | retaining Screw   |

\* Before assembly, check if there is any dust in slide valve (51), Steam Chest (52) and Cylinder block (62), and if they are smooth finished.

\* Put piston rod (63) through rear cylinder cover (64) and gland nipple (65), then, tightly screw into crosshead (1)(66). Piston rod should be locked by packing solution or the like.

\* Wind the graphited yarn around the piston groove a little bit thicker than the external diameter of piston and then squeeze the stuffing with your nail till it becomes to the external diameter of the piston. Applying a few drops of cylinder oil in the yarn, insert the piston into the cylinder (62).

\* Fasten rear cylinder cover (64) on cylinder (62), using packing (61) in between, with hex. screws (H5). (The screw hole of rear cylinder cover should be directing up. The piston should be moving smoothly.

\* Fasten front cylinder cover (60) on cylinder (62), using packing (61) in between, with screws (H5).

\* Fit slide bar (71) on rear cylinder cover with the groove outside by screw (B4). Insert sliding plate (69) into the space between slide bar and crosshead and fasten crosshead back plate (68) on crosshead (66) with screws (B7), as illustrated.

\* Deeply screw the studs (56) into the cylinder (62) and place packing (49) and steam chest (52), as illustrated.

\* Temporarily insert valve spindle (53) into valve block (50) and place them in slide valve (51). The slide valve should remove off the valve block itself if the block is picked up. If the valve is stiff on the block, widen the groove of slide valve (51) by filing. Then, place slide valve (51) and valve block (50) on cylinder upper surface.

\* Put valve spindle (53) through gland nipple (54) and screw into valve spindle crosshead (55). Then, lock them with packing compound.

\* Fasten valve spindle crosshead guide (73) onto steam chest (52) and retain with screw (P4). Insert valve spindle (53) through the guide (73), chest (52), valve (51) and valve block (50) all the way and temporarily retain with screws (P1), as illustrated, so the end of valve spindle won't come off the front guide hole of steam chest.

\* Temporarily fasten steam chest cover on steam chest, using packing (49) in between, by nuts (N2). Tightening should be done after valve setting.

\* Fasten tail rod guide (59) on front cylinder cover (60) by tail rod (58).

\* Retain steam chest front cover (72) on steam chest (52) by screw (P1).

\* Wind a graphited yarn around the valve spindle (53) and piston rod (63) two or three turn and apply a few drops of oil. Then, screw the gland nipples (54)

| PART NO. | Q'TY | NAME                 |
|----------|------|----------------------|
| N2       | 8    | Nut                  |
| P1       | 4    | Retaining Screw      |
| B7       | 4    | " " "                |
| B4       | 2    | Flat Head Screw      |
| H5       | 24   | Hexagonal Head Screw |

(65) into the stuffing boxes of rear cylinder cover and steam chest, till the readed parts remain by 1 mm from the boxes. Too much winding of graphited yarn cause stiff motion of valve spindle and piston rod. Too little winding may cause steam leakage.

\* The righthand engine is assembled, the same way.

## V. INSTALLATION OF THE ENGINES

| PART NO. | Q'TY | NAME                        | PART NO. | Q'TY | NAME                   |
|----------|------|-----------------------------|----------|------|------------------------|
| 74       | 1    | Expansion Link (R)          | 88       | 1    | Motion Plate Stretcher |
| 75       | 4    | Spacer                      | 89       | 1    | Expansion Link (L)     |
| 76       | 2    | Die Block                   | 90       | 1    | Running Board Bracket  |
| 77       | 2    | Radius Rod, Combination     | B7       | 4    | Flat Head Screw        |
| 78       | 1    | Lever, Union Link Assy.     | B9       | 2    | " " "                  |
| 78       | 1    | Running Board Bracket       | B10      | 4    | " " "                  |
| 79       | 2    | Valve Spindle Crosshead Pin | B30      | 1    | " " "                  |
| 80       | 1    | Motion Plate (L)            | B29      | 2    | " " "                  |
| 81       | 1    | Motion Plate (R)            | SW1      | 4    | Spring Washer          |
| 82       | 1    | Lifting Arm                 | H1       | 4    | Hexagonal Head Screw   |
| 83       | 6    | Lifting Link Pin            | SP2      | 1    | Spring Pin             |
| 84       | 2    | Crosshead Gudgeon Pin       | N2       | 2    | Nut                    |
| 85       | 1    | Connecting Rod (R)          | B31      | 2    |                        |
| 86       | 2    | Bearing (ø7 x ø4 x 2)       |          |      |                        |
| 87       | 1    | Connecting Rod (L)          |          |      |                        |

\* Temporarily mount the right and left engine assemblies on main frame, using spring washers (SW1) and screws (H1).

\* Mount motion plate stretcher (88) on main frame together with running board bracket (78) at front stretcher by screws (B30) and B31 at rear stretcher.

\* Pull out valve spindle crosshead (55,70) by releasing the retaining screws (P1) temporarily fastened, in order to keep away from crosshead guide (73) for easier assembly. Fit combination lever (77) in valve spindle crosshead (55,70) and retain with pin (79) temporarily, as illustrated on Fig. 2.

\* Open the expansion link (74)(89) as illustrated on Fig. 2. Fit die block (76) on the stud of radius rod (77), and put them in the slot of expansion link (74,89). Then, close the expansion link and fasten with screws (B7), using spacers (75) in between.

NOTE: Check if the die block is shifting lightly in the slot of expansion link.

\* Mount the expansion link assembly on motion plate stretcher (88) and attach motion plate (80,81) on the stretcher (88) with screws (B10), as illustrated. By releasing the screws used for installing the engines, fasten slide bar (71) on motion plate (80,81) with screws (B9). Then, tighten the screws for engine installation.



NOTE: Check if the expansion links (89,74) are swinging lightly on the

pivot.

\* Fit ball bearings in connecting rods (85,87). Remove the return crank (44)

temporarily fastened with retaining screw (45), and fit the connecting

rods on crank pins. The front end of the connecting rods (85,87) is to be

fastened in crosshead (66) with crosshead gudgeon pin (84) and nut (42),

as illustrated. Refasten again the return crank (44) as it was. Fasten union

link (77) on crosshead (44) with pin (83), as illustrated.

\* Fit lifting arm (82) in motion plate stretcher (88) and retain at lefthand

with pin (SP2), as illustrated, having the same angle.

NOTE: Before retain lifting arm in the stretcher (88), check if the arm is

moving lightly.

\* Fasten lifting link (77) to lifting arm (82) with lifting link pin (82). When

lifting arm is driven, radius rod is moving in the slot of expansion link (89)

(74).

\* Fasten running board bracket (90) on No. 3 stretcher with screws (E29).

## VI. LUBRICATOR, STEAM T PIPE AND EXHAUST BRANCH PIPES

| PART NO. | Q'TY | NAME | PART NO. | Q'TY | NAME |
|----------|------|------|----------|------|------|
|----------|------|------|----------|------|------|

|    |   |                      |     |   |                   |
|----|---|----------------------|-----|---|-------------------|
| 91 | 2 | Extension Pipe Screw | 107 | 2 | Eccentric Rod Pin |
|----|---|----------------------|-----|---|-------------------|

|    |   |             |     |   |                |
|----|---|-------------|-----|---|----------------|
| 92 | 5 | M5 Lock Nut | 108 | 1 | One Way Clutch |
|----|---|-------------|-----|---|----------------|

|    |   |                |     |   |             |
|----|---|----------------|-----|---|-------------|
| 93 | 1 | Exhaust T pipe | 109 | 1 | Driving Arm |
|----|---|----------------|-----|---|-------------|

|    |   |                        |     |   |             |
|----|---|------------------------|-----|---|-------------|
| 94 | 2 | Steam T Pipe Extension | 110 | 1 | Crank Shaft |
|----|---|------------------------|-----|---|-------------|

|    |   |            |     |   |                   |
|----|---|------------|-----|---|-------------------|
| 95 | 1 | Pipe Screw | 111 | 1 | Oil Tank Retainer |
|----|---|------------|-----|---|-------------------|

|    |   |                |     |   |                |
|----|---|----------------|-----|---|----------------|
| 96 | 1 | Steam Manifold | 112 | 1 | Oil Pipe Union |
|----|---|----------------|-----|---|----------------|

|    |   |          |     |   |              |
|----|---|----------|-----|---|--------------|
| 97 | 1 | Oil Tank | 113 | 1 | Oil Tank Lid |
|----|---|----------|-----|---|--------------|

|    |   |                   |     |   |                     |
|----|---|-------------------|-----|---|---------------------|
| 98 | 1 | Oil Pump Cylinder | 114 | 1 | Smokebox saddle (L) |
|----|---|-------------------|-----|---|---------------------|

|    |   |              |     |   |                     |
|----|---|--------------|-----|---|---------------------|
| 99 | 1 | Oil Pump Ram | 115 | 1 | Smokebox saddle (R) |
|----|---|--------------|-----|---|---------------------|

|    |   |            |     |   |                   |
|----|---|------------|-----|---|-------------------|
| 99 | 9 | ø5 Packing | 116 | 1 | Eccentric Rod (L) |
|----|---|------------|-----|---|-------------------|

|     |   |                      |     |   |                   |
|-----|---|----------------------|-----|---|-------------------|
| 100 | 1 | Oil Check Valve Body | 117 | 1 | Eccentric Rod (R) |
|-----|---|----------------------|-----|---|-------------------|

|     |   |                   |     |   |                  |
|-----|---|-------------------|-----|---|------------------|
| 102 | 1 | Ball Valve Spring | 118 | 2 | Return Crank Pin |
|-----|---|-------------------|-----|---|------------------|

|     |   |                  |     |   |                      |
|-----|---|------------------|-----|---|----------------------|
| 103 | 1 | Check Valve Plug | 281 | 1 | Oil Pump Driving Rod |
|-----|---|------------------|-----|---|----------------------|

|    |   |                         |     |   |                 |
|----|---|-------------------------|-----|---|-----------------|
| 16 | 1 | ø4 Stainless Steel Ball | B29 | 2 | Flat Head Screw |
|----|---|-------------------------|-----|---|-----------------|

|     |   |                     |     |   |         |
|-----|---|---------------------|-----|---|---------|
| 104 | 1 | Crank Shaft Bearing | B31 | 4 | " " " " |
|-----|---|---------------------|-----|---|---------|

|     |   |              |     |   |               |
|-----|---|--------------|-----|---|---------------|
| 105 | 1 | Check Spring | SM1 | 1 | Spring Washer |
|-----|---|--------------|-----|---|---------------|

|     |   |            |    |   |     |
|-----|---|------------|----|---|-----|
| 106 | 1 | Crank Disk | N5 | 1 | Nut |
|-----|---|------------|----|---|-----|

\* Fit eccentric rods (116,117) on each expansion link and Return crank with

eccentric rod pin (107) and return crank pin (118), as illustrated.

Return crank (44) should be correctly fastened later.

\* Referring to the illustration, put together the parts nos. 95, 92, 94, as

illustrated, and put together parts nos. 93, 92, 91, too, applying to packing

solution on the threaded parts.

\* First, screw extension pipe screws (91) into each cylinder equally, keeping the T pipe in a vertical and central position. Screw lock nut (92) to the extension pipe (91) carefully.

\* Fit the steam T pipe assembly into each steam chest, the same way.

\* Lubricator Assembly

Push one way clutch (108) into driving arm (109) so that the clutch should fit onto crank shaft (110), by turning the arm and the clutch to the arrowed direction on Fig. 3.

NOTE: When pushing the clutch into the arm, never hit the clutch.

\* Put oil check valve body (100) on oil tank (96), using  $\phi 5$  packing in between and fasten with pump cylinder (97), as illustrated.

The threaded neck of valve body (100) should be taking 40 degree from the oil tank neck to the left and for easier fitting to oil pipe union (112).

\* Put ball (16) and spring (102) in the check valve body (100) and tighten with check valve plug (103), applying packing compound on the thread.

\* Put the pin of crank disk (106) in the slot of oil pump ram (98), and insert the ram (98) into pump cylinder (97).

\* Use check spring (105) on both crank disk (106) and crank shaft bearing (104). \* Screw crank shaft (110) into crank disk (106), as illustrated.

Confirm that when driving arm (109) is driven to the arrow direction, crank disk (106) is driven to the arrow direction.

\* Fasten oil tank retainer (111) on oil tank (96) with spring washer (SW1) and nut (N5). Screw oil pipe union (112) onto oil check valve body (100). The other end of oil pipe (112) is to be connected to steam manifold (95) through the central hole of oil tank retainer (111).

\* Fasten smokebox saddles (114,115) on main frame symmetrically with screws (B31) and at the same time, fasten tank retainer (111) with screws (B29), as illustrated.

\* Hook oil pump driving rod (281) on the pin of driving arm (109) and tighten it by pliers. The other end is to be fastened on ram gudgeon pin (47).

NOTE: Check if the pump is driving in accordance with drivers rotation.

## VII. BOGIE TRUCK, TRAILING TRUCK

| PART NO. | Q'TY | NAME                     | PART NO. | Q'TY | NAME                           |
|----------|------|--------------------------|----------|------|--------------------------------|
| 119      | 2    | Pair Bogie Wheel         | 127      | 1    | Bogie Truck Spring             |
| 120      | 1    | Bogie Stretcher          | 128      | 1    | Trailing Truck Frame (L)       |
| 121      | 2    | Bogie Frame              | 129      | 1    | Trailing Truck Inside Frame(L) |
| 122      | 1    | Guard Iron (R)           | 130      | 1    | Trailing Truck Frame (R)       |
| 123      | 1    | Guard Iron (L)           | 131      | 1    | Trailing Truck Inside Frame(R) |
| 124      | 1    | Pivot Pin                | 132      | 8    | Trailing Truck Leaf Spring Pin |
| 125      | 1    | Spring Holder            | 133      | 8    | Spring Pin Nut                 |
| 126      | 2    | Side Control Leaf Spring | 134      | 4    | Trailing Truck Axle Box        |

| PART NO. | Q'TY   | NAME                          | PART NO. | Q'TY | NAME                     |
|----------|--------|-------------------------------|----------|------|--------------------------|
| 135      | 4      | Axle Box Coil Spring          | 142      | 1    | Trailing Truck Pivot Pin |
| 136      | 4      | Trailing Truck Horn Stay      | B4       | 6    | Flat Head Screw          |
| 137      | 2 pair | Trailing Truck Wheel          | B5       | 2    | " "                      |
| 138      | 1      | Rear End Beam                 | B10      | 4    | " "                      |
| 139      | 2      | Trailing Truck Coil Spring    | H4       | 4    | Hexagonal Screw          |
|          |        | Pin                           | W3       | 3    | Washer                   |
| 140      | 3      | Trailing Truck Coil Spring    | N5       | 1    | Nut                      |
| 141      | 1      | Trailing Truck Front End Beam |          |      |                          |

\* Bend tightly the projecting parts of spring holder (125) with pliers to fix side control spring (126) in spring holder (125), as illustrated.

\* Make bogie frames, using the part nos. 120, 121, 124 and B5. One side frame (121) fastened by pivot pin (124) can swing on it.

\* Attach guard irons (122,123) on the inside of the side frames (121), as illustrated.

\* Fit bogie wheels (119) in the assembled frame, as illustrated on Fig. 4.

\* Put bogie truck spring (127), side control spring, and bogie truck assembly, in that order, and fasten with washer (W3) and nut (N5), as illustrated.

\* Insert spring pin (132) into trailing truck frames (128,130), and put spring pin nuts (133) onto the pin (132). Tighten the nuts (133) with adhesive on the pin, which protrude about 1 mm from the nut.

\* Put together inside frame and outside frame and fasten with screws (B10) at rear. Put front end beam (141) on the fronts of the assembled frame, and fasten with screws (B10). Put rear end beam to the rears of the frames and fasten with screws (H4).

NOTE: Check if the assembled frame touches a flat surface, the full length.

\* After confirming that axle boxes (134) can slide lightly in the trailing truck frame, fit trailing truck wheels (137) in the frame, using axle box coil spring (135), as illustrated, and then, retain the axle boxes with horn stays (136), applying packing compound on the threads.

\* Fasten front end beam (141) on trailing truck bolster (10) with trailing truck pivot pin (142), using coil spring (140) in between. Fasten rear end beam (138) to drag beam (4), using coil spring pin (139), washer (W3) and spring (140), as illustrated.

## VIII. LOCOMOTIVE BOILER

| PART NO. | Q'TY | NAME                     | PART NO. | Q'TY | NAME                     |
|----------|------|--------------------------|----------|------|--------------------------|
| 143      | 1    | Locomotive Type Boiler   | 149      | 1    | Whistle Valve Spring     |
| 144      | 1    | Manifold Header          | 150      | 1    | Regulator Flange Packing |
| 145      | 1    | Manifold Packing         | 151      | 1    | Whistle Valve Body       |
| 146      | 1    | Manifold End Plug        | 152      | 1    | Push Pin                 |
| 147      | 1    | M4 Lock Nut              | 153      | 1    | Whistle Valve Push Lever |
| 148      | 1    | Whistle Valve Connecting | 154      | 1    | Blower Connecting Pipe   |
|          |      | Pipe Screw               |          |      |                          |

PART NO. Q'TY NAME      PART NO. Q'TY NAME

|     |   |                           |     |   |                          |
|-----|---|---------------------------|-----|---|--------------------------|
| 155 | 1 | Blower Valve Body         | 175 | 1 | Blower Needle Valve      |
| 156 | 1 | Pressure Gauge Pipe       | 176 | 1 | M6 Union Nut             |
| 157 | 1 | Pressure Gauge            | 177 | 1 | Firedoor Hinge Pin       |
| 158 | 1 | Water Gauge Upper Fitting | 115 | 1 | M6 Lock Nut              |
| 159 | 1 | Water Gauge Cap           | 57  | 1 | Graphited Yarn           |
| 160 | 2 | ø7 Packing                | 92  | 5 | M5 Lock Nut              |
| 161 | 2 | Gauge Glass Lock Nut      | 264 | 2 | Safety Valve             |
| 162 | 1 | Gauge Glass               | 99  | 2 | ø5 Packing               |
| 163 | 1 | Blower Pipe Nozzle        | 150 | 1 | Regulator Flange Packing |
| 164 | 1 | Water Gauge Lower Fitting | B23 | 4 | Flat Head Screw          |
| 165 | 2 | Check Valve               | H4  | 8 | Hexagonal Head Screw     |
| 166 | 1 | Firedoor                  | N1  | 1 | Nut                      |
| 167 | 2 | Stay Nipple               | B7  | 1 | Flat Head Screw          |
| 168 | 1 | Longitudinal Stay         |     |   |                          |
| 169 | 1 | Regulator Handle          |     |   |                          |
| 170 | 1 | Regulator Gland Nut       |     |   |                          |
| 171 | 1 | Regulator                 |     |   |                          |
| 172 | 1 | Super Heater Header       |     |   |                          |
| 173 | 1 | Steam Inlet               |     |   |                          |
| 174 | 1 | Super Heater              |     |   |                          |

\* Fasten firedoor(166) with hinge pin (177) on the angle of locomotive boiler. The end of the hinge pin should be bent so that it won't removed off.

\* Put regulator flange packing (150) onto regulator (171) and insert regulator into the boiler. Screw steam inlet (173) in regulator (171) through the hole for safety valve (264). Tighten regulator (171) on the boiler with hex. screw (H4), applying packing compound on the flange. The end of regulator (171) is connected into super heater header (172), applying packing compound on the threaded parts. Wind graphited yarn several turns on the end of regulator(171).

Super heater header should be fastened into the boiler so that the neck for super heater (174) may be directing just straight down to super heater union.

Screw regulator gland nut (170), winding graphited yarn around the spindle and applying packing compound on the threde, into regulator (171), as illustrated. Fasten regulator handle (169) onto the gland nut (170) with nut (N1).

NOTE: 1) When screwing steam inlet (173) into regulator (171), be careful not to fall down steam inlet in the boiler.

2) All the parts which relate to steam passages should be fastened using

packing compound on the threaded parts so that steam may not be leaking.

\* Screw longitudinal stay (168) into stay nipple (167), and then screw the stay into the boiler. Both stay (168) and stay nipple (167) should be screwed tightly. \* Winding graphited yarn around the blower needle valve (175), screw into blower valve body (155) and tighten with M6 union nut (176). Put lock nut (92) onto

blower valve body (155) and screw valve body into the boiler to the size of

## BOILER OUTER CASING

| PART NO. | Q'TY | NAME                   | PART NO. | Q'TY | NAME                    |
|----------|------|------------------------|----------|------|-------------------------|
| 178      | 1    | Boiler Cleading        | 188      | 1    | Chimney                 |
| 179      | 1    | Regulator Bell Crank   | 189      | 1    | Chimney Base            |
| 180      | 18   | Handrail Knob          | 190      | 1    | Chimney Square Washer   |
| 181      | 1    | Steam Dome and Sandbox | 191      | 1    | Petticoat               |
| 182      | 1    | Dummy Whistle          | 192      | 1    | Smokebox                |
| 183      | 2    | Sandbox Lid            | 193      | 1    | Head Light              |
| 184      | 1    | Dummy Check Valve      | 194      | 2    | Smokebox door hinge pin |
| 185      | 1    | Step                   | 195      | 1    | Smokebox Front Plate    |
| 186      | 7    | Boiler Band            |          |      |                         |

## NEVER DISASSEMBLE NOR TIGHTEN THEM.

NOTE: The safety valves have already be adjusted at a working pressure level,

casing is mounted. Just remember the setting position at this stage.

\* Safety valves (264) and the packings (99) are to be fastened after outer

length as illustrated so that the push lever is in a vertical position.

manifold header (144) and screw the assembled whistle valve onto it to the

and screw the valve into the pipe screw (148). Screw M4 lock nut (147) onto

(149) and  $\frac{1}{4}$  stainless steel ball (16) into the connecting pipe screw (148)

(153) in the valve (151) and fasten with screw (B7). Put whistle valve spring

\* Insert push pin (152) into whistle valve body (151), then, fit push lever

by bending.

NOTE: Adjust the pipe so that the parts to be connected may be easily fitted

header (144), too.

(144), as illustrated. Connect blower connecting pipe (154) to manifold

fasten with screws (B23). Screw manifold end plug (146) in manifold header

\* Put manifold header (144) on the boiler, using packing (145) in between and

except 160 are to be fastened after fitting firebox cleading (204).

NOTE: All the other parts of water gauge assembly, Nos. 161, 162, 158, 159,

and fasten into the boiler in a vertical position.

\* Screw lock nut (92) onto the long neck of water gauge lower fitting (164)

(92) in between, and lock them with the neck directing downward.

threads. Then, fasten the check valves into the boiler, using lock nuts

\* Retighten the cap of check valves (165), applying packing solution on the

the union onto super heater header (172).

\* Insert super heater (174) into the thickest tube in the center and connect

upward. On that position, lock it by lock nut (15).

nozzle should be deeply screwed and the end of the nozzle should be directing

into blower pipe nozzle (163) at the end plate of boiler. The blower pipe

directing the steam inlet at one o'clock. Screw the other end of the blower

the illustration on the corner. Lock the valve by the lock nut (92),

(N1) and nut (B10), as illustrated.

- \* When the firebox cleading is placed on firebox, fasten the bads with screws screws (B4), as illustrated. Reatin handrail knobs, the same way, too.
- \* Put dummy fittings (205, 206, 207) on firebox cleading (204) and fasten with (B6), as illustrated. Train the sanding pipe against the cleading.
- Temporarily fasten boiler bands around the cleading. Then place sandbox and steam dome (181) on the cleading, and fasten with sandbox lid (183) and screw (N1), having a inclination of about 45 degree to the back.
- \* Put dummy whistle (182) on sandbox (181) and fasten with screw (B17) and nut on the cleading and fasten with screws (B4) and nut (N1).
- rail knob (180) on the cleading, too, the same way, with nuts (N1). Fit step
- \* Put dummy fittings (184, 179) on the cleading, first, with nuts (N1). Put hand-casing.
- \* Enlarge the inside diameter of boiler cleading (178) a little bit for easier and the other necessary parts' fitting.

NOTE: Remove the smokebox front plate (195) from the smokebox for piping

inside.

- screw (B10). Reatin handrail knob (180) on smokebox (192) with nut (N1) at smokebox. Fit smokebox front plate (195) in smokebox (192) and fasten with Retain chimney with square washer (190) and petticoat (191), inside of the
- \* Put chimney base (189) on the smokebox (192) and insert chimney (188) in them. by bending at the back.
- screws (B4). Insert door grip (200) in smokebox door (198) and tighten it
- \* Fasten head light (193) in the recess of smokebox front plate (195) with door can be opened smoothly, and keep air tightness when closed.
- (194), as illustrated. Bend the end of the pin for tightening. Check if the Fit the assembled door on smokebox front plate and fasten with the hinge pin retaining screw (199).
- Fasten dummy handle (201) and screw wheel (202) on the door (198), too, with
- \* Fasten number plate (203) on smokebox door (198) and tighten at the back.

| PART NO. | Q'TY | NAME                          | PART NO. | Q'TY | NAME                 |
|----------|------|-------------------------------|----------|------|----------------------|
| 196      | 1    | Smokebox Door Handrail        | 206      | 1    | Dummy Strainer       |
| 197      | 1    | Smokebox Door Handrail        | 207      | 1    | Dummy Boiler Cleaner |
| 198      | 1    | Smokebox Door                 | 208      | 2    | Handrail             |
| 199      | 1    | Smokebox Door Retaining Screw | 265      | 1    | Blowdown Plug        |
| 200      | 1    | Smokebox Door Grip            | 187      | 1    | Smokebox Crossbar    |
| 201      | 1    | Retaining Dummy Handle        | B4       | 8    | Flat Head Screw      |
| 202      | 1    | Retaining Screw Wheel         | B17      | 1    | "                    |
| 203      | 1    | Number Plate                  | B6       | 2    | "                    |
| 204      | 1    | Firebox Cleading              | B10      | 3    | "                    |
| 205      | 1    | Dummy Generator               | N1       | 20   | Nut                  |



\* Fasten blowdown plug (265) into the boiler, using packing (99) in between.

# X. BOILER CASING AND INNER BOILER

| PART NO. | Q'TY | NAME                   |
|----------|------|------------------------|
| 209      | 1    | Asphan                 |
| 210      | 1    | Fire-grate             |
| 211      | 1    | Boiler Retaining Angle |
| 212      | 1    | Firebox Spacer Ring    |
| 213      | 2    | Barrel Spacer Ring     |
| 214      | 1    | Smokebox Spacer Ring   |
| 215      | 1    | M6 Lock Nut (F x 0.75) |
| B23      | 2    | Flat Head Screw        |
| B29      | 7    | " " "                  |
| B6       | 4    | " " "                  |
| N2       | 5    | Nut                    |

\* Put barrel spacers (213) onto the barrel, the one in the center and the other at about 10 mm from the firebox of the barrel.

\* Insert the barrel into boiler cleading (178). Referring to the illustration 9, tighten the boiler bands (186) at the bottom. Fit smokebox spacer ring (214) into the cleading (178) and tighten them with wire, too, which should be prepared by yourself.

NOTE: The wire should be thin and soft.

\* Fit firebox spacer (212) into firebox cleading (204) and retain with screw (B23). Put them on the firebox and fasten with screws (B10) and nut (N1).  
 \* Put the assembled smokebox (192) onto the smokebox spacer ring (214) and fasten with screw (B29) and nut (N1), as illustrated.  
 \* Fasten boiler retaining angle (211) on the backplate of the barrel with screws (B6), temporarily.

\* Place asphan (209) in the rear frames (3) and retain with screws (B29).  
 \* Put firegrate (210) on the asphan. Then, place the assembled boiler on the frames, adjusting the fitting position to the pipes.

\* Fasten smokebox (192) on the smokebox saddles (114,115) with screws (B29) and nut (N2), adjusting the positions of each handrail knobs in a line.  
 \* Fix the angle (211) on crag beam (4) with screws (B6). Tighten the screws (B6) into the barrel, too.

\* Screw M6 lock nut(215) onto the steam manifold, not too tightly.

\* Screw M5 lock nut (92) onto water gauge upper holder (158). Screw the holder into the barrel, checking that the gauge glass may be fastened in a vertical position, and lock the nut (92). Fit the gauge glass (162) through the upper holder and tighten with packing (160) and gauge glass lock nut (161). Finally screw water gauge cap (159) in the upper holder (158), applying packing compound on the threads.

NOTE: Tightening of the gauge glass should be done carefully so that it may not be broken.

Refer to the illustration 8.

| PART NO. | Q'TY | NAME                      | PART NO. | Q'TY | NAME                   |
|----------|------|---------------------------|----------|------|------------------------|
| 216      | 1    | By-Pass Valve Union       | 224      | 1    | Whistle Steam Pipe (A) |
| 217      | 1    | By-Pass Valve Body        | 225      | 1    | Whistle Steam Pipe (B) |
| 218      | 1    | M5 Gland Nut              | 226      | 1    | Hand Pump Elbow        |
| 219      | 1    | By-Pass Valve Handle      | 227      | 1    | Cab Retaining Plate    |
| 220      | 1    | Axle Driven Pump Suction  | 228      | 1    | Cab Foot Plate         |
|          |      | Pipe (A)                  |          |      |                        |
| 221      | 1    | Axle Driven Pump Delivery | 92       | 1    | M5 Lock Nut            |
|          |      | Pipe                      |          |      |                        |
| 222      | 1    | Whistle Retaining Plate   | H3       | 5    | Hexagonal Head Screw   |
| 223      | 1    | Steam Whistle             | B29      | 2    | Flat Head Screw        |
| SW2      | 1    | Spring Washer             | B6       | 1    | " " "                  |
|          |      |                           | N4       | 1    | Nut                    |

\* Put together cab retaining plate (227) and cab foot plate (228) with screw (H3), as illustrated. Insert hand pump elbow (226) through cab retaining plate (227) and foot plate (228), and fasten with screws H3, spring washer (SW2) and nut (N4), as illustrated, to drag beam (4).

\* Connect hand pump elbow (226) to righthand check valve (165), adjusting the position.

\* Wind the graphited yarn around the spindle of by-pass valve handle (219), as illustrated. Insert the handle (219) into by-pass valve body (217) and tighten with M5 gland nut (218). Deeply screw M5 lock nut (92) and by-pass valve union (216) onto the threaded pipe of the valve body (217). Then, fit the assembly in the cab retaining plate (227) and connect to the lefthand check valve (165). Referring to the length of setting on the illustration on the corner, lock them with nut (92).

\* Connect axle driven delivery pipe (221) to delivery elbow (14) and to by-pass valve body (217). The delivery pipe crawl along the firebox of inner barrel. \* Connect axle driven suction pipe (220) to suction elbow (18) through the space between main and trailing drivers' axles. Put the other end of the suction pipe (220) through the hole of retaining plate (227).

\* Retain the whistle retaining plate (222) to steam whistle (223) with screw(B6). Then, retain them on the No.1 stretcher with screws (B29).

\* Connect whistle (223) and whistle valve (151) by whistle steam pipes (A & B). Whistle steam pipe (B) (225) runs between water gauge and boiler. Another pipe (A) runs between main and trailing drivers' axles.

\* Referring to the illustration 8, adjust the setting position of the water gauge. \* The pipe arrangement on the boiler backplate should be referred to the illustration.

# XII. RUNNING BOARDS, REVERSER

| PART NO. | Q'TY | NAME                      |
|----------|------|---------------------------|
| 229      | 1    | Reversing Lever           |
| 230      | 2    | Spacer                    |
| 231      | 1    | Pin (ø1.2 x 6)            |
| 232      | 1    | Lever Latch               |
| 233      | 1    | Trigger(or Latch Lever)   |
| 234      | 1    | Latch Guide Screw         |
| 235      | 1    | Latch Spring              |
| 236      | 1    | Stand                     |
| 237      | 1    | Lever Fulcrum             |
| 238      | 1    | Lever Quadrant            |
| 239      | 1    | Reach Rod End Piece(A)    |
| 240      | 1    | Reach Rod                 |
| 241      | 1    | Reach Rod End Piece(B)    |
| 242      | 1    | Reversing Arm cover       |
| 243      | 1    | Running Board (L)         |
| 244      | 1    | Running Board (R)         |
| 245      | 2    | Running Board on Cylinder |
| 246      | 1    | Front Deck                |
| 247      | 2    | Cylinder Lagging          |
| 83       | 2    | Lifting Link Pin          |
| H3       | 18   | Hexagonal Head Screw      |
| H6       | 4    | " " "                     |
| B2       | 7    | Flat Head Screw           |
| N1       | 5    | Nut                       |
| SM3      | 1    | Spring Washer             |
| B4       | 2    | Flat Head Screw           |
| SP3      | 1    | Spring Pin                |

\* Make the reverser assembly, referring to the illustration.

NOTE: Check if the reverser latch is sliding lightly by the tension of spring (235), after assembly.

Check if reversing lever (229) is clicked by sector plate.

\* Make the reach rod assembly, referring to the illustration, on which the length is shown.

\* Mount running boards (244,243) on running board brackets (78,90) and fasten with screws (H3), temporarily.

Insert the dummy sanding pipe into the hole arrowed on the running board. Temporarily put together running board (245) and front deck (246) with screw (H3). Then, fasten them to running bars (243,244) and drag beam (5) with screws (H3 and H6), as illustrated.

NOTE: The running board on cylinder (245) can be removed when valve setting.

\* Connect the reach rod assembly to reverser lever (229) and lifting link(77). with lifting link pin (83).

\* Fasten reversing arm cover (242) on the square hole of running board with screws (B2).

NOTE: Now that the reverser is connected to the valve gears, operate the

reversing lever forward, mid and backward. Check if the radius rod (77) are sliding up and down in the slot of the expansion link, evenly. If not evenly driven, adjust the length of the reach rod (240) by the nut (N1).

## XII. VALVE SETTING / AIR TEST

Valve Gears function to drive slide valves (51) in the valve chests (52) to lead live steam into the cylinders and to eject exhaust steam from the cylinders in accordance with the piston strokes. It functions to switch the driving direction if the radius rods (77) are shifted by reversing lever. Valve setting is required to obtain correct motion of slide valves. Its main jobs are to set return cranks (74, 89) 90 degree + advanced angle from its main cranks, and to adjust the slide valves so as to begin to open the steam ports, i.e., to line up the edges of slide valves and steam ports at the dead centre of pistons.

\* The illustration (1) shows the piston at front dead centre and the illustration (2) shows the piston at rear dead center.  
 \* First, set the righthand engine, for instance, to the illustration (1), and the reversing lever in neutral position. Then, loosen the return crank retaining screw (45) and adjust the expansion link in a vertical position, i.e.,

\* Even if the reversing lever is operated forward and backward, the front end of the radius rod won't move at all. Otherwise, the expansion link would not be set in a vertical position. (If so, the return crank should be reset.)

\* Next, open the steam chest cover (48) and loosen the retaining screws (P1) of slide valve block (50), and line up the edge of the slide valve and the steam port, just as illustrated (A-A'). Then, retain the block at that position.  
 \* If the piston is driven to the rear dead centre (illustration 2), the rear edge of slide valve and the rear edge of steam port are in a line (B-B').

NOTE: The important thing in valve setting is that the slide valves are opening both steam ports evenly.

\* The lefthand engine should be adjusted, the same way.  
 \* Refasten the steam chest covers and cylinder lagings (247).

### AIR TEST

Tools: 1. Bicycle pneumatic pump (or air compressor)

2. Driving Bench

3. Heavy machine oil

\* Apply oil to the driving parts such as bearings, cranks, crank pins, etc.  
 \* Connect the air hose of the pump or compressor onto the hand pump elbow (226).  
 \* Set the drivers free on the bench in a horizontal position.

\* Shut the blower valve and open the regulator. Then, pump the air.

If the drivers rotate at any position of the pistons smoothly and evenly to both ways, forward and backward, the valve setting would be correctly done.  
 If the drivers won't move at all or easily braked by hands, and airleaking noise is heard, check the engine again and make valve setting correctly.

NOTE: In case the engine won't drive at all, the valve setting would not be correct.

In case the engine is driving but in a weak power, leakages in the cylinders and pipe connections would be main cause.

#### XIV. DUMMY FITTINGS

| PART NO. | Q'TY | NAME                       | PART NO. | Q'TY | NAME                       |
|----------|------|----------------------------|----------|------|----------------------------|
| 248      | 1    | Smoke Deflector (L)        | 260      | 1    | Dummy Air Compressor       |
| 249      | 1    | Smoke Deflector (R)        | 261      | 1    | Compressor Retaining Plate |
| 250      | 2    | Step                       | 262      | 1    | Pressure Governor          |
| 251      | 1    | Lubricator Casing          | 263      | 1    | ø2 Copper Wire             |
| 252      | 1    | Pipe (R)                   | H3       | 2    | Hexagonal Head Screw       |
| 253      | 1    | Dummy Boiler Water Cleaner | H5       | 4    | " " "                      |
| 254      | 1    | Water Feed Pump            | B4       | 16   | Flat Head Screw            |
| 255      | 2    | Cab Step                   | B20      | 6    | " " "                      |
| 256      | 1    | Air reservoir (R)          | C13      | 2    | Countersunk Screw          |
| 257      | 1    | Air Reservoir (L)          | N6       | 4    | Nut                        |
| 258      | 1    | Dummy Power Reverse Gear   | SM2      | 8    | Spring Washer              |
| 259      | 1    | Pipe (L)                   |          |      |                            |

\* Fasten smoke deflectors (248,249) vertically on smokebox with screws (H5) and nuts (N4) and on running boards with screws (B4), as illustrated.  
 \* Referring to the illustration 9, put together the smokebox front plate (195), smokebox crossbar (187) and smokebox (192), with screws (B10).  
 \* Fasten air reservoirs (256,257) on running boards with screws (B10), using two spring washers (SM2) in between, as illustrated.  
 \* Fit pipes (dummy)(252,259) on running boards and air reservoirs (256,257) and retain with screws (B4).

\* Fasten copper wire (263) in air compressor (260) with adhesive, and fit pressure governor (262) on the wire with the wire remained about 7 mm from the compressor (261). Fasten the compressor assembly (261) on the retaining plate (260) with screw (B4) and then, on the running board with screws (C13).  
 \* Water feed pump (254) is fastened, the same way, as illustrated.  
 \* Fasten lubricator casing (251), boiler water cleaner (253) and power reservoir (258), as illustrated.

\* Steps (255, 250) should be taken care after fastening so that they may not be bet when the locomotive is rolled.

#### XV. C A B

| PART NO. | Q'TY | NAME               | PART NO. | Q'TY | NAME            |
|----------|------|--------------------|----------|------|-----------------|
| 266      | 1    | Cab                | 270      | 1    | Drawbar         |
| 267      | 2    | Number Plate       | 271      | 1    | Drawbar Pin     |
| 268      | 1    | Roof               | 263      | 1    | ø2 Copper Wire  |
| 269      | 2    | Regulator Pull Rod | B4       | 6    | Flat Head Screw |

\* Fasten drawbar (270) into drag beam (4) with drawbar pin (271), as illustrated.

\* Attach number plates (267) on both sides of cab (266) with adhesive and mount on foot plate (228) with screws (B4). Insert separable roof (268) in- to cab (266). When driving, the separable roof would be removed for easier operation.

\* Fit regulator pull rod (269) on regulator bell crank (179) and then, dome (181) after taking the dimensions, and the other end into cab.

\* Referring to the illustration, make dummy pipings from water feed pump (254), dummy drainner (206) and dummy check valve (184), and fasten with adhesive. The upper end of dummy pipe (263) should be fit into the central hole of cab.

NOTE: When piping, dummy water feed pump (254) would be removed for easier piping.

#### XVI. COUPLER

| PART NO. | Q'TY | NAME                           | PART NO. | Q'TY | NAME                 |
|----------|------|--------------------------------|----------|------|----------------------|
| 272      | 1    | Coupler Drawhead               | 278      | 1    | Chain                |
| 273      | 1    | Coupler                        | 279      | 1    | Dummy Economizer     |
| 274      | 1    | Coupler Pin                    | 280      | 1    | Oil Pump Driving Rod |
| 275      | 2    | Uncoupling Shaft Bracket(R)B10 | 4        | 4    | Flat Head Screws     |
| 276      | 2    | Uncoupling Shaft Bracket(L) H6 | 8        | 8    | Hexagonal Head Screw |
| 277      | 1    | Uncoupling Shaft               | N1       | 1    | Nut                  |

\* Fasten coupler drawhead (272) on front buffer beam (5) with screws (B10). Insert coupler (273) into coupler drawhead (272) and retain them with pin (274).

\* Fit air hose (280) on the beam (5) and retain with nut (N1) at the back. Bend the end of air hose (280) in the underside of the coupler.  
\* Put uncoupling shaft (277) through right and left uncoupling shaft brackets (275,276), as illustrated, first, and then retain them on the beam (5) with screws (H6). Chain (278) is mounted in the centre, and is connected in coupler. \* Dummy economizer (279) is removed when filling oil tank with lubricating oil.

#### XVII. BRAKES

| PART NO. | Q'TY | NAME                  | PART NO. | Q'TY | NAME                 |
|----------|------|-----------------------|----------|------|----------------------|
| 282      | 6    | Brake Hanger Bracket  | 287      | 6    | Brake Shoe & Hanger  |
| 283      | 2    | Hanger Spacer (long)  | H5       | 6    | Hexagonal Head Screw |
| 284      | 4    | Hanger Spacer (short) | B7       | 6    | Flat Head Screw      |
| 285      | 3    | Brake Cross Rod       | N6       | 6    | Nut                  |
| 286      | 2    | Brake Pull Rod        |          |      |                      |

\* Remove screws (B28) temporarily used in main frame assembly. Fasten brake hanger bracket (282) on the main frame with the screws (B28), using spacers (283), in the rear part of the trailing drivers. In the rear of leading and



main drivers, fasten the brackets (282), using short spacers (284).  
 \* Fit brake shoe & hanger (287) on the brackets (282) with screws (B7) and nuts (N6), as illustrated, so that the shoe won't touch the wheels.  
 \* Insert brake pull rods into each brake cross rods (285) which are to be fastened on brake shoe (287) with screws (H5). Retain pull rods (287) with adhesive.

XVIII. FEED WATER HAND PUMP

| PART NO. | Q'TY | NAME                     | PART NO. | Q'TY | NAME                    |
|----------|------|--------------------------|----------|------|-------------------------|
| 288      | 1    | Feed Water Pump Cylinder | 295      | 1    | ø10 O Ring              |
| 289      | 1    | Cylinder Packing         | 296      | 1    | Lever                   |
| 290      | 1    | Valve Box                | 297      | 1    | Pin                     |
| 291      | 1    | Valve Box Plug           | 298      | 1    | Extension Handle        |
| 292      | 1    | Suction Valve            | N3       | 6    | Nut                     |
| 293      | 2    | Link                     | B10      | 2    | Flat Head Screw         |
| 294      | 1    | Ram                      | 16       | 2    | ø4 Stainless Steel Ball |

\* Screw valve box plug (291) and suction valve (292) into valve box (290), using ø4 ball in between, as illustrated, with the arrowed part upward.  
 (Packing compound should be applied to the threaded parts of the plug and suction valve.)

\* Fasten valve box (290) on the cylinder (288), using packing (289) in between, with screws (B10).  
 \* Fit ø10 O ring in the groove of ram (294) and insert the ram into the cylinder. Attach two links (283) on the cylinder and lever, insert pins (297) into them, and retain with nuts (N3).  
 \* When driving the pump, extension handle (298) is used onto the lever (296).

XIX. TENDER TRUCKS

| PART NO. | Q'TY | NAME               | PART NO. | Q'TY | NAME                 |
|----------|------|--------------------|----------|------|----------------------|
| 299      | 4    | Tender Truck Frame | 304      | 8    | Bearing Spring Pin   |
| 300      | 4    | Tender Wheel       | 36       | 8    | Coil Spring          |
| 301      | 4    | End Beam           | H3       | 16   | Hexagonal Head Screw |
| 302      | 2    | Center Bolster     | B10      | 8    | Flat Head Screw      |
| 303      | 8    | Bearing            |          |      |                      |

\* Deeply screw bearing spring pin (304) into bearing (303) applying packing compound on the threads.

\* Put spring (36) onto the pin and insert the pin into tender frame (299).  
 Fit bearing on the end of tender wheel axle (300) and fit the bearing (303) in the lon hole of tender frame (299)  
 \* Fasten center bolster on tender frame (299) with screws (B10), as illustrated, and fasten end beams (301) on tender frames with screws (H3), too, so that the assembled frame touch a flat surface.

## XX. FEED WATER PUMP

| PART NO. | Q'TY | NAME                                            | PART NO. | Q'TY | NAME                 |
|----------|------|-------------------------------------------------|----------|------|----------------------|
| 305      | 1    | Tender Water Tank                               | 313      | 1    | Drawbar Pin          |
| 306      | 3    | Pipe Nipple                                     | 314      | 1    | Drawbar Pin Spring   |
| 307      | 1    | Delivery Union for Hand Pump                    | 315      | 1    | Dummy Brake Cylinder |
| 308      | 2    | Delivery and Suction Union for Axle Driven Pump | 316      | 1    | Coal Gate            |
| 309      | 1    | Hand Pump Delivery Pipe                         | 330      | 3    | 45 Packing           |
| 310      | 1    | Return Tube                                     | B6       | 5    | Flat Head Screw      |
| 311      | 1    | Return Tube Orifice                             | E2       | 1    | E-Ring               |
| 312      | 1    | Orifice Holder                                  | W5       | 1    | Washer               |

- \* In tender assembly, packing compound should be used for water tightness.
- \* Put pipe nipples (306) and delivery hose union screw (330) in each hole of tender frame. Fasten with 45 packing (99) and delivery union (307) at the inside of the frame, as illustrated. Fasten pipe nipples (306), the same way, with packing (99) and delivery and suction unions (308).
- \* Mount the assembled cylinder on the base of water tank and fasten with screws (B6), applying packing compound on the threads.
- \* Connect hand pump delivery pipe (309) onto the pump and into the delivery union (307).
- \* Fasten dummy brake cylinder on the tank with screw (B6), applying packing compound enough.
- \* Return tube orifice (311) is for your checking of recycled water when by-pass valve is opened. Connect pipe nipple (306), return tube (310) and return tube orifice (311) so that the orifice can be seen from water filler orifice.

- \* Insert drawbar pin (313) in the hole and put spring (314) and washer (W5) onto the pin from the underside and retain with E-ring (E2).

- \* Coal gate (316) is removed during driving for refueling charcoal.

## XXI. COAL PLATE &amp; COUPLER

| PART NO. | Q'TY | NAME             | PART NO. | Q'TY | NAME                 |
|----------|------|------------------|----------|------|----------------------|
| 317      | 1    | Coal Plate       | 326      | 1    | Coupler              |
| 318      | 1    | Packing          | 327      | 1    | Tender Step (R)      |
| 319      | 1    | Water Filler     | 328      | 2    | Coupler Spring       |
| 320      | 1    | Filler Lid       | 367      | 1    | Number Plate         |
| 321      | 1    | Filler Hinge Pin | B4       | 26   | Flat Head Screw      |
| 322      | 1    | Tender Handrail  | B9       | 2    | " " " "              |
| 323      | 1    | Tender Step (L)  | H3       | 4    | Hexagonal Head Screw |
| 324      | 1    | Coupler Drawhead | H5       | 4    | " " " "              |
| 325      | 1    | Coupler Pin      | N1       | 1    | Nut                  |

\* Put filler lid (320) on water filler (319) and retain with hinge pin (321).  
 \* Put water filler (319) on coal plate (317) and fasten them together with  
 orifice holder (312) and return tube orifice (311) from the underside of  
 the coal plate, with screws (B4).  
 \* Fasten coal plate (317) on tender water tank (305), using packing (318)  
 in between, with screws (B4). Packing compound should be applied.  
 \* Fasten tender hand rail (322) on the corner of coal plate (317) with screw  
 (B4), as illustrated.  
 \* Insert coupler (326) into coupler drawhead (324) and retain with coupler  
 pin (325) and nut (N1). Fit two springs (328) on both sides of the coupler  
 (326) and retain with screw (B9).  
 \* Fasten the assembled coupler on the tender with screws (B3), as illustrated.  
 \* Fasten tender steps (323, 327) on the tender, too, with screws (H5).  
 \* Fasten number plate (267) with adhesive.  
 NOTE: Fill the water tank with water and check if water is leaking and if  
 the hand pump works well.

## XXII. INSTALLATION OF TENDER TRUCKS

| PART NO. | Q'TY | NAME                          |
|----------|------|-------------------------------|
| 101      | 2    | Tender Bogie Truck Center Pin |
| N5       | 4    | Nut                           |
| W3       | 2    | Washer                        |

\* Fasten the center pin (101) on tender stretchers with nuts (N5).  
 \* Fit the assembled tender bogie trucks onto the center pin (101) and fasten  
 with washer (W3) and nuts (N5), as illustrated.

## XXIII. COUPLING OF TENDER AND ENGINE

| PART NO. | Q'TY | NAME                    |
|----------|------|-------------------------|
| 329      | 1    | Reinforce Coil Spring   |
| 332      | 1    | Delivery Hose Union (2) |
| 310      | 1    | Return Tube             |
| 333      | 1    | Silicon Tube            |
| 331      | 1    | Delivery Hose Union (1) |

\* Tender should be coupled in the front hole of drawbar (270) when driving.  
 NOTE: When the locomotive is used for ornamental purpose, the second hole  
 is used for coupling.

\* Put delivery hose union (2)(332) onto return tube (310) and then, insert  
 hose union (331) into the tube (310). Put the other end of return tube onto  
 hand pump elbow (226) and tighten with wire, since it is pressured by hand  
 pumping.

\* Put silicon tubes (333) onto each pipe nipples (306).  
 \* Return tube (310) and silicon tubes (333) should have enough length so that  
 the tubes won't pulled off on sharp curves.  
 \* Adjusting the length of reinforce coil spring (329) to that of return tube  
 (310), put the spring onto the tube.

