Third Addition

Parts Installation Booklet

Do not let looking at a picture or plans of an engine scare you with all the parts, lines and demensions. You are not going to build it all at once as you see it, but build it up a piece and job at a time. You could build a house, as complicated as they are, if some one stood beside you and told you where and how to put each piece. After that you could build one. This is what we are attempting to do in this booklet and kit booklets, to help the beginner get started. So from here on it will be determination on your part to build and engine. Every one who has built an engine has gone thru what you are thinking about it now. Like you tried to learn the skill of your job, they tried to build an engine

These instructions are in much more detail than any other manufacturer gives so as to give the newcomer the greatest possible help. The instructions also assume you have the part in hand to follow directions.

Individual instructions will not be sent with each part however large or small, as this booklet is in lieu of them, and will save you money on parts and us a great deal of individual time consumed distributing per order.Should you not find instructions for a part in this booklet, you will be sent this individual instruction with your purchase of the part(the part and instruction made after this booklet). Insert these in this booklet at the proper page for future reference. We suggest a loose-leaf notebook or essay folder from the dime store.

This booklet will be used in conjunction with engine kit construction booklets, not necessitating reprinting the bulk of all this material in each of them, making them much shorter, containing only what pertains to them or is different than in this booklet. Your particular engine may have some parts located or installed differently than described herein, but basic installation will be the same. After you have made one engine you will know most of the instructions herein, and not have to re-read the same material time and again. Before installing a part, read complete instructions first.

To save several pages of printing and re-reading, it will be understood that you file clean each mating part, rather than tell you each time for about 150 parts. Any sharp-pointed instrument used to hold a part in place, such as pointed heavy piano wire, pointed tip of a file or an ice pick will herein be called a probe. A plastic hammer will mean a plastic hammer, hammer covered with tape or cardboard,wood placed on the part, then hammer the wood, or wood or plastic dowel used against the part,then hammer the dowel. When a certain sized drill is recommended, it will be understood if the hole is for a press fit(tight) for a part's assembly pin, rivet holes, etc., you will first drill it one drill size smaller in a lathe or drill press, or 2 drill sizes smaller for an electric hand drill, then use the proper size drill. In all drilling operations it is helpful to lightly press a small indentation by hand with a scribe, then if it is exactly where you want it, center punch to start the drill, so it will not wander off while drilling.

In many instances we will refer to filing. In such cases,consider the edge of a cut-off disc in your hand grinder, Moto-Tool (electric hand drill could be used but not nearly as good because of its much slower speed, and is very clumsy), as it will remove material much faster than a file, the side of the disc to smooth up, then the file to finish up. We also like these discs better than razor saw for cutting off gatings and cutting small pieces in two. Once you get to remembering to use it, you will use it all the time, and they remove material much faster than grinding wheels and easier, too. They are much easier to use with eye magnifiers, for closer grinding. You should wear glasses as they break easily (until you are used to them) even tho they do not even sting the face when breaking.

It is often helpful to lightly file some castings smooth, remembering many engine parts are castings too, and they get rather rough from painting, so our parts should have some texture,not mirror smooth. Some hex nuts and rivets were purposely made too long to be sure they cast out or so you can file tops of hexes to proper flat again. Remove all gatings and parting lines.

You will find a couple of chisels made about 1/16"(or less) and 1/8" wide are very useful to hand chisel brass or solder from small quarters or corners by scraping and pushing out small slivers. These must be made from good steel, such as old, small files or the file end of the shank. Possibly hardened drill rod would work. One cutting side flat, bevelled on the other, then sharpened on a hand stone.

Often times the engine seems rather awkward to hold for a certain installation, -----you do not want it sitting upright, or on the side. In such casses an old turkish towel, which has a lot of body, can be wadded up so you can lay and hold the engine at any angle. We rarely find the torch getting to it, but if it should, lay a very wet cloth between towl and engine.

Small bits of solder can be made for where Solder In Paste does not give enough solder by melting solid solder about 8-12"above work bench and allowing the drops to hit the work bench, splattering flat in paper thin splatters, which then can be cut in about 1/16" squares. these kept in a small container until needed. The same can be done by holding melted drops about 6-8" above work bench for thicker splatters falling to work bench and simularly cut for heavier soldering.

As you build your engines, there will be some parts that will get bent, such as Pilots, Flagstaffs, Handrail Posts etc. Do not keep straightening these as they may finally break, just leave them bent until the engine is done, ready for painting.

We believe this booklet will be of great help to you----even the rank novice, to get his first engine built. Like anything else, after the first one, they are not too hard. Some of you may feel we should have used more drawings. Maybe so. A book probably could be prepared, but this is not desireable from its cost and what you would pay for. Besides we did not feel more necessary. Most parts can really be assembled just by looking at them, thus no drawing needed just some technical information helpful that drawings would not explain.

S Scale Locomotive & Supply

7120 Oreon Dr. St. Louis. Mo. 63121

Basic Running Gear

#1 DRIVERS, QUARTERED --
Any of these Drivers can be used for other sizes from 1"-2" larger or smaller without being noticeable to the eye. Occasionally you may find a tire whose treadface is a sharp corner and needs rounding with a file. For installation, see #18, Frames. Pick-up on right side.

#1 DRIVER CASTINGS --
If you machine your own Tires, you can vary Driver diameters up to 2" larger or smaller than specified. The hole centers of Axle and Eccentric holes are .233" apart (except 51" Drivers, which are .200"). It is best to machine about .005" off of the front face of the rim for squaring. For use on our Frames, to get proper side play of quartered sets in the Frame, machine enough off of inside face of hub (after machining .002-.005" from front face of rim) to get .206" from face of rear hub to front face of rim for scale Drivers (.216" for hi rail). Generally the O.D. of all Drivers can be machined about .032" (.016" cut). For our Axles, drill Axle holes #23 and Eccentric hole #50 for tapping 2-56. Machine Driver O.D. .001" larger than Tire I.D. for the non-insulated side, and for the insulated side two times the insulation thickness plus .003" larger than the Tire I.D.

#3 COUNTERBALANCES --
For half-round Counterbalances, fit to Driver hub by filing underside of the hub portion of Counterbalance and spokes near hub until Counterbalance sits level on Driver counterbalance. If edge of Counterbalance extends over edge of Driver rim, file edge of Counterbalance until it drops down inside the rim. Tin underside of Counterbalance and top of Driver counterbalance lay Counterbalance over Driver counterbalance and align, noting distance that nearby spokes are from edges of Counterbalances. Solder with soldering iron, not torch on the insulated side. Later you may want to file them thinner to give better clearance for Side Rods. You can make them for Box-Pok and Scullin Disc. It is easier to file flat and parting lines while still on cluster.

#5 TIRES --
For installation of Tires flush with Driver casting, get a flat piece of steel ¼" or thicker and top surface as large as a 79" Driver or larger. Drill a hole in it three drill sizes larger than the Driver's outside hub diameter, and another about .233" away, center to center, three drill sizes larger than Eccentric hub diameter. Then cut some material away between the holes to about .050" deep, so now a machined Driver casting's outside surface can be laid over these holes and the rim all the way around will lay flat on the plate. This plate (jig) can be used for all diameter Drivers. (Short pieces of pipe could be used, but varying diameters would be needed).

For non-insulated side, lay Tire over above holes with Driver casting on top. Tap all around casting, gradually tapping it into the Tire all the way, the Driver hub and Eccentric going down into jig holes. Driver could be laid over jig holes first, then Tire tapped onto the casting, but we do not prefer this method for some unexplainable reason (possibly springing the Tire). The insulated side is done similarly, below. In both cases, be sure Tire is flush with front face of Driver rim. Binocular magnifiers are best for this inspection.

Coat the I.D. of the Tire with epoxy, then insert the insulation, Fish Paper #6.1. It is easier if the insulation is cut about two Tire widths wide so the Driver can be set down into the tube formed, pushing Driver a bit sidewise toward the open ends, allowing the opposite side to go into the tube. First coat the I.D. of the insulation too, then insert the Driver, pushing it down with thumb pressure, and best with magnifying glass see that the Driver face and the Tire face are flush all the way around. See #18 Frames.

#8.1 AXLES --
Grind ends flat, 1.125" long for scale (1.110" for hi-rail). Axle diameter is .162". Drill hole in Frame .163-.164". Drill Axle hole in Driver .154", Gear .162".

#10.1a GEAR --
To install, chuck an Axle in a drill press, then lower the press so the Axle goes between the jaws of your vise. Take the Axle out of the chuck, close the chuck clear up, lay a Gear on the vise over the opened jaws (opened just wider than the Axle diameter), push an Axle down into the Gear to the splines and bring the chuck down on the end of the Axle, pressing it into the Gear. On a lathe, the operation is similar, except the jaws of the headstock is opened up for the Axle to pass thru, with the Gear over the opened jaws, and using the tailstock to press the Axle into the Gear. You can also lay the Gear over the opened jaws of a vise and drive the Axle in with a hammer, but oftentimes the Gear will be a bit crooked, which is alright if just a small amount, but if too much, it can be pried straight when in your Frame, using a screwdriver.

The largest 63" Counterbalance #3.5 does not quite have enough concave curvature by hub, so file or grind a notch in the center about 1/32" deep, then round out curvature until notch is gone. Diameter needs to be reduced similarly.

#10.1b WORM --
This has a .124" diameter hole that can be pressed on 1/8" shafts (DC-86 and DC-84, etc. Motors). To press Worm on shaft, hold Motor vertically with bottom shaft on metal or wood, then put Worm on the top shaft. Lightly tap the Worm onto the shaft, being careful to tap squarely, so as not to bend the shaft. With any care at all, you will not. If the Worm is to go down further, use a small metal tube to tap it on down. For best operation and longer Motor bearing life the Worm should be as close to the Motor as possible. Excess shaft sticking out can be clamped in a vise and sawed off. So as not to bend the shaft, do not hold the Motor rigidly - hardly at all. Before pressing the Worm all the way in, it would be best to install the Motor in the Frame to be sure the Worm is about centered over the Gear.

#12.2 MOTOR, DC-86 (or DC-84, etc.) --
For installation and adjustment, install after Side Rods are broken in, then remove until engine is done, do not torch Boiler with Motor in Boiler.

All our Frames have angled motor beds to take this Motor. The Motor has the Worm pressed on in the proper position and mounting holes drilled and tapped 4-40 for you. To adjust mesh of Worm and Gear, file off front or rear of motor bed so engaged Worm and Gear just barely allows the Driver to turn back and forth, it is not critical, about identical to an AF steam engine. Or (or for final adjustment) try varying thicknesses of any metal sheet stock between Motor and Frame at front screw to loosen mesh, or between Motor and Frame at rear screw to tighten mesh. When the proper mesh is found, a washer can be made of that material to put on that screw. Put in the screws snugly, but not too tight and strip the threads. If you do, a nut will have to be used. Very small final adjustment of Worm-Gear mesh can be accomplished by bending motor bed at rear of gear slot. For repairs, write The Pittman Corp., Sellersville, Pa.
For operation in our engines, loosen one field stack screw, preferably the top front one, as Motor here is furthest from the Boiler, and wrap one motor wire under the screw head in direction the head turns, as the ground wire. The other Motor wire goes to the Drawbar.

This DC-86 Motor and 22:1 Gear-Worm ratio, above, will give prototypical speed for all size Drivers. Of course, switchers will be quite slow as they should be, giving very good, smooth, slow control. But if you want more speed and are used to fast AF engines, a DC-84 Motor could be used with the same installation.

You may have to grind inside Boiler to get the motor in and sometimes the top corners of motor slowly round down, especially small Boilers like Light Mike and Light Pacific. Do not allow Boiler to rest on motor, which is very noisy.

#13.1 FLYWHEEL --
We strongly recommend this Flywheel on DC-86 and DC-84 Motors, see "Price Catalog". Should the diameter be too large, chuck the hub in an electric hand drill and slowly file down. For larger diameter, tin diameter well, but no thick spots. Wrap with desired thickness sheet stock and wrap with wire to hold it tight, then solder with torch. Ends must be butt joints, not a lap. Simply tighten screw on 1/8" motor shaft.

On some engines the Fly-Wheel will have to be installed with the set screw toward the motor.

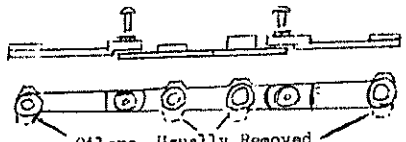
#14 CRANK PINS --
Because these sleeves are so hard to machine, particularly in tough stainless steel (we'll probably have to revert back to regular steel because of machining difficulties), you will find the shoulder on most has a burr at one end, inside and out, and occasionally a little rough and oversized, and will not go into Side Rod. Slide sleeve up on small rat-tailed file until it sticks, then lightly file as you rotate, keeping filing smooth and even. Fillister head screws have been used because of smaller, more prototypical head and Side Rod bearing diameters, with still the rigidity of 2-56 screws. Particularly, Crank Pins under the Cross Head Guides, saw slot in all screw heads almost to the threads, then grind head down so just enough left for good screwdriver grip. This gives clearance for Cross Head Guide and looks better for the others. When screwed into Drivers, remove any thread sticking out on the back of the Driver. The flathead screw for the Main Rod sticks out a bit on the Eccentric Crank, so should be ground down flush with the Eccentric Crank for smaller diameter. All heads can be filed hex shaped, or hex screws put in the sleeves (shoulders). Our #1.1 countersunk Eccentric Crank is attached to the long shouldered #14.2 Crank Pin by removing the shoulder, sliding the Crank on the screw with counter sink next to the flat head, then replace the sleeve. The large end of the Main Rod goes over the sleeve. With the Driver's Eccentric straight down, screw the Crank Pin into the Driver so the Eccentric Crank is about 22° (half of 45°) forward of top vertical.

Check tightness of Crank Pins during first couple hours of break in, as there is extra pressure on them, and one may come out and throw engine off the rail if it should be the Main Rod.

#14.2, long, can be used on most Trailing Trucks.

#16 SIDE RODS --

They are a universal right-left, 4, 6 or 8-Driver Rod, with all possible Oilers and Knuckles. Remove the ones that your engine does not require, usually those on the bottom. For 6 Driver use, remove front section, usually, and for 2 Drivers remove front and rear section, usually. The thick hub is to the outside to space the Main Rod



See #4 Note at the back

Redrill Crank Pin Holes 7/64" or file holes to fit Crank Pins.

Some Rods are slightly narrower in front, some equal width and some marked on back, front or rear. Assemble with .026" straight pins as shown, cutting them off in back as short as your dykes will allow, not longer than about .032 ", then pean over on the back. Small ball pean hammer is much easier to do this than flat-faced hammer. For removal of pin, just file off the peaned portion. Install both Rods using longest shouldered screw in the thick, shouldered hole. Crank Pins may be tight at first. Rods should bind on Crank Pins, as holes were purposely made to fit snug and break into a good fit, rather than larger holes drilled for a sloppy fit.

Because holes can be drilled much more accurarely in Side Rods than Axle holes in Frame, experiments indicate some correction (filing)of Axle holes should be done first only in the Axle holes on each side of the Frame where Axle is tight. Remove Drivers and paint tight Axle holes with Blue Dicum or thin dark, fairly thin laquer. Put Drivers back in the Frame, pick-up on the right side, put Side Rods on. Side Rods should always go on the same side, so mark them, or remove the un-needed Oilers, which will then indicate which side they go on, tighten cover Plate just so the Drivers will turn thru a bit tight. Roll Drivers back and forth on the work bench about 7-10 times. Remove Cover Plate and set the Drivers aside. With small rat-tailed, file areas only on the Axle holes of Main Frame and Cover Plate where the Blue Dicum shows wear. Will file this area. Repaint holes in both Fram sections, replace the Drivers and Side Rods and repeat the process until finally the bind is gone or the Axle holes on each side of the Frame is barely loose with the Cover Plate screwed down tight. If there is still bind, which isprobable, put Blue Dicum in Side Rod holes as explained below for further correction. On our later Frames we have purposely drilled Axle holes slightly under sized for above, which will give better life to the Side Rods, in that they will have smaller, tighter fitting Crank Pin holes, at the same time breaking in the Axle holes.

A reasonably good Blue Dykem,especially for this purpose can be made from an old purple sheet of 'spirits' copying carbon ("Ditto", A.B. Dick, etc.) sheet, that a local printing service may give you, or buy a sheet for about 7¢. Cut about 3 square inches of it into about 1/8" squares, place these in a very small bottle, 1-2 oz. pill bottle. Then fill bottle with laquer thinner, or alcohol if a plastic bottle used. Shake well and possibly sit over night. Then either pour into another bottle, or with tweezers remove the paper squares. You should now have a saturated solution that will give dark purple marks with a brush on an oil free surface. Solution could be poured in an old nail polish bottle that has a small brush.

Now to break in Side Rods. Remove both Rods and with a small wire, paint the Crank Pin holes from the back with dark lacquer or blue dicum, (along with them the

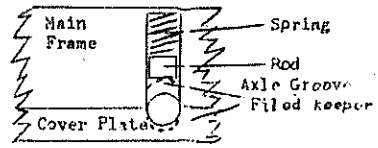
When dry, reassemble Rods on Drivers and roll along the table 4-5 times. Do not apply so much pressure so as to break a Rod, but enough to wear the paint. Remove the Rods one at a time and lightly file the areas inside the holes where the paint is worn off. Repaint the holes, replace the Rods, continuing the procedure until the Drivers roll free, or almost, then roll back and forth on table until free. Once broken in, Rods should go on the same side. It is important when adding each additional part of the Valve Gear, Crosshead, etc., of each side that you check for and remove any binds right then, so you know where they are, as engine was not designed for very loose fits. If fluted Rods are not wanted, fill flutes with solder, file smooth and coat with laquer so the solder will not turn darker than the nickel silver. Of course Drivers should be fitted in the Frame, #18, before the above.

#18 FRAME --

Remove Coverplate from Main Frame, insert Drivers so insulated Drivers are on the left side (geared Driver in rear hole, blind Drivers, if any, in the center). Replace Cover Plate and screws. If Drivers do not spin freely, check for burrs on the Driver hubs and sides of Frame. If Drivers have no side play movement, this may be the trouble, so carefully file the back face of hubs, preferably with a file with a blank side next to the Axle. Do not get the Axle rough or it will rapidly wear the Axle holes. The Frame could be filed narrower instead. The amount of side play needed will vary according to the radius of your curves, number and diameter of Drivers. Normally, the front and rear Drivers just barely have side play, with center Drivers having similar amount to 1/16" maximum for tighter curves, etc. above. If center Drivers have too much side play, solder small sheet stock on cover plate in hub area,then file as desired.If Drivers are still tight, roll back and forth on work bench, or leave screws loose, or place one layer of tissue or typing paper between Main Frame and Cover Plate, between the Axles, until Axles and Axle holes wear in, (We make our center Axles 0-.005" above front and rear Axles).Slotts in Coverplate is to hold oil.

There seems to be a difference of opinion, even from the experts, whether sprung or rigid Frames are best. Some say sprung Drivers have more of a tendency to climb rails, because on a rigid Frame, if one Driver starts to climb, that Driver automatically starts carrying much more weight, thus preventing it from climbing. On sprung Drivers, some prefer springing all Drivers, but if there is some uneveness in the road bed,the engine will sway from side to side. With geared Driver rigid, still some sway. With front and rear rigid, most of the sway is removed. Unless you have a very even road bed, we would suggest the latter of the springing.

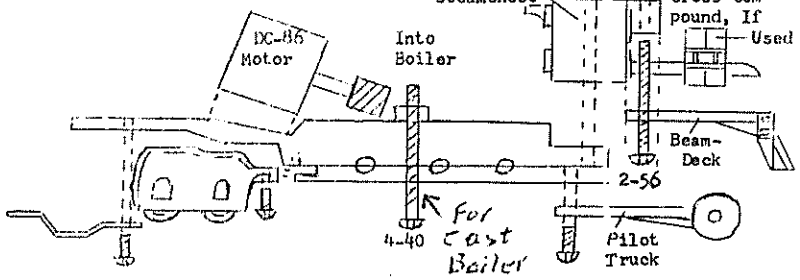
Before springing Drivers in the following method,have the engine completely done, weighted and well broken-in, as with the engine off the rail, the Drivers will not spin free because of the spring tension on the Axle. To check for binds, the springs must be removed. While this probably is not the best springing method, it probably will not be noticeably different to other methods. It is an easy method to change a rigid Frame to sprung and saves the much higher cost of slotting Frame for bearings and bearing cost.



Make according to the drawing, centerpunching the top of Axle groove on each side of the Frame to start undersized drill or center drill correctly. Do not spring geared Driver. Then drill an 1/8" hole on each side for the spring. Should you accidentally drill clear thru the Frame instead of barely to the top, a thin sheet stock can be soldered over the top hole or small piece placed in the hole and soldered. The little brass rod should not be over about 1/8" long, possibly sides lightly filed so it slides easily in the hole. The bottom tip of the spring, particularly, should be bent inward a trifle so it will not score the walls. You will have to experiment with spring tensions until we have them for you, in which case you will weigh the engine completely done,then divide the weight by the number of Drivers, then this is the weight (or tension) spring to use. (Each Driver, sprung or not, will carry the same weight, if engine is balanced midway between first and last Driver. If engine is heavier on the first Driver, which we believe is preferable, then barely pull this spring longer for more tension. This may not be necessary either, since the Draw Bar on the engine is higher than on the Tender, so pulling probably tends to lift the front of the engine. Notice in operation.). Now with a small rat-tailed file,carefully file Main Frame Axle holes about 1/16" deeper, and Coverplate Axle holes about 1/32" deeper, so Axle just fits down into it. The complete sprung engine when set on the rail should just barely compress the spring so the spring and 1/8" rod does not hold the Axle against the Coverplate, causing slight drag. It would be best too,that the bottom of the 1/8" rod be filed curved to fit the Axle, or it will wear more quickly and have to be replaced sooner, which is quite easy.

These Frames being brass, can easily be reshaped or extensions soldered on to a more prototypical shape.

AF Steam Chest will fit on #18.42 Frame, for 69" Drivers, or fitted to the others.



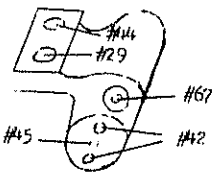
#20 SPRINGS --

Install after the Boiler has been fitted, so they do not touch the Boiler. Since our Frame is higher than the prototype, grind off the bottom of the Springs to make it stick above the Drivers proper-

ly for your type of engine. The Spring can either be soldered directly to the Frame with torch, or to a plate about .016" thick and fitted to the top of the Frame and screwed on using the 2-56 screw holes on top of the Frame (Brake Shoes could be soldered to the plate too). Mark Spring locations on the plate, remove plate and solder the Springs on. If when grinding Spring base shorter with cut-off disc, you grind so that there still is a bottom pin, then drill holes the size of your pins in the plate or Frame and solder them in. The Spring base should overhang the side of the Frame, toward the Drivers about 1/32" (but not necessary). At the point of the offset pin on the bottom of the Spring for larger Driver Frames, you will drill a hole to the inward part of the Frame and fit this pin in and solder. The Hangers, vertical bars at tips of Spring, should go down between the Driver and the Frame, but Driver sideplay on your particular engine, especially center Drivers, may prevent this. This is not necessary as they are behind the Drivers. All Springs are not necessarily at the same elevation.

#18.8J FRAME--
This 79" Driver Frame goes on AF Hudson and Pensylvania K-5 Boiler as this drawing except very rear hole goes into rear of Cab for Hudson and second from rear for K-5. The next one forward for each of these are for the Draw Bar. Instead of 2 Wheel Pilot Truck shown, use the AF one, or our #64.8, which see, and is more prototype and heavier, which will stay on the rail better than the light AF Truck, For Hudson, a shim will need soldering between rear of Steam Chest and Frame.

#25 STEAM CHEST --



Steam Chest Hole Sizes

These were almost impossible to cast so none are perfect, needing some touch-up with a file. The two-piece Chests should first be soldered together using the alignment pins to align them. The Chest sits on the front lip of the Frame and a 6-32 screw going into top large center hole of Steam Chest and screwed into the Frame. If the Steam Chest sits a trifle forward so screw will not go in, file a bit off of the Chest at the Frame. However, if with the screw in, the Chest rotates sidewise on the screw, solder a shim on the Frame or Chest so the fit is snug. Some tend to set tilted fore and aft, needing some filing of bottom rear mounting area on the Frame next to Frame.

After filing off gating you may have to re-contour Cylinder Barrel. Large vertical pipes may have to be bent inward or outward with plastic hammer to get Boiler at proper height, particularly #25.5 with longer pipes. Recontour pipe against Boiler

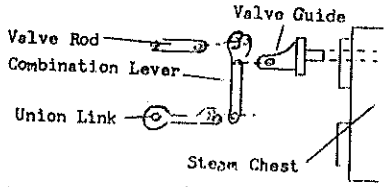
It is probably easiest to install here the Beam-Deck #54, Pilot #60, Cross Compounds on Deck, Pilot and Trailing Trucks, as pictured above, and fit the Boiler.

#25.1 is slightly larger and interchangeable with AF Hudson and K-5 Steam Chests. #25.5 can be fitted.

Running Gear Details

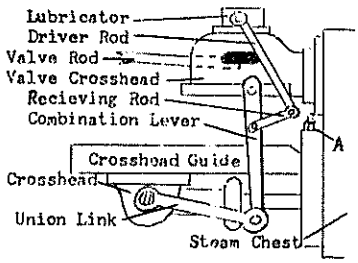
#26.1 VALVE GUIDES --

The pin on the back goes into the top rear hole of the Steam Chest and torch soldered in. Because of the inability to model prototype tolerances of Drivers, Crosshead Guides and all rods, the inside and outside forks of the Valve Guide should be



bent outward about 1/32" so Combination Lever will clear Crosshead Guides (see #30). For same reasons, it has been set outward on Steam Chest too far, so re-contour it to fit the rear Chest Barrel. You may have to adjust Valve Gear's frame fore and aft slightly to get it's Valve Rod properly positioned on Combination Lever. (Re-drill holes .029). (Easiest bent on Steam Chest).

#28 VALVE CROSSHEAD --



Install Valve Crosshead similar to above, in top rear hole of Steam Chest, as shown, and solder with torch (Put wet swabs over center of Steam Chest if 2-piece Chest). Cut the alignment pin about .050" long, then set circular plate of Valve Crosshead behind nut 'A' and push alignment pin into Steam Chest hole. File out rear hole of the Valve Crosshead to receive the Valve Rod from the Valve Gear.

To adjust length of Valve Rod, lay Rod alongside of the Valve Crosshead (outside) and roll the Drivers until the Valve Rod moves to the rearmost position, then cut it off just forward of the rear hole of the Valve Crosshead. Of course, the Valve Gear has to be fully assembled to do this. Loosen the Steam Chest, move it forward and insert the Valve Rod onto the rear hole of the Valve Crosshead. Because of the problems in #32.6, the aggregate error has made it necessary to put the Combination Lever outside the Valve Crosshead instead of inside it. Put the pin thru Combination Lever, into Valve Crosshead and solder in back. Pin head diameter can be filed down some. File out the hole in the Union Link to receive the 2-56 screw of the Crosshead. (File dummy nuts off of face of Union Link, unless holes filled with tube for 00-90 screw.) Rods added later.

#29 LUBRICATOR --

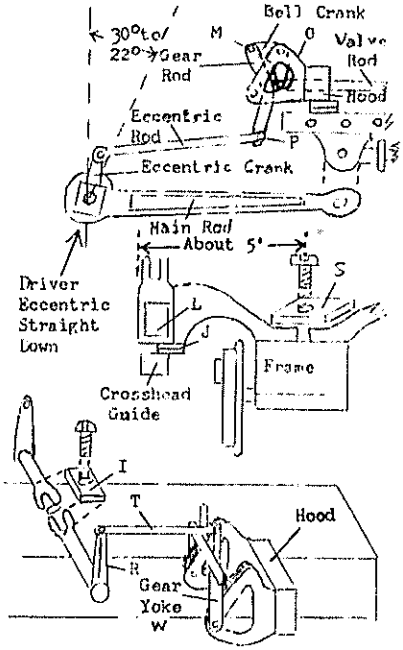
Set Lubricator on top of Valve Crosshead, with bottom alignment pins going into corresponding holes in top of the Valve Crosshead. Some of these pins may have to be filed smaller and shorter with a fine sharp-edged file. Coat both pieces with soldering paint and torch solder. Drill out holes in Rods .022" with hand pin vise. Install Rods as shown, soldering the pins in back. Driver Rod in Lubricator need not have the pin head filed smaller. (Sometimes Lubricators are sit on top of Valve Guides and other places.

#30.1 UNION LINK & COMBINATION LEVER --

The top offset fork on the Combination Lever is installed on the inward side. The large hole of the Union Link goes next to the head of the 2-56 screw of the Crosshead, removing the small rivets here. All other rods are assembled with .021" pins, with a bead of solder on the back.

See #26.1 & #28. The Valve Rod (Radius Rod) of the Valve Gear in Combination Lever will determine fore and aft location of Valve Gear. The bottom in each Rod fork needs deepening with file or cut-off disc, particularly the corners. There may be some bending of these Rods with Union Link screwed tight to Crosshead, so re-drill all Rod holes .026" to .030" and use .021" pins to give some play. Or bending of Union Link can also be releaved by not screwing the Crosshead screw in tight, and very lightly solder the screw on the back of Crosshead to Crosshead, but not enough that you could-not unscrew it. Preferably cover screw and Crosshead here on inside with Pliobond or other rubberized cement that would still allow you to remove screw when you wanted to.

#32.1 BAKER VALVE GEAR, TRIANGULAR --



This installation will be a bit difficult because of its interrelation, adjustment and fitting with the Valve Guide (or Valve Crosshead), Crosshead Guides, Yokes and Crosshead. Generally speaking, the Valve Gear Frame has to be adjusted in and out on the engine Frame so the Crosshead Guide (soldered on in the proper place) aligns with its corresponding hole in the Steam Chest, and up and down so the Valve Rod goes about straight into the Valve Crosshead (or Valve Guide). All of these alignments probably will not be perfect. The Valve Gear Frame is installed on engine Frame temporarily, generally using the 2nd hole from the front on engine Frame to secure it as shown, with Brace 'S' about .050" thick (or 2 - .025") and about 1/2" long with #44 hole. Move Gear Frame in and out so Block 'J' clears the Side Rod.

Install all parts in Valve Gear Frame as shown, except the Valve Gear Yoke 'W' which is installed last and Reach Rod 'T'.

File heads of .025" assembly pins flat and smaller diameter, preferably hex-shaped and installed from the outside. These hard brass pins are used here and elsewhere because of more prototypical size, readily found for replacement and easier than rivets to remove and install by touch of soldering iron (not torch) to place a bead of solder on the back. Radius Rods have been

omitted because they are hardly seen, difficult to fit, assemble and operate. So, center hole of Gear Rod is not used. (Radius Rods are about .075" wide and .300" between hole centers and slightly bent.) Install Bell Crank, then solder it to Gear Rod at angle shown at 'N', then push forward and file 1/16" off of Frame Corner where it touches at 'O'. The Valve Rod is installed on inside of Bell Crank at the angle shown of each, at 'M'. The Eccentric Rod is on the outside of the Eccentric Crank and Gear Rod. Gear Yoke installed straight up or tilted slightly backward and on outside of Frame. Pin just goes thru Yoke and Frame. One pin for each side, not one pin all the way across, then spot soldered on the inside of Frame on each side. Pins without heads should be used.

Power Reverse Lever 'R' screwed to engine Frame about one true inch behind Valve Gear, using tapped 2-56 holes in the engine Frame to secure it. Lever is adjusted inward and outward to line up center of Valve Gear, and base bent upward or downward (or shim up or file off bottom of base) so Reach Rod 'T' (made from scrap) is about level.

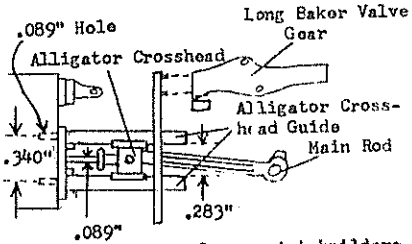
After all Running Gear mechanism is running smoothly, Brace Plates 'S' and 'I' can be securely soldered, making both halves as one.

This Valve Gear has a Hood on it which can be ground off for some engines. For some type Frames, sides of Frame can be filed thinner and a beading from wire soldered around edges, then touched up with a file.

If inside and outside Yokes are to be installed on this, grind off the Hood and Crosshead Guide Mount 'J'. The Yoke will have to be cut in half in the middle and soldered onto the front, with Yoke Valve Rod hole squared over the Frame Valve Rod hole. For further instructions, see Yokes #34. These or Single Crosshead Guides and Crosshead are installed next, #37.1, and final adjustments of the Gear Frame on engine Frame. For final fitting of Valve Rod in Valve Crosshead #28 or Valve Guide #26.1, see these.

After all rods are on, you will find various points sticking, since in these areas models cannot be scaled. Check these. Angle of Eccentric Crank may have to be more vertical than shown. Side Rods and/or Counterbalances may be striking block 'J'. Bell Crank may be striking Frame at 'O' or 'L'. Soldered ends of pins catching or a part bent. Main Rod bent or twisted so hubs bind, or some Rods need slight bend to remove bind. When 'P' is in forward position, it should almost touch rear of Crosshead Guide. If not, touch point 'M' with soldering iron and push bottom of Gear Rod forward. Eccentric Crank may need to be bent outward to clear Main Rod, or tube in Crosshead moved forward. Slot in Crosshead may have burrs or need filing out so Main Rod does not bind here. The circular flange on base of Crosshead, on the inside may be striking the Crank Pin, so needs filing off, or Crank Pin head too long and striking on Crosshead or Crosshead Guide.

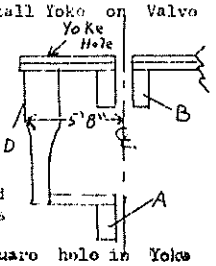
#32.2 BAKER VALVE GEAR, LONG TYPE --



(Dimensions are for scratch builders, as Steam Chest is pre-drilled.)

Parts and gear installed as above, except there are holes in front of Gear Frame to receive and align Yokes #34.1,.2 and .3. Alignment pins in Yoke that goes into the front of the Valve Gear Frame may have to be filed to half diameter, from outside, in order to go into Gear Frame.

Also read #32.1, Triangular Baker for general location. Install Yoke on Valve Gear Frame. Measure from side to side to get the center line. With jewlers saw or cut off disc, saw in half thru CL of mounting brackets 'A''B' that goes onto the engine Frame. Be sure Yoke and Valve Gear cross members are soldered where they are cut. File square hole in Yoke 1/16" lower. Grind outside of mounting brackets edge 'B' narrower, so it wilfit against leafsprings and allowing outside of Valve Gear Frame from 'D' to be generaly 5'8" from side to center of engine Frame, and Yoke 'A' back from Steam Chest body, making center hole of Yoke in line with the outside fork of the Valve Guide. These forks will later be bent outward. Rear Cross rod (Power Reverse Lever) round into just a little to clear 2nd Driver. Yoke should now clear Counterbalances. Yoke could be ground off on inside to give more counterbalance clearance. See #14 to prepare Crank pin heads. You may have to remove Hanger(vertical rod) of Loaf Spring on inside. It will be helpful when each side of the Yoke-Valve Gear Frame has been properly fitted and located, to scribe on engine Frame around Gear mounting brackets 'B' to easier locate later, or should it slip away.



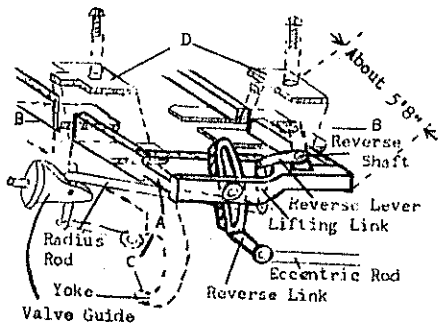
The Power Reverse rod from side to side of Valve Gear comes right at spot in back 'A' wherescrew is located on engine Frame to screw Valve Gear Frame down, so grind rod flat there, down to bracket. Now make bracket 'D''D' (in Walcherts instructions) fit in and screw down to hold Valve Gear Frames in proper location. "Solder In Paste" can be put between these assemblies to solder down later. Now bend down each side of Valve Gear Frame so hole in Yoke almost aligns with 2 holes in Valve Guide horizonally. The internal parts of Valve Gear can be put in now, except Valve Rod, and drill out all holes of parts .026-.028". Be sure Bell Crank and Gear Rods are not soldered at 'M'(Triangular Baker). Bend each fork of Valve Guide outward to align with hole of Yoke horizonally and redrill these holes .029" for realignment.

Attach Reach Rod(made from scrap sheet stock)from Power Reverse on left side : to the Power Reverse Lever.

This Valve Gear does not have the single Crosshead Guide Mount #34.1 as does the Triangular Baker Valve Gear. Install so that the flat portions on the top of the frame are level. Other installation is same as above with same internal parts. The small V-shape sticking down on the bottom of the Frame near the front is for some very few Frames that are shorter than this Frame, so these are to be ground off, or for the shorter Frames, saw across at the front of this "V", removing the front portion, replacing the cross member to attach the Yoke to. Part of front cross member may have to be ground out a bit to clear Drivers.

#32.3 WALSCHAERTS VALVE GEAR --

This Frame, as with the Long Baker Frame, was extremely hard to cast, so none are perfect, therefore need some straightening and squaring. Beading on this one can be filed a bit shallower and any holes in it added with solder from your soldering iron when all assembling is done, then



carefully file even. Align bottom pins (remove top pins) of Yoke with holes in front of Valve Gear Frame. Because Yokes and Frames did not always shrink the same in casting, they may not perfectly align, therefore, file either the inside or outside of the pins (as needed) until they are flat and will go into the Frame holes. After alignment, remove crosspiece 'A' with cut-off disc or file. #34.) Inside Yoke will have to have a bit filed away where bottom of Frame will not seat. Add thick soldering paste to each part, clamp one side together with lock tweezers or old pliers and solder with torch, then other side similarly. This set on engine Frame, the top of Gear Frame should now set parallel to engine Frame, and hole 'A' should be level with Valve Guide center. Locate how far back the Frame should be for your particular engine and mark the engine Frame. With cut-off disc or razor saw, cut in half at B-B. These halves are pulled apart on the engine Frame so Yoke goes over the Crosshead Guides at C-C. See #36 and install. (Single Crosshead Guide and Single Yoke installed similarly.) Between halves B-B, screw a 2-56 screw into engine Frame thru little 1/2" long .025"-.050" scrap sheet stock braces D-D. When running gear is completely done and running perfectly, these braces can be soldered to B-B, making Gear Frame all one piece again (thick Soldering Paint could be put under these when installed). (See 5'8" spacing in drawing.)

Be sure front Gear Frame cross member has an arc ground for Driver clearance, if needed, particularly if Drivers are to be sprung later.

For installation of internal parts, it will be easier, tho not necessary, to remove Gear Frame from engine. File tops of all nuts to give better shape and file all parts to be soldered. Assemble according to drawing, observing the Reverse Link is a tight fit in Gear Frame, so its hubs filed a bit thinner, file inside of Frame a bit, all four inside surfaces of Reverse Link, inside and outside surfaces a bit of the fork of the Radius Rod, since the latter goes thru the Reverse Link with an easy fit. Note that the fork fits close to the center section of Reverse Link; mash fork with pliers if necessary. Remove bottom inside nuts of Reverse Link so Link will force down inside Frame. Note bottom lever of Link turns rearward. All parts are assembled with .026 pins, heads filed flat and much smaller diameter. Clean out all holes with #71 drill. If a forked rod hole did not cast out, put it's mating part in the fork, then drill out. When torch soldering these .026 pins thru Frame into Reversing Link, have the Radius Rod behind the holes, so pins will not go in too far, preventing fork from being raised and lowered in the Reverse Link. These pins are headless, filed almost to the Frame, to show a shaft, but will be nearly impossible if need to be removed later, or they can be left longer so tweezers could pull them out (with torch). Reverse Lever on right side is L-shaped, dotted lines, left side is just the bottom curved piece, and both well

soldered on bracket,with lower leg horizontal. There are pyramidal holes in the back of these brackets for the connecting Reverse Shaft from side to side,of about 3-4" diameter rod to be soldered in after center section of Frame has been soldered. On the Lifting Link and Radius Rod junction, use a headless pin, flush on each side, and each carefully soldered so solder does not spread and lock the joint.

#34 YOKES --

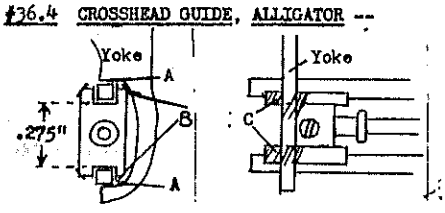
All these have alignment pins to properly fit Long Baker and Walschaerts Valve Gears interchangeably. The shrinkage of Yokes and Valve Gear Frames was not always the same, so you may have to file inside or outside of the pins flat so they will go into Frame holes. Occasionally, Gear Frame is sprung on one side from casting so both pins on that side will not go into holes, so straighten the Frame here. The Inside Yoke has steps on the bottom for many New York Central engines and many others. Most engines do not use them, so grind them off just under Crosshead Guide mount. Solder onto front of Valve Gear one side at a time using lock Tweezers or old pliers to hold the two parts together. Be sure Valve Rod hole of Yoke and Gear Frame match. The bottom pins of the Yoke always go into the bottom holes of the Gear Frame. You may have to drill out Frame assembly holes with #67 drill. With razor saw or cut-off disc, cut the Yoke and Gear Frame in half, see picture at #32.3.

Now Crosshead Guides can be installed. See #36.4, #37.1's 3rd, 4th, 5th and 6th paragraphs, and #37.8.

Alternate methods-Because of difficulty to scale Yoke, Valve Gear and Crosshead Guides spacing from engine Frame(as explained elsewhere) to to adjust the Yoke outward so Crosshead Guides set in Yoke seats properly, the Yoke and Valve Gear Frame will be out too faron the sides. To Correct this, adjust the Yoke-Valve Gear Frame just so lengthwise CL of GearFrame is about 1/32" outward of Valve Guide CL. This leaves Crosshead Guides Justoutside their seat 'C'-'B' in the Yoke on the bottom, To get the Guides far enough in Yokeseats to solder, either a.) bend bottom of the Yokes in area 'A' outward, so it slides over Guide about half way. Probably a bit will have to be filed off of 'C'& 'B'. b.) Filed off 'B' & 'C'. Then fit about .012"thick narrow sheet (tin can or brass stock) around 'B' & 'C', allowing it to stick out plenty for past Guides at first, as a new seat for Guides, and solder in, filing front and back edges flush with Yoke surfaces. Fit Crossheads into this new seat, now remove excess sheet stock sticking out past Guides. This method most prototypicall, but most difficult. c.) Crosshead Guides can simpy be soldered into Steam Chest and float in the Yoke, or just outside of it, not soldered. We would recommend this to most modlers, or a.). In any of these methods, the Guides can be soldered in the Yoke or Steam Chest, not both, for Frame-Steam Chest seperation. We would recommendthe latter as much the simplier, with Guides in the Steam Chest a bit loose. For USRA's and most other engines, step 'D' is ground off along dotted lines 'D'.

#36.1 CROSSHEAD GUIDE, SINGLE --
See #37.1.

#36.4 CROSSHEAD GUIDE, ALLIGATOR --

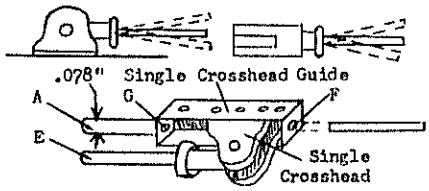


Before installing, prepare Crossheads, #37.8. The short shaft of it goes perpendicular into the Steam Chest up to the Crosshead Guide's brackets. On the top Guide the bracket is on the bottom, and on the bottom Guide it is on top. Lightly file the three surfaces that the Crossheads slide on, also corresponding surfaces on the Crosshead groove. Insert Guides into Steam Chest holes and slide Crosshead between Guides. More may have to be filed from Crosshead side of the Guides to get a bit more spacing of Guides so Crosshead will slide up close to Steam Chest or bend Guide away from Crosshead close to Steam Chest, then bend it down again just to rear of the bracket on the Guide. This is un-noticeable but effective. Place Guides in their position on the Yoke, see drawing.

Now the Valve Gear Frame, holding the Yokes, have to be adjusted in and out to align Yokes with the Guides, see #37.1, 4th paragraph. Guides may have to be bent outward slightly at Yoke so Guides are actually outside the Yoke slightly, depending how all alignment comes out for you, to clear Crank pins. Theshaft of Crossheads may sumularly have to be bent very slightly up, down, inward or outward so they will slide between Crosshead Guides and in Steam Chest holes freely. you may have to use Blue Dye on from Frame on Crosshead Shaft to determine this.

If Crosshead will not slide freely rearward into the Yoke, file a bit off of the Yoke until it does. Since the Crosshead slides back into the Yoke, remove Crosshead and break corners 'B' some with file and mark shaded area 'C' and groove well with lead pencil, then oil the area. Slide Crosshead near Yoke, put soldering paste between Yoke and Guides at 'A', then add a small bead of solder at their junction. Apply torch on these two Yoke-Guide points, When solder melts, with your probe slide the Crosshead back into Yoke to properly space Guide in Yoke. Or instead, do not sit the Guide up against the side of the Yoke, giving space for Crosshead to slide back. Solder may form a fillet, to be filed away.

#37.1 CROSSHEAD, SINGLE --



Set the 'V' on top of the Crosshead on a flat surface and see that the shaft is straight as viewed from top and side. File shaft smooth. File and tin the 'V' slot and the 1/16" tubing. Lightly hold the shaft in a vise and solder the tubing on the forward part with soldering iron, using your probe to hold it in place. The shaft should slide in the Steam Chest hole freely. (File one side flat for AF Steam Chests, or AF hole filed round.)

File both ends of .025" piano wire to clean, for the Crosshead Guide, and inside Crosshead Guide at 'G' and 'F' for the best of soldering. Tin ends of wire well. Slide the wire into hole 'F' and thru Crosshead tubing onto shallow hole 'G'. If hole 'G' is not well defined, it should be drilled deeper, even if not straight or a bit larger. For best soldering, use the torch on the outside only, not on the wire inside, using either very thick Soldering Paint or Soldering Paste and a small pin head sized sliver of solder, latter preferred. Place shaft 'A' in vise horizontally or slightly downward. Hold wire near 'G' with tweezers to hold wire in hole 'G'. Then well solder hole 'F' first. Then hold shaft 'A' vertically in vise, place bead of solder and flux at 'G', wet swab on 'F' and torch 'G' on the outside, using probe to spread solder. Any surplus wire sticking out of 'F' ground off almost flush. If Crosshead does not slide back and forth freely, allow Crosshead set at the tight spot, then melt solder at that end of Guide so wire will re-center.

Remove Drivers and insert Crosshead guide shaft in Steam Chest, as shown at #37.1 Of course, Crosshead shaft will slide in its hole in Steam Chest. Slide Crosshead to rear position of Crosshead Guide, and inside the Steam Chest remove all of the Crosshead shaft that appears there.

Now the final adjustments of Valve Gear Frame on engine Frame is made, slightly bend up or down (or shim between Gear Frame and engine Frame to raise it, or bottom of Gear Frame here filed thinner to lower it) to meet the Crosshead Guide, which are well soldered with soldering iron, with swab on 'F'. Also Gear Frame moved in or out to clear Side Rods, and to solder Guides offset on the block 'J' (32.1) exactly as shown under the Gear Frame. You probably will have to bend the rear of the Crosshead Guide slightly outward so the Valve Gear's Valve Rod will have a bit better alignment with the Valve Crosshead (or Valve Guide), a compromise made.

These should all move freely, ready to put on Eccentric Crank and Rod, and Main Rods. File out the inside of the Crosshead to remove any burrs, and fit the Main Rod to see that it works freely.

The circular flange on the inside of the Crosshead shaft base can be ground off to prevent it from striking on the Crank Pins. See last paragraph of #32.1 for other malfunctions.

#37.8 CROSSHEAD, ALLIGATOR --

The small marks in the bottom of the grooves are to retain lubricant. See #36.4 and last paragraph of #32.1. While Crosshead is in the most rearward position of the Crosshead Guide, any of the shaft seen in the Steam Chest can be cut off in there, so it will not strike the front of the Chest in the forward position. The Main Rod goes in the rear hole and secured with the 2-56 screw. If any part of the screw goes thru the Crosshead to the inside, cut it off flush with the Crosshead.

Sometimes there is a burr or sphere inside, to be cleaned out with narrow file or chisel made from about 1/16" wide old small file or drill (this is handy for scraping solder from around various soldered parts).

#40 MAIN RODS --

#40.7, .8 and .9 Rods have different length flutes on each side to fit your particular engine. These are universal right-left Rods, with all Oilers. Some engines have the Oilers on just the top, some both.

Remove the long flat-head Crank Pin from large hub on Side Rod and Driver. Remove the sleeve from the screw. The head should be filed hex-shaped and saw slot a bit deeper, then file head down a bit so that the Eccentric Crank now put on with the countersink is next to the head and head flush with Eccentric Crank. Replace sleeve and put large end of the Main Rod over the sleeve with Oiler on top, if only one Oiler. With the Eccentric of the Driver straight down, tighten the screw down tight on the sleeve with the Eccentric Crank at about 30° from top and forward, as shown at 32.1. Sometimes it may have to be set a bit more vertical to reduce travel of Eccentric Rod. The small end of the Main Rod goes in the rear end of the Crosshead, with a 2-56 screw thru both. (NOTE: Install only one rod at a time, Main or Ec-

centric Rod. Then turn Drivers and remove any binds, then add another Rod, remove binds, etc.) See #32.1, last paragraph, for malfunctions. Tip of Rod may have to be ground much narrower and a bit thinner to fit freely into Crosshead. Sometimes Rod bent a trifle curved in front or rear. File rod shinny.

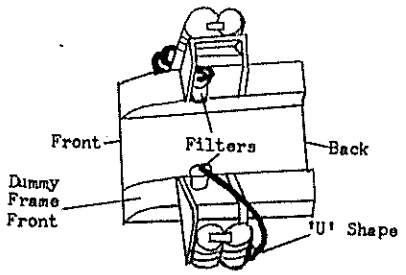
#41 ECCENTRIC CRANKS --
See #40, Main Rods. File shinny, and tin small hole on inside. Opposite side of countersink. File all rods shinny.

#42 ECCENTRIC RODS --
With previous Running Gear mechanism running freely, install wide end of Eccentric Rod on outside of Eccentric Crank, small end on outside of Baker Valve Gear's Gear Rod or Walschaerts' Reverse Link. The .026 pins are soldered on the back with blob of solder. While turning Drivers, remove any binds. See #32.1, last paragraph.

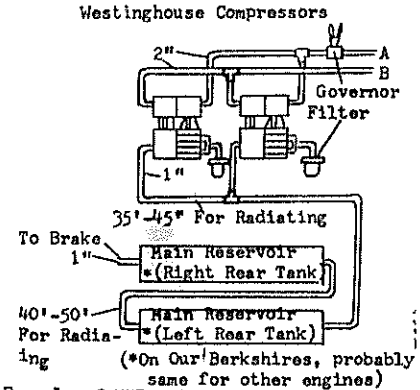
#42.2 ECCENTRIC RODS--Top inside corner of fork may have to be ground down a little with cut-off disc and rear portion of Valve Gear's Gear Rod (or Reverse Link) ground off, making its hole nearer to rear edge.

#45.1, .9 & .11 COMPRESSORS, SINGLE --
These can be soldered directly to position or with threaded hole in back, screwed to sheet stock, then this bent at an angle to Boiler contour or Boiler Front and soldered, by tinning Boiler and bracket first, scribe location on Boiler, then hold in place with probe while torching on. For most engines, including USRA H.& L. Mikes they are even with Running Boards. For H.&L. Pacifics 2" past edge of Running Boards. For easier installation see #138 Tanks, 2nd paragraph. Holes in the pattern were missed for the Filter, so drill these out with #74 drill as indicated in drawing.

#45.2 CROSSCOMPOUND, DUAL --



Westinghouse Compressors



(*On Our Berkshires, probably same for other engines)

*Example of NKP & PM Berkshires. Probably other 2 and three tank engines are the same.

A--To Cab or Turret Hand Valve.

B--Exhaust into Feedwater Heater, Smoke Box, or Main Exhaust Tubes.
(New York Air Brake Compressor Piping the same if drawing is turned upside down and Filter and Reservoir connections reversed.

For single Compressor, of course omit one Compressor and Piping.

This installation is for mounting on Pilot Deck. For installation, see #18, Frame, which should fit all our Frames. After engine is completed, Soldering Paint should be put between base plate and Pilot Deck, then soldered together to form a single unit. These then could be soldered to the Steam Chest.

#47.1 COMPRESSOR FILTER --
One per Cross Compound, located about 8" from the Compressor. See Compressor piping also, above.

Bend piping on each Filter as shown for each side. Some Compound Bracket castings did not cast the hole thru on the right side where piping goes thru, so punch it out. File clean the bottom of each Filter, and place it sits on on the Frame Front. Put thick Soldering Paint on both surfaces, set Filter in place and hold with probe while soldering with torch. Then put very wet swab on this one while soldering the other one in place.

Solder 1" U-shape on each Compound as shown. Now wrap wet string around these U's at the Compound and solder 1" piping from Filter to it. Piping can be left off if you wish, but it is not hard to put on.

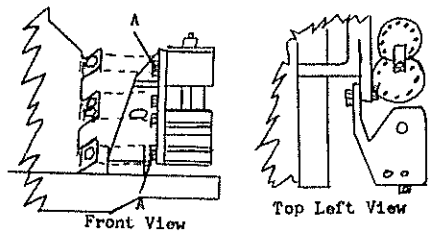
Some engines with Compounds on the side or on Boiler Fronts have Filters just out from the U, and on right of Compressor.

On some engines, instead of a Filter, this line goes into the Cab.

#48.1 COMPRESSOR GOVERNOR --
The piping cast on is 2", which can be soldered right to the Turret. In case of Open Turret, since the pipe valve on the Turret is too small to hold the 2" piping securely, also solder the piping to the top of the Turret as it comes over forward and down to the Compressor, such as on the USRA engines. The other end of the Governor first center punched by hand with point of scribe to get the center, then deeper center punched to start #62 drill, which is drilled about 2 diameters deep while holding it with pliers. Then another 2" piping from here on to the Compressor's right top hole, after it has been cleaned out for solder. The Governor usually is located about half way between the Turret and the Compressor. If 1" piping is to be used, cut off the 2" piping and grind and file smooth to Governor. Hold it with pliers and center punch as above, and drill #74 hole in each end. Solder piping in each end, putting wet swab on first joint before soldering second joint, preferably using annealed piping.

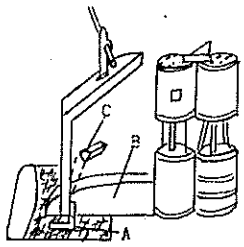
See drawing #45.2.

#50.1 SHIELDS, SINGLE --



Put these on after all other parts of Pilot Beam parts are on. Set Shield on the Pilot Deck so slotted side of the Shield with hex nuts set over nuts 'A'. You will see these nuts (when Shields are used) have to be removed from the Compressor with file or small chisel. Now Shield will fit flat on the Compressor Bracket, as in top view. Put thick Soldering Paint on inside portion of Shield and mating part of Compound Bracket and bottom of Shield, as well as Pilot Deck. Solder with torch.

#50.4 SHIELDS, DUAL --



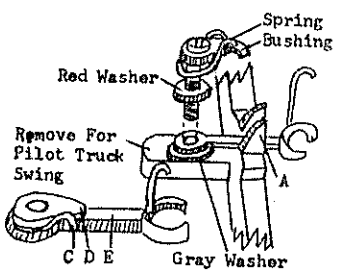
This C&O type Shield is set on the Beam right next to the dummy Frame Fronts. The base angles are too light to hold the Shield, so small scraps of brass, 'C', dropped between Shield and the Frame Front and soldered, will support the Shield. Soldering iron can be used (or torch), holding the Shield with a probe stuck in a Shield hole. Handrail only installed as above. 'B' Dummy Frame Front.

#52.1 GRAB IRONS & POSTS--
Assemble Grab Irons in the bottom two holes on the face of the Shield, the 5" Handrail Posts in the larger top hole, and torch in, which should not loosen Shield. Solder .020" piano wire Handrail into 5" Posts, from Shield to Shield. Use small flame, barely touching the Post and wire. These Posts can be used on Boiler Fronts of some engines, such as USRA's for circular Grab Rail, and the Grab Irons used on Domes.

#54.1 PILOT BEAM-DECK & COUPLER POCKET --
See #25 drawing.
This is a rather large casting with projecting parts, so straighten all knees 'A' in a straight line and vertical. Other straightening by hitting with plastic hammer or hitting with wood dowel(or plastic). File out imperfections. All assembly holes are cast or started for you for all Pilots, Steps, Uncoupler Brackets and Coupler. These can now be put on, then the Coupler, below.

For most engines the Beam must be about 6" to 1' further forward than prototype (1' for 2 Wheel Truck or 6" for 4 Wheel), so Pilot Wheels will clear Steam Chest and under portion of Beam. Therefore Pilot Truck should first be installed, then Deck fitted to Steam Chest, usually requireing 6" to 1' off of rear of Deck, and drilling a new hole from thru Steam Chest . It is better to have Deck too far forward at first, then move it back, rather than the reverse proceedure. Be sure to grind off rear portion under Deck, behind Threaded hole for Coupler, as shown in Coupler drawing.

Coupler, Kadee MK-6 - This Coupler has been used for design purposes because of it's popularity and prototypical size. A wider swing can be obtained by filing the pocket slightly wider and the Coupler shank narrower. As in the drawing, cut all washers and plastic bushing in a wedge-shape on one side, so as to fit between knees 'A'. File out all flash and parting lines inside pocket, top, sides and bottom, just to



clear the shank. Later you will probably want to file more out on the top. Assemble as shown. The vertical spring legs are placed upon top of the bushing for much easier assembly. Screw the screw into the Deck snug, tight against the plastic bushing. The Coupler should now swing freely right and left,and slight up and down play. If it does not, remove the offending metal. Now move the Coupler to the far right and with your probe, push the left vertical spring off of the bushing and down along side of the Coupler shank. Now move the Coupler to far left and drop the right spring similarly.

For the Coupler to operate, leg 'C' must rest against plastic bushing knob at 'D', and vertical against Coupler shank 'E'. The Coupler turns easily around the plastic inner diameter. The bushing is held rigid with the screw. 'D' must be centered on shank 'E', or Coupler will not spring to center.

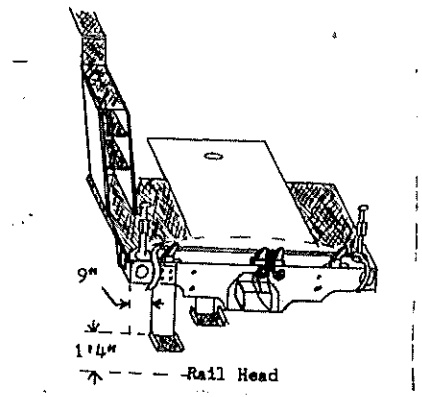
Temporarily install Boiler (which also has a 4-40 screw thru bottom center of the Frame, up into the Boiler), Cross compound (if used), and Pilot Deck & Beam with Coupler installed. Now measure Axle center or rail head to Boiler in front, or Boiler center and compare for your particular engine.

With Drivers on the rails, center of Coupler should be NMRA 17/32" above rail head. Now if you find Boiler and Coupler too high in front, file off Steam Chest at Frame, or if both are low, shim here. If Boiler only is high, Coupler height OK, file off top of Steam Chest saddle only or bottom of Boiler. If Boiler height is OK but Coupler too high, put shim between Pilot Deck and Steam Chest, or if Coupler too low, file a bit off of bottom front of Steam Chest. You may find rear Boiler saddle on the Frame too high or too low, so file saddle down or shim here.

#54.2 PILOT BEAM-DECK & COUPLER POCKET

Same as above except there are no knees to brace the Pilot. Little straps can be made of .012"-.016" sheet stock and cut about 1/32" wide and soldered on as shown, at each vertical Pilot member and in the center as on the prototype. This probably should be put on before other Pilot and Beam parts, putting swabs here when putting on the others.

#56.1 FLAGSTAFFS --



The Pilot should be installed first, as it's pins will hold it in place. The Flagstaffs and Uncoupler Brackets at the same time, their pins also help hold it in place for the following steps. Put wet swabs over these and then solder on the Beam and Pilot Steps. The Staff's flag slots are forward. If shorter Staffs are wanted after installation, cut out a section or cut off top.

#57.1 UNCOUPLER BAR BRACKETS--

Install angled forward at the top.

There are alignment pins on bottom to locate them in Beam holes. Pins may need filing shorter, but better drill holes deeper to help hold them while soldering. See #56.1. To make Uncoupler bars from .016 piano wire, bend the small loop in the center with long-nosed pliers. Push the wire thru the center Bracket and into the end Bracket. Hold pliers on the wire right next to the inside of the center Bracket and bend the loop portion out toward the Beam as pictured. Similarly, hold the pliers on the inside of the end Bracket and bend the end as shown. This leg is parallel to the center leg, but with a slight curve. If both legs are not parallel, push up on one leg and down on the other to spring them parallel.

#60 PILOTS --

These are rather delicate, thin castings, so bend to proper shape, touch up with a fine file, remove gatings, and while not necessary, would help minute detail some if you would sharpen the cracks where straps of metal meet, by using the cutting edge of an old razor blade, knife or Barett file sharpened to sharp edge on one side. File all edges of strapping flat again, as they rounded some in casting. File tops of hex nuts flat to return some of the shape. File assembly pins on back of vertical straps short enough that they will go into the two vertical alignment holes on either side of the Coupler Pocket of the Beam. Some Beams did shrink more than the Pilots did, making the vertical straps crooked if alignment pins of Pilot are forced into Beam holes, so file these pins to less than half the diameter, off of the outside. The top horizontal straps should lay flat across tops of all knees (if your Beam has knees). The two outer vertical straps flat on knees there. The bottom horizontal strap bent in a v-shape, the point in the center being about 5" forward of the top strap. File all mating surfaces, apply thick Soldering Paint to each and solder with torch holding if necessary, the Pilot on one side to the Beam with a probe, then the other side similarly.

#60.1 Pilot can be used for P.R.R.'s K-5 engines, and other if Steps are carefully ground off with a cutoff disc.

#60.3 Pilot should have #62.2 and #62.5 or similar Steps.

#62.1 BEAM STEPS --

The step portion is bent out with long-nosed pliers. These are fitted to the Pilot Beam according to the drawing, the excess cut from the top above the Beam. This is about the last part to be soldered to the Beam. See drawing at #56.1 Put wet swabs on other Beam parts, pre-tin Step and Beam location, then hold step in place with probe while torching on. They probably will not be straight the first time so will have to be re-heated and straightened a bit.

#62.2 CENTER BEAM STEPS --

These have pins for alignment holes cast or drilled in the bottom of the Pilot Beam. Heat the Beam back away from the Pilot, so the Pilot does not get red hot by the time the Beam is hot enough. Hold in place with a probe, and wet swabs on other parts.

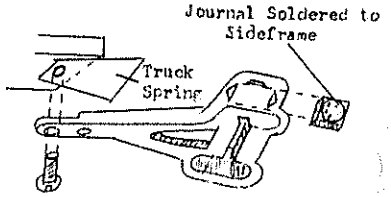
#62.5 PILOT STEPS --

Solder on Pilot with torch, see drawing. Pilot will not come off of Beam.

#62.8 FRONT STEPS --

These are installed after the Boiler and Running Boards are on. Fit Steps between the Pilot Deck and Running Boards, cutting off the excess of the Steps on top, which were purposely made too long for long use. Generally the bottom of the Step will set on the rear, outside edge of the Deck tread. Put wet swabs on other Beam parts and hold Steps with probe while soldering on with torch. On some engines, part of the inside side of the Step is removed for the Cross Compound Air Pump, usually left side. Do not solder Running Board to Front Steps, for Running Gear- Boiler seperation.

#64.1, .2 & .3 PILOT TRUCK, TWO-WHEEL --



KINSMAN WHEEL installation. Pull wheels off of axles. With razor saw or cut-off disc, cut off the plastic axle cover, leaving only a stub to insulate the Wheels from the Axle Bearing (cutting this off with a knife will break the plastic). Put the Axle thru the Axle Bearing, then apply epoxy, Pliobond or model glue in the Wheel's axle holes and reassemble the Wheel Set. Slowly grind off the spindles and gauge the set.

AF WHEEL installation. Pull wheels off of Axles. File about 1/32" off of each inside Wheel Hub. Reassemble as Kinsman Wheels above, and slowly grind off the spindles.

Pilot Wheels will be furnished with what we have excess stock of at the time, sheathed (plastic axle cover, above), unsheathed, kind of metal, with or without spindles(which are easy to remove), but in the size you order. Ultimately they will generally be furnished without spindles. You can specify the matal you want, in case we have it in stock.

For small diameter Drivers, filing Frame Cover Plate about 1/16" thinner on the bottom at the Pilot pivot area would be advisable.

The Truck Spring is soldered to Frame CoverPlate after screwing wood into threaded hole to keep solder from filling the threads. Preheat the Cover Plate with torch to melt solder, then solder the spring on wiht soldering iron. Just barely have tension on the Truck, as too much tension tends to make Pilot Wheels climb the rails. Pivot screw is ground to a length so that there is just enough head below the Truck Yoke to allow the Truck proper up and down movement to follow track rise and fall for grades, switches, etc. Pivot screw is screwed up against the Main Frame with fair tension to prevent it from coming unscrewed. When removing the Cover Plate, it would be a good idea to loosen this screw before replacing the Cover Plate, then tighten it after Cover Plate screws are tightened.

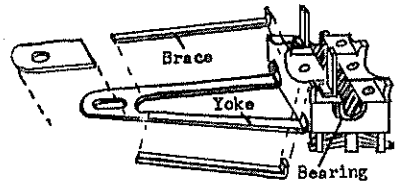
Sometimes to get proper spacing of Truck between Pilot and Steam Chest, you may have to elongate one of the Pivot holes, then solder a washer (or scrap) on top of the Truck Pivot at this proper hole location. The forward-most Pivot Hole is the prototypical location (not good for most layouts), the second hole should give good results down to a 27" radius. For better operational appearance or tighter curves, you may want to extend the Yoke and

Pivot by soldering a U-bracket on the Pivot making the Pivot further back, so the Truck pivots at a smaller angle, in which case you would have to drill and tap another screw hole in the Cover Plate.

There is a flat side on the Bearing to move Wheel location forward or backward a small amount in the Truck Frame, by placing the flat side in front or back. Or the flat side on top or bottom to raise or lower Axle and Truck for large or small Drivers, so Truck Yoke is almost level. For larger Drivers, you may have to put a washer or two between Pivot and Frame to level the Yoke.

Latter Wheels may be assembled like #64.6 Trucks, no brass bearing, in which to make the Yoke sit level with small Drivers, file off top of pivot, or file bottom of Frame Cover Plate thinner. For larger Drivers, add material.

#64.6 TWO-WHEEL INSIDE-BEARING PILOT, COMMONWEALTH --

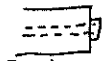


These Trucks, order Wheelsets without insulation stiffenor between the Wheels, of Wheel size and metal you want. First, file or cut insulation stub off between Wheels no longer than 1/32". The Axle simply drops in Truck Axle slot. If Truck is too wide for this, file bearing (collar) on each side of Truck shorter, until Wheel set drops in and has about 1/64" end play (side movement). For hi-rail, a lot of this bearing will have to be removed, particularly on the insulated side (left); file the bearing slightly shorter on the bottom, then file at an angle toward the hole, so hole area is still slightly shorter to prevent catching on Wheel insulation. On the bottom of the Truck there are two lugs sticking up; bend these down over the Axle and solder if desired, tho not necessary. These lugs were afterthought additions, so if received without a lug or one breaks off, solder a strap on with soldering iron, with wet string wrapped around Wheel insulation, but touching Truck as little as possible. So the Yoke will clear bottom of Frame, the Yoke will need to be bent downward slightly at the Truck and about halfway to the pivot, bent upward again about level to slightly higher (or Frame Cover Plate filed about 1/16" thinner here). Install pivot screw in Yoke and determine Truck location to properly clear Steam Chest and Pilot Beam, see last paragraph of #54.1. Make washer and solder in proper place over the elongated pivot hole. On the front you will see 2 nuts on the bottom lip. At similar location on the back is soldered (from scrap) a strap brace, similar to, and up to the Yoke. Spring application same as #64.1, above.

See #64.1, 5th paragraph.

#64.8 4 WHEEL INSIDE BEARING PILOT TRUCK-- This Truck has been purposely designed to be as heavy as possible, so springs would not be needed. So drill out the 14 holes that dead endon the bottom with a #51 drill, clean 4 square holes, put in soldering paste flux and fill with solder. A noticeable increase of weight will be noted. This truck has a lot of mass for good casting, so some touch up with small file may be needed, including filing top of nuts flat. Caster's gating at back end is easily removed with edge of "cut off disc", then filed. Even if not removed, it cannot be seen in back.

File axle slots smooth on bottom and sides with small file just so 1/16" axle drops in snugly and turns freely. Then solder any small scrap into slot near each wheel, allowing axle some up and down motion. Or just solder thin sheet or shim stock over whole bottom or slot only. Use soldering iron for this so the insulatiin on the wheel is not melted. A soldering iron tip for the torch is good for this giving all the heat needed. Be sure insulation on the wheel are smooth and insulation on each wheel set protrudes inward from wheel equal distance. The bottom of the truck hub at the slot should taper inward (narrower) at the bottom as shown. Most of this hub removed for hi-rail and inside insulation of wheel very short. For scale and hi-rail it is best to have plenty of end play of wheel set in the truck to better take curves, as well as up and down play to better ride turnouts and uneven rail. Should your wheel set have spindles, slowly grind off on insulation side. be sure pick-up wheels are on the right side.


Front View

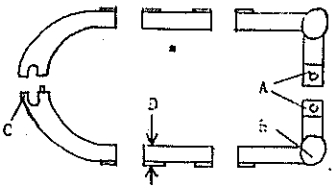
We would strongly recommend using a draw Bar, as it is complete trouble free particularly on not too even rail and 27" or less radii. Its main disadvantage is that it does not look well flopping around when engine is hand held. Make of any thin sheet stock about 1'8" wide, narrower at rear of Truck, and a length so flange of rear Wheel 1/16" from Driver flange. Pivit on top of Truck at hole provided (with curved slot curved rearward) by tapping this hole 2-56 thread and usinga short Crank Pin screw or Bolster screw. Or drill #42 and put 2-56 thru Draw Bar and into top of Truck with 2 nuts in bottom of Truck with lock or fibre washer between nuts, not tightening nuts to Truck. The other end of Draw Bar pivits at the 2nd cover plate hole of the Frame. Remove this screw and place a Crank Pin shoulder (sleeve) over it. Replace it in Frame, thru Draw Bar. The Bar will have to be curved slightly to clear Truck and Frame, even some spring tension can be applied to Truck, tho we do not believe it is desireable.

Another method for 27" radius or more is to drill a #42 hole in the Main Frame just behind Steam Chest screw, on the bottom, and solder in 7/8" long 5" piping (.091, using thick Solder In Paste and torch. before installing Truck, drill out the center hole, used above for pivit, large enough to get a small screw driver in and head of 2-56 screw thru. This hole will be used for removing the front Boiler screw without removing the Truck. Now bend rod forward close to Frame, then bend vertical again just above Steam Chest screw, so that when slot of Truck is placed on this rod, (slot curved rearward) the rear wheel flange is 1/16" from Driver flange. Setting engine on short piece of Flex-Track is easier to view this and if rod is too long. Make small washer to fit over end of rid and solder on about 1/16" from bottom of Truck slot. Grind off sides of washer, so that Truck can swing further to each side. For slightly less than 27" radius, you can lengthen slot on each side right into the leaf spring almost to the Rocker Arms, with a dental burr. Sometimes you might have to file the Frame thinner above these wheels, paricularly for hi-rail.

Will be easier to adjust wheels with motor out, so engine can be rolled over the worst spots on the layout.

For installation on AF engines, solder the head of a long 4-40 screw, brass, in center of curved slot, (curve rearward), then rest of screw up thru slot on AF Steam Chest, with Pliobond or other rubber base cement, on threads where nut goes on, or mesh threads slightly so nut will not come off. Place large washer between nut and AF

#65.1 FOUR-WHEEL COMMONWEALTH DELTA TRAILING TRUCK --



This is a very difficult casting for the caster to make, understanding it was first cast in wax, which was pulled out of a rubber mold. So this wax and the resulting casting is often sprung some. Therefore, the first job is to straighten it.

First look at the casting from the bottom and see that the slots are in line on each side and the rear cross-member 'A' is at a right angle to the side frame. If not, straighten with plastic hammer. Now look at the casting from the rear, the side frames should also be at right angles to the cross member. File both assembly pins so they go into mating holes. Put in rear pin first, the front pin will probably not go into its hole on the opposite side. If not, the Yoke protruding the most forward is to be bent rearward by setting the Rocker Cup 'B' on a board and tapping 'C' with a plastic hammer about as hard as you would drive a small tack. If point 'C' bends doing this, it is easily straightened with pliers. Recheck all straightness and squareness, also sighting from top of one sideframe to top of the other to see that both sideframes are level with each other.

NEW YORK CENTRAL HUDSON

This Truck is not exactly like the N.Y.C. Hudson's but can be made so if you will drill holes in corners as indicated and filed out between, or drill some of this surplus also. The origional 3 holes from starting corners, with their diameters maintained. Be sure left side, insulated, of wheels do not touch Truck. For hi-rail, some of the inside of Truck will need grinding away.

Now the spacers in the bottom of the Journal slots of the sideframes can be cut out with dykes, although cutoff discs in a handgrinder would be easier (wear glasses). Leave barely a stub, to be filed out more accurately, and just barely file slots to clear and roughness that cannot be readily seen, also triangular bearing plates on the side and on the inside. The Journal's ways (grooves) are similarly cleaned, just barely filed on the three sides, also grinding and filing off the gatings. On the Roller Bearing Journal about 3" of the square gating is left on the bottom to hold the Journal from quite going to the bottom of the sideframe. The little holes at the top of the Plain Journals where the lid goes in did not always cast well, so drill these out with .026" drill. At this point for alignment, the spindle holes in the Journals should be drilled out with a 1/16" drill, if spindles will not already go into Journals, tight fit OK now.

Assemble Journals in sideframe slots; if one does not fit one slot, try another slot and different Journals first. Those that do not fit any with forced thumb pressure, you will note the width of these sideframe slots is usually ample, it is the thickness of the Frame 'D' that is too great, so file inside and outside until Journal slides in freely.

Now hand assemble Truck, Journals (without springs), Wheels and washers. With electrical pick-up of Drivers on the right side, pick-up Wheels of the Truck on the

right side too, insulated Wheel and insulated washer on the left side. Set the truck right-side up on the table, all Journals at the top. Lay a bit of wet cloth over Wheel Axles for safety, then tack solder the rear cross-member, after applying a bit of soldering paste and small bead of solder, using the Torch. While holding to do this, hold at the bottom of the sideframe tightly so the top will go outward (bottom inward). Now hold Truck upside-down, the Wheels should spin freely; if not, from an end view, the top of the sideframe is angled inward, so bend them vertical (bending the rear cross-member) until Wheels turn freely.

If tread of the Wheels do not rub against top of the sideframe, the Yoke can be soldered. You may have to use washers on either side to keep Wheels away from sideframes. The front Wheel will probably be the only one to rub, so either file away offending sideframe or bend each Yoke of sideframe rearward as before, to spread sideframes apart (be sure Journals are in when bending). Or, make .020" thick shim to fit over front assembly pin (and file to rest of the Yoke contour after Yokes are soldered). When Wheels clear properly, solder truck together.

Occasionally insulation on wheel sets stick out too much, beyond about 1/64" to 1/32", if so, of course trim shorter

Remove Journals and re-drill spindle holes about .068", reassemble in Truck with springs. Make retaining cover plates over Journal slots from scrap and either solder these on or drill #60 holes and tap 00-90 for 00-90 screws. Springs may have to be lengthened a bit for very light tension only, or more with Booster Engine. The Plain Journal lid pins are easily mashed into the holes of the Journal with long-nosed pliers.

File Yoke hole 'C' smooth and corners rounded so pivot screw slides freely. Pivot screw is a 2-56 long-shouldered screw. The head and Yoke is down considerably below the engine Frame. Point 'C' of the Yoke should not touch engine Frame when backing up, causing derailment, so file some from the very front of 'C' if necessary.

To get more swing of Truck on some layouts, you may have to grind rear of engine Frame narrower or some off the bottom, or have Journals sit higher in sideframes to lower the Truck, particularly for small Drivers. The length of the Pivot hole slot was made for average use and casting strength, but if the Truck derails on curves, the flanges are cramping against the rail from not enough side movement of the Truck, so the slot will have to be filed longer. The nuts on the Roller Bearing Journals have been purposely cast too long so that you can file them flat again with a fine file.

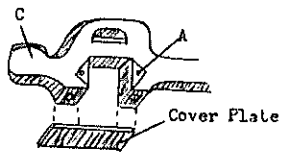
Roll complete running gear on your tightest curves and cure any derailments caused from Pilot and Trailing Trucks. Be sure rail is properly gauged, as well as all wheels and Drivers.

After painting, oil Journal slots and put small bead of oily cotton in each Plain Journal to hold lubrication.

Usually these trucks used a 36" and 45" wheels, but other engines used other diameter combinations.

NOTE: It would be a good idea on all moving parts that carry current around the engine and Tender to lubricate with graphite grease, such as Trailing Truck spindles and it's pivot point (possibly a very light spring here), Tender spindles and bolister pivot and Draw Bar at Tender end, especially the spindles. Use any light grease or silicone grease and mix plenty of graphite in it. Get the graphite from the hardware store in a vial for lock lubrication.

#65.7 & .8 TWO-WHEEL COMMONWEALTH DELTA TRAILING TRUCK --

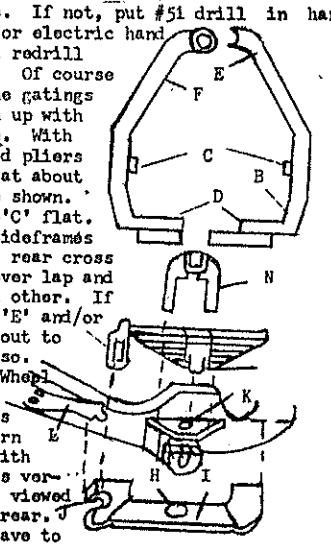


A large casting such as this is very difficult to cast at all, so naturally there are some imperfections on all castings which need to be filed away. Even small amount of touch-up will show little or no imperfections after painting, if so, you will be the only one to know. Should some pedestal slots be too open (none should be), set front lip of Yoke on piece of wood with rear of frame straight up, and hit back of Truck Rocker 'C' with plastic hammer. This will close pedestal slot some. Should you close it too much, you can pry it open more with a screwdriver. If Journal does not sit flat in pedestal, lay inside of pedestal 'A' on top of a narrow anvil or other metal (block preferably), or even wood, and hit outside of pedestal sharply with plastic hammer. This will even up the two sides of the pedestal. This will probably open up the pedestal slot some, so slot will have to be closed a bit as done above. If you want more Journal travel, a bit can be filed off of the bottom of Journal preferably, and/or top, as well as top of pedestal. Since these Journals do not operate much, they could be soldered in, instead of sprung. For further details, see #65.1. We are not fully satisfied with this one piece Truck, so later may be cast and assembled more like #65.1 & .2. Also read #67.1 on Wheels.

#65.13 HODGES-COLE TRAILING TRUCK--

This Truck is a universal USRA era Hodges Truck as used on L. Mikes or Cole Truck as used on H. Mike, H.& L. Pacifics, or H.& L. Mountains, depending what parts in the kit is used.

First put Wheel Set in sideframe axle holes and view from top and rear to see that Wheel normally sets papallel to inside of sideframe. If not, put #51 drill in hand pin vise or electric hand drill and redrill straight. Of course remove the gatings and touch up with fine file. With long nosed pliers bend 'B' at about the angle shown. File 'C'-'C' flat. Put two sideframes together, rear cross members over lap and meet each other. If not bend 'E' and/or 'F' inor out to make the so. Now with Wheel set in, the Wheels should turn freely, with sideframes vertical, as viewed from the rear. You may have to file more off of 'C'-'C'.



For Cole Truck, set spring pin in horizonal plate 'I's 'H' hole and cut pin just long enough that remaining pin will go on into Journal hole K. Remove plate, put spring in hole'K' and twist Shackle 'G' so it will fit over Equalizer arm 'L', which should be about 6" out from sideframe, and bent upward to go into shackle. Shackles break off rather easily so is best to bend the shortest one, which is more rigid. should it break off, use Shackle on the other end. When fitted, cut off tge Shackle in other end of the Spring. It is best to File off the strap around the Spring on the bottom at 'M'. Set Spring in 'I' plate again mark area 'J' to to be cut out for the Schackle to go thru to the Equalizer Arm. Plate 'I' of course sets flat on triangular plate 'K', 'H' overhole 'K' and Spring pin thru holes 'H' and 'K'. File clean all mating parts in this area, add thick Solder In Paste and torch together. Do other side simularly.

The Hodges Truck is simularly assembled, except the horizonal plate 'I' is not used, instead the vertical plate 'N' is used, slide down in front of the Spring, in-to slots between Journal and sideframe. This is not used in the Cole. Both Shackles are used here. The rear one prototypically goes to the Engine Frame--of course cannot here, so solder to the sideframe. Should you be making a Cole and Hodges Truck, make the Hodges first, in case a Shackle breaks off, which can be used on the Cole.

We think the easiest way to Solder the sideframes together is to clean mating parts, put soldering paste on mating parts, insert Wheel Set with pick-up on the right side, cover other soldered parts with wet swabs (and axle), then lay small beads of solder on cracks of mating parts and torch, preferably with Truck upside down. This allows the solder to all flow into the cracks, no blobs on the outside. If Wheel does not turn freely, view from the rear, you will see the sideframes are not vertical. With slip joint pliers on top of Spring and bottom of Journal, slightly bend to straighten.

We found too late the Yoke on these Trucks are 1'6" too long. Should you want to correct it after Truck is assembled, shape and solder a solid brass block between Yokes, to rear of present pivit in area 'E', or solder heavy sheed stock on bottom and top of Yoke here, or between the Yokes here, then redrill a new hole 1'6" to rear of present pivit. Then slowly grind (so as not to melt the solder) the old pivit off and well rounded. Later we will correct this to give 6'6" between pivot center and axle. Before making above change, check this demension, in case you have this old instruction after we have made above change.

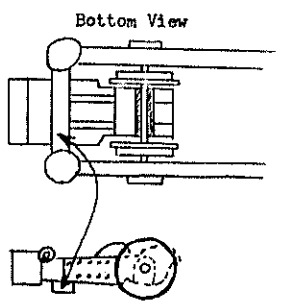
#67.1 JOURNALS, SOLDER ON --

From #64.1 & .2 Pilot Trucks. If you have Plain or Roller Journals on a diesel or other Truck and want the opposite type, grind them off and solder, epoxy or Pliobond these on.

#67.2 JOURNALS, SPRUNG --

From #65.1 & .2 Trailing Trucks for other uses or scratch building.

#70.1 BOOSTER ENGINE --



This was made of type metal to give the most possible weight on the Trailing Trucks to reduce derailment. Booster Engine is installed with rivets up, and you should order the large spoked wheel sets

without stiffener sheath between wheels, Axle only. There are several ways to install it. 1.) Slot the front from the bottom, so the Engine will set down on the top of the Truck cross-member and slot over the front Axle. Put several loops of paper over the front Axle, between Axle and Engine slot and coming out the bottom, to give clearance between them. Then epoxy between Engine and cross-member and over bottom of cross-member. When epoxy is set, the paper can be pulled out. 2.) Another method is to drill a hole thru the Engine where the front Axle goes thru, instead of a slot. Then press or epoxy a short tube in each end of the hole as a bearing, with a 1/16" hole. Then disassemble the Wheel set, push the Axle thru the Engine (these tubes), with Engine setting on top of the cross-member, reassemble the Wheel set, gauge and square the set. To regauge the Wheel set, you might have to file a little off of the insulation so the Wheel will go in a shade further. Here the Engine can be held on the Truck only by the Axle,or bands of epoxy from Engine over bottom of cross-member (for easier removal later). For Booster Engine Pipe installation, see #152.1.

Boiler & Boiler Parts

#72 BOILERS -- (Cast Boilers)

Demensions in below Boilers are sectional diameters. Demensions between arrows are where diameters change. Be sure to remove front of Smoke Box. where indicated, relocating Smoke Box-Boiler junction, so other Boiler demensions come out in proper place. Also sawing off excess at rear of Fire Box. #72.7 Boilers take less removed material than where they appear on the other Boilers here, and coded MKac on side of Smoke Box, when available. (These Boilers cost us $6.00 delivered to you undrilled---expensive

Boilers are available either drilled and tapped for Cab locations and most general Frame location, or undrilled. If drilling is not done, after filing Boiler, drill Running Board holes proper distance from center line. In either case, make a slight center punch hole at each end of the cast-on center line of the Boiler. Then the whole Boiler can be filed smooth for soldering, but leave the punched holes until the very end of construction. After filing, center lines can be lightly scribed back to take measurements from throughout engine construction. Just before painting, very light filing will remove scribed lines. Dividers or bent wire can be used to measure from center line to parts. An effort has been made to make Boilers interchangeable with a variety of Frames. Where this has not worked out for you and new hole will overlap the old one, screw a screw in the old hole with Soldering Paint and torch in, then center punch new hole location, drill and tap. Should any Fire Box rivets run together, saw between them with razor saw or file with sharp-edged file, then round top with file. Fire Box need not be filed smooth as they are naturally rough. File Boiler smooth for soldering, tho not to perfection in the Boiler Band area, as here it will be filed more on installing the Bands. These Boilers, being cast, are practically indestructable and give necessary good traction weight. The middle hole is to secure the Frame to the Boiler, and the front hole for front Frame securing thru the Steam Chest, see #18.

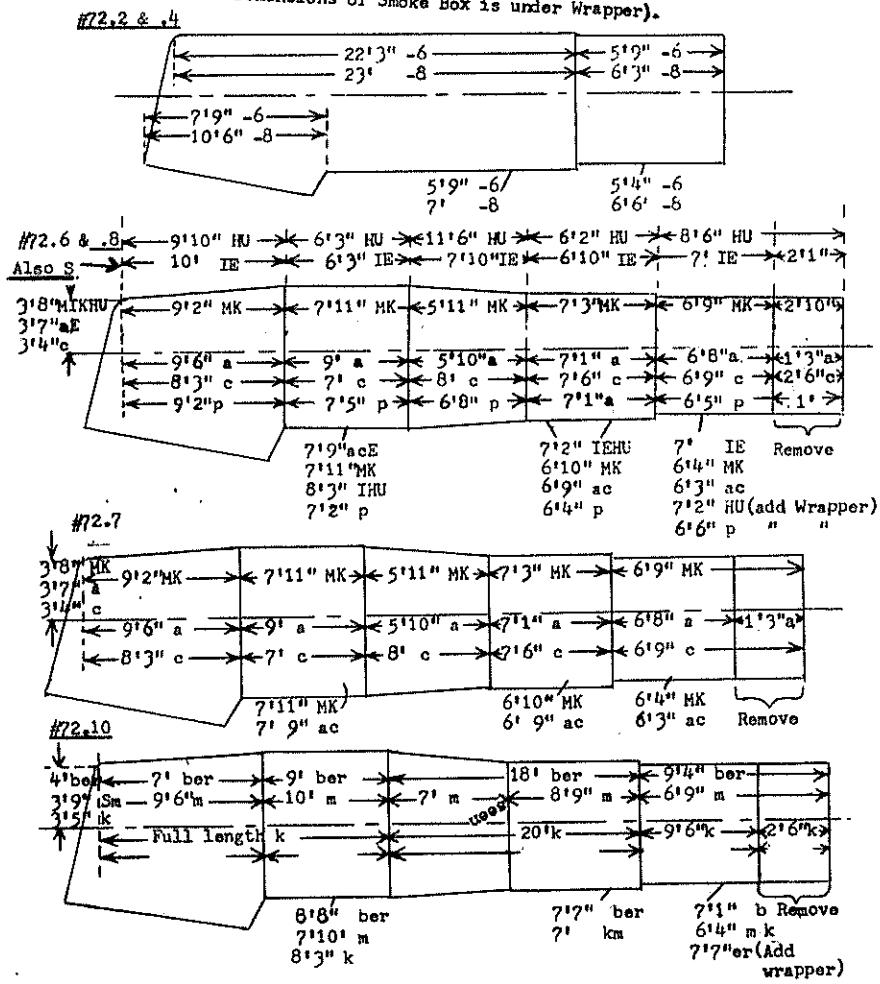
When installing Frame with Motor on it, the Motor probably will hit top of Boiler inside. Mark these Boiler spots with a pencil, then grind it out with cut-off disc or slower, small grinding wheel, to get plenty of clearance. Also at Motor brushes and worm, if necessary. On small Boilers, such as Switchers, you may have to file or slowly grind(so it will not get hot)the top rear corner of Motor off, after well wrapping Motor with wet cloth to hold filings. Do not allow Motor to touch Boiler in operation, as it will be noisy.

Laquer inside of Boiler or Blue Dicum (see #16 to make) where motor hits Boiler. Insert Motor on Frame in Boiler, working motor back and forth, up and down to scratch Dicum off of Boiler. Grind these areas until motor does not touch the Boiler. Before putting motor in Boiler to check fit, tap and blow out dust each time to prevent grit getting in motor, and when done wash out Boiler well.

Locate where Boiler is to be cut off, if necessary, then relocate where the Smoke Box has to be filed back to, if necessary, and scribe all around the Boiler as a reference to cut and file excess length. Relocate the punch holes on the CL(center line) within the Boiler area. Cut off a shade too little material and file to demensional length. Rear side angle of Fire Box not critical, most of it is in the Cab.

When filing to a smaller diameter, a caliper will be needed, which is cheap at the hardware or surplus store, or can easily be made from scrap tin or brass stock screwed together at one end. Determine how much diameter has to be removed, say 8", or 4" per side. File 4" from on top as measured by the caliper and ruler, then similarly file a flat on the bottom. With the same procedure, file flats at 90° to the above. Also file flats between each of these and preferably again between these. Now go back on the Boiler where there is material that has to be removed there and follow the same procedure, and further back if need be. If you find a great deal has to be removed, grind these flats with bench grinder, leaving the diameter about 4" larger, and file the flats to about 2" too large. Now with this octogon shaped Boiler you can barely grind these corners off a bit. You can now file both around the Boiler and lengthwise easily, quickly and quite accurately. In this filing some high spots will show up, which can be ground with your cut-off disc, to further speed up the shaping. These procedures will greatly speed up the total shaping. In this rounding try not to lose all of the 2" over size, as you will want a final overall filing to remove flaws and a very final filing between Bands when they are installed. Getting a good shaped Boiler is rather important,as you have see "Cross-Kitted" engines in HO in magizines that had Boilers much too large or too small in diameter, giving them a horrible look. The above will prevent this. Do not worry if you miss the length or diameter by 2"-4",

(Start all measurements forward and rear from front of Fire Box, remove excess from each end. Demensions of Smoke Box is under Wrapper).



Smoke Box could be an extra 6" long to compensate for extra long Pilot Deck and thus better fit of Front Steps, and look better. Of coursethis will make Boiler Front from Steam Chest body 6" less on the plans. It is best that Smoke Box diameter is left slightly larger diameter until Smoke Box Wrapper is fitted (not soldered), to see how these fit the Boiler Front.

it will be un-noticeable. Some Boilers of a type (Mikes etc.), even of the same era will vary slightly as to the diameter and length of these sections. You will want to file the Smoke Box about 1/16" to 3/32" smaller diameter than the Boiler next to it, or about a 1/32" step here for .012" thick Wrapper to go on. If your engine has a flush Smoke Box to Boiler, you need not file Smoke Box down, possibly hold a piece of sheet stock around the junction as a straight edge and very lightly file a junction groove around the Boiler. Of course, if the Boiler is cast with a smaller Smoke Box, then you will have to solder a wrapper around it to build it up to the Boiler diameter. See #74 for instructions.

Should Boiler-Frame screws be tight screwing into Boiler, elongate Frame and Steam Chest holes. After Bands are on, sand Boiler and Bands with very fine sand paper, or emery paper, so they will take paint better. Sanding of all other smooth filing is a good idea too.

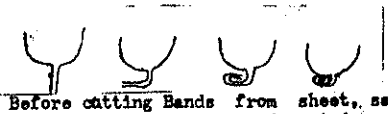
#74 SMOKE BOX WRAPPER --

Some engines do not have all rivets on the double row, for instance for MKP Berkshires the forward row of rivets are removed 2" above the CL on both sides, and over top of Boiler. Tap down rivets slightly before filing off. (Of course rivets close to Boiler proper.) Some engines such as CMO and PM Berkshires the wrapper as just a plain Wrapper even with the Boiler.

Before installing Wrapper, scribe front CL on front edge of Smoke Box so it can be scribed back on the installed Wrapper. Should some holes already be in Smoke Box, such as for Running Boards, to locate on Wrapper, wrap Wrapper around Smoke Box, wired on ready for soldering, then stick stiff wire in Smoke Box holes (from inside) to mark the Wrapper. Now Wrapper can be removed, these points punched and drilled.

Riveted Wrappers are of .012" sheet stock, leaving about a .032" step-up to the Boiler. Non-riveted Wrappers will be .025" to .032" thick so they will come up flush with the Boiler. For installation, file Smoke Box clean for soldering. Heat with torch to melt solder, then use soldering iron, wood or cloth to spread the solder. Of course, the Smoke Box should be in its final length. Solder on it, or tinned Wrapper should not be thick anywhere, excess brushed off with cloth. Wrap Wrapper around Smoke Box so ends meet at the bottom with about 1/16" gap between ends. Cut or file holes on the bottom for the assembly screw. To be safe, screw match stick in the hole to keep solder out of the threads. Wrap wire (preferably soft iron) around Wrapper to hold it tightly in place while soldering. Put several small spots of thin Soldering Paint around Wrapper as an indicator when other solder has melted. Heat the Smoke Box from the inside all around until Soldering Paint turns black a couple of seconds. The end gaps on the bottom should just about meet now. It would be best to pin these ends to the Boiler with at least two pins on each side, or screw down with flat-head 00-90 screws, tho it may not be necessary if care and wet swabs are used here on later nearby soldering. See #76, last paragraph. If rivets are to be filed off, first lay Wrapper on piece of metal and barely mash them down a trifle.

#76 BOILER BANDS --



Before cutting Bands from sheet, sand or grind back clean with hand grinder, to take solder, then tin whole sheet. Do not worry about cutting each Band perfectly straight, they are much easier to file straight when soldered on the Boiler.

Rub each side of each Band over the round side of some tool to remove the cut-burrs, then tin one side very thin, no blobs. File Boiler just enough to take solder well, every blemish need not be removed here. Mark Boiler with heavy scribe where each Band goes. Start putting Bands on at smallest diameter, pushed to larger diameter. The angle on bottom of Fire Box acting the same. Wrap Band around Boiler with tinned side inside, with the Band about 1/4" short of its proper position, with the ends bent up on the bottom of the Boiler. With pliers across these two ends and up tight against the Boiler, clamp these two ends together to tighten Band to Boiler. Cut off surplus of these ends beyond about 3/8" long. Then with long-nosed pliers, bend these over and down tight against the Boiler. Now mash the Bands down on the Boiler with a hammer. The Band should be almost tight. Spread soldering paste all around the Boiler where this Band should slide up to, and push the Band toward it. You should not be able to push it into position yet, so tap the Band all around with metal hammer. This will flatten all marks in the Band flat to the Boiler, so you can push the Band further. If it still will not go into position, continue the tapping, which will now stretch the band until it will go into position good and tight and flat. On tapered Boiler sections, on the small side of the Band there may be a sizeable crack all the way around from uneven taping of the Band width, so tap with hammer, preferably ball pean, on tight large diameter side, all around. This spreads the Band on that side. Occasionally a small crack length can be taped down directly.

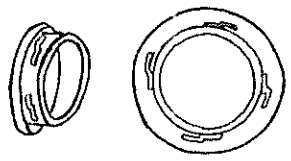
The above is really not hard and greatly adds to the engine detail. The following Bands over the Fire Box are more difficult. Apply Bands over the Fire Box in similar manner, except the Bands are bent over the bottom of the Fire Box and into the Fire Box to hold them while soldering. Start with front Band. When all Bands are on back to the Fire Box, add a bit of Soldering Paint along each edge of each Band. Fold an old cloth (Terrycloth best) in many folds, to hold the Boiler at the Fire Box. Apply torch between Bands, starting at the front, until the Soldering Paint turns black for a couple of seconds, or solder shines. Or easier set front end of Boiler on level block. Heat between Bands with torch, and with small stick dipped in paste flux run it along each edge of Bands, which easily spreads and flows solder under Bands. After all Bands are Soldered on, lightly tap them all around with hammer to mash the Band close to the Boiler, in case an edge is sticking up, do not over do it tho. Should there be a Boiler flaw from grinding or filing, very thick Solder In Paint can be put over them while soldering on the Bands or other parts. It may be that later parts may go over this area.

These Bands can be cut off just above the rivets with a sharp knife or make a small chisel about 1/8" wide from an old small file (for future use) or for the job from drill rod, which should be heated to a good red hot and immersed in water. If possible pin the ends before cutting off, as described in the last paragraph.

The Bands were made too wide, as in the installing, you will get them a bit crooked, so now file the edges of the Bands to straighten and make them narrower, and finish the Boiler filing, more pressure against the Bands. When proper Band width is achieved, file the tops of the Bands so there is hardly any left. If you have not tapped the Bands well, removing all imperfections while installing, do not file thru. Bands were scribed rather than cut, as some engines have wider Bands. You could rescribe them on the back. Latter we may discontinue scribing Bands because of time. They should be cut about 2" wider than engine calls for, and filed narrower on Boiler.

The ends of the Bands Should now be pinned if possible, particularly at the Fire Box, or wet swabs put over the latter for all nearby soldering. The turned under tips on the bottom of the Boiler not cut out until ready for painting. However pinning is not difficult if you will center punch the center of each Band near the Boiler bottom and at edge of rivets on Fire Box, being sure these tips are well soldered. Then drill #58 drill about 2-3 drill diameters deep. Well break the corners of the hole (chamfer) with a drill 5 sizes larger. Stick #18 copper wire into the hole, which should fit quite snug, and cut it off with about 1½-2 diameters sticking out. Pean this down with a ball pean hammer, or use a small flat end punch made from a nail, which is used to drive down the wire. If the wire bends, the punch can be held at an angle to correct it. If you do not have this exact size wire, use a close size and the appropiate size drill that will give a tight fit of the wire in the hole. (The drill should not be over .003" larger than the wire, and considering too that your drilling will probably be over size.) When the wire does not seem to want to go down any further and spreads out, it has gone as far as it will go. Should you ruin a hole, drill another beside it. To be safe, the first drilling could be much undersize as a guide and less strain on Band. Now the Bands can be cut off as described above, and filed narrower, as above.

#78 BOILER FRONTS --



NOTE: After fitting Boiler Front to Smoke Box, but before installation, it is much easier to install all parts on the Boiler Front first, that have mounting pegs, as they will stay in place while soldering other parts, including Front Steps which will stay in place once soldered. They can all be soldered at once except Number Boards and Classification Lamps which are soldered on last.

First, file the Front to the diameter of your Smoke Box. These Fronts have a mounting ring to hold it in the Smoke Box. Probably the easiest and best method, after all parts are soldered on the front, is to glue, epoxy or Pliobond long strips of card stock around this ring, ends butting together, not overlapping, and held with rubber bands until adhesive sets. Add successive layers until a good fit is obtained. Any excess diameter scraped or cut away with a knife, in case one side sticks out too much. We simply wrapped narrow strips of adhesive tape around the ring, and it worked well. If one side sticks out too much, add a short strip on that side. A bit more difficult is solder (with iron) four little brass springs of about .010" spring brass, brass weather stripping, or even half-hard brass around the ring, while the front is set in large blob of wet tissue to prevent the front parts from coming off.

If the Smoke Box holes are too small on some Boilers to insert some Boiler Front ring flanges as described above, grind off the ring flush to the back of Boiler Front.

File the Front just a bit larger than Smoke Box (Smoke Box Wrapper on). Then locate a heavy cardboard tube or metal pipe or tube that will go into Smoke Box. Cut about ½" length of this and epoxy or Pliobond to the Boiler Front back, after all larts are soldered on the Front. The tube diameter can be built up as previously described. Or solder brass or copper tube on in lieu of epoxying, in which case the Front parts are put on afterwards one at a time, with swabs on rest of Front so as not to loosen the ring. Probably best is to grind out the Smoke Box hole to fit the Boiler Front ring with cut-off disc, prefereably, or grinding wheel or metal cutting burr. The ring could be filed down some too.

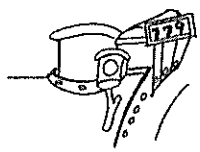
If resistors are needed for lights, coat inside of Boiler Front with epoxy and let it set for insulation, then lay resistor inside and put narrow band of epoxy over the resistor down to the Boiler Front to hold it. Wires can be similarly secured to Boiler Front. If they ever need to be removed, the bands are easily broken with a knife. Holes thru Boiler Front for wires are drilled much oversized, corners rounded with a drill 5-6 times larger size, then coat the holes with epoxy as insulation, and allow to set before putting wires thru.

#80.1 & .2 BELLS --
File off top Boiler Front nuts that would be beneath the Bell mounting. Locate spots to drill holes for mounting pegs, center punch spots to easily start #55 drill. Drill, insert pin and solder. See #78, first paragraph.

#80.5 BELL, BOILER MOUNTED--Drill about #50 hole and redrill #48. This Bell may be a bit high for some engines, so the base can be filed or ground from the bottom until base diameter us 9" or less. Install so Ringer Arm is to the outside if mounted off center of Boiler.

#82.1 NUMBER BOARDS --
After all other parts are on Boiler Front, remove third, fourth and fifth Boiler Front nuts down from the top center. Align Number Board nuts to those removed, and torch on by putting wet swabs on other parts (may not be necessary) and hold the Number Board in place with your probe. When first soldered on, they probably will not be square so re-heat and barely move. Put wet swab on this one and install the other one. See #78, first paragraph.

#84.1 CLASSIFICATION LAMPS



File hole clean to take the Micro-miniature bulb, and straighten the stand to fit on the Boiler Front for some engines or Boiler for others. Leave about 1/16" of the gating for an assembly pin.

For Boiler Front installation, file off about the seventh nut from the top or one after the one below the Number Board. For Boiler mounting, bend the base stand so the lamp will fit on the Boiler close to the Number Board like the drawing. Locate spot for the mounting pin, center punch and drill #57 drill, then redrill #56 Work base pin into the hole, possibly filing a bit from it's diameter. Solder on with torch, mostly played on the Boiler Front, to prevent overheating of Lamp. You may have to hold in place with your probe. See #78, first paragraph.

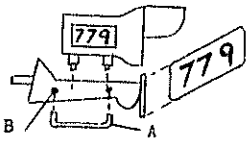
For Boiler mounting, pre-heat the Boiler, tin it and Lamp base, insert Lamp pin and torch the Boiler close by until soldered.

Drill about 1/16" hole in the Boiler Front or Boiler to run the wires thru, barely coating this hole with epoxy for insulation and allow it to set. Soak Micro-miniature Bulb base in laquer thinner to loosen and remove the black base of the bulb. This will allow the wires to bend here without breaking the fine wire. Carefully pull off the red insulation, insert the bulb in the Lamp, run the wires thru the Boiler Front hole and barely epoxy the bulb base in the Lamp at the bottom, also barely put a thin coat over the wires at the bulb base, making no point of sharp bend; also coat the hole thru the Boiler Front with epoxy. These can easily be removed if the bulb is to be replaced. For securing resistors or resistor bulbs inside the Boiler Front, see #78, Boiler Fronts and #605.1, Micro-miniature Bulbs.

Varying roads used different colored Lamp lenses, so use those of your road. If bulbs are used with colored lenses (jewels), scrape off the backing.

#86.1 MARS LIGHT --
Install same as below Headlights, except the following. Bottom of the Mars Light stand is about 3-4" above the Headlight on the Boiler Front. Pencil mark location of mounting pin of the stand, center punch and drill 3/64" hole, then re-drill #55 for closer fit. Fit Light on the stand and install both on the Boiler Front to see if the Light sets square, if not the back of the stand may need some filing. Unless you want to drill holes for light wires now (see #86, Headlights), the stand can be soldered to the Boiler Front, then the Light in the stand. See #78, first paragraph.

#86.3, .7 & .8 HEADLIGHTS --



File Light pins smooth to fit stand holes, after flash drilled out of stand holes with #031 drill. Ascertain what bulb you will use first and how it will be installed. Grain-of-Wheat is about best, but our #605.1 Micro-miniature could be used, particularly where more resistance is needed in series with another bulb. Of course, holes will have to be drilled in the bottom of the Headlight oversized for the wire, and coated with epoxy for insulation. For most engines, hold Headlight and stand so Headlight is in the very center of the Boiler Front. Mark where the stand pin touches the Boiler Front, center punch to start the drill, about .0625 hole, solder pin in, then the Light in the stand. Should the pin be too small for the hole, barely center punch 1-4 places around the pin, one at a time and seeing if it fits before next punch. For some engines, similarly hold Headlight and stand toward bottom of Smoke Box Front so top of Headlight is just level with bottom of the Front Door (with clamps).

Drill out Hand Rail Post holes at 'B' .021" and bend .020" wire or straight pin for Hand Hold in shape of 'A', and solder in. Make Visor from about .010" or .012" sheet stock in shape of picture, and solder on with wet swab stuck under stand. Or, glue or epoxy on thin sheet card stock. (Cast-on would elevate cost noticeably). Make the front Number Plate 'C' 8"x26" with corners just broken and solder on as shown. Put number decals on this. For the Number Boards, take some thin, clear plastic sheet and carefully cut and file to fit into illuminated Number Boxes tightly. Line edge of Boxes with glue or epoxy and push plastic flush with outer edges of Box. Round lense is optional, but paint silver inside.

After painting, put light numeral decals on black background, Number Plate and Number Boards.

#92 WASHOUT PLUGS --
With a pencil, lay out all the Plug spacings with vertical lines on the Boiler, then the distance up from the CL (centerline) as viewed from the side, not curvature distance, for your particular engine. Right and left side are usually a bit different. Center punch these locations heavily for easier starting of the drill. For Round Head Plugs, first drill .081", then re-drill with .089" for accuracy. For Open Head Plugs, drill .093", then re-drill .104". (If electric hand drill is used, use a drill size smaller for the first drilling.) With a fine file, just barely file the parting lines off on the sides of the Plug shank. Put this shank in the holes and drive in with plastic hammer. Should the Plug not want to go in all the way, take a sharp instrument like a needle and scrape out the brass shaving under the Plug head next to the Boiler. Soldering Paint could be put in the hole first, so later nearby soldering will solder them in.

#94 BOILER AND BOILER FRONT STEPS --
These can be soldered on when soldering something else close. Best to preheat and pre-tin the Boiler to melt solder, then lay Step in place and re-heat. When first installed, they probably will slide out of place, so use probe to hold in place. The Boiler Front Steps can be soldered on at the same time as other parts there with mounting pins.

#96 ENGINE PLATES --
On practically all engines the Builder's Plate is centered on the crossing lines of the Boiler's CL (center line), horizontally, and vertical line between center of Smoke Stack and center of Steam Chest, on both sides. (In one type engine of one road, a different series may be built by another builder, thus different Builder Plate.)

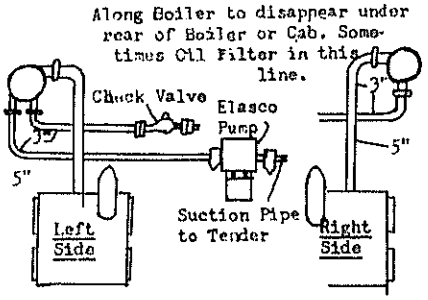
Usually the Owner's Plate is just barely above the Builder's Plate, sometimes below, on one or both sides. Sometimes located elsewhere such as rear of Frame under the Cab.

The Superheater Plate barely above the Owner's Plate, if no Owner's Plate, then above the Builder's Plate, on one or both sides, or no Plate at all. Some engines do not have Superheaters, thus no Plate.

These photoengraved Plates are true scale reductions, therefore small print can not be read. We suggest they be attached to the painted engine with a rubber base cement (Pliobond, tire patch cement, etc.). Then lightly paint with a brush, no thick paint. Should the engine need repainting and the Plates cleaned of old paint with laquer thinner, the Plates can easily be peeled off with the tip of a knife.

#100.1 FEEDWATER HEATER, WORTHINGTON S --
These are located on top of the Smoke Box, generally about 2" behind the Smoke Box Front, with Smoke Stack right behind it. File bottom of it to contour of Smoke Box. Also fit Smoke Stack, Superheater Door, Sand and Steam Domes, Pop Valves, Lower Water Alarm Casing, Handrail Posts, and Blow Off Mufflers in their positions. All these can be set on top of the Boiler, with Soldering Paint, and soldered all at once.

#100.34 FEEDWATER HEATER, ELASCO---This casting has quite a bit of mass for the process, so filing touch up will be necessary. There are several models of Elasco Heaters, mainly piping difference coming out of the Heater. This seems the most popular type. Below is the typical piping. You will have



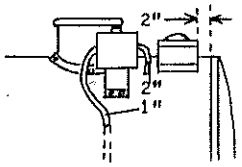
to route piping according to your particular engine, it is different for many engines.

Usually the Heater cylinder (tank) is level with top of Boiler or slightly above it. Hold Heater next to Boiler Front and mark where pins go, to drill 3/64" holes 2'6" apart. For engines with Heater on top of the Boiler, cut off mounting brackets and grind into Boiler, carefully fitting Heater into recess, flowing solder to fill the cracks with your torch, then add piping. The large piping need not actually go into Steam Chest, but just down against it, for easier Boiler operation from Steam Chest. You may have to file the diameter of the large piping to get it to go into the Heater, and clean out holes with a drill. We cannot always get piping the actual 5" diameter.

#102 SMOKE STACKS --

Stacks are always on the Smoke Box top and vertically in line with center of the Steam Chest. See #100.1.

#104.1 MILLER MUFFLER --



These are located either to the right or left side and just forward of the Smoke Stack's center line. With Boiler in normal upright position, and after Stack, Domes etc. are on, preheat the spot a bit with the torch, place Muffler in place and hold there with your probe, and solder in place. The 2" piping goes right into the Smoke Box. Some engines have the 1" piping going down under bottom of the Smoke Box, dotted lines, some into Smoke Box as shown by solid lines.

#106.1 SUPERHEATER DOOR --

Remove gatings, bend to contour of Smoke Box, longest dimension going across Smoke Box, and large knob on the left. Tap with plastic hammer to easier contour. Preheat Smoke Box and use plenty of thick Soldering Paint, or amply pre-tin Door, and torch on. There are two sets of starter holes to be drilled #72 to install #175.1 Grab Irons. All engines do not have these. Some engines, particularly those that have Smoke Box Wrappers flush with the Boiler, have just a plain, thin sheet door with a few small screws that can be punched in or left plain. See #100.1.

#108 SAND DOMES --

File bottom to contour of your Boiler location. If it appears the base plate will be filed too thin, then finish the contouring by setting Dome on Boiler and tapping front and rear of Dome with plastic hammer to get center of base plate to fit here. To get the sides of the base plate down on the Boiler, tap these with plastic hammer, wood or plastic dowels, while holding Dome square. Slight, careful bending with pliers may be needed. There are starter holes in the top corners of Domes to be drilled about 1/16" deep with #72 drill and install(later) #175.1 Grab Irons. These seem fragile, but we have never had one get bent. On #108.1 Dome, some engines have 2 in front, others 2 in back. The USRA types, one on each side. See #100.1.

Should your Boiler be somewhat smaller diameter than Dome was designed for, lay Dome vertically over Sander Block holes on the edge of work bench and strike the top Sander Block holes with plastic hammer to bend Dome slightly, preferably slightly too much. Then set Dome on the Boiler and tap with plastic hammer. It will contour to the Boiler.

#109 SANDERS & SANDER BLOCKS --

For #109.2 Sanders drill .024"(#73) hole in Sand Dome; for #109.1 and #110.6 drill .036" (#64);#110.2 .033" (#66); #109.3 drill #62 hole about 3" above Dome base. Exact hole size will depend on how much parting line is left on pins, and mashing of pin when cutting off with dykes. Especially the latter should be filed off. Some 1" piping holes in Sanders should be drilled .021" and deeper to better hold piping.

Add Solder In Paste to pin and Dome, then stick in Sander Block or Sander in and retorch, torch mostly on the Dome.

For Sanders in Blocks, see #110 below.

#110 SANDER BLOCKS (and Sanders)

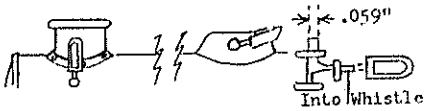
Sander Blocks are installed after Sand Dome is soldered on the Boiler. There are pins on the back to go into holes in the sides of Sand Dome. Some filing of these pins or carefully bending with pliers, or tapping with plastic hammer may be necessary to get them even. When all are even, disassemble, apply plenty of Soldering Paint on both parts, reassemble, and torch all on one side at a time, with torch mostly on the Dome--the Dome will not come off of the Boiler. Do the other side similarly. After most other engine parts are on and ready to put piping on, Sanders go into the Sander Blocks at least the diameter of its piping (to hold better); if they will not, drill out Blocks with .021" drill at the time of soldering, also at this time drill .021" holes in the Sanders for piping. Clean piping on Sander, coat it and hole with thick Soldering Paint and solder in with torch just until Paint turns black, with torch mostly on the Sander Block. Cover it with wet swab and similarly solder the next one, etc. (NOTE: When cutting piping, it mashes slightly wider, and will not go into close fitting holes, so file these edges round again.) If Domes are epoxied on Zamac Boilers, Sanders, Blocks and Dome should be soldered together first. Then Dome epoxied to the Boiler, and then piping soldered on. Anneal about 1½' (actual feet) of 1" piping to a light red hot, then cut in lengths from Sander to bottom of Boiler, at proper angle for your engine. Cover all Sanders in Blocks with wet swabs, file tips of piping to roclean, coat it and Sander hole with thick Soldering Paint, insert piping and torch with small flame, just until Paint turns black. Put wet swab on that one and similarly solder the next one, etc. If careful installing the piping, all piping can be put in all Sanders on a side and solder all at once. Solder the other ends of the piping on the very bottom of the Boiler, preferably slightly pre-heating the Boiler here, not quite to melt solder, then solder with soldering iron. Method here depends how well attached the ends of the Boiler Bands are. (If AF Boiler, drill holes thru Running Boards next to the Boiler to run the piping thru, then bend the piping inside the Boiler and epoxy here.

Note: #109.1 Sanders & Blocks are right and left,---Sander piping to the rear.

#112 STEAM DOMES --

Probably a little filing under the base plate will get them to fit the Boiler, but if not, see #108 Sand Domes. The cast hole in the side is for the Whistle, generally on the left side. See #100.1.

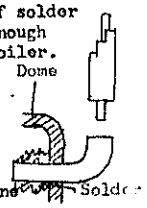
#114.1 WHISTLE (MODERN)



These are made in two pieces so they can be mounted at any angle, in left hole of Steam Dome, or into Boiler just below Smoke Stack, such as C&O Berkshires.

See #114.2 for genneral assembly.

#114.2 CHIME WHISTLE--Locate proper position on Steam Dome or other location. Drill #55 hole in Steam Dome, left side, for Whistle base. Clean pin at bottom of Whistle and hole in base, add Solder In Paste and torch, with steps of Whistle forward. Clean and tin pin of base with plenty of solder sticking to it and pin long enough to go well into the Dome or Boiler. Hole in Dome need not be clean, preferably make it dirty with dirt or oil. Preheat Dome a bit, insert Whistle base into hole. Hold the Whistle at about the right angle for your engine and rotate the baseon its axis as you slowly remove the torch, so that the solder does not stick to the hole, but forms a blob of solder on the inside of the hole so it will not come out. This allows you to move the whistle up or down at will, down when the engine is turned upside down for working on it, or up in the normal position. Generally these Whistles are leaned forward about 30°-45° above the horizonal (as for USRA light Mike and both Pacifics). On some engines, such as heavy Mikes, it simularly leans backward, steps upward. The final turning of the Whistle in the base can be done after the base has been soldered in the Dome. The lever on these Whistles were added to the pattern as an afterthought and is very small and delicate, so did not cast out on some castings. Some prototypo whistles did not have these levers.



#116.1 POP VALVES, TRIANGULAR---File to contour of Boiler. Torch to Boiler. See #100.1.

#116.2 POP VALVE, RECTANGULAR-Installed same as #116.1 Triangular PoP Valve. See #100.1.

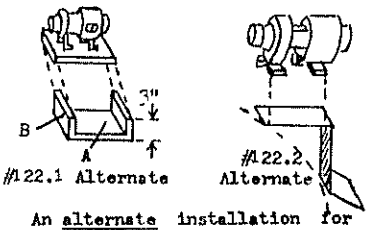
#116.3 POP VALVE UNITS--While holding with pliers, with cut-off disc, cut gating to a length that will just go thru the Boiler. If cut off with Dykes, file cutting mashes round. File pin clean to take solder. Locate position on Boiler for center Valve, then the two side Valves 7" from center Valve, center to center. Center punch each location and drill #54 then #53. The side Valves are angled slightly outward at the top, center Valve straight up. Apply Solder in Paint to holes and Valves and tap or push into hole with pliers. Torch in with flame

mostly in the Boiler. See #100. .

#118.1 LOWER WATER ALARM CASING --
Cut bottom pins about 1/16" long, locate position for your engine (probably about 20" on left side of Boiler top, about above front of Fire Box). Scribe spots for pins, center punch, re-check pin locations and drill 2 .032" holes angled toward the very center of the Boiler, as these sit at an angle. Apply Soldering Paint on pins and in holes, then carefully tap the pins into the holes. These can be soldered when soldering something nearby, such as Turbogenerators. See #100.1.

#120.1 BLOW OFF MUFFLER --
File bottom to contour of Boiler top at about middle of Fire Box area. Set on top of Boiler and torch on along with #100.1 (which you should see).

#122 TURBOGENERATOR --
Hold #122.1 in proper place with probe on left side, forward of the Cab, while soldering on. If two are used, put wet swab on the first one. #122.2 generally sits on top of the Boiler, but different stand can easily be made for off-center location.



#122.1 Alternate

#122.2 Alternate

An alternate installation for #122.1, where it is to set across top of Boiler. Grind off all the angle section, leaving only the flat base. Bend a small base 'A' from scrap stock, to fit Generator base, and slightly bend for Boiler contour. File sides 'B' flat to help remove bend. Position base on Boiler and solder. Amply tin Generator base and top edges of base 'A' and torch Generator on the Boiler base . Same idea can be utilized for lengthwise installation.

#122.2 Generator could be made to mount on side of Boiler by removing all of its base to the feet (best to grind off with cut-off disc). Make an angle bracket, solder this to the Boiler, then solder Generator feet to the bracket with torch.

#124.1 CAB --
READ COMPLETE instructions before starting to work. Grind or file portion of Cab front almost to the scribed line. Do not quite fit to Boiler yet. Grind off gatings. Straighten any bent lugs. If your engine uses a welded Cab rather than a riveted Cab, file off all rivets, leaving just barely a rounded base to indicate a weld, every so often. Sides with casting warps can be laid on a flat piece of wood, rivets down, and tapped all over with a hammer. Fronts and backs straightened similarly. The roof may have a casting sag in the middle. To straighten, lay roof on a board, rivets down, with water Gutter not touching the board, and the Wind Deflector off over the edge of the board, then pound the inside with a hammer.

Put both sides on the back, then put the enclosed .036" wire thru the lug holes to hold them together (Holes can be tapped 00-90 and screwed together). Assemble the front similarly. If all corners do not fit snugly together, tap them with plastic hammer. Spot solder each corner, midway between top and bottom with soldering paste and soldering iron, away from lugs and wire.

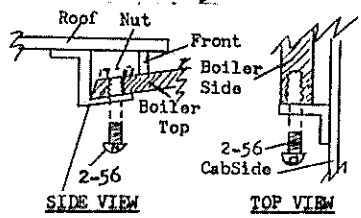
The roof will not fit at this point. To check, hold roof on Cab so the side of the roof meets the side as it should fit. You will see on the opposite side the roof is away from that side. If neither roof side will rock down to meet the sides, there is a bar spacer under the sides of the roof, and this bar should go between the Cab's front and back. If it will not go between them for alignment, then file about 1/64" off of ends of the bar until it does. Do the same on the opposite side if necessary (usually neither side will have to be so filed). From casting, the roof is too flat. Set it vertically on a piece of wood, on one side, and strike it along the other edge (side) solidly with plastic hammer, bending a bit more curvature than is necessary to fit the front and back of the Cab, so the roof sides are near the Cab sides, but the center of the roof is about 1/16" above the Cab front and back. Now hold the roof on the Cab and pound the roof along the front and back with plastic hammer, bending the roof to the contour of the Cab front and back. Do not hit the water gutters, as they will bend. The roof should now fit the Cab, and assembly wires put in roof. The underside of the roof can be filed to a more perfect contour for the front and back and the very edges thinner, but not back under front and back. (For casting they had to be made thick.) Sometimes it may be that the roof shrunk a little too much, and you will have to file the roof a bit thinner along the center to allow it to come down and meet the sides. (Your cutoff disc is good for this.) Or on the Cab sides file a bit off of the tops of the lugs and bottom of the lugs of the Cab front and back.

Now locate the Cab on the Boiler, fore and aft, as your engine dimensions call for, and file to fit the Boiler, with the Cab roof the proper height above the Boiler. (Our Berkshires are 1', and USRA's 1½' above Boiler.)

With the roof off, windows can now be filed out of the Cab front. The Cab front could be removed for this, first drilling a hole in the window area, scribed lines, then file the rest, or use a dental drill for most of it, file finish. Because the Cab side is thick, file window clear out to the Cab side, the side acting as outside window pane.

The roof can now be installed, permanently soldered, as well as the sides. Joints (cracks) between front and sides can now be filled with solder and filed smooth if desired.

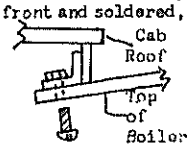
To attach the Cab to the Boiler, there are 2 tapped holes on the rear of the Boiler. On the rear top edge of the Boiler drill a #50 hole and tap 2-56, or drill #42 hole and solder a nut on top of the Boiler, dotted lines. Screw a piece of wood thru Boiler and into nut for alignment and keep solder out of threads. Make 2 small straps of about .016" thick stock and about ¼" wide, drilling #42 hole in one end. Make another with #42 hole for Roof attachment of about .025" thick stock, about ¼" wide. Screw this one with a 2-56 screw into under-



SIDE VIEW TOP VIEW

side of Boiler top (or nut on top). Bend it UP over Boiler edge tight and solder well to underside of Cab Roof, as indicated. Similarly bend and screw the 2 straps with #42 holes, to rear back edge of Boiler and solder well to Cab sides. With the bracket soldered to the Roof you will probably have to cement the Hatches on the Roof. Now Cab can be removed by unscrewing this 2-56 screw from inside the Boiler and the two 2-56 screws on the rear edge of the Boiler.

Another installation of the top bracket, and probably easier is to install simular to the drawing, except the bracket is on top of Boiler, bent up to Cab front and soldered, then nut soldered on top of it. First heat screw red hot to oxidize it and prevent solder sticking to it, then screw it into the nut from the bottom while soldering bracket to nut and bracket to Cab front.

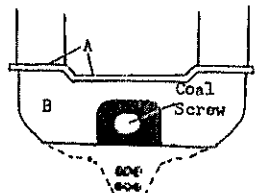


Of course complete Cab could be torch soldered to the Boiler by soldering the Cab front to the Boiler. Several re-heatings may be necessary to get it perfectly square from top and side views.

If the hole in the Cab front is too large for your Boiler, a narrow wrapper will have to be soldered around the Boiler to make up the difference, soldered to Boiler, preferably pinned on, then it or Cab is filed to fit the other.

These Cabs do not have Hatches cast on so that it can be used for those engines that have different number and placement of Hatches. Hatches are made from scrap and soldered to roof with Soldering Paint and torch or cement, as your engine calls for. Scribe Hatches on Roof and file the rivets off underneath. As an example: NKP & C&O Berkshires have a single Hatch in the center .500" square, .050" thick and .150" from roof front. Rails .030" square and .470" long. The Pere Marquette has 3 Hatches. The center Hatch is .560" square, .050" thick, and .150" from roof front. The side Hatches .390" square, .050" thick, .032" from center Hatch and .500" from roof front. Rails as the NKP above, and probably on center Hatches only.

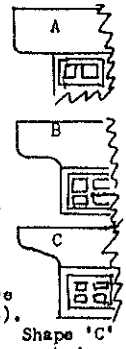
For Baffle Plate, use any sheet stock .016" or thicker. It is cut to fit snug on top of Frame, which can give support. First the Frame that extends to rear of it is cut off. Sand both sides with course sand paper to later take paint better. Put wet swabs on Flooring sides. Apply Solder In Paste to both parts and lay engine upside down. Put Buffer vertical up from Cab floor, lay about 3 little bits of solder at the junction, and apply torch until soldered.



Rear View Into Cab

Not only can a treaded floor 'A' (or any sheet stock) be added to your Cab, but plate 'B' can be soldered on below the floor, down to about even with top of Trailing Truck, some on down past 'prototype' location of Draw Bar and Safty Bar holes, dotted lines, and varies widely as to shape from engine to engine. This plate helps fill in the back of the Cab, prototypically. It is set forward of the Cab back about 3". Of course a hole will have to be cut for your model's Draw Bar. As shown, there is a large hole around the Coal Screw, Conveyer. Some floors have a greater or less break than shown above, probably to align with the Tender floor. On some Cabs the floor does not extend out past the Cab side as shown here. For appearance, if floor is extended out past the Cab side, it should be about .025" thick, prototypically about 1" (.016"). Fit around motor, and 2" past sides, front and back of Cab.

#124.2 CAB, USRA TYPE--Read and assemble same as #124.1, except this one goes together much easier, by vertical veins under roof, going between Cab front and back. Fit Cab front close to curvature of Boiler, final fitting later, after squaring Cab when it is being assembled. Be sure front, back and sides are even with each other on the bottom when assembling, and bottom and top of Cab sides measure equal widths from front to back. all roofs are not the proper curvature, tho can be cirved properly in front and rear with your fingers, carefully. NOTE, there is one row of rivets on the Roof that are widely spaced, this is the rear of the Roof. The Cab windows are nearer the rear. When the Roof has been well fitted, hold Roof on, if necessary, and solder the corners of the sides to front and back, after disassembly and filing of all mating parts and short pins put in matinglugs. The front windows are cast in except for a very narrow strip in the outer side scribed line, to be filed in now. The large scribed area is the window frame, which on some engines you will have to remove Cab front material right up to it. Sometimes this whole frame is opened up for more air to the Cab. For versility, the shape of the Roof can be as 'A', as pre-USRA era (have seen picture of a USRA light Mike whis way) tho most USRA's seem to be as 'C'(so there must have been some USRA changes). Some later engines shaped as 'B'. Shape 'C' is much more popular. Some engines had a comprimise of these shapes, for instance 'C' shape a bit higher cutaway. Draw the shape on the Roof eith pencil, then grind and file to shape by sight, which is very easy. No necessary detail is removed in doing this.



On the front edge of the roof you will notice 4 larger rivets, which you can fabricate Grab Irons from about .016" wire, to be soldered inder the roof here, Some few engines had these on top instead, Also some Cabs had these Grab Irons just below, outward, of the Water Gutter on edge of the Cab side. Some Cabs also had a long Grab Rail on the roof, about 7" above the Cab side, from front of Cab Roof location to rear of Roof. Use about .016" piano wire.

USRA Cabs did not have Wind Deflectors as later engines did. If your Cab calls for one, first cut one from paper about 6" wide and fit, then make another from any thin sheet stock, fit and first tack solder together with small chip of solder and torch, then add more solder as needed in between tacks, doing a small length at a time, with mating surface well cleaned so solder will flow well and with some scrap laid under back of Deflector to hold it at the proper angle. Also wet swabs on all nearby joints

Some earlier engines did not have Water Gutters, so carefully grind these off with cit-off disc and file. Also different Cab Hatches than described below.

Hatches varied in size and number between various engines. For USRA, center Hatch 1'6" wide, 6' long, 1½" thick and to" from Roof front. Each side Hatch 2" (looks better 3"-4") to side of center Hatch, 2'x2' x1½" thick and 2'8" from front of Roof. Rails 1½" square, butted against front of side Hatches, one on each side, and extending to 1' from front of Roof (about 1'8" long). Note, the drawing of our USRA light Mike is wrong, (2" thick Hatches and Rails look much better. Rails on side Hatches only).

See #124.1 for Cab floor and Baffle Plate.

#124.3 Cab see NOTE #2

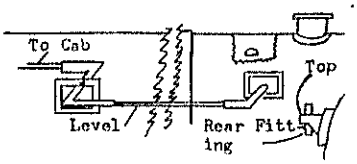
#126.1 TURRET, COVERED TYPE --

After Cab has been installed with it's top mounting bracket, fit and solder, or Fliobond the Turret in place, up against the Cab front. When soldering, put wet swabs on nearby parts that may fall off. Front protrusion of the Turret can be removed for some engines.

#126.4 OPEN TURRET--Touch up with file. Straighten large elwow piping, grind off gating and recontour here. The Turret goes just in front of the Cab about 9"-12" from the main Turret body, with the valves toward the Cab, located on top center of the Boiler. Locate position, mark, center punch and drill #53 drill and redrill #52 hole for elbowed piping to go thru, after cutting it just long enough to just go thru the Boiler. Lightly file the elbow below the round plate to take solder and remove mashes from cutting. Apply Solder In Paste to this and in hole. Press or tap into hole, with other round plate flat on the Boiler. You may have to cut the center rod out of center valve shorter. (There is supposed to be ¼" piping from each valve into Cab here, but these are too small to cast. This area is hidden by the Cab any way). Some later Turrests did nothave the elbow portion.

Use a #54 drill to clean out the 3"piping holes on each of the two large valves, coming out the sides, and drill the holes a bit deeper. of course do not do this until time to add the pipint. Simularly clean the left side small valve on top with .0225" drill and drill deeper for the 1" piping down to the Cross Compound Air Pump Pump. As piping comes over Injector there (to Compressor), solder piping to top of Turret for rigidity. Piping from Injector to Tender can be soldered to bottom of Cab or to bottom of Baffle Plate.

#128 THROTTLE RODS --



Be sure both pieces have .021" or .026" holes in end of levers, if not use scribe to make center holes, and drill each with pin vise, at least 1/16" deep.

From your plans, locate positions on your engine, on right side only (early engines did not have them), measuring up from center line vertically, not Boiler curvature. For forward fitting, Stuffing Box, drill a hole and then file square so Box goes all the way in up to the flange. For the rear fitting, drill .043" hole. Clean .025" piano wire (.020" prototypical) and torch in with small flame until Solder In Paste turns black.

Dental burrs of various sizes can be used in hand grinder to come close to a square, finish with a file. Burr will load up with zamac, so you will have to stop occasionally and clean out with point of scribe.

#130.1 CHECK VALVES (NATHAN) --

These are used in pairs, one on each side of the engine, usually located about 1'3" behind Smoke Box and on Boiler CL to about 1'7" above it. Best to drill out starter holes .055" to better take 3" piping. Drill .059" hole in the Boiler for the mounting pin on the back, then tap it into the hole along with some Soldering Paint and solder with torch mostly on the Boiler. (You need not file the mounting pin that is mashed from cutting.) Solder well the 3" piping into the Valve. The Valve will not come loose from the Boiler. Piping on the right side usually goes to the Injector, and on the left side to the Hot Water Pump. A different type Check Valve goes on top of the Boiler of some engines. This may be adapted by cutting off part and redrilling piping hole.

The top of the oval center section can be ground off and filed oval too, for older type Check Valve, such as USRA's.

#132.1 INSPECTION DOORS-- File off cutting mashes from pin. Locate position on Smoke Box, center punch, drill 1/16" hole, add Solder In Paste to both mating parts and and tap Doors in the hole. Solder in with torch mostly on Smoke Box. Best to pre-heat Smoke Box. The projection with the hole in it goes to the top.

#134.1 HANDRAIL POSTS--

Lay out first and last Handrail post above the CL for your particular engine, by side view projection, not around Boiler, then draw a line between them. For the other side, measure Boiler curvature from the first side, to reduce error. Measure locations of all other Posts, center punch and drill #59 toward the center of the Boiler. Get a shinny .025" piano wire from your hobby shop for Handrail. (.020" would be prototype but .025" looks more prototype.) Cut a short length, 1", grind tip to a pyramidal point to use as a drill, or .025" drill, to drill out all Handrail Post holes that may be cast undersize. Cut Posts from the cluster with dykes at the groove on the base. The cutting will slightly mash the Post, so the mesh should be filed off so the Post will fit in the holes. Separate Posts according to size: 2 very short, 5½" for very front near CL or very rear of Boiler occassionally; 6 medium length, 8½" for rear of Boiler forward; 8 long, 10½" for Smoke Box rearward. Insert the Posts in the proper holes with longnosed pliers, with the projection at the top (clamp) of the Post upward, after first putting thick Soldering Paste on Post base and in the holes and wet swabs on any nearby parts that may come off. Play medium length torch flame just away from the Posts on the Boiler until Soldering Paint turns black for a couple of seconds.

Sand Handrail very clean, push thru 1st 10½" forward Post, on back thru the others to within about 8" of the Cab. Bend Rail down in front for lower Post at the CL, if there is one here. Cut Rail off just below that Post, then push the Rail into it. Bend all Posts so they make the Rail straight from the side view. From the top view prototypically the Rail is curved and sometimes a bit crooked. Place liberal amount of thick Soldering Paint around each Handrail and Post hole. Use a very small flame from your torch until the Paint turns black and immediately remove, going on to the next one. This Handrail is just temporary to protect Handrails and the tip until all parts and piping are on the Boiler. In this process the Handrail will be ruined. When replacing, cut Handrails between Posts unsolder and remove Rail segments, then replace Handrails as before. When ready to paint, a very small bead can be epoxied on each end of the Rail, if your engine has them.

#136 RUNNING BOARDS --

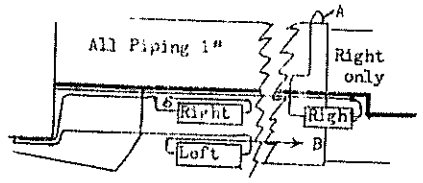
Running Boards should be put on about first, before CL is filed off. Then after they are located, they can be removed. Use scrap #16 wire, usually furnished with Boiler, clean for soldering, tin it, and cut 4 pieces .200" to .250" long, and 2 .400" long for Running Board studs (to hold Running Boards). For holes for the studs, locate how far below CL by side view projection, not around Boiler, particularly on Smoke Box) and add 6". Locate about 3 for Main Board. With Steam Chest and Frame on

Boiler, locate one stud on Smoke Box forward of Steam Chest Body and one behind. Studs on the Main Board can be located behind parts such as Tanks, tho you may have to grind into back of part to fit around stud, builder's choice. Locate stud holes on other side of Boiler by curvature measurments of the first side, to be sure both sides match. You could measure from drawing to get studs between lower Boiler parts and vertical Steam Chest Pipe. Outer edge of Board even with Cab side, and inside filed to contour of Boiler(or ground).

Center punch and drill #55 (.050") if wire is used that we furnish. Start drill perpendicular to Boiler until flutes of drill are into metal, then drill angle can be changed to angle of the Running Board, except those on the Smoke Box, which are too low. This is no problem as wire stud can be bent for proper angle. Drill about 1/8" deep. For easier installation of studs, if they are loose in the holes, and so they will not come out while installing other parts later, mash the tips of studs slightly with a hammer, so studs will have to be tapped into holes. Apply thick Soldering Paint in Boiler holes, insert long studs in front holes, with .300" sticking out. In the remaining rear holes insert the short studs with .100" to .150" sticking out. Solder these in with torch mostly on the Boiler. Bend each stud straight out, and file off bottom front edge of them, to make studs less obvious from the side. Also file slightly flat on top for Running Board to set on, if necessary. File inside edges of Running Boards to contour of Boiler from front to back, with the outside edges parallel to each other and longthwise center line of the Boiler. Tin bottom of entire Boards for soldering to studs and later soldering. We find the easiest way to install Boards after they have been fitted, is to set engine on end (high) of building block (see Price Catalog, p-20 #13)and put thick Soldering Paint on top of each stud, then set Running Board in position, square up, and hold Board down on forward stud with probe while torching on, then a rear stud. Now turn engine upside down, put soldering paste on each stud and Board with a small bead of solder. Again holding the Board against the stud with the probe while torching each one on. Now with pliers on Running Board, over studs, bend Boards and studs at right angles to the Boiler, by bending the studs. From the straight Running Board stock, cut and fit the short forward Board, bending it up at right angles, to meet, and be soldered to the above rear Board, and it's stud. If the main, rear Running Board stock was too short for your engine, the front Board can also be bent back to meet it, making up the length shortage. Here and at meeting of the front and rear Boards, it is best to solder a very short piece of scrap over the soldered joints, under the Boards, and back from the edge so it will not be readily seen.(These studs are generally located so as to be hidden behind Tanks.) A few more studs should be located and added later, when the Board is removed, for added strength. Boards are generally about 2-4" away from the Boiler. Normally when soldering close to the Boards,they will bow some,but straighten when cool. But if you get too much heat on them, they will not straighten, and Boards will have to be unsoldered from the studs to remove the bow. Put plenty of wet swabs on them when soldering nearby. The narrow end of tapered Running Board goes toward the Cab.

If desired, and would be simplier, before inserting studs, locate, drill and assemble Washout Plugs #92, Check Valves #130, Handrail Posts #136, then insert Board studs. Put Boiler and Steam Chest on Frame, locate and fit all parts on top of Boiler , Stack #102, Feedwater Heater #100, Domes #108 & #112, Water Alarm #118.1, Generator #122 (if on top),Throttle Rod Levers #128 (if used) and Turret #126. By putting all these in place at once, they all can be soldered at once by heating the Boiler from the inside with the torch.

#138 RESERVOIR TANKS. --

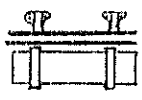


A-To beneath left Running Board behind Hot Water Pump.
B-To Cross Compound Air Pump.

Turn Boiler upside down, locate Tanks where they should go and lay scraps of metal between the Tanks and Running Board to give a spacing of about .032" (metal later to be removed). The edges of the Tanks are about even with the edges of the Running Board. For this spacing you will probably have to use small, cleaned scraps (for soldering) between the Tank and the Boiler. If the Tank sticks out too far, grind a bit off of the back. Now paste flux all meating parts and lay strips of solder over this area. Place plenty of wet swabs over the Running Board and torch solder, spreading the solder with wire or probe.

A much simplier method of installing Tanks, side mounted Pumps etc. Drill #54 hole about ¼" deep in two places in each end of the Tank or Pump. Put about ½" of our 2" piping in the holes, putting Solder In Paste around the junction and torch in. (Do not put the Solder in the hole first, as piping will lift out when heated). With pins straight and parallel to each other, carefully position Tank on Boiler and mark pin locationon the Boiler, Center punch to start drill, drill in just to start drill, then drillstraight into Boiler as viewed from the side. Now Tank canbe tapped into the hole, and positioned up or down, or endwise by bending the wire. Use of a hammer may be helpful for this. Put Solder In Paste around pins and Boiler, put wet swabs on nearby parts and torch on Boiler.

Simulated Tank Studs at best are very difficult to install. Unless an expert, they should probably be omitted, or cemented on. They are soldered on the Boiler just above the Running Board, in line with the Tank Bands on the Tank. It is best, easiest, to tin the back of the Studs while still in the cluster, then bend them back and forth with long nosed pliers until they break off. Put pencil marks on Boiler just above Stud location for centering Stud while soldering, as Tanks will be covered with wet swabs. Put wet swabs on all near-

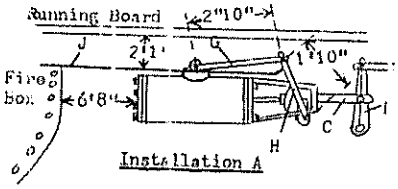


by parts, top and side of Boiler, and all along edge of Running Board, pushing the swabs down between Board and Tanks, especially on the Board studs. Install as #94, tinning spot with Solder In Paste while preheating. The nearby swabs will have to be re-weted many times with eye droper. When all are soldered on, squirt area with water to quickly set the solder, then prod each hard, to be sure they are well soldered. These Studs locations could be tinned when Soldering on the Tanks then,Boiler re-torched to solder on the Studs. NOTE; To center punch the Boiler that has parts soldered on the other side, lay the Boiler in your lap.

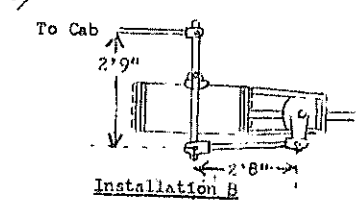
Clean solder residue away, set bracket in place, they will stay in place with Boiler in this position. Either add very thick Soldering Paint between bracket and Boiler, or soldering Paste on both and a bead of solder in the crack and torch mostly the Boiler to melt the solder, using probe to spread solder or reposition the bracket should it move. When done use an eye droper of water to quickly cool the spot. This is good to use elsewhere to quickly cool before heat spreads to other parts. Now bend the brackets with long nosed pliers until Tanks fit properly. You may have to bend the base of the bracket upward or downward, then its tip upward or downward. Put thin Soldering Paint in the piping holes so they will tin, rather than oxidize and later be difficult to solder. Solder Tank to brace, the brace will not come loose from the Boiler, nor the Tank come loose from the brace when later soldering on the piping. The first Tank installation will be all thumbs, but the rest will be quite easy.

Later when piping is put on, anneal (soften) 1" piping by getting red hot, then pull thru fingers to straighten it, scrape ends to clean for soldering in Tanks. Insert into hole in the Tank, along with Soldering Paint, and torch the Tank, not the piping. The Tank will not come loose if you use a large flame to solder quickly before the heat travels to other soldered spots. This piping may be a bit different on your engine. The solid soldering of Tanks to Boiler makes a good place to pick up the engine.

#142.1 ALCO H POWER REVERSE CYLINDER --



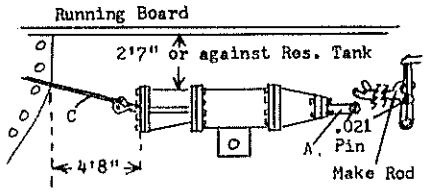
Installation A



Installation B

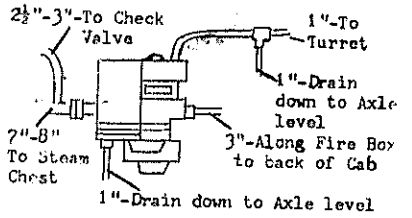
With scrap sheet stock make levers C & G and H. With large steel straight pin or small nail sharpened to small point, punch holes in lever stock as indicated, WHEN cut to length and width. (When punching holes with a nail, punch part way thru,turn stock over and punch rest of the way thru, then tap flat. Better to drill .022" and use .021" pins if available, or drill .026" and use .025" pins. Heads can be filed smaller. Solder the pins just enough in back to hold them in. Locate position of the Cylinder for your engine, example above, and with outer of Cylinder even with outer edge of Running Board, or sight from front so Cylinder's Reach Rod 'C' is about vertically and horizonally in line with Valve Gears Reverse Lever. Mark spot thru Cylinder hole, center-punch and drill Boiler #60 for 00-90 screw, or drill #50 for 2-56 screw, or Cylinder can be soldered directly on the Boiler, after scribing location on Boiler. For easier soldering, amply pre-tin Cylinder base and Boiler with torch, then hold Cylinder in place with probe while torching on. Join Reach Rod, C, to Reverse Lever E of Valve Gear with just the tight fit of a pin that joins them, so the pin can readily be removed when the Boiler and Frame are taken apart. .020" piano wire, J, goes to the Cab, just under the Running Board.

#142.2 FRANKLIN F-2 POWER REVERSE --



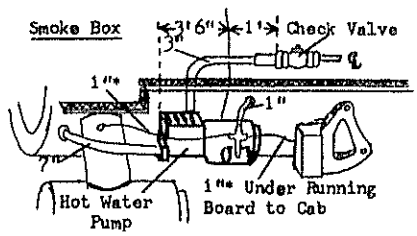
Locate on Boiler, above example, and install as #142.1 above. You may have to file off top portion of mounting bracket to allow Power Reverse to fit up close to Reservoir Tank. Rod C is .020" piano wire soldered into Cylinder universal and onto Cab just under the Running Board. When taking Frame off of the Boiler, be sure you allow Cylinder rod A to slide out of the Reverse Cylinder for separation. See #138 2nd paragraph for alternate installation.

#144.1 BL PUMP, HEATER (WORTHINGTON) --



#144.2 ELASCO PUMP--This is very easy installed, simply turn Boiler on it's side so Pump sits by it's self in place on the Boiler. Some mounting brackets got sprung in casting, so straighten them. Grind the mounting bracket so Pump's outer edge is even with outer edge of Running Board. See #100.3 and #138 2nd paragraph, alternate installation. Refere to #100.34.

#144.3 HOT WATER PUMP (WORTHINGTON) --

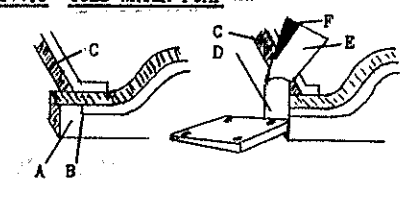


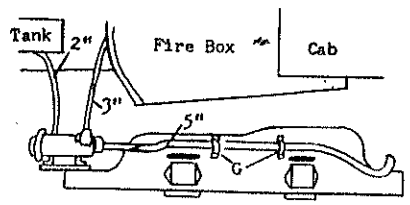
*Not readily seen, could be omitted

Holes are tapped 2-56 in back to screw directly to Boiler Front, or make a bracket which would be soldered to the side of the Boiler, or screwed. See #138, 2nd paragraph for alternate installation.

This is located, usually, on the Boiler, just under the Running Board on the left side just to rear of the Steam Chest. The tapped hole in the back can be used to screw to sheet stock strap, which in turn can be soldered to the Boiler at the proper angle. Some few engines had these on the Boiler Front. See #138, snd paragraph.

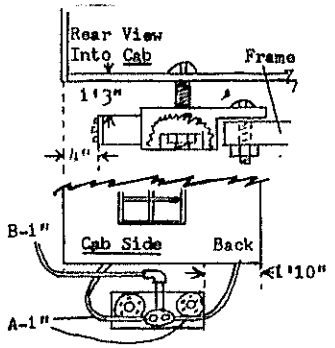
#144.6 COLD WATER PUMP --





File flash from pegs of Pump legs and drill flash out in stand holes so each fit the other, assemble and solder together. Legs are a bit delicate, if one should break off it is not noticeable, the other three will hold well enough. The back legs can be strengthened with added blobs of solder in back. Splice 5" piping onto the 5" piping of the Pump at an angle, to run back along side of the Truck to the rear of the Cab on the left side,and turn inward about 1½'. Round shoe lace could be put on it and draped onto the tender, with quite a bit of slack for curves. If Booster Engine Pipes are used the piping will have to end right at the end of the Truck. About .050" wide straps of about .012" sheet stock made into 2 clamps 'G' securely soldered to hold the 5" piping, or piping soldered directly to the sideframe. Put wet swabs on the splice center assembly of the truck,and around the wheel spindles, particularly the insulated ones, to keep from melting them. (For AF Trailing Trucks on left side, file or grind off 'A' on front part of 4-wheel Truck, right up to the beading 'B', flush with brace 'C'. Not necessary on brass trucks because of angle yoke.) Now vertical edge of the Pump Base 'D' will sit at front edge of sideframe just filed off, with horizontal section on top of Truck brace (yoke) 'C'. Then move Pump inward and outward until the 5" piping runs close to the Truck sideframe, possibly having to bend the piping inward a bit to the sideframe.) For the brass Truck,installation is similar, except that portion 'F' is left on for better securing to the brass yoke. (On AF Truck remove 'F', file all mating parts rough and epoxy liberally 'E' to 'C' and 'D' to 'A'.) On brass Truck, put wet swabs on all above soldered points again and solder 'E' to yoke. Because of the Truck swing it is best to leave off the 2" piping that runs up under and behind the Tank, and the 3" piping running up and inward, in front of the Fire Box. If they are installed it will take careful adjustment.

#148.1 STOKER ENGINE, DUAL --

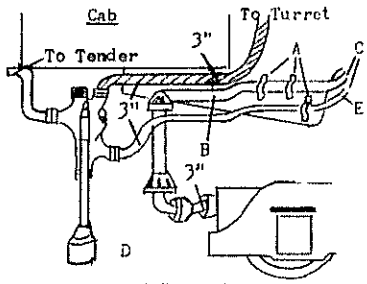


The Stoker Engine can be installed in several ways, all shown above. The one that we prefer is to simply locate the proper position for the Engine, then solder it to the Frame under the long Bracket of the Engine added for this purpose. Second preference is bolting it to the Frame. In either of these cases, the piping if added, should just go a short way because of getting bent up when Frame and Boiler sections are separated from time to time. It could be bolted to the Cab floor, as shown in the cutaway, in which case the added piping would be protected. Do not solder to Frame and bolt to Cab too, then you could not separate Boiler and Frame sections. Washers could be placed between Engine and Cab floor for spacing. You might have to grind off part of the dummy bracket on the bottom of the Engine to clear the Trailing Truck.

Piping 'A' and 'B' could use pipe fittings. 'B' disappears toward center of Engine in front of the Fire Box, 'A' goes alongside the Stoker Engine to the center of the Boiler.

#148.2 STOKER ENGINE, SINGLE--Locate where it goes beneath left side of Cab, and outside tip just flush with side of Cab. This will gennerally allow you to solder rear end of Engine top or bottom on top of engine Frame, or grind off a little from rear of Engine or add a little to it or the engine Frame. For engines that has an Injector in this area, you will have to move the Stoker Engine forward to just clear the Trailing Truck, to allow room for the Injector behind it. Some engines have the Injector just behind the Trailing Truck, so of course the Stoker Engine will have to be moved a bit rearward -----all this to give slightly more room for the swinging Truck, such as on the USRA's. See Injectors, #154.2.

#152.1 BOOSTER ENGINE PIPES --



E-To behind Power Reverse, on to right Check Valve.

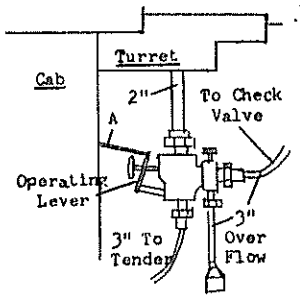
The Pipes, as you will receive, will be bent with the fingers so the top pipes are 90° to the bottom pipes.

From the above drawing you can see these are held in place with heavy 5-6" piping. They are located about 8" inward under the Cab side. Area 'B' is bent outward to go around Fire Box. Area 'C' is about 22° outward from the bottom center of the Boiler and goes on forward, on the right side, and inward to behind the Power Reverse, on between the Valve Gear Frames and disappears. The left side does not go inward toward the center of the Boiler as far as the right side until it gets to the Power Reverse Lever, then turns inward as on the right side and disappears. On both sides, be sure they clear the Trailing Truck. The bottom end goes to the Booster Engine, normally, but the Trucks swing too much for models, even if hinged some way, so the piping will have to pass behind the Booster Engine and be connected to the similar piping on the other side for better rigidity. This will be close fitting between the Injector and Booster Engine. There are starter holes in the Booster Pipes to solder in the 5"-6" piping with thick Soldering Paint. These starter holes could be drilled deeper.

#154.1 INJECTOR, LIFTING --

This is best held on the Boiler by the piping. This is the general location, sometimes on the left side (sometimes on both sides) or in the Cab. Rod

'A' is .020" piano wire, operating the Lever Rod, and runs into Cab as indicated. The Overflow Funnel is down over the Rail instead of as drawn.



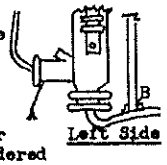
#154.2 INJECTOR, NON LIFTING--Right
#154.3 " " " Left

Left Injector looks the same on the left side as the right, above. #152.1

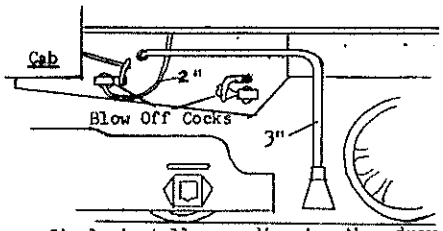
Some Injectors are mounted as shown for some engines, others are rotated on the vertical axis to the left, so the overflow Funnel 'D' is to rear of the Injector. Since heavy piping is used, it is just as well to use the piping to hold it in place. First bend the piping from the right Check Valve to the Injector location by sight, as drawn, and about 1' inward from the Cab's side, and solder in the Injector. Do the same with the one from the Turret. Before soldering this one, wrap very wet string around the first joint. Use plenty of Soldering Paint. When it turns black from the torch remove the torch, immediately. Of course the top rear piping normally goes to the Tender, but is not installed, instead is soldered to the bottom of the Cab for added support of the Injector, or round shoe lace could be draped from it to the Tender. Straps 'A' are to hold piping in place and rigid, but hard to solder on. Probably easier to center-punch straps(pipe brackets) and Fire Box, then drill with .025" drill to about .075" deep in the Fire Box, then rivet on with .025" copper wire and a small punch, then solder them also. Areas 'C' are bent inward around Fire Box along Boiler, to about 22° from bottom of vertical centerline of the Boiler. (22° is about half of 45°.)

Above are for right-hand Injectors. Early engines (USRA era) also had left-hand Injectors, with an extra Turret fitting for it on the left-hand side. The other fittings went to the same places on the left side. Two of these were used instead of the Hot Water or Cold Water Pumps in early years. See #214.1, Draw Bar for piping idea.

For some engines, such as the USRA's, remove the top rear fitting to the Tender, and in it's place use the bottom fitting, after cleaning out the casting gating with edge of cut-off disc and file, then center punch and drill out #62 or #53 hole for 2" or 3" respectively (piping). Piping from here then is soldered to the Baffle Plate 'B', see #124.1, to better secure the Injector. Really best to drill a hole in the very bottom of the Baffle Plate for this piping to be soldered on. Best to drill all holes deeper in Injectors too. On some engines, such as the light Pacific, the rear of the Injector can be soldered right to the Baffle Plate. Where the Stoker Engine is located here in rear of the Injector, therefore Injector and in its piping close to the Trailing Truck, To give more room for this piping to clear the Trailing Truck remove one of the plates on the Injector's coupling mate, 'A'. This is the one going to the Check Valve. Of course you will have to bend this piping sharply up.



#156.1 OVERFLOW FUNNEL --



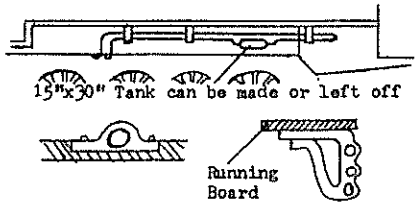
Simply install according to the drawing, on the right side only, WELL SOLDERED, using 3" piping. See #160 for soldering. The piping in front to the Fire Box bends inward along the Boiler to just above the Rail, then bends downward to just above the Rail as shown. Adjust exact Funnel location so that Truck or Driver does not hit it.

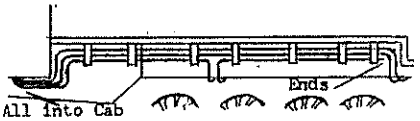
#160 PIPING --

Almost all 1" & 2" piping is easier to use and install if annealed by heating light red hot, then pull thru thumb and forefinger (index) to straighten it. This oxidizes the brass a bit, so will need cleaning before soldering. Our larger piping, 3" and larger is soft, as it has the necessary rigidity. Some small piping, 1" & 2", that is exposed to easy bending from handling, such as Cooling Coils and other piping under the Running Boards etc. it is best to use piano wire. It really is not as difficult to bend as it would seem. It is cheap if practice is needed, using long-nosed pliers. You will always want to hold the long-nosed pliers just back of where you want the completed bend to go. When cutting brasswire it mashes the piping slightly wider, preventing it from going into exacting holes, pre-drilled or cast, so the meshing needs to be filed away. When torch soldering small brass piping to large parts or Boiler, where much heat and a large flame is needed, pre-heat the large part or Boiler first to melt solder, then put the piping in place, playing the heat around the area, far enough away that the piping does not get red hot. Torch soldering piano wire is much better than iron soldering because of the greater heat available for proper fusing, using small flame until the wire just barely turns gray. If iron soldered, often it will appear secure, but some flexing breaks it loose from the shiny smooth wire surface.

By rule of thumb, install the heaviest piping first, then piping clamps, followed by all piping close to Boiler. The Handrails last, replacing temporary ones. On the 2"& 3" piping we used soldering paste and very small chips of solder. No piping protypically has sharp bends. For piano wire you can get a good bend by starting the bend with long nosed pliers, then move the pliers back about 1/32", and bend again, then repeat it several times. However this makes it more difficult to get the bend to end up where you want it.

#162.1 COOLING COIL PIPE CLAMPS --





Pipes disappear under Boiler

Examples as used on C&O Berkshires.

These are not as hard to install as they appear, and should be installed about last, as torching close by will soften or warp the piping. Various engines will vary greatly as to number of Pipe Clamps, number of pipes or size, how far they go, etc. File away any imperfections of Clamps, drill out small holes with .024" drill in hand pin vise, to remove casting imperfections, preferably turning the drill backwards to round the loops. The unneeded loops are filed off just down to the strap, which is then bent back up to the top strap and Running Board as a brace. See drawing. When bending these for installation, to keep the loops from closing up some, you can put small scraps of .020" or better .025" wire in the loops while bending them.

When all Clamps are properly bent, use one long length of .020" wire as a guide, by putting all pre-shaped and tinned Clamps on it, preferably in the bottom loop. Then well solder all Clamps to the underside of the Running Board with a soldering iron. Then the guide wire can be removed and permanent piping put in. .020" piano wire is much easier to install then brass wire, because it is perfectly straight and will not bend from handling. If the piping is looped at one end of the engine, bend the long piping like a long hair pin, then push both ends into all the Clamp loops. Other bends are made with long-nosed pliers held just short of where you want the end of the wire to go --- the loose end of the stock wire being bent. Very little practice will make you an expert. Ends of piping under Boiler and Cab need not be soldered, just float, since piano wire is spring wire and will stay in place. With all piping installed, apply good thick blob of Soldering Paint at each piping-Clamp joint, and heat with tip of small torch flame, just until the Soldering Paint turns black and piano wire at the joint turns gray.

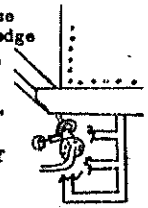
These Clamps can be cut to make individual or multiple pipe clamps for piping on the Boiler, Trailing Trucks, etc. file crosshatched areas off as shown in drawing. When soldering on the Boiler, first tin the Clamp, pre-heat the Boiler and tin it, then immediately put the Clamp in place and torch again, around the Clamp. Use a minimum of solder, so it does not fill the loop.

Care must be exercised when lifting the engine or this piping or Running Board will get bent.

#165 VALVES --

These have starter holes to more easily solder the piping in, or better yet to drill the hole a bit deeper to better solder and hold the wire in. Use thick Soldering Paint for very good unions, using small torch flame just until the Soldering Paint turns black, then immediately remove the torch, particularly when soldering the piping in the Valve, after wrapping wet string around the first joint.

#164.6 4" TENDER VALVE--These are usually located on front edge of Tender Frame on both sides, just behind the Step, laying flat and inward about 1' from Step, and below Frame about 6" to take piping from engine (see #144.6) on the outside of the Valve with a sharp bend, Then from inside of the Valve into Tender. Handle sticks out past front of



Tender Frame. We are guessing these were used on engines after the USRA era, probably on all modern engines, and will add much to the details of your Tender

#175.1 GRAB IRONS --

Cut from cluster with dykes leaving about 1/32" of the pins for assembly holes, and file the mash cuts round. For most places that these are needed, Sand Domes, Compressor Shields, Tender Hatches, etc., there are starter holes which should be drilled about 1/32" deep with #74 drill. The part should be preheated to melt solder, then the Grab Iron with Soldering Paint on the pins inserted into the hole with tweezers while heating around the hole area until solder melts.

#178.4 BLOW OFF COCKS

At #156.1 are examples as on the NKP and PM Berkshires. Drill about #63 or #64 holes in Fire Box at the above spots by sight. Coat Cock's pin and the hole with Soldering Paint and push pin into the hole, turning it back and forth to seat it. Cover nearby parts with wet swabs, pre-heat Fire Box from the inside some, then the outside to melt the solder, playing the torch around the Cock. Solder 2" piping in whatever fitting your engine calls for, cutting off the other one. Solder handles on Cocks as indicated, or #77 holes could be drilled in handles and Cock for a #26 (.016") wire pin soldered in. The Push Rods to the Cab from the Cock is about .015" piano wire.

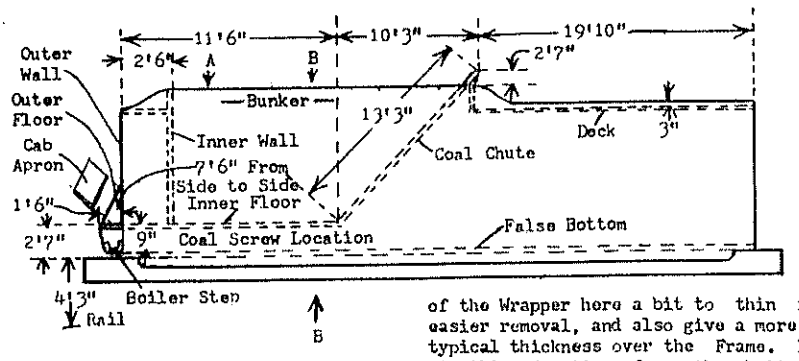
Tender Parts

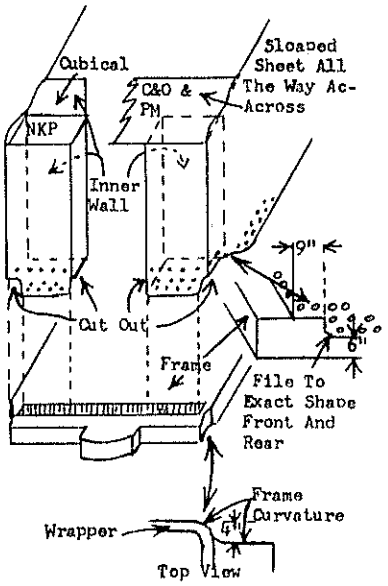
#200.1 TENDER WRAPPER (MODERN) --

Basically, Tender Wrappers seem to be installed in one of three ways on the Tender Frame. a.) The bottom of the shell appears to sit flush on top of and at the edge of the Tender Frame all the way around. b.) Same except the shell extends out over sides of Tender Frame, as in the USRA era. The shell not at the Frame ends. c.) The shell extends down over the side of the Tender Frame almost to the bottom, while the ends wrap around over the top of the Tender Frame, inward from the Frame ends (End Sills).

Installation of a.) & b.) above is rather simple. Solder .032" thick brass sheet stock in the bottom of the shell, and screw the plate to the Frame from the bottom. Then between these assembly screws, cut out large holes to install the wiring. Installation of c.) is not difficult but different. Description here, for example, is for NKP, C&O, and PM Berkshires; C&O Hudson; NYC Hudson and Mohawks. (The latter two are longer wrappers. Many of the following detailed instructions would also apply to c.) and b.) above.)

Unless already done on your Berkshire Tender Wrapper, remove all material in excess of 2" below bottom row of rivets all the way around the Wrapper, or a bit more, so that when Wrapper is installed on the Frame, the bottom two rows of rivets in the front and rear goes down onto the slots on front and rear of the Frame and do not show, leaving only the top row to show on the ends. (Some Tenders have only one row of rivets on the sides so proportionally more has to be removed from the bottom.) Notch out each corner, as on drawing, so front and rear of Wrapper drops into slots, and Wrapper sides slide down over the sides of the Frame to about 6" from the bottom of the Frame. (This notching and fitting is for Berkshires, and many other modern engines. Your Tender may be different, and reason for extra rows of rivets in front and rear that are hidden.) To be able to remove Wrapper from Frame at will and hold Wrapper close to sides of Frame, one of two ways may be employed. a.) With Wrapper on the Frame, fit about 4 - 1" wide





strips exact width of Frame from side to side, down in Wrapper, on top of Frame, about equally spaced and away from Bolster Screws. b.) Or better, in lieu of the strips, fit a false bottom (furnished) down in Wrapper close to sides and ends, right on top of the Frame and exact width of Frame. Use any scrap stock about .016" thick, or a couple of layers of tin can stock soldered together. Both the lower inside edge of the Wrapper and the top edges of the false bottom should be tinned. The Wrapper barely tinned, the false bottom amply tinned. Then when soldering these together, add additional soldering paste and beads of solder at intervals. (Do not use acid core solder anywhere around engine or tender, unless well washed afterward with detergent soap.) In either method, hold Wrapper down on the Frame with the left hand, with several layers of wet cloth under the fingers, and tack solder, at first, the Wrapper and false bottom at various spots with soldering iron or torch. Then inspect length of the Wrapper, that it is equally spaced from bottom of the Frame. If it is OK, then permanently solder the Wrapper to the false bottom, short distances at a time, being careful not to heat the Wrapper too much and warping it. The above procedure also holds the Wrappers close to the Frame the full length. The Wrapper can now be attached to the Frame, see #211.1. If the Wrapper is difficult to get off of the Frame, check the bottom inside edges of the Wrapper for burrs caused from cutting or grinding the bottom. If there are none, file the inside of the Wrapper here a bit to thin it for easier removal, and also give a more prototypical thickness over the Frame. Looking at this junction from the bottom, you might see some slight waviness, where the Wrapper is not tight to the Frame. Lightly tap these areas with plastic hammer.

Install the Deck, see #209.1.

Next to go in is the Coal Chute and Inner Floor, which is in one piece. But first install the Outer Floor to get the level for the Inner Floor, both are an extension of the other. See drawings. This done, fit the Inner Floor up against the Outer Floor and bend the Chute up about 12' from Front Wall (not Inner Wall). This will make the excess length of this material, Inner Floor and Chute, at the top of the Coal Chute. The Inner Floor and Coal Chute will of course go from side to side of the Wrapper. It will be helpful to pencil off the location of the Floor-Chute location on the inside of the Wrapper before installation. Carefully fit and Chute the top of the Coal Chute to the top curvature of the Wrapper. As before, first tack solder in place for exact location, then permanently solder short lengths at a time, with top of Chute right on top of vertical section of Deck. NOTE: You will not be able to get all dimensions to come out to these exact prototypical ones, so do not worry too much about them. These will get you close. Install the Inner Wall, and the cubical shown on the drawings, noting that for the C&O and PM Berkshires there is no cubical, but a plate at an angle all the way across (scrap material).

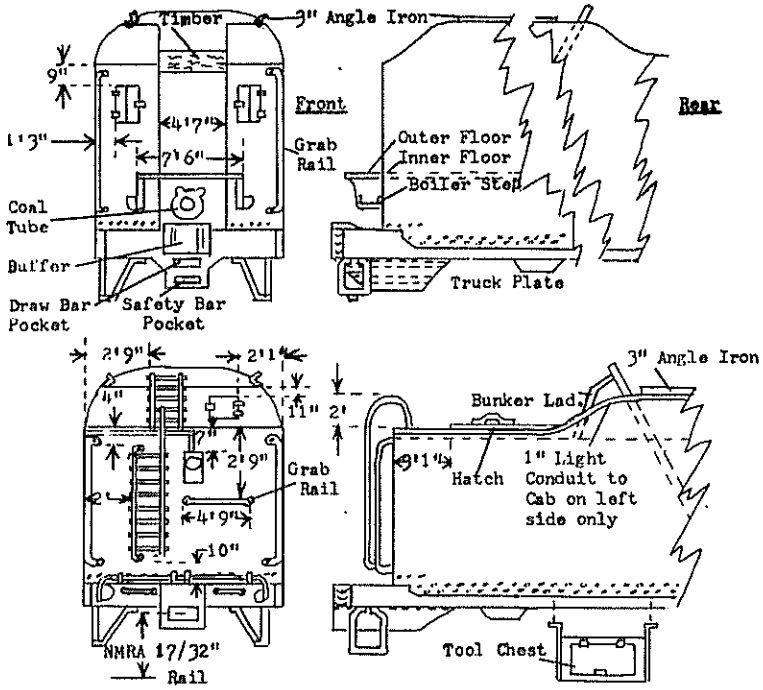
TENDER FINE DETAIL --

Material is not furnished as Tender will probably be filled with coal, but if you want to install the slanting interior sides and Baffle Plates, the dimensions are given in the drawings. The center of the Tender Floor from the Coal Chute to the Inner Wall has a 12" wide slot over the Coal Screw. Some sort of a screw may be found to put in here, about 12" in diameter.

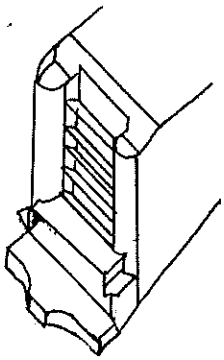
A very small angle iron, 3" each side can be soldered on the inside top of the Coal Bunker, see drawing. It is on the full length of the top of the Bunker only, just tack soldered in several places on the inside. Before this is put on, Beading can be soldered around the entire top of the Wrapper, using slightly oversized .020" brass or copper wire, which has been annealed, then drawn thru the fingers to straighten. This is a bit difficult to put on so most may want to omit it. Tin the entire top edge of Wrapper and the wire, then start soldering it on the top edge of the Wrapper in front, soldering only a short length at a time, so as not to unsolder that already on, probably best for most to tack solder at first for some length, using a soldering iron. Then straighten with pliers, and permanently soldor. When this is done you can file the Beading perfectly straight.

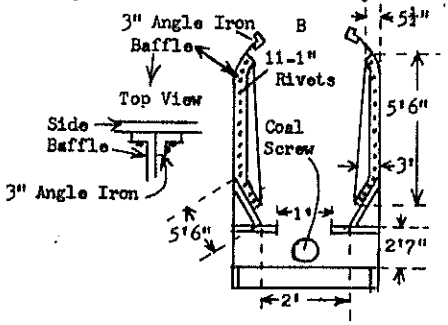
For the front and rear Grab Irons, rather than using brass wire, that bends easily, and making a flange that lays along the Wrapper, as is prototypical, but is much too little soldering surface, we find a

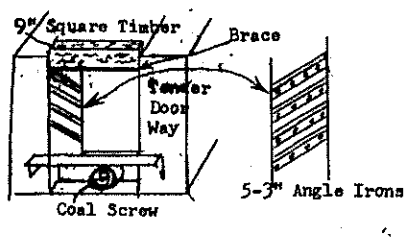
As examples, the following demensions are for the NKP, C&O and PM Berkshires, probably same or near for C&O Hudson.



much more rigid and permanent method is to make the Rails out of .020" (or .032") piano wire, bend them to shape for the location, each end going directly into the Wrapper. On the front and rear of the Tender Wrapper above the horizontal rows of rivets at the top and bottom, there is in each corner a separate rivet punched. These are not rivets but location holes for drilling out for the Grab Irons. One pair of these rivets is missing in one corner, as the die did not have room to put them on so you will have to locate them. Or, for some other Wrappers, hold one in place, mark the spot for one end and drill the hole, then insert the Rail in the hole and mark the hole location for the other end, then drill that hole. This procedure better aligns the holes. (Before drilling, either center punch the hole locations or push an indentation in the Wrapper with your scribe orprobe . Now insert the Rail in the holes with very thick Solder In Paste and torch solder with small flame and using the probe to make the solder flow well around the wire and hold, giving a slight fillet, for a good secure attachment allowing the wire to turn gray at the joint. Thus it will not fall off later. Should you get the holes just a too far apart or too close, use your grinding disc to grind a trifle off of the inside or outside of the pin on both ends so both align with the holes.







Along the sides of the Doorway, from the Inner Floor to the timber on top are angle irons, probably 3", slanting down and rearward at about 45°. On these are placed planking across the doorway to hold the coal back. Of course, when soldering the angles on, put wet swabs on any nearby soldering that may come loose.

Outer Floor bracket is held on the Wrapper with 3" angle irons. This Outer Floor may have to be made shorter than the 1'6" shown for shorter than 30" radius curves.

Particularly on 30" radii, possibly less, you could fit an Apron(plate) between and over the Tender Outer Floor and the Cab Floor. A pin could be put thru the Apron in the Cab, with the Apron extending well back into the Tender and rounded to take the curves. You will have to experiment with this.

If desired, a bit of scrap material could be soldered on top of the cast Buffer above the End Sill, and corners rounded (it could not be cast this way). The front of the Buffer and corners rounded a bit. A Safety Bar Pocket below the Draw Bar Pocket could be added too, see drawing, with hole thru it for screw to the Draw Bar.

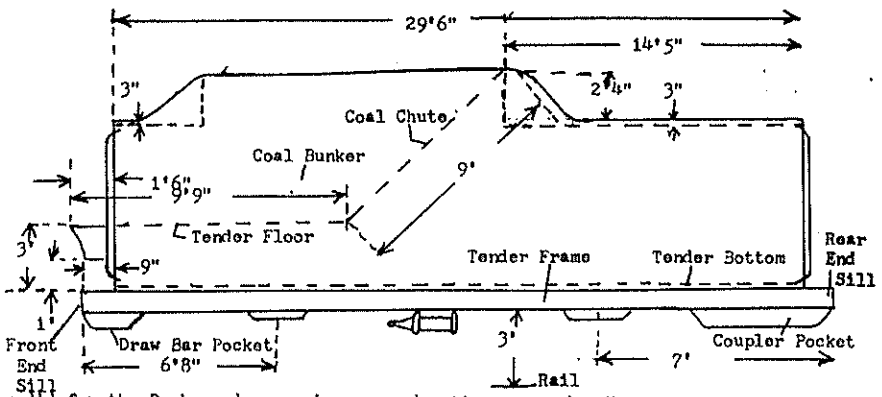
The horizontal Grab Iron (or Rail) to the right of the Ladder is installed exactly the same as vertical Grab Rail, explained above.

#200.5 WRAPPER, USRA TYPE--There seems to be some variance in them, particularly how far rearward the Coal Chute goes, and the shape across the top of the Coal Chute. Some scrap with some rivit detail may be included with the kit for some added details that you may want to add or the bottom or Chute may be sent too long for these details, so save scrap. Tender Bunker sides straight, not curved inward at top like later Tenders.

The first step is to grind and file the sides of the Deck to just barely clear the rivets, 10' wide. This will be the width of the Tender. The Tender bottom is then cut this width and same corner radii, cut a trifle long and fit later. Cut Tender floor same width, (Coal Chute-floor). File front and rear of Bunker from ⌒ to ⌒. Cut the Coal Chute-floor a bit long and bend about 45° at their junction, fit later. When it is installed the Chute portion will be at an angle of the rivets on the side of the Wrapper. See #209.1.

Installation is started by first tinning with soldering iron the Deck's under side and inside of wrapper all around where the Deck will go in, top edge of Coal Chute-floor, top and bottom edges of Tender inside of wrapper all around. First install the Deck 3" below top of wrapper, along the top row of rivets. It will be difficult to hold the Deck even all the way around, so the tack soldering method will be best. That is, get the Deck in proper position in one place and solder just this one spot, then further on get in position and solder that spot, etc., until soldered all along. Start the soldering at the back, but first note that the Deck is bent upward to meet the Coal Chute, or add a piece so it will, or on some Decks it goes straight on to the Chute without being bent upward. All soldering done from bottom. If no light bulb is to be installed inside, the tack soldering is enough, otherwise solder short lengths at a time between tacks. This soldering is best done with a heavy duty soldering iron, otherwise a torch, with thick folds of cloth under the fingers, droping small bits of solder at each soldering spot. An eye droper of water could be kept handy to wuickly chill the solder in case the fingers get too hot. You will not doubt find this fitting and soldering a bit difficult with a torch. Holding each side of the wrapper between fingers will give the pressure to hold wrapper against the Deck while soldering. If solder does run up the sides of the wrapper above the Deck, make a small chisel from a nail about 1/16" wide to scrape out the excess solder, then brush with stiff brush, preferably brass. Do this later when all soldering is done. You may notice bottom radius of corners different than the top, so with long nosed pliers bend bottom radius the same as the top corners.

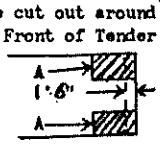
Bend the curved door way of the Tender, 'C' perfectly straight and both sides equal distance inward. You should square the back edge of Tender bottom with a square, cutting off square, same for the front after drawing doorway contour. A 10¢ store square is good enough. Then fit the Frame bottom into the wrapper at the back only, tight against the back and draw around the doorway contour, then cut out these contours, a bit long, then fit bottom inside the wrapper. Then set wrapper upright on the workbench and push the bottom down to the bottom of the wrapper, and pushing the bottom rearward. Now tack solder the bottom at the back, and various spots along the side. You may have to re-position the bottom from spot to spot and solder these spots as you go along, like



you did for the Deck, and pressing on each side (with fingers over folds of cloth) to hold the sides aginst the bottom at that point, When all soldered, fill in between with plenty thick solder, short stretches at a time so positioning of the bottom will not change. File crosswise of the Tender bottom to remove high spots and level solder. You should get a smooth filing of the solder along the edges as this area Will overhang the Frame.

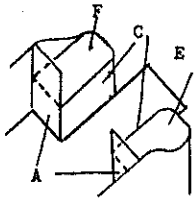
Now to install the Frame to the Tender bottom. Drill a #50 hole thru the outer starter Bolster holes for 2 wheel Truck. (If 6 wheel Truck is used, drill out inward holes #50 and tap for 2-56). Position Tender on Frame so Tender is inward of the Frame ends (End Sill) 9" at each end and side of Tender over hangs the Frame equally on each side. Be sure front of Frame is in front. Distinguishable by the size of Coupler and Draw Bar pockets, Draw Bar the shortest. Now Stick a piece of piano wire, long pencil lead etc. in the forward assembly hole to mark the spot to drill on bottom of the Tender. Prefereably to drill this hole in the Tender Bolster hole that is not used. Drill it #42 and counter sink it with a larger drill to use a 2-56 flat head screw, round head could be used. Drill rear one too. Stick a wooden handle of something up inside the Tender bottom where you want to drill it, center punch against handle, then drill #42. Sand around this hole in side and tin. Sand the bottom of a 2-56 brass nut too.. Cut a wooden match down (or make such a dowel about about ¼" or longer) in diameter and screw it into the 2-56nut. With a cut-off disc side, sand the hex sides clean and put plenty of Solder In Paste on and around the bottom and hex sides and hole in the Tender bottom, inside. Stick the end of the dowel that Solder In Paste is on the nut bottom into the #42 hole inside the Tender bottom. Add a small chip of solder on a couple sides of the hex and torch to Tender bottom. The stick will prevent solder from getting into the threads, hold and align the nut to the hole. Do good soldering here. Remove the stick and screw the Tender Frame to the Tender bottom. Either drill the other #42 hole thru the Frame hole into the Tender bottom carefully aligned, or mark the hole and drill. Disassemble Frame and wrapper and simularly solder a nut on the inside at the rear, except you will have to hold Tender up and torch from the bottom, outside. The first screw screwed in may start hard with solder in the lead thread. With the Frame on the wrapper, stop and assemble the Trucks and put them on the Frame.

Lay the floor portion of Coal Chute over top of wrapper front, over walk way, and extebding past front of Tender 1'6", Mark area with pencil to be cut out around doorway, iniatially cutting about 1/8" less off at 'A' than needed. When fitting, more may be cut off here. The shaded area is the portion removed. Now place Chute-floor in the proper location in the wrapper, Chute angle and all, then set Tender up to the Cab to see that Tender floor and Cab floor are level to each, when they are, mark with a pencil on the inside of the wrapper near the front the floor height. Chute should be over the angled rivets inside of wrapper. Most coal Chutes seem to be flat across the top, with the corners slightly rounded for the USRA's. Appearently later the corners were more rounded, then later the top oval from center outward, of varying shapes. With the Chute-floor in place, mark with a pencil inside the wrapper along the floor, up the Chute and door ways, then sand these areas to take solder, and tin,--of course edges of Chute-floor on the top side. Hold Chute-floor in place with fingers on each side of wrapper and pressing together (with folded cloth under the fingers). A heavy duty soldering iron is best for here, otherwise a torch. Put soldering paste on both mating pieces and lay small bits of solder along the cracks and tack solder all around first, then resolder again, as on Deck

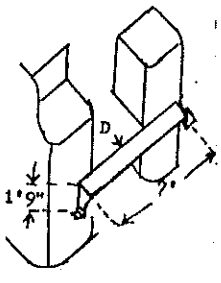


If rear light wiring is used, drill holes in the Tender bottom over the Frame sections, so they will not be seen. These holes can be used to thread the wire to the rear light.

To make the front cubical of the Tender, from scrap, fit and solder in a small piece at 'E' 'F' 3" below top of Tender front, then fit and solder in 'A' behind it. Notice this one comes to the top of the Bunker, froming a cubical. Before fitting 'E' 'F' be sure each side of bent in portion is bent in equally on both sides.



DETAILS--A platform can be made as shown from scrap and soldered over top of Tender floor extending out in front of Tender. Make a fillet at 'D' with soldering iron, between Tender floor and platform junction. At the bottom tip of platform, 'D', solder a Boiler Step on each side. The front edge of platform may have to be curved rearward.

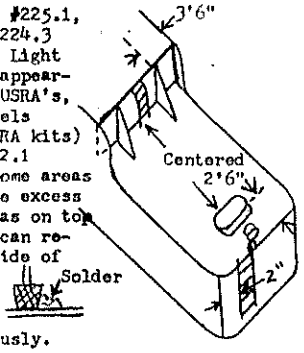


For interior details of Baffles(3 of them, Beading, Coal Screw (except L. Pacific), and corner, long, Grab Irons, see #200.1 Tender Wrapper under "Tender Fine Details.

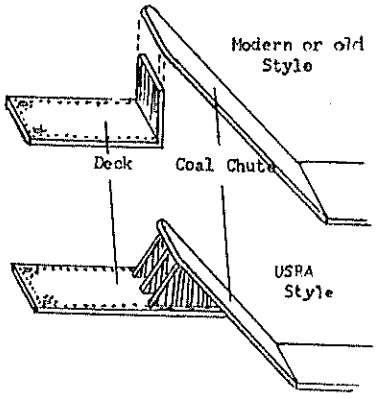
It would be adviseable to add 2-3 ounces of weight to Tender for much better electrical pick-up

FOR USRA's--First fit and install triangular veins at front of Deck (see #209.1),

Bunker Ladder #225.1, rear Ladder #224.3 Hatch #217.2, Light #86.7 or .8 (appearently not on USRA's, but later models and not in USRA kits) and Stops #222.1 and .2. In some areas where you have excess solder, such as on top of Deck, you can remove it with side of dental burr. Or small chisel, deser bed previously.



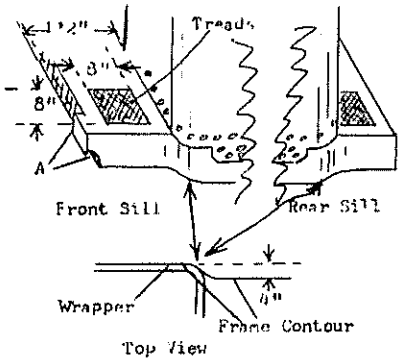
#209.1 TENDER DECK (TOP) --



These are made a shade wide so they can be used on all Tenders. To install, first cut a large hole or holes in false bottom for access under the Deck area with cut-off disc and hand grinder. Do not get hole too close to Wrapper or assembly nuts and lose rigidity. Tin underside edges of Deck liberally, and inside top of Wrapper sparingly, where Deck goes, including where Deck bends up to meet the Coal Chute, as indicated on the drawing, shaping also to the curvature of the Bunker top. Place Deck in place, approximately, and wrap light wire around the Tender with enough tension to hold the Deck in place. Then carefully, using torch or soldering iron, tack solder about 6-8 easily accessible spots from the inside, with the Deck about 3" below the top of the Wrapper. Then if Deck is even all the way around and fitted to the Bunker curve, you can permanently solder by adding more flux to the entire joint plus a few beads of solder along the joint, and torch, using your probe to spread the solder. Caution: Do not get too much solder on the joint. so that it runs thru the joint to the top, making a fillet there and covering the Deck rivets -- which is the reason for soldering from the bottom. It is helpful to solder only short distances at a time, rather than a long strip of melted solder. Any objectionable solder that does come thru to the top, it can be scraped away with a knife and brushed with a brass wire brush, which does not damage the brass detail -- remember this for other places. The little holes at the rear of the Deck are left as they are, they are water drains. On some Tenders they do not have the vertical section of the Deck at the Coal Chute, but the Deck extends on level to the Chute, then there are vertical triangular fin braces, about three of them. USRA's probably had 2 veins, possibly 3 and possibly none, just the vertical section, your choice.

#211.1 TENDER FRAME --

Your Frame and Draw Bar has been designed to eliminate all Tender wiring (unless lights are used), therefore, the Tender and engine parts should not touch to avoid shorts. Assemble Buckeye Trucks according to their instructions, then disassemble, unless you can get the Bolster Screw in the Truck Bolster without removing the Wheels. Drill 7/64" hole in the Truck Bolster for #212.1 Bolster Screw's shoulder, then re-drill #35. Screw the Truck Bolster to the Frame, shoulder of the screw thru the Bolster up tight to the Frame to lock screw in tight. Assemble Truck and Wheels after the Wrapper is fully installed. When the Trucks are installed, top of each End Sill should be 4'3" above the rail heads. If sill too high, remove Trucks and grind off Frame pivot the amount it is too high, if Wheels will clear the underframe. The Coupler and Draw Bar Pockets are prototypical length, so you may have to grind off the inside length to clear the Trucks, unless you re-drill the pivot holes in the Frame Bolster about 1/16"-1/8" rearward, or the Truck Bolster hole forward. Install the Coupler of your choice, so its centerline (CL) is NMRA 17/32" above the railhead. No instructions are being given here because various types will be used, and the Coupler manufacturer will give their instructions. A Cover Plate can be soldered or glued(for easy removal) on bottom of the Coupler Pocket, with a hole thru it to screw, if Plate soldered on. Holes have not been drilled in the Frame for securing the Wrapper, as each modeler may want to secure it differently. As a suggestion, after the false bottom is in the Wrapper, 4-#43 holes can be drilled thru the bottom of the Frame on the flat portion, under each rear Wheel in front and each front Wheel in the rear, thus out of sight. After the holes are all drilled, set the Wrapper on the Frame and drill thru the Frame holes and thru the false bottom. Now tin around these holes on top of the false bottom, and the bottoms of four 2-56 nuts. Cut wooden dowels or match sticks and screw them thru bottom of false bottom, up thru the 2-56 nuts. The dowels give both good alignment of the nuts to the holes, holds them tight to the floor and prevents solder from getting into the threads. The wood can be wetted a bit, and then torched at an angle to reduce wood burning, the nut will solder quickly to false floor. The bottom holes in the Frame should be countersunk to take flat-headed 2-56 screws. Before painting, if desired, the flat screw heads can be filled with a poor mixture of plasticwood or other filler (putty), sanded smooth and painted. It can easily be scratched out for disassembly. The bottom of most Frames need no filing as prototype is cast too.



Top View

With the Wrapper secured on the Frame, round each of the notches near the front and rear of the Frame to the curvature of the corners of the Wrapper, as in the small drawing. If desired, the front Sill can be prototypically ground and filed to the contour at 'A', and Treads soldered in from scrap Running Board material. Draw Bar and Coupler pockets are prototypical widths on the outside. For your curves, you may have to either file the pockets wider on the inside, or the Draw Bar and Coupler Shank narrower, or both. For tighter curves, you may have to make the pivot screws here nearer the Frame and than drilled for you.

#211.4 FRAME, COMMONWEALTH OPEN FRAME, CAST--These Frames are sand cast (too large for lost wax, and too expensive for dies). So they vary widely from Frame to Frame as to smoothness. Many castings were rejected because of thin flange, thus increasing because of thin top flange, thus increasing cost. We took the roughest sample casting and prepared as follows, which made a very nice Frame when done and painted. You may omitt some of these. First of all the prototype Frame was a rough sand casting, so your model Frame should not be finished smooth like sheet stock. But if sides of Beams very rough, go over them with the side of a dental burr, long style,  . Your dentist will be glad to give you old ones, he throws away many of these. This operation will remove high spots of the pebble effect, and somewhat square cornors. One burr will clean about 3-4 Frames. The burr may get a bit dull at the tip, so slowly grind the tip off. A file could be used, but much harder and slower. The Truck swivel will need to be filed smooth and flat, gatings filed off. Our rough sample had bottom surfaces of flange and the outside of the sides very rough, which we smoothed with side of cut-off disc. Of course the top of Frame needs only light filing to level high spots. The Draw bar and Coupler Pockets were made prototypical lengths, the long Pocket for Coupler, rear. You may have to remove some of the length of inward end, so Trucks will clear on your tightest curves, particularly hi-rail with larger flanges. Prototypically Frame is cast as "I" beams for strength. This is impossible for us to cast. Few will want to add it as it would be extremely difficult, but if you do, about the thickness of sheeting flange to be added (about .032" to .040") should be removed from the complete bottom surface, except cut out for Truck Pivit. Probably easiest to add this in strips, rather than sheet, then cut holes. The Coupler and Draw Bar holes are drilled and tapped 2-56 in the most generally used locations, but can be drilled and tapped in other locations. The tops and ends of Frame (End Sills) could be filed smoother, where they extend past the wrapper (side of cut-off disc could be used instead of file). Note, wrapper will overhang the sides of the Frame. Be sure top of Frame is flat. Install Cast Steps and Strap Steps later, #222.1 and #222.2 and Draw Bar #214.1, same for Coupler.

The end most Bolder holes in the Frame are for 4 Wheel Trucks, which most gennerly will be used (for Andrews Trucks), and these holes come drilled and tapped for you. If 6 Wheel Trucks are used, drill inward most holes #50 and tap 2-56 for our Bolster Screws #212.1. The unused Bolster holes can also be drilled #50 and tapped 2-56, hole countersunk with larger drill so a flat head screw can be used to screw Frame to Tender bottom.

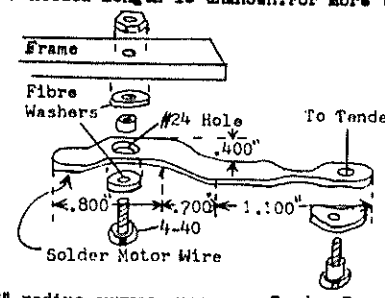
With this done go on to Wrapper #200.5.

#212.1 BOLSTER SCREWS --

These steel 2-56 screws are used for wireless Tenders. For installation, see Frame #211.1 and Buckeye Trucks #234.2. If Truck Bolster is too tight when Bolster Screw is screwed in, the Truck Bolster is too thick and the sleeve is not seating against the Tender Frame; so file or grind the Bolster thinner on the screw-head side. If the Tender wobbles too much from side to side, the Truck Bolster is too thin; make a thin washer to put under the screw head. These are reject Crank Pin Screws usually, so do not use for Crank Pins. While these are used on all our Tender Trucks, #14.2 long Crank Pins can be used on most Trailing Trucks.

#214.1 DRAW BAR, INSULATED TYPE --

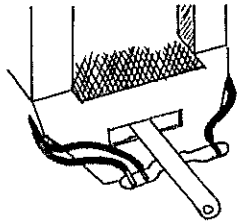
A 1/32" thick brass Draw Bar stock only is furnished for you to shape, as dies to stamp them would be very expensive, besides your needed length is unknown. For more than



27" radius curves, use rear Tender Draw Bar Pocket hole and on Frame the next to last hole, or for less than 27" radius curves, use rear engine Frame hole (and a nut), possibly rear Tender Pocket hole; experiment. For tight curves, about a #10 wire could also be used as a Draw Bar, bending loops at each end, filing loops flat to fit tube and shouldered screw, with wire at loop at engine Frame continued to take the Motor wire. Before using the furnished Bar, it is best to make one out of any scrap to determine where the holes are to be located. The drawing will give the approximate locations to start with. The prototypical space between engine and Tender is about 3', which you can use for over 27" radius curves. It is suggested that you make a slight curve in the Draw Bar, so if the engine and Tender should be spaced just a bit more, the Draw Bar can be straightened a bit, or if they can be drawn closer, bend a bit more curve in the Bar. Assemble according to the drawing, the Bar going over the tube and insulated washers on each end of the tube so the screw can be screwed up tight on these washers. Bend the spring bronze washer in a curve for Tender end. The engine end of the DrawBar is bent downward to clear the engine Frame, and to solder a free swinging flexible wire that goes to the Motor (other engine wire grounded to the Motor or engine Frame).

If Tender Light is used, a wire will have to be draped between engine and Tender to look like water pipes. An easy connection for this (or regular Tender wires, when used) is a 1/8" tubing, with one wire soldered in the end of it. Then cut about .005" thick spring brass or bronze in a strip about 1/16" wide or less, and bend as shown in drawing. This slides onto the tubing. This makes a very simple connection, and is easy to pull apart by pulling on the wires, without fear of breaking the wires. You do not have to get hold of each connector to pull apart, as other jack and plugs. Cover all exposed brass and solder with epoxy for good thin insulation. Even better, an oversized hole can be drilled for the tubing in the Tender Wrapper, well-coat this hole with epoxy as insulation, then when it is set, epoxy in the tubing with the wire already soldered in. This is effortless to connect and disconnect. A cover plate can be soldered (or glued for easy removal) over the

bottom of the Draw Bar Pocket, with a hole in it to reach the screw.



Engine piping can appear to go to the Tender by running them to a brass cross member soldered on the Draw Bar. The piping can be small, quite flexible 'spaghetti' from wire or an electronics shop. Larger piping of small round shoe string, smooth type string or nylon stained or dyed black. The latter Pliobonded at each end. For the 'spaghetti', solder short stubs of wire on the cross member to tightly push the 'spaghetti' on. Various engines will have different numbers and sizes of hoses.

#216.1 BUNKER DOORS --
Solder these on with torch, where needed for your engine, putting wet swabs on other nearby solderings. See #200.1

#217.1 HATCHES --
These are long Hatches for more modern large Tenders, soldered on the Tender Deck lengthwise as shown in Price Catalog. Lay Hatches in proper position (usually two or three or more tight together),pencil around them on the Deck, then remove the rivets underneath, place wet swabs all around Deck and Wrapper junction, then solder in place with torch, holding in place with probe if necessary. Use thick Soldering Paste here. Starter holes are cast in Hatches for Grab Iron handles. Drill these deeper with #72 drill and install #175.1 Grab Irons, which you should see. These Hatches could be used as singles or doubles crosswise or lengthwise.The square corners can be filed round. See Tender drawing for sample location.
See #200.1.

#217.2 HATCH, USRA TYPE--Install as above. Are usually installed crosswise on Deck, such as on USRA Tenders, 2'9" from back, centered on Deck with hinge forward, example see #200.5

#220.1 REAR LIGHT, RECESSED TYPE --
These are used on more modern engines, recessed into the Tender Wrapper as shown in Tender drawing. It can be illuminated from inside the Tender by lightly epoxying the bulb wires to the Light or Wrapper inside, or small bracket made to support bulb, epoxy-coated for insulation. There is usually a 1" conduit that goes strait up from the Light to the beading of the Tender and follows the beading, under it, right on over the Bunker to the front of the Tender. All other pictured Headlights in the "Price Catalog" were used for Tender lights too. When wiring these, leave the wire a bit long above the false bottom, so that you can separate the Wrapper and Tender frame a couple of inches, for easier working.
See #200.1 for typical location.

#222.1 TENDER STRAP STEPS --Locate on all four corners of Berkshires (C&O, N&P & PM) and many other Tenders, while only on rear corners fo some, like USRA's with Cast Steps on front corners.
Turn Tender Frame upside down, with or without the Wrapper on it. Locate spot for Step at edge of Frame. File Frame clean to take solder for Step and brace. Cut some braces from about .012" sheet brass, about 1/16" wide. Hold Step in place, rung straps down, then bend brace to shape and cut to length. Solder brace to step with small torch flame.Now the Step and brace will sit on the frame, both pre-tinned. Apply thick Soldering Paint on the Frame at Step and brace location and pre-heat the Frame to melt the solder, getting a good coating, probe may be needed to spread it a bit. Add more Soldering Paint, put a wet swab on the brace on bottom of the Step, set the Step in place on the Frame and torch the Frame only until soldered -- stray heat will heat the Step enough. These Steps seem fragile, but these braces make them very rigid. Various Tenders have different shape to topmost strap that is attached to the Frame which can be bent as required. See Tender Wrapper drawing, #200.1

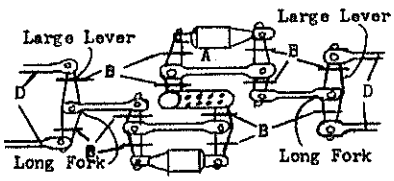
#222.2 TENDER STEPS, CAST TYPE --
Most USRA's used Cast Steps on front corners, Strap Steps on rear. Grind gatings down to about 1/16" long, file around pin lightly to remove rough spots. Then locate and center punch their location on the front corners, flush with front and sides (End Sills. Drill these 1/32" deep with #54 drill, then redrill #53. This is a tough brass, so remove the drill occassionally to remove chips and cool or lubricate, if only with saliva. The same if any tapping to be done and screw in little at a time. push step in with a back and forth motion until it seats. If it will not seat, remove some pin length or diameter. Then remove them and put Solder In Paste around edges of step, but not in the hole, reassemble and torch solder. You might have to add more Solder In Paste around formed cracks and resolder, to be sure they are filled. You could grind off pin and solder on directly. Pre-heat Frame to melt SIP, insert step and retorch.

#224 LADDERS --
Locate position for your Tender and torch on,with medium flame, to rear of Tender, with angle at end of long top rail soldered on top of Deck, as pictured in "Price Catalog". Also see #200.1 & #200.5

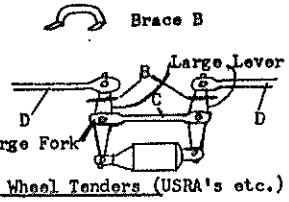
#225.1 BUNKER LADDER --
Sits on Deck, leaning slightly forward and against Coal Chute. See Tender Drawing. Put wet swabs on nearby soldering. Also see #200.1 & #200.5

#227.1 TOOL CHEST --
These are generally on the left underside of the Tender Frame between the Trucks and slightly forward of Tender middle, and 4" inward from the side. Bend top strap ends as shown in "Price Catalog" for soldering to the Frame. Pre-heat and tin the Frame, then put Chest in place, heating the Frame only until soldered. See #200.1

#231.1 & .2 BRAKE SYSTEM, 12-WHEEL AND 8-WHEEL --



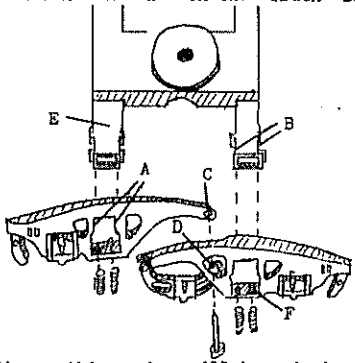
12 Wheel Tenders (Berkshires)



8 Wheel Tenders (USRA's etc.)

Draw a line from corner to corner on bottom of Tender Frame to locate the center. This is where you drill a .059" hole for the leverage bracket 'A' (or just the center of the 'C' lever for the 8-wheel Tender), and is soldered in. Make rods 'D' for 12-wheel Tenders by bending one end of a narrow strip of sheet stock to simulate one side of a fork, or for 8-wheel Tender cut one rod in half, soldering a small rod (wire) to it, so it and all rods 'D' go out under the Wheels. On the bench assemble all rods, levers and Brake Cylinders with .021" pins according to drawings. Pin heads can be filed smaller and hex-head, then soldered underneath. Locate where holes for Brake Cylinder pins are to be drilled by setting the whole assembly on the Frame, and drill them 1/16". Put Cylinder pins in their holes with wet swabs on the rigging soldered points and torch in by torching from the top of the Frame. To keep the various levers from falling away from the Tender Frame prototypically, make small brackets of wire, of shape shown, to be looped over the rods and to the Tender Frame.Solder these on with the torch on the top side. All the prototypical locations 'B' need not be used. For model purposes, all these can be omitted if the rods and levers are rigidly soldered together.

#234.1 & .2 BUCKEYE 6-WHEEL TRUCKS --
Drill Bolster Pin holes for size Bolster Pins being used, .110" (#35) for our #212.1 Bolster Pins. Be sure Bolster is thin enough for Bolster Pin sleeve to go all the way thru. If when the Bolster Pin is tight, it's sleeve tight up against the Frame, the Truck is too tight, then the Bolster will have to be filed thinner under the head of the Bolster Pin. If the Tender sways too much sidewise on the Truck Bolster,then a thin washer will have to be put under the head of the Bolster Pin. The washer probably will have to be made, to be thin enough. Remove gatings and very lightly file each Sideframe Bolster slot 'A' and Bolster groove 'B' to remove any bumps that might be sticking up. There might be thin depressions, but do not file them out, only roughness. The top corners of some Plain Journal lids may be bent upward from casting, so tap corners down with small rod and a hammer. If Wheel Set Spindles will not go all the way into the Journal holes, drill out with #51 drill (#40 for AF Wheel Sets). Put single-bearing Sideframe on the Bolster then double-bearing Sideframe, as shown. Now holes 'C' & 'D' should be in alignment for .027" assembly pin. If holes do not align, bend Bolster arm 'E' so they do. The backside of hole 'C' should be countersunk just a little with #60 drill turned in your fingers,and this area filed to take solder. Put .027" pin thru hole 'D' then 'C', the head on the outside and filed hex shape.Put paste flux on the pin in back and the Sideframe there. Hold double Journal Sideframe in left hand and place small rod, nail set, flat nail, or back of a drill between pinhead and workbench. Press downward the soldering pin in will hold pinhead tight to



outside of Sideframe. Get a good fillet of solder around pin and Sideframe. Cut the pin off as close as you can and grind down to about 1/32" stub, or less.

Put one Sideframe on Bolster 'D' and hold in left hand upside-down so as to hold Bolster at top of Sideframe,and install all Springs. Springs are easily installed by putting a length of thread thru one of the middle loops to keep it from flying away if it slips out of assembly, then place the Spring over spring pin 'F', rearward one first, then place a knife blade on the top edge of the Spring and push it inward to the top Spring pin. (While not necessary, Spring installation is easier if you would grind the tops of the springs flat by holding the Spring down over one prong of the tweezers and grind the tops flat with the side of cut-off disc.) Now put the Wheels in this side. If Wheel insulation sticks out far enough, insulation washers will not be needed. Install other Sideframe. If Wheel Sets prevent this Sideframe from going on, some of Wheel insulation probably is too long and will have to be filed back, preferably hubs on inside of Journals filed shorter. (For hi-rail, both will have to be done, and possibly some of the insides of the Sideframe ground thinner.) (These hubs and insulation protruding on Wheel Sets are to make washers unnecessary.) Since Wheel Sets fit snugly in Truck, the center Journal hubs should be filed about 1/64" thinner for more end play than the end Wheel Sets.Before filing hubs,sight lengthwise of the Truck to see how Flanges align, and file hubs accordingly. One Wheel Set might have longer insulation sticking out, causing slight misalignment of the Flanges, and needs shortening, or hub here filed shorter.

#234.3 ANDREWS 4 WHEEL TENDER & CABOOSE TRUCK (USRA)---These are very simple to assemble..First see if Wheel Spindles will go into Bearings all the way, if not drill deeper with #50 drill. Check Wheel set's insulation sticking out, removing over 1/32". On one side of Truck's Sideframe, grind or file slots across Wheel Bearing to about 132" deep as a guide to how much length of the bearing to now grind down or file to shorten the Bearing, grinding out slots. (Do both sides of Truck for hi-rail). Drill #32 drill thru Bolster hole for Bolster pin. Put Leaf Springs of Bolster thru sideframe hole, you may have to force it, Then install Coil Springs here(put a length of thread thru Springs so they do not flip out and get lost. Put Wheels in this side, both insulated or non-insulated. Put Bolster thru other sideframe while at the same time starting Wheel Spindles into Journal Bearings. Install other 2 Coil Springs. Install on Tender with #212.1 Bolster screws.

#234.4 4 WHEEL COMMONWEALTH DROP EQUALIZER TENDER TRUCK---We believe this was used on some passenger and mail cars.

Remove all gatings. Very lightly file the 3 sides in all Journal's slotts 'A',all surfaces 'C' and inside Sideframe 'B' to remove roughage and beads. Take one loose Journal and slide it into all Sideframe slotts. It should slide in freely, if not, slott 'B' is sprung slightly closed, so either file it out or bend open a bit. Lay each Sideframe together 'J', Journal slotts of one matched to the Journal slotts of the other. If they are not in perfect alignment, bend one so it matches the other. Otherwise wheel axles may not come out parellel, then recheck with loose Journal to fit. Bottom of Journal is rounded. To be sure Journal on the Equalizer arm fits in slotts 'B', slide Journal in-

to slott like drawing. Some of the forks 'E' were bent when caster cut the gating. Straighten these somewhat with long nosed pliers so each fork is at right angles to Equalizer Bar and tip 'E' is at right angle to it's vertical bar, also on Journal 'A' side. File clean inside of all forks 'E'. Slide Equalizer Bar 'D' onto Sideframe 'B' 'C'. Now this bent fork can be mashed against Sideframe with long nosed pliers to further straighten it. Probably the Journal here will not slide up and down freely in Sideframe because Equalizer Bar on top or side of Journal is binding, so push a knife blade down between Equalizer Bar and Side frame to give a little spacing for free movement, The loose Journal added now should give free operation of both Journals. Simularly prepare other Sideframe etc.

If you want the ultimate in appearance file all outside surfaces as this appears an all machined Truck, not cast as most are.

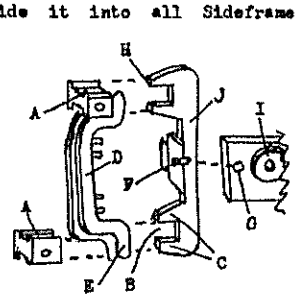
Before final assembly be sure holes'G' on both ends fit both Sideframe pins 'F'. This hole can be drilled out with #56 drill. Bolster pin hole drilled out #35-#33.

We prefered grinding off retainer plate pins 'H', insert Journals and solder on a small narrow retainer plate across the bottom to hold Journals in. Before soldering, run pencil lead over all close parts here, and pre-tin each piece (and remove residue) to prevent solder from running and soldering moving parts together. Add a bit more Solder In Paste to each Sideframe part, lay retainer plates in place and solder with torch or soldering iron.

Insert both pick-up sides of wheels in one Sideframe, insert Bolster hole 'G' over pin 'F' (with round swivel plate upward). Put other Sideframe also over opposite wheel spindles and pin 'F' in hole 'G'. Set Truck on table with wet cotton swab over nearby wheel. Put Solder In Paint over small length between Sideframe and Bolster, along with small bead of solder, and solder with torch or iron. With other side simularly soldered you may see one end of Truck wider than the other. A slight un-noticeable bending of Sideframe will correct this.

With Journals working freely, insert springs on one pin, then use a knife blade to compress spring over other pin. Put about an 8" thread thru spring in this installation in case spring should flip out, thus not loose it. Check length of springs. cut shorter to 1' or stretch to 1'. If the cut ends of springs are toward the inside of the Truck they all seem to set evener.

Use our #212.1 Bolster screw or #14.1 Crank Pin screws to screw Trucks to Tender Frame. If sleeve of screw doesn't go thru bottom of Truck Bolster hole with about 1/64" sticking thru the top, file down top of Bolster swivel plate 'I' until it does or by hand,turn a #25 drill in bottom of this screw hole so screw head will go in a bit further. This sleeve,shoulder, is screwed up tight to bottom of Tender swivel so Truck will turn freely. Should you need to lower Tender Frame closer to rail for your plans, file material from Tender Bolster Swivel Plate, not the Truck plate 'I'.Or if Tender needs to be raised, solder a washer on Tender Bolster swivel so hole of washer is exactly size of hole, so Bolster pin sleeve will now seat well to the washer.



#234.5 & .6 6 WHEEL COMMONWEALTH CAST STEEL TENDER TRUCK---The instructions for these will be sent when you order them.

#240, 241 & 243 WHEEL SETS --

On special request, these are available without 1/8" diameter spacer(stiffener) between Wheels. Wheels can be pulled off so 1/16" axle can be put thru Pilot Trucks, Booster Engines,etc., reassemble, gauge and remove wobble, if any, with pliers. Some of the spoke sets will be furnished as cast (when castings are good), so they will need light filing with fine file of tread and flange. All Wheel Sets have insulation protruding on insulated side so insulated washers will not be needed. Also, most of our Trucks will have hubs(spacer) on inside of Journals to hold Wheels away from Sideframes, so washers will not be needed. From sight you cannot tell NS Wheel Sets from brass. Even in natural metal it is difficult when machined, as the NS is a slightly lighter yellow. To differentiate between types of Sets, the axles have been coded with epoxy as near to prototype colors as possible, as follows:

One side pick-up.....dark brown axles.
Two side pick-up.....medium brown axles.
NS one side pick-up.....gray axles.
Steel wheels.....dark shinny black Wheels.
Brass & NS.....dull dark gray Wheels.
(Some NS Wheels came out shinny black.)

#260.1 PARTS INSTRUCTION BOOKLET---This booklet. Individual instructions will not be sent for any part, however complicated. It would be a good investment to have this booklet on hand. It will give you some ideas besides much easier assembly of our parts particularly Tenders, Trucks, Valve Gears, Piping, popular Boiler demensions etc.

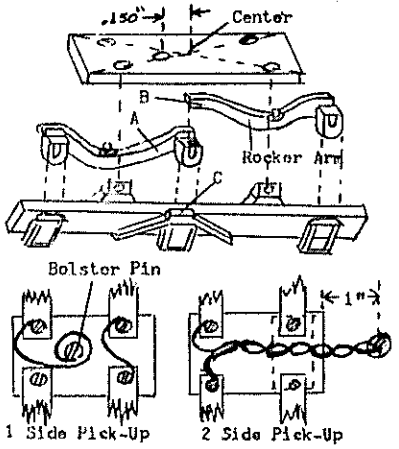
This booklet, kit booklet and plans will be furnished only with "Basic Running Gear" of any of our kits or conversion kit. If you order a "Boiler Section" or "Tender Section", this booklet is not furnished. We make this booklet available to you at our cost to help you and reduce prices of parts by not having to put individual instructions with each and every part ordered, which takes enormous time, thus a savings to you. This is one instance of not wanting to be "Penny Wise And Pound Foolish", just for 45¢. For a novice to a fair builder this is a must. Any new parts and instructions coming out, file in proper place in this booklet.

If you have this latest instruction booklet and are ordering a kit,you can note this to us and deduct 45¢.

#400.1, .2 & .3 COMMONWEALTH 6-WHEEL PASSENGER TRUCKS (PULLMAN STANDARD) --

The Springs enclosed in the kit are assuming you will put the Bolster Pin .150" off-center in the Truck Bolster, so Bolster Pin is easily removed,without disassembling the whole Truck. (If the Bolster Pin is put in the center, the weight table is slightly high). With Trucks on the car, Springs preferably should just barely compress, 1/32", to ½ compressed. We did not drill Bolster holes or furnish Bolster Pin, not knowing what your application is - wood plastic or metal car Bolster, or whether you want the Bolster Pin off-center or in the center of Bolster. Draw a line from corner to corner of Bolster for center Bolster Pin location, or measure .150" ahead or behind this point for off-center location. Look over all castings, straighten, then grind or file off gatings and imperfections. Grind all Wheel Spindles .090" to .100" long, then round corners with fine file. If Spindles do not go into Journals

to the Wheel Hub, drill out Journal with #49 drill, hold Journal tightly and feed drill slowly so drill will not grab. File about 1/64" off of inside of Journal Hubs, a bit more on the center Hubs. Holding Sideframes as shown, assemble double Journal in left slot of Sideframe, from the inside, forcing if necessary, then the single Journal on the right side, with the tip of



Rocker Arm at 'B' in the little groove on top of center Journal. This is only a preliminary fit. For preliminary assembly and fit, lay fiber Bolster on top of projecting lugs on Sideframe and screw wood screws in from the bottom to thread holes in Bolster and be sure Bolster fits lugs. If center Bolster Pin holes are used, remove all wood screws, and install the Bolster to the car underframe. If off-center installation is chosen, then remove all but one screw and insert a Wheel Set where the screw was left in, holding the wheel in by holding outsides of Sideframes with thumb and pointer finger. Spread Sideframes and insert center wheel, then other end wheel. Put in the other screws, grinding off the points that stick thru the top.

Note: Both side pick-up assembled as above; for one side pick-up, all insulated wheels on one side with insulating washers.

Check length of Springs. They should not be over .200" total length (13/64ths"), unless Bolster hole is .150" off-center, in which case Springs on the Bolster hole end of Truck must be .025" (1/32") longer. If none are already that long, stretch them. If stretched too long, cut off with dykes. Springs a little long will increase the load they will cary. If Springs are flat on top they are a bit easier to install, but we did not see any noticeable difference in looks or operation to warrant double cost to make them flat. They can easily be made flat by holding Springs down over jaws of tweezers with just the tip sticking out and ground with the flat side of your cut-off disc. Wedge a piece of wood between top of Journal and top of Sideframe slot, to hold Journal down. Lay a Spring on bottom of Spring base pin (with thread thru Spring to keep from losing it). Hold Truck in left hand, with thumb slightly over bottom tip of Spring, lay knife blade on top of Spring and compress it while pushing inward under top Spring pin base. Lift left thumb up to hold Spring in, and pull knife out. Be sure Spring is down over each Spring pin base.

Holding Truck right-side up, lift each Journal one at a time. Some will stick up because in casting, Rocker Arms are bent so Journal is crooked and sticking in slot. So hold Journal firmly with long-nosed pliers and twist it to sit vertically. Occasionally the double Journal piece will look like it is either too long or too short for the Sideframe slots, or Spring does not sit vertically, so bend Rocker Arm 'A' near Journal to the right or left to lengthen the Journal spacing, then bend the Journal vertically. See that Brake Shoes are not touching Wheels when Springs are compressed. Journal on the car, point 'C' should clear the bottom of the car as little as possible when the car rocks sidewise on the Trucks.

Now Wheels should turn quite freely, even dry, after rolling Truck back and forth on the bench to wear in, both with Springs compressed and not compressed. If not free, there is probably not enough side-play of the Wheels between the Sideframes, Hubs are binding, so either loosen wood screws and pull the Sideframes apart, if they will not pull apart any, the ends of the Sideframes can be bent outward without noticing it, or have to be disassembled and more filed off of the Journal Hubs. The center Wheel should have about 1/32" to 1/16" side play, depending on the sharpness of your curves. The end Wheels clearance just enough not to bind. If one of the Journals compresses more than the other end, that sideframe may be bent downward a bit, or the other end is a bit high, or both. These Sideframe ends can also be bent up or down without noticing it. Or Spring tension can be adjusted. After the first Truck, the others will go together easily.

You now have one of the finest and best looking Trucks on the market. They sure give an uplift to AF rivet-sided cars. The original AF 4-wheel Trucks were much too near the ends, to reduce swing of car ends on their tight curves, so mount these Truck ends about 1 true inch from end of car.

You have noted from handling, the Rocker Arm at 'B' occasionally sticks up out of the seating groove of the center Journal so remember this when handling the car, otherwise the center Journal will not spring. This cannot happen in operation as springs hold it in place.

There are probably a number of ways to wire the Trucks. The drawings should work very well, giving least bending of the leads and breakage, and omitting all soldering possible, which is a source of trouble, as breakage usually occurs here. Instead the wires are looped under the wood screw heads in the direction the screws are turned. The both side pick-up wiring is the braided drawing of the wires. Dotted line is to show where cardboard or light plastic could be put across bottom of lugs to hold wires underneath, close to Bolster. One Sideframe wire could be soldered to the Bolster Pin head (as shown for one side pick-up), with a soldering lug inside the car on Bolster Pin, to carry the current on. On the one side pick-up the wire is coiled around the Bolster Pin a full loop to reduce bending at one spot, and soldered to Bolster Pin head. It would be a good idea on these to wire both Sideframes together as shown, so spindles and Journal on one side are not carrying all the current, but dividing the current to the other side thru the Axle and back to the first Sideframe. It would be a good idea to have some solid detail or screw project below car bottom between Sideframes to prevent Trucks from turning clear outward when handling and pulling wires off or out of place, also a car looks terrible when showing a car and the Sideframes are sticking straight outward.

This Truck was especially chosen because it was used on the last of the wood cars and the first of the steel riveted side cars, so is versatile in use. We have even seen it on many modern steel cars with braces at each end and all rivets on Main Beam removed.

We believe you now have one of the finest looking, detailed Trucks on the market in any gauge, that probably operates as perfectly as any truck can.....even out-of-round Wheels roll as well as perfect Wheels.

#600 SPRINGS --

There is not much more to say about these that is not already explained in the "Price Catalog".

It might be repeated, most Springs are available, and they are few, are fine wire and coils widely spaced. Ours are more prototypical, in that the wire is heavier, and closely would for those who want the best, and Springs that actually spring, not be equalized from sloppy fit of Truck parts.

See 4th paragraph of above #400.1, .2, and .3 Trucks.

#605.1 MICRO-MINIATURE BULBS, 6 VOLTS --

Quite by accident, these bulbs were found to take 12 volts, extremely brilliant, but did not see how long it would stay lighted. However, at the rated 3 volts the bulb barely lighted. At 6 volts, the bulb still had a trace of yellow color, but was bright. At 8 volts, very bright and white. Obviously, the bulb rating is higher than 3 volts, probably 6-8 volts. We will consider them 7 volts.

They will fit into almost anything you will want to use them for: Headlights, Number Boards, Marker or Classification Lamps, Caboose and passenger interior Lamps, Signal and Switch Lamps, and other uses you will think of with a hole as small as .052" (#55 drill) diameter and .150" long. Note, these are cheaper by the dozen for these uses.

If there is a black area at bulb base, do not bend the wire here as they will break. You might be able to solder them back together, if so, epoxy over soldered area. It is best to remove the black material by soaking in laquer thinner for safe bending of the wire, and getting the bulb in a shorter hole. When bulb is all installed, be sure the two wires are separated at the base, then apply a little bead of epoxy that has slightly more hardener in it than manufacturer calls for, for more flexibility. Put the number of bulbs in series (used or hidden in the Boiler) whose added rated voltage equals the highest voltage you operate on, plus or minus 1 volt. Thus, 2-6 volt Micro-Miniature bulb in series for 12 volt operation, or 3 in series for 16 volt operation. Or, put the number of bulbs or resistors in series (used or hidden in the Boiler) whose added resistance equals 26 ohms for 12 volt operation or 35 ohms (approx.) for 16 volts, plus or minus 4 ohms is un-noticeable, but on the plus side would increase the bulb life. To check an unknown bulb or resistor in series with Micro-Miniature, wire them across your rail and slowly turn up your throttle to a point where the bulb lights up to barely turning white, or an acceptable brilliance to you. If this is the highest voltage used on the layout, it is OK. If not bright enough, there is too much resistance (possibly two bulbs or resistors could be put in parallel). Or if brightest brilliance is reached before highest operating voltage, there is not enough resistance, possibly adding another Micro or AF bulb in series. Some helpful bulb characteristics are:

6 ohms=16 volt AF bulb (some may be different).

13 ohms=6 volt Micro-Miniature bulb.

16 ohms=18 volt Grain-of-Wheat bulb.

Two bulbs or resistors can be placed in parallel to reduce their ohms or volt rating to one half, for additional value possibilities. NOTE: On most AF transformers (probably Lionel too) the voltage starts at 6-10 volts, which may burn out these bulbs by themselves. This may also be true of commercial rheostats and variacs (powerstats).

#609.1 FLEXIBLE WIRE --
This small easily installed and hidden flexible wire is good for low current wiring of Headlights, Classification, Marker, Signal, passenger, tender and Caboose lights, both side pick-up Trucks, and between engine and Tender if two wires are used (and draped like hose).

#612.1 SOLDER IN PASTE--
This is probably as cheap, possibly cheaper to use than regular solder as practically none is wasted, against about 50% - 75% of regular solder is either filed away or spread out where it does not hold anything. Instructions say not to torch flame on solder. It can be done if flame is played around solder until part heats up, such as tinning a flat surface, to keep solder only heating quickly causing quick steam and poping solder off. This doesn't happen when solder is between pieces. The liquid will evaporate over a period of time, just add some water. For detailed use, see "Soft Soldering" in our Price Catalog, page 15. A jar will last for years. After soldering, wash or brush away the residue with a wet brush. This and torch do not leave large blobs of solder on your parts to cover detail, or have to be filed away as with soldering iron. Remember, with a soldering iron, there has to be solder on the iron and the part to transfer the heat to solder the part. This bridge of solder has to be filed away, with torch you do not have this.

#614.1 CYNOACRYLATE ADHESIVE(Cy-no-a-crelate)--This adhesive may be the break -- thru you have been waiting for, that almost any one can now build an engine, as most of the engine can be assembled with this------like gluing on parts, (except sheet stock to sheet stock). It sets in 3-10 minutes, so you can go right on building (3 minutes if parts fit well or 10 minutes on poor fit of parts). Or easy to repair after finished and painted. Can be used on almost every material, (except very absorbant materials like soft wood, cloth, etc.) all metals, hard wood, plastics and around the house, glass, leather, china, porclain and rubber,-----to simular or dissimular materials. Just think, cement plastic, wood or rubber to your engines, Very good on Zamac. No mixing of adhesive, colorless and transparent, tho not a crack filler. One 2 gm. tube probably enough for one engine, as a very minute amount from tube spout used on one part only, then rub the 2 pieces together, hand press together and let set. This is not a glue therefore the less used and more contact of surfaces the stronger the bond and quicker set. Mating surfaces should be as perfect a fit as possible such as a Dome curvature being near perfect to Boiler curvature or flat surface really flat to another flat surface. Parts that fit only at points will not be strong--conversely perfectly fitting parts are most difficult to remove. One way to get a good fit is put emery paper or cloth between mating parts and work one back and forth.

You can build an engine as far as you are able to solder, then use this adhesive to finish, preferably soldering the smaller pieces, Or solder very small pieces having small contact area such as Draw Bar Brackets, Classification Lamps, Piping Clamps, etc. cement all others, including Piping in Clamps. Put wet swabs on cemented parts when soldering nearby. Solder backs of pins thru all Rods. This allows many more modelers to build engines and probably in half the time of all soldering. Of course it can be used on cars, structures or any other hard material.

When not in use, store in refrigarator for long long life. Keep spout wiped off to prevent adhesive build up and lid won't fit,

We believe the ease and quickness of building and engine is well worth the price. To remove a part, use Acetone or heat above temperature to melt solder, 435°.

CAUTION--Do not get a small amount on your finger and rub it on another finger as it takes 1-2 seconds to cement them together

#616.1 S SCALE 63' RULE --
This is especially useful to scale the popular HO scaled drawings from magazine and books to S. See "Price Catalog" #616.1,

#700.1 FIGURES --
Small, less obvious bases are designed with feet on the bottom to stand better on rough surfaces. Gating for casting is located here too, so should be shaved out with a sharp knife, and feet could be narrower too. Bases are purposely designed too so they can be cut off, neatly filed around the feet, holes drilled in the feet and needles or steel straight pin (with head to hold adhesive) inserted and epoxied, glued or carefully soldered. Then the pin can be stuck right in the scenery without a base. The Engineer and Fireman can be glued, Pliobonded or better epoxied to cab side, or seat provided in the Cab for them to sit on, or as drivers in some vehicles, sitting in Box Car doors, on boxes, logs, equipment, etc. Pedestrians walking and standing can be used at passenger stations, on street corners, mail boxes, window fronts, around houses, yards, gas stations, around industry, autos and trucks, along tracks, or spectators of work going on. Sitting figures and others with bottom half cut off,, can be used in Passenger Cars, autos, trucks, busses and Cabooses. The in Passenger Cars, autos and trucks. The stump of one figure can be cut off and the "gentleman" sit on benches and chairs, etc. Workmen are probably most useful of all, used to work on engines, Drivers, Wheels, cars, autos, trucks, track and tie work, on trackside, gas stations, industry, lifting or pushing boxes and other equipment, load and loading equipment, barrels, boxes, etc. Boxes, barrels, shovels, picks, etc. can be made and glued or epoxied in their hands. With imagination, endless things can be done with these. The squatting figure can work on things on the ground, in Flat, Box, or Gondola Cars, or on engines, repairing tires, track, turnouts or around fires, along with the stump figure.

Painting --
These figures are cast with clothing for easier painting. Figures do not stand very close inspection, so great painting detail need not be done, just a "lick and a promise". Testor's Pla colors at 10¢ per bottle are good or any enamel. Use a very small brush about the size of a tooth pick or cut out the bristles to this size. When mixing colors, use only a few drops of each color. Colors should not be glossy, so add about 6 parts of face or talcum powder to one part paint, experiment as to amount. It is easier and quicker to paint a number of figures at a time, selecting about 5-6 colors, using about 2-4 colors per figure, besides flesh color. (Flesh color easily made with white, little brown and less red.) Lay out all figures in a line. Probably easiest to start from top of figure down, first paint all hats or hair(and shoes)at a time, then faces (and hands), then shirts jackets or coats, then pants, then ground or grass. In this manner the paint next to a painted area you can take a little care, while at the other end where there isn't, painted care does not have to be taken, to save time and effort. Then when dry, paint the next adjacent color down the body. By using lacquer type paint, and painting about 10-12 figures, by the time you have painted the last figure's color, the paint will be dry on the first ones, so you can paint another color on it. So figure painting is really quite simple, fun at the same time. Your children would probably like some, or do the painting.

- - - - E N D - - - -

We believe this booklet will be of great help to you----even the rank novice, to get his first engine made. Like anything else, after the first one, they are not too hard.

Some of you may feel we should have used more drawings. Maybe so. A book probably could be prepared, but this is not desireable from its cost and what you would pay for, besides we did not feel more necessary. Most parts can really be assembled just by looking at them, thus no drawing needed, just some technical information helpful that drawings would not explain.

On closing we would like to relate an experience.

The other day one of my long associates mentioned he is a model railroader. I never dreamed he was.

It would be a good idea to check our friends and work associates. They may also be modelers, or have been thinking about model railroading but didn't know any one to inquire about it. Showing your S gauge layout could develope an S gauge buddy.

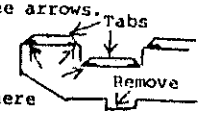
For some reason many model railroaders do not tell their friends and associates about this hobby. You may be surprised who you know that is a model railroader, or is interested in starting.

NOTE #1
Since Side Rods are cheaper and easier to replace than Frames, we would suggest the fitting of the Side Rods only, rather than the axle holes as noted below. After cutting off the pin as close as your dykes will cut as described below, use the side of your COD to grind the pin flat(not longer than 1/32"), this is easier to pean the pin. To repeat do this peaning carefully, so as to pean, spread the end of the pin, and not bend the pin at all. Just a tiny bit will make the Side Rod longer or shorter, making this break in to cause the Side Rod holes much larger. We have found an easier way to fit, break in the Side Rods. After Side Rod is fully assembled, screw one end of the Side Rod into one of the end Drivers, one side of the Frame for now. Now lay the Side Rod over the other Eccentric holes of the other Drivers, with all holes horizonal, over the junction of the Main Frame and Cover Plate. Now look down into the other holes of the Side Rod, easiest with magnafying glasses, and see if the Side Rod holes are near-exactly over the Eccentric holes. If not, the Side Rod with the Hub will probably be the one that will be off a little, and the hole will need filing to center it over the Eccentric hole. But also notice the other holes. It could be that only one hole is off, so rather than file one hole a lot, and be quite large, the other holes can be filled to help compensate. for instance say you have to file that one hole on the left so it will move to the right, the other holes can be filed some on the left. Even when this side, if filed properly, you cannot turn the Drivers thru freely, as these rods will buckle, so assemble the other side simularly. Best that the first side well filed so the second side will be easier to fit and know where the trouble is. The axles will probably lock when tightening down the Cover Plate screws, so put strips of paper between the axle holes, between Main Frame and Cover Plate. This will greatly increase the life of the Frame, removing them when the axles become loose. Every tiny bit of bind need not be removed, as when the engine is complete and running with a load, this will quickly wear out. You will have to remove and replace the Side Rods several times after filing.

NOTE #2

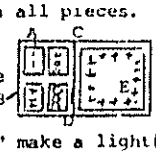
124.5 Cab, 9-8-0--In case you are on the fence, carbon rod soldering makes this Cab assembly quite simple in comparrison to torch or soldering iron--actually enjoyable, like minature spot welding, tho is still soldering.

Cut out all pieces, removing the out line lines, except the front and back of the Roof and it's rear cutout. The lines act as beading. Some Cabs did not have the angular cut out at the rear of the Roof, but this one did, so cut this area out, leaving the lines as beading. For other Cabs just file the line away. Small tabs were put on the parts, thinking they would make assembly easier, but instead they make assembly harder, cannot bend them sharply or accurate, so remove all of them, 2 each on the front and back, side of the back, top of each side, top and center of Baffle Plate, see arrows. There are small engraved marks showing where

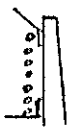


to bend tabs or corners, arrows above. On the top of the sides, scribe a line between these scribe marks so you will know how far to grind the tabs down. as dotted lines, same for front and back, being especially careful on the front and back meeting ths sides. Later engravings probably will not have these tabs. On the treaded floor, leave 9" extra length on both the front and back and 6" on each side for extensions past the Cab. When assembled, any extra length can be ground off with the COD beyond 1/32". In a number of areas all cannot be easily cut out, so will have to be cut out in little pieces, the rest ground out with COD. The Fire Box at the RB(Running boards) should measure about 7' across, which are the outside lines on the Cab front. The top outside lines are about right. So cut out this area not quite to the outside lines and fit to Boiler, Fire Box,now or later. After all pieces are cut and ground out, lay engravings side down on a piece of steel, vise, drill press and lightly tap with hammer to get nice and flat. Straighten all pieces.

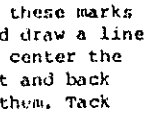
Windows--For windows you want to cut out, lightly scribe a line down the center of the small windows as 'A', then every 1/16" make a light punch mark with a sharp scribe and hammer, so as to start a # 60 drill. In the large window scribe a line around it's diameter 1/16" from the pane 'E', and scribe across these lines every 1/16", 'B' & 'E', punch these cross lines as before, then for better control, drill all these with #60 drill, then redrill them with #50 or #54, 'D'. The #60 can be drill with your Dremel hand tool with a small chuck in it, but since the Dremel has such a high RPM. keep drill drenched with slaiva as lubricant and coolent, much better than water. Finish the windows later. The front and back windows to be drilled later too, as drilled out now makes bending the corners almost impossible. After the cab is formed, you can redrill these holes while holding the drill at an angle, which will drill out the web between the holes, and then filed down. Grind off the burrs in the back.



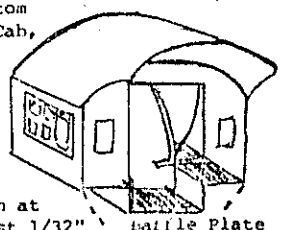
Cab Forming--With long nosed pliers bend the corners by holding the pliers in the corner so the guide marks just barely along the side of the side of the pliers and holding the window section in the pliers next to you so window section does not bend, hold very tight and bend the corner. Sight across bottom and side while holding the open corner together and bend assembly as square as you can, even tho not perfect. Solder the side over the back edge, as with drawing it is easier, holding the corner down on the bench for soldering iron or carbon rod, or on steel, asbestos or brick for torch. Just tack solder at first to be sure corners properly jointed, then solder the other end.



Roof--To form, bend it over about a 1 1/4"- 1 1/2" diameter form, such as aspirin, Tylenal, herb bottles, shovel handle etc., broom handle to small a diameter. The last 3/4" over about 1" diameter form. About the last 1/2" bent length wise of the long nosed pliers jaws--but cateful, careful, so as not to get bend marks on the Roof. Beading along side the Roof should have been removed, and Roof very slightly overhang the sides(some others seem to be flush). There are CL marks on the front and back of the Roof, transcribe these marks on the bottom and draw a line between them, to center the Roof on the front and back when you solder them. Tack solder the center of the Roof to the front or back only for now, noting the little notch at the angular cut-out is even with the back of the Cab see sketch.



Floor--Bend with long nosed pliers, noticing the bend marks along the pliers as before. Look at in all directions and bend even and square. Fit to bottom of Cab,



with at least 1/32" Baffle Plate sticking out all around the bottom of the Cab, you should have much more, that will be ground off even after soldered in place. Should there not be enough material sticking out past the sides, the vertical part can be bent outward slightly. When you get the Floor bent to fit the bottom of the Cab about as close as you can, pencil or scribe Floor along outside of Cab sides. Inside these areas pre-tin, same for bottom edges of Cab sides, front and back, then add a bit more solder to these areas. Hold it and Cab together with a glove over your hand and tack solder one side, then see if the other side will fit properly, if so, solder that side, then solder the first side perminent. We used a 30W. Soldering iron for all this.

Cab to Boiler--Now you can file out all the windows. Later cement clear plastic on the inside. The front and back windows can now be drilled out and filed, if you wish.

Baffle Plate--We overlooked this, so cut out as previously drawn, removing the tabs. Solder to bottom of upper Cab floor and against the lower floor and solder from the back.

Cab to Boiler--Here you have two choices to assemble the Boiler to the Cab. Finish Soldering the Roof to the front, back, and sides, one place each then soldering Cab front to the Boiler from the outside. Especially useful if noticeable cracks between Boiler and Cab that needs solder fillet. If both fit well, then Roof can be removed and front tack soldered to Boiler in about three places on the inside where solder shows little, at each RB location and at the top. Then the Roof re-soldered on. We prefere the latter, especially if you are not going to paint the engine. In either case, it is better to mark the Boiler where the soldering is to be and pre-tin these areas to get a good solid joint---do not want the Boiler to come loose a year from now. Also in either case you should first tack solder the front to the Boiler and view Cab from each side and top to see if it is square and really not perminantly solder to the Boiler until the rear bracket is installed to attach the Cab to the Frame, next, may not appear sqare then

Cab(Rear Boiler) to Frame Mount

Make bracket from scrap brass about 1/4" wide and about .025" thick and what ever height to get the Boiler CL here 9'9" above rail head, as at the Smoke Box. Drill #43 hole in bottom of bracket