Gas Valve and Regulator

by Malcolm Beak

Several of you probably know by now that although I am interested in models generally, my primary involvement is with radio controlled steamboats. Most of the steam plant I have made during the last ten years or so has been gas fired. Apart from those that used Propane, the gas line between container and burner has always been silicone rubber pipe. Pressure in these lines would normally be 20 - 30 psi. Despite the prophesies of doom and destruction no trouble has ever been experienced with the silicone itself. There were occasions when pipes blew off, but these were always rectified by fitting brass sleeves over the silicone tube over the length of the joint, and since then, no troubles have been experienced. Needless to say, some members of the steamboat fraternity have given me some stick concerning the safety aspects of using silicone tube at such pressures. Hopefully the combined on/off valve and pressure regulator described here would have gone some way to calming their fears. All high pressure gas is confined within the valve and regulator, and the silicone tube now only contains gas at a regulated low pressure. On checking several of my burners this is typically 5 - 10 psi. However with the recently published letter in Model Boats from Dick Knee I can see that my hopes have been dashed. Nevertheless, the design is still presented here with the outlet modified for connection to a copper pipe.

When using Butane or Butane/Propane mix for firing model steam boats, one has several choices of type of container for the liquefied gas.

1) Custom made container
2) The Camping Gaz cartridge range
3) A selection of commercial screw top canisters

1) It is probably best if these are used as the last resort. Home made gas tanks are now subject to pressure testing similar to boilers. The pressures involved can, however, be very high. For example a tank for straight Butane has to be tested at 190 psi while one for propane must stand 560 psi. There should be no problem in constructing containers capable of withstanding these pressures, but finding a tester with a gauge to cope with the higher pressures needed for propane and some of the butane/propane mixes may not be easy.

2) Camping Gaz cartridges have to be held in a frame and are then punctured using the on/off valve incorporated in the frame. This has always seemed to me to be a rather crude system requiring more space in the boat than other types (due to the surrounding frame) and wasteful of gas. The cartridge cannot be resealed, and if insufficient gas remains for a run, it has to be discarded and a new one fitted.

3) This is the one that concerns us in this article. Screw top canisters come in a range of sizes. These are the easiest to use in model boats provided a suitable valve can be found. Those supplied by the canister manufacturers all seem to be rather large and cumbersome and are quite expensive (I look forward to being corrected on that point). A few years ago Treetower sold a compact and reasonably priced valve, but I believe that is no longer on the market.

One feature all these valves have in common is that as they are screwed onto the canister, a fixed pin projecting down the centre of the thread pushes open the spring loaded seal in the top of the canister. There is always an escape of gas as the seal is opened and before the "O" ring seal in the valve contacts the flat area at the top of the threaded boss. Similarly, gas escapes as the valve is removed. The manufacturers recommend that the valves should be removed each time after use, although I doubt that this recommendation is often observed. The actual control of the amount of gas that is released for use is done with a spindle having a tapered end working in a hole, adjustment being made with a screw thread on the spindle shaft.

The design presented here does away with the fixed pin and the tapered spindle. Examination of the general arrangement drawing will show that in this case the projecting pin is advanced and withdrawn on a screw thread, so opening or closing the valve built into the top of the canister. The control for anything less than full flow provided by this method is not quiet so good as with the tapered spindle valve, but in our case this does not matter as the valve is wide open the whole time, and the flame size is adjusted by regulating the outlet pressure. Another examination of the general arrangement shows how this is done, and a glance at the individual components reveals that they are not at all difficult to make.

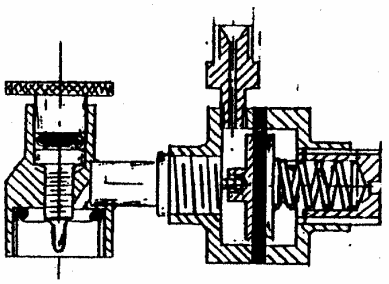
Points to note are that the rolled thread on the canisters is a very nominal 7/16" x 28 tpi (7/16 UNEF). The top diameter is down and the bottom diameter is up resulting in a not very great depth of thread engagement..

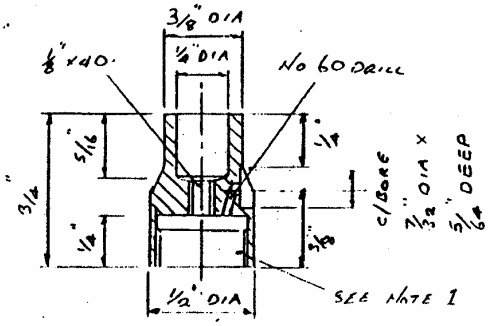
There is nothing that requires great accuracy - the most important point to observe is that the mushroom on the regulator valve should be level or a thou or so below the housing surface that the diaphragm sits on - definitely not above it. Too far below and all the spring adjustment will be needed just to push the diaphragm down to contact the valve (use of a heavier spring will reduce the sensitivity of the device). Above the surface and the diaphragm itself will open the valve. The car tyre valves seem to come in three designs. One sort is longer than the other two and has a long external spring at the bottom, another has a small spring around the operating spindle at the top of the valve. The one that we want has the spring concealed within the casing. They can be bought new at motor accessory shops, or secondhand from your friendly tyre and exhaust centre.

Although shown as a combined unit, there is of course no reason why either valve or regulator should not be made as a separate item.

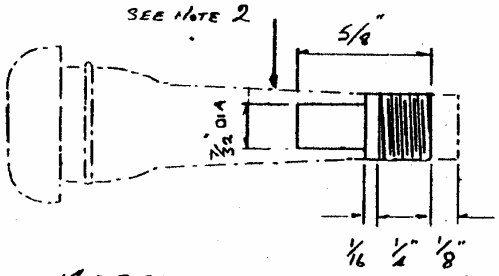
COMBINED GAS VALVE AND PRESSURE REGULATOR

MB 20-2-92

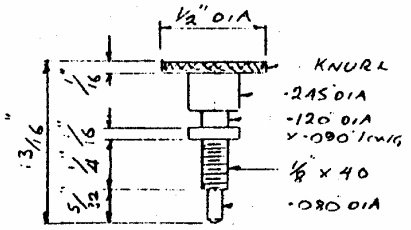




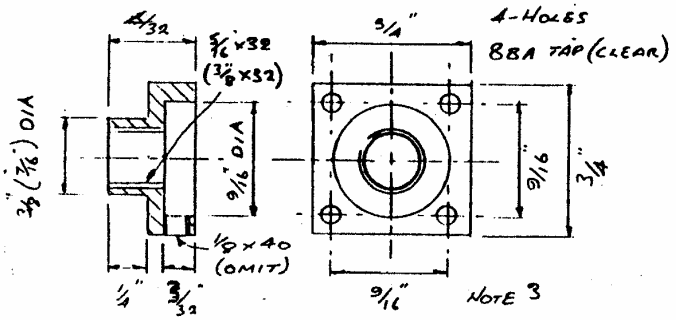
VALVE BODY BRASS



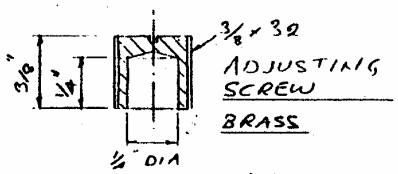
MODIFIED CAR TYRE VALVE HOLDER

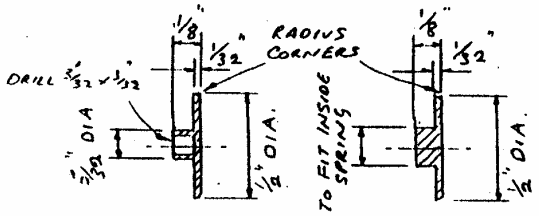


VALVE SPINDLE BRASS

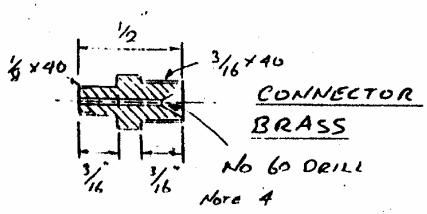


REGULATOR BODY AND (COVER) DURAL





LOAD SPREADERS DURAL



Notes on the drawings for a combined gas valve and regulator

1) Thread on gas canisters is a modified form of 7/16 UNEF (7/16 x 28 tpi) and needs the tapping size increased to 0.408" dia. (you may get away with a 13/32" drill). Use a standard tap or screw cut the thread. Note that the inner end of the hole is recessed to take the "O" ring seal.

2) Hacksaw the end off the valve about where indicated by the arrow. Grip the threaded portion (5/16 x 32) in a split bush and machine away the rubber and brass to leave the shape shown. The plain end is silver soldered into the valve body and the threaded end is loctited into the regulator body so that with the tyre valve and load spreader in position, the face of the load spreader is flush with or slightly below the top face of the regulator body.

3) Where dimensions for the regulator *cover* differ from those for the *body* they are shown in parenthesis.

4) The outlet connector is loctited into the side of the regulator body. It will probably be most convenient if it points horizontally rather than vertically as shown in the general arrangement drawing.

Other items.

Diaphragm :-	1 mm thick neoprene sheet.
Spring :-	7 coils of 0.029" dia wire, 0.248" OD and 7/16" free length, or what you can get hold of. Depth of hole in adjusting screw may need to be changed if spring length is much different from that shown.
O ring :-	Ref.: 006 for valve spindle.
O ring :-	Ref.: 011 for seal on can top.