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# THE COMMUNICATIONS RECEIVER

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EDITED BY

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All correspondence requires SASE for reply.



## NATIONAL NOTES CONTINUED

### NO. 7 — RESTORING THE NATIONAL PW DIAL DRIVE

**Introduction** — In 1994 this column introduced National Notes, a continuing compilation of assorted ideas and facts about the multitude of National Radio Co. products. We continue in this issue with a noteworthy piece of bench work by George Gunnoe, K3DA, (24 Smithfield Village, East Stroudsburg, PA 18301) on the famous and ubiquitous PW dial drive, originally designed by Grayden Smith and introduced by National on the 1934 HRO. Since National was also in the parts business, these dial drives are often found at flea markets, and just as often they do not work properly; the action can be stiff, the dial may slip numbers on turning, and they are old. Read on...

— K3ZJW

**T**his is a complex mechanical device, and the problems may be related to any or all of the following: Gear lubrication, the bearing, the offset hub, the dial per se, the drive shaft, the fiber washers, and the knob. National built two versions, the PW and N-PW drives. The latter, an in-line design, was first used on the NC-100 series receivers, and has a different gear assembly than the right-angle unit used with the HRO.

After working on several of these dials, a routine was developed to correct the problems.

#### DISASSEMBLING

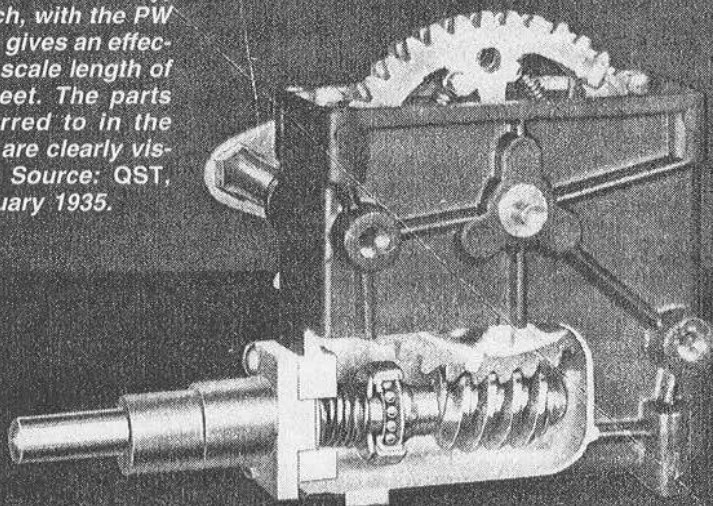
Remove the dial (if problems here, see the August 1994, issue, Note No. 1) and set it aside. Turn the drive shaft by hand and note the force needed. Next, remove the four screws from the top of the housing and check the relative locations of the two spring-loaded split halves of the large circular bull gears. They should be positioned so that the two small holes

line up. When the unit is reassembled, the spring tension will have to be restored to this spot. Also, before proceeding, note that a stud on the gear will hit against a projection inside the top cover, acting as a limit stop. Note its location for reassembly.

Slide a nail through the two lined-up one-eighth inch holes in the large circular gears to take up the spring tension. Now remove the offset hub from the lower front, and carefully slide it off the shaft. Note if it binds the shaft. Remove the spring and the fiber washers on each end; these may be bent out of shape. Now grasp the worm-drive shaft and carefully work it and the bearing from the housing. If you have to use a vice to hold the shaft, protect the soft steel from scoring. Slide the bearing off, noting which way it goes on the shaft (flat side towards the spring; concave side towards the worm drive).

Check the rotation of the large bull gears but do not remove them unless they

The PW Condenser drive assembly, which, with the PW dial, gives an effective scale length of 12 feet. The parts referred to in the text are clearly visible. Source: QST, January 1935.



Regarding a product such as the new PW Condenser, no better advertisement can be written than a plain description of its design features. The drive is smooth and positive, through a steel worm and accurately hobbled worm gear, preloaded with springs to eliminate backlash and wear. The worm bearing is conical with a ball-bearing thrust, spring-loaded to take up wear. The entire drive is enclosed, the ratio being 20 to 1. The rotor shaft is  $\frac{3}{8}$ " in diameter, grounded in the center, and rotating in insulated bronze bearings at the ends. There are four radial bearings, and two ball thrust bearings. Each rotor is individually insulated, contact being made through a four-leaved brush. Plate shape is straight-line frequency, and Stator insulation is Steatite. It is made with one, two, three or four sections. The dial is of a new micrometer type having an effective scale length of twelve feet, and reading to one part in five hundred. As the dial and condenser sections are floating, the condenser is immune to distortion from warping of the panel or chassis.

Equally suitable for laboratory instruments, or for the finest High Frequency Receivers, we feel that the use of the PW Condenser is indicated wherever high precision in calibration is desired.

**NATIONAL COMPANY, INC., MALDEN, MASS.**

show mechanical damage and there is no other way.

### **MAINTENANCE AND REASSEMBLY**

Start by cleaning out all the old grease, using a solvent such as gasoline or a light oil as WD-40. A 10-mil shim worked back and forth between the gears will help. Swabs, Q-tips, etc., will all aid the cleaning. The grease may be quite

hard, especially on the worm drive. Relube all the moving parts, using almost any good grease; use oil on the shaft bearings. [Ed. note: Gasoline is very dangerous. If you must use it as a "solvent," do so only out of doors.]

Now check the condition of the shaft where it goes through the offset hub; it can be cleaned with emery cloth until

*Continued on page 10*

## — NATIONAL PW DIAL DRIVE

*Continued from page 9*

smooth. It should measure 0.310 inches. Next, examine the ball bearing unit and its mounting on the main shaft, and touch up any score marks with emery cloth. Lightly lubricate with grease.

To make the drive action smoother and to correct a major problem, I found it necessary to replace the aged and distorted fiber washers with thin steel ones. Mine measured 0.680 inch OD, 0.330 inch ID and 0.020 inch thick. Note that the washer must just fit through the housing hole, but be big enough to ride on the outer race of the bearing. The assembly consists of the bearing, a washer, the spring, and a second washer.

Another significant source of trouble is the zinc casting offset hub that the numbered dial rides on. It must be miked for roundness and size, and more often than not it will be found to be oversized and out-of-round, sometimes enough to kill the whole dial drive. The nominal size of the dial hole is 0.560 inches, and the hub should be slightly smaller, by about 2-3 mil. Work the hub down with a file and every cloth to correct size, checking frequently to be sure it is round. Take enough time here to do a good job, and it will pay off. A 0.312 inch drill bit passed through the shaft hole in the hub will clean it out. Using a swab, regrease the hole.

Grease the worm drive and its rear tapered support bearing. Being sure of the correct parts placement, wiggle the assembly back into the housing, after first restoring tension on the spring-loaded gears (a third hand helps here, or use the nail through the two holes as above). Replace the hub, with the side marked TOP up.

At this point, with everything lubricated, I take an old knob, drill out the hole to 0.312 inch, and use it turn the shaft to work the lube into key areas. When the the drive shaft is working correctly, with minimal binding, the PW dial should be taken apart, thoroughly cleaned,

relubricated with any good thin grease, and reassembled. (The procedure is detailed in National Notes No. 2, OTB 35-3, August 1994. If you need the info, send me a SASE.)

Fit the dial to the gearbox, with the two internal tension springs vertical and the top number centered in its window, at 250. If the mechanism now works freely and smoothly without clicking or hanging up, you are home free. However, it may take several on-offs of the dial, and honing of the hub and the dial hole, to finish the job. A bluing dye can be used to locate the high spots on the hub; where the dye is removed, hone these down. If there are raised spots on the dial opening, or if it is less than 0.560 inch, I polish with emery cloth.

### COMMENTS

If the dial plate is warped it has to be replaced, or the internal stress relieved by clamping it to a heavy, flat piece of metal and heating in an oven to 212-240 degrees F for an hour, then allowing to cool slowly. Unfortunately, this approach may require a repainting job if the temperature reaches 240 or above.

Zinc dye castings have a tendency, depending on storage conditions, to increase in dimension (grow) with time. Literature references indicate about 0.001 inches in five years; thus the hub in 40 years could "grow" as much as 0.004 inches, enough to cause trouble. Furthermore, the growth will be uneven due to the offset center hole, resulting in an oval.

The fiber washers, when exposed to oil and pressure over time, tend to flex with the force of the spring. This will bind the inner race of the bearing, causing heavy drag. Replacement with steel washers seems to work well, even though the original design probably used the fiber to act as a noise suppressor and insulator.

The in-line N-PW drive has a totally different gear assembly, but the problems with the offset hub and the dial, and the corrections, are the same.