With nostalgic interest in the "thirties" and the "forties" in popular swing, growing number of hobbyists are recreating or restoring vintage automobiles, telephones, furniture and radios of that era. Auto buffs restore old Model A's and scour the junkyards for a good Dusenburg or Pierce-Arrow chassis to be rebuilt. More and more radio amateurs, entranced by the virtues, beauty and simplicity of the ham gear of that era, are rebuilding and restoring old-style receivers and are putting old-time amateur transmitters on the air.

..It is neither easy to find the old ham gear, nor is it always simple to trace the circuitry and get it working. The necessary detective work, however, is part of the fun. The enjoyment of fixing and using antique equipment seems to be a rapidly growing facet of our hobby. Faced with the wrap-around cabinet, solid state circuitry and the complexity of s.s.b. gear, many hams shy away from home construction. Old-time gear, with its basic circuitry, straightforward assembly and functional style is admirably suited for the amateur who wishes to combine his talents at equipment construction and restoration with the satisfaction of having a station different from the run-of-the-mill, transceiver and linear amplifier.

..With a series of articles to be presented at random, W6SAI introduces many of CQ's younger generation of readers to the "golden age" of amateur radio and to some of the marvelous radio equipment in use at that time. This article covers a pioneer receiver, and a later article will present an old-time c.w. transmitter that you can build yourself and put on the air.

BY WILLIAM I. ORR, W6SAI, 48 CAMPBELL LANE, MENLO PARK, CA #94025

The Year is 1931. National Radio introduces the SW-3 All-Wave Receiver.

Do you remember?

Perhaps you do.

Perhaps you were there.

Perhaps you were the young lad on that long-ago day on Cortlandt Street, gazing in awe at the dazzling display of radio equipment in the dusty windows of row upon row of radio stores . . . or maybe you were the old timer, scratching his head over the complexities of erecting the new fangled doublet antenna . . . or perhaps you were the avid DX'er, working J2GX on 14,399 kilocycles, with a trusty 210 and brand-new SW-3 bandspread receiver . . . If you were, you were fortunate enough to have lived in the "golden years" of amateur radio, when shortwave transmission and DX was as new as the sunrise . . . an art, not a science.

Today's radio amateur newcomer, with his transistorized s.s.b. exciter, solid state keyer, desk-top linear and tri-band beam atop a crank-up tower can never know the thrills and

glory of the golden years of shortwave radio. Each QSO was an event, and the enjoyment was doubled by the fact that most of the station equipment of the average amateur was home made . . . and worked!

An outstanding landmark of that bygone era was the famous National SW-3, one of the first shortwave receivers designed and manufactured exclusively for the radio amateur. Years ahead of its time, the SW-3 revolutionized receiver development and amateur radio. Here is the full story of this amazing set, many of which are still in use today . . . 40 years later!

Development of the SW-3

The SW-3 was designed in the late twenties with the idea in mind of developing a product that would have appeal to the radio amateur as well as being adaptable for use by the airlines as a reliable, light-weight receiver for commercial aircraft. In particular, Pan American was looking for such a unit for their early flights to South America.

At that time, PAA's feeling was that a radio operator with good c.w. equipment would prove more reliable for long distance, over-water communication than the weighty, cumbersome telephone equipment operated by the pilot and used by other airlines at that time.

The only available receiver that might do the job was the obscure SW-4, a rather cumbersome set designed after a prototype receiver developed in the RCA Van Cortlandt Park Laboratory and manufactured in small quantities by National and Westinghouse. By its weight and size, and the fact that the plug-in coils proved to be ready absorbers of moisture, the SW-4 proved to be unsuited for the trans-oceanic work in the PAA planes.

Little was understood at that time as to why the performance of the SW-4 receivers, using such coils, varied so tremendously with the weather. However, about 1930, the old Boonton Rubber Company became one of the pioneer bakelite custom moulding companies. This company had close connections with the radio industry through a sister company, Boonton Radio Company. The bakelite moulding powder sold by the original Bakelite Corporation was based upon the use of wood flour filler which was extremely hydroscopic. Moulding, in those days, was done with steam, rather than electric heat and—as a consequence—moulding rooms were extremely humid. The coil forms moulded by this process varied tremendously in their Q and good and bad coils could be wound on forms that (to the eye) were exactly the same.



Fig. 1—The SW-4 Thrill Box, grandfather of the famous SW-3 receiver. The four tube SW-4 covered the range of 15 to 570 meters with 6 plug-in coils of doubtful Q. The receiver was built in a steel cabinet and had a UX-222 untuned r.f. stage, a 200A detector, a 240 first audio stage and a 171-A second audio stage. The receiver was either sold as a kit for about thirty dollars or completely wired for about thirty five dollars. Hydroscopic coil forms absorbed moisture from the air and receiver performance was erratic, especially in damp weather. Obsoleted in 1931 by the SW-3, the old SW-4 is a collector's dream today!

In an effort to solve this problem, the Boonton Rubber Co. switched from the old filler to a ground mica filler and changed over to electrically heated presses. The result was, for the first time, the availability of precision, high-Q moulded coil forms that permitted the manufacture of uniform inductors. The new material was used for coils for the SW-3 receiver, and National Co. registered the trade mark "R-39" for the forms. The first production run of coils and receivers was made during the summer of 1931.

During the long, useful life of the SW-3 receiver, over 10,000 units were built and the set was used by amateurs, commercial stations, airlines, ships and uncounted expeditions as a compact and wholly reliable receiver. Even today, the SW-3 is still in active service and doing a good job of coping with today's complex communication problems!

The SW-3 Design

The SW-3 receiver, manufactured by the National Company (then of Malden, Mass.) is a 3 tube set having an r.f. stage, regenerative detector and single audio amplifier. A feature of the receiver is the "single dial control," with r.f. and detector tuning ganged. The SW-3 uses plug-in coils, covering the radio spectrum from 9 to 2000 meters in 10 coil sets. In addition, extra coils provided bandspread for the

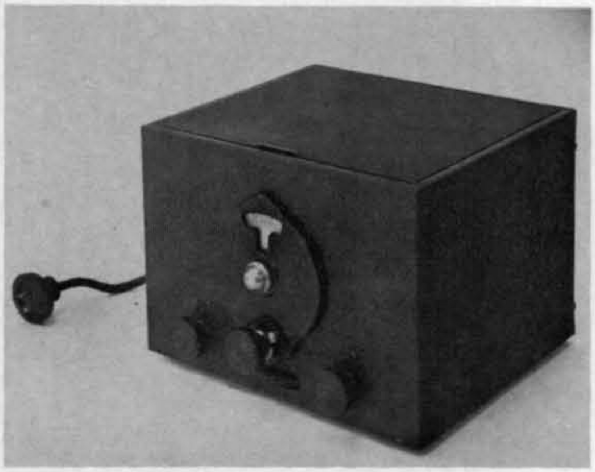


Fig. 2—National SW-3 receiver was ultimate set for DX'er in 1931. This 3-tube tuned r.f., regenerative detector receiver provided bandspread reception on 80, 40 and 20 meter bands with unique plug-in coils. Beneath center tuning dial is the horizontal adjustment for r.f. gain. At left is the r.f. turning control and at right is the regeneration control. A 4-prong plug on power cable provided operating voltages from external power supplies or dry batteries. SW-3 receiver still performs well on c.w. and s.s.b. today.

10, 20, 40, 80 and 160 meter bands. The receiver is contained within a steel, black crackle finished cabinet measuring about 9" on a side.

During the course of the 14 year production run, three basic receiver designs were used. The most popular version, and the one covered in this article, is the a.c. powered version using 2.5 volt glass tubes. A chart is included showing the main differences between the various versions of the receivers, and coil information for the entire SW-3 "family".

The circuit of the SW-3 receiver was developed by the engineers of National Company, with the assistance of David Grimes (ex-W2GKM), at that time the Director of the RCA License Laboratory. The first prototype models of the receiver were built in the home laboratory of James Millen, W1HRX (then W1AXL), in North Reading, Mass. The first production receivers were made during the summer of 1931 and the first advertisements for the new receiver appeared in the fall, 1931 issues of *QST* magazine.

The very first SW-3 receivers were apparently not made under an RCA license. To limit patent infringement liability, inasmuch as National did not hold an RCA license at that time, the receivers were sold as unwired, and (presumably) were wired by a so-called "Jackson Laboratories" before shipment. The Jackson Laboratories was a dummy company with no assets and was named after one of the streets on which the National Company was then located! (Early SW-3's having the Jackson Laboratories stamp on the shipping carton are a vintage collector's item).

The first version of the SW-3 (Model 1) used an r.f. stage with a type 35 variable-mu tetrode, a regenerative detector using a second 35 tube, and an impedance coupled audio amplifier with a type 27 triode. During the 14 year lifetime of the receiver, tube types and components were continually juggled about, but the basic circuitry and layout remained essentially the same.

Within a short time, two more versions of Model 1 receiver were produced. The first version was made for mobile use, employing 6-volt heater type 36 and 37 tubes in place of the 2.5 volt tubes. The second version employed the fragile, microphonic 1.4 volt d.c. tubes (30 and 32) for dry battery operation. Relatively few of these three early Model 1 receivers seem to exist today.

The Popular Model II Receiver

The Model II version of the SW-3 appeared about 1936 and employs the interchangeable 2.5 volt or 6.3 volt pentode tubes, and the circuit of this popular model is shown in the schematic. The r.f. stage uses either a 58 or 6D6 tube, with stage gain controlled by changing the cathode bias by means of the variable control, R_1. This potentiometer is mounted horizontally below the tuning dial and is controlled by a thumb dial, conveniently calibrated in signal strength units. An auxiliary tuned circuit (R.F. TUNE) permits the r.f. stage to be aligned to the particular antenna in use.

The detector uses a second 58 or 6D6 tube in a plate feedback circuit, with regeneration controlled by a screen voltage potentiometer, R_2. The detector is impedance coupled to a 27 or 76 triode audio amplifier which has high impedance magnetic earphones connected directly in series with the plate lead.

Many Model II receivers seem to have been manufactured during the period 1936-1940 and these are the models that turn up most often in today's want-ads.

The Model III Receiver

The final Model III version of the SW-3, called the "Universal" model appeared shortly before or after World War II. It uses metal tubes (6J7 and 6C5) and by means of a clever

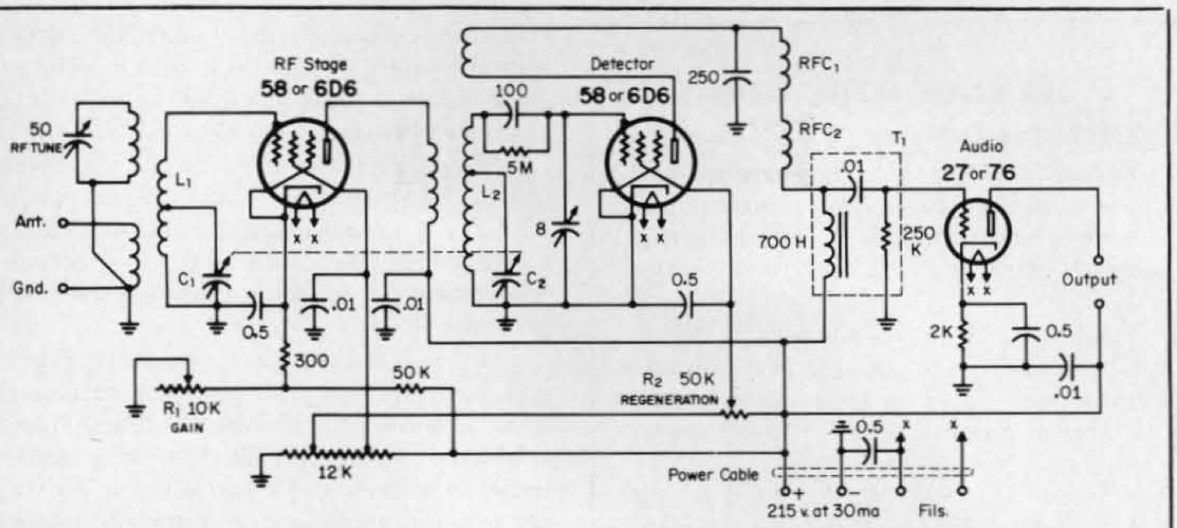


Fig. 4—Schematic of Model Two version of National SW-3 Receiver.

switching system, is convertible to battery operation with the substitution of 1.4 volt octal tubes (1N5 and 1A5). Few Model III receivers seem to exist today, and it is not known how many were made. It is surmised that production was slim, as the superheterodyne receiver was becoming increasingly popular at this time, and the regenerative receiver was entering into eclipse.

Table I summarizes the various versions of the SW-3, including the numerous coil sets.

The SW-3 Today

Any model of the SW-3 is a collector's item today and the lucky owner of one of these beautiful pioneer receivers will have a pleasant surprise coming to him when he gets it working properly. Considering that the SW-3 was designed before single sideband became a household word, it is amazing to discover how well the little receiver performs in this mode. While the SW-3 tends to be somewhat electrically and mechanically unstable on the highest ranges (10 meters, for example), stability on the lower bands (particularly 160, 80 and 40 meters) is compatible with today's operating demands. The regenerative detector is extremely sensitive and the SW-3 can "hear" as weak a signal as the most modern receiver. To one accustomed to today's multi-stage, multi-tube (transistor) receiver, the quiet background noise and the high earphone level developed by the three tube SW-3 is quite impressive.

The SW-3 requires a plate supply of about 125 to 200 volts at a total current drain of less than 20 milliamperes. National Velvet power supplies designed for the SW-3 are occasionally available and do the job, provided the old electrolytic capacitors are replaced with new ones. For more stable operation, however, a modern voltage regulated power supply is suggested.

Because the average signal level today is much higher than the level of 1931, the SW-3 exhibits a tendency to overload on strong, local signals, much in the manner of some of



Fig. 3—Simplicity of the SW-3 circuit is revealed when cabinet lid is lifted. At the left is the r.f. stage, with the plug-in coil between tube shield and cabinet. Two gang tuning capacitor is at center, with detector stage at the right. Detector coil had padding capacitor mounted in the top for calibration adjustment. At rear of SW-3 is audio coupling unit and audio output tube. Plug-in coils had their own grid leads, and grid leads usually used with non-bandspread coils may be seen clipped to holders mounted on inside edges of shield compartments.

Table I—
Variations In SW-3 Models

SW-3 Model One

Version I: Uses 35, 35, 27 tubes and color coded coils. An audio volume control potentiometer is used instead of an r.f. gain control. Uses "10-20" series coils.

Version II: As above, but with 36, 36, 37 tubes and B+ switch for mobile operation. Later models incorporated r.f. gain control. Uses "10-20" series coils.

Version III: Uses 30, 30, 32 (1.4 volt d.c.) tubes. Incorporates B+ switch. R.f. gain controlled by antenna coil potentiometer. D.c. bias supply required. Uses "10-20" series coils.

SW-3 Model Two

Uses 58, 58, 57 (2.5 volt) tubes or 6C6, 6C6, 76 (6.3 volt) tubes. Uses "60" series coils. The schematic of this popular receiver is shown in the illustration

SW-3 Model Three ("Universal")

Uses 6J7, 6J7, 6C5 (6.3 volt) tubes or 1N5, 1N5, 1A5 (1.4 volt) tubes. Incorporates a.c./d.c. filament switch standby switch, earphone jack (some models) and bias resistor in B-minus return. Uses "30-40" series coils.

NOTE: The only apparent difference in the various coil series is the number of turns in the feedback ("tickler") coil. Many coils are interchangeable between the different receivers. The tickler coil may be easily rewound, adding or subtracting one or two turns to make one style of coil work in a different receiver design. Tickler winding should permit regeneration to occur with control potentiometer set at about midpoint.

today's more expensive receivers. The simple solution to this problem is to insert a 50 mmf variable capacitor in series with the antenna lead at the set, adjusting the capacitance value on a strong signal to reduce the overload condition. Alternatively, the SW-3 will perform wonders on a 15 foot wire antenna with less chance of overload than when used with the customary station antenna.

Tuning the SW-3

How many of today's radio amateurs have used a regenerative receiver? (Old Timers can skip this section, as they know by heart the idiosyncracies of this type of set). Here are some tuning hints for the newcomer and super-het owner.

Today's amateur, used to the direct read-out in kilocycles on many deluxe receivers could be at a loss using the uncalibrated dial of the SW-3. One of the first tasks, therefore, is to make a calibration chart for each set of plug-in coils.

The SW-3 requires more operator expertise and know-how to achieve best results than does a modern receiver designed for the appliance operator. There's less circuitry between listener and signal, so to speak, in the old set, and an expert operator can make the SW-3 perform wonders, just as a cowboy can guide his lithe, wiry pinto pony into places where the driver of a luxury Cadillac dare not follow.

Let us begin. The SW-3's sensitivity level is set by the REGENERATION control, at the right of the panel. Advancing the control will cause the detector to go into regeneration, at which point a soft plop will be heard in the 'phones. The R.F. TUNE (left-hand) control is adjusted for maximum sensitivity also, which occurs at the point where regeneration commences with minimum detector screen voltage. Thus, the two controls are adjusted in step until regeneration occurs with r.f. tune control

(continued on page 94)

Table II—SW-3 Receiver Coil Data

Range (kc or mc)	Coil Set Numbers: Universal Model 3	Model 2	Model 1
90-160 kc	42	72	22
150-220 kc	41	71	21
190-280 kc	40	70	20
250-390 kc	39	69	19
320-650 kc	38	68	18
500-900 kc	37	67	17
690-1500 kc	36	66	16
1500-2700 kc	35	65	15
2500-4500 kc	34	64	14
4200-8000 kc	33	63	13
7.0-12.0 mc	32	62	12
12.0-21.0 mc	31	61	11
19.0-35.0 mc	30	60	10

NOTE: Bandspread coils have suffix letter A. For example, the 80 meter bandspread coils are 34A, 64A or 14A. Early Model 1 coils are not numbered, but are color coded.

TFME POWER SUPPLY
FOR
Regency HR-2



Over 2 amps fully REGULATED with short circuit protection and low ripple content. Suitable for use with other similar transceivers. HF-144 RPS $39.50 add $3.00 for shipping

Regency	HR-2	$229.00
Crystal	146.34MHz	6.50
TFME	HF 144RPS	39.50
TFME	HF 144RW pre-amp	16.50
	installation	3.50
	shipping	3.00
Total	Value	$298.00



TFME SPECIAL For $269.99

TFME 2 METER PRE-AMPS



HF-144M L 132 to 148 MHz
M 148 to 160 MHz
H 160 to 174 MHz
Service Station price $16.50
User list price $22.50
Approx. installation time 20 minutes.

HF-144U L 132 to 148 MHz
M 148 to 160 MHz
H 160 to 174 MHz
Service Station price $16.50
User list price $22.50
Approx. installation time 30 minutes.

HF-144PK 200V B+ to 12V D.C. Regulator $ 1.25

SATISFACTION GUARANTEED
Full one year Parts Warranty upon our Inspection

PLEASE ADD 60¢ FOR POSTAGE AND HANDLING

WRITE TODAY FOR OUR FLYERS WITH DETAILED INFORMATION AND PRICING OF PRODUCTS SHOWN.

TOPEKA FM ENGINEERING
3501 CROCO ROAD
TOPEKA, KANSAS 66605
(913) 233-7580

PLEASE USE YOUR ZIP CODE NUMBER ON ALL CORRESPONDENCE

ATTENTION

HW-100, -101 owners
SB-100, -101-102 owners

Add 25, 50 & 75 kHz calibration to your rig at low cost. New plug-in conversion allows you to spot sub-bands and band edges quickly, accurately. Built-in power supply eliminates troublesome batteries . . . plug-in construction means no extra cables, wiring or external boxes. Factory assembled & tested; unconditionally guaranteed for 1 year. Only $11.95 postpaid. Order now.

benton harbor r & d, 460 w. napier avenue, benton harbor, michigan 49022.

ELECTRONIC FIST . . THE PROFESSIONAL KEYER



Check the Reviews . . . . . .
- QST, March 1971
- POP. ELECT., July 1970
- CQ, January 1971
- 73, January 1971
- Ham Radio, August 1970, December 1970, March 1971
- IC MEMORY FOR EK-39M now only $39.95!!

CURTIS ELECTRO DEVICES From your ham dealer or direct. Box 4090, Mountain View, California – 94040

long. An indoor one will do. If the interference disappears, the culprit is either receiver overload or a problem in your normal antenna system, such as loose or corroded connections, leaky insulator, etc. that could produce non-linear responses. In the case of receiver overload, a parallel-tuned trap (adjusted to the BC station frequency) , in series with your antenna input, should help. A high-pass filter with a cutoff below 3.5 mc (and / or with maximum rejection at the B.C. station frequency) also would be a good bet.

If with the small antenna the problem still exists, the cause probably is due to non-linear devices in your locality that are activated by the BC signal. This could be rusty, loose or corroded gutters or drain pipes, house plumbing, fencing, wires. TV antennas or masts, etc. The best way to track down these might be to use a portable receiver with a small antenna or direction-finding loop. Since others are not affected, the cause is no doubt in your immediate neighborhood.

We have a lot of trouble like this in the New York area, particularly due to mixing of the many stations located here. The effects change between day and night and even with the weather!

Manual-Appeal Thanks

John Gaudio, K7VIN, wishes to express his thanks to the many readers who came to his rescue with a manual on the Elmac AF-67. We, too, appreciate their aid to a fellow amateur.

73, Bill, W2AEF

SW-3 Receiver

(from page 38)

peaked and the regeneration control at the minimum (counter-clockwise setting) that permits regeneration. A few moments listening to a weak c.w. signal will permit this adjustment to be made faster than the time it takes to read about it.

S.s.b. and c.w. signals may now be tuned in the normal manner, remembering that the ear, rather than a non-existent i.f. system provides selectivity, and that all signals have a mirror-image on the other side of zero beat.

The regenerative receiver is ill-suited to a.m. reception as detector sensitivity suffers badly when the regeneration control is retarded for normal a.m. reception. An a.m. signal, however, may be zero-beat in the same manner as an s.s.b. signal for the satisfactory reception.

And now that you have acquired the knack of listening to your treasure . . . good DX to you!

(continued on page 96)

2 METER FM



Standard's SR-C826M Transceiver

- *12 Channels (4 supplied)*
- *10 watt power output*
- *Hot MOSFET receiver front end*
- *Low drain—all silicon semiconductors*
- *Full 6 month warranty*

Complete, ready-to-go! Connect power and antenna and you're on the air! **Only $339.95**

NEW! 25W. 851SH ....only **$449.95**
3W./6 channel 811SH **199.95**

Send QSL or circle number for detailed brochure

ERICKSON COMMUNICATIONS
4657 North Ravenswood Avenue
Chicago, Ill. 60640 (312) 334-3200
a division of Carl E. Erickson Co.

PLEASE USE YOUR ZIP CODE NUMBER ON ALL CORRESPONDENCE

PERSONALIZED ENGRAVING

ELECTRIC
ON-THE-AIR SIGN
WITH CALL



Works on 110 VAC
$12.95





Metaltex Lapel Bar — $1.50 Metaltex Tie Clip — $2.25
SEND FOR FREE CATALOG
ARNOLD'S ENGRAVING
2041 Linden St. Ridgewood, N.Y. 11227

ATTENTION DX'ers!

We will forward your QSL cards throughout the world for only 2 1/2 cents each. Or ...Send us $10.00 for a yearly subscription to our service. Then, during the next 12 months send your QSLs to us with no additional payment. Send your cards or write for further details to:

MARLOW QSL SERVICE
108 Woodcrest Lane, Doylestown, Penna. 18901.

Where are the 10,000 Receivers Now?

A mint condition SW-3 receiver is a rare gem, indeed. Where did all the 10,000 sets manufactured by National Company disappear to? The majority, sadly, have been junked over the years or caniballized for parts. However, a sizeable number were tuned to 600 meters and used as auxiliary receivers on the West Coast tuna fishing boats. San Francisco radio stores remember a large sale of 600 meter plug-in coils for the SW-3 about the time radio amateurs traded the regenerative receiver in on the new superhetrodyne sets.

Interest among radio amateurs is reviving in this wonderful radio receiver, and those SW-3's showing up in want-ads are quickly snapped up by collectors. This little receiver still occupies a warm spot in the heart of many old-time amateurs who worked their first DX with this magic, black box of tricks, so many years ago.

The author wishes to thank Mr. James Millen, W1HRX, of the Millen Mfg. Co., Malden, Mass. for much of the background material contained in this article.

Meter Dials *(from page 44)*

lightly sand everything off down to the bare metal and start over. If the lettering does not come out as you wish, it can sometimes be removed carefully with a pencil eraser and done over. When the plate is finished to your satisfaction, carefully slide it into place with the new face up and replace the screws. Then return the movement to the meter case. You now have a meter which reads exactly what you want it to and is a distinctive part of your own equipment.

EDITOR'S NOTE: An added benefit with W9IWI's system is that should it be necessary at a later date to return the meter to its original state, one simply has to flip the plate over, and the job is done.

Our Readers Say *(from page 8)*

especially as a permanent resident. I feel this should be looked in to.

James W. Craig, W1FBG
Portsmouth, NH

Editor, *CQ*:

Just read the editorial comments in May '71 issue—great! It's about time someone tells it like it is re W2NSD / 1. My most hearty congratulations to you and *CQ*.

Bob Clapp, WB6YHD
La Puente, CA