A 20 Meter Tower-Mounted "Bird Cage"

BY FRED A. FARINET, JR.*, W8PYL

After closely examining the mechanical problems of the "Bird Cage" antenna, the author has come up with an excellent arrangement whereby he uses his tower for the main support. The rotor that drives the ten meter beam also drives the "Bird Cage".

THE death of 10 meters has caused some wrinkled brows at my QTH. When 10 died last time, I took a leave of absence from ham radio and became a more or less normal member of the household. This was rather enjoyed by the XYL who hadn't seen much of me for about four years. Wrinkled brows predominated this time since the XYL decided several years ago to "join 'em rather than fight' em" and consequently became K8ITF. An avid enthusiast, she had no intention of either of us taking a leave of absence from ham radio.

To meet the situation, I decided that something had to be done to put the station on 20 meters. G4ZU's article on the "Bird Cage"[1] was timely for me since I had been trying to determine how to manage a good antenna for 20, utilizing my present tower, with a minimum of constructional changes.

The tower at W8PYL is 40 feet high and consists of five triangular shaped 8 foot sections. The bottom cross section is approximately 18 inches and the top section approximately 6 inches (feels more like ½ inch when you're hanging up there). A dural mast 1½ inches in diameter extends 4 feet above the tower and supports a 10 meter three-element beam. The other end of the dural mast passes down through the tower and mates with the antenna rotator, within the tower, at about the 10 foot level.

To use the G4ZU method of "Bird Cage" support (¼ wave length of pipe), a section of dural would have had to been added to the existing dural mast and would have raised the 10 meter beam to approximately 21 feet above the tower and the "Bird Cage" completely above the tower. This method of supporting the "Bird Cage" and beam would undoubtedly have resulted in the loss of the entire system with the first high wind.

With this in mind, and the desire to utilize the tower for the principal support, it was decided to devise some form of construction that would permit rotation of the "Bird Cage" around the tower, require no guys, and leave the 10 meter beam intact at its present height.

Approximately one month was spent sketching, scrounging and scrutinizing before a reasonable design evolved. Two more weeks were spent in "making like a monkey" to complete the system.

This article was prepared to aid others in determining methods of "Bird Cage" construction and to indicate the results that can be ex-

*1608 Rangeley Avenue, Dayton 3, Ohio

View of the Bird Cage mounted on the mast. The 10 meter antenna still rests above the new unit and both are driven by the rotor.

[1] Bird, D., "The G4ZU 'Bird Cage' Aerial", *CQ* 1960.

pected from such a system (for this service the writer expects only S9 reports from interested readers).

Preliminary Planning

Preliminary planning indicated that some type of platform for the top and approximately mid-point of the tower would be required. These platforms would support the top four elements and bottom four elements, respectively. The top platform could be placed around the dural mast above the tower and below the 10 meter beam. This platform would be secured to the dural mast in a manner which would allow it to rotate with the mast. The bottom platform could be placed around the tower, receive its support from the top platform supporting system and be free to rotate concentrically around the tower.

A clearance hole could be cut in the center of both platforms and both platforms slid down from the top of the tower after the ten meter beam was removed. Since I did not want to remove the 10 meter beam, each platform would have to be split and the two pieces of each platform rejoined on the tower.

The vertical wires of the "Bird Cage" were to be cut slightly longer than calculated and fastened to the top element ends. The bottom of these vertical wires would be fastened to the bottom elements and, by rotating the system so that each element end, in turn, would be within reach from the roof of the house. Tuning could be accomplished by changing the bottom platform's distance from the top platform and refastening the vertical antenna wires accordingly. A 52 ohm transmission line would be used to feed the driven element at the bottom platform and a 300 ohm ribbon stub used to tune the reflector.

Construction

This general plan was followed in constructing the "Bird Cage". Since few readers will have exactly the same set of problems and since commercially available hardware varies from one area to another, no attempt will be made to give the complete constructional details. However, enough detail is included to materially aid interested readers in constructing their own antenna.

Platforms

Tempered masonite ⅜ inch by 2 foot square is used for the platforms (the material most desired was plexiglass or its equivalent but the price of this material was found to be prohibitive). A circular hole to clear the dural mast is cut in the center of the top platform and a 12 inch hole is cut in the center of the bottom platform for tower clearance.

Eight strips of plastic approximately 3 inches wide and ⅜ inch thick join the platform halves. A series of holes were drilled in the plastic strips and matching holes drilled in the platforms. The platforms were split and then the

View of the upper and lower platforms supported by a Christmas tree stand. The large opening in the lower platform permits it to rotate around the mast. The bottom platform is split and secured with two pieces of plastic. The vertical supports are set into the two clamps on the bottom platform. Top view of the upper platform shows the elements mounted 90° apart and secured with U clamps. The two halves of the platform are also coupled with two strips of plastic.

plastic sheets were used, in "splint" fashion, to rejoin the platform halves.

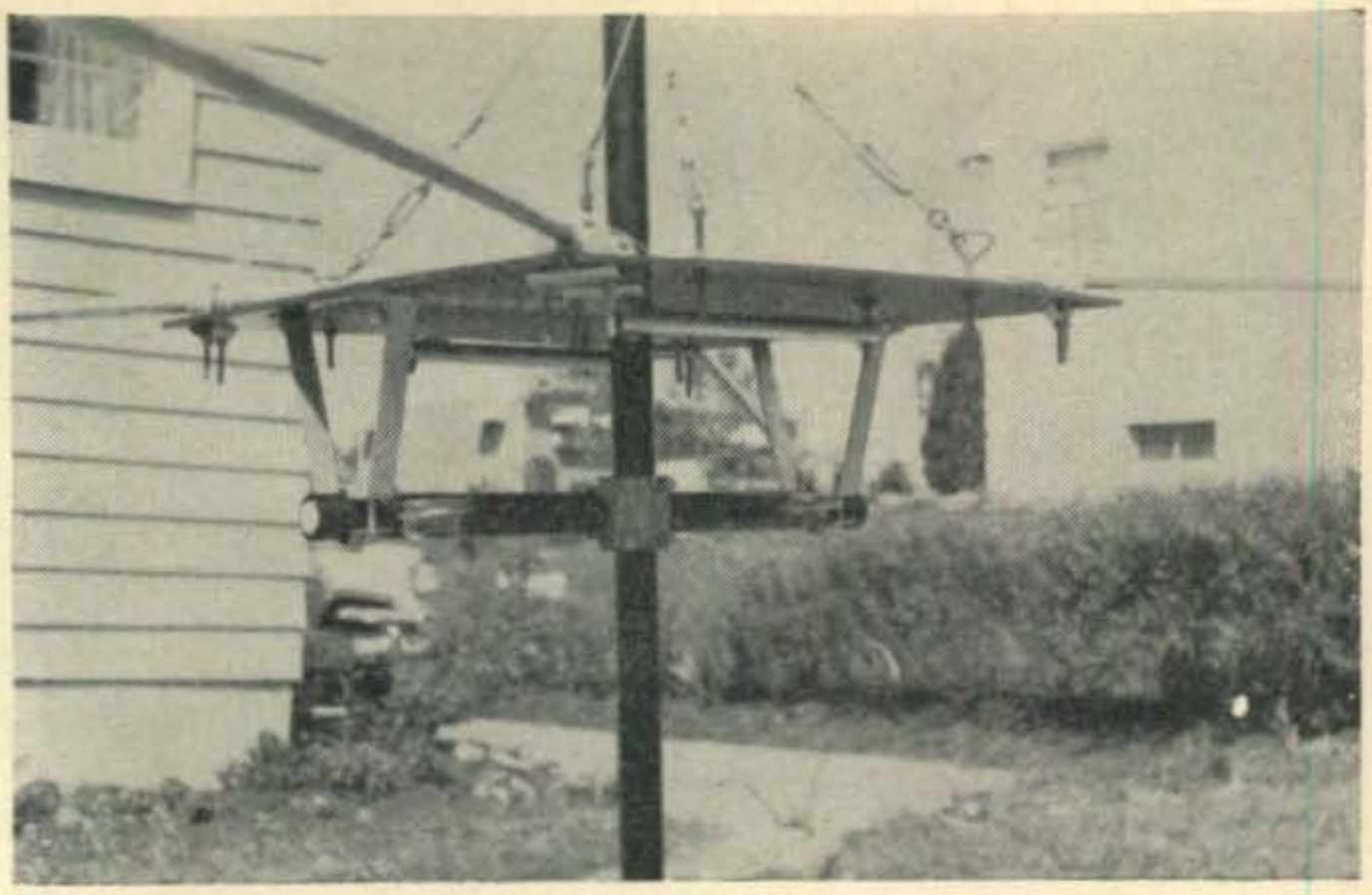
Elements

Dural tubing elements ¾ inch by 8.73 feet (length in accordance with G4ZU's formula for 14.1 mc) are mounted at each platform corner, 90 degrees apart. Two "U" clamps fasten each element to its proper platform. To maintain symmetry, the ends of opposing elements are separated by a distance greater than the 12" diameter hole of the bottom platform. A 16 inch separation was used to allow greater tower clearance.

Two pieces of ¾ inch tubing approximately 8 inches long, with holes drilled in each end and mounted on the underside of the top platform, strap the driven elements and the reflector elements together, respectively. Holes in the ends of each of these pieces of tubing are secured by the bolts of the "U" clamps. This same type of strapping is used on the bottom platform elements except for a break of about 1 inch at the center of the ¾ inch tubing to permit connection of the stub to the reflector elements, and the coaxial feedline to the driven elements. Copper ground straps are fastened to the ends of each element to be used as solder connections for the vertical wires.

Guying The Platforms

The top platform is supported from the mast



View of the underside of the upper platform. The platform is secured to the crossbar by a pair of TV stand-off mounts. Guys and turnbuckles supporting the top platform may be seen on top. The two U clamps on the crossbar are to clamp the vertical supports for the lower platform.

by 4 umbrella-type guys (approximately 18 inches long) and suported from beneath, by two "V" shaped 12 inch brackets (the type used to support TV masts alongside of a house). Eye bolts are used on the platform to secure the platform ends of the guys. Turnbuckles are used for each of the quys and a "Slip on" bracket attaches to the dural mast and terminates the opposite end of the umbrella type guys.

A 1½ inch by 2 foot piece of pipe, fastened at right angles to the dural mast beneath the top platform, serves the dual function of supporting the lower ends of the "V" brackets and the vertical "pendulum like" members which drop down to support the lower platform.

The lower platform is equipped with turnbuckles and guys in the same manner as the top platform. The guys are secured at their upper ends by attaching each pair to a "slip around" type guy-ring bracket placed on each of the two vertical "pendulum like." members.

A tour of the local junk yards turned-up 20′ × 2″ × ¾″ rectangular shaped aluminum tubing. Two of these were purchased and used for the "pendulum like" members of the platform support.

Clearance holes are cut in the lower platform to accommodate the lower ends of these "pendulum like" members. "U" prackets on the 2 foot pipe beneath the upper platform secure the "pendulum like" members to the top platform. Bolts should be placed through the "pendulum like" members on the ends to be clamped to insure that they will not slip from their "U" bolts at some later time.

All open ended tubing is plugged with corks to prevent water from entering and also to assure that the "Bird Cage" won't "whistle like a bird" during high winds.

During "mock up" of this system the XYL suggested the use of a piece of pipe supported by a Christmas tree stand to hold things in position. This suggestion proved to be a good one and is highly recommended for builders of "Bird Cages".

This description has hardly been exhaustive but the pictures show enough detail to allow the reader a good idea of the construction.

Assembly

The "mock up" is partially disassembled and the parts placed near the foot of the tower. One half of each of the platforms is removed from it's complimentary half. The plastic "splint" pieces were left in place on the other half of each platform and the underside support of the top platform was left intact. All elements are left in place. At the top of the tower, the "slip around" type guy-ring bracket is put into position on the dural mast. The half of the top platform with most of the hardware on it is hauled up first and set in place. The second half follows. The plastic "splint" pieces and umbrella type guys aid in the positioning of the platform until all bolts are secured.

The assembly of the remaining portions of the antenna are routine in nature and consequently will not be described. When everything is assembled, the rotator may be used to turn the antennas to check that their system rotates freely. The bottom platform should show no tendency to bind on the tower.

Environmental Tests

Nature voluntarily took over the task of environmentally testing the antenna almost as soon as the last bolt was secured. For over a week it rained! The temperature went up and down and the wind produced gusts of up to 60 m.p.h. The antenna withstood this beating despite one neighbor's prophesy that the whole thing would come down through the roof during the first high wind.

Tuning and Troubles

During short periods when the weather was changing tempo, a "grid dip" reading was obtained. Much to my dismay, this reading was 17 mc. Calculation indicated that approximately 15 feet (7.5 feet per vertical wire) of additional length was required to bring the antenna to resonance at 14.1 mc. Between the rain storms, 300 ohm ribbon stubs were added to the reflector and driven elements. The 52 ohm transmission line was connected directly across the

[*Continued on page 112*]

Space [*from page 108*]

servers to American amateurs for forwarding to the Project OSCAR Association. In many cases relay by amateur radio circuits will be the fastest way of getting this information from foreign locations to Sunnyvale. All reports sent via amateur radio should be followed up with a written report, however, for QSL verification.

WARNING!

OSCAR II's signal on 145 mc will often be weak. It is making history, and will be copied in every corner of the globe. KEEP THE CHANNEL CLEAR. It's a great tribute to amateur radio that there was not a single report of QRM on OSCAR I's frequency. Let's keep this record, and the frequency clear.

SEND IN THOSE REPORTS.

73, George, W3ASK

RTTY [*from page 83*]

boards for the W2JAV transistorized terminal gear described in the February, March, and April RTTY COLUMNS. We can now report that it is a sure thing, and at a very reasonable price. The details may be obtained by dropping a line to your RTTY Editor at 431 Woodbury Road, Huntington, New York. Don't forget to enclose the stamped self-addressed envelope.

See you on RTTY. How about 52.6 mc f.m.?

73, Byron, W2JTP

Birdcage [*from page 45*]

end of the driven element stub. The s.w.r. with this arrangement was about 2:1. Good reports were received in Europe, Canada and most districts of the U.S., both on a.m. and c.w. Several U.S.S.R. stations were also worked on c.w. Since this arrangement technically and mechanically, hardly seemed a good one, some solution had to be provided for the needed increase in length between the upper and lower portions of the antenna. The amount of physical separation could not be increased without adding to the "pendulum like" members and raising the antenna higher on the tower. This solution was not considered satisfactory. Next coils were placed in each vertical wire. This arrangement worked, but didn't satisfy me due to G4ZU's comments about loss of power in antenna coils. The final method consisted of adding the required length to each of the vertical wires and then pulling the centers of each, in toward the tower and securing them with nylon cord tied to the "pendulum like" members.

The technical advantage, pointed out by G4ZU, of having the antenna voltage points clear of surrounding materials, was lost with this arrangement, although there has been no apparent practical disadvantage.

Just why this particular "Bird Cage" required 15 feet of additional length over the calculated values, using G4ZU's formula, is not known. However, there are several differences between G4ZU's proposed "Bird Cage" support and this

tower-mounted "Bird Cage". The 10 meter, 3 element beam is 2 feet from the top elements and the 40 foot tower runs between the driven and reflecting elements. These factors *may* account for the required change of "Bird Cage" length. The reflector, with the present arrangement, was "grid dipped" with the 300 ohm stub at 13.5 mc. The reflector will be properly tuned later.

Final Results

With this arrangement, the standing wave ratio is nearly 1:1 over the entire 20 meter band. From local reports, the front to back ratio appears to be around 20 db. Little radiation is indicated from the antenna sides and sharp directivity is evident to the front.

In spite of the miserable conditions existing on 20 meters during the test period, particularly during weekends, the antenna has performed well. Over a two week period, with 150 watts input, about 70 contacts were made. Most of these were on a.m. All U.S. districts heard, were worked. Europe, Africa and Alaska were contacted on a.m., and three U.S.S.R. stations were worked on c.w. Reports have averaged 10 db over S9 on a.m. ■

Novice [*from page 87*]

1914 and the present type equipment. Come on fellows, help.

Steve Skinner (13) 3518 Lakin Avenue, Great Bend, Kansas, needs some brother ham's advice and help to get the Novice ticket.

James V. Kelly, 13024 Clovis Avenue, Los Angeles 59, California, Phone: NEvada 63662. Jim says he is willing to work all that is necessary and then some to get in this hobby. By golly, most people don't want to work enough!

Douglas F. Goldsmith, 278 Chestnut Street, Liberty, New York would like a local ham to help explain what cooks.

Arthur R. Tolp (age 46), 1124 Rose Avenue, Fort Myers, Florida needs help: is there a local code and theory class in Fort Myers?

Help Wanted: Letters, hints, kinks and anything of interest to our many readers to make this column interesting. See address at head of column.

There it is fellows. I thank all of you for the interesting letters and for the pictures. You can see the difference between this month and last month, you sent no pictures last month. And as I said, we welcome letters from other countries; you read this don't you? Good DX and no QRM. 73 Walt

Sideband [*from page 97*]

contact from up in Iceland." [Norm went on to list a number of stations to whom he will send cards and noted that he and George, PJ2AA had a QSO on the very last day of Norm's operation from Iceland so George, be patient!—ed.]

From Alfred Schlosshauer, DJ4WN: "I have written a description of the 2-watt exciter which was published in *DL-QTC* of October, 1961. With the sunspot cycle as it is, I turned some of my s.s.b. activities to 3.8 mc and I was very much surprised to hear and work some ZL's on this band. A ground plane antenna 60 feet high was quickly erected one Saturday afternoon in October, made of a bamboo fishing whip and some insulated hookup wire. Limited garden space gave some problems how to place the four radials. On October 24, ZL4OD and ZL4KD were worked with