Remotely Tuned | All Band

MOBILE ANTENNA

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An antenna installation which has made it possible, while the car is in motion, to completely retune the receiver, transmitter and antenna from one band to another in forty seconds.

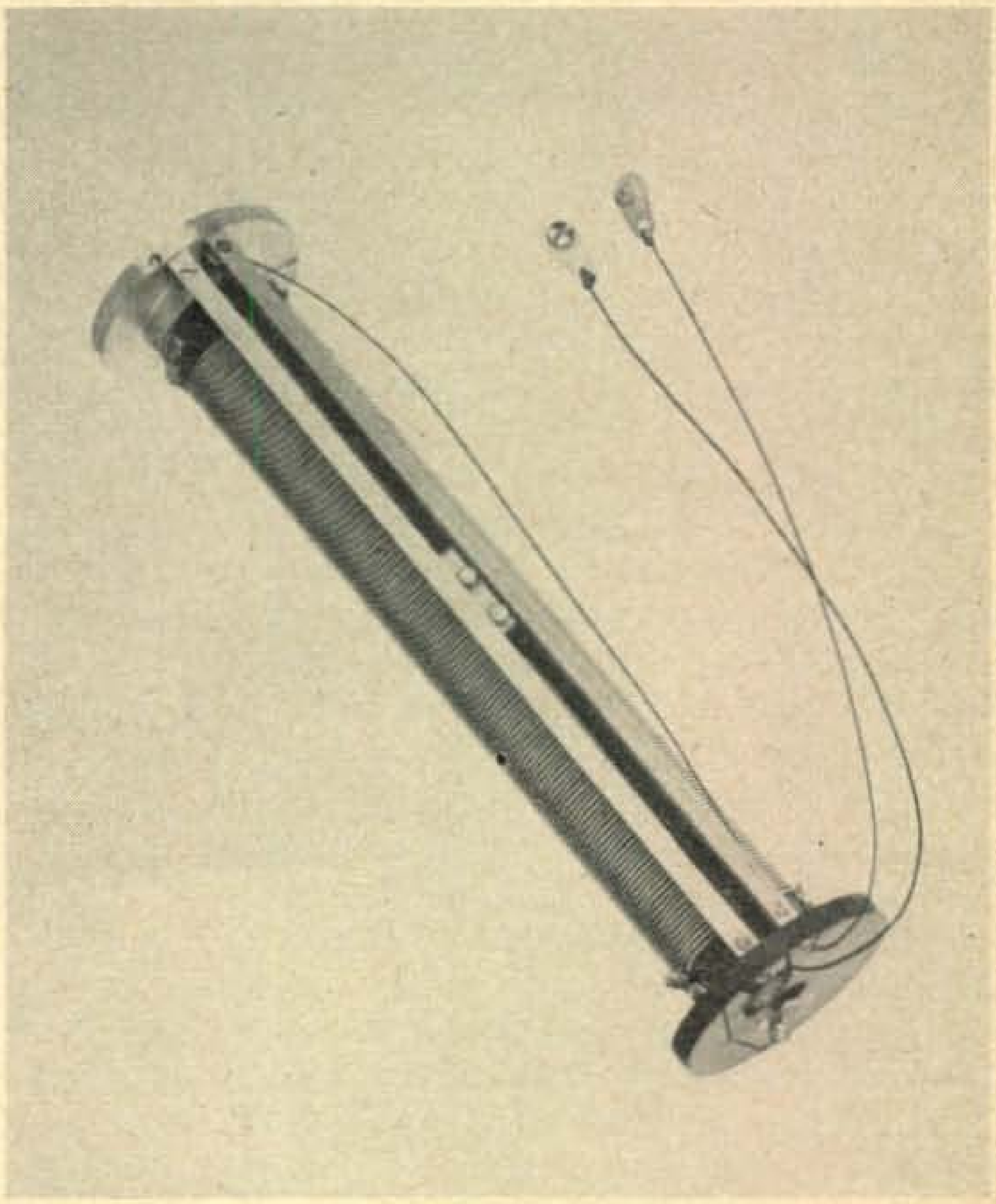
Having a mobile installation that would operate on all bands, 10 through 75 meters, tuned from the driver's seat of the car, it was desirable to have an all-band antenna, also tunable from the driver's seat. There seemed to be no published information for such an antenna. There were many ideas for antennas which tuned with plug-in coils, or with sliding contacts for coils, but none which could be remotely tuned over the entire range of bands from 3 to 30 Mc. After several months of experimenting, an antenna meeting this requirement was developed.

Since a high Q antenna, which is necessary for efficiency, tunes over such a narrow band of frequencies, it is gratifying to be able to tune the antenna while receiving signals in different portions of the band.

Now with the antenna tunable on all frequencies, the VFO on the transmitter is more practical.

The only remaining feature needed was a means of indicating when the antenna was tuned efficiently, insuring maximum signal being radiated. This was solved by a simple pick-up loop which will also be described in this article.

W5BIW has been licensed since 1929. He particularly likes to do his own construction, likes clubwork (is Past President of the Mesilla Valley Radio Club), and mobile operation. His favorite bands are 75, 20 and 10 meters. Presently employed as an Electronics Technician in the Physical Science Laboratory of New Mexico College of A. & M.A.



Mechanical construction of the slider and coil is simple. A weather-proof plastic tube covers the coil.

Loading Coil

The theory of this antenna is not new. Electrically it consists of a loading coil with a variable tap that shorts turns to the shield. When the tap is set to short out all the turns, the antenna is used on 10 meters. The dimensions of the coil are not critical. If the diameter of the coil is smaller it will be necessary to make the coil a little longer and to add a few turns. Using a metal shield makes it possible to use a coil of less turns than an unshielded coil would require. In the photos you can see several views of the mechanical construction of the loading coil. *Figure 1* is a sketch showing the detailed dimensions. Since the antenna coil is mounted in the center of the antenna, some of the problems of a sliding tap are overcome. It was felt that on a base-loaded coil, the sliding

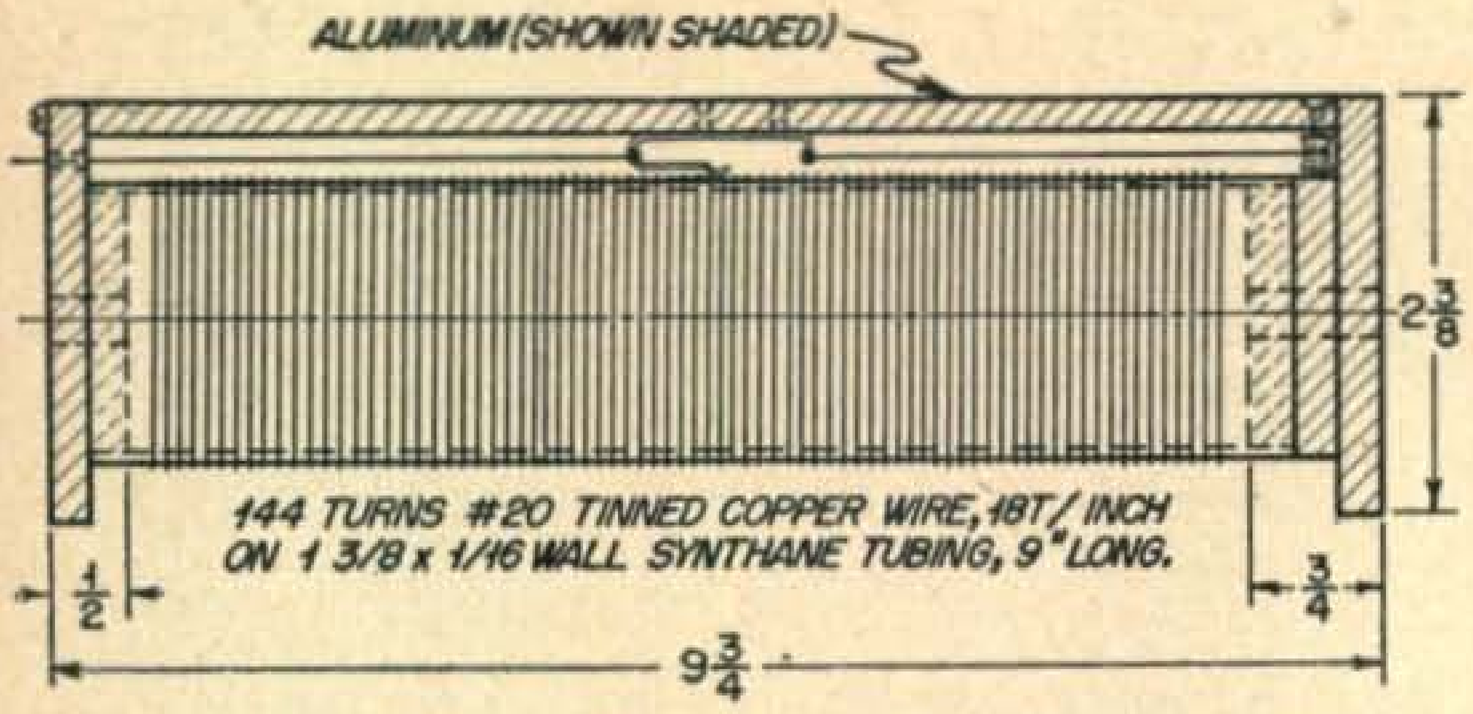


Fig. 1. Detailed dimensions of antenna coil.

contact would probably give some trouble due to the high current at this point in the antenna. The coil has now been in use for several months and the contacts on the coil and tap stay perfectly clean.

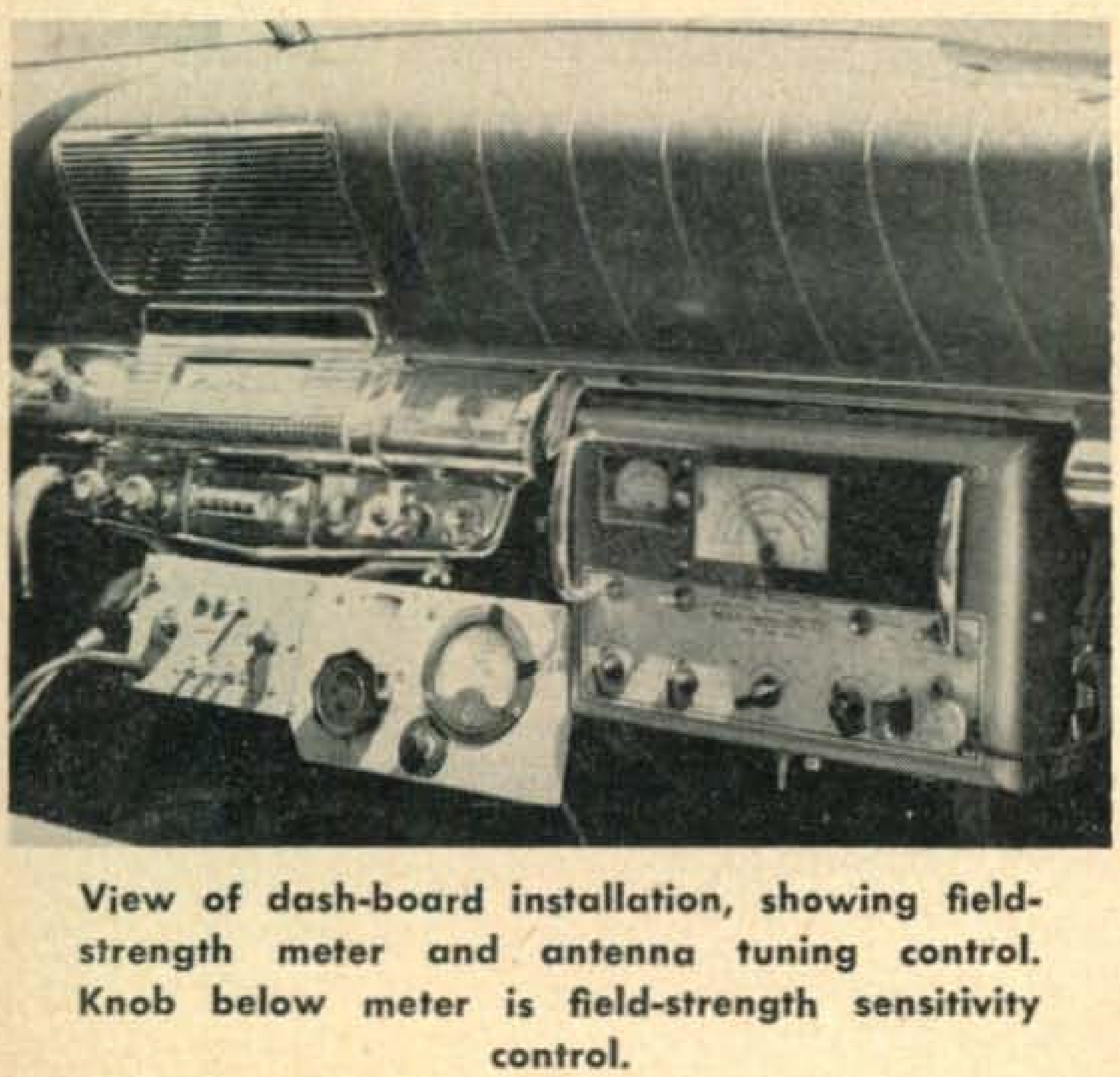
Mechanical System

The mechanical system used to move the tap is shown in the photographs and sketches. *Figure 2* illustrates the dial cord and drive mechanism. The dial with the large knob, located on the control panel, is coupled to a flexible speedometer cable. The other end of this cable is coupled to a reel located under the antenna mount. The diameter of the reel is ⅝ inches, this diameter chosen because the dial shaft makes four turns for full scale, 0-100, and it was necessary to move the tap on the loading coil about 7 or 8 inches. A ⅝-inch reel drives the dial cord about this much. The gear located at one end of the reel is only used as a stop, and any means could be used. Since the antenna will whip while the car is in motion, there will be some slack in the cable at times. This slack is taken up by a spring-loaded double-pulley mounted directly under a feed-through in the antenna mount. The slack in the line will amount to about one-half inch. The feed-through for the dial cord through the antenna mount was made by drilling a small hole through the center of a ¼-20 bolt. A ¼-inch hole was drilled in the base of the antenna mount and

Coil in place. Note dial cord for remote tuning, and field strength loop in rear window.

this bolt inserted.

The dial cord is threaded as follows: One end of the cord is attached to the reel, the cord is wound around the reel a couple of turns, then goes through the take-up pulley, then through the feed-through, up the mast section, and over a pulley mounted below the loading coil, then back through the feed-through, the take-up pulley, and then wound around the reel a few turns, and fastened to the reel. At this point, if the dial is turned from 0 to 100, the dial cord will travel up or down by the side of the mast for a distance of about 7 or 8 inches. The



View of dash-board installation, showing field-strength meter and antenna tuning control. Knob below meter is field-strength sensitivity control.

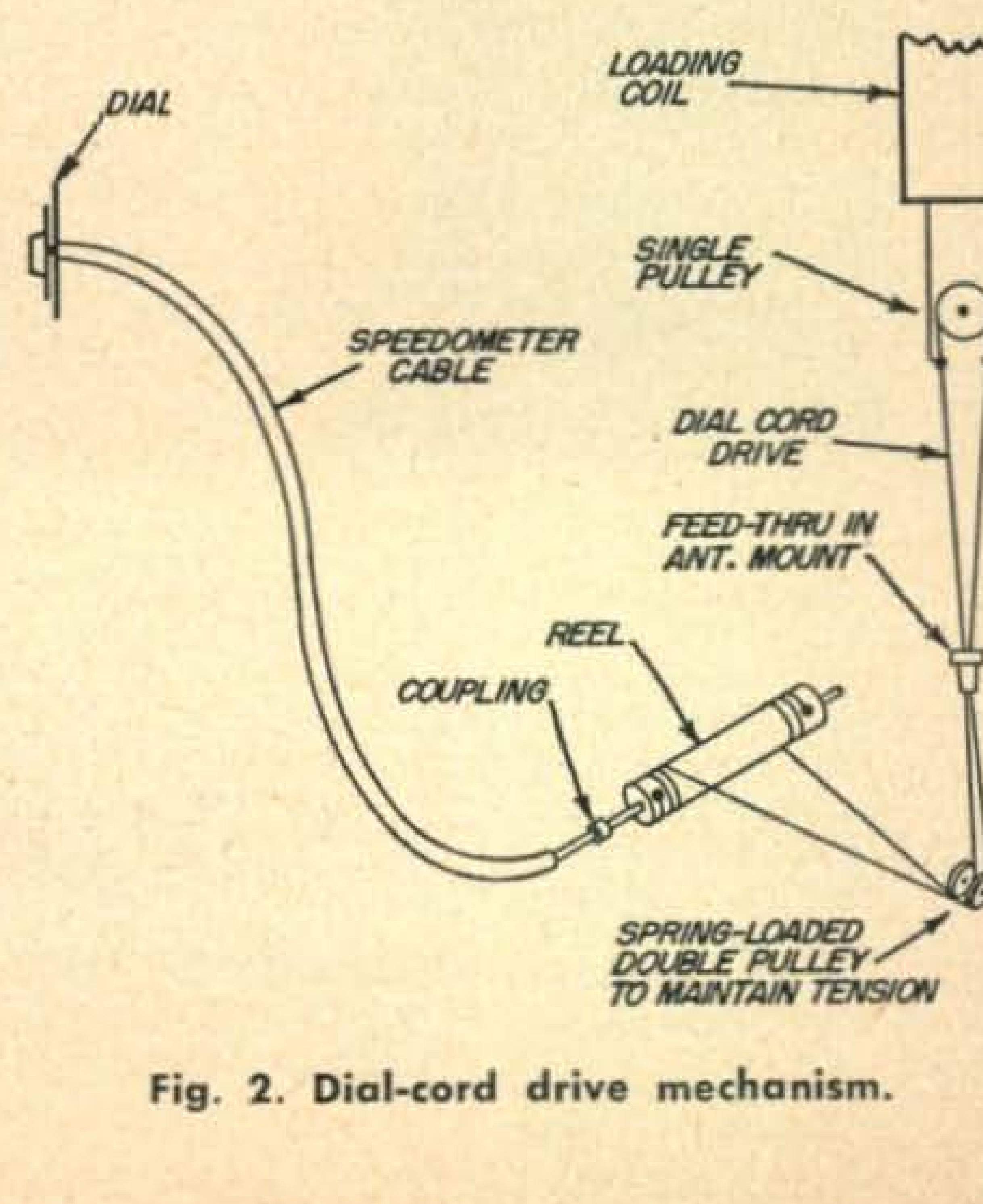


Fig. 2. Dial-cord drive mechanism.

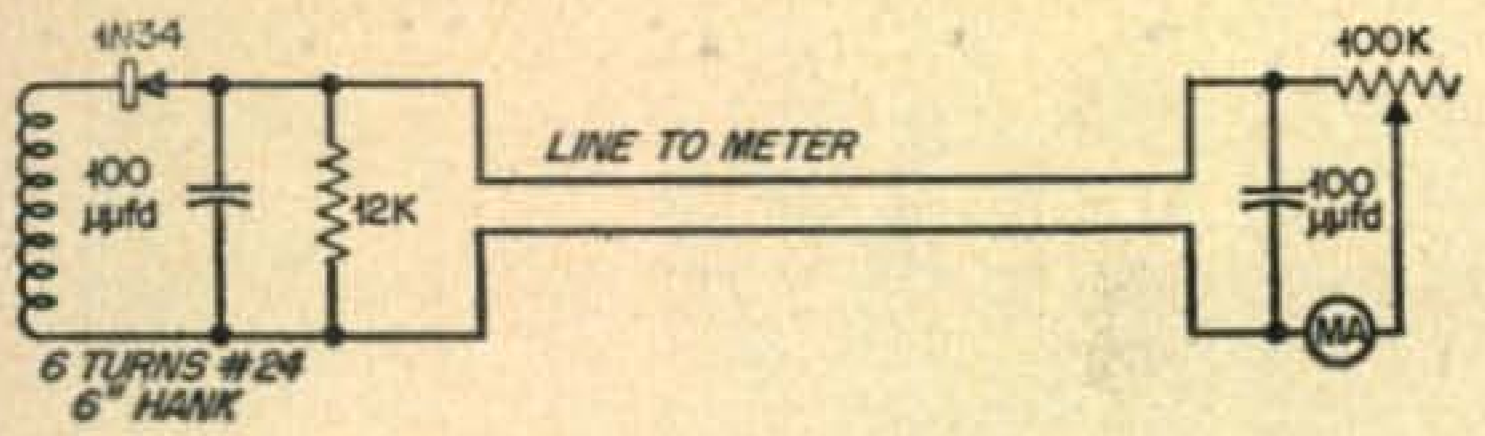


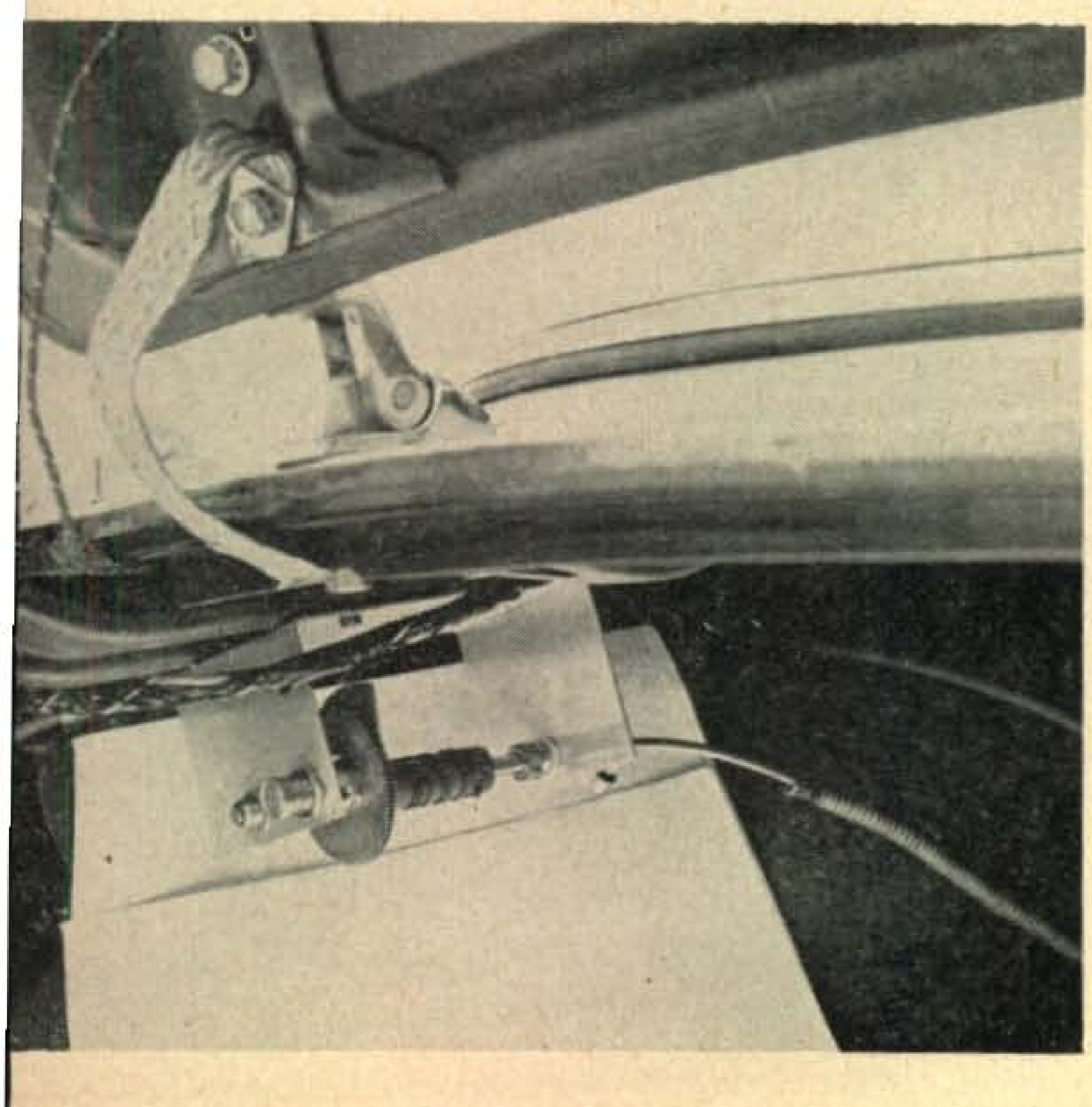
Fig. 3. Field-strength meter diagram.

slider on the antenna loading coil has a dial cord attached, one end of which goes over a roller at the top of the coil, then both of these short lines pass through two small holes in the base of the coil form. One line is to pull the slider up, and the other to pull it down. To connect these two lines to the drive cord, first set the dial on the control panel to 0 which will be the 10-meter position. Pull the line which moves the slider down to the base of the coil and attach it to the side of the drive cord which was traveling down while the drive was being turned to 0. Then the other line coming from the base of the coil is fastened to the other side of the drive cord, leaving approximately ½ inch slack. Leaving this slack introduces some backlash, but this is not objectionable and makes it possible to set the slider and back up on the dial slightly to relieve any strain on the slider, so that the slider will stay in position when the antenna whips. These short lines from the loading coil are fastened to the drive by means of clamps.

Problems Encountered

There are probably many ideas which could be used to accomplish this same movement of the slider on the coil. This particular arrangement was used because of the parts and materials which were readily available. It might be well here to explain a few of the ideas which were used during development, and which proved to be unsatisfactory. The first model consisted of a dial cord tied to the tap on the coil, and fed through copper tubing directly to the dial. Stretch of the dial cord and friction in the copper tubing proved this method undesirable. Replacing the dial cord with piano wire did not overcome this difficulty. It was decided to try using speedometer cable to drive a reel mounted under the antenna mount, then using dial cord from the reel to the slider on the coil. After the speedometer cable was installed, the dial cord was used without the upper single pulley which is mounted on the mast under the antenna loading coil, the dial cord being connected directly to the tap on the coil. This model did operate but if the antenna whipped or was hit by a tree the tap on the loading coil would be moved, detuning the antenna. This problem was overcome by mounting a single pulley under the antenna loading coil so that some slack could be left in the line going to the tap.

Flexible cable from dash terminates in trunk, controls lower end of dial cord. Gear shown is used only as stopping mechanism.



Tuning Indicator

At first the antenna was tuned by using the indication of the final plate meter of the transmitter. After making several tests it was found that this was not always a good indication of maximum tuning of the antenna. A field strength meter was used and the tap on the antenna could be moved to obtain the greatest reading on the field strength meter. This seemed to be a simple, fool-proof method of tuning the antenna, so a small pick-up loop and an 1N34 crystal was mounted in the rear window of the car, with an indication meter mounted by the side of the antenna tuning dial. *Figure 3* shows the diagram of this indicator system.

Conclusion

This antenna installation has been in use while making several trips around the state, has been tested while driving over rough roads, has hit trees while transmissions were being made, and through all of these tests has proved to be very stable. Signal reports have been better than those received with fixed-tuned loading coils. Better signal reports are probably a result of proper and maximum tuning for each frequency used. When using fixed loading coils or coils which have to be tuned with the operator standing beside the antenna, maximum efficiency cannot easily be obtained without going through a time-consuming process. This antenna is tuned with the trunk closed, all car doors closed, and the car moving with the antenna leaning back. It is even possible to tune the antenna when conditions are not ideal, such as operating in the vicinity of trees, power lines, or objects which might tend to detune the antenna. The increased pleasure in mobile operation has more than paid for all the work involved in making this installation.