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The F- type Rawinsonde

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(*Received 13 August 1955*)

For obtaining information about upper winds in cloudy weather, the radar A.A. No. III, Mk. III, operating on 204 mcs has been in use at a few stations in India (Venkiteshwaran 1950). Dipole passive targets are employed with this equipment, its maximum range being 20,000 yds. Upper wind data only up to about 8–10 km are obtainable with this equipment during the monsoon period when it is most cloudy (Venkiteshwaran and Yegnanarayan 1951). Gupta and Venkiteshwaran (1953) have adopted this radar to follow the F-type radiosonde (Venkiteshwaran, Thatte and Keshavamurthy 1948) with a signaller operating on 204 mcs. In this case, the transmitter in the radar is not used and the receiver with its phasing switch alone operates. With this arrangement, the elevation and azimuth angles of the radiosonde are obtained every minute. To obtain information about pressure, temperature and humidity, the signals from the superheterodyne receiver of the radar are tapped and amplified and recorded in a special attachment constructed for this purpose. With this adaptation upper wind information could be obtained to much higher levels than it was possible with the radar employing a dipole passive target. Recently a few sets of rawin equipment type SCR 658 were obtained from M/s Metox Co., Paris and some radiosonde observatories were equipped with this instrument for determining upper winds. As the rawin operates on 400 mcs and the radiosondes on 75 mcs, the balloon carries with it two instruments: (1) a signaller on 400 mcs which is followed by the rawin for azimuth and elevation angles of the balloon, and (2) the F-type radiometeorograph with its own ground equipment for obtaining records of pressure, temperature and humidity for which the height of the balloon at each instant is obtained. This arrangement being uneconomical and not quite satisfactory, early attempts were made to see whether a suitable technique could be devised with which the radiosonde and its signaller alone can be tracked with the rawin equipment and the radiosonde data also recorded with a simple attachment to the rawin ground equipment.

The signaller on 400 mcs can be easily used with the F-type radiosonde (Fig. 1). The signals are received intermittently from the radiosonde, and a complete Olland cycle with 1000 signals occurs in about $1\frac{1}{2}$ minutes, the number of signals received per second being about 10. This results in signals of 1/20 sec duration being transmitted 10 times in a second. The phasing switch motor of the rawin equipment, on the other hand, is of 1450 r.p.m. and the duration of a full revolution is about 1/25 second. The 4 pips on the CRT of the rawin equipment though fluctuating, can be easily employed to operate the aerial to get all the pips of equal heights. However, even within the period of 1/2 minutes taken for the Olland cycle, signals of longer duration are obtained due to the fixed contacts and those due to the meteorological elements, these further facilitate the orientation of the aerial properly.

However, when the F-type radiosonde with a signaller operating on 400 mcs was followed by the rawin equipment and the output signals from the rawin ground equipment further amplified in the output stage of the radiosonde receiver, the records

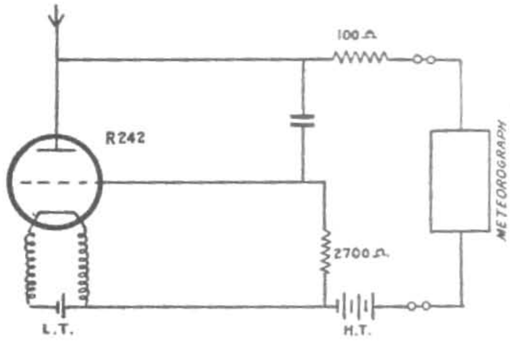

Fig. 1. F-type Rawinsonde transmitter (400 MC S)

obtained on the paper tape were not satisfactory and easily decipherable.

The rawin receiver is provided with two channels after a common input path containing the R.F. mixer and two IF stages. At the end of the second IF stage, one branch goes as an "Amplitude modulation" path for "direction finding purposes". The other path has a frequency modulated type of circuit consisting of three additional IF stages, a noise limiter, a discriminator and audio amplifier followed by a clipper and a shaper. This second path has been designed for use with the American type of frequency modulated radiosonde, so that the output from this path can be directly fed into the recorder.

The F-type radiosonde receiver (Haddar et. al 1953) is of super-regenerative type and the recording mechanism consists of a detector and a D.C. amplifier for feeding a current of about 30 ma. to a recorder coil during signal periods. This recorder coil is in the plate circuit of a final 6F6 stage. During "off" signal periods the thermal agitation noise of the receiver predominates. This gets detected by a 6H6 preceding the D.C. amplifier, thereby providing a negative bias to the first stage of the D.C. amplifier. This in turn by a sequence, cuts off the final 6F6 stage thereby cutting off the current through the recorder unit.

In the rawin receiver also, during the "off" signal periods the thermal agitation noise of the input R.F. stage exists. But in addition to this, there are present disturbances due to the making and breaking of the H.F. Contactor in the phasing switch of the rawin ground equipment. These disturbances have predominant effects not only in the "off" signal periods but also in the signal periods, thereby mutilating the record on the paper tape. Further it was found that the presence of a discriminator in the circuit, (which was needed only for frequency modulated signals) instead of an amplitude detector, had adverse effects and mutilated the records further. These difficulties were overcome as described in the following paragraph.

First, the discriminator was reconnected as an amplitude detector as shown in Fig. 2. The effects of the H.F. Contactor disturbances due to the phasing switch during "off" signal periods of the meteorograph could be minimised by the proper choice of polarity for the detector output. This was done by choosing the 'upper' half of 6H6 double diode as shown in Fig. 2. This output was again shunted by a 0·01 microfarad condenser. During the 'on' signal period of the meteorograph the H.F. Contactor disturbances also come with the signal thereby mutilating the record. This defect is magnified with greater amplification after the detector, especially due to the presence of the clipper and shaper of the rawin circuit. The clipper and shaper were, therefore, completely eliminated from the circuit. The detector output was amplified by one half of 6SL7GT circuit employed in the rawin circuit and then fed directly to the audio-stage of F-type radiosonde receiver. It is found that when the volume control is adjusted for high input voltage beyond a certain limit, the amplification of the disturbances of the H.F. Contactor becomes high enough to mutilate the record in the paper tape. Thus it is necessary to keep the volume control below a certain limit. Fig. 3 represents the modified rawin and radiosonde circuits successfully adopted for obtaining both wind and radiosonde data with a single valve transmitter on 400 mcs.

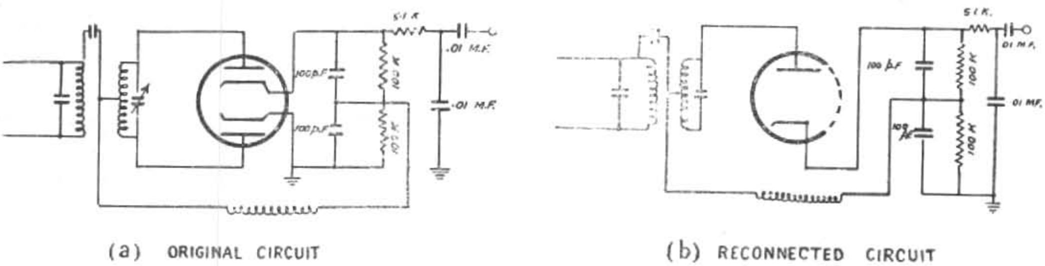

Fig. 2. Discriminator and the reconnected A. M. detector

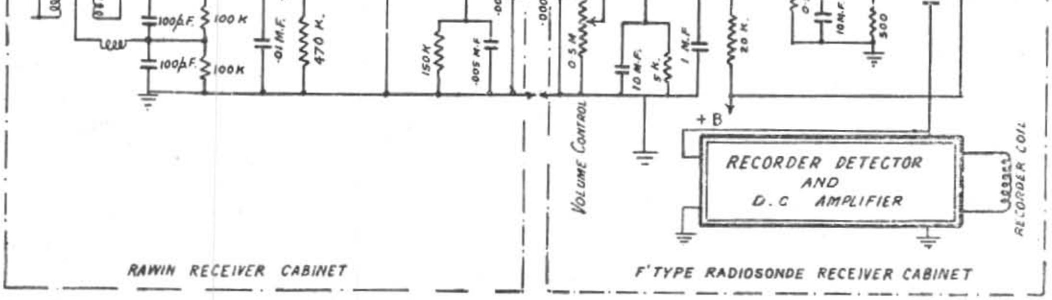

Fig. 3. Modified rawin and radiosonde receiver circuits

By the above method it has been possible to get a satisfactory record of the F-type radiosonde signals. The record compares very well with the usual F-type radiosonde record. The advantages of this method are—

1. Simultaneous measurements of all the data necessary for computing winds and plotting a tephigram with a *single valve transmitter.*

2. The 'fading' of the signals for high angles of elevation found in the radiosonde receivers is very much reduced due to the proper alignment of the receiving aerial.

The authors are grateful to S. P. Venkiteshwaran for his interest and guidance. They are thankful to their colleagues B. K. Gupta, B. B. Huddar and G. P. Srivastava for their active co-operation and valuable discussions during the investigation.

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