Single-Control For Your Present Receiver

A Geared Condenser Unit Which Can Be Applied to the Roberts Knockout, the Phonograph Receiver, the Browning-Drake, the Super-Heterodyne, and Many Other Popular Receivers

By ALLAN T. HANSCOM

¶ THE methods so far brought out for single-control of radio receivers have all been those which used a group of condensers all tuned by one dial—which simultaneously varied the frequency (wavelength) of each circuit in which the various condensers were connected. This method, due to Hogan, is quite workable, but it allows nothing for variations in the individual coils in the circuits. The unit described here may be applied to any circuit in which two coils of approximately the same value are tuned by condensers. Due to the ingenious cam arrangement on the first condenser of the single-control unit described in this paper, any irregularity in the first secondary coil of the circuit to which this unit is applied, may be compensated for by a preliminary adjustment of the first condenser. This is not a how-to-make-it article but the elements of the device are standard. The mechanical features of the complete unit could only be made by a constructor with more than ordinary mechanical ability and a good machine shop at his command. The single-control element should prove so helpful to the home-assembler that we feel no hesitancy in publishing this article, although the unit cannot be made, but must be bought.—THE EDITOR

THE necessity for selectivity in radio receivers is becoming more evident as more stations take the air, and radio listeners will probably welcome a more simple method of tuning which will not in any sense detract from the efficiency of their receivers.

The ultimate in receiver design should have one station selector, one control for volume and one control to turn the set on and off. The old single-circuit receiver approached these requirements but did so at the expense of the selectivity which is an urgent requirement nowadays. The single-circuit set radiates most distressingly and so it has been gradually superseded by sensitive receivers of more desirable types.

Practically the only possible way to secure selectivity in the receivers in general use today, is by means of two or more tuned circuits. Now, since each circuit must be tuned separately, we have two or three tuning controls on most of the receivers now popular. It was early apparent that this difficulty could be overcome, provided the two or more tuned circuits could be controlled simultaneously with a single knob or dial. To do this successfully required laboratory methods which can not be adopted by the average constructor, and—more important—do not go hand in hand with quantity production in manufacturing.

With these ideas in mind, the writer has developed a method which permits of the simultaneous tuning of two circuits, and at the same time makes possible a slight variation of one circuit without disturbing the other, in order to compensate for slight variations in the two.

This makes the reduction of one tuning control possible, and in the case of the standard neutrodyne or other tuned radio frequency receivers, the number of controls is thus reduced from three to two. In sets using a single stage of tuned radio frequency, such as the RADIO BROADCAST three- and four-tube Knockouts, the Browning-Drake, etc., as well as most super-heterodynes, the number of tuning controls is reduced to one, and the simplicity of the tuning is a pleasant surprise to a person operating one of these sets for the first time.

The essential feature of this assembly consists of two Remler condensers mounted in such a manner that their capacities may be simultaneously varied with a single Marco dial reading through 180 degrees. In addition, one of the condensers may be varied through 20 degrees of dial movement without disturbing the setting of the other condenser. At the mid-point of the vernier setting, the two con-

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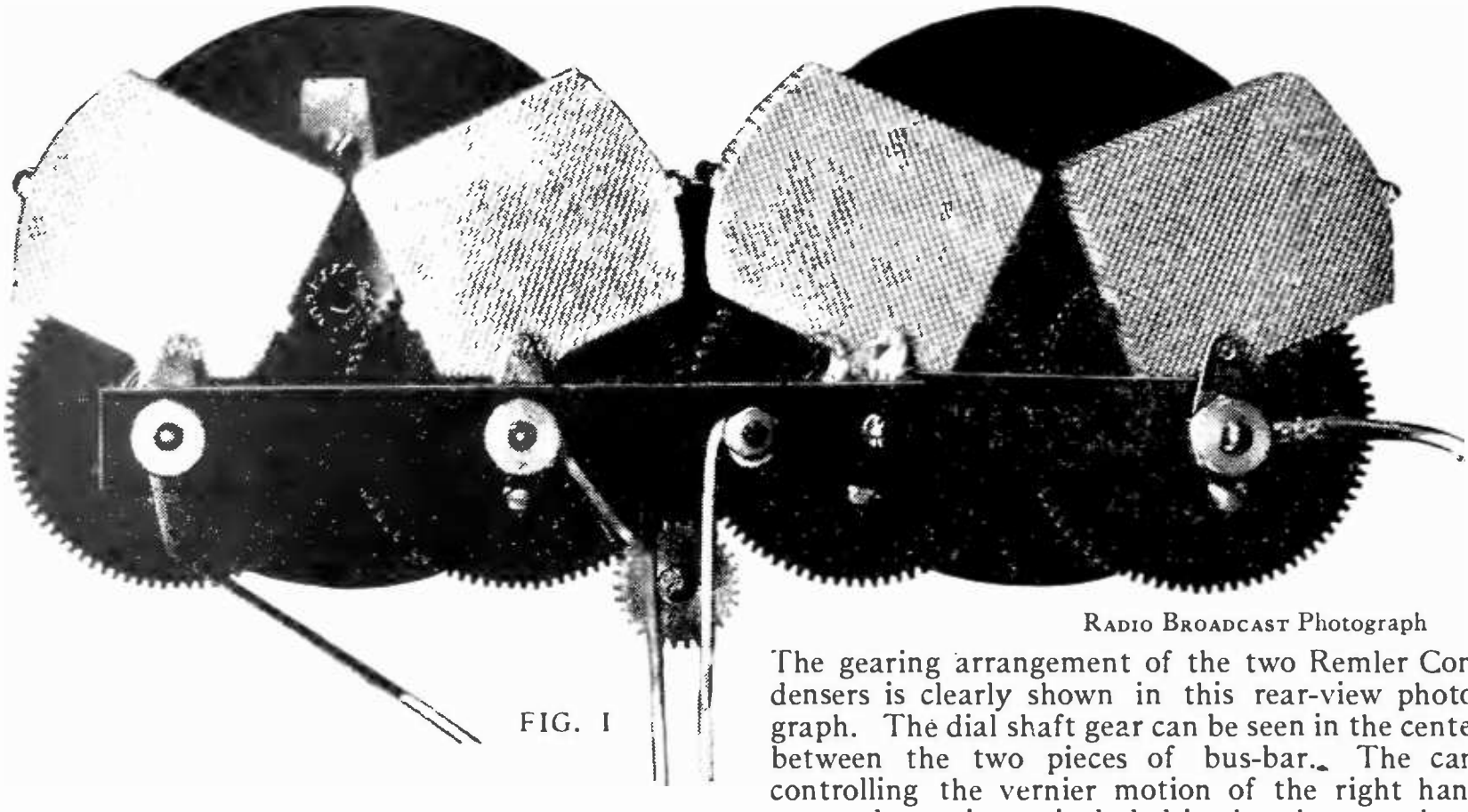

FIG. 1

RADIO BROADCAST Photograph

The gearing arrangement of the two Remler Condensers is clearly shown in this rear-view photograph. The dial shaft gear can be seen in the center between the two pieces of bus-bar. The cam controlling the vernier motion of the right hand condenser is not included in the photograph

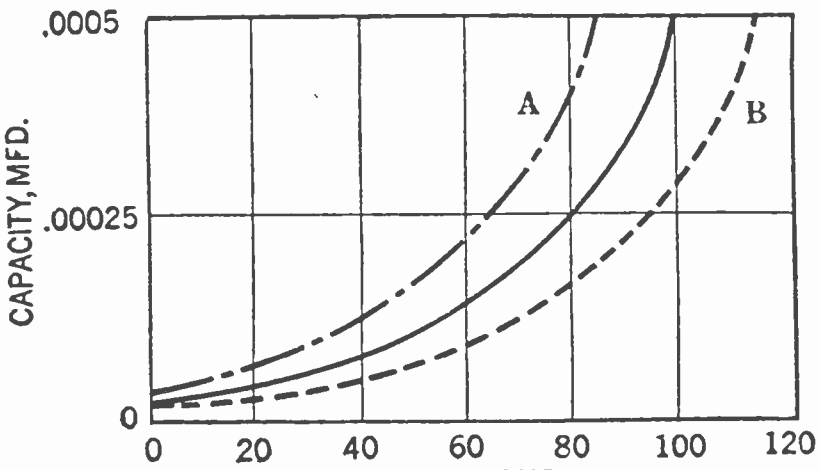

FIG. 2

The curve in the center shows how the capacity for one condenser will increase or decrease with respect to the dial readings. The dotted curves, A and B, depict how the values vary as the vernier is adjusted between maximum and minimum points

densers have equal capacity at any dial reading and the vernier gives a plus or minus variation sufficient to cover the ordinary inequalities of tuning. This arrangement has the following important advantages:

1. Dial may be logged.
2. Straight line wavelength curve of the condenser spreads stations evenly on the dial.
3. Vernier variation at any setting is proportional to wavelength.
4. The main dial and vernier not electrically connected, thereby avoiding hand capacity effects.
5. Condensers each have separate terminals and may be connected independently.

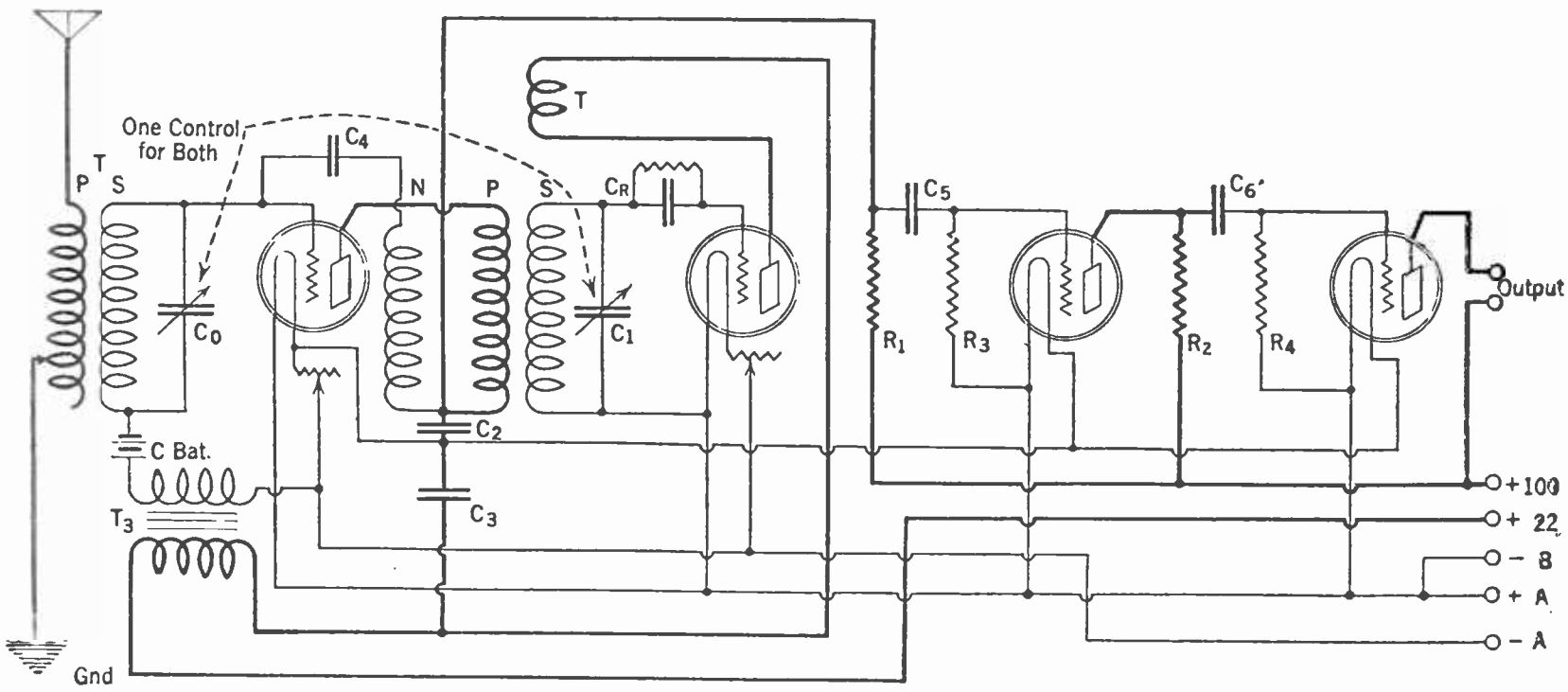

FIG. 3

The application of the single-control feature described in this article, may readily be applied to the Roberts Knockout receiver, a diagram of which appears above

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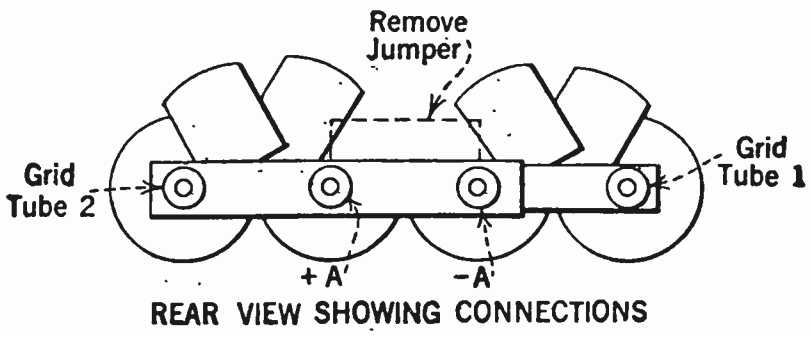

FIG. 4B

If the idea suggested in Fig. 4A. is tried out, the fan can follow the connections marked in this diagram for the two condensers

6. Side-by-side mounting saves space and conforms to layout of set.

The applications of the single control capacity element to various circuits will be taken up at length, and a description of the device is first presented in order that the details may be made clear. From the photographs we see that the two condensers are mounted so that the gears will engage with each other and consequently the rotation of one condenser will affect the other one simultaneously. The dial shaft gear is shown in Fig. 1. This drives the left hand condenser which in turn is geared to the one on the right. The cam which controls the vernier motion of the condenser on the right can be seen in the photograph of the back of panel view of the four-tube RADIO BROADCAST phonograph receiver. The condenser is mounted so that it may be raised or lowered by the motion of the cam and yet the position of the gear which engages with the left hand condenser remains fixed. If the main dial shaft is rotated, both condensers will be affected, but the motion of the shaft containing the cam will vary the capacity of the right hand condenser but will in no way affect the one on the left. Fig. 2 represents the curve of one condenser and if the vernier is set at the mid-point, the other condenser will have an identical curve. In Fig. 2, A represents the curve of the right hand condenser with maximum adjustment of the vernier, while B in Fig. 2 represents the minimum adjustment.

In the application of this device to a receiving set, it is necessary to bear in mind certain fundamentals which apply to tuned circuits. For a given frequency (wavelength), a certain value of C (electrostatic capacity) must have a definite value of inductance, the frequency, (wavelength) being a function of the product of these two. If we increase the

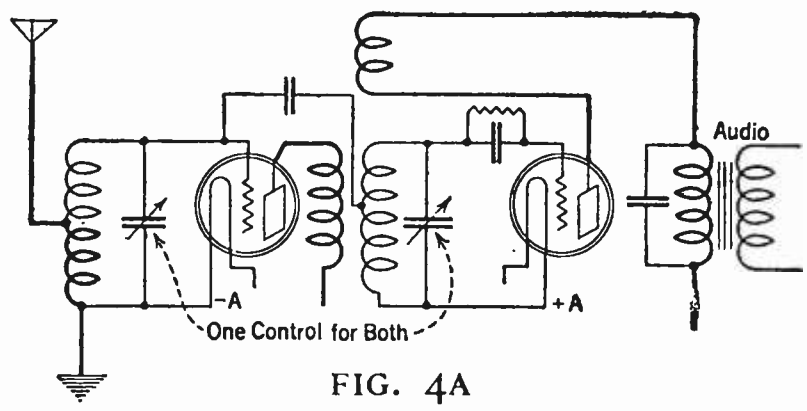

FIG. 4A

The Browning-Drake and Silver circuits, which are almost identical, have two variable condenser controls, and it is possible to cut this down to one control by employing the system outlined by Mr. Hanscom

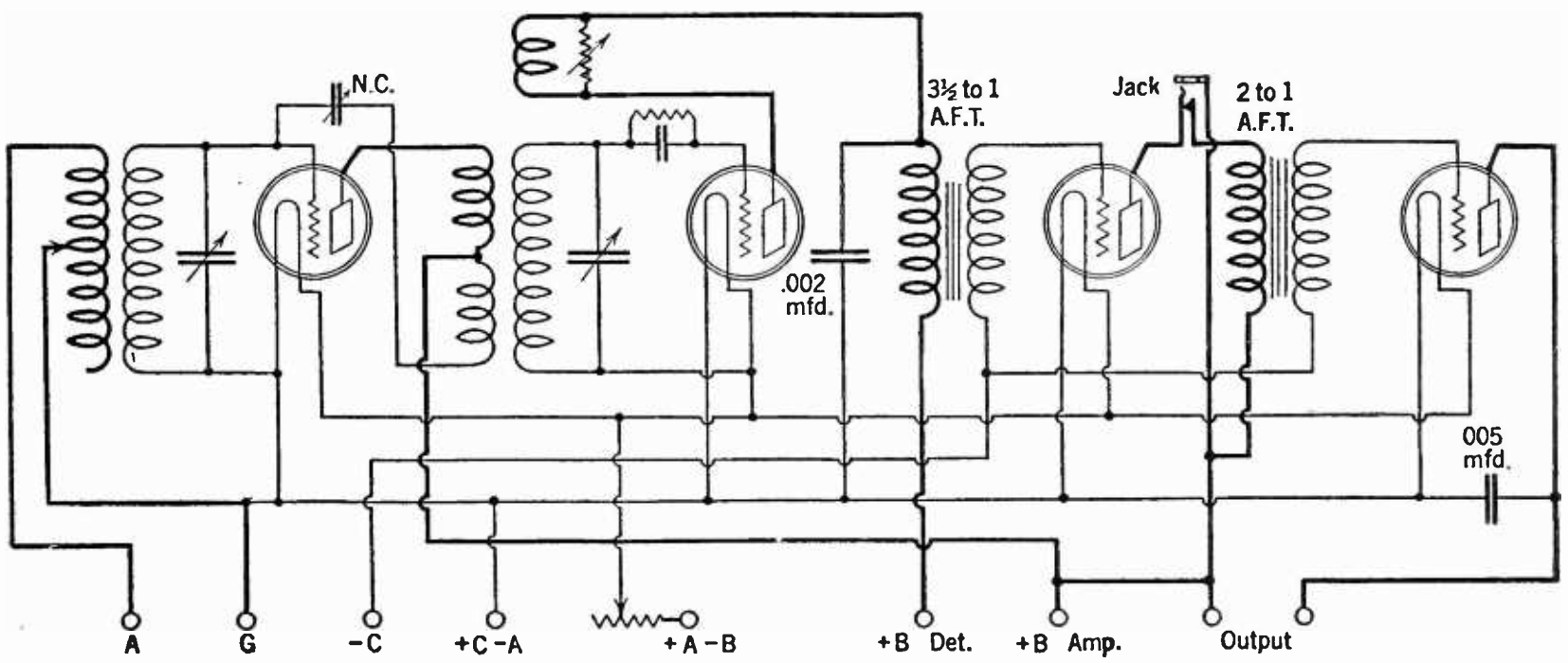

FIG. 5

The single control unit may readily be applied to the RADIO BROADCAST Phonograph Receiver. In this way only one control will be necessary for the condenser shown across the secondary tuning coil and that across the secondary of the r. f. transformer. The connections in Fig. 4B apply in this instance also.

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inductance we must decrease the capacity in order to tune to the same frequency (wavelength) value. It should therefore be apparent that, if two circuits are going to be tuned with this capacity element, the inductance of each circuit should be approximately equal. When these inductances are equal, it will be found that the adjustment of the vernier is unnecessary throughout the entire frequency (wavelength) range, but the vernier makes possible the necessary correction for differences in inductances and distributed capacity of the circuits.

APPLICATION TO THE ROBERTS KNOCKOUT RECEIVER

FIGURE 3 represents the Roberts circuit, which consists of a stage of tuned, neutralized, radio frequency amplification and a tuned detector with tickler feed-back together with a stage of reflexed audio amplification. As applied to this circuit, this single-control capacity element should be connected so that the condenser which is controlled by the vernier will tune the first radio frequency stage. It is suggested that a small fixed condenser be connected between the antenna and the tap on the first tuning coil, particularly if the set is used with a long antenna. If the single-control device is applied to a Roberts Knockout set which is already in use, it is well to make the necessary adjustment in order that the two dials will read alike before the element is installed. If you find, for instance, that the antenna tuning dial is always lower than the second dial, this should be corrected by inserting a small fixed condenser, from .0001 to .00025 mfd. in the antenna lead. If the dial still tunes low, this may be corrected by removing a few turns from the antenna tuning coil. This is necessary only in extreme cases, and if the dials can be made to read within four or five points of each other, you may install the single-control without any change in the set. In most Knockout, receivers this change is brought about by means of the antenna switch, which compensates for antennas of various lengths.

It is suggested that the plates of the two condensers which are nearest each other, should be connected to the filament end of the respective coils to avoid coupling effects. The single-control capacity element has a flexible connection between these two sets of plates, and in the case of a positive return to the detector filament, this connection may be removed and the wiring then made in the usual manner care being taken to supply flexible leads to the left hand condenser. The single-control capacity element is mounted on the rear of a panel by means of three screws and nuts, and the template gives the location of all the necessary holes.

SINGLE-CONTROL FOR THE BROWNING DRAKE RECEIVER

THE Browning-Drake receiver (completely described in RADIO BROADCAST for December, 1924), is deservedly one of the most popular circuits in use to-day, and it has earned this popularity through the excellent results which are obtained with it. This circuit differs from the Roberts only in the method of neutralization and in its lack of reflexing. Some of the kits which are on the market for its construction are provided with a .0005 mfd. variable condenser for the first stage and a .00035 mfd. condenser for the second stage. This results in the left hand dial reading lower than the right, particularly on the lower frequencies (longer wavelengths). In most cases however, the single-control capacity element can be installed in the regular manner. If it is found that the vernier must be turned to the extreme position so that the first condenser has more capacity than the second for any given setting, this may be corrected by lengthening the antenna or by connecting it to a tap on the coil a few turns nearer the grid end of the winding. If it is found that the vernier works best in the other extreme, where the first condenser has less capacity than the second, it can be corrected in one of three ways. One can shorten the antenna; connect a fixed condenser .0001 to .00025 mfd. capacity between the antenna and the tap on the first coil, or move the tap on first coil nearer the filament end. It will be found that the original inequalities can be taken care of with the vernier, but bear in mind that the proper adjustment of these inductance and capacity values will make the vernier almost superfluous, leaving only one, frequency (wavelength) control.

SINGLE-CONTROL FOR THE SUPER-HETERODYNE

THE super-heterodyne circuit consists essentially of two tuning controls, one to adjust the loop or antenna coupler and the other to vary the oscillator frequency, the latter to produce the proper beat for the intermediate amplifier. The single-control capacity element lends itself admirably to this type of circuit, because the proper value of loop inductance may be obtained by using the proper size and number of turns on the loop. To do

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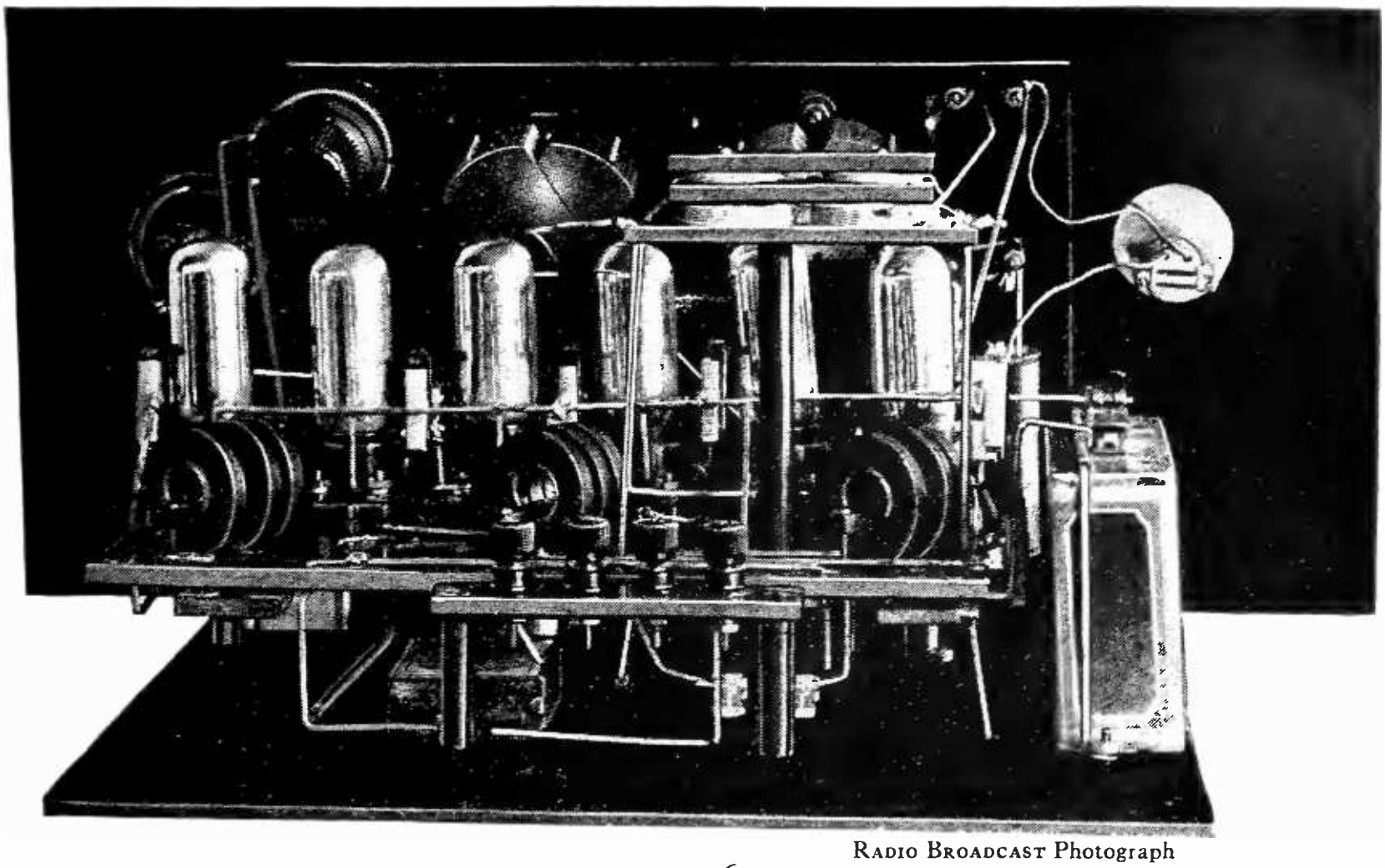

RADIO BROADCAST Photograph

FIG. 6

This illustration depicts the second harmonic super-heterodyne described by Mr. Hanscom in the November, 1924, RADIO BROADCAST. The single-control capacity element has been found ideal under actual working conditions, in this type of receiver

this, it is only necessary to vary the loop turns until a point is reached where the desired frequency (wavelength) range can be covered with the least possible variation of the vernier. The super-heterodyne is different from the tuned radio frequency set in the respect that it depends for its proper action on the constant difference of frequency between the two tuned circuits. It is, therefore, only necessary to provide the same tuning range in each of the circuits and the vernier can be set so that one condenser will always provide more capacity than the other, thereby providing the desired beat frequency. It is possible to calibrate a super-heterodyne for either the upper or lower setting of the oscillator. Below is given the dial settings of a two-dial super-heterodyne with a given loop.

	LOOP	OSCILLATOR
1199 kilocycles (250 meters)	8	11½
999 kilocycles (300 meters)	16	24
833 kilocycles (360 meters)	27	38½
750 kilocycles (400 meters)	33½	48
600 kilocycles (500 meters)	51	73

This shows a total dial movement between the limits specified, of 43 points for the loop tuning and 61 for the oscillator. To correct this, three turns were removed from the loop after which the readings were as follows:

	LOOP	OSCILLATOR
1199 kilocycles (250 meters)	13½	11½
999 kilocycles (300 meters)	24½	24
833 kilocycles (360 meters)	39	38½
750 kilocycles (400 meters)	50	48
600 kilocycles (500 meters)	75	73

It will be noticed that there still exists a considerable difference in the dial readings, but the total scale movement for each condenser is the same, and the vernier adjustment may be set at a position which will give uniform results throughout the entire scale. On practically all super-heterodynes the oscillator tunes sharper than the loop, and the single-control capacity element should be connected so that the right hand condenser will tune the oscillator, leaving the vernier for the fine tuning adjustment on the loop.

SINGLE-CONTROL FOR THE RADIO BROADCAST PHONOGRAPH RECEIVER

THE popular Roberts Knockout circuit is the basis of the set which has been featured by this magazine as being the best receiver for the money that can be built by the home constructor. By utilizing the capacity element, a phonograph receiver can be constructed as a true one-control set. A simple receiver, made to specifications supplied by RADIO BROADCAST and incorporating this de-

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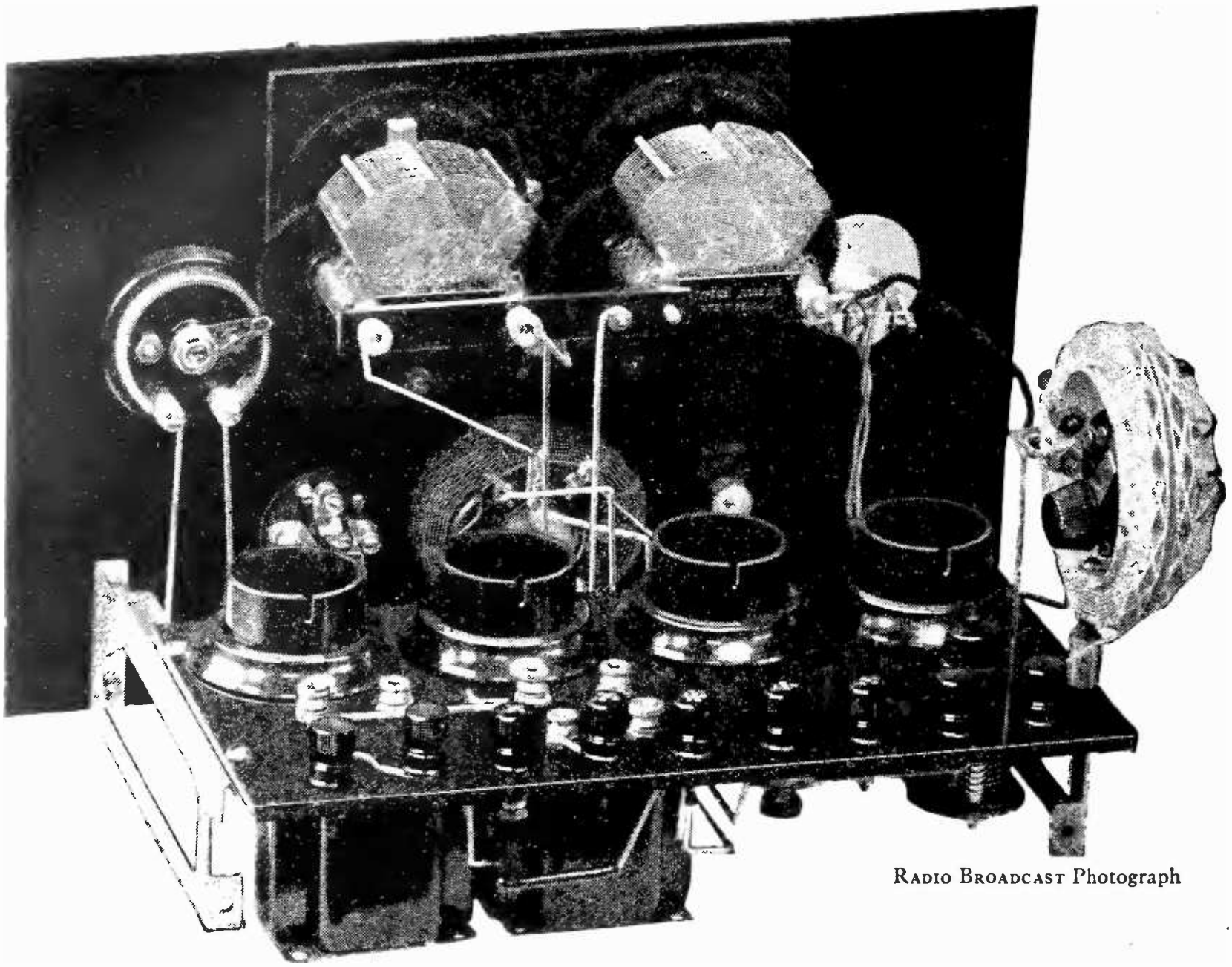

RADIO BROADCAST Photograph

FIG. 7

A variation of the RADIO BROADCAST Phonograph Receiver employing the single control capacity element. The cam which controls the vernier action of the condenser on the right, is shown beneath that condenser and is partly hidden by the detector tube socket. A Claratuna unit is employed for the r. f. coupling. This unit comprises a radio frequency transformer to which is tightly coupled the tickler coil. Regeneration control is accomplished by a variable resistance incorporated within the Claratuna

vice, is shown in the photograph. There are four tubes, consisting of one stage of tuned radio frequency, detector, and two stages of audio. The front panel measures only $12\frac{3}{8}$ by 8 inches and the sub-base measures 5 by 10 inches. This is supported to the front panel by means of Benjamin brackets. The binding posts are mounted along the rear of the sub-panel and the Thordarson audio transformers are fastened beneath it. The Sickles antenna coupler contains a four-point switch to compensate for various lengths of antennas, and the coupling element between the radio frequency tube and the detector is a coil with fixed tickler, known as the Claratuna, mounted beneath the tuning element. The regeneration is controlled by a carbon resistance shunting the tickler coil. This gives a smooth even control without the necessity of moving coils, the space required for the radio frequency unit being reduced to minimum. This receiver gives excellent volume, distance and selectivity, and the simplicity of tuning is a revelation.

Fig. 5 shows the wiring diagram of this phonograph receiver. The negative filaments of all tubes are connected together and to the ground. Use of the complete antenna coupler and the coupler between the first and second tubes, makes the wiring of the set a simple matter. The audio transformers are mounted with the cores in line and not at right angles, and the metal shieldings of the transformers are connected together and to the ground. A Chelten Midget condenser is used for neutralizing and its position is not critical. It is located on the sub panel at the end nearest the antenna coupler, which is clearly shown in the photograph.

EDITOR'S NOTE

THE opinion is prevalent among some broadcast listeners that the use of straight line frequency, or wavelength, condensers will relieve most of the present difficulties in tuning. There are cer-

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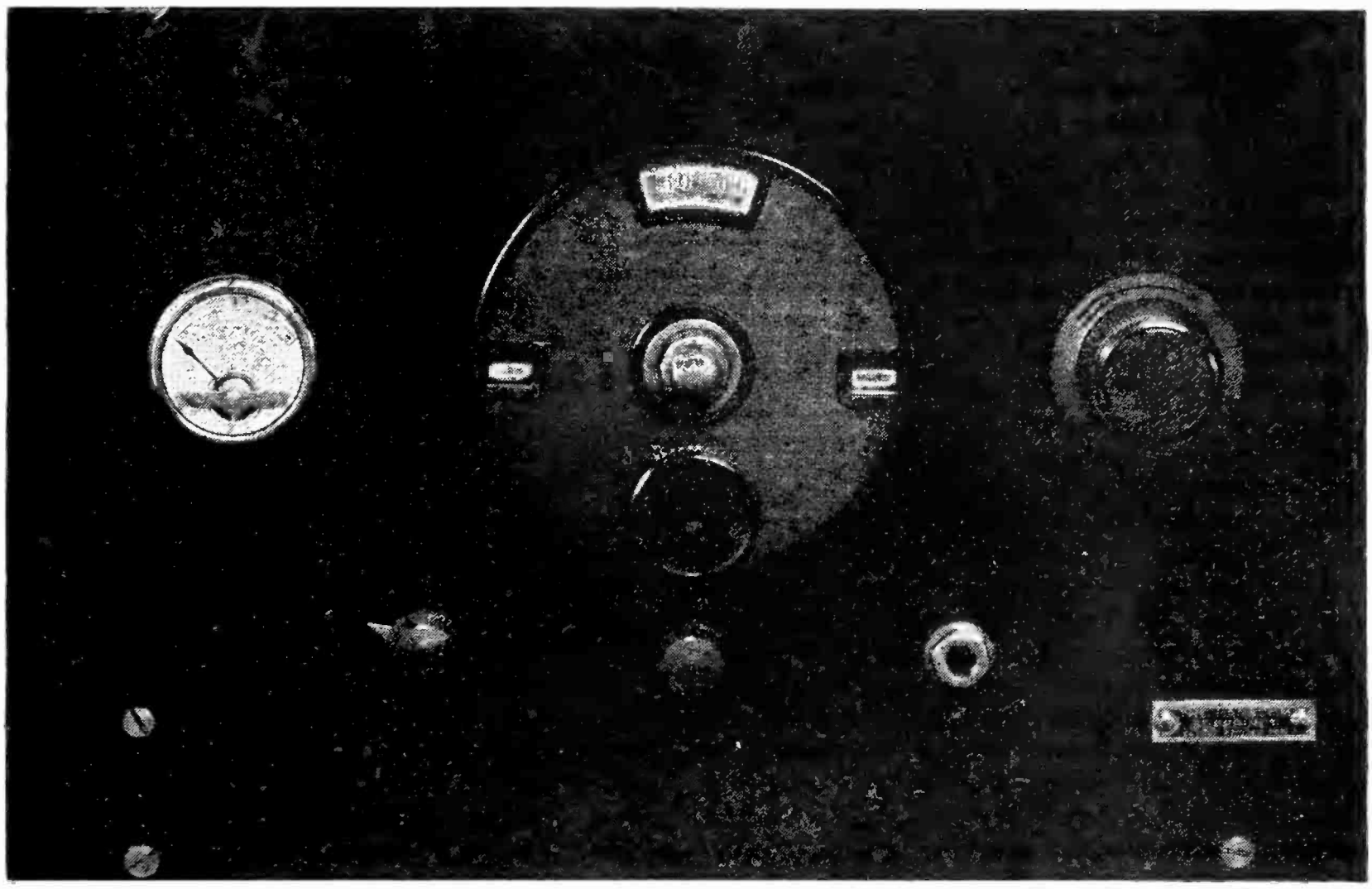
tain things that these condensers will do, and naturally others that they cannot do. What the phrase, straight line condenser means is that a given number of degrees on the condenser dial represents a certain number of kilocycles, or wavelengths, regardless of which end of the scale is being used. This is of distinct value at the higher frequencies (lower wavelengths) and will enable the user to distinguish many of the stations now in class A. Condensers of this type will not eliminate the heterodyning of two stations that stray from their assigned frequencies; they will not separate two stations that are on the same frequency, as many in Class A are, and they will not eliminate any of the tuning troubles that arise at the transmitting station.



RADIO BROADCAST Photograph

FIG. 8

A front-of-panel photograph of the receiver shown in the preceding diagram. The apparatus on the panel, reading from left to right, include a voltmeter, the single-control dial, rheostat, and (bottom row) vernier control knob, resistance control and phone jack. A Hoyt filament voltmeter is included, and the use of filament meters is recommended in all receivers. Operating tubes above their rated voltage very materially decreases the life of a tube

The New Size of "Radio Broadcast" for November

WITH the November number, RADIO BROADCAST will be three and a half years old. During its career the publishers have tried, through every means in their power, to produce a magazine which, from the reader's point of view, should take the leading place in the radio field. Judging from letters which from time to time trickled into our office—letters of gratitude from our readers, backed up by healthy circulation figures, it appears that we have not failed altogether in this respect. It has been our constant endeavor to make the word "quality" synonymous with both our editorial and advertising contents. Now, it is not our custom to celebrate a birthday every six months, but nevertheless it happens that in November, we shall signalize the occasion by introducing RADIO BROADCAST in a new form. The public support and approval of the magazine has been so unqualified that its physical size and appearance must be improved in addition to the improvements which from time to time we are constantly effecting in the editorial pages. November fifteenth, 1925, will be our red letter day then, and we hope that our readers will, by their universal

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