b. That are not affected by tuning. 3, 6, 20, 21, 26.

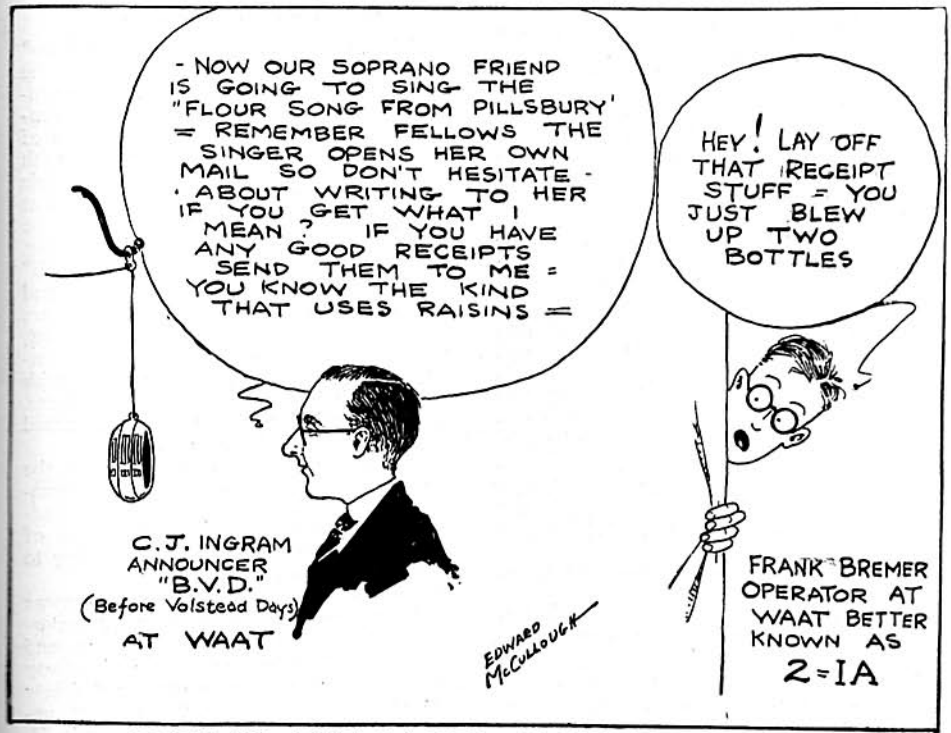
E. Howls, hisses, squeals, whistles, and grunts in amplifiers. 16, 23, 24, 41.

F. Humming or buzzing sounds. 22, 33, 34, 36, 37.

G. Unsteady or wavering signals. 8, 9, 10, 12, 25.

TROUBLE-SHOOTERS' APPENDIX

1. Tickler coil connections reversed, no regeneration; remedy, reverse coil or its leads.
2. Batteries run down.
3. Tube not making proper contact with socket terminals.
4. Polarity of battery reversed.
5. Transformer burned out.
6. Grid condenser shorted.
7. Aerial or ground disconnected.
8. Coils loose and vibrating, causing unsteady signals by varying induction between coils.
9. Too low capacity in antenna, regeneration is difficult to control at extremely low capacities; where 11- or 13-plate condensers are used in antenna and set is unstable, place fixed condenser of capacity .00025 in parallel.
10. Rain causes leaks off aerial, etc., making signals unsteady.
11. Poor connections to aerial or ground.
12. Defective rheostat and unsteady filament current.
13. Telephone windings broken or burned out.
14. Storage battery capable of delivering current to detector tube, but drain on battery from amplifiers is sufficient to reduce voltage on detector filament below critical point.
15. Lighting amplifier tubes, after adjusting detector, throws detector tube out of adjustment when operated on same battery; always tune in on detector with amplifiers lighted, if same battery is used.
16. Primary of transformer reversed.
17. Too much "B" battery voltage on detector plate.
18. Too much inductance in tickler coil.
19. Too high grid leak resistance.
20. Plate leads touching grid condenser or its leads or near them.
21. Excessive detector filament voltage.
22. Ground and plate leads parallel and close together.
23. Cause of howling in stages in excess of two is difficult to assign. Good remedy is placing of fixed condenser of capacity .001 across secondary of last transformer.
24. Transformers too close together.
25. Tube oscillating intermittently due to poor connections to antenna or ground. This is often a difficult trouble to locate. When the antenna or ground (whichever connection is defective) is removed, the noise ceases, leading the operator to believe that the noise comes from without. As a matter of fact, the breaking of his antenna or ground connection through poor contact changes his wave-length intermittently and the set ceases to oscillate and then breaks over again with a popping or knocking sound.
26. Excessive grid charge. Detector tube paralyzed. This may result in a howl of any pitch from a shrill whistle down to a slow knocking sound, at intervals of 10 to 20 per second, depending upon time interval of recovery and paralysis. Remedy, decrease filament voltage, loosen tickler coupling, or decrease plate inductance and lower the grid leak resistance.
27. Moisture in transformer shorting between turns or layers. In this case the noise may be heard with primary of transformer, telephones and battery in series. Remedy, place transformer in oven and dry out at moderately high temperature and impregnate with paraffin.
28. Plate and grid coil leads interchanged, with "B" battery shorted to negative filament. This produces a terrific knocking.
29. Phone condenser shorted.
30. Dust, etc., between plates of variable condenser. When the antenna condenser is shorted, a knock or click occurs as the train of oscillations in receiver is stopped with increase of wave-length.
31. Getting fingers against metal parts connected to oscillating circuit while tuning.
32. Primary circuit not tuned.
33. Grid condenser on bottom of cabinet or resting on table may pick up vibrations or hum from light circuit.
34. Grid coil disconnected.
35. Tube oscillating below critical filament temperature. It is often the case (more frequently than generally supposed) that weak signals are due to the set oscillating below critical filament temperature, thus making it necessary to reduce the temperature too low in order to clear the signals. Some tubes oscillate much more readily than others. This condition is proved by increasing temperature above oscillating point when signals will increase in audibility, but become more and more distorted. Remedy, less plate inductance, less "B" battery, higher antenna capacity, lower phone by-pass capacity.
36. The majority of humming sounds originate in the plate circuit and are caused by using hook-ups where the plate is directly connected to aerial or by a faulty connection causing leaks from plate circuit to ground. Where a very close coupling is necessary between plate and grid coils to produce maximum regeneration humming sounds are more pronounced.
37. After charging storage battery from a home charger, a decided hum is picked up from light circuit if the charging leads remain connected to battery.
38. Knocking sounds that cannot be tuned out and that are not received with antenna and ground disconnected are usually static. Remedy, commit suicide.
39. Bank wound coils made at home are often improperly wound and are frequently absolutely dead in the receiving circuit. Do not use home-made bank wound coils unless you understand method of winding.
40. Steady whistling notes that disappear but do not change pitch with tuning are due either to two broadcasters on the same wave or to your neighbor listening in to rotten music with his set oscillating. Remedy, go over to his house and offer to show him how to tune his set and get kicked out. Otherwise you can substitute a 5-watt tube for your detector, put 100 volts on the plate and tune in on the same station with your set oscillating, and slightly out of phase. This will discourage him in about five minutes and he will listen to something else.
41. Poor connections and worn apparatus in general. Occasionally it is well to pull the set apart and rewire it. The results are sometimes surprising.



GONE BUT NOT FORGOTTEN
STATION WAAT OF THE JERSEY REVIEW, J.C. N.J.
THE PIONEER NEWSPAPER STATION OF THE EAST

GENERAL ELECTRIC CO. TO INSTALL TWO MORE BROADCASTING STATIONS

Plans are nearing completion for the erection of two more giant radio broadcasting stations by the General Electric Company, according to an announcement recently made by Martin P. Rice, director of broadcasting for that company.

One of the new stations will be located near San Francisco and the other is indefinitely placed at somewhere between the Pacific and Atlantic Coasts. Both will be modeled after General Electric Company station WGY at Schenectady, N. Y., and the experience gained by the engineers in this station, after fourteen months' operation, will aid greatly in the plans to give radio listeners in other parts of the country a radio service of the highest transmission quality.

Mr. Rice recently returned from the coast after a tour of inspection. He was accompanied by Harry Sadenwater, engineer in charge of the technical operation of General Electric Company radio broadcasting stations. Sites were investigated in and near Oakland and San Francisco, Cal., in Denver, Colo., and Dallas, Texas.

In each city visited, Mr. Rice received assurance of co-operation from the chamber of commerce and municipal officials, who were alive to the advantages and prestige which may accrue to the city which is the home of a powerful broadcasting station.

The expansion of radio broadcasting by the General Electric Company from one to three stations is part of program agreed upon some time ago by the General Electric Company, the Radio Corporation of Amer-

(*Continued on page* 96)

rang loud and clear in response to a call from the transmitting station. See diagram (C). Both of these bell devices have been successfully demonstrated at the University. This device will operate with A.C. on the filament. The 60-cycle hum of house lighting current is not strong enough to operate the relay, and in addition the bell is designed for 16 cycles. A switch for stand-by periods meets the question of wear on storage batteries. The excessive cost of tubes will take care of itself soon by patent expirations.

The important point in these developments seems to be that there is nothing complicated in radio control. The equipment here is of the most simple, everyday type. The methods used are old fashioned principles rehashed. The power amplifier has made this possible. In reviewing these developments the one which seems to have an immediate application is the bell-ringing device. A number of radio bells have appeared from time to time in the scientific papers. It is for you to keep on experimenting. The public will pick the more practical of these and put it to work. One of the present needs for an automatic signaling device in radio is in connection with the radio telephone systems installed in the police headquarters of the larger cities. With any kind of a signaling device, the stand-by charges for these stations can be reduced. The man who has to sit listening for calls can be released for other duties. When such a system is established, radio will have taken a step forward in placing itself alongside of its present competitor, wired telephony.

In concluding, we have this message for the radio experimenter. Bear in mind the premium that the world pays for simple effective ideas. Reflect that in the early seventies the great Western Union, with its vast financial resources, was powerless in its fight against Bell when he handed to the world an idea for a telephone based on simple, practical and economic principles. Neither can the great communication corporations of today, hostile to radio amateurs, stand in the way of the humblest if he can bring forward an idea which the public can really use. For such there must, of course, be a time, a place and a demand. Radio control meets these conditions, and is calling upon you for ideas.

The writer takes this opportunity to publicly thank the electrical house of Hughes Peter Co., the Heaton Musical Stores, and the jewelry firm of Bancroft Bros. & Co., of the City of Columbus, for their generous donation of equipment and labor in connection with the writer's efforts, also the public press of this city for its sympathetic support. He would like at this time to acknowledge his indebtedness to his associate, Mr. Paul G. Edwards, for invaluable suggestions, and also the assistance of the student staff, Mr. Bejcek, Mr. Mitchell, Mr. Gravitt and Mr. Arter. To the untiring efforts and enthusiasm of these young men the success of our efforts along radio control is due.

General Electric Co. to Install Two More Broadcasting Stations

(*Continued from page 29*)

ica and the Westinghouse Electric. This plan contemplates the erection of nine large broadcasting stations. Of this number the Westinghouse has now three in operation, those at Pittsburgh, Pa., Chicago, Ill., and Springfield, Mass. The New York station of the R. C. A. is on top of the Aeolian Building on 42nd street and was opened recently. The General Electric Company now operates WGY at Schenectady, N. Y., and will have a second station near San Francisco and a third somewhere between the Pacific Coast and Schenectady, N. Y.