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Real and Imaginary

by "Vector"

Whatever Happened to the Likely Lads?

For what follows you can blame the recent Letters to the Editor on the subject of Marconi's 1907 patent for producing c.w. from a spark source. It seemed such an odd-ball invention that I wanted to know more about it, so I did what I always do on such occasions; I called on a friend of mine who is an ardent collector of old books on radio and kindred matters.

I didn't call in vain. He dug out a volume "Telephony Without Wires" (P. R. Coursey, Wireless Press Ltd, 1919) which is a mine of information on the subject. It seems that right from the start of wireless telegraphy lots of people had had a go at telephoning via spark-generated waves, the general approach being to connect a microphone in place of the morse key. Seeing that the original spark gaps produced heavily damped wave-trains with large chunks of nothing in between them (relatively speaking) the lack of success was predictable.

A little later some experimenters transferred allegiance to the arc system or the h.f. alternator, but others concentrated on trying to produce undamped wave-trains at faster sparking rates. The book traces the development of quenched spark, as it was termed, and devotes two chapters to methods of producing continuous waves from spark. I mustn't encroach upon the sacred ground of the correspondence columns, but there is no doubt that spark-begotten c.w. was no myth. Incidentally, you might be interested to know of two familiar names who made important contributions to the state of the art; one was W. Dubilier and the other — wait for it! — was H. Yagi.

Why, I wondered, seeing that input/output efficiencies of up to 75% were claimed, did such methods of producing c.w. die the death? Coursey gives part of the answer in connection with the smooth-disc approach; it was apparently only suitable for low powers (and output power was particularly important then because there were no amplifiers at the receiving end). Furthermore, the disc had to run at very high speeds even to achieve radiations of the order of 30kHz, while frequent gap-cleaning operations were necessary. Nevertheless, Marconi developed the 1907 device extensively and a highly sophisticated version (the timed disc c.w. generator) emerged which continued as the standard Marconi transmission system until the early 1920s when thermionic valves took over. P. R. Coursey's book has pictures of a 300kW installation and it's quite a piece of ironmongery.

Marconi, of course, was primarily concerned with telegraphy for trans-world communication and so introduced an audible note by means of studs on the discs to break up the pure c.w. (if pure is the right word, which it probably wasn't!). It certainly wouldn't have approached the regularity of valve-generated waves.

So that's what happened to one likely lad. I sometimes wonder, though, whether we aren't mistaken in assuming that nothing of value remains in the field of spark research. Consider, for a moment, a few unrelated facts. Spark techniques had developed into a highly efficient means of producing electromagnetic waves of all frequencies from centimetric to v.h.f. Even by 1907, rudimentary means had been found whereby c.w. could be obtained from it. And what of the oscillating crystal of 1911 in which a microscopic spark seems to have been a key feature? Remember, too, that Tesla suggested that spark-generated waves might be used for what we now call radar and, indeed, a primitive form of it was patented in 1904. Given the accumulated know-how of the past seventy years, isn't it just possible that somewhere lies the germ of, let's say, a simple, cheap sub-miniature radar transmitter for use on road vehicles in fog? Or something?

I've just mentioned Tesla. Now, there's a colourful character, if ever there was one. What was he? Charlatan? Showman? Mystic? Eccentric? Genius? Certainly he was continually bursting into the headlines with extraordinary inventions, a large proportion of which never got beyond print: automatons, communication from Mars, death-rays — you name it, Tesla had had a go at it. Yet over and beyond this, Tesla was a visionary-genius with a great number of solid patents to his credit, a pioneer of polyphase a.c. (he designed the alternators for the first Niagara Falls hydro-electric station) and a man who was years ahead of his time in matters concerning high potential, high frequency currents. A man whose worth is recognized by the bestowal of his name upon the unit of magnetic flux density. A complex character indeed.

In 1899 Tesla set up an impressive laboratory at Colorado Springs and before long announced that he had found it practicable to send and receive telegraphy and telephony around the world: many thousands of messages could be sent simultaneously. A cheap and simple device which could be carried in one's pocket would record the message.

But this was only the beginning; in addition, Tesla claimed that he could also distribute power in unlimited amounts without the aid of wire conductors. His "magnifying transmitter", as far as he described it, was essentially a circuit of very high induction and small resistance; the mode of operation (he said) was the diametrical opposite of conventional wireless telegraphy, the electromagnetic radiations being insignificant. With proper conditions of resonance obtained, the circuit "acts like an immense pendulum, storing indefinitely the energy of the primary exciting impulses upon the earth and its conducting atmosphere".

Eventually his transmitter was to emit a wave complex of a total maximum activity of 10 million horse power (this, added Tesla, rather unnecessarily, "is obtainable only by the use of certain artifices"). As a start he proposed to distribute 10,000 h.p. under a tension of 100 million volts "which I am now able to produce and handle with safety".

One of the chief benefits of the scheme, as Tesla saw it, would be the illumination of isolated homes, each one of which would have a power collector on its roof and with the lighting derived from vacuum tubes operated by h.f. currents. Tesla added that the driving of clocks and other such apparatus would be a feature, commenting that "the idea of impressing upon the earth American time is fascinating and very likely to become popular".

As far as one can gather, then, his idea was to set the entire earth into electrical oscillation at a frequency of 150kHz and to pump in power to be in resonance with the waves that he was sure would travel from the transmitting centre to a point diametrically opposite it on the earth's surface and then return. This travelling power could be tapped off anywhere by means of a tuned circuit, an earth connection and an elevated collecting rod. (How he proposed to stop pirating is not clear.)

Tesla built a central power plant and transmitting tower for his "World Telegraphy" at Long Island, New York. The tower was 187 ft high and topped by a hemispherical head 68 ft in diameter. The externals were completed by 1902 and some equipment installed, but by now the backers were crying off and Tesla was desperately short of money.

Tesla was forever dreaming up projects and then abandoning them, often because of lack of money. Many were undoubtedly crackpot but, on the credit side, he produced a great number of viable inventions. Isn't it possible that a careful search might reveal a few likely lads among those abandoned?

Real and Imaginary

by "Vector"

". . . through a glass, darkly . . ."

I think it was Jerome K. Jerome who said that it was impossible to enjoy idling unless one had plenty of work to do. Like when the project you're working on comes to pieces in your hands and is miles behind schedule and the Group Chief is making savage barking noises at your cell door. Under such conditions one of the best ways I know of wasting half-an-hour of the firm's time — and I pass this on in full awareness that I shall not get the Queen's Award for Industry for it — is to speculate upon what electronics will be like in A.D. 2000.

Somehow, A.D. 2000 has a remote ring about it. "So what?" is the thought that springs to mind. "I shall be too busy supporting daisies to bother." If that's your attitude, permit me to point out that the baby born today will be only twenty-seven years old when the tape-recorded joybells ring out.

One tip before you start, though (if I may presume). Don't be too influenced by Mr. Spock and his colleagues of "Star-Trek". They're much farther ahead in time and they've got some pretty far-out hardware, including the one which disintegrates a human body into its constituent atoms and then reassembles it on some far distant shore at the speed of light (very handy for dodging the queue on the Exeter by-pass). But they still seem to be stuck with vintage 1960 radar and TV screens; their radio still on occasions emits 1930-ish squawks and they're still stuck with control knobs and push-buttons. Not a thought-operated device in sight . . . but let him that is without sin cast the first stone. I've already fallen into the trap by mentioning tape recording which may well be in the museum by A.D. 2000.

There are snags in this crystal-gazing business, I find. At a superficial level it seems straightforward enough. Old Moore Vector can predict l.s.i. circuits that will make our present ones look like St. Paul's cathedral by comparison; he can visualize fully automated airways and driverless road vehicles belting along in safety at credible speeds, monitored by electronic ices through all sorts of weather. Genuine 3-D colour TV (holographic?) with storage facilities is a "must"; probably the ultimate status symbol will be a viewing room in which illusions are presented from the four walls, floor and ceiling to immerse the viewer in the scene. The input signals may be piped into the house or they may originate from a space station covering the entire country, or even half the globe.

The computer will be ubiquitous; not only in factories and offices but also in the home, where every detail of domestic life — well, almost every detail — will be organized by the machines, which by 2000 may have developed perilously close to the capability of original thought. The postal services as we know them will probably have disappeared in favour of facsimile and data transmission into the home.

I could go on *ad infinitum* but you can just as easily make your own blueprint for the future. Where we're likely to come seriously unstuck is that we can take no account of two factors, each of which can throw hefty spanners into our prognostica-tive machinery. These are, respectively, serendipity and possible changes in social structure.

Serendipity, the act of making discoveries unexpectedly and by accident, had had a greater influence on the development of electronics than profes-sional self-esteem would have us admit. And when it happens it naturally disrupts the trend more than somewhat. For instance, in 1872, progress in communications was entirely in terms of signals transmitted via wire conductors. In that year a forecast of likely developments by the turn of the century might have included a trans-world telegraphic linkage by cable, possibly the electric telephone and — if you were a way-out prophet — even television over land-line (which didn't in fact materialize but a lot of people were trying). But in 1872 it would have taken a super-seer to declare that in 1901 signals would be sent across the Atlantic by means of electromagnetic waves. No-body in 1872 could foresee that Hertz was going to upset the technological applecart; although this wasn't serendi-pity, some of the discoveries that made wireless telegraphy into a practical system undoubtedly were.

Neither can we allow for radical changes in social structure. Taking a worst case, it is even now within our power to bring a nuclear Flood of world proportions upon ourselves. If that happens and the only survivors belong to a primitive race, all our crystal-ball gazing would become a nonsense. Electronics would vanish.

Or, as a less extreme example, there may be profound changes in outlook. Ever since history began, technology has developed via the profit motive; invention has centred in areas where there has been money to be made from it. In the Industrial Revolution the workers had a grim time of it;* living conditions were appalling and education was a prerogative of the rich. Great strides have been made since then and one of them is in the proliferation of universities and technical colleges, to enter which the password is intelligence, not the possession of this world's goods. But education is not the mere acquisition of knowledge; its most important function is to train the brain to enquire and to question.

Is it surprising then that the student population is beginning to bite the hand that feeds it? Is it surprising that a militant minority is becoming increasingly disenchanted at the prospect of a lifetime spent in the industrial or commercial rat-race and is intolerant of the established order? It's an ostrich attitude to pretend that all drop-outs are bone-idle unwashed layabouts; no doubt the movement has its quota but the great majority are highly intelligent youngsters who don't like the shape of things as they are and are saying so. It is they who will be the influential citizens of ten or fifteen years' time and while youthful intolerance may have mellowed somewhat by then, it is their views, whatever they may be, that will determine the pattern of the future, for the student revolt is a world movement.

What has this got to do with electronics? Everything. For electronics is a Vicar of Bray industry which follows dutifully in the wake of events. At present much of it is devoted to trivia and all of it to the almighty dollar — for example, presently existing techniques could be developed to make our roads much safer, but they would add perhaps £30 to the cost of a car, so nobody bothers overmuch. Safety devices have to be the subject of legislation before they are generally adopted. A change of outlook for the better would change the whole direction of electronics accordingly.

If, on the other hand, the change is in the direction of Orwell's "1984", then electronics will become the servant of the police state. The character of broadcasting could change overnight from a benevolent institution to an instrument for brainwashing. Even in the present state of our art, private conversations can be listened to across the street without the need for a bugging device in the room; telephone conversations can be tapped with ease; computer stores can be "milked" from a mile or so away — and at the moment we're not even trying awfully hard!

Perhaps after all we'd better give crystal-ball gazing a miss and get back to the job in hand before the Group Chief goes completely berserk.

*There is disagreement among historians on this point. Controversy is centred on both the material standard of living and the quality of life. — Ed.

Fifty!

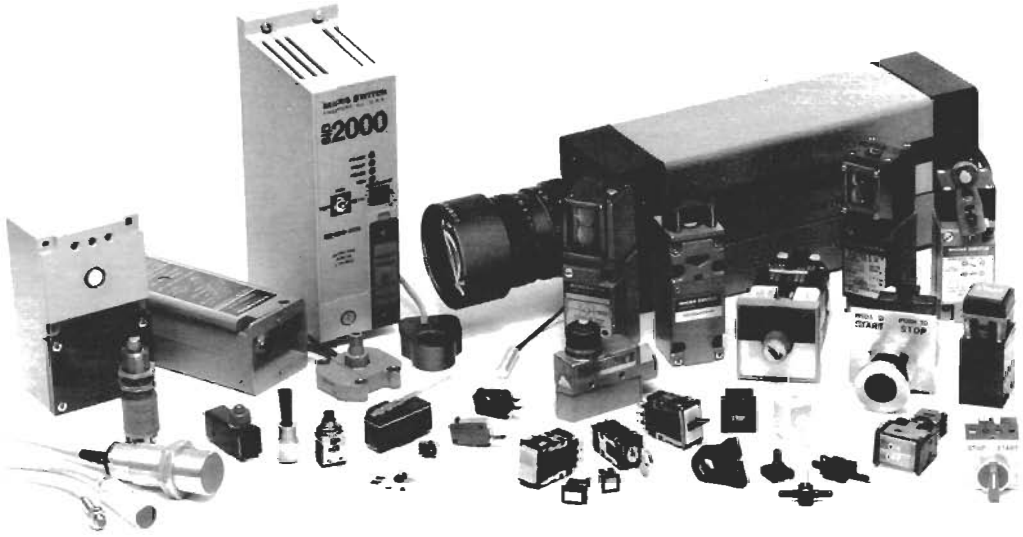
A walk through the years with MICRO SWITCH

As MICRO SWITCH's 50th anniversary celebration draws to a close, we invite you to take a look back at some of the events that have made us the world's switching and sensing leader.

The 30's

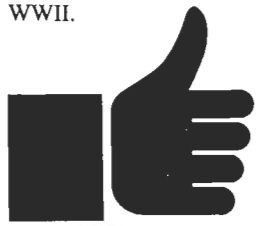
1932 The first precision snap-action basic switch was invented by Peter McGall, who was an employee of Burgess Battery Co. at the time. It was developed to meet close tolerance switching requirements for a chicken brooder.

1937 Under the MICRO SWITCH corporation banner, our first sales force consisted of two salesmen. Today, MICRO SWITCH employs over 150 field sales engineers in 21 branch offices throughout the U.S., and our products are sold all over the world through an international distributor network.



The 40's

1943 The first of three Army/Navy "E" (for excellence) awards was presented to MICRO SWITCH to recognize our achievements in providing quality products for use in armed forces equipment and vehicles during WWII.

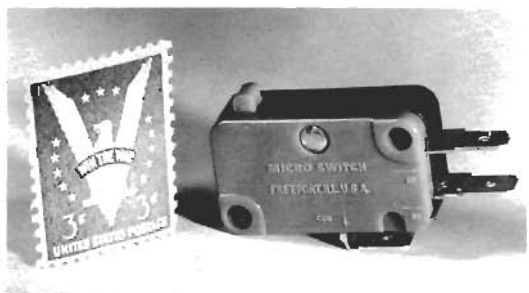


The 50's

Honeywell

1950 MICRO SWITCH corporation was purchased by Honeywell but retained its identity as an industry leader for solid state and electromechanical switches, sensors and manual controls.

1952 The mercury switch line was put in place, forming the manufacturing foundation of the critical component for Honeywell round thermostats.



1947 The V3 electromechanical basic switch was introduced. The name was chosen to represent Victory in Europe, Asia and for MICRO SWITCH, and because the size of the switch was about the same as the 3-cent stamp in circulation at the time.

The 70's

1955 Our first foreign facility, in Newhouse, Scotland, was established.

1956 The industry's first lighted pushbutton was introduced by MICRO SWITCH.

1957 MICRO SWITCH introduced the industry's first electronic proximity sensor.

1976 MICRO SWITCH developed the first solid state vane switch for use in automotive ignition systems.

1976 When Viking I landed on Mars, one of our hermetically sealed basic switches controlled the actuation of the arm that collected samples from the planet's surface.

1977 A new display van rolled out to visit customers and distributors throughout the U.S. Over 271,000 visitors have seen our products in action on this traveling display.

The 60's

1962 MICRO SWITCH played a part in the first manned orbit around the earth. Our products were used both in the spacecraft navigated by John Glenn, and in ground control equipment at NASA headquarters.

1966 Our Special Equipment Department was formed. Over 80 percent of the equipment used in our manufacturing facilities is designed and constructed by these in-house equipment specialists.

1965 The first Hall effect solid state switch was introduced.

1968 MICRO SWITCH came out with the world's first solid state keyboard.

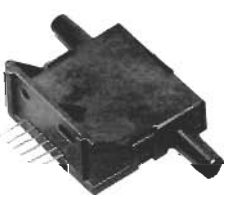
The 80's

1981 Researchers at the University of Utah chose reliable MICRO SWITCH pressure sensors to help make sure their artificial heart beat properly.

1983 The first programmable display pushbutton using LED technology was introduced.

1984 A new sensing technology called permalloy was perfected. It has since been incorporated in temperature, current and position sensors.

1986 A new breakthrough in pressure sensing technology allows liquids to be in contact with both sides of the sensing integrated circuit chip.



1987 A sensing technology which incorporates a microscopic bridge etched into a sensing chip was introduced. An airflow sensor using this technology is sensitive enough to detect breathing in a person at rest.

1987 The Optoelectronics Division of Honeywell in Richardson, Texas was made part of MICRO SWITCH, increasing our sensing capabilities. They produce optical sensors and encoders, and will also produce many of the integrated circuit chips used in other MICRO SWITCH products.

1987 Honeywell's Visitronics operation joined MICRO SWITCH, strengthening our vision sensing capabilities for industrial automation.

1988 The beginning of our 51st year. In 1988 and beyond, our focus will remain on providing quality switches, sensors and man-machine interface controls to meet our customers' requirements.

Together, we can find the answers.

MICRO SWITCH
a Honeywell Division

The Telemobiloscope

An Edwardian radar

by V. J. Phillips Ph.D., B.Sc(Eng)

University College, Swansea

If one were to ask the proverbial man-in-the-street when radar was invented, and by whom, he would probably reply that it came into being sometime around the date of the second world war, and was the work of Watson-Watt and his colleagues. In the sense of producing a reliable operational device this answer would indeed be correct, but the average person is usually most surprised to learn that the first working demonstration of radar seems to have been given in 1904 by one Christian Hülsmeyer of Düsseldorf. His device was not known by that name of course but was called the Telemobiloscope. This article outlines the invention and relates it to other early devices.

MANY of the text-books on radar refer to the fact that Heinrich Hertz had demonstrated during the course of his classic experiments (1886-8) that metallic objects reflect radio waves. Some mention that related techniques were being used during the 1920s to measure the height of the ionosphere by reflection of radio waves, either by phase-shift measurements on the received signal or by pulse techniques. Naturally these experiments had nothing to do with navigation or the avoidance of collisions at sea.

The chance observation in 1922 of Taylor and Young, who noticed that the movement of ships on the Potomac river caused phase-shifts in radio signals received nearby, usually gets a mention, as do the words of Marconi who, during the course of a lecture to the Institute of Radio Engineers, in New York in June 1922 said:

> "It seems to me that it should be possible to design apparatus by means of which a ship could radiate or project a divergent beam of rays in any desired direction which rays, if coming across a metallic object such as another steamer or ship would be reflected back to a receiver screened from the local transmitter on the sending ship and thereby reveal the presence of the other ship in fog or thick weather. One further advantage of such an arrangement would be that it would be able to give warning of the presence and bearing of ships even should these ships be unprovided with any kind of radio."

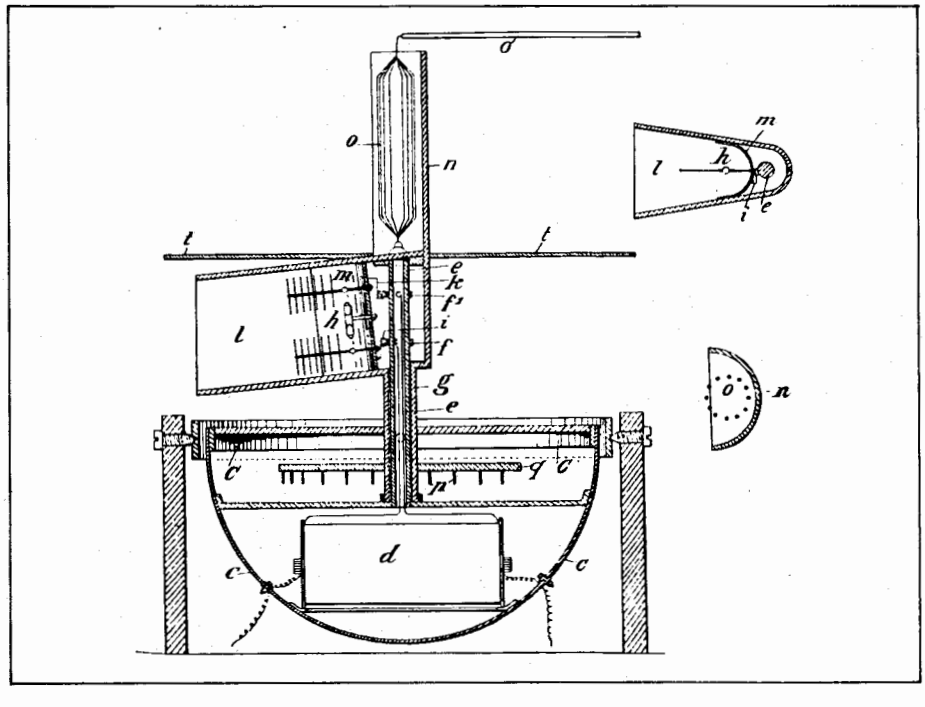


Fig. 1. *Hülsmeyer's first patent. Parts identified by letters are described in the text.*

The general impression usually given is that the germ of the idea appeared in the 1920s but that nothing much was done about it until the following decade. Very few books mention the earlier work of Hülsmeyer*.

The matter was brought to my notice by a short note in the *Electrical Magazine* of 1904[1] which is a report of

> "apparatus brought out by Mr Hülsmeyer of Düsseldorf and demonstrated to the North German Lloyd. The new invention is based on the principles of wireless telegraphy and is intended for viewing ships and metallic objects at sea. In wireless telegraphy the transmitter and receiver are used separately on different ships, but are both on the same ship with the telemobiloscope. The electric waves, not being able to reach directly the receiver, must be reflected by metallic objects on the sea (that is ships) so as to arrive at the receiver on a broken path. The advantage afforded by this invention is mainly that ships fitted with the transmitter and receiver will be able to view any other ship devoid of these apparatus. It will even be possible to inform the captain on the bridge in the case of distances ranging from 3 to 5 km of the position of an approaching ship to enable him, when luminous and fog signals fail, to alter his vessel on the right course so as to avoid accidents in time. Experiments made so far on small instruments designed for shorter distances have given every satisfaction."

Hülsmeyer was granted British Patent No. 13,170 on his apparatus in 1904, and in the same year he was granted a further patent, No. 25,608, embodying certain improvements on the original device. The drawing of his first patent is reproduced here in Fig. 1. An induction coil *d* contained in the hemispherical bowl C generates a high voltage which is fed up inside the hollow shaft *e* to two slip rings *f* and *f'*. Two brushes *k* and *i* bearing upon these rings convey the voltage to a Hertzian spark transmitter. This appears to be of the type which is often known as a Righi spark gap, consisting of four balls, the inner two being enclosed in oil which has the effect of quenching the spark after a short time. Two rods, with

* The Encyclopaedia Britannica and the book "Radar System Engineering" by L. N. Ridenour (McGraw Hill 1947) are two exceptions.

cross-pieces, are fixed to the outer balls. The capacitor formed by the gap and rods is charged by the coil and when the voltage is sufficiently large a spark occurs which effectively causes it to be discharged through the inductance associated with the rods. The result is a damped oscillatory flow of charge, the associated electric and magnetic fields causing the emission of a pulse of r.f. By means of a reflector *m* and a shaped tube or funnel *l* these radiations are emitted in one direction only. The reflector and funnel are also shown in plan view in the small drawing at the top of Fig. 1. In the words of one of Hülsmeyer's patents it forms

> "a projector which throws the electric waves in the form of a cylindrical bundle."

The funnel *l* is mounted on the outer tube *g* which enables it to be turned to point in any desired direction. Above this spark transmitter, and screened from it by the metal plate *t*, is the receiving aerial *o*. A semi-circular screen *n* rotates with the transmitting funnel so that the aerial is affected only by signals arriving from the appropriate direction. It also screens it from unwanted interfering signals from other directions.

The whole arrangement is mounted in gimbals to combat the motion of the ship. The receiving aerial is connected by wire *o'* to a coherer-type receiver. For those readers who may not be familiar with the coherer it is illustrated in Fig. 2. It was found in many different forms but essentially it consisted of a mass of metal filings lying between two metal plugs, the whole being contained in a glass tube. Normally the mass of filings exhibits a very high electrical resistance but when a voltage such as that induced in the aerial is applied across the plugs the resistance drops very markedly. This change in resistance can be sensed by connecting a battery, in series with a galvanometer or telephone receiver, across the device. The coherer remains in this low-resistance condition until it is mechanically disturbed and so it was customary to provide an automatic tapper to shake it back to the high resistance condition and prepare it for the reception of another pulse of voltage from the aerial.

It was suggested in Hülsmeyer's specification that in operation the whole apparatus would be rotated slowly in a stepwise manner by a clockwork or electric motor acting on cogwheel *q*. When a signal was received this gave an indication of the direction of the reflecting vessel. As a further convenience it was suggested that the officer who would be sitting in his cabin listening to the signals might be provided with a remote indication of the direction in which the transmitter was pointing at any time.

Fig. 2. *Basis of the coherer, which was used as a detector in the radar.*

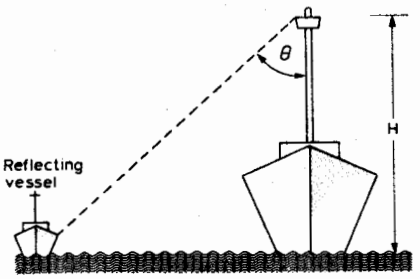


Fig. 3. *Trigonometrical principle of estimating the distance of a reflecting vessel. H is the height of the radar aerial.*

The apparatus described so far is only able to indicate the direction from which the signal is coming. In his second patent Hülsmeyer suggested making use of the fact that if the height *H* of the aerial is known together with the vertical angle θ (see Fig. 3) from which the reflections are arriving, then it is a matter of simple trigonometry to determine the distance of the reflecting vessel. Two devices are described in this patent, the first (shown in Fig. 4) being a simple modification of the previous apparatus. A horizontal rod *Q* is mounted on the screening plate *t*. A weight *G* can be moved along this rod, causing the whole transmitter to tilt in the gimbals. The transmission can then be beamed at any vertical angle θ and, if desired, the rod can be calibrated directly in terms of distance. It is not really clear from the patent whether the receiving aerial is also on tilt, or whether it is mounted separately. The weight is moved until the received signal is greatest and then the distance may be read off the rod directly.

The second modification is rather more complicated, and is shown in Fig. 5. Two lenses, *R* and *S*, are mounted in the transmitter tube. (There is nothing in the patent on how these lenses are constructed or on what material they are made of.) The tops of the lenses are connected to the threaded pieces *U* and *V* which project through a slot and engage with the threaded rod *V*. The bottoms of the lenses are connected by the bar *X*. Rod *Z* sliding in guide *Y* is connected to the centre of *X*. As the screw thread turns the lenses will be tilted but will still remain parallel to each other. The radiations, it is stated, will then be emitted at a vertical angle which may be varied. When the lenses are not required they may be parked in the position shown in dotted lines, presumably by pushing in the rod *Z*.

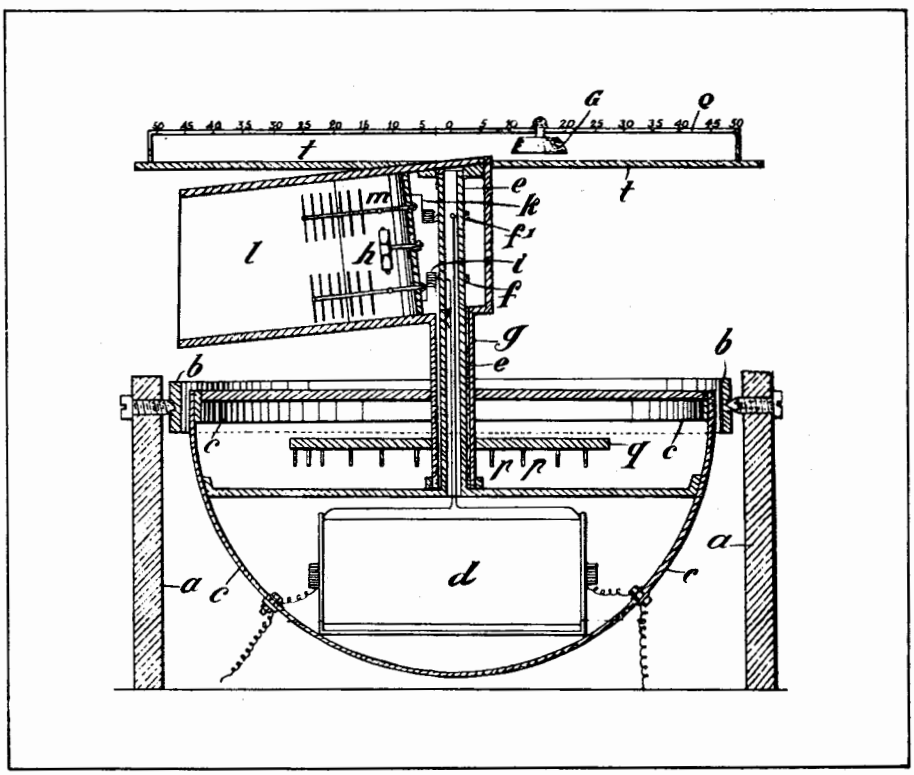


Fig. 4. *Hülsmeyer's first modification; to allow the transmission to be beamed at any vertical angle.*

The limitations imposed upon this invention by the technology of the day are very apparent here. Quite apart from the vagueness about the construction and action of the lenses in Fig. 5, how was one to determine the vertical angle of the maximum signal? The coherer was really only capable of giving a simple yes/no indication. Under carefully controlled laboratory conditions it was sometimes possible to obtain a quantitative measure of the strength of the signal from the resistance in the cohered state, but such an indication was far too unreliable to be of any use operationally in an environment such as that aboard ship. Many writers on the subject of coherers, the present author included[2], testify to the extreme sensitivity of the device to the slightest mechanical vibration. Some workers with them[3] were reduced to making their measurements at dead of night to avoid disturbance from people walking about the building. What hope was there aboard ship with the engines thumping away and the whole vessel bouncing up and down on the waves?

Again, how was one to ensure that the height *H* in Fig. 3 remained constant, since the ship would be moving vertically up and down on the swell in addition to the other motions which the gimbals attempted to counteract. Perhaps one ought not to be too pessimistic here when one remembers that in a thick fog the sea is often calm.

Anyhow, whether from indifference on the part of the maritime community or simply from the limitations of the technology, the idea never caught on and, if you will pardon the phrase in the circumstances, seemed simply to sink from sight. Let us acknowledge, however, that if the report in *The Electrical Magazine* is to be believed the device seems to have worked to some extent. It must, therefore, be counted as the first attempt to use the phenomenon of reflection in a practical way for purposes of navigation. One is tempted to say that it must also be considered as the first *pulsed* radar since the emission was in the form of short damped pulses of r.f. Perhaps this is overstating the case, though, as no attempt was made to time the arrival of reflections as in the subsequent development of radar proper. I wonder whether it is just possible that, seventy-odd years later, there might be someone who has some first-hand knowledge of these trials or might perhaps remember a colleague reminiscing about them?

As a footnote to this story it is perhaps of interest to mention that a patent was granted to John Logie Baird (none other) in 1928[4] for a method of "seeing in darkness by utilising radiation outside the visible spectrum". His proposal is illustrated in Fig. 6. Object 6 is "illuminated" by radiation from the spark transmitter 2. The scene is then viewed by one of his normal television scanning discs 8, a radio aerial 10 being substituted for the photo-cell used when

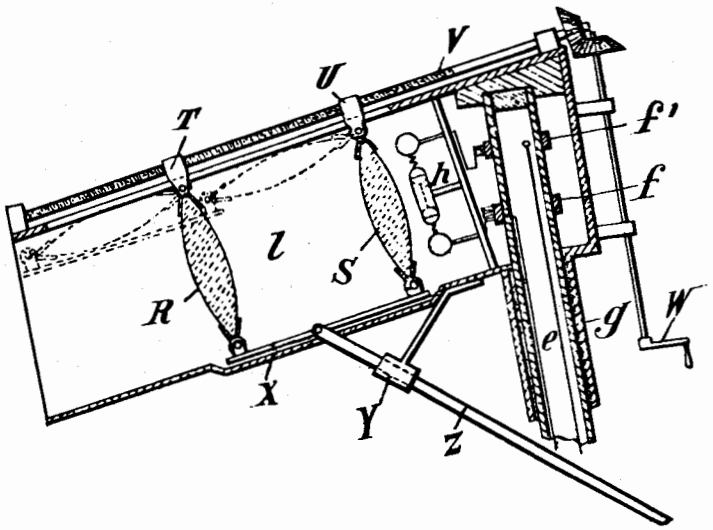


Fig. 5. *Second modification, for tilting lenses to vary the vertical angle of the transmission.*

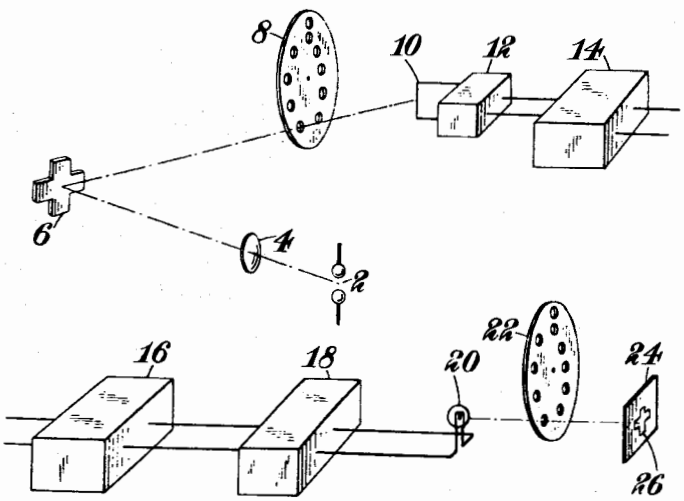


Fig. 6. *Baird's patented proposal for "seeing in darkness."*

illumination was by visible light. A detector 12 is followed by various amplifiers which vary the brightness of lamp 20. The disc 22 then reconstructs the image as in his television receiver.

Two further points are of interest here. The first is that Baird was also granted an almost identical patent[5] which proposed using infra-red radiation for illuminating the object. The second point is that the transmitter shown is a simple Hertzian spark gap, although by that time generators of continuous r.f. were readily available. It is difficult to see how a simple spark transmitter which essentially produced pulses of r.f. would be compatible with a continuously rotating scanning device.

In view of all the controversy which has recently surrounded the work of Baird one is very reluctant to stick one's neck out too far, but let me just say that I know of no practical demonstration of this apparatus having been given, and from the details in the patent I would be most surprised if it ever worked. □

Acknowledgement

The patent drawings are reproduced by permission of the Controller of Her Majesty's Stationery Office.

References

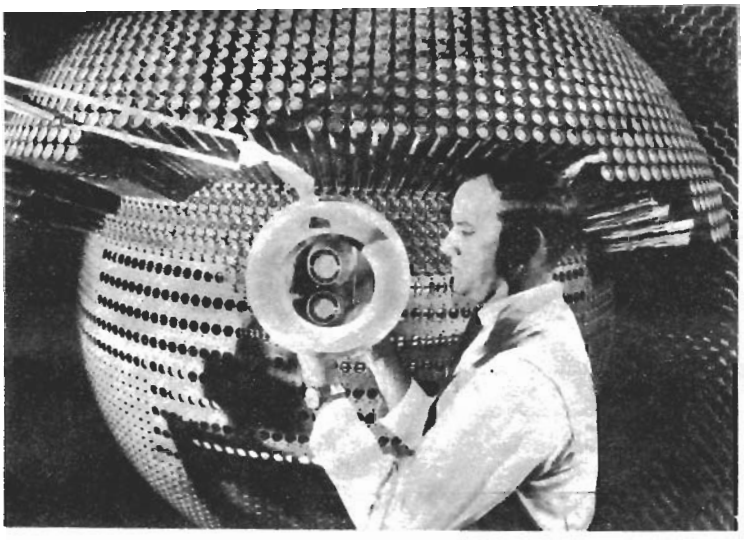
1. "The Telemobiloscope", *The Electrical Magazine* (London) vol.2, 1904, p.388.

2. Phillips, V. J., "Some filings-coherer experiments," I.E.E. Weekend meeting on the History of Electrical Engineering, Manchester, July 1975.

3. Taylor, A. H., "The coherer – a review," *Physical Review* (New York) vol.16 No. 4, April 1903, p.199.

4. British Patent No. 292,185.

5. British Patent No. 288,882.



CLEAN SWEEP . . . Radars break down frequently because motors and gears are hard pressed to turn antennas. Phased-array radars change all this by sweeping radar beams electronically. Hughes Aircraft now has a prototype of what may be the most powerful phased-array radar ever. Called ADAR and developed for the Air Force, it has hundreds of energy feeds which are adjusted with a high-power magnifying device.

Electronics in the News

Smile, Fellas! . . . This gal has a determined look, and determined she should be. She's at the controls of a color TV camera which, according to its manufacturer, Toshiba, is the smallest and lightest ever made. Weighing 10 lbs. and designed for CCTV, VTR and industrial TV applications, the 11 x 4 x 7-in. camera has a new optical system and control unit which permit a simplified design. Two pick-up tubes are used—one for luminance and one for color signals—which have been combined with control circuits that provide a standard NTSC signal. Just one cable connects camera's signal to TV receiver below.

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Pacesetting quality, performance and design. Features include: unique "Blend" control for continuously variable channel separation—from full monaural to full stereo, 4-position Selector, Mode, Loudness and Phase switches. Individual bias and balance controls. Harmonic distortion, less than 0.25%. IM distortion, less than .5%. Hum and noise 77db below full output.

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PROFESSIONAL STEREO CONTROL CENTER

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- "Null" Balancing System • Response 5-40,000 cps ± 1 db
- Bridge Control Provides Variable 3rd Channel Output
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Sensitivity 2.2 mv for 1 volt out. Dual low impedance "plate follower" outputs 1500 ohms. Less than .03% IM distortion; less than .1% harmonic distortion. Hum and noise 80 db below 2 volts.

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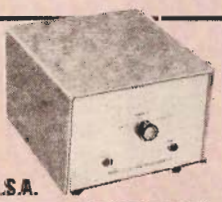

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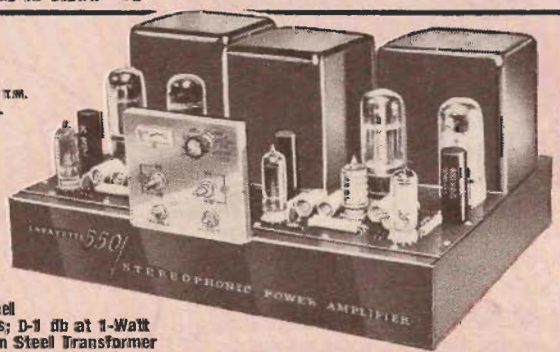
KT-550 Criterion™ 100-WATT BASIC STEREO AMPLIFIER



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- Rated at 50-Watts per Channel
- Response from 2-100,000 cps; 0-1 db at 1-Watt
- Massive Gain Oriented Silicon Steel Transformer
- Multiple Feedback Loop Design (over 50 db)
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SOLID-STATE TV CAMERAS

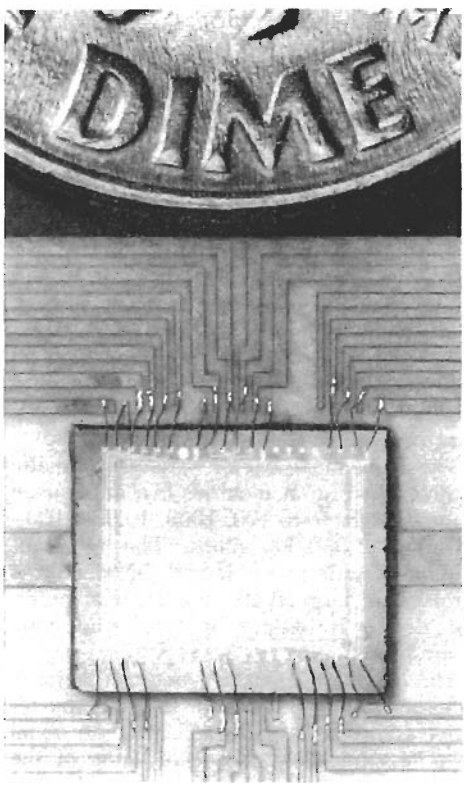
BELL LABS: In This Corner

ENGINEERS at Bell Laboratories have built an exploratory model of a new solid-state video camera that, like the RCA unit on the opposite page, consists essentially, of a flat chip of silicon covered with an insulating oxide over which is an array of metal electrodes. The image sensing system is a two-dimensional array of 128 by 106 light-sensitive cells. The active area of the device is 3 by 5 millimeters and the metal electrodes are nine micrometers wide, spaced two micrometers apart.

Like the RCA camera, Bell Labs' entry demonstrates an application of charge coupling, the semiconductor principle first announced by Bell Labs a couple of years ago. The Charge Coupled Device (CCD) operates by manipulating small packets of electrical charge within the solid slice of silicon. Light incident on the silicon is absorbed, creating an electrical charge which is stored locally at the surface of the silicon under the metal electrodes. The amount of stored charge is proportional to incident light flux. By varying the voltages on the surface electrodes, the charge is moved to an output electrode where it becomes an analog electrical signal representing light variations along the scanned line of the original picture.

Image on monitor at top is produced by solid-state video camera on workbench.

Chip of silicon covered with an array of metal electrodes is heart of camera.



Are Silicon Integrated Circuits

Mobile Teleprinter System for Law Enforcement

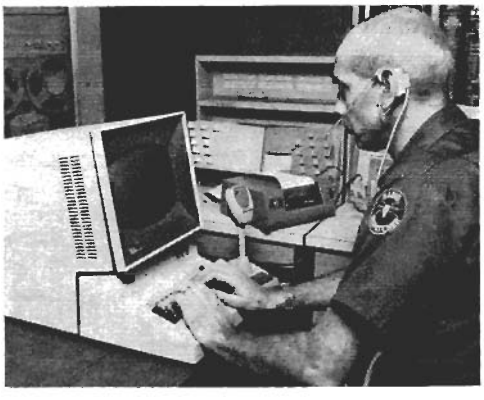
EARLY in December of last year, Sheriff Robert A. Bender of Allen County, Indiana, unveiled a unique mobile teleprinter system designed to provide a direct and automatic radio link between the patrolman in the vehicle and the regional, state, and federal crime information computer files. This first such system to be used in the U.S. employs Motorola teleprinters in ten patrol cars.

Officer in printer-equipped vehicle receives hard-copy response to query.

With the teleprinter system, officers in the printer-equipped vehicles would follow normal procedure in radioing the dispatcher for information on vehicle license numbers, wanted persons, etc. However, with the teleprinter on hand, the officers then receive a printed hard-copy response over a 2-way radio channel. Information requested is passed on directly and automatically from the Indiana regional crime information system computer in Fort Wayne to the patrol car.

Since teleprinter communications are transmitted in tone form, which can be decoded only by the printer system, all messages are completely secure. Consequently, if the dispatcher is alerted to a crime in progress, he can transmit this information to any and all vehicles equipped with the teleprinter without fear of unauthorized monitoring. Should an all-points bulletin or wanted persons' description be broadcast while an officer is away from his vehicle, the hard-copy message would await him on his return.

The printer system operates at a 100 word/minute rate to provide quickly and accurately any information required, even long descriptions and lists of detailed information. This means that the time between the request for and receipt of the information can be drastically reduced, making for more effective law enforcement. And to further reduce time, once the request is passed on to the information agencies, it is sent directly to the mobile teleprinter without having to go through the dispatcher.



Computer information retrieval and message switching are at headquarters.

When the system is finally completed, teleprinter-equipped patrol cars will have almost immediate access to the state criminal files in Indianapolis through the Indiana Data and Communications System as well as to the National Crime Information Center (the NCIC of TV law enforcement show fame) in Washington, D.C.

Serving as the Region II headquarters for the Indiana Criminal Justice Planning Agency, the Allen County communications network provides computer information retrieval and message switching functions for the law enforcement agencies in nine northeastern Indiana counties. ◈

OCT 1972

SPECIAL OF THE MONTH

Westinghouse 3" Panel Meter
Model NX35 0-500 Microamperes DC . . . ea. $4.95

PLATE TRANSFORMER BARGAIN

Made by Chicago Trans. Co. 3000-0-3000 Volts RMS, @ 300 Ma. Primary 115V., 60 Cy. Type FS. Full case. Pri. tapped to reduce Voltage to 2500 V. RMS. BRAND NEW, BOXED IN ORIGINAL CASES. A TERRIFIC VALUE AT.....$29.95 ea.

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Made by Pioneer. Input 6 VDC. Output 400 V. @ 175 Ma. Mounting bracket attached. Removed from equipment. All checked and guaranteed. This is your chance to get a small rugged Dynamotor at only.....Ea. $12.95

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0-10 Volts DC (1000 ohms/v)	"	6.95
0-1 Ma (KV Scale)	"	6.95
0-50 Ma DC	"	6.95
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100-0-100 Microamp	$5.95	100-0-100 Microamps	$7.95
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3	MFD—1500VDC	2.65	1	MFD—4000VDC	2.75
5	MFD—1500VDC	2.85	15	MFD—5000VDC	49.50
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10	MFD—1500VDC	3.75	3	MFD—8000VDC	24.95
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3	MFD—2000VDC	2.95	.001	MFD—50KV	14.95
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25 assorted 10 Watt	$1.95
25 assorted 20 Watt	2.50
50 assorted 5, 10, and 50 Watt	4.95

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10 Watts. From	1 Ohm	to	70K Ohms. Ea.	$ .15
20 Watts. From	4 Ohms	to	50K Ohms. Ea.	.20
25 Watts. From	1 Ohm	to	100K Ohms. Ea.	.30
50 Watts. From	3 Ohms	to	100K Ohms. Ea.	.40
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12 MMF	32KVDC. $10.95	250 VA	$33.65
50 MMF	32KVDC. 12.95	500 VA	48.65

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15V AC relay SPST 15 Amp contacts	1.75
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WHAT'S New in Radio

The products described in this column are for your convenience in keeping up-to-date on the new equipment being offered by manufacturers. For more complete information on any of these products, write direct to the company involved.

U.H.F. GRID DIP METER

Boonton Electronics Corp., Boonton, N. J. has announced a new u.h.f. grid dip meter, the Model 101B.

The instrument operates in the frequency range 300 to 1000 mc. in three steps. The frequency scale is approximately linear throughout the ranges which include 300-425 mc.; 425-650 mc.; and 650-1000 mc. employing three plug-in coils mounted externally on the u.h.f. probe, allowing ease of coupling to the circuits to be measured. The dial is individually calibrated to a frequency accuracy of ± 2%.

The instrument may be used to measure capacity, inductance, circuit *"Q"*, and choke resonance as well as functioning as an auxiliary signal generator, an absorption wavemeter, and

as a means of determining many other factors in u.h.f. circuitry.

Full details on the Model 101B are available from the company without charge.

CD RECEIVER

A small radio receiver which can be worn like a hearing aid has been developed by two engineers at *General Electric Company's* Syracuse plant.

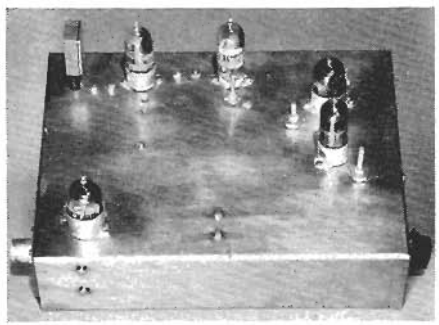
Designed primarily for civil defense applications where a compact, lightweight receiver operating from a minimum number of flashlight cells is required, the radio is tuned to a single broadcast frequency of 1240 kc.

The radio has a hearing-aid type earphone and weighs about five ounces. Further development work is being done before the radio is mass produced.

CONVERTER

Palisade Electronic Corp., 1025 Palisade Ave., Palisade, N. J. is now offering a new crystal-controlled converter, the UHF-C2.

The new unit tunes the frequency range 432-436 mc. and can be used with any receiver that covers from 11 to 15 mc. The chassis is of copper-plated steel and uses five tubes. A 6AJ4 is used as a tunable tuned-line r.f. amplifier, a 6AM4 is the mixer, a 6CB6 functions as the 11 to 15 mc. i.f. amplifier while two 6J6's are used as



the crystal oscillator and frequency multiplier. The input and output fittings are coax.

The approximate gain of the converter is 25 db and the noise figure is 7 db. Sensitivity is 2 microvolts. Bulletin UHF-4 covering this unit is available on request.

SINGLE-SIDEBAND FILTER

Burnell & Company, 45 Warburton Ave., Yonkers, N. Y. is currently marketing a single-sideband filter for amateur receivers.

Designated as the Type S-15000, the new filter utilizes a toroid coil instead of the crystal filters formerly required. The unit is compact in size and easy to install. Fixed-tuned and hermetically sealed, it requires no adjustment, is rugged and trouble-free. It may be installed in any existing amateur receiver and is also suitable for incorporation in new equipment.

Descriptive literature, including a schematic and response curve, is available from Dept. D of the company.

RADIATION DETECTOR

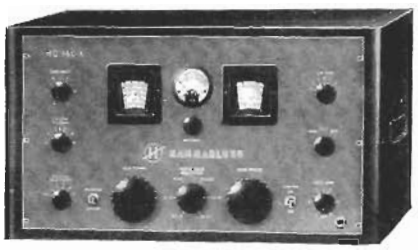
El-Tronics, Inc. of 5th & Noble Streets, Philadelphia, Pa. has recently introduced a radiological survey instrument, the "Rad-Tek."

Approved for use by the Federal Civil Defense Administration, the new

unit was built to FCDA's rigid specifications and requirements. It is a ruggedized ionization-type of instru-

1954

"He Wants To Keep In Touch With WALTER ASHE"



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Self-contained power supply, VFO, modulator, TVI suppressed, 160 through 10 meters, 75 watts input on CW.

In kit form at low price to be announced.

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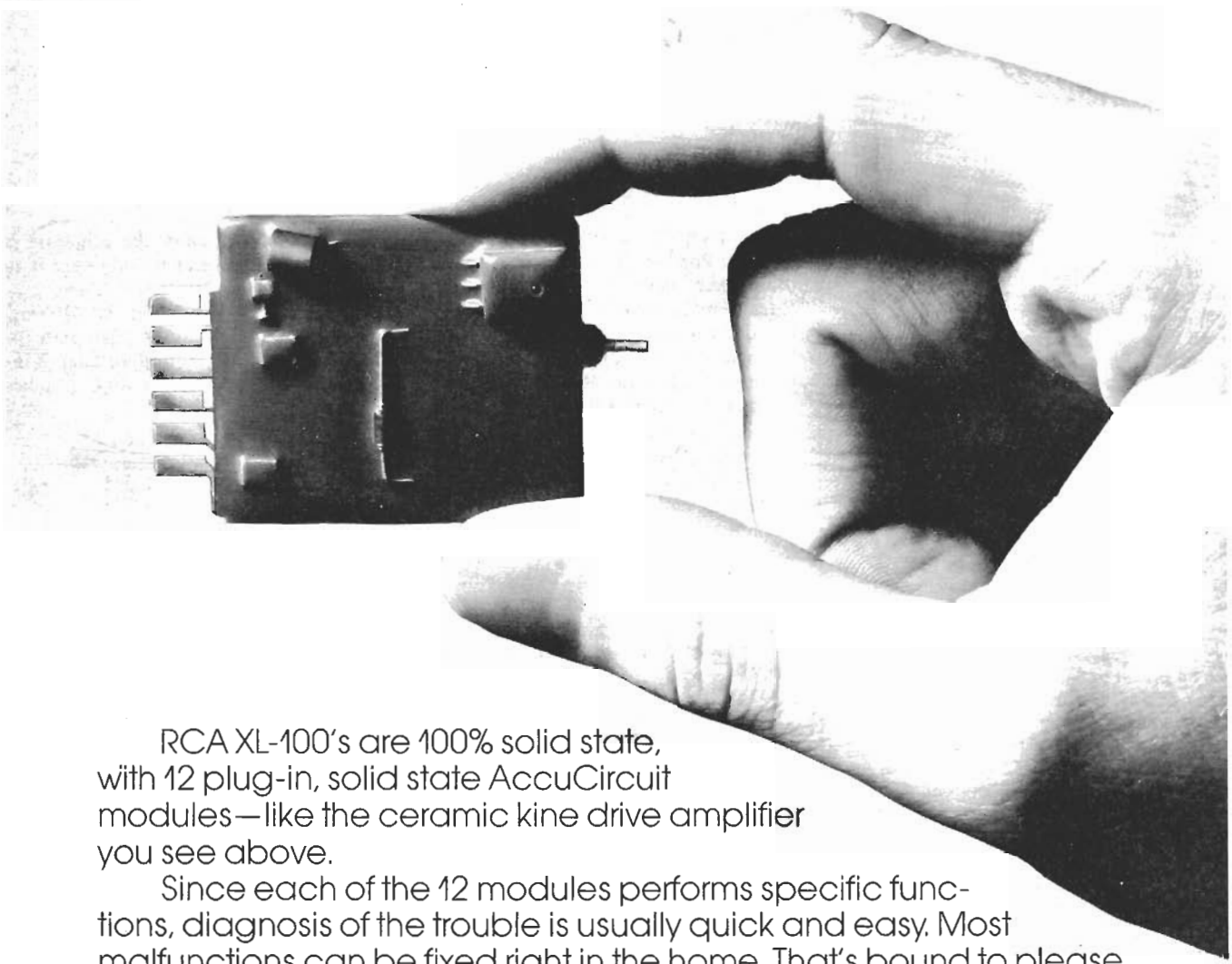
Why RCA XL-100's can be a quick fix:



RCA XL-100's are 100% solid state, with 12 plug-in, solid state AccuCircuit modules—like the ceramic kine drive amplifier you see above.

Since each of the 12 modules performs specific functions, diagnosis of the trouble is usually quick and easy. Most malfunctions can be fixed right in the home. That's bound to please your customer.

So when it comes to servicing RCA solid state color, XL-100's let you make more house calls—in a lot less time!

And you won't waste so much time hauling sets back and forth to the shop.

Something else: Whether you're servicing an XL-100 console, table model or portable, most modules are interchangeable, function for function. That will make your life easier, and you won't have to worry about stocking a large parts inventory.

RCA XL-100. It's already got a great reputation.

It could even add to yours.

RCA XL-100 100% Solid State AccuColor

Circle 11 on reader service card