COMMERCIAL RADIO

May 1934

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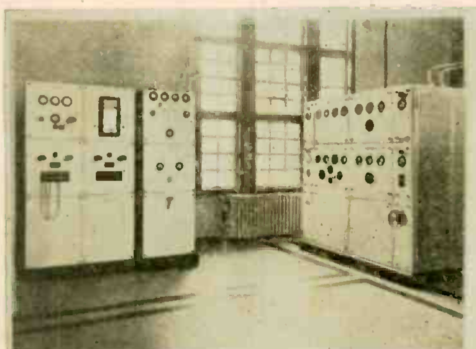

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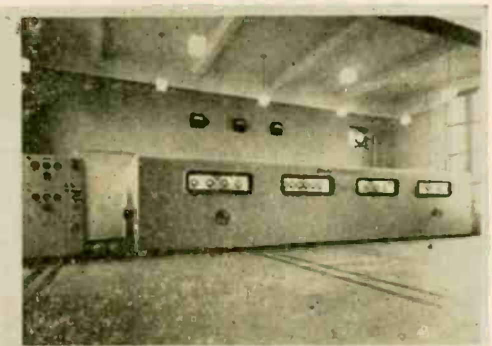

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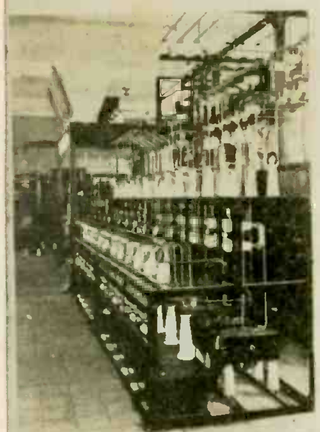

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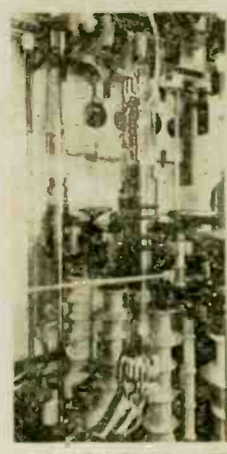

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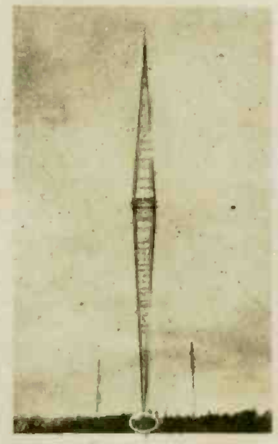

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A MONTHLY JOURNAL DEVOTED TO THE COMMERCIAL RADIO & ALLIED FIELD

PUBLICATION OFFICE.
NEW YORK
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VOLUME III NO. 9

COMMERCIAL RADIO

(FORMERLY "C-Q")

The Only Magazine in America Devoted Entirely to the Commercial Radio Man

Contents for May, 1934

THE disinclination of the "big fellows" in radio to wanting to be either regulated or controlled as recently shown in the matter of the telegraphist's code as shown by RCA, American Telephone and Telegraph, Western Union, and Postal; along with registered disagreement on the agitation for centralizing authority in one board is rather irritating to the Washington authorities.

Land station, point-to-point station, and other men affected by the code when it eventually comes out have been looking forward to some satisfactory agreement, so that like practically every other group they will have a working plan.

It is natural for big industry to not want to be interfered with by the government. Without a doubt regulations of every sort are disagreeable. But, in the face of what has gone, and what we all believe will come, it is doubtful if there is any point to gain by friction.

Perhaps when it is all settled and finished, it will be found that like taking medicine that is disagreeable; after all it is for the best.

JAMES J. DELANEY,
Editor

L. D. McGEADY,
Business Manager

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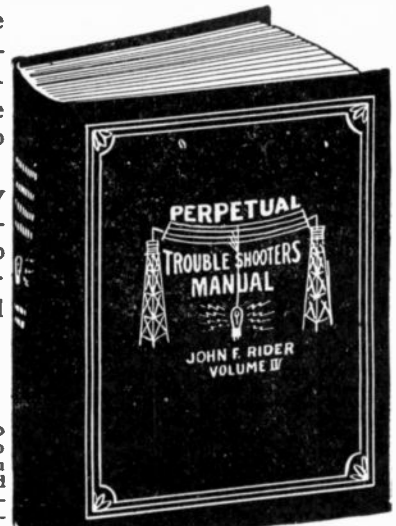

"I do not hesitate to say that Volume IV is the most important of all the manuals I have issued. Volumes I, II and III found their place in the servicing world as important aids to the service man . . .

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You will witness a new era in radio servicing during 1934 . . . and it is only the start of complex radio service problems . . . Research laboratories in contact with receiver manufacturers forecast increased science applied to radio receiver design . . . We are passing out of the three and four tube receiver stage—back into the 8, 10 and 12 tube stage with highly complicated electrical networks . . . Hourly use of radio service data will be imperative. . . ."

John F. Rider

No service man, or service organization, can operate effectively without Volume IV . . . Advances in radio receiver design have been so numerous within the past twelve months that no ordinary text is able to keep abreast of these new ideas . . . Volume IV, by including receivers as recent as February, 1934, affords you service data coverage on—dual oscillator systems—bucking bias voltages—automatic noise control—reflexed i-f and 2nd detectors—reflexed r-f, detector and a-f amplifiers—combination rectifier-power pentodes—electric coupled oscillators—single envelope multi-tubes—automatic noise gates and tuning indicators—compensated volume controls—continuously variable frequency compensation circuits—phase shifting tubes—voltage doubler rectifier circuits, etc.

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VOLUME III

1185 Pages, $7.50

This volume covers the period between middle 1932 and about June of 1933. It also includes some old receivers which were secured subsequent to the publication of Volumes I and II. Volume III also contains some point-to-point data and the world's only set catalog identifying about 8,000 models.

All of these manuals contain schematic wiring diagrams, socket layouts, chassis diagrams, voltage data, photographic views, resistor data, condenser data, electrical values, alignment notes, i-f peaks, trimmer location, continuity test and point-to-point data, etc., etc. All manuals are loose leaf bound in "instant-removal" type binder and contain cumulative index.

JOHN F. RIDER, Publisher

1440 Broadway NEW YORK CITY

THE BUDAPEST ANTI-FADING ANTENNA*

By F. HOLLAND, C. E. STRONG and F. C. McLEAN

THE most inmportant factor limiting the area over which a single broadcasting transmitter can establish a perfectly reliable service is at present the phenomenon of fading. The quality of reception is frequently impaired by fading at distances less than those at which a modern high power transmitter can establish the minimum signal strength required for excellent service. Fading is, therefore, a serious obstacle in the way of the utilisation to the best advantage of the limited number of wavelengths available for broadcasting services.

Fading is due to interference at the receiving point between the directly propagated wave and high angle waves which are reflected down again from ionized layers situated some distance above the surface of the earth. Improvements in antenna design directed to increasing the ratio of the horizontally propagated field to the high angle field offer the best means of mitigating the effect. One way of meeting this requirement to a very considerable extent is the use of a vertical antenna of such height that the natural wavelength is between two and three times the wavelength on which the antenna is to be operated. This means the use of structures of much greater height, compared to the working wavelength, than has been usual in the past, and a new technique in antenna construction becomes necessary if the advantages are to be realised on the longer wavelengths in the medium wave broadcasting band.

The conventional system, consisting of an antenna suspended between two steel towers, can no longer be satisfactorily employed even if the towers are insulated at the base, on account of reactions which arise from currents introduced in the towers causing distortion of the distribution of field strength in the horizontal plane and giving rise, under certain conditions, to an increase in the unwanted high angle radiation. The solution arrived at lies in the use of a single steel mast of special form, acting as the radiator (Fig. 1).

The longest wavelength for which an antenna of this type has so far been constructed is 549.5 metres, and the honour for the undertaking goes to Hungary. The antenna operates in conjunction with the new "Standard" 120 kW. transmitter at Lakihegy near Budapest. The mast is higher than the Eiffel Tower and is, therefore, the highest structure in Europe and the tallest mast in the world. It was constructed by the Hungarian State Steel Works to designs prepared by the Blaw-Knox Company, Limited, in co-operation with the Bell Telephone Laboratories, Inc.

The following is a general survey of the theory of operation, of the chief mechanical features, and of the observed results.

It has been shown by Ballantyne and others that for a given power fed into a vertical antenna the horizontal field increases with the height, up to a certain definite value, after which it decreases with further increase of height. The maximum occurs when the ratio of the working wavelength to the fundamental wavelength $\frac{\lambda}{\lambda_0} = .39$. As the fundamental wave length of a vertical radiator is approximately 4.4 times the height, it follows that the antenna height for maximum horizontal field is about .58 of the working wavelength. Thus for the Budapest station working on 5495 metres, a mast 318 metres high would have the optimum figure of merit. The height actually chosen is slightly less than this, namely, 307 metres, for reasons which will appear later.

The relative increase of horizontal field with mast height expressed in terms of the ratio of the working wavelength to the fundamental wavelength, $\frac{\lambda}{\lambda_0}$, is indicated in Fig. 2, which shows radiation diagrams in the vertical plane assuming perfectly conducting earth.

The high angle field, it will be observed, decreases with mast height until the antenna is half a wavelength long, that is

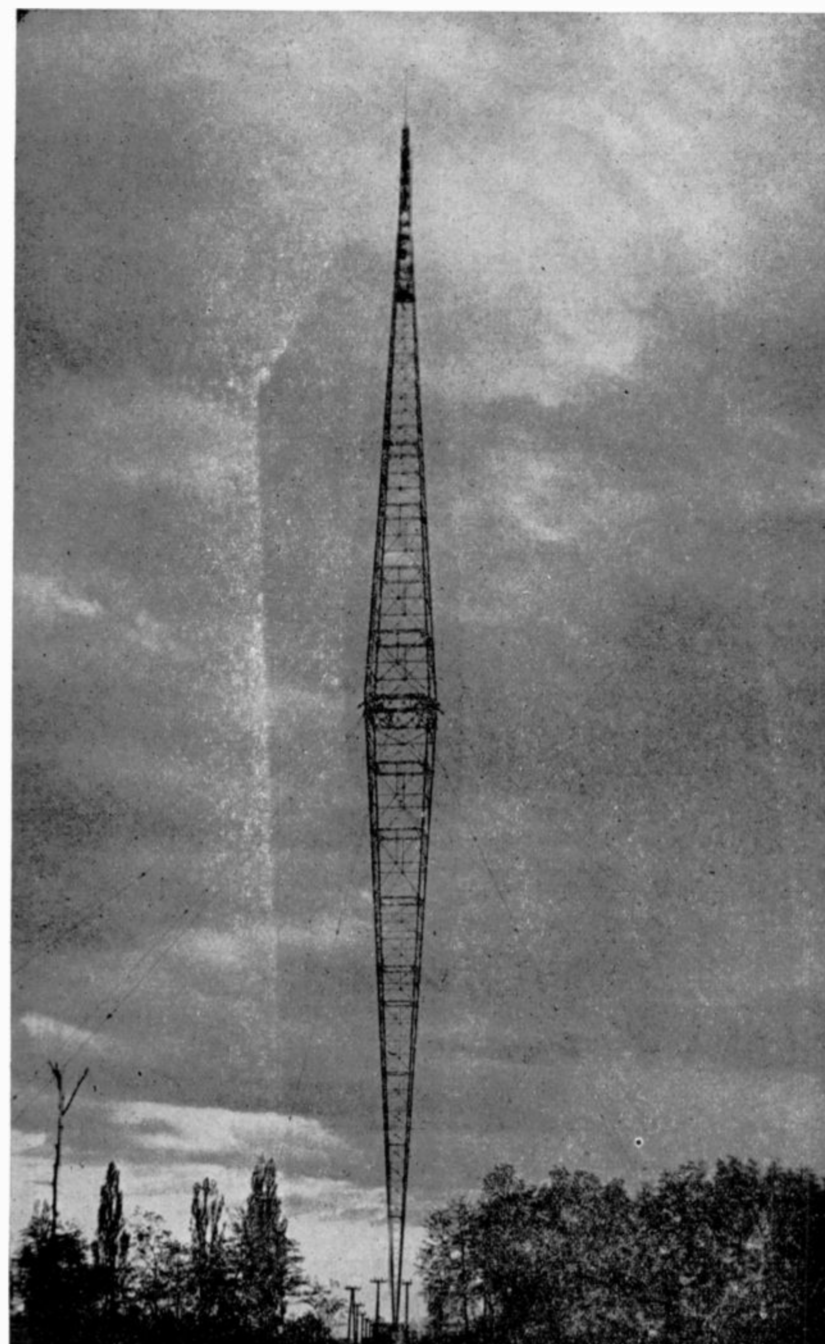

Figure 1—Anti-Fading Antenna at Lakihegy near Budapest Overall Height—307 m. (1005 ft.).

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*Reproduced by courtesy of "Electrical Communication" April, 1934.

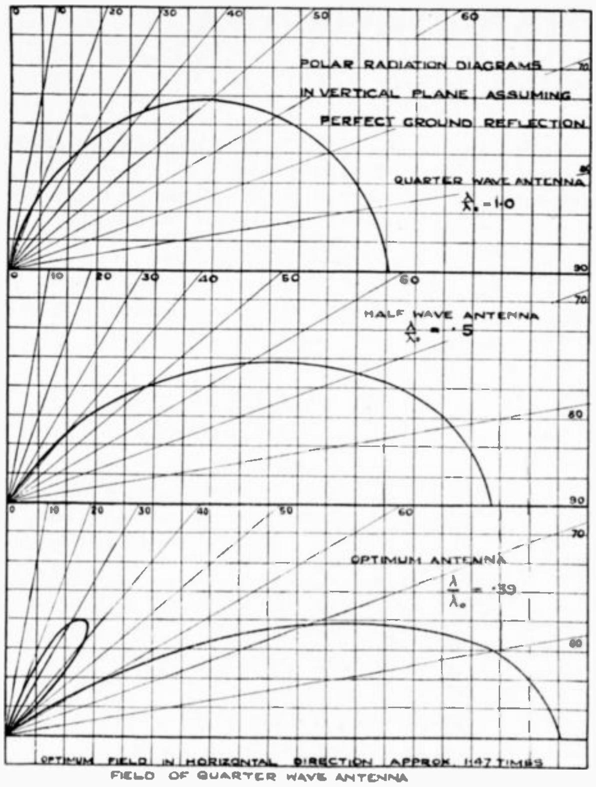

Figure 2—Field Strength Distribution Diagrams.

$\frac{\lambda}{\lambda_o}$ = .5. Increasing the height further, a secondary loop of high angle radiation occurs. Fig. 3 shows more precisely the variation of the horizontal and high angle fields with height of the antenna

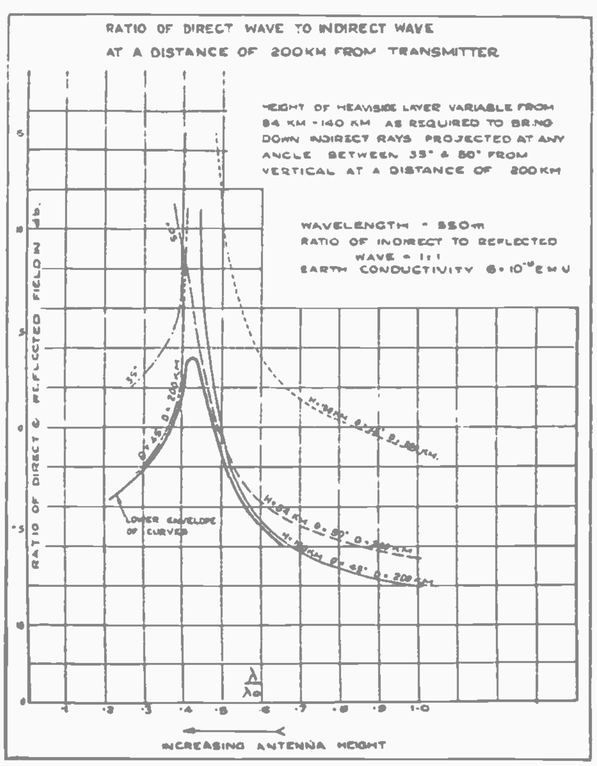

Figure 4—Variation of Ratio of Direct and Reflected Fields with Antenna Height.

expressed in terms of the ratio of the working wavelength to the fundamental wavelength of the structure, calculated for an assumed antenna loss resistance of 10 ohms and for perfect ground reflection. It will be observed from the upper curve that the hori-

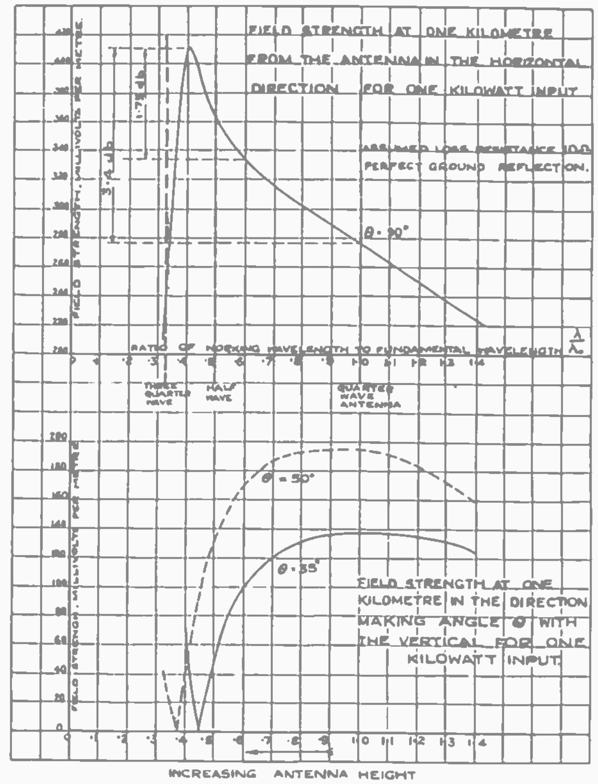

Figure 3—Horizontal and Inclined Radiation from Antenna.

zontal field reaches a maximum when $\frac{\lambda}{\lambda_o}$ = .39, and then the

(Continued on Page 25)

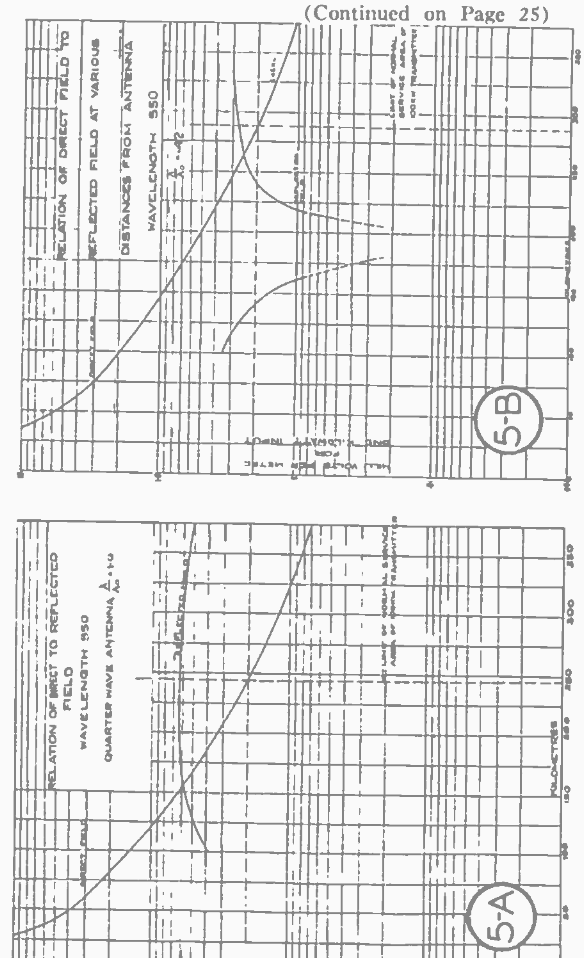

Figure 5—Values of Direct to Reflected Fields

PIONEER WIRELESS OPERATORS

By Dr. LEE De FOREST

While all the foregoing was transpiring on the Atlantic Coast, the Great Lakes and inland as far west as Kansas City and Colorado points, the Pacific Coast also had been active.

It was as early as 1902, I believe, that the English Marconi Company erected a few wireless stations on certain of the Hawaiian Islands for inter-island commercial traffic Not much information is available regarding the success or failure of these primitive Pacific installations.

The first commercial radio stations to be established on the Pacific Coast were located at San Pedro, Cal., and Avalon, Catalina Nsland. These were owned and operated by a Los Angeles newspaper, the primary purpose of which was the furnishing of news to a paper printed on Catalina Island and called "THE WIRELESS." This circuit also handled commercial traffic. A few years later these stations were taken over by the Pacific Wireless Telegraph Company, a stock-jobbing concern which finally was discontinued in 1908 or 1909, but before this latter date stations were erected in the Merchant's Exchange Building, San Francisco, and Goldberg Bowen Bldg. Oakland, between which points commercial traffic was carried on. Also, stations were erected on Queen Anne's hill, Seattle, Port Townsend and Victoria for the same purpose.

This company's culminating effort was the construction of what was to be a trans-Pacific station on top of Mt. Tamalpais in December, 1905. Huge wooden masts, 200 or 300 feet in height, were put up and an enormous open core induction coil built, which was to produce a spark several feet in length. As the tale goes, the coil's length was so great that in order to house it, it was necessary to provide holes in the walls of the building to allow ample space for the core! All of the transmitters of the Pacific Wireless Telegraph Company were of the untuned open spark gap type and their first detector consisted of a needle lightly touching a carbon disc. In the fall of 1906 an extraordinary wind storm caused the collapse of both poles, resulting in the discontinuance of the station.

In 1904 the United States Signal Corps erected stations at Nome and St. Michaels on opposite sides of Norton Sound, Bering Sea, thereby connecting Nome with the long signal corps telegraph line which ended at St. Michaels.

These pioneer Army stations in the far North were a source of great satisfaction not only to the Signal Corps but to the American De Forest engineers who designed and constructed that apparatus. Capt. Wildman, U. S. A. had been put in charge of this entire job, and I venture to say that no wireless equipment was ever subjected to more rigorous, severe, and uncompromising inspection and test than that Capt. Wildman supervised. The apparatus was first assembled and tested out for many months between Fts. Wadsworth and Hancock, N. Y. before it was finally accepted for shipment to Alaska. Two Signal Corps operators were thoroughly trained and then entrusted with the tough job of installing and operating in Nome and St. Michaels. There for the first time it was found necessary to use a counterpoise, of chicken netting, fastened on stakes above the frozen *tundra*; for actual conducting "ground" lay perhaps 75 feet beneath this perpetually frozen and non-conducting layer. Capt. Wildman whose wireless enthusiasm led him to immolate himself at Nome through the long dark winter, personally supervised this work.

Operator Seargant Applegate was his mainstay. So well were these first Alaska wireless stations manned and operated, so thoroughly had Capt. Wildman foreseen every possible contingency and provided every manner of replacement, that the service was maintained uninterruptedly for 18 months after its first initiation. Then occurred a brief suspension, sufficient to make all the white population of Alaska beyond the reach of the St. Michaels-Seattle cable realize how completely dependent they had become, for contact with the outside world, upon this still new miracle, "the wireless."

In the Spring of 1905 the American De Forest Wireless Telegraph Company established an office in the old Palace Hotel in San Francisco. For a transmitter, the old 60-cycle straight gap equipment was employed. In connection with their receiver, the operators utilized the "Walliston-wire" electrolytic detector. The call of the station was PH, after the Palace Hotel.

In 1906 the navy erected its first Pacific Coast radio station on the Farallon Islands, and soon afterward built others at Mare Island, Yerba Buena, North Head, Tatoosh, and Bremerton. These were equipped with the then well-known Massie Wireless Telegraph Company's apparatus. As there were no radio laws in those days, the owner of a commercial station would choose a call of his own liking. It would invariably be a two-letter call, because at that time there were plenty of them to go around. Mare Island's call was TG, Yerba Buena's TI, and Farallon Islands TH. About this time the U. S. S. Ohioan, equipped with similar apparatus, steamed out to sea for the purpose of conducting tests with the established government stations. This was the first Pacific Coast vessel to be equipped with radio.

During the great fire of 1906, both the "De Forest" and the "Pacific" companies' San Francisco stations were destroyed. The "Pacific" started immediately to rebuild, and the "De Forest" reincorporated under the name of the Occidental and Oriental Wireless Company. The latter obtained a new station site on Russian Hill, San Francisco, on a lot owned by the School Department. Upon completion this station was sold to the then newly organized United Wireless Telegraph Company, which operated it for some time under the original call, PH. The station was subsequently moved to Hillcrest, Daly City, and from there, after the Marconi Company took over the interests of the company, to its present location at Bolinas, Calif., where it is now known as KPH and is owned by the Radio Corporation of America. Needless to say, there is no part of the original equipment at the present location only the call letters. Timothy Furlong acted as first operator for both the Palace Hotel station and the United station on Russian Hill. J. O. Watkins relieved Mr. Furlong when he was assigned to the Standard Oil barge No. 3. Barge No. 3 was the first commercial vessel to be equipped on the coast. L. Malarin, until recently Pacific Coast sales manager for the Radio Corporation of America, was one of the early operators at the Russian Hill Station.

Altho the earthquake and fire put old "P. H." on the Palace Hotel out of business before it could be of service during that frightful cataclysm, our station at San Diego arose to the occasion, to first notify the U. S. war vessels in Pacific waters of what tragedy was transpiring at San Francisco. Witness this appreciative letter from Rear Admiral Goodrich:

United States Pacific Squadron, Flagship Chicago
San Francisco, Calif.

May 2, 1906

J. A. Stillman,
Am. De Forest Wireless Telegraph Co.,
San Diego, Calif.
Dear Sir:

There is no doubt in the world that the promptness with which I was able to hear the news while at sea on the 18th of April of the disaster at San Francisco was due to the existence and activity of the wireless stations of which you are in charge.

I shall take pleasure in mentioning this circumstance in my report on the affair to the Navy Department.

Yours very truly,
C. F. Goodrich,
Rear Admiral U. S. N.
Commander in Chief—Pacific Squadron

And while on this theme of pioneer wireless on the Pacific Coast I may as well jump ahead one year, to cite an additional interesting episode recounted by Bernard Linden, now Supervisor of Sixth U. S. Radio District, regarding a radio pioneer operator who first came to me for a job back in the days of the little glass pent-house wireless station on top of 17 State St., New York.

In February 1907, A. A. Isbell, until a year or two ago Pacific Coast division manager of the Radio Corporation of America, a position now held by G. Harold Porter, equipped the then new steamship President, now named Dorothy Alexander, at Camden, N. J., with a three KW Massie set, in the receiver of which was used a Fessenden electrolytic detector. The transmitter was of the open spark-gap type with a conductively coupled antenna working on a wave-length of 900 meters. (The wave-length and power to be employed by a station in those pre-law days were optional with the owner of the station.) Mr. Isbell arrived on this vessel at San Francisco 49 days later, coming via the Straits of Magellan. This vessel was the first one of the merchant marine in the Pacific to have radio and Mr. Isbell was the first commercial marine radio operator. This vessel and the same operator had similar honors in the same year when the vessel entered the Bering Sea enroute to Nome. The station made some extraordinary records for those days. After leaving the Delaware Capes it kept in touch with the Brooklyn Navy Yard station for 2,000 miles; picked up the naval radio station at Point Loma when 1,000 miles south of that point, and when going to Nome constant communication was maintained with the naval radio station at North Head until the vessel passed through Unimak Pass. Quite naturally these achievements attracted a great deal of attention and much publicity was rightfully received. Incidentally, Bernard Linden was himself an operator on the S. S. President in the early days of radio.

But the most interesting commercial working of wireless on the Pacific Coast, prior to the later installations of the Federal Wireless Telegraph Co., were through the stations already mentioned, at Catalina Island and on the mainland at San Pedro, covering a distance of some 22 miles. These two were a success from the start and, by enabling the publication of a daily newspaper in the village of Avalon, aroused more wide-spread interest in the future value of wireless for commercial ends than could a score of shore-to-ship stations.

The sustained success of this enterprise was, I believe, chiefly due to the enthusiasm and skill of our first Los Angeles operator, H. L. Bleakley, whose uncanny swiftness at the key, Robert Marriot had described to me in Denver in 1905, where I first met Bleakley in a crude shack at the base of that tall smelter chimney.

For further interesting details of later operations along the Pacific Coast I shall return in a subsequent chapter of my narrative.

During the year 1905 the success of our American Wireless had become so well authenticated abroad—what with the 1904 work in the China Sea for the London Times, the earlier demonstrations for the G. P. O. across the Irish Channel, Holyhead to Howth, and now the increasing number of vessels reaching England equipped with the yankee apparatus—that a group of London financiers headed by Lord Armstrong was persuaded to attempt to introduce the system directly into Great Britain.

Accordingly "Mac" Horton as chief operator, Harry Brown as his assistant and George Barbour, as erecting engineer, were exported, and domiciled in dreary London.

This situation appealed strongly to me as affording a possible opportunity for trying out the long-distance capabilities of 45 KW D. F. at Manhattan Beach. Consequently a nightly transmitting schedule covering some weeks in advance was mapped out, and intrusted for faithful fulfillment to the hands of "Driver" Harris. Then I set sail in February 1906 on the old "Lucania" once more for London.

It was decided at the last moment not to carry the Audion receiver with me, but to leave this with Babcock at 42 Broadway, for further research and possible improvement. I had abundant reason later on to regret this decision.

Aural Radio Range Signals Shown Visually by New Device Developed by Commerce Department Engineers

A DEVICE which visually interprets the signals of aeronautical radio range beacons which are received through headphones and are relied upon by airmen for directional guidance under conditions of poor visibility, has been developed by W. E. Jackson and L. M. Harding, radio engineers of the Aeronautics Branch, Department of Commerce, it was announced today by Rex Martin, Assistant Director of Aeronautics in charge of air navigation.

"The device includes an indicator which fits into the instrument panel," Mr. Martin explained. "It is similar to that developed for use with the Department's experimental radio system for blind landings and can still be used for this purpose if desired. It has an open face with two needles, one vertical and the other horizontal. The vertical needle is the chief indicator. If the aircraft moves off the course defined by the radio beacon, this needle moves accordingly in the same direction. If the plane is exactly on course, this pointer remains in the center of the dial. The horizontal indicator shows the volume of the received signals which can be adjusted by the pilot.

"In addition to the indicating instrument there is a small converting set which is attached to the aircraft's regular radio receiver. This set fits into a small box 6 inches long by 7 inches wide and 7 inches deep. No changes are necessary in the regular receiving set.

"When the signals are received they are passed into the converting box and changed into impulses which actuate the visual instrument in front of the pilot. The signals may be received through the headphones simultaneously, thus giving visual or aural indication as the pilot desires.

"If the headphones are used, however, the pilot will hear a predominant dot or dash when off course, depending upon the direction, instead of the familiar Morse code A (. -) or N (- .). It is necessary to change the character of the signals transmitted by the radio range beacons in order for the visual indicator to function. The airman would still hear a steady signal when on course.

"One of the chief advantages of the new device is that it requires only a slight and inexpensive change in cams at the radio range transmitters.

"The general problem of making radio range signals available to airmen in a visual form has been before the Department of Commerce for several years. One of the first solutions considered was that of installing visual type transmitters at radio range stations which would actuate two vibrating reeds on aircraft instrument panels. However, this method would have cost about $500,000 for the entire airways as against less than $500 for the system just developed.

"The arrangement developed by the two radio engineers has undergone extensive flight tests which have shown it to be satisfactory. However, no definite plans to place the new system in operation on the Federal Airways will be made until it has been given practical service tests by those airmen who fly the airways regularly, and not then unless these expert users of the aids to air navigation signify their wishes for the new device."

Mr. Jackson anad Mr. Harding have been working on the development of this arrangement for several months.

Proposed "Master" Shipping Industry Code

(Continued from Page 33)

law to be divided into watches may be worked for eight (8) hours in any twenty-four (24) hour period. They shall not be required to perform any work at sea when off watch except such work as is necessary for the safety of the vessel, passengers, crew or cargo.

Eight (8) hours shall constitute the maximum work day in port for the deck and engine departments.

No overtime shall be paid in any department except as may be provided for in any Division or Subdivision Code.

Workaways shall not be carried to the exclusion of members of the crew.

Attack on Radio and Cable Rates

An attack on the rates of cable and radio were laid before the Interstate Commerce Commission recently by Mr. G. M. P. Murphy, on behalf of Radio and Cable Users Protective Committee.

Directing his charges at RCA Communications, Inc., the Western Union Telegraph Company, French Telegraph Company, and Commercial Cable Company, Mr. Murphy stated:

"I have reluctantly but definitely come to the conclusion that the methods of these companies in dealing with their customers has become so arrogant and unreasonable that the only hope of fair treatment for those whom I represent lies in effective government regulation of the nature to which other utilities in interstate commerce are generally subject."

Telegraphists' Code

It seems assured that the Government will write its own telegraphists' code. With Western Union and Postal unable to agree, although trying to do so for several months and RCA and American Telephone claiming exemption from this field, Administrator Hugh S. Johnson has practically given up hope of the group getting together on anything.

If this happens, it will be the first time that an industry has failed to get together on some sort of code, compelling the government to write one for it.

Correction

In the article "The Control vs. Plate Current," published in the April issue, the lines: "Although in various classes of present day amplifiers in use *a positive bias is applied to the Control Grid*" the noted words should have read "the Control Grid is subjected to positive excitation swings."

BRITISH EMPIRE BROADCASTING*

By C. M. BENHAM and P. H. SPAGNOLETTI

THE provision of a broadcast service from the home country to the distant regions of the Empire has for some years past confronted the British Broadcasting Corporation with a problem of ever increasing urgency and great technical complexity. Now this undertaking, surely one of the most ambitious yet attempted in broadcasting, has at last been successfully brought into practical operation.

Progress is never steady but is marked with periods of obvious achievement and periods of apparent stagnation. It is, however, in these periods during which no creative work is evident, that the way to future attainments is paved. Over eight years ago the long distance radio telephone service opened a new era in world communication. Since then, expansion of this service has taken place, until now practically every country in the world is in telephonic communication with every other. The period occupied by this expansion may have appeared to many as one of technical stagnation, but in reality, by allowing the accumulation of data relating to short-wave propagation, it has made possible the new Empire service.

It is no exaggeration to say that the entire engineering of the Empire Broadcasting Station has revolved 'round the question of wavelengths.

Long - distance radio communication is practical, except in special cases, only when short wavelengths are used, and the Empire equipment must, therefore, be of the short-wave type. Fortunately, the colonies and dominions of the British Empire are so distributed longitudinally as to be conveniently divided into time zones, i. e., areas which have approximately the same local time. This will lead naturally to four main zones:

Zone.	Time displacement from London.
Australia	8 hours early
India	4 hours early
Africa	0
Canada	6 hours late

The result of such a division is that each zone may be treated separately and the best conditions obtained for the individual areas; Empire broadcasting thus becoming a question of transmission to areas as opposed to non-directive transmission or general broadcasting. This zonal division has the advantage that radiation may be concentrated over the desired area, giving a gain in field strength received. Furthermore, different wavelengths may be used for the various zones. This last point is of great importance and dominates the whole scheme (Fig. 1).

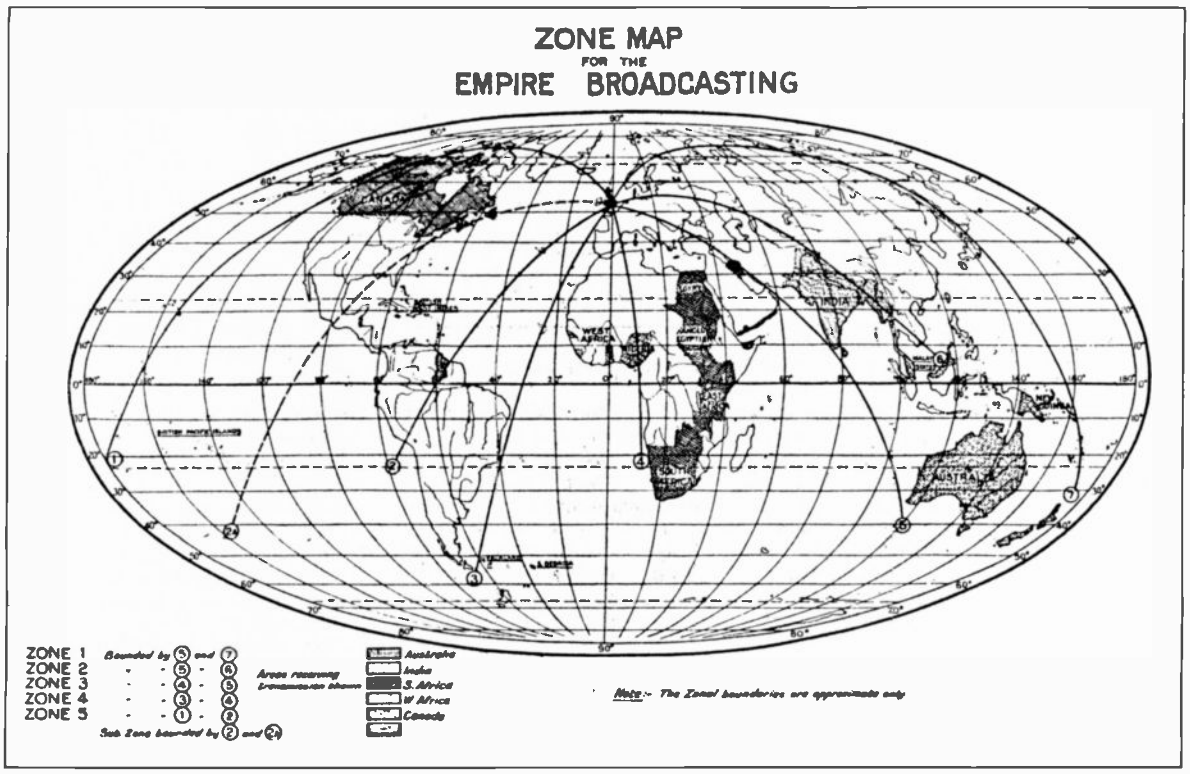

Figure 1—Zone Map.

Considering the first of the four zones given above—Australia—this is the farthest away of all, and the transmission must travel through twilight conditions whichever path around the world is used. It will not be expected, therefore, that wavelengths of 15 metres, using the daylight path, or 37 metres using the dark path, will give reliable service; both may be used for short periods, but their useful duration is limited and uncertain. The twilight band (25-29 metres) has been found to give the most reliable service, using either the dark or daylight path as conditions demand.

The second zone—India—presents a different problem. During the day 17-metre transmissions have been found to be very satisfactory, although the useful period of this wavelength is much curtailed in winter due to the lower ionisation in the upper layers. Towards dusk, and for a period varying with the time of the year, this zone may be served by a wavelength in the neighborhood of 25 metres, being followed approximately two hours later by the regular night wave of about 32 metres.

In the case of the third zone—Africa—the problem is very similar to the preceding one. These territories lie almost due south and during the day shorter wavelengths may be used with excellent results. The twilight conditions demanding intermediate wavelengths last for a comparatively brief period before the regular night waves of 32 metres, or even longer, become operative. The British territories in this zone vary enormously in distance from England, and for the nearer areas it will be advisable to utilize a longer wavelength. A further complication in the case of Africa is the question of interference from atmospherics and this has resulted in using shorter wavelengths (25 metres) which, although they give lower field strength at night, have a higher field strength to noise level ratio. If Africa is treated as a whole, the angles subtended by the farthest east and farthest west points will prevent any useful concentration of radiation, and for this reason Africa is best divided into two zones.

*Reproduced by courtesy of "Electrical Communication" April 1, 1934.

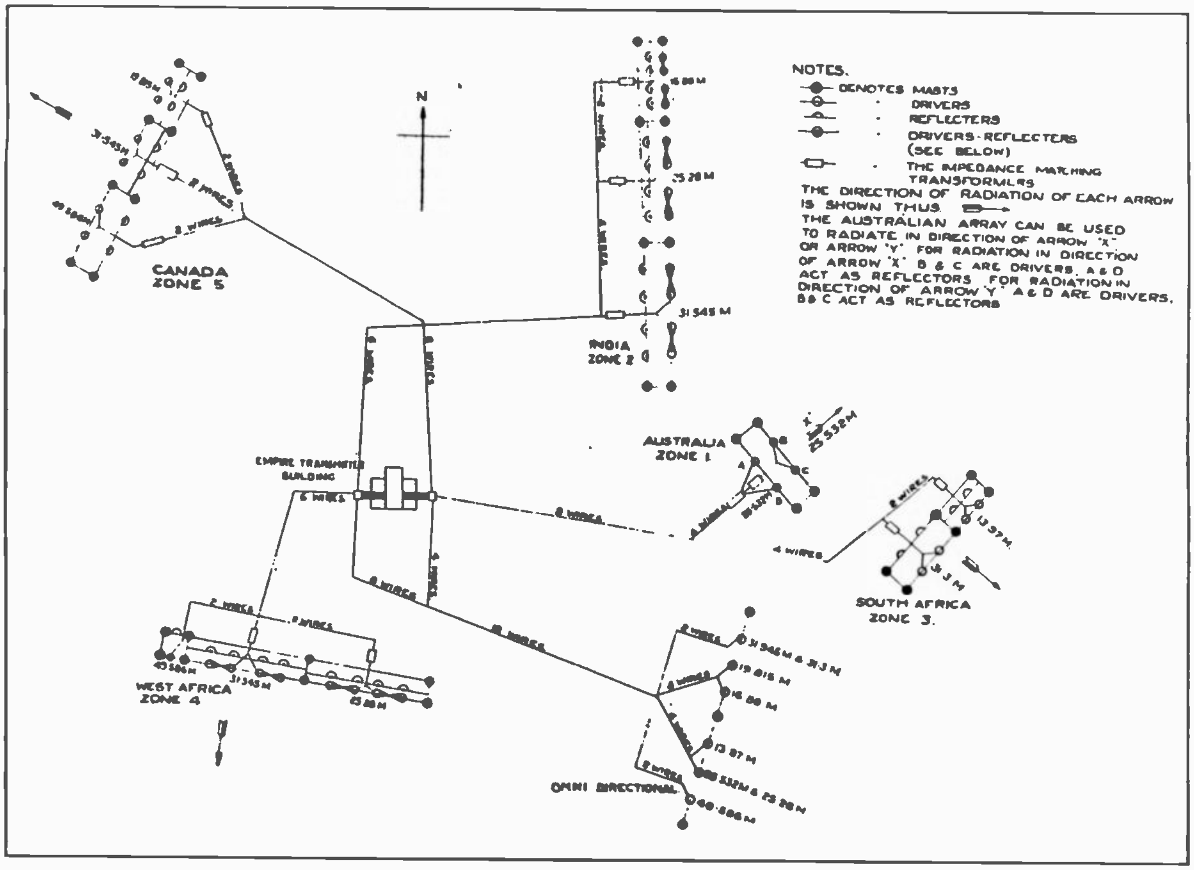

Figure 2—Diagram—Empire Station Aerials and Transmission Lines.

The position of the dividing line is based on the fact that the Cape and surrounding area require shorter wavelengths for day transmissions, while the western area, being closer to England, may be more advantageously served on the longer bands.

The last big group of British territories includes Canada. The great circle path to Canada passes very near to the North Pole and even in summer we cannot call this a true daylight path. All wavelengths, therefore, will be higher than normal for distances of this order. Particularly will this be the case for the next two or three years, as we have been in a period of minimum sun spot activity. A satisfactory day wave for Canada would be of the order of 19 metres, and night waves of 31, 50 and even as high as 70 or 80 metres may be used. Naturally we should expect that on this circuit, which is entirely confined to the Northern Hemisphere, conditions would be more affected by seasonal variations than would be the case with circuits which are equally in both hemispheres, such as the South African circuit.

Before considering the transmitting apparatus, it is convenient to examine the aerial arrays used in the fulfillment of the zone scheme outlined above. These arrays are divided into five blocks, one for each zone, distributed 'round the transmitter building (Fig. 2) The site being high, the ground falling away on all sides, an "unopposed view" is obtained by every array of at least ten miles—considerably reducing ground and obstacle absorption.

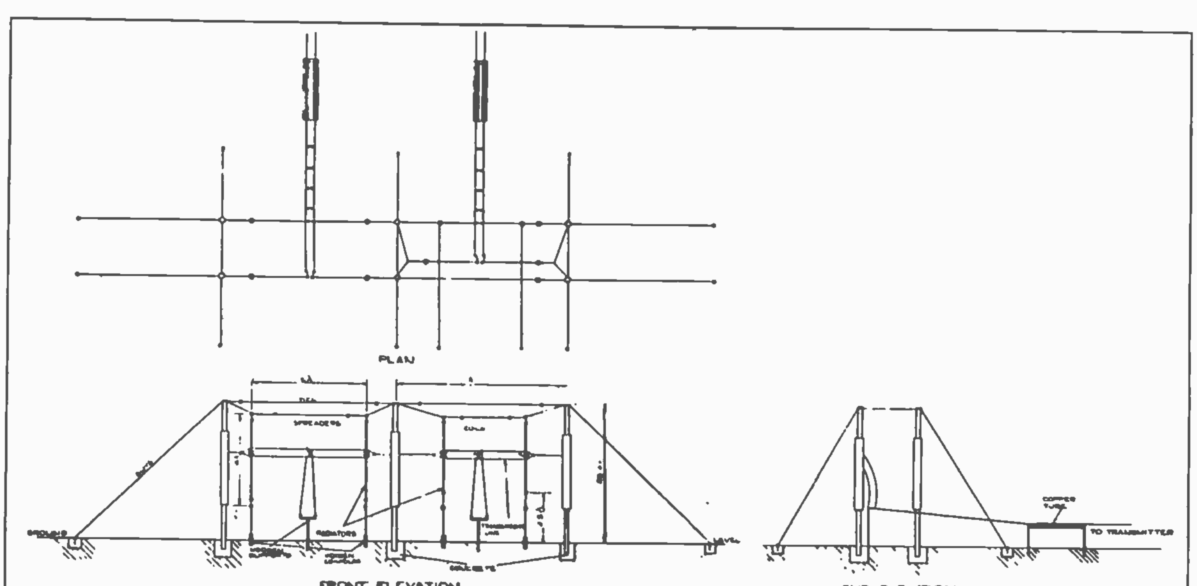

Figure 3—Diagram—Simple Directive Transmitting Antenna for Empire Broadcasters, Showing Two Element Structure.

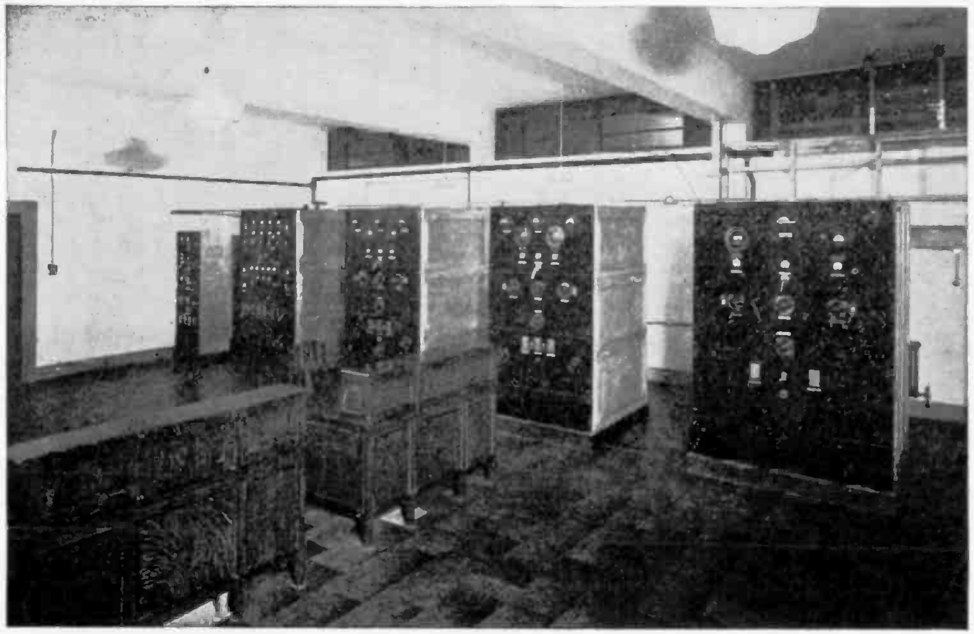

Figure 4—View of One Transmitter Showing the Five Radio Units and the Control Desks in the Foreground.

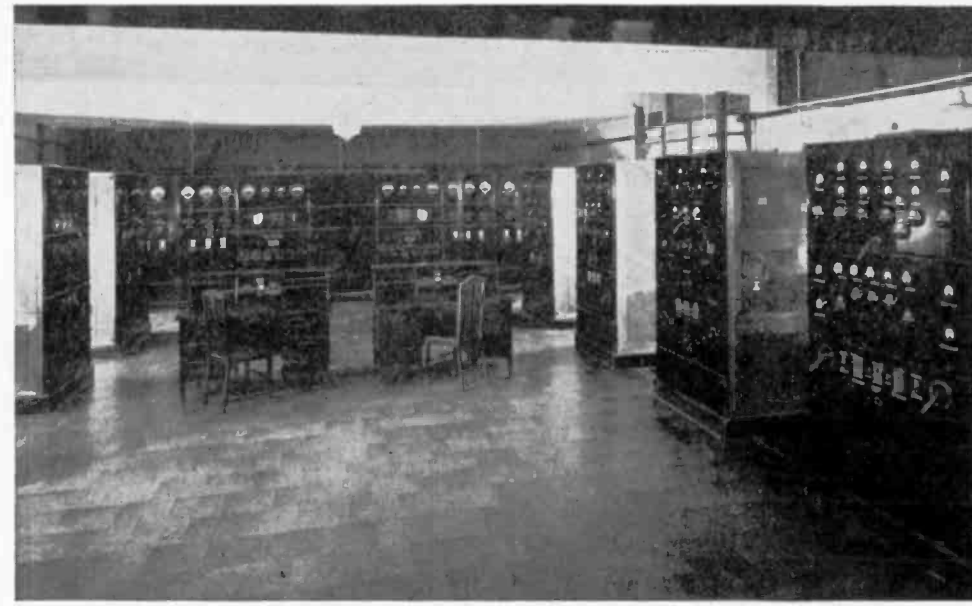

Figure 5—Transmitter Hall Showing Twin Transmitters on Either Side and Power Control Board at End.

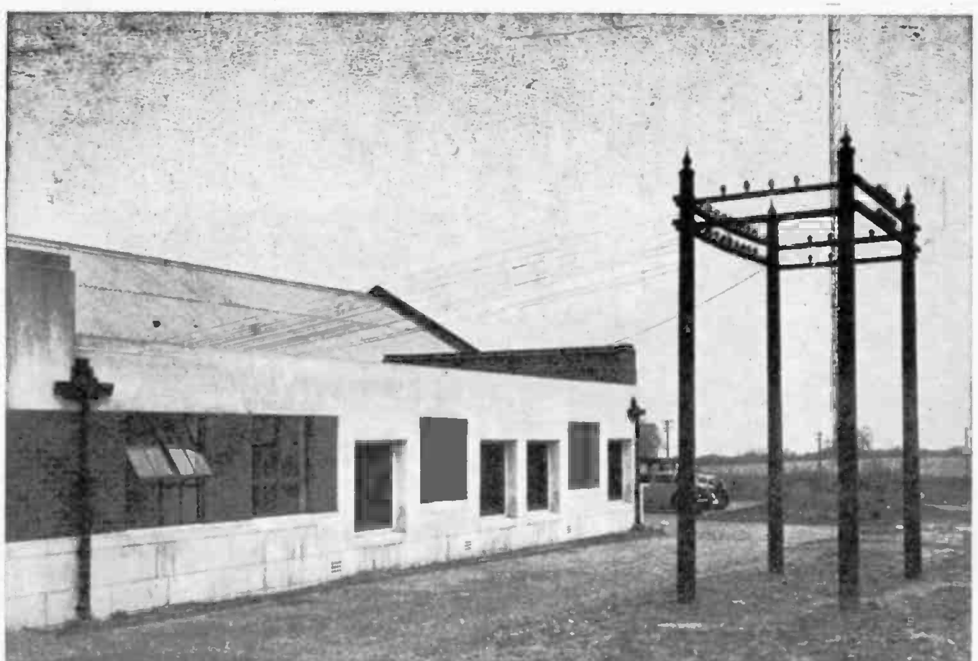

Figure 6—Distribution of Framework for Transmission Lines.

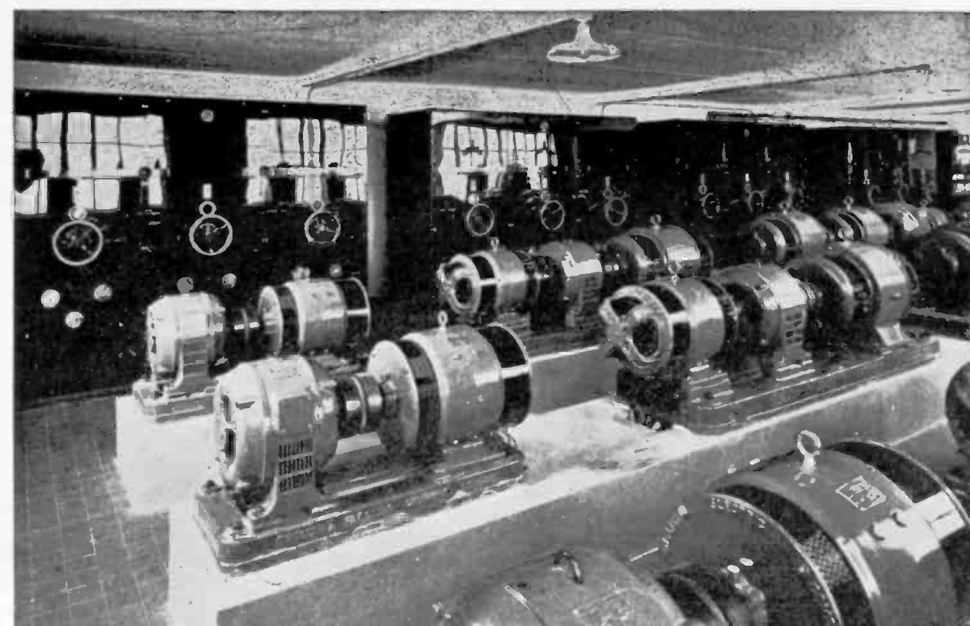

Figure 7—Motor Generator Sets with Starters in Background.

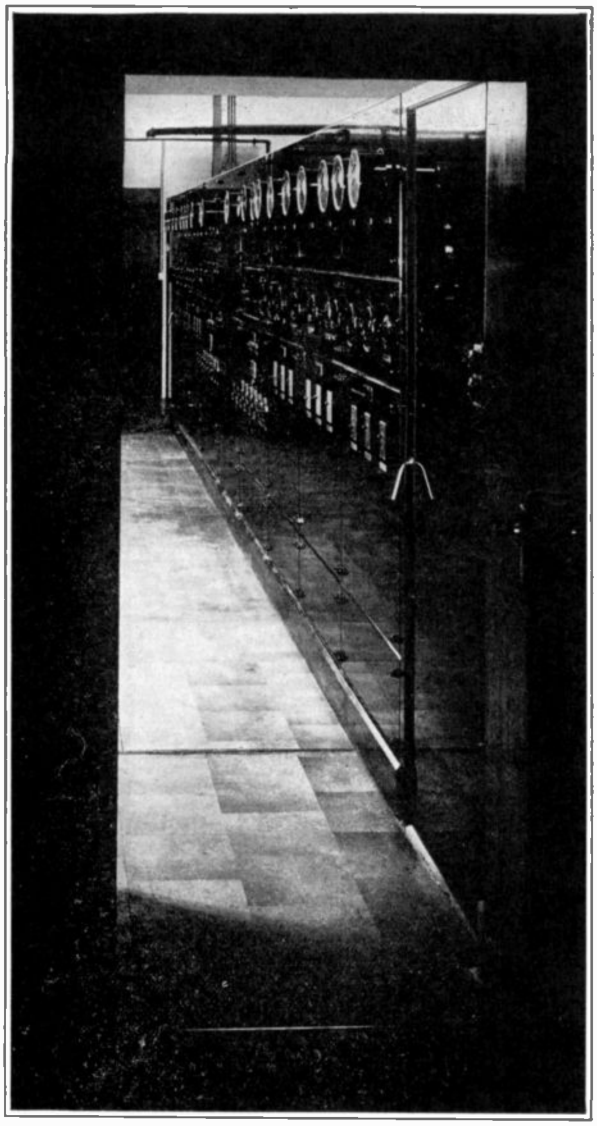

Figure 8—The Main Control Board Centralising the Control of All Apparatus in the Building.

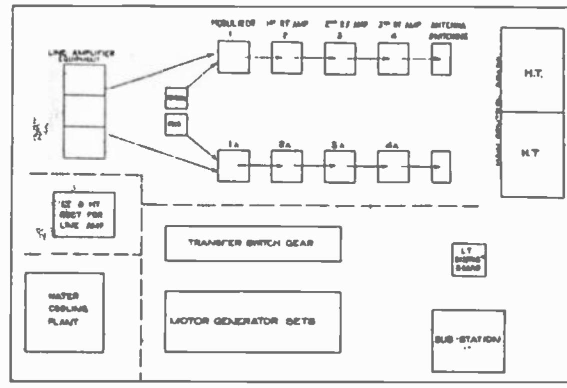

Figure 9—Block Schematic of Twin Empire Broadcasters.

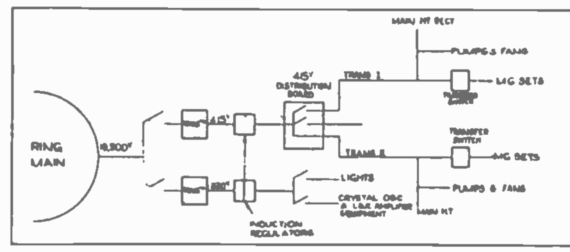

Figure 10—Distribution of Power Supplies on Empire Station.

The individual blocks are simple both in character and structure. They are best visualized with reference to the simplified drawing reproduced in Fig. 3. Vertical dipoles and reflectors are used, the number of elements depending on the aperture of the beam required. The type of mast employed for supporting these aerial arrays was determined by two factors—economy, since the scheme was to a great extent experimental, and the elimination of unnecessary stay wires. The masts taper at both ends and require to be stayed only at the top. All the essential stays and flying stays, the number of which has been reduced to a minimum, have been broken up by insulators to reduce the possibility of resonance.

We have now outlined the main considerations involved in transmission to the colonies, from which it will be possible to envisage the type of apparatus required for the transmitters. Due to the desirability of giving programs to the zones on alternative wavelengths (we are not able to select the optimum wavelength for each day as in commercial radio telephony), two transmitters are necessary with facilities for complete interchangeability between these and all the ærial arrays. The transmitters themselves must be capable of working over the band from 13 to approximately 50 metres, and must have arrangements for quick wave changing on any of the broadcast allocations in this band.

Figs. 4 to 8 show views of the Empire Broadcasting Station.

Radio Transmitters.

The two radio transmitters are housed in a single building containing all the apparatus for generating a high frequency carrier and modulating this with speech or music. The station is operated, as will be shown later, from a ring main and, in view of the reliability of this source of supply, prime movers have not been installed.

Layout.

The layout of the short-wave station depends mainly on three factors:

(1) Electrical considerations.
(2) Economy in space and material.
(3) Appearance.

I. Electrical Considerations.

It is, of course, necessary to keep the low power ends of both equipments away from the power amplifying stages, and the line amplifying equipment must be isolated as far as possible from the radio circuits. Further, it is desirable to arrange for the control of all apparatus to be located near the radio units themselves; the reason for this is important in this particular case of broadcasting, since the transmitter has to be started up and shut down often during the course of a day's operation. The last stages must be placed so that they can easily be connected to the transmission lines through the ærial selector switch and at the same time give the facility for changing one transmitter to the set of ærials normally associated with the other.

II. Economy.

On large installations the cost of cabling and cable ducts forms a very considerable proportion of the whole. The apparatus must, therefore, be distributed so as to keep the leads short and avoid long and unnecessary trenches.

III. Appearance.

Symmetry of layout and suitable placing of apparatus means that the finished station gives a good impression to visitors and to the operating staff, and this in turn reacts favorably on its operation and maintenance.

The layout shown in Fig. 11 was decided upon as the one fulfilling the above requirements to the greatest degree.

The speech input equipment is situated in the two rooms near the entrance of the building. These rooms are screened electrically by copper cloth which is connected to earth immediately outside the building, while the power supply apparatus, installed in a nearby room, feeds the equipment through screened cables. The main transmitting hall houses the twin transmitters; these are situated on either side of the hall facing inward, with the low power units near the entrance and the high power units at the farther end.

Facing the entrance to the room are the control boards and the high tension rectifying plant supplying the anode voltage for the later stages of amplification.

(Continued on Page 22)

A HARD-BOILED BUNCH

By VOLNEY G. MATHISON

MAYBE some time or other while thumbin' the pages of your call-book you have come across the call letters K-V-I. If you did, they probably didn't interest you. All the book has to say is "K-V-I, Unga Island, Alaska." There ain't no details, an' the type is pretty small. By rights it should be printed in letters a foot high, while as for th' details—well, a while back I happened to get acquainted with some of 'em, as you may judge when you peruse the following:

It all started one day up in Cunningham's office, when I was grumblin' about the seagoin' wireless game.

"This goin' to sea is the bunk," I tells Cunningham. "For th' last ten years I've been hoppin' from one berth to another like a flea in a ten-cent lodgin' house and I'm gettin' sick of it. First thing I know I'll be growin' old an' gray at this game, an' I'll be a pretty lookin' sight poundin' brass with a long white beard draped around th' receivin' tuner, or hangin' down into th' drip-pans of th' motor generator. I'd like to land a nice steady shore job some place where I could settle down an' spend th' rest of my life in peace an' quiet."

"If you mean that, you've took the notion into your head at just the right time," exclaims Cunningham. "The Alaska Codfish Company down on Steuart street are looking for a man to go up to Alaska and run their wireless station on Unga Island."

That afternoon, we breezes down to Steuart street, an' Cunningham introduces me to the big chief of the cod-fishin' concern, a gentle an' friendly ol' war-horse with a sea-tanned map an' snow-white hair.

"Unga Island is the largest island of the Shumagin group, on the south side of the Alaskan peninsula," he tells me. "It's about half way between Kodiak Island to the northeast and Dutch Harbor to the southwest. There is a naval radio station at both of these places, but none in the six hundred mile stretch between. That is why we built a station of our own on Unga Island. The station is at Unga, an Aleute village on the southern end of Unga Island, where we also have the headquarters of our cod fisheries."

"Is it a quiet place?" I asks.

"A mail boat calls at the island about three times a year," he answers. "And there is otherwise no touch with the outside world, except through the wireless station. There are no passenger steamers running there; in fact, no vessels of any kind but our own fishing schooners. It should be quiet enough, if that is what you want."

"Yes," I replies. "Is it a permament job?"

"Absolutely," he answers, in a tone like he meant it. "In fact, you will be required to sign a contract to stay two years. I can assure you that you'll like Unga. You have a fine two kilowatt set to handle; and the people are very congenial."

"Then what's th' present operator leavin' for?" I asks. "Is he retirin' on account of old age?"

"No, he has—he has ceased to operate," he answers, with a queer kind of twinkle in his eye. I didn't exactly understand that, but I guessed it was all right, an' I signs the two-year hitch.

Three days after, I gets aboard the "Maweema," an ancient-appearin' an' bad-smellin' three-master sailin' schooner, loaded to th' scuppers with salt, an' tough-lookin' codfish snailers. A tow-boat drags us out through the Golden Gate, an' we shake out our rags to a cold head wind. Soon as we was clear of the land, all hands gets drunk. I puts in a few pleasant nights listenin' to the fishermen an' sailors forward fightin' and' howlin' an' whoopin', while in the cabin th' skipper an' the mates gambled an' squabbled an' raised particular hell. Meanwhile the wind changes into a southeasterly gale, which takes us off shore a-flyin'. The farther we went, th' harder she blowed. Jibs an' mainsail were ripped to rags; a top-mast comes down; th' deck-load goes adrift: an' to make things more comfortable, a sea tears off th' cabin skylight one night, an' I wakes up to find my grips sloshin' around in a couple feet of sea-water.

After 43 days of head winds an' hurricanes, we sights Simeonof Island, a gigantic snow-covered pyramid of lava stickin' up out of the ocean, on the outer edge of the Shumagin group. A squally southwest gale drove us by Simeonof, an' on into the Straits of Nagai, where I had my first look at Unga Island. It was about 18 miles long, an' maybe six wide, fringed with reefs an' rocks, an' topped with two towerin' white peaks. We comes sweepin' up Nagai Straits on the wings of the snow-storm, an' comes at last to anchor in Squaw Harbor, a little cove on the eastern side of Unga Island. Accordin' to the charts, the town of Unga was about eight miles away, on a little inlet called Delarof Bay.

The next mornin' a power-boat, the "Alasco II," comes round from Unga, an' I goes back on her. She was piloted by a crazy-lookin' highbinder with a long droopin' black moustache, an' a pair of fists like rhinoceros' knuckles. After informin' me that his name is Hammer th' Head-Cracker, he inquires who I am. When I tells him I'm a key-puncher, he looks glum.

"Yuh won't be here long," he says, darkly. Then he shuts up like a clam.

After skirtin' a few miles of high, dark cliffs, we finally swung into Delarof Bay; an' I saw the town of Unga. Down at the foot of a steep, snow-blanketed mountain I saw a gloomy-lookin' village—frontin' on the bay a hundred small houses an' shacks; down on the beach some weather-beaten warehouses an' sheds. Up on a knoll in the middle of the town stood a government commissioner's combination dwellin'-shack an' court-house; below that a hard-lookin' dance hall grinned in the face of an old tumble-down Russian church. Farther up on the rise was a cemetery twice the size of the town, bristlin' with white-painted crosses, set so thick that from the bay they looked like a field of daisies.

Just above a little wharf, juttin' out from the beach, was a steep, rocky knoll about a hundred feet high, an' on top of it were the wireless masts. They were maybe a hundred an' thirty feet high, an' four hundred feet apart, an' were loaded down with heavy guy wires—to keep 'em from bein' blowed clean to Kamchatka, the Head-Cracker explains.

Half way down the face of the hill was the station house, a white-painted shack hangin' by its eyebrows on a narrow ledge of granite that stuck out from the cliff. The heavy swell from the Pacific was boomin' against the rocks just underneath, an' some times a cloud of white spray went flyin' up over the shack.

Just as we were swingin' up to the wharf there appeared a little spurt of pale-blue smoke up on the hill above the wireless shack, an' about the same instant a bullet smashes one of the window panes in the front of the pilot house.

"Duck below!" yells the Head-Cracker, as another bullet rips a cloud of splinters off the window sill, an' a third one puts a dent in the compass binnacle. Without askin' no questions, I dives inelegantly down a companionway into the engine room. As I crawls up behind the engine, on the lee side from the bullets, I sees the Head-Cracker haul a young cannon outa his jeans an' start blazin' away at the guy up on the hill. He empties his six-shooter, reloads, an' empties her again—meanwhile the fellow on the hill busts a few more panes of glass, an' puts half a dozen holes through the bulkhead. Just as the Head-Cracker was loadin' his gun for the fourth time, the shootin' from shore stops.

"Is th' battle over?" I asks, stickin' my head up through the companionway, cautious like.

"Not by a damn-sight!" roars the Head-Cracker, stowin' away his Krupp-junior. "It's only postponed till I git ashore—I'm getting' weary of arguin' with that guy!"

"Then it was you he was bombardin', not me," I exclaims, feelin' a lot relieved.

"It's Hog-Tooth Wilson," sputters the Head-Cracker. "Coupla weeks ago we was figgerin' who'd licked the most codfish snailers last year, an' Hog-Tooth figgered he'd licked one more'n I had, so I licks him to make it a draw. Now he's goin' snoopin' 'round gunnin' for me, which ain't no way to treat a friend."

By this time we was alongside the wharf. Gettin' ashore, I meets the Brainless Swede, the superintendent of the codfishin' outfit, who shows me the way up to the wireless house. The Head-Cracker comes grumblin' along with my grips, but soon as we reach the shack he drops 'em and goes swearin' off up the hill with his hip-pocket artillery ready for action again.

The rectangular-shaped radio shack was divided off into three small rooms; one for the sendin' apparatus, a sleepin' room in the middle, and an operatin' room on the end facin' the ocean. The sendin' set was a trashy-lookin' made-to-order rig, with a lot of helices to get a 2500 meter wave—a two kilowatt panel set with a flimsy synchronous gap coupled up to an old condemned hoistin' motor that'd been made over into an alternator. This was belted to a contrary-lookin' one-lung gasoline engine, on the opposite side of the room—about a five horse-power. A second belt from the engine went to another made-over motor, which furnished direct current to excite the alternator. The transmitter had a leaky oil condenser, a hammy-appearin' transformer, with a secondary windin' about the size of a ball of knittin' yarn, an' a phony oscillation transformer that looked like it'd been squashed by an elephant steppin' on it. That was about all there was to it, except for a lopsided name-plate on the panel, announcin' it was a "Hellkum Special"—whatever that is.

I started in right away to get the set in workin' order, but I was bothered a lot by people stringin' in with messages. One guy, a fur-trader, brought 12 at one lick.

"Some of these is kinda previous," he remarks; "but I want'a get 'em off while you're still here."

"Still here!" I exclaims. "I just got here!"

"I know it," he answers. "Otherwise, you wouldn't be here."

I didn't exactly get the drift of that just then, but I did later. By night I had the set in shape, an' 51 messages on file. It was snowin' an' stormin' outside, an' at 5 o'clock it was pitch dark. I figures I might's well begin tryin' to raise N-P-R, so I starts the engine; but when I gets in, I hears a devil of a racket bustin' up the ether. Listenin' awhile, I makes out it was N-P-R an' another loud synchronous spark signin' K-O-X-N, which I learns later was another codfish company station. They were havin' a grand wireless battle.

"I can pound brass a damn sight better than you ever will pound it, you mushroom-fisted son of a sourdough biscuit!" I hears the codfish code-slinger yellin' at the navy gink. "If you ever make any more breaks about my fist, I'll come up there an' make your homely map look like a busted tomato!"

"Aw, dry up, you fire-eatin' moonshine-guzzler," answers the gob at N-P-R. "You've got so many codfish fins growin' on your back you can't keep your shirt on no more,—better go jump in the ocean, where you belong, fishie."

"I'll fix you yet, you flat-footed, knock-kneed squaw-chaser!" howls the codfish key-puncher. "I'm goin' to fill you so full of lead you'll have to go to your grave in a 10 ton truck!"

This keeps on for about half an hour, until both the gadget an' the codfish desperado was so mad they could only stutter on their keys like a couple of crazy omnigraphs. At last, I risks a call to N-P-R, but all I gets is a roar of Q-R-T's for about ten minutes; then all of a sudden I hears a new fist take the key at the navy station.

"K-V-I, K-V-I de N-P-R, N-P-R," he says. "Never mind those two little honey-birds—just havin' their usual evenin' lovin' match—both full of sourdough brew—bad stuff—I got your biz of last two months—72 messages—Q-R-V."

"Yes, all set," I answers. "Got 51 here."

About 11 o'clock I had all his messages. I starts in to shoot mine, but before I'd got more'n seven or eight of 'em away somethin' goes flooey with the transmitter. I dashes into the power room an' discovers the sendin' condenser is shot. It takes about fifteen minutes to fish the busted section out of the oil an' stick in a new one. I starts hammerin' again, but on the 16th message the spark goes out of synchronism, an' dies slowly away. I rambles out into the power room again, an' finds the couplin' between the gap an' the alternator is carried away. Lashin' it up temporary, I tackles the key once more, but on the thirty-third message somethin' blew up again. This time I finds the power room full of smoke, an' I discovers the transformer secondary is burnt black as a newly-wed's biscuits.

"Looks to me like I landed one nice, peaceful quiet little hell of a shore job, all right!" I mutters to myself, as I shuffles out a couple thousand transformer laminations to replace the burnt secondary.

On the forty-ninth message the engine stopped. As the lights were on the direct-current generator, this leaves the shack pitch dark. I lights a candle, an' finds the fuel-pipe to the engine is busted off the carburetor, an' gasoline is runnin' all over the floor. Blowin' the candle out quite instantly, I bandages up the pipe in the dark with a piece of friction-tape. At last, soakin' with engine oil, gasoline an' sweat, I drags through the fifty-first message, an' signin' off with N-P-R, I turns in to dream of millions of shootin' condensers an' explodin' gas tanks.

The next mornin' I meets Dopey Driffield, the government commissioner, a sleepy old worm who'd been in Unga more'n thirty years, an' who seemed to be sufferin' from a chronic case of Alaska lazyritis. He tells me he's learned somethin' about wireless from previous brass-pounders, an' has a little spark-coil ham set of his own.

"Say, what become of the operator before me?" I asks him, as we stand out in front of the town pool hall. He starts to answer, but just then a vampy-lookin' little black-eyed girl comes trippin' along an' gives me a sly, teasin' smile. I starts to return the smile, with interest, but Dopey punches me in the ribs.

"Look out!" he whispers. "That's Mexican Frank's wife—he's standin' behind you!"

I peeks around out'a the corner of my eye, an' when I sees a bad lookin' Mexican standin' close by, glarin' green-eyed at me, an' with one hand on his shootin' gear, my smiles freezes fast.

"You was askin' about yer predecessors," remarks Dopey, after a minute; "I'll show you where they is."

Leadin' me out into the cemetery, just back of the town, he brings me up to three white-painted pine slabs, all set nicely in a row. Takin' a slant at the first board, I reads this cheerin' inscription, done in crooked black letters:

"HERE LIES STANLEY HINCH
A Wireless Operator
DRILLED BY LONG BILL'S COLT

On the Last Night of September, 1920."

"He was the first one," says Dopey. "He got full of moonshine one night, an' started singin' a Hungarian op'ra under Long Bill's bedroom window. Long Bill thought he'd got bit by a Malamute mad dog an' was dyin' from hydrophobia, so he shot him to put him out'a his misery. Bill always was a kind-hearted ol' fence-rail."

By this time I was readin' the second slab:

"HERE LIES FRANK MYERS
A Wireless Operator
STUCK THROUGH THE GIZZARD
By Dago Mike in Soapy's Barroom
December 5, 1920."

"What'd he do?" I asks.

"He was a nice boy, but he was plumb foolish," replied old Dopey, pensive-like. "He mixed into a war argiment in Soapy Komedal's soda water joint, an' said 't'hell with th' kaiser.' Right there German Charlie yanks out his gun an' makes the chauco stand up on th' bar an' repeat 'Hurrah fer th' kaiser!' fifty times, but before he could get done with it, Dago Mike, th' bartender, got peeved an' rammed a butcher knife clean through him—Mike always was a good patriotic Dago, so we couldn't blame him."

I didn't say nothin', but rambles over to the third signboard:

"HERE LIES THE LEFT FOOT AND
THE RIGHT EAR OF EDGAR NELSON
A Wireless Operator
BLOWED TO HELL BY
NITROGLYCERIN
February 7, 1921

"Edgar stayed with us th' longest—three weeks," says Dopey, thoughtful-like. "One day he went to visit th' gold mine up th' bay, an' just fer a joke Hardpan Pete slips a can of triple X blastin'-caps in his pocket. Comin' back to town, Edgar fell down a cliff, an' all we could ever find was his left foot an' his right ear—we knew it was his right one because Bull Barney, th' moonshiner, had nicked it th' day before, practisin' with a new automatic. I was sorry to see Edgar go to pieces that way, but he had no business fallin' off'n the bluff."

"Seems to be a healthy place fer brass-pounders, don't it," I remarks, already seein' four little slabs in the code-slinger's row. "I know now what th' old bird in Frisco meant about that operator ceasin' to operate."

"There's only one wireless man ever stuck it out around these parts," replies Dopey, "an' that's Fightin' Hell-Fire, the guy that built this station. He's just built another at Pirate Cove, over on Popoff Island, about twenty miles from here. The call's K-O-X-N—mebbe you've heard him."

"Yes, I did, last night," I answers. "He seems to be a lunatic."

"That he is," declared Dopey, fervently; "an' he's a tough guy. Besides his reg'lar six-shooter he packs a little Colt automatic in his mackinaw pocket; an' th' other day I seen him shoot a wart off'n Black Ola's nose at a hundred feet without even pullin' th' gun out'a his pocket—shot right through th' cloth. He'll probably be over soon's we have a storm—he has a fishin' dory with a little engine in it, but he never travels unless it's blowin' a hurricane—says he gets tired moochin' along in a boat in calm weather."

Just as we was leavin' the cemetery, I notice a couple fellows comin' with picks an' shovels.

"They're comin' t' dig a hole for Hog-Tooth Wilson," says Dopey, yawnin' like it didn't amount to nothin'. "Th' Head-Cracker plugged him last night in self-defense—Hammer never would stand fer anybody abusin' him."

Durin' the next three weeks I didn't see much of anybody. I didn't feel like venturin' out of the wireless shack, an' anyway, the set didn't give me a chance. I never got through a schedule with N-P-R without a couple of breakdowns. First a condenser would shoot; then the gap-

(Continued on Page 34)

HIGH POWER BROADCASTING TRANSMITTERS AT BUDAPEST AND KALUNDBORG

By C. E. STRONG

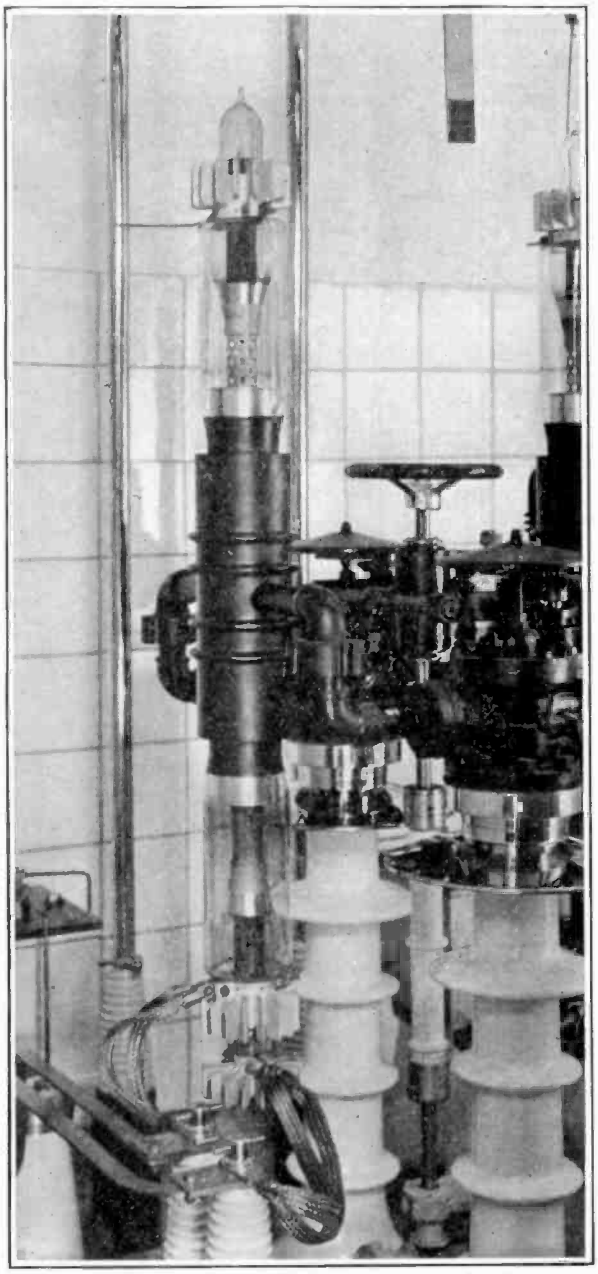

Figure 1—120 kW. Vacuum Tube—Kalundborg.

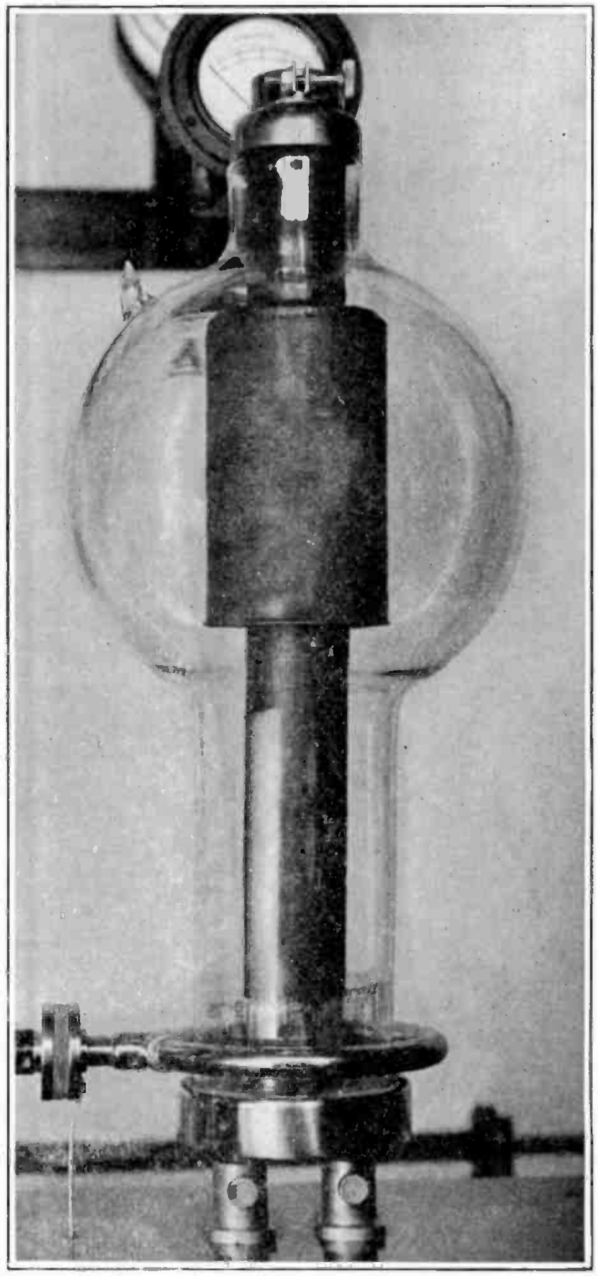

Figure 2—20,000 Volt, 250 kW., Hot Cathode Mercury Vapour Rectifier Tube—Kalundborg.

THE year 1933 was a year of extensive development of the broadcasting services in Europe and the Standard Companies took a very prominent part in the work involved. Eight new "Standard" transmitters were installed and put into service in that year. Of these stations, the two largest, namely, the 60 kW. transmitter at Kalundborg, Denmark, and the 120 kW. equipment at Budapest, form the subject of this article.

The Kalundborg equipment was built by Standard Telephones and Cables, Limited, with the cooperation of The Danish Post and Telegraph Administration, and the Budapest station was constructed by Standard Electric Company, Limited, Budapest, in cooperation with The Royal Hungarian Postal Administration.

Both transmitters were built according to the same general design, prepared by the Central Laboratories. They are, consequently, very similar in their main lines and may conveniently be described together. There are, however, a number of differences in the equipment in the two stations due chiefly to local regulations and individual wishes expressed by the Administrations concerned.

A distinctive feature of these stations is the form of construction of the power amplifier equipment, in that this apparatus, following the practice commonly adopted in the installation of indoor high voltage power plant, is installed in brickwork cubicles.

Other points of special interest are the use of a small number of valves of high power in the last stage, each having a reserve valve in position which can cut in at a moment's notice the use of high efficiency mercury vapor rectifiers for the high voltage d-c. supply (Figs. 1 and 2); the reduction of the number of components and control circuits to an absolute minimum in the interest of reliability; the special design of the water cooling circuit; and the elimination of rotating machinery, except for the single filament machine and the water pumps, by the utilization of dry metal rectifiers and hot cathode mercury vapor rectifiers for the low-power supplies.

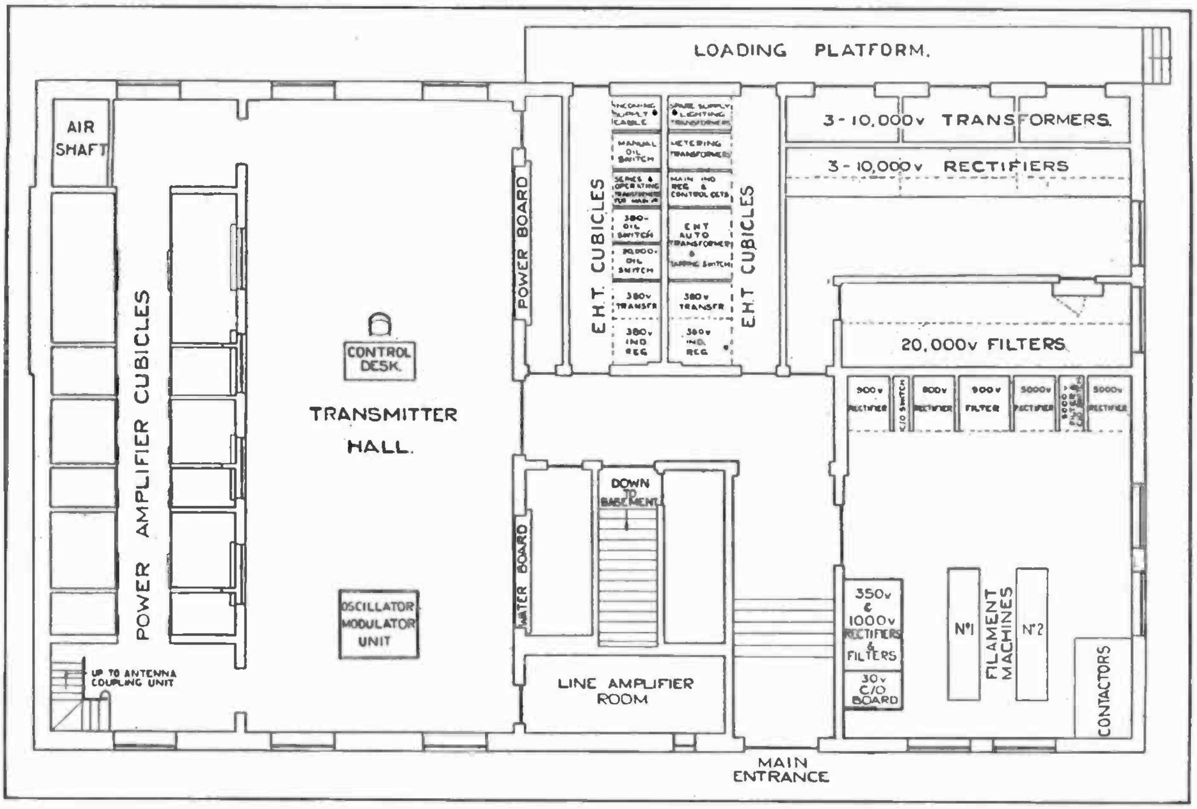

Figure 3—Layout of Kalundborg Station.

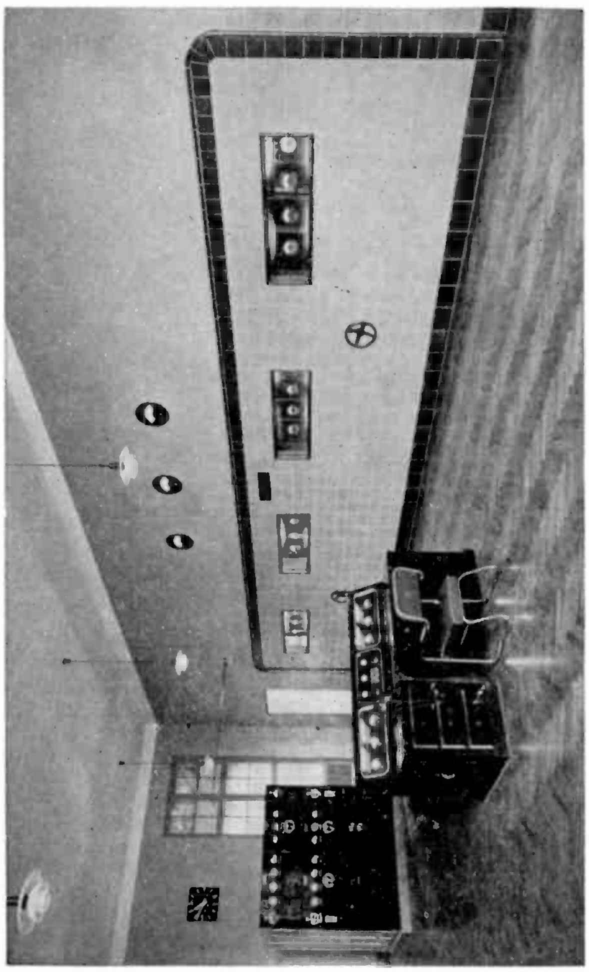

Figure 4—Oscillator-Modulator Unit, Control Desk and Front of High Voltage Radio Frequency Cubicle.

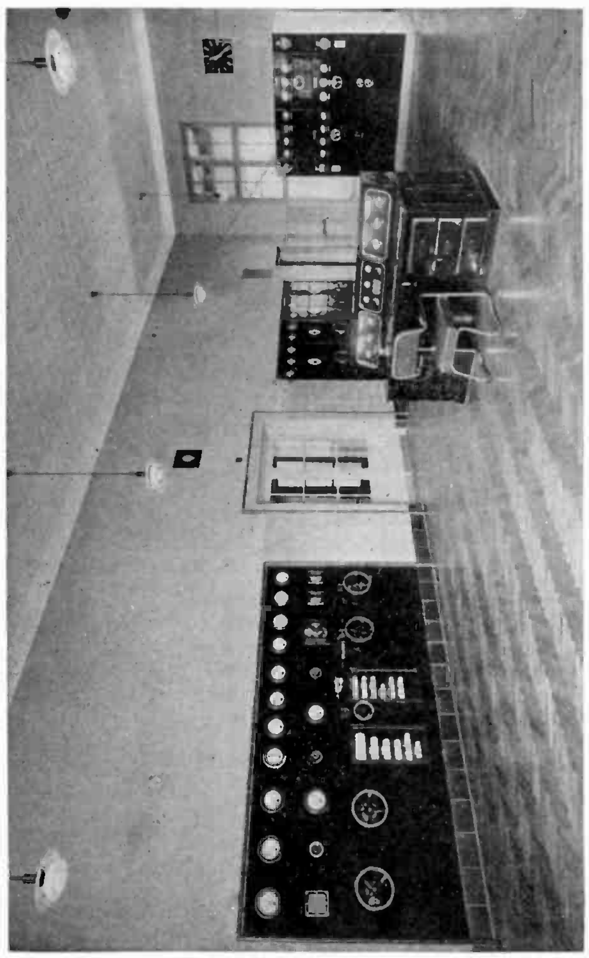

Figure 5—Power Board and Water Control Board

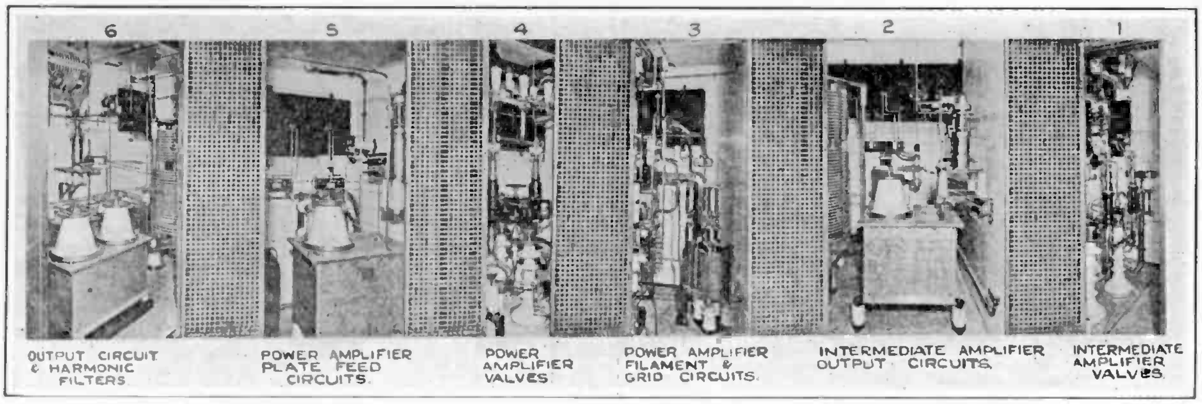

Figure 6—Kalundborg Transmitter—Layout of Cubicle Compartments on One Side of Corridor.

The transmitters are laid out in single-story buildings having basements for the accommodation of water cooling plant and cable racks.

The layout of the Kalundborg station is shown in Fig. 3.

In the main transmitter hall (Fig. 4) we have the low-power radio unit, designated the "Oscillator - Modulator Unit," the power amplifier cubicle, the power control board, water control board and the control desk. All the controls of the station are centralized in this room and, from his position at the control desk, the attendant can keep a watch on the meters both of the radio apparatus and of the power equipment.

Immediately behind the power board are the cubicles accommodating the high-tension switchgear, voltage regulators, meter transformers, etc., and behind the cubicles are three enclosures accommodating, respectively, the high voltage rectifier equipment, smoothing filters and the rectifier transformers, the latter being in vaults with access only to the outside of the building. On the opposite side of the building behind the water board is the room containing the low-power rectifiers for the oscillator-modulator unit and for grid bias supply, the control circuit contactors and the filament machine with its spare. The basement, in which is installed the water cooling plant, is immediately below the transmitter hall, and from it a cable tunnel projects centrally under the part of the building devoted to power equipment.

In so far as the radio apparatus is concerned, the Budapest and Kalundborg transmitters differ only in the number of valves in the last stage of amplification. The radio frequency equipment is in two main sections — the low-power stages in the oscillator-modulator unit, and the intermediate and final power amplifiers installed in cubicle form.

The oscillator-modulator unit comprises five distinct units, as follows:

(a) The crystal controlled master oscillator, (b) two-stage amplifier unit, (c)

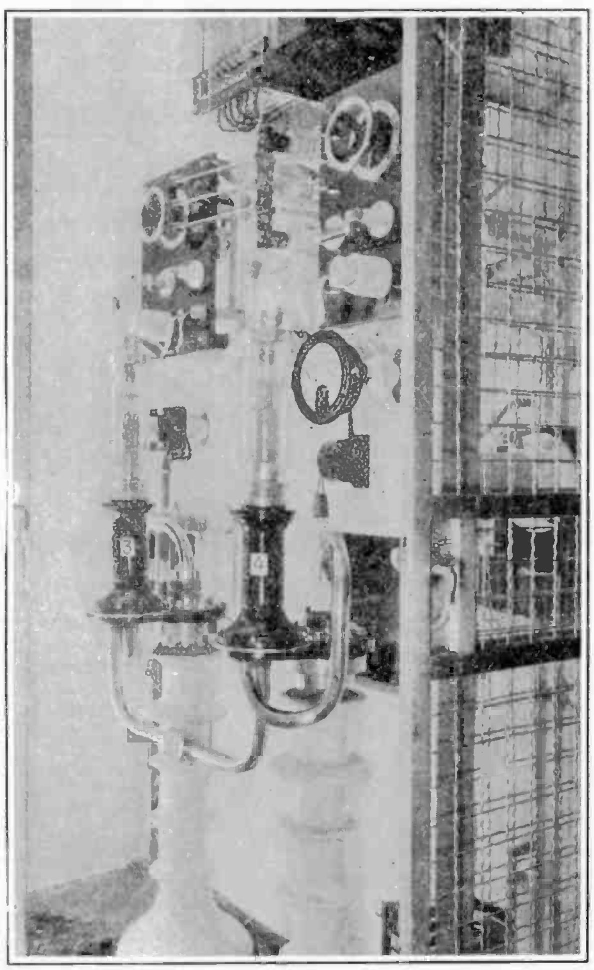

Figure 7—Budapest Intermediate Amplifier Valve Compartment.

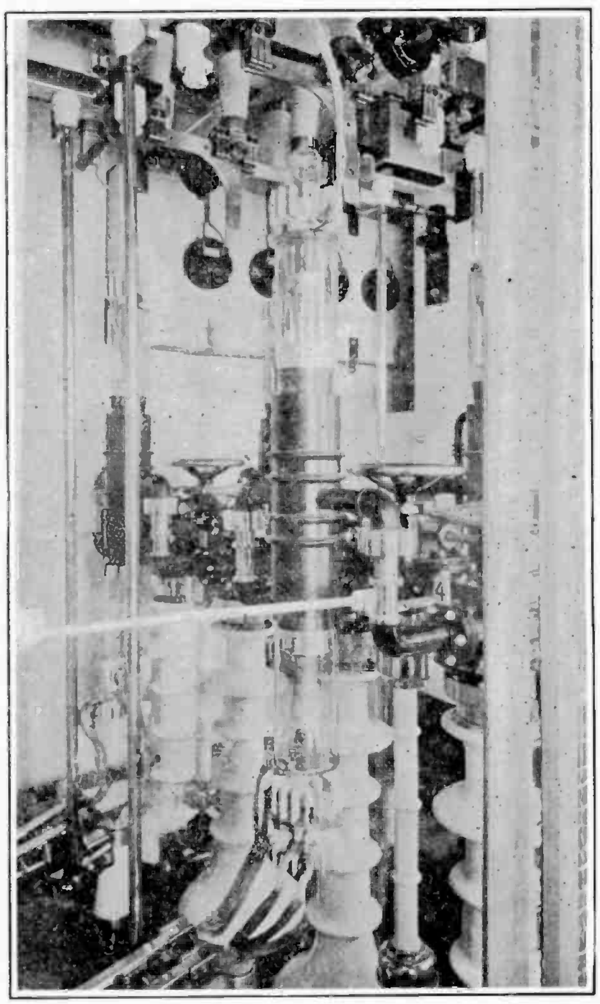

Figure 8—Budapest 120 kW. Valve Compartment.

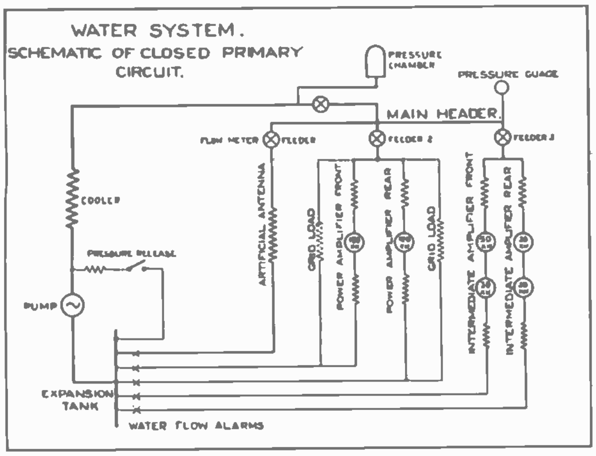

Figure 9—Diagram of Kalundborg Water System

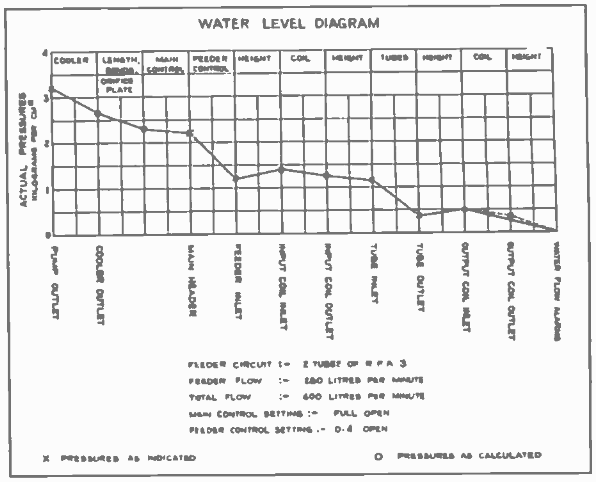

Figure 11—Water Circuit Level Diagram.

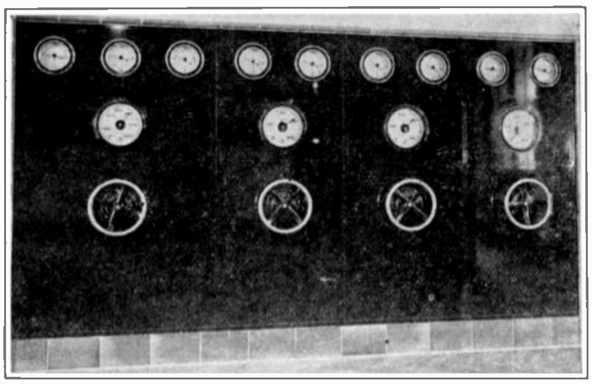

Figure 10—Kalundborg Water Control Board.

modulated amplifier, (d) radio frequency amplifier following the modulated amplifier, and (e) three-stage voice frequency amplifier unit feeding into the modulated amplifier plate circuit.

Each of these units is in a separate box which can easily be withdrawn from the main assembly for inspection. Each unit can, therefore, be individually tested by working into a suitable fixed impedance simulating the input impedance of the following stage, so that the overall performance of the equipment can be logically analyzed.

Accessory components, such as grid bias potentiometers and smoothing filters, anode dropping resistances, etc., are installed on a number of rack-mounted panels with dust covers, situated in an accessible position inside the main framework to the rear. The doors of the main framework are mechanically interlocked with isolating switches to ensure full protection to personnel.

The output of the oscillator-modulator unit can be modulated to 95 per cent without the introduction of distortion products exceeding 5 per cent of the fundamental in amplitude. The output circuit is de-

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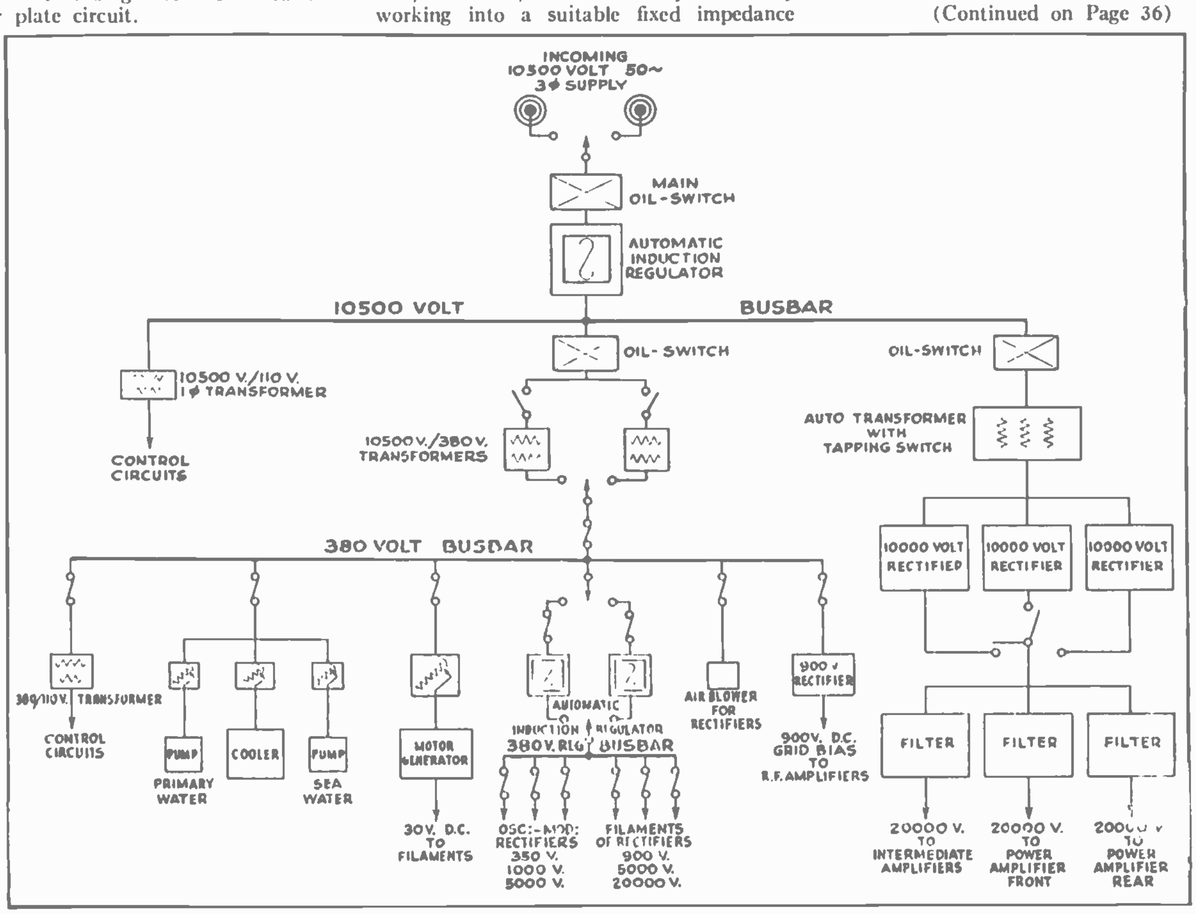

Figure 12—Schematic Diagram of Power Circuits.

PROPOSED "MASTER" SHIPPING INDUSTRY CODE

ARTICLE I—PURPOSE

TO EFFECTUATE the policies of Title I of the National Industrial Recovery Act, this Code is submitted as a Code of Fair Competition for the Shipping Industry, and, upon approval by the President, its provisions shall be standards of fair competition for such industry and shall be binding upon every member thereof. This Code may be referred to as the General Shipping Code.

> Note: In a notice sent out under date of March 28th, signed by Hugh S. Johnson, Administrator; and K. M. Simpson, Division Administrator, it was stated that the Code has been revised in view of evidence presented at the public hearing held on January 31, 1934, and evidence presented subsequent thereof.
>
> Notice was given that objections had to be filed with the Deputy Administrator, J. B. Weaver, Dept. of Commerce Bldg., Washington, D. C. prior to noon April 14, 1934. Hearings were held April 26th, 27th, and 28th, at which objections were made. The main objections from shipping circles were to conditions laid down in Article VII. It is pointed out, and must be understood, that wages specified are only minimum wages, and maximum hours that are to be worked. For different classes of boats and shipping, labor agreements may be entered into by collective bargaining between employee representatives, and employing units at higher wages or lesser employment hours, as stated in Article V.
>
> Since there is not likely to be any major change in this proposed code, we are publishing it in full.

ARTICLE II—DEFINITIONS

Section 1. As used in this Code and the Division and Subdivision Codes words and phrases have the following meaning:

(a) "Act," "Administrator," and "President" means respectively the National Industrial Recovery Act, the Administrator for Title I of the Act, and the President of the United States.

(b) The term "Shipping Industry" includes—

(1) the operation by owners, operators or agents of all vessels of all flags engaged in the foreign and domestic commerce of the United States, and

(2) the business of contracting stevedores and such other operations as may be found by the Administrator properly to be within the shipping industry.

(c) The term "Member of the Industry" means all those engaged in the Shipping Industry as herein defined, including owners, operators, and agents.

(d) "Members of the Code" means any "Member of the Industry" who files a written assent to this Code as herein provided.

(e) "Member of a Division" means a "Member of the Code" who is concerned with a vessel engaged in a Trade of a Division and files a written assent to the Division Code as herein provided. "Division" includes "Subdivision."

(f) "Concerned with vessels" means owning, operating or acting as agent or contracting stevedore for any vessel.

(g) "Owner" means any individual, firm, association, corporation or other form of enterprise, who owns or charters the whole or any part of a vessel.

(h) "Operator" means any individual, firm, association, or corporation or other form of enterprise who manages or operates a vessel.

(i) "Agent" means any individual, firm, association, corporation, or other form of enterprise who acts as agent for an owner or operator.

(j) "Employees" means any and all those engaged in the industry, however compensated, except a Member of the Industry.

(k) "Foreign Commerce" shall include, among others, a voyage from a United States port to the high seas and return without touching at any other port.

(l) "Trade of a Division" means the particular trade in which are operated vessels with which the Members of the Industry within a Division are concerned, and because of which operation they are entitled to become Members of the Division.

(m) "Carrying Unit" means and includes all the vessels being operated at any time in a trade of a division or subdivision by an owner or operator, including parent and/or subsidiary and/or associated corporations thereof or for which a member acts as agent.

(n) "Qualified Vote" means a single vote to be cast by the owner and/or operator and/or agent combined for each "carrying unit"; provided that when used in Section 10 (a) of Article IV the term "qualified vote" shall mean a single vote to be cast by the owner and/or operator and/or agent combined for each complete 20,000 gross registered tons of vessels included in each carrying unit; provided, further, that if a vote is taken during an open navigation season at least one vessel of the "carrying unit" shall have been loaded and sailed or scheduled to sail within thirty days of the vote. If American and foreign flag vessels constitute part of the same carrying unit, then, if the gross registered tonnage of the American vessels exceeds that of the Foreign vessels, the qualified vote shall be cast only with the American Members of the Division; otherwise only with the foreign Members of the Division.

(o) Words of one gender shall include corresponding words of all genders; the plural includes the singular and vice versa

ARTICLE III—APPLICATION

Section 1. This Code shall apply to all owners, operators, agents, and contracting stevedores of all vessels of all flags engaged in the foreign and domestic commerce of the United States, and all other operations as may be found by the Administrator properly to be within the shipping industry. Any Member of the Industry may become a Member of the Code by filing written assent to the Code substantially in the form hereto attached, marked Appendix I.

ARTICLE IV—ORGANIZATION

Section 1. Members of the Industry shall be divided into four groups, as follows:

(a) Group I shall include all Members of the Industry concerned with vessels carrying freight or passengers in foreign or domestic commerce not included in the other groups.

(b) Group II shall include all Members of the Industry concerned with vessels carrying freight or passengers on inland waterways and the Great Lakes except vessels included in Group III and passenger and self-propelled cargo vessels on coastal bays and sounds and the Hudson River.

(c) Group III shall include all Members of the Industry concerned with local service vessels, such as towboats, lighters, barges, ferries and all similar vessels.

(d) Group IV shall include all Members of the Industry engaged in the business of contracting stevedores and such other operations as may be determined by the Administrator.

(e) The Administrator may transfer Members of the Industry from one group to any other group.

Section 2. (a) Members of the Industry comprising Group I shall be organized into the following divisions, viz:

(A) Foreign-Trade Divisions.—Foreign-Trade Divisions shall be organized for each principal foreign trade route, as approved by the Administrator, and each division shall include all Members of the Industry concerned with vessels operating in the route of the division.

(B) Atlantic Intercoastal Division.—The Atlantic Intercoastal Division shall include all Members of the Industry concerned with vessels operating between Atlantic Coast ports and Pacific Coast ports by way of the Panama Canal.

(C) Gulf Intercoastal Division.—The Gulf Intercoastal Division shall include all Members of the Industry concerned with vessels operating between United States Gulf of Mexico ports and Pacific Coast ports by way of the Panama Canal.

(D) Atlantic-Gulf Coast Division.—The Atlantic-Gulf Coast Division shall include all Members of the Industry concerned with vessels operating in coastwise trade on the Atlantic and Gulf of Mexico Coasts.

(E) Puerto Rican Division.—The Puerto Rican Division shall include all Members of the Industry concerned with vessels operating between Atlantic Coast or Gulf of Mexico or West Indies ports and Puerto Rican ports and between Puerto Rican ports.

(F) Atlantic-Gulf and Hawaiian Division.—The Atlantic-Gulf and Hawaiian Division shall include all Members of the Industry concerned with vessels operating between Atlantic Coast and Gulf of Mexico ports and the Hawaiian Islands.

(G) Pacific Coast Division.—The Pacific Coast Division shall include all Members of the Industry concerned with vessels operating in coastwise trade on the Pacific Coast, and from Pacific Coast ports

(Continued on Page 30)

FIRST HIGH VOLTAGE GRID-CONTROLLED STEEL RECTIFIER MADE HERE

DEMONSTRATIONS of the operation of the first high voltage grid-controlled steel rectifier tube made in the United States were held recently at the Allis-Chalmers Manufacturing Company plant in Milwaukee before several groups of prominent radio engineers from many parts of the country. Compared to the largest glass vacuum tubes used in broadcasting stations at the present time, this steel rectifier tube is of entirely different construction, of a much larger size, and higher rating. It is about six feet in height and three feet in diameter, and weighs more than one ton.

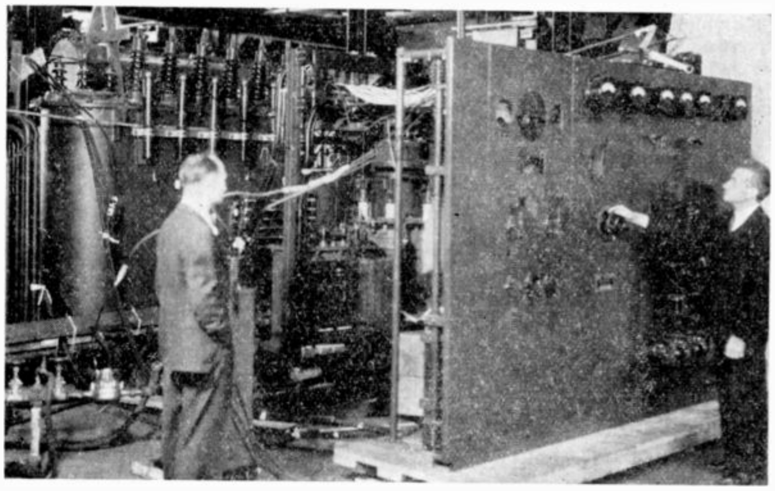

Fig. 1—View of control board, showing accessory apparatus

This new steel tube is actually equivalent to six rectifier tubes combined into one. Unlike other radio tubes familiar to most people, it contains no filament, but makes use of a mercury arc. For this reason no filament burns out. Also unlike other tubes which are evacuated and sealed-off and which gradually lose their vacuum in service, this new steel-tube is continually evacuated by means of vacuum pumps.

The tube is rated up to an output voltage of 25,000 volts d-c, and has been successfully tested at higher voltages. This voltage is much higher than required by any radio transmitters today, and is several times higher than attained by motor-generator sets used to supply direct current power to radio broadcasting transmitters. The tube will deliver one million watts of direct current power.

It takes less than one second to place this new steel rectifier tube in service, and it can be completely controlled from a remote operation position. The arc drop loss within the tube is so small that it can be operated at more than 99.9 per cent efficiency.

An outstanding feature of this new Allis-Chalmers grid-controlled steel rectifier tube is that it can automatically protect radio equipment by cutting-off power in less than 1-60 second to clear a flashover in the transmitter and can automatically replace power on the transmitter in less than 1-10 second thereafter. An interruption of only about 1-10 second could rarely be noticed in a broadcast program, whereas now programs are occasionally interrupted for several minutes because of flashovers in tubes or across condensers in the transmitter. The speed of operation of the new tube in automatically cutting-off power to clear a flashover is very much more rapid than the speed of operation of circuit breakers, and after clearing a flashover power may actually be restored to the transmitter before most high speed circuit breakers could have even opened the power supply circuit to interrupt the flashover short-circuiting current.

Another outstanding feature of this new type of rectifier tube is that its direct-current output voltages can be adjusted to any value between maximum and zero by means of a very simple control circuit operating on the tube itself. This eliminates the necessity of using voltage regulators or transformer tap changing switches which are expensive items in the cost of radio transmitting equipment.

Whereas this high voltage grid-controlled steel radio rectifier tube is the first one to be built in the United States, about three dozen have already been made by the Brown-Boveri Company in Europe. Eleven of the high power radio stations in Germany are using this type of rectifier tube, and the largest manufacturers of radio transmitting equipment in Europe have adopted it. A single power rectifier tube is all that is required for stations operating at from fifteen thousand watts to several hundred thousand watts power output. The Allis-Chalmers Manufacturing Company in the United States is associated with the Brown-Boveri Company of Europe.

Because the life of this steel rectifier tube is unlimited and because it can be rated so high, it should enable many stations to greatly increase their power output. Only one of these steel rectifier tubes would be required for a station operating at an antenna power output between about one thousand watts and three hundred thousand watts, whereas two tubes would be required for a broadcasting transmitter operating a five hundred thousand watts power output. It is predicted that this

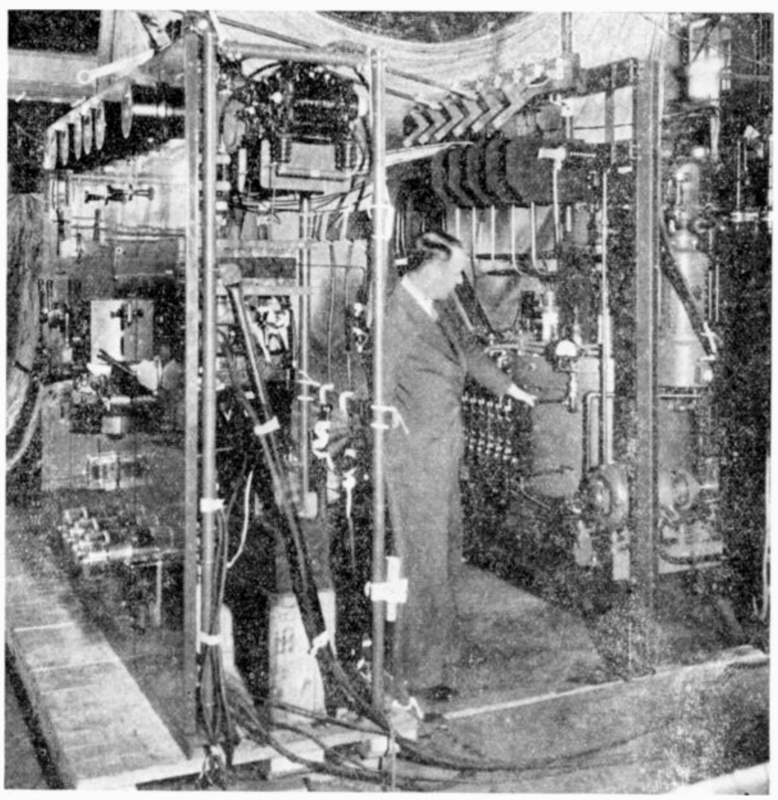

Fig. 2—Side view back of control board of rectifier under test

new grid-controlled steel rectifier tube made by the Allis-Chalmers Manufacturing Company will contribute a very important advance to the radio broadcasting industry in the United States.

Notes on WLW Transmitter

Full 100 per cent modulation up to its peak power output of 2,000,000 watts; uniformly flat frequency characteristics; audio harmonics below 10 per cent,: and an increase in signal strength at all points of about 325 per cent is claimed.

Secondary service area of approximately 1,000 per cent greater than on former 50 kW.

Frequency characteristics essentially flat (within 2 decibels) from 30 to 10,000 cycles.

Vertical antenna tower 831 feet high, stress load of 450 tons, base contact surface 5 inches, and porcelain base walls are less than 2 inches in thickness.

Twenty-eight radio engineers and 12 microphones used in remote control pickup at dedication exercises, May 2nd.

One thousand four hundred gallons of oil, with total weight of 100,000 pounds, represents the largest audio transformer ever built.

Twenty 100,000-watt tubes costing more than $35,000, are used in the transmitter.

A million gallons of water pumped through the cooling system daily, at rate of 1,200 gallons per minute.

Main transmitter panel is 52 feet wide

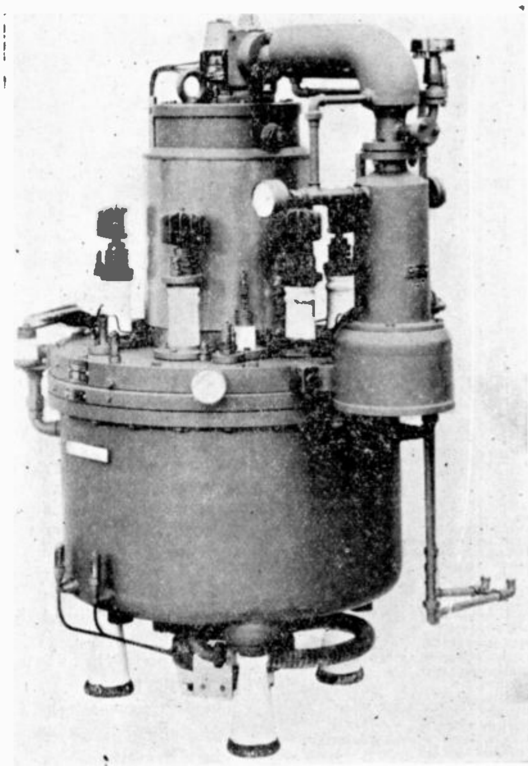

Fig. 4—Close view of high voltage, grid-controlled mercury arc-rectifier without any connections made either to it, or from it. The Anodes are the larger uprights in center, four showing. Auxiliary anode, or arc holding anode shown between main anodes. Cathode or D. C. connection shown at bottom between insulators at base. Hose at bottom is for water cooling system

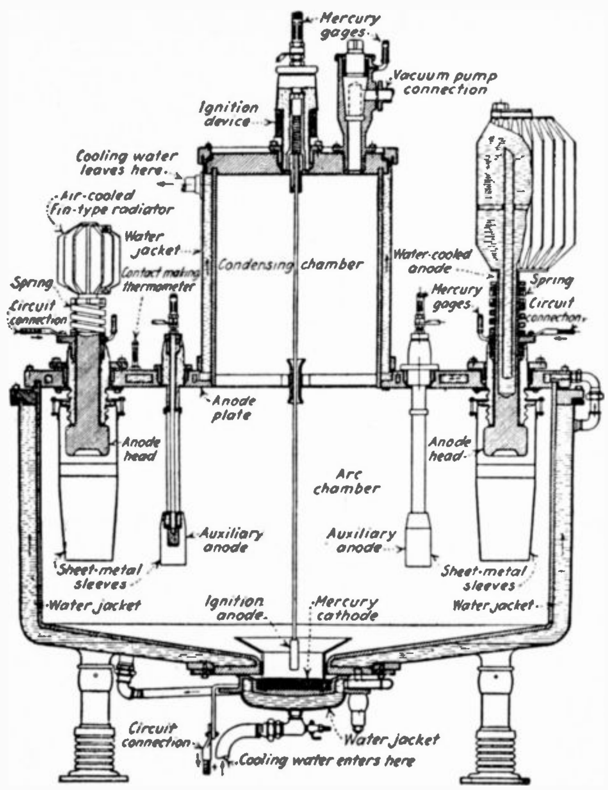

Fig. 3—Outline sketch, of typical Allis-Chalmers Mercury Arc Rectifier. Note, this is slightly different design than rectifier described in article, but graphically shows parts of device

and 13 feet high. It contains last radio frequency stage, audio amplifiers, modulators, and plate supply.

New NBC Sales Welding Plan

Edgar Kobak, recently elected vice president in charge of sales for NBC, announced that all advertisers with national or semi-national distribution, whether they wish to use networks, transcriptions, or local programs, will be served by salesmen assigned to national accounts. Strictly local advertisers such as department stores, banks, and local distributing agents will be served by other men specializing in this type of business. All salesmen in each NBC Division, whether working on national or local business, will be members of a single sales department and report to one divisional sales manager, who will be the NBC territorial division sales manager in the territory, such as Eastern, Central, or Western.

When the reorganization is completed, every NBC managed station will represent the National Broadcasting Company as a whole, and will not confine itself to so-called "local, spot or transcription" representation as formerly. This plan with a wide variation of rates in favor of local advertising has long been in use by newspapers, in selling space.

Radio Release, Ltd., who have taken over the former KMTR studios in Hollywood announce that they will not make sample records with hopes of selling series, but will distribute episodes of series already completed and ready for actual immediate delivery. W. O. Watson has been appointed chief recording engineer. Pressings will be done at Columbia.

British Empire Broadcasting

(Continued from Page 12)

The array selection platform and the transmission lines to this are directly above the last amplifier. There are ten transmission lines (twenty wires) terminated at each of the windows where switching is affected by a simple plug and socket arrangement.

On the left of the main hall is the cooling room containing water pumps and air blowers with their necessary starting apparatus. Th s room is separated from the main hall by two smaller rooms, one containing the rectifying equipment for the speech input apparatus, and the other being a valve and general store, with the result that there is little mechanical disturbance in the transmitting hall due to the cooling plant.

At the right-hand side of the transmitting hall is the power generator room. All generators are in triplicate, thus providing a spare set which is made easily available for use by the transfer switchgear (situated on the left-hand side of the room). The substation which houses the incoming supply of transformer and the main induction regulator forms a separate room in this right-hand wing of the building.

The whole layout is remarkably compact, at the same time of good accessibility and appearance.

Description of the System and Apparatus in the Transmitting Building (Fig. 9)

The line amplifying equipment is simple in function and design. The program from the main studios is carried by land to the radio station, where it is amplified by these line amplifiers to a suitable level for the input of the transmitters. The amplifier consists of two resistance-capacity-coupled stages, the input and output impedances being 600 ohms. Its frequency characteristics are almost flat from 30 to 10,000 cycles, the maximum variation being ½ db. over this range.

A program volume indicator is provided with a decibel characteristic enabling a good visual check to be obtained on the acoustic level.

The control rooms are acoustically treated in order that they may react as quality checking rooms. A key on the input to the monitoring amplifier enables it to be switched either to the output of the line amplifier or to the output of a small rectifier fed from the last stage of radio frequency amplification. A direct comparison may, therefore, be made between the program provided to the transmitter, and the program after rectification from the last stage of the transmitter itself.

Power supplies for this equipment are obtained from rectifiers. Two low-tension rectifiers, one normally acting as a spare, and two high-tension rectifiers are assembled on two racks. Dry plate rectifiers are used for the low tension, while hot cathode mercury vapor valves are the rectifiers used on the high tension side. A further rack of apparatus contains the necessary smoothing equipment for the filaments, grid bias and high tension. (The grid bias is also obtained from a rectifier fitted to the smoothing rack.) It is interesting to note that not a single battery of any kind is used in the entire installation.

Transmitter

The transmitting apparatus itself is housed in five units. Each transmitter is tuned to operate on any of six wavelengths between 16.9 and 50 metres. These six bands are specially reserved for shortwave broadcasting. The transmitter is capable of giving unmodulated carrier power of 12 kW. and this can be modulated to 95 per cent without any appreciable distortion; that is, the strength of the audio frequency harmonics introduced into the modulation envelope is 30 decibels below the fundamental modulating tone.

The functions of the five units are as follows:

The first unit of each transmitter contains four crystal oscillators. Any one of these can be switched on to the transmitter with which it normally works or, if desired, on to the other transmitter. Each transmitter, therefore, may operate on one of eight frequencies. The frequency stability of these oscillators is approximately forty parts to one million, care having been

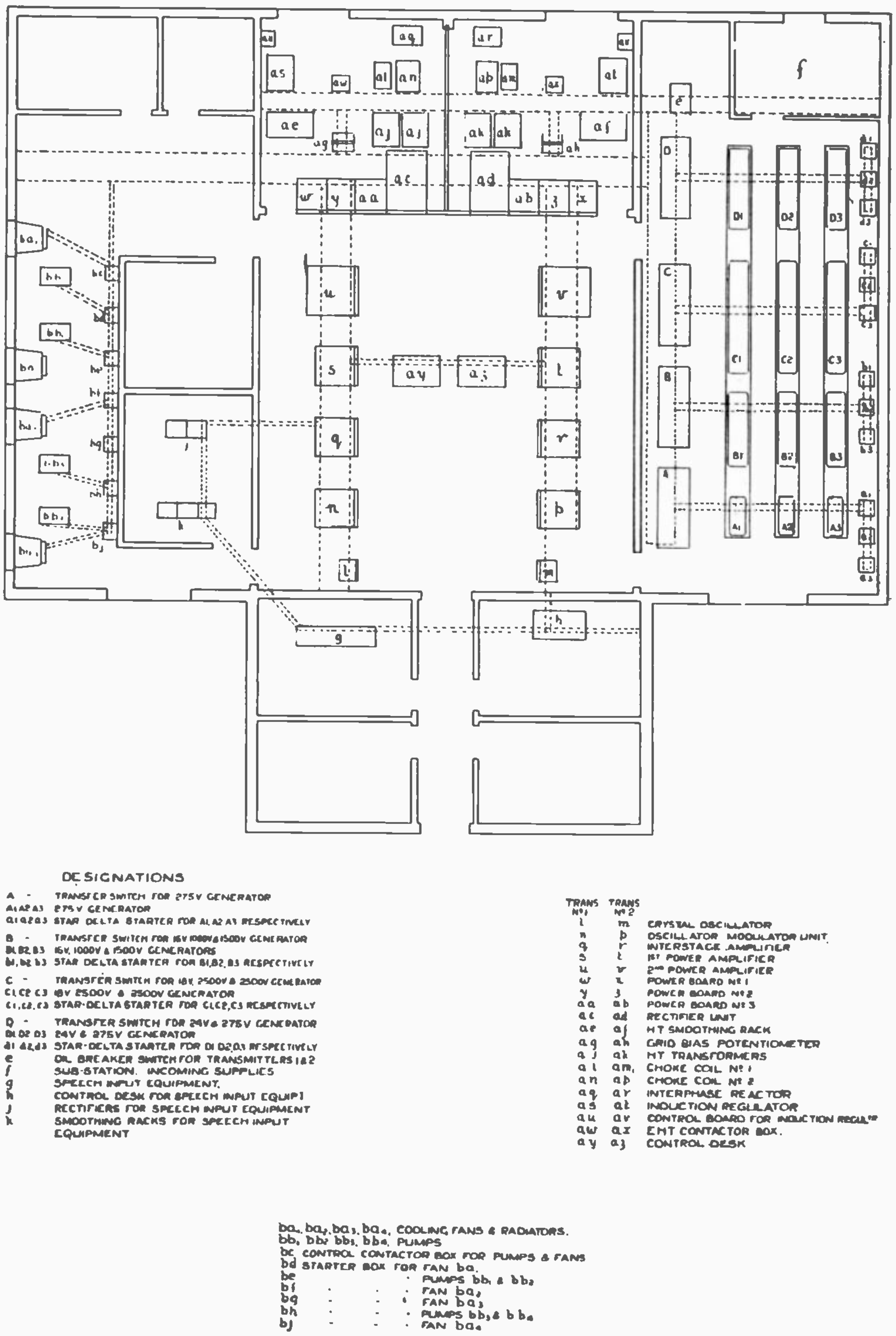

Figure 11—Floor Plan of Empire Broadcasters.

taken to eliminate variations due to temperature or voltage on this stage. The second unit contains circuits for raising the crystal frequency to that required for radiation. It is not economic to grind crystals to the low wavelengths required for short-wave broadcasting. Crystals are, therefore, made to operate on some submultiple of the required frequency. Three stages of multiplication may be used if desired. The last multiplier stage drives the modulated amplifier consisting of two 250-watt valves. The modulation system is also contained in this unit. The output of the line amplifiers is transformer-coupled to two valves in push-pull. This stage is capable of handling approximately double the power required for the modulated amplifier. The depth of modulation is accordingly not restricted by any limits imposed on the modulator valves. The frequency characteristic of this stage will determine the overall frequency characteristic of the transmitter, since there can be no question of side-band cut-off on these wavelengths, and this characteristic does not vary by more than 2 decibels between 50 and 8,000 cycles.

The third, fourth and fifth units are radio-frequency power amplifying stages. Each stage steps up the power by approximately the ratio 6:1. The small power stepup greatly adds to the ease with which the transmitters may be tuned on any wavelength.

The full advantages of the unit type of construction are well illustrated in this transmitter. Access may be obtained to both sides and the back of each unit by means of doors and removable panels. Only the radio-frequency circuits with their essential apparatus are housed in units, all the control relays, smoothing circuits, etc., being external. Certain mechanical features present interesting points. The units themselves are made of duralumin with polished slate front and nickel fittings, presenting a remarkably pleasing appearance. All insulators are made either of Pyrex or Mycalex as the heavy dielectric losses at these frequencies prohibit the use of the more usual insulators, such as Lakelite, phenol fibre, etc.

Control and Operation of Transmitters.

Two of the most important features of the Empire Station are the centralization of control and the safety precautions which have been taken. The latter have been carried out in accordance with the most modern power practice, resulting in the use of mechanical interlocks throughout the system.

The main control board carries all the regulators for the necessary filament, grid bias and high tension supplies for both transmitters. In addition, safety circuits and their associated relays, alarm circuits, etc., are fitted to the back of this main board. Behind this, and forming part of it, are the two main rectifiers for supplying high tension for the last two stages of power amplification.

Isolating fuses enable faults to be quickly located on any control circuit. The front panels of the control boards are polished black slate, lining up with the radio-frequency units in appearance.

The argument is sometimes put forward that this centralization of control, involving as it does additional apparatus, renders the plant more liable to breakdown. However, it has the advantage, important in the particular case under consideration, of making the starting up or shutting down of a transmitter a matter of a few minutes only. Furthermore, failures, if such do occur, are of a minor nature and may be quickly rectified.

In addition to the protection of important and costly apparatus by automatic alarm circuits, etc., the safety of the operating staff has been given the utmost consideration. The system of mechanically interlocking all doors with an isolating switch, as well as providing an electrical interlock, renders the danger to personnel absolutely negligible. It is not possible to have access to any dangerous voltage without isolating the voltage supply and earthing the components in question. Each radio cubicle and the entrances to the two control boards are fitted with this mechanical isolating and earthing switch.

Under the heading of the operation of the transmitter must be considered wavelength changing. It is not possible, due to the number of octaves covered, to have circuits which may be tuned by a variable capacity alone and, therefore, the inductances for each tuned circuit are made in the form of detachable coils. To change the wavelength it is necessary to change the inductances in each of the radio-frequency circuits; the fine adjustment of these circuits being obtained by variation of capacity. The heavy loading of the grid circuits and small power step-up ratios between the radio-frequency amplifiers enables the wave changes to be made rapidly, since it is not necessary to line up the working conditions of each unit with the extreme accuracy usually associated with the high power frequency amplifiers. The latitude allowable in the adjustment of the controls of these transmitters is definitely a feature of the installation.

In order that the lining up of the transmitter may be correct on modulation, a meter (a recently developed type of peak voltmeter) is connected to the modulated amplifier stage giving a direct reading of the percentage modulation. The complete operation of shutting down the transmitter, changing wavelength and starting up again occupies two operators about ten minutes.

Power Supplies.

Fig. 10 shows how the main incoming a-c. supply is transformed down to the required voltages and distributed to the apparatus. It will be noticed that there are two separate supplies in the building,

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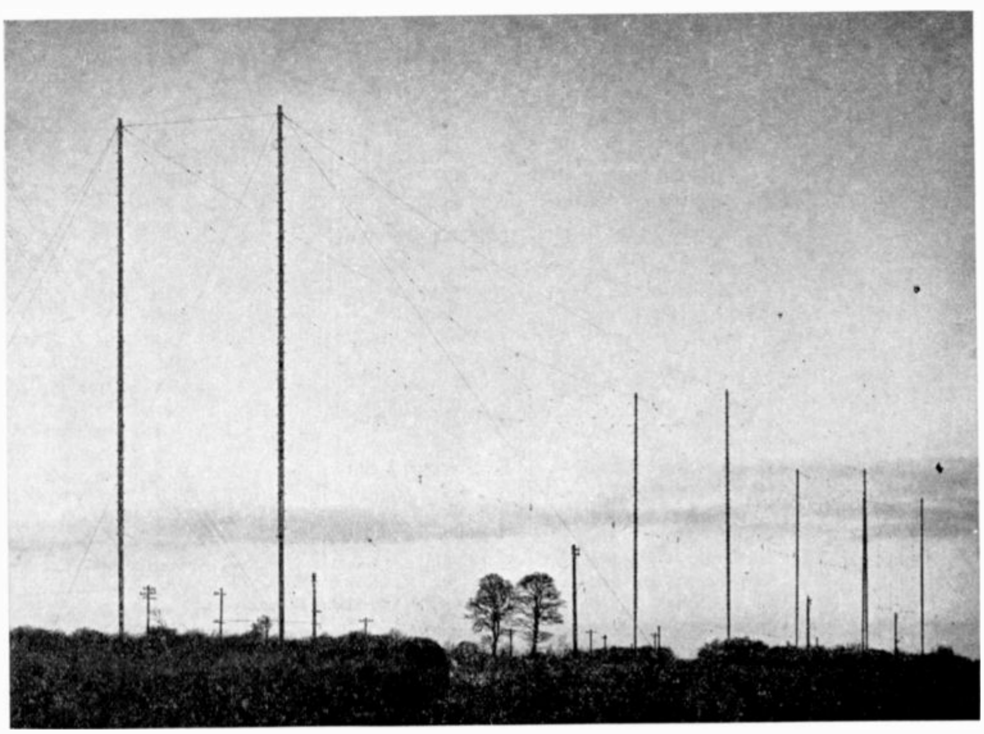


Figure 12—The Indian Zone Block of Aerial Arrays Empire Broadcasting.

PRESS; TIME; AND WEATHER SCHEDULE

HIGH FREQUENCY AND LOW FREQUENCY

If operators on overseas duty will keep us informed of additional calls it will be appreciated. Everyone is invited to help keep this list up to date.

By MARL H. FALLON

Confirmed skeds up to April 1st, 1934

In addition to list published in last month issue.

Acknowledgement is hereby expressed to "Radio Amateur Call Book" for the use of this time form.

GCT	EST	CALL	STATION	METERS	
0000	7:00 PM	KPH	San Francisco	24.15	TFC
0048	7:48	GBR	Rugby, England	34.72, 18750	TFC BC
0100		WRH	is off the air now apparently		
0100	8:00 PM	ZLV	New Zealand	18.5	Px
0200	9:00 PM	KSE	Los Angeles, Calif.	36	TFC
	9:00	KPH	San Francisco	35.55	TFC
0255	9:55	FFZ	Shanghai, China	36, 610	Time
0300	10:00 PM	FFZ	Shanghai, China	36, 610	WX (first in French, then English)
0300	10:00	JPD	Japan	22.64	Px (Repeats twice)
0418	11:18	WSL	Sayville, N. Y.	34.60, 54, 9200	Px Tfc
0430	11:30	KPH	San Francisco	35.5	TFC
0500	Midnite	VAB	Vancouver, B. C.	36.01	Px (not confirmed)
0530	12:30 AM	KPH	San Francisco	35.55	TFC
0730	2:30 AM	KAA	Manila, P. I.	35 5	Wx
	2:30	KPH	San Francisco	35.55	TFC
0810	3:10	FCJ	Rabat, Morocco	53.5	WX (Some kinda)
0830	3:30	CTW	Portugal	41	Wx (Portgual)
	3:30	FGA	Dakar, Africa	26	Wx
0854	3:54	FFZ	Shanghai, China	36, 610	Time, Wx (first in French)
0900	4:00 AM	FFZ	Shanghai, China	36, 610	Wx
0957	4:57	SUZ	Cairo, Egypt	21.95	Wx (code)
1000	5:00 AM	VIS	Sydney, Australia	48	Px
1100	6:00 AM	KPH	San Francisco	35.55	TFC
1200	7:00 AM	FLJ	Issy-Les-Moulineau	32.5	Wx
1230	7:30 AM	VIS	Sydney, Australia	48	Px (Repeat of 5 a. m. px)
1400	9:00 AM	KAA	Manila, P. I.	36.01, 600	Wx, TFC
	9:00	XGX	doesn't send PX now		
1600	11:00 AM	SAB	Goteborg, Sweden	36	TFC
	11:00	KAA	Manila, P. I.	36.1	Px (Automatic QSZ)
	11:00	GHC	Baghdad, Iraq	43.1	Wx
1700	Noon	LGN	Bergen, Norway	34 6	Px (Norwegian) O. K.
1800	1:00 PM	VIS	Sydney, Australia	48	Px
	1:00	KPH	San Francisco	24.15	TFC
	1:30	FGA	Dakar, Africa	35.8	WX
	1:30	FLE/FPD/FLJ	Paris	23.07, 32.5, 2650	WX apparently
1840	1:40	FNJ	Ajaccio, France	44.2	WX apparently
1900	2:00 PM	GBR/GIC/GID	Rugby	22.13, 34.72, 18750	PX
	2:00	KPH	San Francisco	24.15	TFC
2000	3:00 PM	SAB	Goteborg, Sweden	36	TFC
	3:30	KPH	San Francisco	24.15	TFC
2100	4:00 PM	IBF/IDR	Rome	33.09	PX
	4:00	KPH	San Francisco	24.15	TFC
2300	6:00 PM	PCH	Holland	36	TFC
	6:00	KPH	San Francisco	24.15	TFC

Skeds on Intermediate Waves

GCT	EST	CALL	STATION	METERS	
0000	7:00 PM	WPA	Port Arthur, Texas	2290	TFC BC
0156	8:56 PM	VPS	Hong Kong, China	2800	Time
0200	9:00 PM	JCS	Choshi, Japan	600	Time
0230	9:30	XSG	Shanghai, China	600	Wx
0318	10:18 PM	FFZ	Shanghai, China	2100	Wx (First in French)
	10:55	NBA	Balboa, C. Z.	2270, 6500	Time, hydros
0400	11:00 PM	VAS	Louisburg, N. S.	2804	Wx (Forecast)
0400	11:00	JDA	Dairen	600	Wx (local)
	11:00	VPS	Hong Kong, China	600	Wx (Forecast)
0418	11:18 PM	KPH	San Francisco	690, 2380	Wx, TFC
0450	11:50	JGA	Tokio, Japan	4000	Wx (First in Jap.) ?
0500	Midnight	VPS	Hong Kong, China	2913	Wx
0556	12:56 AM	VPB	Colombo, Ceylon	2300	Time, Wx, Tfc
0600	1:00 AM	JCS	Choshi, Japan	600	Wx
0656	1:56	VPS	Hong Kong, China	2913	Time
0810	3:10 AM	KPH	San Francisco	2380	TFC, PX
0827	3:27	VWC	Calcutta, India	2000	Time, Wx, Tfc
0900	4:00 AM	VTR	Rangoon, Burma	1200	Wx
	4:00	VWM	Madras, India	1000	Wx
	4:00	VWB	Bombay, India	1000	Wx
0918	4:18	FFZ	Shanghai, China	2100	Wx (First in French)

(Continued on Page 29)

The Budapest Anti-Fading Antenna

(Continued from Page 6)

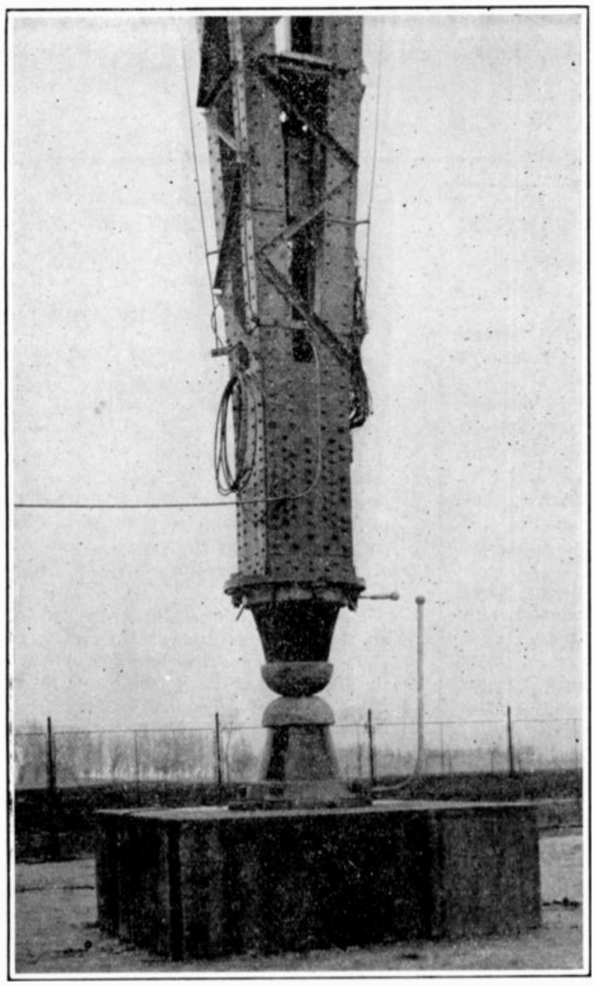


Figure 6—Base of Tower Showing Base Insulator.

field at a distance of one kilometre from the antenna for an input power of one kilowatt is 410 millivolts per metre. This field is 3.4 db. above the field established by a quarterwave antenna and 1.75 db. above the field from an antenna having $\frac{\lambda}{\lambda_0} = .6$ which is representative of the normal high T antenna employed in many stations. To put these results in another way, a 100 kilowatt transmitter with an antenna of the optimum height, sets up the same useful field as a 150 kilowatt transmitter with a high T antenna of $\frac{\lambda}{\lambda_0} = .6$ or as a 218 kilowatt transmitter working with a quarter-wave antenna.

In addition to the considerable gain in useful field obtained by a high vertical radiator there is a very valuable reduction in the unwanted high angle radiation, as will be seen from the lower curve. The high angle fields fall off as the height is increased up to values of $\frac{\lambda}{\lambda_0}$ between .38 and .45, after which they begin to increase again owing to the appearance of the secondary loop referred to before. Taking the height of the Heaviside layer as 100 kilometres, the radiation in the directions for which the curves are drawn, namely 35 and 50 degrees to the vertical, would arrive back at the surface of the earth at distances of respectively 140 and 238 kilometres from the transmitter and would cause severe fading at such distances in zones where the reception would other-

(Continued on Page 27)

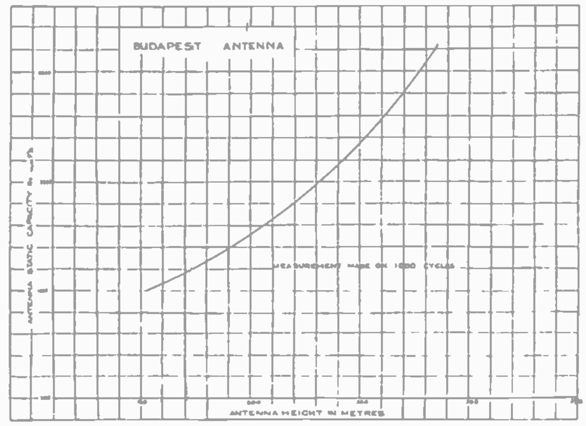


Figure 7—Antenna Capacity.

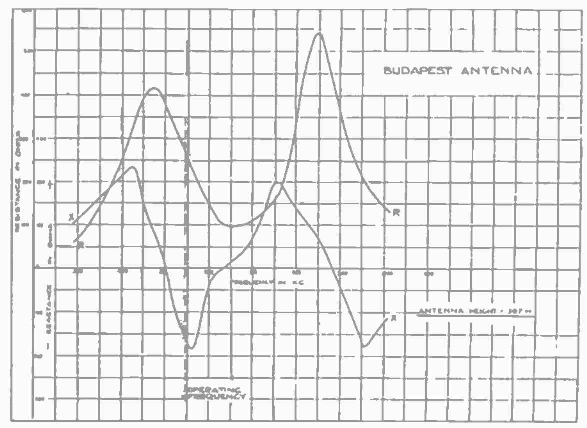


Figure 8—Antenna Impedance—Frequency Characteristic.

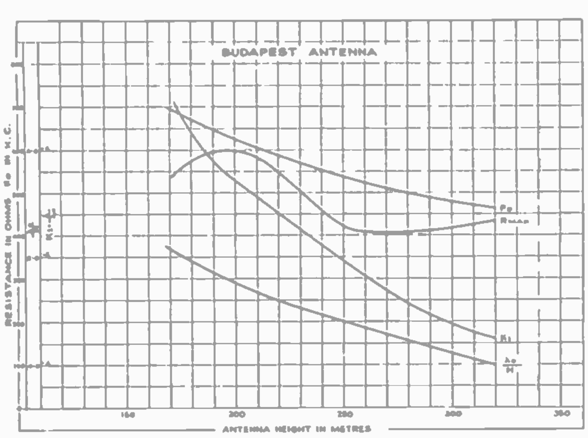


Figure 9—Antenna Characteristics—Height Curve.

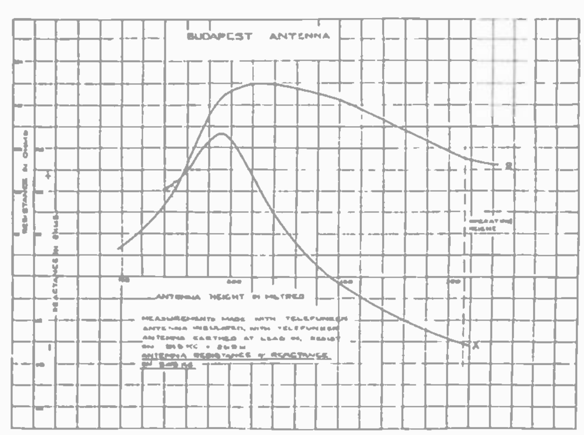


Figure 10—Antenna Impedance on the Operating Frequency.

BROADCAST STATION NEWS

DEFINITIONS

Broadcast Stations are defined by the Federal Radio Commission as follows:

The term "broadcast station" means a station used for the dissemination of radiotelephone emissions intended to be received by the public.

The term "clear channel station" means a station licensed to operate on a frequency designated a clear channel.

The term "high power regional station" means a station licensed to operate simultaneously with one or more stations assigned to the same frequency designated for such use and with authorized power of not less than 5 kilowatts.

The term "regional station" means a station licensed to operate simultaneously with one or more stations assigned to the same frequency designated for such use, and with an authorized power of not less than 250 watts nor more than 1,000 watts at night, and not more than 2,500 watts during daytime.

The term "local station" means a station licensed to operate with other stations assigned to the same frequency designated for such use, and with an authorized power of 100 watts at night and not more than 250 watts during daytime.

The term "unlimited time station" means a station licensed to operate without a maximum limit as to time.

The term "limited time station" means a station licensed to operate, on a frequency designated as a clear channel, during daytime, and until local sunset, or until sunset at the dominant clear channel station, and in addition during night hours, if any, not used by the dominant clear channel station.

The term "daytime station" means a station licensed to operate during the hours between 6 a. m. and local sunset, or until sunset at the dominant station if farther west than the daytime station.

The term "sharing time station" means a station the operating hours of which are so restricted by the station license as to require a division of time with one or more other stations, using the same frequency in the same geographic area.

The term "part-time station" means a station, the operating hours of which are specified in the station license as a fraction of the total hours of the broadcast day, and the use of the same frequency during the remainder of the time not assigned to any other station in the same geographical area.

The term "specified hours station" means a station the exact operating hours of which are specified in the license.

BROADCASTING "LINGO"

From RCA Radiotron Reference Book

ADENOID TENOR: one with a "tight" voice.

ANNOUNCER'S DELIGHT: sarcastically applied to the announcer's control box in the studio.

BIRDIE: the tweet tweet sound sometimes heard on long distance lines

BLASTY: the blasting sound; too much volume.

BRING IT UP: order to increase volume.

BUG JUICE: a term describing carbon-tetrachloride.

BUGS: trouble in the equipment caused by something not immediately obvious.

CANS: headphones.

CORN FED: when the performance of either a singer or instrumentalist lacks culture.

CROSS FIRE: Morse telegraph code picked up by program lines.

CROSS TALK: conversation picked up from a foreign source.

CROSS TONES: foreign tones picked up.

DEAD MIKE: a microphone out of service.

DOWN IN THE MUD: very low reproduction volume.

FADE IN or *FADE OUT*: gradual reduction or increase in volume, respectively.

FIGHTING THE MUSIC: lacking ease in singing.

FINAL SHOT: the last test of a program.

FUZZY: a voice lacking clarity.

GELATINE TENOR: one with a vibro or tremolo in his voice.

HAYWIRE: relates to equipment in poor condition.

HOND IT DOWN: an order to reduce volume.

HOT SWITCH: a rapid program change from one point of origin to another.

KILLIE LOO BIRD: a flighty coloratura soprano who sings with a florid style.

LINE HITS: clicking noises heard on program lines.

LOCK JAW: the voice of one who sings as if tired.

NEMO: programs originating outside of the studio.

NERVOUS BARITONE: one who over-emphasizes the dramatic effect.

OLD SEXTON: a bass with a sepulchral voice.

ON THE BEACH: out of a job.

ON THE LOG: an entry in the studio records, complimentary or otherwise.

(Continued on Page 39)

Code Authority for the Radio Broadcasting Industry

National Press Building,
Washington, D. C.

Rules and Regulations Governing

Administrative Order No. X-6.

By virtue of the authority vested in me as Administrator for Industrial Recovery, I hereby prescribe the following rules and regulations which I deem necessary and advisable to carry out the purposes and intent of the Executive Order of the President dated February 8, 1934, with reference to the posting and display of the terms and provisions of Codes of Fair Competition:

1. Every person subject to any Code of Fair Competition shall, within thirty (30) days from the date hereof, the effective date of such code, or the date upon which he becomes subject thereto, whichever is latest, unless he has previously so registered, register the full name of his enterprise together with a statement of the number of shops, establishments or separate units thereof and their location, with the Code Authority of the Trade or Industry of which he is a member. Every such person who may open for business an additional shop, establishment or separate unit after such registration shall, within thirty (30) days after such opening, register the same in like manner.

2. Upon registration, or as soon thereafter as is possible, each such person will be furnished with official copies of provisions of any Code of Fair Competition to which he is subject relating to hours of labor, rates of pay and other conditions of employment. Such official copies of such provisions will contain directions for filing complaints of violations of such provisions. Such official copies, with such directions, shall be kept conspicuously posted at all times by such person in each shop, establishment or separate unit of his enterprise to the extent necessary to make them freely accessible to all employees.

3. Whenever any modification of or exemption or exception from any Code of Fair Competition permits any such person to pay lower wages or work his employees longer hours or establish conditions of employment less favorable to his employees than those prescribed by the provisions contained in such official copies of Code provisions, the Code Authority, on the request of such person, will furnish him with certified copies of such modification, exemption or exception in sufficient number for posting alongside of such official copies of Code provisions.

4. No person subject to a Code of Fair Competition shall display or furnish any incorrect copies of such provisions, direc-

(Continued on Page 35)

The Budapest Anti-Fading Antenna

(Continued from Page 25)

wise be good in the case of a medium wave high power transmitter working over average ground.

half-wave point of view of the secondary loop of high angle radiation. It can be deduced, however, from curves such as those of Fig. 4, that for antennae working on comparatively long wavelengths, e.g., 400 to 500 metres, with good ground conditions, the increase in horizontal field makes up for the increased high angle for maximum horizontal field. Actually, for a transmitter working on 550 metres, a ratio of working wavelength to fundamental wavelength between .42 and .44 would be a good compromise.

The effect of the high antenna on fading within the normal service area is illustrated more clearly by the curves of Fig. 5.

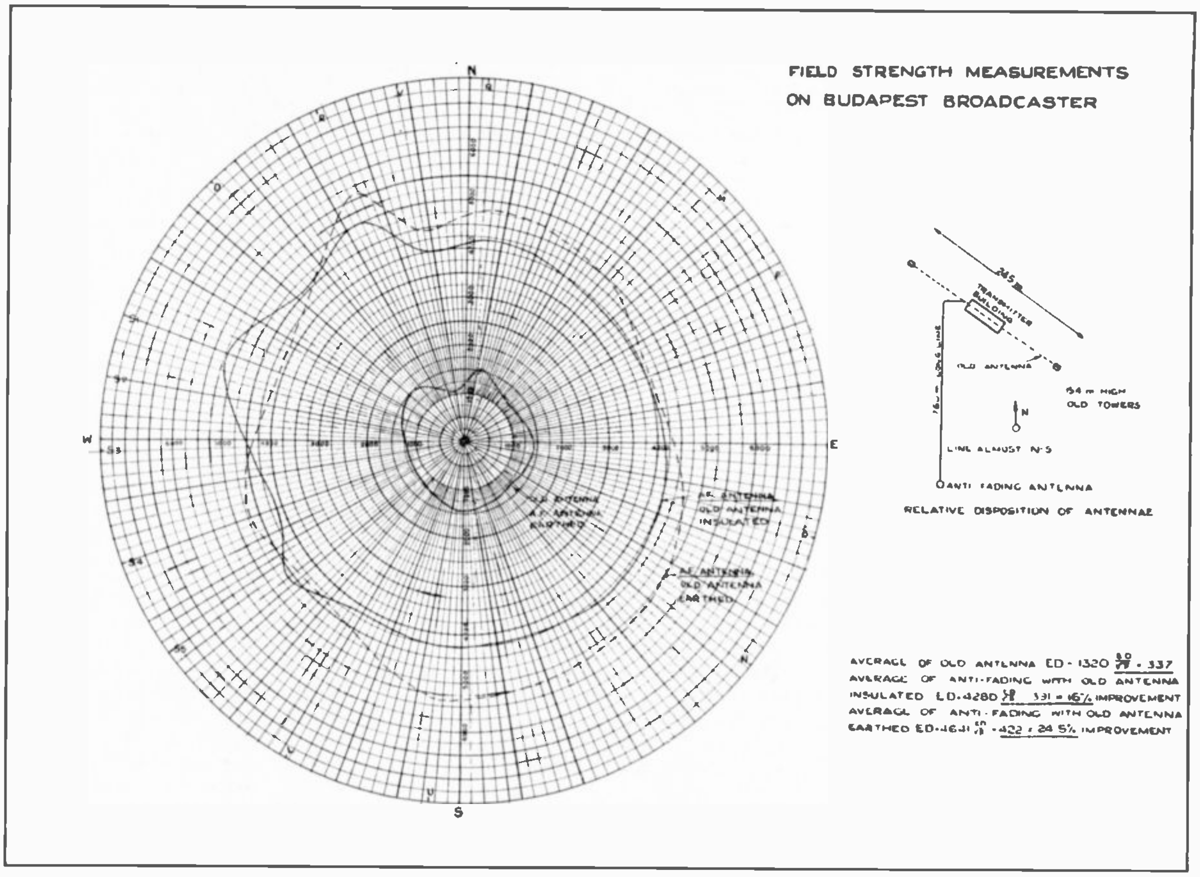


Figure 11—Field Strength Contour Map.

From the point of view of fading, a question arises as to whether it is advisable to increase the height beyond the field, and we find that the condition for minimum fading at the edge of the normal service area is close to the condition

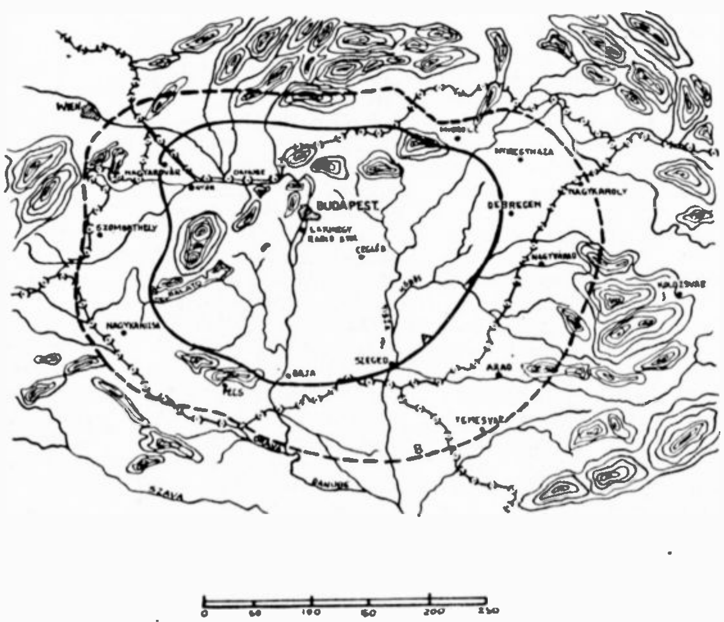


Figure 12—Map Showing Extension of Fadingless Zone.

The curves on the left represent the case of a quarter-wave antenna and those on the right, the case of an antenna of the optimum height. The curves sloping downwards from left to right show the useful field strength at different distances for one kilowatt input to the antenna, duly corrected for attenuation on the basis of a ground conductivity of 10^{-13} electromagnetic units. The curve on the right shows higher fields than that on the left, corresponding to the better figure of merit of the higher antenna. The other curves give the values at which reflected fields arrive back at ground level, assuming 100 per cent reflection at an ionized layer 100 km. up.

If we assume that reception will be noticeably impaired by fading if the reflected field at the receiving point exceeds one-fifth of the directly propagated field, it appears from the curves that the expected limit of the zone of excellent reception would be at 120 kilometres from the transmitter for the case of a quarter-wave antenna, but would be pushed out to about 210 kilometres for the case of a high antenna having a ratio of working wavelength to fundamental wavelength equal to .42.

The value of $\frac{\lambda}{\lambda_0}$ finally chosen for the Budapest antenna was .435. The working wavelength λ being 549.5, the height of the structure had to be adjusted so that the natural wavelength λ_0 should be 1266 metres. This fundamental wavelength was obtained for a tower height of 307 metres.

The peculiar form of mast construction illustrated in the first figure represents an excellent solution to the mechanical problems imposed by the special electrical requirements. The mast must be completely insulated and it is necessary, in order that correct current distribution should be obtained, that the capacity from the base to ground should be as low as possible.

The guy cables are attached at one section only, near the middle of the mast. This point corresponds very nearly to the voltage node, and the voltage applied to the guys is therefore very small, so that the question of guy insulation is simplified. The base insulator (Fig. 6) is comparatively small in volume and hence not liable to internal overheating under the applied radio frequency voltage.

The mast is square in section and copper cables are carried from top to bottom at each corner on the outside of the structure to ensure good high frequency conductivity. Additional cables are provided at the centre sections where the current has the highest intensity.

The height of the structure can be varied by 12 per cent from 285 to 315 metres by raising or lowering a galvanised steel pole projecting from the top, thus providing for possible error in forecasting the natural wavelength.

The base insulator is in the form of two cones meshed together at their narrower sections by a ball and socket connection in steel castings, permitting the antenna to pivot freely at this point.

The insulator has a total height of 1.5 metres. Its largest and smallest diameters are 90 cm. and 45 cm., respectively. It was proof tested to a compressive load of approximately 1,500,000 lbs.

The cross section of the tower increases uniformly from top and bottom towards the centre where eight guys are connected, two at each corner. The centre section is a square of 14.6 metres side.

Owing to the considerable width at the section at which the guys are attached, the tendency for the tower to rotate about the centre in the case of unequal wind loads on the upper and lower halves, is taken up by strains in the guys rather than by a large sheer resistance at the base.

The steel work was designed to have an adequate factor of safety for two conditions of loading:

(1) Wind load applied to the portion above the guys only. The condition allows for a wind pressure of 30 lbs. per square foot acting on 1½ times the projected area of steel in one face.

(2) Wind load applied over the total length of the structure. This provides for a graduated wind pressure from 25 lbs. per square foot at the bottom of the structure. increasing uniformly to 51 lbs. per sq. foot at the top of the structure, acting on 1½ times the projected area of the steel in one face.

The structure was so designed that when the maximum load on any member, based on either of these conditions, was increased 50 per cent, no member was stressed above the elastic limit of the steel in the case of tension members, or the crippling strength in the case of compression members.

The guys are 2¼ inches diameter wire rope specially prestretched to eliminate the elongation that usually occurs some months after the first tensioning, and to ensure a constant modulus of elasticity. In the prestretching process each guy rope was subjected to a stress of 170 tons. In the structure the guy wires have maximum initial tension of 34 tons and in service the maximum stress will not exceed 150 tons. Each guy wire is divided into four lengths. At the connection to the radiator itself, two guy insulators are inserted, the other separate lengths being divided by one guy insulator, making a total of five insulators per guy. The anchor points for the eight guy wires are spaced equally round a circle of 180 metres radius. The guys are at an angle of 40° to the horizontal. Each guy insulator when completely assembled was subjected to a proof tensile test of 170 tons. The insulators are so constructed as to eliminate tension in the porcelain.

The foundations comprise one centre foundation block and eight guy anchorages. The position of the guy anchorages in relation to the centre block required very accurate setting, as it was imperative that all the guys should have the same initial tension. The centre block was designed exclusively for compression, while the guy anchorages were designed for tension and sheer. The foundations are of reinforced concrete construction.

For warning to aircraft, six red lamps are installed on the tower, two at the top, two one-quarter way down and two halfway down the tower. The lamps are supplied with alternating current fed through high frequency choke coils and cables passing through the tubing of the antenna loading coil to a transformer mounted in the base of the tower.

The adjustable pole at the top of the tower terminates in a large sphere to avoid corona effects due to the high radio frequency voltage at that point.

The theory requires very low resistance in the ground below the antenna and an extensive earth system was, therefore, installed. It consists of radial wires buried 50 cm. deep in the ground going out to a distance of 180 metres from the tower. The wires are terminated near the base of the tower in a circular bus bar. The site on which the antenna is erected is ideal from the standpoint of the performance of the antenna, as the earth resistivity is exceptionally low.

The foundations were laid and the tower constructed in a period of twenty-seven weeks. Work on the foundations was started on the 28th of April, 1933, and was completed on the 27th of May. The erection of the structure itself commenced on the 6th of July and the antenna was ready for testing on the 4th of November.

During construction, measurements were made periodically of the impedance of the structure and curves were made showing the variation of impedance with height. These measurements could be made only after the height had passed 140 metres when the temporary uninsulated guys were removed after the installation of the final guys. The measurements included observations of the static capacity of the mast and of the resistance and reactance of the antenna between the base of the tower and ground on wavelengths from 300 to 1,000 meters. The latter measurements were made by means of a high frequency impedance bridge.

Fig. 7 shows capacity plotted against height, and Fig. 8 is a typical curve showing the resistance and reactance plotted against frequency for a certain tower height. A series of such curves were made for various tower heights. From these curves, the natural wavelengths for different heights are determined by noting the frequency which corresponds to the half-wave operation of the antenna as indicated by the points of maximum resistance. It is observed that the zero reactance points do not correspond exactly to the points of maximum resistance. This effect is due partly to a slight inaccuracy in the measuring bridge, and partly to the effect of the capacity of the antenna base insulator. From these results the curves of Fig. 9 were drawn showing natural wavelength and the ratio $\frac{\lambda}{\lambda_0}$ plotted against height. As the construction proceeded, watch was kept that the curves converged towards the required values for the height forecasted, and finally on the basis of the results the adjustable pole was set to the height required to give a ratio of $\frac{\lambda}{\lambda_0}$ equal to .435.

The curve of Fig. 10 shows the antenna impedance at various heights for the operating frequency of 545 kc. From this curve it will be seen that the tuning of the antenna is not sharp and that there will be no appreciable side-band cut-off due to the sharpness of resonance in the antenna.

It is evident also from Fig. 10 that although we should lose the special advantages of the antenna, it could, if necessary, be fed on any frequency below 545 kc. since there is no point at which the antenna impedance is so high or the resonance curve so sharp that difficulties in feeding would be experienced. The antenna would not be suitable for frequencies higher than 545 kc. on account of the increased loop of high angle radiation.

With a power of 120 kW. delivered to the antenna, two series of field strength measurements were made. The first of these was with the antenna of the old station disconnected and the second with the old antenna grounded. The two series were necessary because it was found that the old antenna, which was also tuned to 545 metres, although at a distance of 750 metres, affected slightly the field strength diagram of the new antenna.

The field strength measurements were made with a Standard Field Strength Measuring Set at a number of points spaced more or less equally at a distance of about 5 km. from the antenna. Some check measurements were also made with a loop antenna and thermocouple, the results agreed closely with those of the Field Strength Measuring Set. The measured field strengths were multiplied by the distance from the antenna and corrected for attenuation by the Sommerfeld formula, taking an earth conductivity of $y = 10^{13}$ electromagnetic units as determined from previous field strength measurements. The values of the corrected field multiplied by distance are shown in Fig.

11. From this diagram it is seen that the average ED product with the old antenna insulated is 4280. This corresponds to an antenna Figure of Merit of 391, expressed as the field in millivolts per metre at a distance of one kilometer for an input of one kilowatt. With the old antenna earthed, absorption in this antenna was reduced, resulting in an improvement in the ED product to 4641 and giving a Figure of Merit of 422. The diagram is also more nearly circular, but the nature of the surrounding country renders an absolutely circular diagram improbable.

The measured antenna Figure of Merit of 422 is higher than the calculated maximum as shown in Fig. 3 for a loss resistance of 10 ohms, but agrees very closely with the value calculated on a basis of a loss resistance of 5 ohms.

Fig. 11 shows also the field strength results for the old high T antenna with an input of 15.3 kW. This antenna has a ratio of $\frac{\lambda}{\lambda_0} = 0.63$. The measurements were made with the Blaw-Knox antenna earthed. The antenna Figure of Merit works out at 337, which agrees well with the value which would be predicted from Fig. 3.

From a comparison of the two results it appears that in the better case, the new antenna gives an increase of field in the horizontal plane of 24 per cent as compared with the old antenna. Expressed in terms of transmitter power, this would be equivalent to an increase in carrier power from 120 kW. to 185 kW.

The increase in direct field combined with the simultaneous decrease in high angle radiation results in a very considerable enlargement of the area free from fading, as may be seen from Fig. 12. From observations and reports received up to date, it appears that the limit at which fading becomes apparent to listeners has been extended from a distance of 120 km. for the case of the old high T antenna

$$\left(\frac{\lambda}{\lambda_0} = .63\right)$$

to a distance of between 180 and 200 km. This is equivalent to more than doubling the service area of the station.

The results obtained have completely justified the sound judgment of the Technical Department of the Hungarian Administration in deciding to erect the tower. This decision required considerable initiative inasmuch as the structure is the largest of its kind in the world, and reflects the greatest credit on the Hungarian Postal Administration, and especially on Messrs. J. Erdos and E. Magyari.

The responsibility for ensuring the soundness of the design and construction, as well as for verifying all possible requirements for safety, was carried by Mr. P. Tanto of the Ministry of Commerce.

The general coordination of the project was arranged by the Standard Electric Company, Limited, Budapest, and in particular by Messrs. C. F. Deshy and C. Gyorgy.

Ship Construction Up

Lloyds Register of Shipping report published last month and covering the previous three months shows an increase of 40 per cent. in ship construction.

The figures shows the different countries status of the last three months of 1933, and the first three months of 1934.

PRESS, TIME AND WEATHER SCHEDULE

(Continued from Page 24)

GCT	EST	CALL	STATION	METERS	
0926	4:26	FLE	Paris	2650	Time
0930	4:30	GNI	Niton, England	600	Wx (Southern Area) TFC
	4:30	GLV	Seaforth, England	600	Wx (Western Area) TFC
0948	4:48	GCC	Cullercoate, England	600	Wx (Eastern Area) Tfc
	4:48	GCK	Valentia, Ireland	600	Wx (Western Area) TFC
0950	4:50	GZQ	Aden, Somaliland	2000	Wx
1000	5:00 AM	XSG	Shanghai, China	600	Wx
	5:00	JDA	Dairen	600	Wx (local)
1100	6:00 AM	JGA	Tokio, Japan	4000	Wx (First in Jap.)
1200	7:00 AM	WPA	Port Arthur, Texas	2290	TFC BC
	7:00	JCS	Choshi, Japan	600	Time, Wx
	7:00	VPS	Hong Kong, China	600	Wx
1255	7:55	VPS	Hong Kong, China	2931	Time
1300	8:00 AM	VPS	Hong Kong, China	2931	Wx
	8:00	JDA	Dairen	600	Wx (local)
1358	8:58	VAV	Chebucto Head, N. S.	600	Time
1400	9:00 AM	FFZ	Shanghai, China	610	Wx (First in French)
1418	9:18	FFZ	Shanghai, China	2100	Wx (Repeat of above)
1548	10:48 AM	GZP	Matara, Ceylon	2000	Wx
1600	11:00 AM	VAS	Louisburg, N. S.	2804	Wx (Forecast)
1618	11:18	VCE	Cape Race	660	Wx
1626	11:26	VWC	Calcutta, India	2000	Time, wx, tfc
1640	11:40	VAV	Chebucto Head, N. S.	750	Wx
1650	11:50	KOK	Los Angeles, Calif.	730	Wx (local)
1700	Noon	VWB	Bombay, India	1000	Wx
	Noon	VWM	Madras, India	1000	Wx
	Noon	VTR	Rangoon, Burma	1200	Wx
1705	12:05 PM	WPA	Port Arthur, Texas	2290	TFC BC
1748	12:48	GZP	Matara, Ceylon	2000	Wx
1755	12:55	NBA	Balboa, C. Z.	2270, 6522	Time, hydros
1800	1:00 PM	FFZ	Shanghai, China	610	Wx (first in French)
2000	3:00 PM	WPA	Port Arthur, Texas	2290	TFC
2030	3:30	GNI	Niton, England	600	Wx (Eastern Area) Tfc
	3:30	GLV	Seaforth, England	600	Wx (Western Area) Tfc
2048	3:48	GCK	Valentia, Ireland	600	Wx (Western Area) TFC
2200	5:00 PM	JDA	Dairen	600	Wx (local)
2226	5:26	FLE	Paris	2650	Time

By ERNEST W. BLACK

2355-2400 6:55-7:00 PM E.S.T. NAA. Arlington, Va. 3315

0100	WPN	New York	34.5	Px
0800	KUH	Manila	27, 35.9	Px
1300	KTK	San Francisco	34.5, 46.8	Px
1700	KUH	Manila	35.9, 54	Px
2230	KTK	San Francisco	17.9, 24.1, 34.5	Px

Proposed Shipping Industry Code

(Continued from Page 19)

to Hawaii or Puerto Rico and between Hawaiian ports.

(H) Tanker Division.—The Tanker Division shall include all Members of the Industry concerned with ocean-going tanker vessels in ballast or when used for the carriage of liquid cargoes. When carrying other cargo they shall be subject to rates prescribed by the divisions governing trades in which such cargo is carried.

(I) Bays and Sounds Division.—The Bays and Sounds Division shall include all Members of the Industry concerned with passenger and self-propelled cargo vessels engaged in local service on the Hudson River, and coastal bays and sounds tributary to the Pacific Ocean, Atlantic Ocean, and Gulf of Mexico, excluding vessels included in Group III.

(J) General Divisions.—Other divisions may be organized with the approval of the Administrator.

(b) Separate subdivisions for any particular trade routes, or special kinds of service, may be organized under their governing divisions (A to J) by a majority of the Members of the Division operating vessels in any particular trade route or special service.

Section 3. (a) Members of the Industry comprising Group II shall be organized into the following divisions, viz:

(A) Northern Division.—To include all Members of the Industry concerned with vessels operating within the Great Lakes, their connecting and tributary waters.

(B) Eastern Division.—To include all Members of the Industry concerned with vessels operating on inland waters between Eastport, Maine, and Key West, Florida, extending westward to, but not including, the Mississippi waterway system, or operations within the Great Lakes.

(C) Western Division.—To include all Members of the Industry concerned with vessels operating on inland waters of Alaska and on the Pacific Coast between the International Boundary Line on the North and the International Boundary Line on the South, extending eastward to the Rocky Mountains.

(D) Southern Division.—To include all Members of the Industry concerned with vessels operating on the inland waters between Key West, Florida, and the Rio Grande River.

(E) Central Division.—To include all Members of the Industry concerned with vessels operating on the Mississippi River from its source to the Gulf of Mexico, including tributaries thereto excepting the Great Lakes, their connecting and tributary waters.

(F) General Division.—Other divisions may be organized with the approval of the Administrator.

(b) Separate subdivisions under the above divisions may be organized on the basis of kinds of service, or geographical limits, as approved by the Administrator.

Section 4. Members of the Industry concerned with vessels included in Group III shall be organized into divisions, including subdivisions thereof, on the basis of types of vessels, or kinds of service, or geographical limits, as approved by the Administrator.

Section 5. Members of the Industry comprising Group IV shall be organized into divisions, including subdivisions thereof, on the basis of kinds of service, or geographical limits, and may adopt their own rules or procedure, as approved by the Administrator.

Section 6 (a) The Members of each Division shall elect a Chairman who shall preside at all meetings, and a Secretary who shall keep a minute record of the proceedings of all meetings, both of whom shall perform such other duties as may be directed by the members. The members may be represented by proxy. The Members of each Division shall have power to determine the proportionate part of the cost of administering this Code and the Division Code hereinafter provided for, which shall be borne by the Members of the Industry engaged in the Trade of the Division, upon the basis of the gross registered tonnage operated in such trade, or other equitable basis, or as otherwise may be agreed, which costs of administration shall only include compensation to and expenses of the members of the National Shipping Labor Board, as provided for in Section II of Article V hereof, the expenses of the Division Code Authorities, reimbursement to the National Recovery Administration for the salaries and expenses (including office expenses) of the four principal Administration Members provided for by Section 2 of Article VIII hereof, and such other expenses as may be authorized by the Members of the Division, all subject to the approval of the Administrator and the Members of the Division; to recommend to the Division Code Authority amendments to, exceptions from and modifications of the Division Code; and shall, either themselves or by delegation to the Code Authority, collect all necessary information and statistics that may be required under the Act; may appoint and empower committees to act in their behalf; engage attorneys, statisticians, accountants, research workers and clerical assistants, and fix their compensation; and may do generally all things permissible under the Act and under the Division Code and necessary to effective administration of the Division Code, including the delegation of authority to the Division Code Authority as hereinafter provided. Rules of procedure may be adopted governing the conduct of the business of the division. The action of the Members of any Division, other than a Foreign Trade Division, on all matters coming before them shall be determined by two thirds of all the qualified votes of all Members of the Division, or as otherwise may be agreed, except that Members of the Division Code Authority shall be elected as hereinafter provided.

Section 6 (b). In addition to the information and statistics required to be submitted as provided in (a) above, the Members of the Industry shall furnish to Federal and State agencies such statistical information as the Administrator may deem necessary for the purposes recited in Section 3 (a) of the Act; provided that nothing in this Code shall relieve any member of the Industry of any existing obligations to furnish reports to any governmental agencies.

Section 7. The action of the Members of any Foreign Trade Division on all matters coming before them may be determined by a unanimous vote of all the qualified votes of all the Members of the Division, except that the members of the Division Code Authority shall be elected as hereinafter provided. In the event of the Members of the Foreign Trade Division failing to agree, as above provided, on any matter submitted to them, then the members concerned with American flag vessels and the members concerned with foreign flag vessels shall vote separately, and the action of the division shall be determined by a majority vote of each of the two groups. If a majority of both groups fail to agree, then the matter shall go to the Division Code Authority. An appeal from an action of the Division Code Authority, or from the failure of the Code Authority to act, may be taken by a Member of the Division to the Administrator, whose decision shall be final.

Section 8. Any subdivision organized pursuant to the above authorizations shall be organized in the same manner as a division. Members of the Subdivisions shall have and may exercise similar power and authority to that vested in Members of the Division; shall have similar voting rights on matters coming before the subdivision as are enjoyed by Members of the Division: shall be subject to all appropriate provisions of this Code governing divisions; may adopt rules of procedure governing the conduct of the business of the subdivision; and may elect a Subdivision Code Authority as hereinafter provided. All Subdivision Code Authorities shall have the same status, authority, and procedure as Division Code Authorities.

Section 9. If the organizing provisions of Sections six (6), seven (7) and eight (8) above are impracticable of application to the divisions and subdivisions organized under Groups II, III, or IV then such divisions and subdivisions may be organized in the manner approved by the Administrator.

Section 10 (a). A Division and Subdivision Code Authority, or other governing body, comprised of such numbers as shall be determined by each division and subdivision, shall be elected by the Members of the Divisions and Subdivisions, respectively, of Group I, unless otherwise agreed, by a majority qualified vote; except that in each Foreign Trade Division and Subdivision the members concerned with American flag vessels and the members concerned with foreign flag vessels shall each separately elect by a majority qualified vote an equal number of members of the Division and Subdivision Code Authorities, respectively, provided that in all of the above elections each Member of the Division or Subdivision shall have or participate in at least one qualified vote. The members of Division and Subdivision Code Authorities shall each hold office for one year and until a successor shall have been chosen. They may be removed for good cause, after notice and hearing, by the divisions or subdivisions electing them. Vacancies shall be filled in the manner provided for original election.

(b) Division and Subdivision Code Authorities, or other governing bodies, for each division and subdivision of Groups II, III, and IV shall be elected by the Members of the Divisions and Subdivisions, respectively, in the manner and of the number determined by them by majority vote, and failing such determination, as may be prescribed by the Administrator. They shall hold office, be removed, and vacancies shall be filled as provided in paragraph (a) above.

Section 11. Each Division and Subdivision Code Authority shall designate a Chairman, who need not be a Member of the Industry and whose duties shall be prescribed by the Code Authority. The Code Authority may organize its meetings and adopt its own rules of procedure, except that a majority of the members thereof shall be necessary to constitute a quorum at any meeting, and a majority vote of all the members shall be required for any action. It may appoint a Secretary, appoint and empower committees and individuals to act in its behalf, engage attorneys, statisticians, accountants, research workers, and clerical assistants, and fix their compensation. It shall be the duty of the Code Authority, and they shall have authority under this Code and under the Act, subject to the review and disapproval of the Administrator:

(a) Generally to perform such acts within the Code as may be prescribed by Members of the Division or Subdivision, and to all things necessary to an efficient administration and to effect compliance with the Division or Subdivision Codes, in conformity with the Act.

(b) As Trustee for all Members of the Industry engaged in the Trade of the Division or Subdivision, in order to support the administration of this Code and/or the Division or Subdivision Codes, to collect from and bring about equitable contribution by all such members, and to that end to determine, and if necessary, sue for the proportionate part of the cost of administering this Code and/or the Division or Subdivision Codes which shall have been determined by the Members of the Division or Subdivision as provided in Section 6 above, and to disburse the amount so collected, all as may be approved by the Administrator.

(c) To issue explanations of the provisions of any Division or Subdivision Code, which shall constitute a prima facie construction of their meaning and application.

(d) To hear an appeal by any Member of a Division or Subdivision from any action taken by the Members of the Division or Subdivision, and to affirm, modify, or reverse such action. Pending such appeal the action may be suspended.

(e) To hear an appeal by any Member of a Division or Subdivision from any failure to take action on any proposal regularly brought before such members, and to approve or disapprove such failure. If the Code Authority directs that the proposal be acted upon, and the Members of the Division or Subdivision thereafter fail to do so, then if the proposal is designed to amend or supplement any Division or Subdivision Code, any member may present the proposed amendment or supplement to the Administrator, and, upon his approval, after such notice and hearing as he may prescribe, such amendment or supplement shall become a part of the Division or Subdivision Code.

(f) To hear and investigate all complaints of violations of the Division or Subdivision Code, subject to regulations issued by the Administrator.

(g) To suspend as a Member of the Code anyone found guilty of violating the Division or Subdivision Code, or failing to file written assent to the Division or Subdivision Code.

(h) To foster the formulation of arbitration agreements, either limited or general, between parties affected by the Division or Subdivision Code for the purpose of settling controversies arising thereunder.

(i) Where the Code Authority is of the opinion that this Code or the Division or Subdivision Code has been or is being violated, the Code Authority shall endeavor to effect compliance amicably, or assist the complaining party in bringing complaints of violation before the proper authority.

Section 12. If the Administrator shall determine that any action of Members of the Code or a Division or Subdivision Code, or of any agency thereof, may be unfair or unjust or contrary to the public interest, the Administrator may require that such action be suspended to afford an opportunity for investigation of the merits of such action and further consideration by such members or by such Code Authority or agency pending final action, which shall not be effective unless the Administrator approves or unless he shall fail to disapprove after thirty days' notice to him of intention to proceed with such action in its original or modified form.

Section 13. In order that Code Authorities shall at all times be truly representative of the Members of the Industry and in other respects comply with the provisions of the Act, the Administrator may prescribe such hearings as he may deem proper, and thereafter, if he shall find that any Code Authority is not truly representative of the Members of the Industry or does not in other respects comply with the provisions of the Act, may require an appropriate modification in the method of selection of the Code Authority.

Section 14. Members of each Division and Subdivision shall, by actions taken in the appropriate manner respectively authorized by the provisions of Sections 6, 7, and 8 above, propose codes supplemental to this General Shipping Code, each to be appropriately designated (name of Division or Subdivision) Division Code, which may establish standards of fair competition for the Members of the Industry, and may provide for the regulation of any other matter with which the division or subdivision may be especially concerned. Such codes shall, upon approval by the President, be codes supplemental to and a part of this Code, and shall establish standards of fair competition, and be Codes of Fair Competition, under and pursuant to the Act, for the Members of the Industry; provided that the President may, before approving any proposed Code, hold, or cause to be held, by any federal officer or employee, department, commission, or bureau of the Government, such public hearings on any proposed code as he may determine to be advisable in the public interest. Written assent to a Division or Subdivision Code substantially in form of Appendix I, appropriately modified, may be filed by the Members of the Division or Subdivision with the Division or Subdivision Code Authority, and failure to do so shall disqualify the party in default as a Member of the Division or Subdivision and of this Code, but shall not relieve such party from the duty of complying with the Division or Subdivision Code or this Code, in accordance with the provisions of the Act.

Section 15. Proposals for the amendment or supplementation of a Division or Subdivision Code may, with the approval of the Members of the Division or Subdivision, be made by the Division or Subdivision Code Authority, and, upon approval by the Administrator, after such notice and hearing as he may prescribe, such amendments and supplements shall become a part of a Division or Subdivision Code and of this Code.

Section 16. Proposals for the amendment or supplementation of this Code, if approved by a majority of the Division and Subdivision Code Authorities and ratified by two thirds of all the divisions and subdivisions, shall, upon approval by the President, after such notice and public hearing, as he may prescribe, become a part of this Code.

Section 17. The cost of administering this Code, provided by Section 6 above to be borne by the Members of the Industry, shall be equitably apportioned among the divisions and subdivisions by the Administrator.

ARTICLE V—LABOR

Section 1. (1) Employees shall have the right to organize and bargain collectively through representatives of their own choosing, and shall be free from the interference, restraint, or coercion of employers of labor, or their agents, in the designation of such representatives or in self-organization or in other concerted activities for the purpose of collective bargaining or other mutual aid or protection; (2) no employee and no one seeking employment shall be required as a condition of employment to join any company union or to refrain from joining, organizing, or assisting a labor organization of his own choosing; and (3) employers shall comply with the maximum hours of labor, minimum rates of pay, and other conditions of employment, approved or prescribed by the President.

Section 2. No individual under sixteen (16) years of age shall be employed in the industry, and no individual under twenty-one (21) years of age shall be employed as a stevedore.

Section 3. Provisions fixing minimum rates of pay, maximum hours of labor, and other conditions of employment on board American vessels shall be inserted in each Division and Subdivision Code and made applicable to the operations of the Members of the Industry subject to the jurisdiction of the respective codes; provided that the minimums and conditions contained in Schedule A hereto attached shall be incorporated as minimums and conditions in divisional codes of the Divisions or Subdivisions of Group I, in respect to American vessels, except codes of Bays and Sounds Divisions or Subdivisions and codes applicable to the interisland trades of Puerto Rico and Hawaii, and Pacific Coast steam schooners, and Alaskan Trades; provided, further, that the provisions of said Schedule A shall not themselves fix maximum rates of pay for the classifications of employment listed in said schedule.

Section 4. Longshoremen, tally clerks, checkers, cargo repair men, maintenance men, and all other dock workers, except watchmen, baggage clerks, and ship caretakers, shall not be employed for more than forty-eight hours in any week averaged over a period of four weeks.

Section 5. The minimum rates of pay at each port for longshoremen, tally clerks, checkers, cargo repair men, maintenance men, watchmen, baggage clerks, and all other dock workers employed on an hourly or daily basis shall be as specified in the applicable division or subdivision codes; provided, however, that pending the adoption of the division or subdivision codes the wages actually paid on February 1, 1934, shall not be reduced.

Section 6. No person employed in clerical or office work shall be permitted to work in excess of forty (40) hours in a week averaged over a period of eight (8) weeks. An average work day shall not exceed eight (8) hours provided that this shall not apply to outside solicitors or to persons employed in a managerial or executive capacity who earn not less than thirty-five ($35.00) dollars per week.

Section 7. The pay of the classes of employees mentioned in the preceding section shall not be less than fourteen ($14.00) dollars per week, provided that office boys and girls and messengers may be paid not less than eighty (80) per cent of such minimum wages, but the number thereof shall not exceed five (5) per cent of the total number of employees covered by the provisions of this section.

Section 8. (a) No employee shall knowingly be permitted to work for two or more employers for a longer period than permitted herein for a single employer.

(b) No employer shall reclassify employees or duties of occupations while continuing the same class of labor, or engage in any other subterfuge for the purpose of defeating the purposes or provisions of the Act or of this Code.

(c) Within ten days (10) after the effective date hereof, each employer shall post, and thereafter maintain in conspicuous places accessible to employees, full copies of this Code and any amendments or modifications which may later be approved.

Section 9. (a) Compensation for employment now in excess of the minimum wages specified in the preceding sections five (5) and seven (7), shall not be reduced notwithstanding that the hours worked in such employment may be reduced.

(b) Pending the adoption of Division and Subdivision Codes wages paid to employees on American vessels of Group I, except vessels of the Bays and Sounds Divisions and Subdivisions, vessels engaged in the interisland trades of Puerto Rico and Hawaii, and in Alaskan trades, and Pacific Coast steam schooners, shall not be less than the rates of pay set forth in Schedule A.

(c) Provisions in this code, or in any Division or Subdivision Code, shall not supersede any law within any State which imposes more stringent requirements on employers with respect to age of employees, wages, hours of work, safety, health or sanitary conditions, insurance, fire protection, or any other working conditions imposed by this Code or any Division or Subdivision Code.

(d) Provisions in this code, or in any Division or Subdivision Code, shall not supersede provisions with respect to hours, wages, and conditions of employment as to specific projects required therefor by competent governmental authority acting in accordance with law.

(e) The Administrator shall appoint a committee of six to study maximum hours of employment of employees in the Steward's Department of American vessels, three of whom shall be selected from the Members of the Industry operating American passenger and cargo vessels, and three from the representatives of the employees in the Steward's Department. Said committee shall make an investigation of the Steward's Department and shall report its findings, together with a schedule of maximum hours of employment, to the Administrator. The report shall be referred by the Administrator to the appropriate Code Authorities for such action as the Code Authorities and the Administrator may determine.

Section 10. Two Divisional Shipping Labor Boards for the conciliation of Labor disputes, one to have jurisdiction of disputes with shore labor and the other with officers and unlicensed members of crews, shall be created for each division or subdivision. Each Board shall be comprised of four members, two to represent the class of labor of whose disputes it has jurisdiction, appointed by the Administrator, with the advice of the Labor Advisory Board, and two to represent the shipping industry appointed by the Code Authority of the Division or subdivision concerned, in such manner as the Authority may determine. With approval of the Administrator one Board may act for more than one division or subdivision or more than one port. Disputes arising with any officers or seamen shipped for a round voyage shall be subject only to the jurisdiction of the Divisional Board functioning at the port of engagement or discharge. An appeal from the decision of a Divisional Board may be taken to the National Shipping Labor Board unless it refuses to hear the appeal. If agreed by the parties to a controversy the Divisional Labor Board having jurisdiction over the class of labor with which the dispute is concerned may act as a Board of Arbitration with power to select an umpire to sit for the arbitration, and in such case its decision shall be final and binding on the parties to the arbitration.

Section 11. A National Shipping Labor Board shall be appointed by the President for the conciliation of labor disputes. The Board shall be comprised of six members, two to be appointed from shipowning Members of the Industry, two from employees or representatives of employees of the Shipping Industry engaged in shore labor, one from unlicensed members of crews or their representatives, and one from licensed members of crews or their representatives. Four members of the Board shall sit as a committee to hear and conciliate labor disputes which, with its consent, shall be appealed to the Board from a Divisional Labor Board. The four members so sitting shall be the two members appointed from among the shipowning Members of the Industry, and the other two shall be the members appointed from the class of labor (shore or sea labor) with respect to which the particular dispute under consideration arises. The Board shall meet at such time and places as it may determine. If agreed by the parties to a controversy, the committee provided for above may act as a Board of Arbitration with power to select an umpire to sit for the arbitration, and in such case its decision shall be final and binding on the parties to the arbitration. The Board shall exercise its good office to promote harmonious and effective cooperation between employers and employees. The members of the Board shall be paid on a per diem basis for the above actual services rendered, with reasonable traveling expenses, to be approved and paid through the Administrator as part of the cost of administering this Code.

Section 12. The National Shipping Labor Board, in cooperation with the Code Authorities of the various divisions and subdivisions and the United States Department of Labor, shall undertake a study of the decasualization of longshore labor and, so far as practicable of application, formulate rules and regulations therefor and present the same to the longshoremen and to the respective divisions and subdivisions whose members are employers of the labor concerned, with a view to making the same effective by appropriate amendments of or supplements to the Division and Subdivision Codes.

Section 13. The provisions of this Article shall not affect the internal discipline of foreign flag vessels, or the regulation of rights and duties of officers and crews of foreign flag vessels towards their vessels or among themselves, or their relations with their owners under contract made without the United States.

ARTICLE VI—UNFAIR PRACTICES

Section 1. The following practices are unfair methods of competition and constitute a violation of this Code, and may be supplemented in the Division and Subdivision Codes:

(a) Giving directly or indirectly or offering to give anything of value for the purpose of influencing or rewarding the action of any shipper, consignee, or broker, or prospective shipper or consignee, or to any officer, employee, agent, or representative thereof. These provisions shall not be construed to prohibit free and general distribution of articles commonly used for advertising, except so far as such articles are actually used for influencing business as above defined.

(b) Giving or allowing, directly or indirectly, by any device, to any shipper, consignee, or broker, any commissions, bonuses, rebates, refunds, or credits of any part of the freight money or other compensation received, or contracted to be paid, for any transportation service originating in or destined to continental United States, rendered by any Member of the Industry, when not extended to all shippers, consignees, or brokers under like terms and conditions.

(c) Disseminating, publishing, or circulating any false or misleading information relative to any Member of the Industry, or to the credit standing or ability of any member to perform any service, or to the conditions of employment among the employees of any member.

(d) Inducing, or attempting to induce, by any means, any party to a contract with a Member of the Industry to violate such contract.

(e) Aiding or abetting any person, firm, association, or corporation in any unfair methods of competition forbidden by this or any Division or Subdivision Code.

(f) Stating in any dock receipt or bill of lading a date other than the actual date of shipment or receipt for shipment, as the case may be.

(g) Knowingly to use or permit the use of any false classification, false weights and measures, or false report of weight or measurement.

(h) Rendering to any shipper or consignee any service outside or beyond that reasonably called for in the contract of affreightment or tariff, unless approved by the Members of a Division, or a specified compensation for such service shall be paid by the Shipper or consignee.

(i) Preventing or attempting to prevent, directly or indirectly, through the medium of any agreement, conference, association, understanding, or otherwise, any Member of the Industry from extending service to any port or terminals.

(j) Paying freight brokerage or passenger commission fees on any other than a basis which may be prescribed in a Division or Subdivision Code.

(k) Giving any contract to load and/or discharge any cargo on representation that the cargo will not be given the carrier unless the broker or shipper or consignee is permitted to appoint the stevedore, unless expressly authorized in any Division or Subdivision Code, provided that this shall not apply to charter party commitments.

ARTICLE VII—STABILIZATION AND REGULATIONS OF RATES, FARES, AND CHARGES

Section 1. Each Division or Subdivision Code may prescribe rules and regulations to be complied with by Members of the Industry, and rates, fares, and charges, which shall be the minimum rates, fares, and charges, no less than which may be charged by Members of the Industry.

Section 2. Any minimum rates, fares, and charges contained in or prescribed under any Division or Subdivision Code, or amendments thereof or supplements thereto, shall be printed and kept open to public inspection by the Members of the Industry subject to such Code. Except as otherwise required by law, the governing Division or Subdivision Code Authority may, in an emergency, authorize a temporary reduction of any minimum rate, fare, or charge without previous notice to the Administrator, but such reduction shall be immediately reported to the Administrator. Before any other change in any minimum rate, fare, or charge contained in or prescribed under any Division or Subdivision Code is made, thirty days' written or telegraphic notice thereof shall be given to the Administrator, who, if substantial protest against the proposed change is made, may order a public hearing thereon at such time and place and on such notice as the Administrator may determine otherwise the change shall become effective on the expiration of said thirty days' notice, unless expressly disapproved by the Administrator. The time of notice may be reduced or waived, in the discretion of the Administrator.

Section 3. Sworn complaints from any source, charging that any rate, fare or charge, rule, regulation, or practice, is unfair or unreasonable, shall be referred to the Administration representatives for adjustment as provided in Article VIII hereof. If any complaint is not satisfactorily adjusted locally as provided for in Article VIII hereof, the Administrator shall have, and is hereby given, authority to enter upon a hearing of such charge, after such notice and under such rules and regulations as he may prescribe, and if he finds the complaint sustained he may suspend such rate, fare or charge, rule, regulation, or practice.

ARTICLE VIII—ADMINISTRATION REPRESENTATIVES

Section 1. The Administrator may appoint such number of Administration Representatives as he may in his discretion deem necessary so that there may be available an Administration Representative to sit without vote on each Division and Subdivision Code Authority, who may follow activities of the Code Authorities and advise the Administrator in connection with all matters requiring the approval of the Administration, and may attend meetings of the Code Authorities when such matters or any other matters affecting the welfare of the industry are acted upon.

Section 2. The Administrator shall appoint an Administration Representative to be located permanently at each of the following headquarters or such other ports as the Administrator may decide: New York, N. Y.; New Orleans, La.; San Francisco, Calif.; Chicago, Ill.

Section 3. In addition to the duties described in Section 1 above, it shall be the duty of the Administration Representatives appointed pursuant to the provisions of Section 2 above to receive complaints from any source, charging that any rate, fare or charge, rule, regulation, or practice, is unfair or unreasonable, and to assist in the adjustment of such complaints, if possible, by the appropriate Code Authorities of the Divisions or Subdivisions. In the event such complaints are not satisfactorily adjusted, the Administration Representative shall forward copies of the complaints to the Administrator, together with a full report of the action of the Division or Subdivision Code Authority thereon.

ARTICLE IX—COORDINATION

In the administration of this Code and any Division or Subdivision Code, the Administrator shall utilize the assistance of the United States Shipping Board Bureau, Department of Commerce and/or Interstate Commerce Commission to the fullest extent deemed advisable by him, through hearings, investigations, or otherwise, and recommendations based thereon certified to the Administrator, in respect of rates, fares, charges, classification, rules, regulations, practices, and other appropriate matters, to the end that various branches of executive authority may be brought into effective coordination.

ARTICLE X—MONOPOLIES

Section 1. Neither this Code nor any Division or Subdivision Code shall be interpreted or applied so as to promote or permit monopolies or monopolistic practices or to eliminate or oppress small enterprises or discriminate against them.

ARTICLE XI—GENERAL SHIPPING COUNCIL

Section 1. A General Shipping Council, comprised of three members, shall be appointed by the President from among representatives of Members of the Industry. They shall hold office at the will of the President.

Section 2. Any Member of the Council may sit with and participate in (without vote) the meetings and deliberations of the Members of the Division and Subdivisions and their respective Code Authorities. It shall be the general duty of the Council to observe the operation of the codes and to act in an advisory capacity to the industry and to the Administrator.

ARTICLE XII—TREATIES

Section 1. Provisions of this Code or any Division or Subdivision Code shall not violate any treaty.

ARTICLE XIII—CANCELLATION—MODIFICATION

Section 1. This Code and all the provisions thereof are expressly made subject to the right of the President, in accordance with the provisions of Clause 10 (b) of the Act, from time to time to cancel or modify any order, approval, license, rule, or regulation issued under Title I of said Act, and specifically to the right of the President to cancel or modify his approval of this Code or any Division or Subdivision Code or any conditions imposed by him, upon his approval thereof. In submitting this Code, or in filing written assent to this Code, the subscribing parties do not thereby consent to any modification thereof or waive any constitutional rights.

ARTICLE XIV—EFFECTIVE DATE

Section 1. This Code shall become and be effective on the 15th day after approval by the President and for one year thereafter.

SCHEDULE A

The minimum rates of pay for personnel aboard American flag vessels together with quarters, subsistence, maintenance, and cu.e as customary shall be as follows:

	Per month
Chief Engineer	$200
1st Officer and 1st Ass't. Engineer	150
2nd Officer and 2nd Ass't. Engineer	130
3rd Officer and 3rd Ass't. Engineer	110
Carpenter	60
Boatswain	60
Quartermaster	55
A. B. Seaman	50
Ordinary Seaman	35
Water Tenders	60
Oilers	60
Firemen (Oil Burners)	50
Firemen (Coal Burners)	52.50
Coal Passers	40
Wipers	37.50
Chief Steward	100
Combination Steward and Cook	100
Chief Cook	85
2nd Cook and Baker	60
Messmen	40
Messboys	30
Cabin Stewards and Waiters (Passenger ships)	40
Senior Wireless Operators	80
Junior Wireless Operator	70
Senior Wireless Operator (when only 1 carried)	85

The members of the deck and engine departments on all sea-going vessels shall while at sea be divided into three (3) watches, except that members of the deck and engine departments (other than officers, sailors, firemen, oilers, water tenders, and coal passers) who are not required by

(Continued on Page 8)

A Hard-Boiled Bunch

(Continued from Page 14)

electrodes would strike an' break off; the gasoline pipe busted again; wirin' shorted in the conduits; fuses blew; the engine coolin' tank springs a leak an' floods the joint; an' chronic hot bearin's on the alternator throwed the belt off, which wound up in the engine flywheel an' got tore to strings. Considerin' everything, I had a right pleasant time.

The engine kept gettin' crankier every day, until at last she laid down on the job an' quit fer good. I primed an' oiled an' sweated an' swore, but 'twasn't no use. The next day it was blowin' a howlin' storm. Big seas were boomin' against the rocks under the wireless house, roarin' like giant cannon, an' the wind shook the shack till I half expected her to go off into the bay. Just when the gale was at its worst, I sees a little gray dory comin' divin' through the seas. In a few minutes it was in the shelter of the cove.

"It's Hell-Fire," says Dopey, who'd been tryin' to help me with the engine. The storm-king makes his boat fast alongside the dory wharf, an' comes up to the shack.

He was a big six-foot savage, an' looked like a first-class pirate, with his red mackinaw, corduroys, highcut musher boots, an' a black fur cap. He had a big gun in his belt under his mackinaw, an' walked like he was ready to start a battle on a second's notice.

"Fine weather," he grunts, rubbin' the frozen salt crust off his face onto the sleeve of his mackinaw, which was runnin' with sea water. "I hope it holds on till I get back to Popoff."

When I tells him about the engine trouble he goes into the power room, an' glares at the one-lunger.

"Buckin again, eh!" he snarls in a voice so hard-boiled it makes the engine look kind'a green an' sick. He squirts a little primin' in the cups, whips out a few special cuss words, punches a couple levers, an' kicks the flywheel—an' the engine begins hummin' like a Pierce-Arrow.

After I'd cleared with N-P-R, we sit by the coal heater in the operatin' room an' chewed the rag.

"Today is my twenty-eighth birthday," I remarks. "An' if some fortune teller had ever told me that on this day I was goin' to be sittin' in a shack on a sea-washed rock up in Alaska among the crowd of gun-powder maniacs, I'd a told her she was crazy."

"You say today's your birthday," exclaims Hell-Fire.

"Yes," I answers, which was the foolishest thing I ever done in my life.

"Then you gotta make a dance in th' hall tonight," he declares. "I'll go out an' tell th' gang, an' we'll make things ready."

I protests strong against that, but he tells me it's got to be done.

"To make a birthday dance is the oldest custom in the Shumagin Islands," he insists. "If you don't, they'll think you're stuck up—they'll come up here an' shoot th' shack t' splinters."

I'd seen all the shootin' I wanted already, so that night we have the dance—an' it was a dance I'll not forget. The dance hall, which was perfectly round an' about fifty feet in diameter, had once been a cyanide tank in the gold mine up the bay. It'd been roofed over, windows put in the walls, had a big coal heater on one side, an' a bench runnin' all around the wall. It was all decorated up with paper bells an' truck an' was lighted by a single big coal oil lamp hangin' from the ceilin'.

But if the dance hall was wild an' wooly, the dancers were wilder an' woolier. Evenin' dress was mackinaw coats, rubber boots an' shootin' artillery. The women was mostly Aleute breeds, an' all sat on one side of the hall, with the men on the other. The orchestra was a leather-lunged accordion an' a mistuned guitar, while the style of dancin' was rag, dip, shimmy or anythin' you please. The fishermen were half full of brew, an' among them I notice Mexican Frank, watchin' me with a kind'a evil eye.

Before the dancin' had been proceedin' more'n two hours, there'd been four fist fights an' a dozen cursin' matches.

"It's a pretty good dance, but it's too blame slow," grumbles Hell-Fire, about 10 o'clock. "I wish somebody'd start somethin' an' put a little life in things round here."

I feels pretty uneasy after this, but things goes along fairly peaceful, until at last some addle-brained boob hollers out, "Ladies choice," an' right then was where I gets in trouble. I'd been keepin' carefully away from Mexican Frank's wife all evenin', but now what does she do but come straight over an' chooses me for her partner. Everybody was pretty well tanked up with the sourdough brew, an' the rough-neck orchestra tore off a wild an' woolly one-step that got faster an' crazier, until at last when the finale arrives with a grand smash of mad music, the fiery-eyed breed-girl, gone crazy with dancin' an' moonshine, throws her arms plumb around my neck an' plasters a red-hot kiss right on my lips.

The next instant, I sses a cannon spoutin' fire in Mexican Frank's fist, an' a speedy bullet clips a groove through my hair, which must'a been standing straight on end.

"Whoopla! Hurrah!" howls Hell-Fire, joyously, producin' his forty-five centimeter howitzer an' blazin away at the lamp. He puts it out first shot, an' then there started the blastedest pandemonious of fightin' an' howlin' an' cursin' an' shootin' you ever could imagine. It beat the roughest Tom Mix movin' picture ever made by forty times, with guns spittin' fire in th' dark an' everybody millin' an' stampin' like a crowd of wild bulls.

Seein' a gleam of light, I makes for it, an' dives through a window, landin' in a puddle of mud an' slush outside. It was still rainin' and blowin' an' dark as pitch, but I scrambles along the bank to my shack in about five seconds, an' gets the old gasoline mill goin'. Sittin' in, I calls C-Q a couple times, but don't raise nobody. I hears the crowd of gun-fightin' maniacs yellin' an' shootin' out among the shacks, an' comin' closer all the time. Gettin' desperate, I opens up full power an' pounds out distress signals—which I figgers I was justified in doin' under them circumstances.

"S-O-S, S-O-S, S-O-S, de K-V-I, K-V-I, K-V-I," I hammers out, slow an' heavy.

Listenin' I hears a jerky little spark start up an call:

"K-V-I, K-V-I, de N-R-X, N-R-X; this is the revenue cutter 'Unalga,' twenty miles west Unga—what's the matter? Is Unga Island sinkin'?"

"No, but it ought to," I pounds back. "Th' shootin' iron artists are havin' a grand killin' campaign, an I'm leavin' th' island instantaneously — please ask th' skipper if he'll come by an' pick me up."

The kid on the cutter tells me to Q-R-X; but in a minute he comes back again.

"Sorry, O-M," he says, "but the skipper says he won't come near that cursed Unga Island f'r all the love in heaven or all th' money in Rome—hope you come out all right."

"Yes, I'll come out with more holes 'n a colander, if I stay here—" I hesitates as a bullet splits a panel in the door, an' another one drifts clear through an' knocks the lid-lifter off the stove. "Tell your skipper I'm drivin' straight to sea in a fishin' dory, an' ask him for th' love of Peter to come an' pick me up."

I stops to listen, but about that time another bullet ploughs into my desk, maybe two inches from the key-knob; then still another one comes, sput! right into my audion-bulb, an' a piece of flyin' glass gives me a bad gash in the chin—you see th' scar's here yet.

Abandonin' the shack, I gets out in the rain again, an' half tumbles down the hill to the dory wharf. Climbin' into one of the dories I was somewhat acquainted with, I lets go the painter an' starts the little engine in the stern. As I dashes out into the storm there comes a rattle of heavy artillery from up on the rocks, an' a few minutes later I hears about twenty-five power dories comin' poppin' out into the bay after me, full of crazy codfishermen, still whoopin' an' shootin'.

Gettin' out into Nagai Straits, I drives straight to sea through the sleet an' rain. The fishermen seemed to get more speed out of their dories than I could out of mine, for they kept gainin' on me. Their bullets come whistlin' closer an' closer all the time, until pretty soon they began plunkin' against the side of my dory. I huddles down in the fishy-smellin' bilge water in the bottom of the boat, steerin' mostly by guess work; an' all the time the codfish dories was gettin' nearer an' the bullets was hittin' harder. At last a whistler bores through the bulkhead an' punctures the fuel tank.

In a few minutes the engine begins to miss an' slow down. I was just beginnin' to believe it was all off with Sir Samuel Jones, when all of a sudden, crash! the dory bangs into somethin' that staves in the bow an' sends me head over heels into the ocean. My hands come against a smooth iron wall, an' lookin' up in the darkness, I sees I'm right alongside the revenue cutter "Unalga." The crew had heard me hit, an' they lowers a line, which I gets hold of. As they haul me up on deck, the cutter's searchlight starts sputterin', an' somebody turns it out onto the crowd in the pursuin' dories, who were still shootin'. In the nearest one, I could recognize Mexican Frank.

"Come back an' fighta like a man, you coward!" he howls, wavin' a smokin' high-power cannon in one fist an' some kind of a big gleamin' carvin' knife in the other. "Come back, damma you, an' I shoota you so full of lead you seenka to the bottom without ballast!"

"Let's get away from this god-forsaken island," mutters the skipper of the "Unalga," an' he rings the engine telegraph up to full ahead.

Half an hour later the cutter's code-slinger hunts me up with a message.

"It was routed to K-V-I, but I told N-P-R you were here, and I took it for you," he explains, handin' it to me. As I unfolds it, I sees it's all the way from Frisco, an' addressed to myself.

"Samuel Jones, Unga Island, Alaska—With best wishes for a happy birthday; the gang and myself join in hoping you are enjoying the acme of peace an' quiet at Unga.—Cunningham."

"Amen!" I mutters, as the "Unalga" hooks up to a fourteen knot clip, an' heads out to sea.

Code Authority for the Radio Broadcasting Industry

(Continued from Page 26)

tions, modifications, exemptions or exceptions.

5. A person subject to more than one code, when official copies have been so turnished, shall so post such copies of such provisions of every code to which he is subject.

6. Nothing in these rules and regulations shall relieve anyone from complying with any provisions of any Codes relating to posting, displaying or furnishing copies of Codes or of Provisions of Codes.

Hugh S. Johnson,
Administrator for Industrial Recovery.

(Official Seal, National Recovery Administration.)

Washington, D. C., February 12, 1934.

William S. Hedges Advances

An NBC announcement states that effective immediately and operating under Richard C. Patterson, Jr., executive vice president of the company, William S. Hedges will be manager of all NBC managed and operated stations. His former connection was KDKA.

Recent Broadcast Station

On April 20th, a Federal Radio Commission order was entered effective April 27, 1934, granting authority to use 50 KW power to Station KNX, Western Broadcast Company, Los Angeles, Cal., in place of previous 25 KW power used. A particular consideration was "that the programs broadcast over applicant's station are meritorious and that the same material is not available over any other station."

Station WMAQ, National Broadcasting Co., Inc., Chicago, Ill., was granted authority to install new 50 KW transmitter and increase power from that of 5 KW previously used. The order effective May 4th.

National Battery Broadcasting Co., St. Paul, Minn., was granted authority to use 25 KW daytime only. This is an extension of previous authority granted Nov. 1, 1933, to the same station KSTP.

WLW, the Crosley Radio Corp., Cincinnati, Ohio, was granted authority to use the 500 KW W8XO transmitter on its regular time for a period ending August 1, 1934, and the station is now transmitting with this power

CLASSIFIED ADVERTISING

Commercial Radio will accept classified advertising at the special rate of five cents per word.

Remittance in full must accompany copy, closing date for classified advertisements is the 15th of the month preceding publication date.

High Power Broadcasting Transmitters at Budapest And Kalundborg

(Continued from Page 18)

signed to feed into a resistance potentiometer grounded at the center, having a tapping at each side going to the grids of the first stage in the amplifier cubicle. By means of this potentiometer the drive on the amplifiers can be adjusted to the required level.

The cubicle contains two stages of amplification referred to respectively as the Intermediate Amplifier and the Power Amplifier. Both stages are in push-pull and both work with an anode voltage of 20,000 volts.

The cubicle is divided into two halves by a corridor which runs longitudinally from one side to the other, and each half cesses. On the wall above the cubicle in the transmitter hall are mounted three large meters indicating amplifier plate voltage, total plate current and antenna current. Their faces are illumined from the back.

The number of compartments on each side of the corridor is six. The first three are devoted to the intermediate amplifier and the remainder to the power amplifier. The corridor and the layout of the compartments on one side of the push-pull circuit are shown in Fig. 6. Fig. 6 is false in perspective, as it is made up of a number of photographs taken from different angles.

The first compartment contains the valves of the intermediate amplifier (Fig. 7). There are two 30 kW. valves on each side of the push-pull circuit, one of which is in reserve. The reserve valves can be

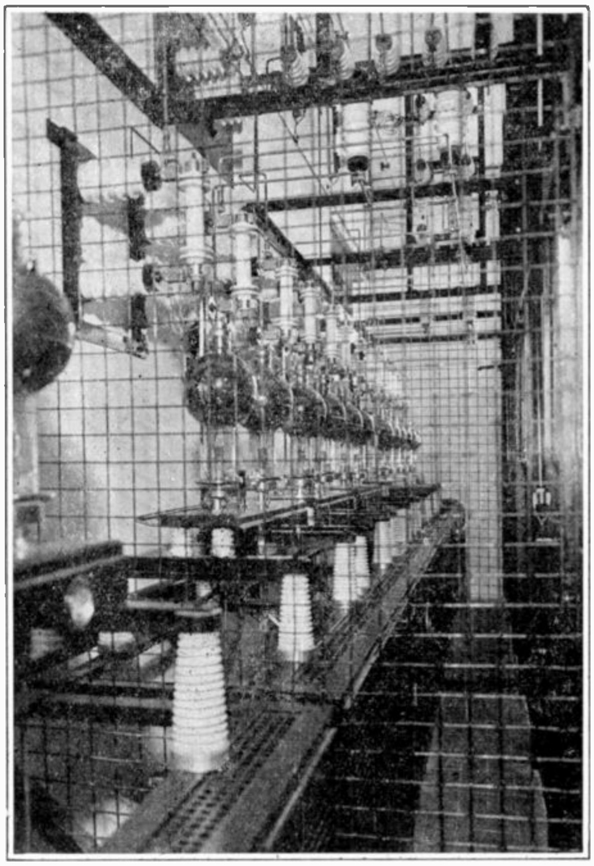


Figure 13—20,000 Volt Rectifier Equipment.

is again divided into compartments by transverse partitions. The apparatus is disposed symmetrically about the central corridor in accordance with the symmetry of the push-pull circuit. The corridor is fenced off on each side by expanded metal partitions in which there are gates leading into the several compartments. These gates are mechanically interlocked with the high tension isolating gear. The compartments are indirectly lighted and the apparatus can be inspected from the corridor while in operation. The cubicle is electrically shielded by copper mesh built into the walls, floor and ceiling to prevent the radiation of harmonics generated by the amplifiers.

The measuring instruments are mounted behind plate glass in recesses in the wall of the cubicle in the transmitter hall. The meter faces are illumined by lamps concealed around the edges of the re-

quickly cut in by means of three-pole change-over switches.

In the second compartment is installed the intermediate amplifier output circuit. The large condenser seen in the center of the photograph is the node stopping condenser. Although the normal working voltage is 20,000, the condenser is rated for a working voltage of 30,000, allowing an adequate reserve for the heavy surges which are set up on the occurrence of a "flash arc" or Rocky Point effect in a valve, causing a temporary short-circuit on the high-voltage circuit. To the right, mounted on a bracket on the wall, may be seen one of the two oil-filled neutralizing condensers used to balance the plate to grid capacity of the valves.

The carrier power output from the intermediate amplifier is 5 kW. for a 60 kW. transmitter, and 8 kW. for a 120 kW. transmitter. The power is dissipated in water cooled resistances in parallel with the grids of the power amplifier. These resistances are installed in the third compartment, in which are also located the grid stopping and by-passing condensers and filament circuit equipment of the power amplifier.

The fourth compartment is the valve compartment of the power amplifier (Fig. 8). In the 60 kW. transmitter there is one 120 kW. valve with a second in reserve on each side of the push-pull circuit. In the 120 kW. equipment there are two 120 kW. valves in operation, and two in reserve on each side of the circuit, making in all four valves in operation with each valve having a reserve associated with it. Each pair of valves, one valve in operation and the other in reserve, is mounted on a pair of tall porcelain insulator bushings which project through the floor of the cubicle into the basement beneath. The bushings have a channel through the center and the cooling water is brought up through one bushing and leaves through the second of the pair. For the purpose of changing from one valve to its reserve, a mechanism is provided for each pair by means of which the cooling water and the filament and grid connections are simultaneously switched over.

The mechanism for each pair of valves is operated by a handwheel located between them. This handwheel controls the water cocks directly and, driving through porcelain shafts, operates the grid switch above the valves and the filament change-over switch in the previous compartment. The change-over may thus be completed in a matter of seconds. The grid and filament switches are insulated for 20,000 volts so that a valve which has failed and been cut out by the change-over mechanism can be left in position no matter what was the cause of failure, whether a complete internal short circuit or a burst water jacket, or any other fault. In the case of the valve compartments, the expanded metal gates are backed by glass so that if a leak should occur in the water system within the cubicle there will be no danger to the personnel due to contact with a jet of water at high voltage.

The fifth compartment contains the oil-filled balancing condensers, and the anode feed circuits of the power amplifier valves. Each valve in operation has a separate 30,000 volt stopping condenser and anode choke coil. In series with each anode choke coil is a 20,000 volt fuse and a device for registering momentary overloads in the valves, as such short-time overloads do not trip the circuit breaker owing to special provisions made to secure that result.

The sixth compartment accommodates

the output circuit and harmonic filters on one side of the circuit, also half of a 600 ohm water cooled artificial antenna. The output circuit feeds into a balanced 600 ohm transmission line going to the antenna tuning and coupling circuits. The 600 ohm water cooled antenna is capable of dissipating continuously the normal output of the transmitter when fully modulated. It can be switched in, in place of the antenna transmission line for testing. Accurate thermometers and a flow meter are provided so that the power dissipated in the artificial load can be precisely determined.

The harmonic filters in the sixth compartment provide sufficient attenuation to ensure the requisite suppression, account being taken of the harmonic radiation which could occur from the antenna transmission line.

Fine adjustment of the tuning of the output circuits of the intermediate and power amplifiers is provided for by short-circuited turns operated from handwheels on the front wall of the cubicle. These controls when once set do not require day-to-day adjustment.

The meters in the recesses in the front wall of the cubicle include a plate current and grid current meter for each valve, circulating current meters in series with fixed reactances across the grid indicating the RMS grid swing on each side of the push-pull circuit of both amplifiers, power amplifier output circuit coupling leg meters on each side and transmission line current meters on each side of the line. The feed current of the antenna itself is registered on one of the large meters above the amplifier cubicle, as mentioned before.

Monitoring rectifiers are connected permanently to the output circuits of the oscillator-modulator unit and of the intermediate and power amplifiers. Their output leads are brought to the control desk, where they can be switched either to a modulation meter or a cathode ray oscillograph, both mounted in the desk. These monitors are used for routine observation of the modulation and for taking load curves and frequency response curves at the output of each of the three main sections of the transmitter.

It will be clear from the description which has been given and from the photographs that the cubicle construction as applied to the high power radio frequency equipments permits an ideally logical layout of components considered from the point of view of the electrical circuit. The use of the walls as supports for components results in economy of floor space. Large components as required for adequate factors of safety are neatly accommodated without sacrifice of accessibility, satisfactory shielding of harmonics is obtained and full protection of personnel is ensured.

The water cooling system of a large radio station requires careful design. The system adopted at Budapest and Kalundborg comprises a closed primary circuit in which distilled water is used, and a secondary circuit in which is circulated sea water, in Kalundborg, and well water in Budapest. A schematic diagram of the primary circuit at Kalundborg is given in Fig. 9. The circuit for the 120 kW. transmitter is the same except that there are separate feeders for the power amplifier valves on each side of the push-pull circuit.

The distilled water is contained in a tank in the basement. The water is drawn from the tank by the primary circuit pump, and passed through the water-to-water cooler to the main header situated in the basement immediately below the water control board in the transmitting hall. From the main header the water is distributed to the feeders, of which there are three in Kalundborg and four in Budapest. In Kalundborg, the first feeder is for the valves of the intermediate amplifier on both sides of the push-pull circuit. The second feeder serves the valves of the power amplifier and the water cooled grid resistances, and the third feeder is for the water cooled artificial load. The outlet from each valve is brought back separately to the tank, and in each return pipe there is a water flow alarm provided with electrical contacts arranged so that if the flow falls below a specified volume the transmitter is shut down to save the valves from suffering damage.

The water is led up to and away from the valves through porcelain coils providing sufficient length of water column to obtain the necessary high resistance between the valves at 20,000 volts and the rest of the system at ground potential to avoid serious electrolysis. There is one inlet and one outlet coil for each 120 kW. valve in operation, and one two-way coil for each of the two intermediate amplifier valves. These porcelain coils are installed in the basement immediately below the valve supporting bushings through which the water is led to and from the valves.

The supplies to the feeders are regulated and measured at the water control board in the transmitting hall. A photograph of the Kalundborg board is given in Fig. 10. The board comprises four panels. The first is for the control of the supply to the main header and the three others are for the feeders. The large meters indicate the flows in litres per minute. Of the three smaller meters on the first panel, one reads main header pressure in kilograms per square centimeter, and the remaining two indicate the temperature of water at the main header and the temperature at the tank. The small meters on the second and third panels read the temperature at the outlet of each valve, and those on the fourth panel indicate the inlet and outlet temperatures of the artificial antenna. The thermometers have electrical contacts which can be set to give an alarm if the temperature exceeds a given value.

The main control on the first panel is operated nearly full open and the feeder controls are set to obtain the specified feeder flows. By keeping a record of the feeder control settings required to maintain the specified flows, early warning is given of any increase in the hydraulic resistance in the feeder circuits. The flow in the first feeder to the valves of the intermediate amplifier is 120 litres per minute, and the flow in the second feeder for the two 120 kW. valves and the grid resistances is 280 litres per min. The artificial load when in operation takes 100 litres per minute in the 60 kW. transmitter and 200 in the 120 kW. equipment.

The system is operated with a main header pressure of between three and four kilograms per square centimetre. A pressure release valve is provided at the outlet of the pump which can be set to open at a given pressure, thus limiting the maximum pressure sharply to the chosen value.

In order to take full advantage of the factors of safety for pressure allowed in various parts of the system, particularly in the valve jackets, a shock absorber in the form of an air pressure chamber is included in the system. In this way the necessity of designing the system for "live" loads was avoided.

The hydraulic conditions in the system are recorded in pressure level diagrams prepared for each feeder, together with the part of the circuit common to all feeders. Such a diagram is shown in Fig. 11, representing the case of the feeder to the two 120 kW. valves of the power amplifier of Kalundborg. The system is designed to have good pressure regulation so that adjustment of the flow in one feeder does not materially affect the flows in the others.

A spare cooler is included in the equipment of the transmitting stations. The one installed in Budapest is a water-to-water cooler similar to the regular equipment, while the reserve plant at Kalundborg is an air blast cooler. This type of reserve cooler is used at Kalundborg to avoid a shut-down which might result from a stoppage in the sea-water intake to the regular cooler under exceptional weather conditions.

The power supply equipment of the 60 kW. and 120 kW. stations is the same in general conception. The representative case is shown diagrammatically in Fig. 12.

Reliability has been the first consideration and an outstanding feature of the equipment is its straightforward simplicity. It was the aim to achieve full protection for personnel, logical sequence of operations, and the necessary interlocking and signalling to protect valves and other equipment in case of a fault, with an absolute minimum of complication both in circuit and components.

The next consideration was efficiency, and this led to the use of mercury vapour rectifiers (Fig. 13) for the high power high voltage d-c. supply.

Dry metal rectifiers and hot cathode mercury vapour rectifiers are used for the low-power supplies for the oscillator-modulator unit and for grid bias. This results in simplification of the problem of voltage regulation, since all the low-power supplies can be controlled by a single a-c. automatic regulator; it also saves maintenance by reducing the number of rotating machines. The 26 volt filament supply is the only one for which a machine is used, and in that case the voltage is maintained constant by means of a d-c. automatic regulator.

The Kalundborg power control board, which may be seen to the left in Fig. 3 (lower), is made up of four panels. The first panel, on the left, is the incoming supply panel concerned with the energising and metering of the 10,500 volt main bus bar. The handwheel on the left is for selecting either of two incoming cables, and the one on the right controls the main oil switch which is mechanically interlocked with the gates of the power equipment cubicles behind the board.

The second panel is for the feeder to the 380 volt transformer energising the main 380 volt bus bar feeding the filament machine, pumps, grid bias rectifier, air blast cooler, etc., and the 380 volt regulated bus bar supplying the low-power rectifiers for the oscillator-modulator unit and the filaments of the 20,000 volt high-power rectifier. The 380 volt feeder oil switch is electrically operated by a push button on the control panel. The small handwheel to be seen on the panel is for working an isolator interlocked with the doors of the fuse recesses.

The third panel is for the control of the 26 volt d-c. filament machine. The d-c. automatic voltage regulator is mounted on this panel.

The fourth panel is the feeder panel for the 20,000 volt rectifier supplying the anodes of the intermediate and power amplifiers. The 20,000 volt feeder oil switch is electrically operated from buttons on the panel. The handwheel on the panel operates the tapping transformer for varying the voltage under load.

The low power rectifiers for the oscillator-modulator unit and for grid bias supply are in duplicate and means are provided for switching over quickly to the reserve equipment, leaving the other set completely isolated and free to be attended to. The rectifiers are mounted in free standing units as indicated in Fig. 12. One unit contains two complete 5,000 volt rectifiers, one in the upper half and the other in the lower half of the unit with the change-over gear in the centre section. A second unit contains similarly two 900 volt grid bias rectifiers. These sets are three-tube hot cathode mercury vapour rectifiers.

The third unit contains two sets of 380 volt and 1,000 volt dry metal rectifiers, and the fourth unit contains the control circuit contactors and the main grid bias potentiometer.

The 20,000 volt rectifier equipment is required to deliver 12 amperes in a 60 kW. station and about double that in a 120 kW. station.

The Kalundborg equipment is a "Standard" hot cathode mercury vapour rectifier comprising three 10,000 volt six-tube sets, any two of which may be run in series, the third unit being held as reserve. The overall efficiency of this equipment including transformers, and taking account of necessary transformer damping resistances, but not taking account of resistances in series with the radio valves to protect them from surges in case of short circuit, is 94 per cent and the power factor is .9. Each rectifier tube is separately fused and the very important result is achieved that if a tube fails it cuts itself out without interrupting the programme and need not be replaced until there is a normal intermission in the programme.

In Budapest the 20,000 volt supply is taken from either a Brown Boveri tank type mercury arc equipment or from a "Standard" hot cathode mercury vapour rectifier of the type described above. The tank type rectifier is of the pattern developed by the Brown Boveri Company of Baden, Switzerland, and is the first equipment of this type operating at 20,000 volts. The arc is formed in a steel tank which contains the necessary formed electrodes and which is kept continually evacuated by means of auxiliary pumps. In addition to the rectifying electrodes, the rectifier is equipped with control grids designed to limit the effect of overload in the external circuits and "arc-back" in the rectifier. The efficiency of the Brown Boveri rectifier and the power factor on full load are approximately the same as for the hot cathode mercury vapour rectifier.

The 20,000 volt rectifier works into three filters, one feeding the intermediate amplifier and the other two feeding the two sides of the power amplifier. By this arrangement we get minimum plate remodulation for a given investment in condenser KVA and maximum current limitation in the case of a short circuit in the radio valves.

Resistances are included in series with the filter chokes and again in the anode feed circuits to the valves of the intermediate amplifier and to each separate valve of the power amplifier to limit the maximum short circuit current and to suppress surges in case of "flash arc." Extra resistances normally shorted by fuses are inserted in series with the smoothing chokes. In the case of a persistent "flash arc" the fuses blow, cutting in the extra resistances which in general stop the arc without interruption of service. Only in the worst cases is the 20,000 volt circuit breaker opened, causing an interruption in the transmission until the voltages can be brought on again by the operator.

In regard to performance, it is sufficient to say that the standards generally recognized and formulated by the C.C.I.R. have been fully met by these transmitters, and the reliability is up to the highest attainment of modern practice.

In the successful realisation of these projects, we owe very much to the whole-hearted cooperation of the Administrative Authorities concerned, and we desire to express our grateful appreciation for the technical assistance and friendly help accorded by Mr. Kay Christiansen, Chief Engineer of the Danish Post and Telegraph Administration and his Consulting Engineer, Mr. Rob. Henriksen, as well as to Mr. Tersztianszky, Chief Engineer of the Royal Hungarian Postal Administration and his assistants, Messrs. J. Erdos and E. Magyari.

Broadcasting Lingo

(Continued from Page 26)

ON THE NOSE: a program executed according to order.

PEAKS or *KICKS*: the maximum point of the needle swing on a volume indicator.

PIPE or *PATCH*: a temporary and removable connection on studio equipment.

RIDING GAIN: keeping program volume within practicable limits.

SCOOPER: a singer, usually a contralto, who slides up and down the scale without distinguishing clearly between notes.

SCRATCHES: noise caused by faulty equipment.

SHORT VOICE: one with a limited range.

SOUR or BLUE: voice or instrument off pitch.

TALKING IN HIS BEARD: a muffled voice.

TOWN CRIER: one who sings too loud.

UP THREE MILES: indicates very high amount of volume.

WOODEN VOICE: lacks clarity and expression.

WOOF: a word used in making tests, but having no meaning.

British Empire Broadcasting

(Continued from Page 23)

one at 220 volts feeding the lighting system, crystal oscillators and the line amplifying apparatus, and the other at 415 volts supplying the transmitter plant, the object being to prevent any possible overloads on the main equipment that might affect the lights or the low power equipment. Complete isolation of either transmitter may be effected by the operation of a single oil breaker which is interlocked with its own main control board.

The supply to the building is 3-phase, 50 cycles at 10,500 volts; after being stepped down to 415 volts this is converted to the correct d-c. voltage for the filaments, grid bias and high tensions by motor generator sets. The exception is the high tension for the second and third radio-frequency amplifiers, obtained from a double 3-phase thermionic rectifier. The motor generator sets are arranged in three rows (see floor plan), each row providing the complete supplies for the transmitter, the third acting as a standby. The a-c. supply to the motors, the output of the generators and the control circuits, may be switched to either transmitter by the transfer switchgear in the generator room; these switches are mechanically interlocked to eliminate mistakes. The control (starting, stopping and excitation) is normally effected at the main control board but, for maintenance purposes, facilities are provided for this to be done independently at the transfer switch cubicles of either transmitter. The outputs of the generators are fused at the transfer switch cubicles.

Water System and Cooling Plant.

A closed water system provides cooling for the anodes of the valves. Distilled water is forced 'round the system by centrifugal pumps and is cooled by air-blast coolers. Electrical isolation for the anodes of the valves is effected by the use of rubber hose coils. All connections, where the possibility of electrolysis exists, are made of antimonial lead, which resists chemical action which might be set up due to the liberation of either nascent hydrogen or oxygen. The pumps are in duplicate; the system operates normally with three or four fans running.

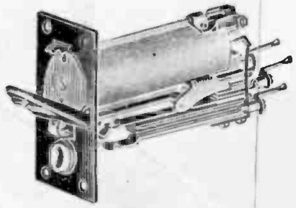
Installation and Testing.

Preliminary work on the Empire Station was begun in January, 1932, and the first six months were occupied with the engineering, manufacturing and preliminary testing of the apparatus. Installation was commenced at the beginning of August and the whole equipment was available for overseas tests on November 14th. The formal opening of the Empire Station took place on the 19th of December, 1932. On Christmas Day the King's speech, with the special Empire Program, was broadcast to the Empire.

Reports from the Colonies on the preliminary tests and early programs indicate that the equipment is more than able to fulfill its function and that the British Broadcasting Corporation is to be congratulated upon its judgment in embarking on this project.

Army & Navy Surplus

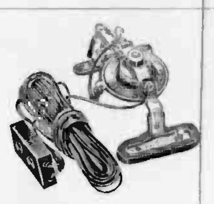
You Know the High Quality



Relay and Jac's combination, 350 ohms, 6 volt $1.00

INDUCTION COILS, Battery Telephone Type .... $.75

NEW—Edison Storage Battery Type BB-1, 10 volt, 37 amp., contains 7 cells. Complete in steel portable case $15.00



Magnavox anti-noise microphone, good for home broadcasting $1.50

CONDENSERS. Mica, op. volts 12,500 cap. .004

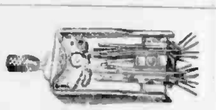
Dubilier, new	$7.50
Dubilier, used	5.00
Wireless spec., new	5.00
Wireless spec., used	2.50

Condenser, Dubilier, mica, volts 40,000. cap. .0012-.001-.0008 or .003 .... $10.00

Condenser, Dubilier, mica, op. volts 8,500 cap. .004 .... $5.00

Condensers, Dubilier, mica, op. volts 8,500 capacity .0004 mfd. $5.00

Condensers, Murdock .002 mfd. 5000 volt $1.00



Anti-Capacity Switches W. E. 12 and 14 Terminals, all with Platinum Contacts, value $3.50 each. Our price 95c each

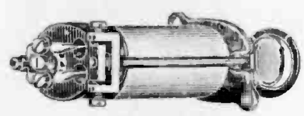
Motor Generators

120 d.c., 110 or 220 a.c., 500 cycle 250 watt $30.00
120 d.c., 110 or 220 a.c., 500 cycle 500 watt .... $40.00 to $75.00
120 d.c., 110 or 220 a.c., 500 cycle 1 kw. .... $75.00 to $100.00
120 d.c., 110 or 220 a.c., 500 cycle 2 kw. .... $50.00 to $150.00
120 d.c., 110 or 220 a.c., 500 cycle 5 kw. .... $95 to $250.00
120 d.c., to 20 d.c., 2 kw $60.00
120 d.c., to 400 d.c. 2 kw. $45.00
120 d.c., to 600 d.c., 2kw $65.00

Just bought 70 of these from U. S. Navy and you can have them at 1-4 of Navy's cost.
Our price $25.00

New Westinghouse Generators

Used either as Generator or Dynamotor
Fil. Volts 6.9. Plate Volts 400-500.
Fil. Amp. 3.75 Fill M. A. 250.
Complete with filter 9-16 inch shaft, 3 in. long, weight 30 lbs.



Special

Can be used with the new Vacuum Contact when operated on 45 volts. Western Electric Signal "Drops," 1000 ohm, type D-12 .... $1.00

U.S. Navy Oxidized Brass Running Lights, 15 inches high overall—12 lbs. Either red or green. $7.50 each or $12.00 per pair. Kerosene type, easily converted to electric.

New Low Price

Dynamotor 32-350 volt, ball bearing, 80 mills. Special $9.00
Per pair $15.00
Western Electric Switchboard C. W. 928. Control board for Dynamotor System C. W. 927. Consists of starting switches, fuses 0-50. 500 volt voltmeter with switches for testing main lines and output. Also contains complete filter system. Very special $8.00

Generators

110 volt a.c. 900 cycle self-excited 200 watts $10.00
165 volt a.c. 600 cycle self-excited 250 watts $15.00
110 volt a.c. 600 cycle, self-excited 250 watts $25.00
1500 volt d.c. 660 mills, 1 kw., Esco 1750 r.p.m. $45.00
240 volt 500 cycle, self-excited 2500 r.p.m. 250 watt, (also hand drive) $25.00
120 volt d.c. 5 kw 60.00
120 volt d.c. 20 kw. 115.00
600 volt d.c. 2 kw. 45.00
220 volt a.c. 500 cycle 1 kw. 45.00
220 volt a.c. 500 cycle 2 kw. 60.00
12 volt d.c. 60 amp. 15.00
12 volt d.c. 33 amp. 7.50

Baldwin Headphones, Genuine Mica Diaphragm 2000 ohm. Regular $15.00 value $3.50

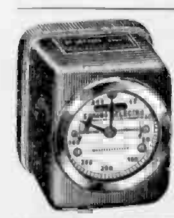
VOLTMETERS, D. C. portable new Weston model 45, 3 scale 0-3-15-150 guaranteed 1-4 of 1 per cent accurate $40.00
Ammeters, D.C., portable, new Weston model 45; 3 scale 0-1-5-15-150 with 3 ... external shunt and leads 1-4 of 1 per cent accurate $30.00

EDISON STORAGE BATTERIES

All Types

1.2 Volts Per Cell

A-4 Amps. 175 Per cell	$3.50
A-6 Amps. 225. Per cell	4.00
A-8 Amps. 300. Per cell	5.00
B-4 Amps. 90. per cell	3.50
M-8 Amps. 11. Per cell	1.00
L-40 Amps. 25. Percell	1.50
J-3 Amps. 37. Per cell	3.00



Ampere hour meter, Sangamo, battery charge and discharge, type MS 0-500 scale, capacity 15 amp. $10.00

NAVY AIRCRAFT DYNAMOTOR, Gen. Elec. new 24-1000 volts, 1 amp. extended shaft with pulley, can be driven by motor or propeller, giving 24 volts output for filament and 1000 volts for plate or driven by its own input of 24 volts. Value $250.00. Our special price $50.00

DYNAMOTORS

24-750 volt Gen. Electric 200 mills $27.50
24-1000 Gen. Elec. 1000 mills 50.00
24-1500 Gen. Elec. 2 1-2 kw. output $95.00
12-350 volt 80 mills 18.00
12-750 volt 200 mills 30.00
32-350 volt 80 mills 9.00
32-300 volt 60 mills 7.50
Dynamotor Armatures, General Electric triple commutators, d.c. 24-1500 volt $12.50

Postage and deposit of 20 per cent. required on C. O. D. orders. No orders shipped for less than $1.00—WE DO NOT ISSUE CATALOGS.

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