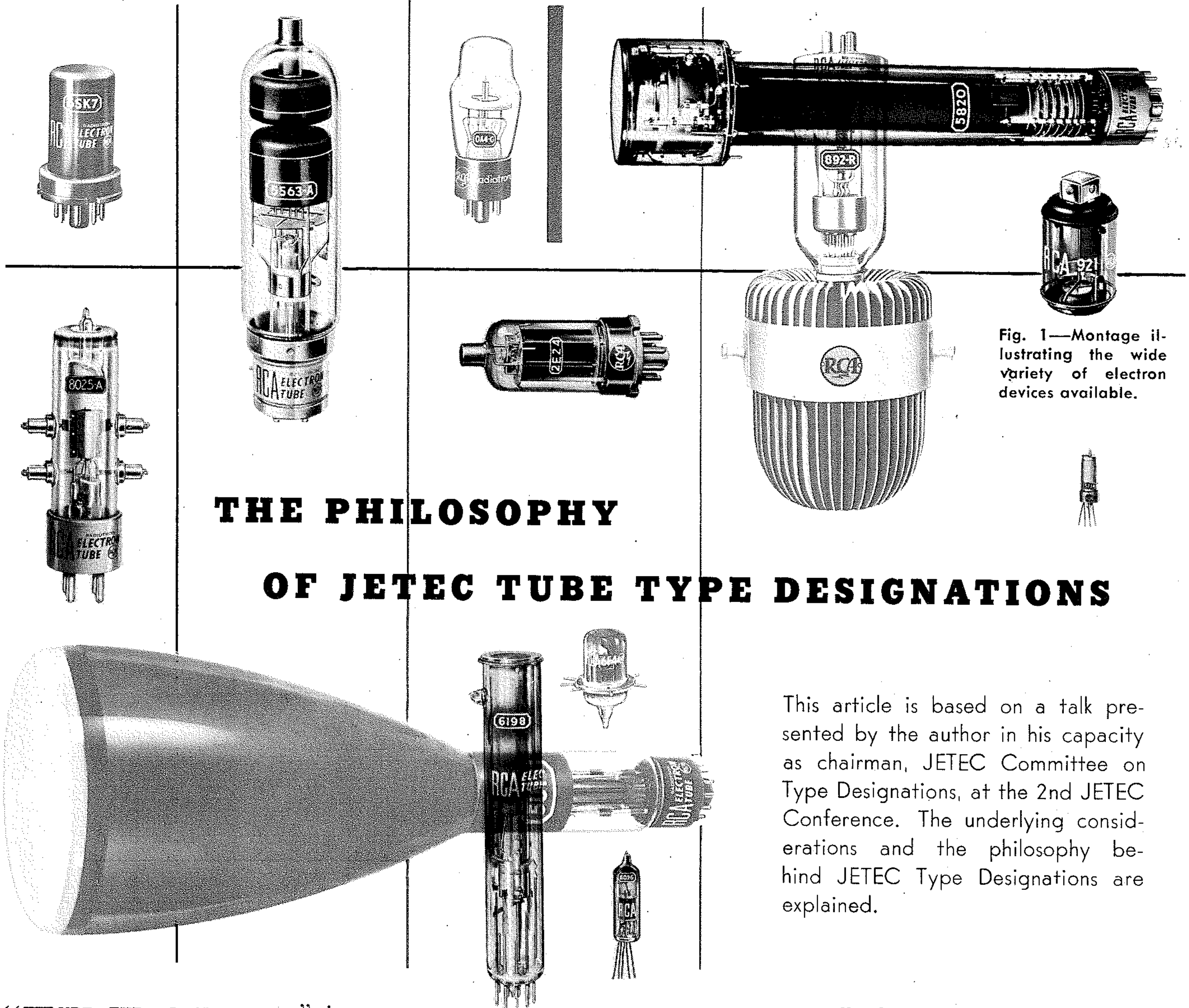


Fig. 1—Montage illustrating the wide variety of electron devices available.

THE PHILOSOPHY OF JETEC TUBE TYPE DESIGNATIONS

This article is based on a talk presented by the author in his capacity as chairman, JETEC Committee on Type Designations, at the 2nd JETEC Conference. The underlying considerations and the philosophy behind JETEC Type Designations are explained.

by **R. S. BURNAP,** *Manager*
Commercial Engineering
Tube Division
Harrison, N. J.

"TUBE TYPE DESIGNATIONS" is a topic very much like politics. It is a subject on which almost everyone has ideas and a willingness to state them and to argue for them vigorously. But as to whether the ideas are workable is often another matter. As in politics, the test of practicality is not talk but the results. That is where the members of the JETEC COMMITTEE (Joint Electron Tube Engineering Council) are at a decided disadvantage. We talk, and in our sessions talk at great length, but we also have to live with the results of our talking.

Most of us on the committee have had experience in developing and administrating company designation systems in addition to our experience on an industry-wide basis. However, most of our knowledge on this subject has been taught us by our mistakes. We have learned that, too often, the apparently obvious solution quickly develops grievous faults, and that hindsight is no substitute for foresight. The committee operates as a seeker of the truth. But what is the truth? As in politics, the truth can present many fronts depending on the observer's viewpoint and background, the nature of the matter with which he has to deal, and what he considers to be the important objectives.

CONSIDERATIONS COVER A WIDE AREA

In our subject of type designations for electron devices, we have an extraordinarily complicated problem. First, we must consider a product which can take many forms. With some of these we are already familiar; with others, we may suspect that they will be made some day. With still others, we have as yet no inkling of their possibility. It is no accident that the electronic industry is one which frequently makes people ask "what will they do next?"

But, in addition to these purely technical considerations, we must consider a user group which has a tremendous variety of interests and needs. Users can range from the casual purchaser of a renewal tube for his portable radio to the man who expects to determine the basic features of an unknown tube from its type designation. Consideration must also include tube manufacturers having only a few product lines, as well as those with many; large and small equipment manufacturers with their wide diversity of product lines and their highly specialized requirements; military users with their intricate equipment, elaborate procurement and spare parts provisioning procedures, and difficult maintenance problems.

Thus, establishment of a satisfactory designation system involves not only engineering but also commercial and psychological considerations. There is no easy solution. There is probably no solution that will be completely satisfactory to anyone, let alone to everyone.

What, then, is the philosophy of the current JETEC type designation system? First, it is an evolving philosophy, and one which today must take into account factors which either were not important, or were unknown when the first RMA system for receiving tubes was formulated in the early 1930's.

WORK BY EARLY COMMITTEES

At that time, only tube types designed primarily for use in home-entertainment equipment were involved; pentodes were just coming into use, multi-unit tubes were not even considered, metal and miniature tubes with their different basing arrangements were not even dreamed of, and the need for exact interchangeability of types bearing the same designation but made by different manufacturers was of minor significance. Circuits for early radio sets were not as critical as modern electronic equipment. The volume control, abetted by the fact that the average ear is very uncritical of large changes in volume, considerably simplified tube interchangeability requirements.

Under these circumstances, the first designations committee came up with what appeared to be a simple and logical system. It comprised 3 symbols; a first number indicative of the filament or heater voltage of the tube, a letter assigned in sequence starting with A except for rectifiers which started backwards from Z, and a second-number which indirectly identified the type as a diode, triode, tetrode, or pentrode as the case might be. Of course, even in those early days, it was necessary to remember that a first-number 1 identified 2-volt filament types, that a first-number 2 identified 2.5-volt heater types, that heater types added one to the second number of the designation, and that full-wave rectifiers followed special rules.

This receiving tube system is still in use today but chiefly as a method of assigning distinctive designations to receiving types rather than as a method of identifying the specific characteristics of a particular tube type. Over the past 20-odd years, the changes in and diversification of receiving tube design have made necessary a great many new rules to keep the system workable and to assist in its administration, but the amount of information which can be gleaned from these modern-day designations is relatively small and quite often misleading.

OBJECTIVES OF A JETEC SYSTEM

What should be the philosophy, or the objectives of a JETEC types designation system?

First, the primary objective is to provide designations which unequivocally distinguish the products they identify from each other.

Second, the designation should be brief so that it can be easily memorized, quickly stated, and legibly printed on a small product such as a subminiature tube or a transistor. As a practical matter, the designation should comprise 3 to 5 symbols.

Third, it is important that the system provide for stability and continuity in its administration; require a minimum of changes in its rules with changing situations; and be free from administrative errors whether they be caused by differences in interpretation of the rules, or just human mistakes.

And finally, it is desirable to provide a system or combination of systems which provides useful information to assist in remembering individual designations and their significance.

HOW PHILOSOPHY EVOLVES

In evolving the philosophy of a type designation system, it is on this final objective that we find the greatest diversity of opinion. Some might make it the No. 1 objective. Some are willing to settle for broad classifications; others want rather specialized information. Many of those who have had to deal with a multiplicity of tube types and a wide variety of their applications doubt that the amount of accurate and useful information which can be incorporated in a type designation and remembered is in the long run worth the trouble. Systems intended to accomplish even a little in this direction are cumbersome in their administration and require constant patching. They require the memorizing of many complex rules as well as constant alertness for exceptions which are sure to occur. Moreover, regardless of how complicated a mnemonic system is, it can never, of course, take the place of tube classification charts and technical data sheets.

A further and not-to-be ignored difficulty common to industry systems for assigning type designations is one inherent to all community activites. Reference is made to the fact that participation in a community activity even on a voluntary basis may require giving up some of one's preferences for the common good; and, of course, participation in the Types Designation System is entirely voluntary.

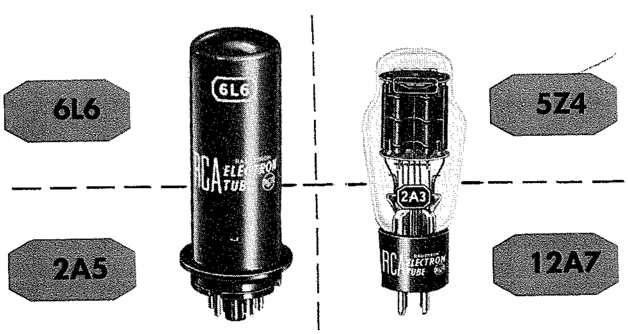


Fig. 2—The first numbering system comprised 3 symbols, alphabetical and numerical.

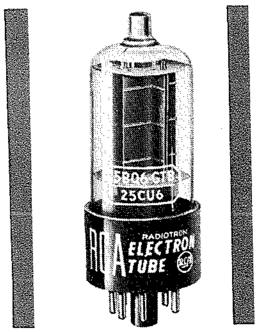


Fig. 3—Objectives are to achieve simplicity, flexibility, keeping designations to 3, 4, or 5 symbols.

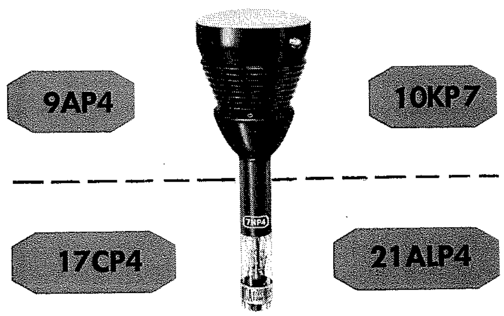


Fig. 4—The "JETEC" system adopted for cathode-ray tubes involved a "P" term to identify phosphor.

It would be very difficult to evolve a workable industry designation system which would provide the flexibility of a company-administered system. Furthermore, the use of an industry-system designation detracts in the minds of some from the prestige of the company originating the new product. On the other hand, the availability of an industry designation system which electron device manufacturers can utilize any and every time they develop a new tube type does make it easier for a user to buy a tube product from several manufacturers with assurance that it will work properly in his equipment.

JETEC SYSTEM FOR CATHODE-RAY TUBES

The second JETEC system established just before World War II was intended to cover picture tubes, although it was quickly extended to include oscillograph types as well. Again, we had initially, as we did with the receiving-types system, a line of products specialized for a particular field of application. In this case, it was decided that important characteristics of such tubes were the size of the faceplate and the nature of the viewing surface.

Thus, a system was established which used a first number to identify the tube size in inches, a letter symbol assigned in sequence, and a P term to identify the phosphor. Since then, of course, we have encountered the problems of overscanning, rectangular faceplates, projection types, use of light absorbing faceplate glass, glare-proofing, aluminizing, built-in capacitors, and other refinements not anticipated when the system was set up. Because of the basic simplicity of this system, it has survived these changes quite well so far as picture tubes are concerned, although there are rumblings of difficulties on the front represented by oscillograph and allied tube types.

JETEC "WAR" SYSTEM

During the war, a third system was introduced as a war measure to take care of all tubes other than receiving and cathode-ray types. This system was based on the use of a first-number indicative of the filament or heater power, a letter symbol indicative of the structural or functional class of the device, and a second number assigned in numerical order.

While this system served its immediate purpose, not everyone was happy with it. The first number of the designation had size and power-handling significance only when the type was intended for power applications, and even in those cases fell down on cold-cathode and pool tubes; the first assignment of letter symbols was inadequate, necessitating new assignments every time new classes of tubes evolved; and types were developed involving two classes requiring arbitrary classification of these types in one class or the other.

A fatal defect of this particular system was the difficulty of anticipating and controlling the assignment of new class letters. Every new variety of device called for a new class letter regardless of its future importance. At the end of the war, we had used up practically all of the letters of the alphabet and were faced with the problem of compound coding-letters. Since it was usually impossible to foretell future developments until they were presented for type designations, the choice of suitable class letters presented serious administrative problems.

JETEC NUMERIC SYSTEM

As a result, one of the first assignments of the JETEC types designation committee following the war was the formulation of a new system for tubes and devices other than receiving and cathode-ray types. Faced with the problem of evolving a system capable of handling all classes of non-receiving tubes and all classes yet to come, as well as one which would not require more than 5 symbols, the committee came to the conclusion that *a straight numeric system* offered the maximum of simplicity and stability with a minimum of administrative problems.

True, such a system would give the user no help in interpreting the type designation, but on the other hand neither would it supply any incorrect information or information likely to misinterpretation.

Furthermore, it was the committee's considered opinion at the time this system was recommended that no system of designation coding could take the place of tabulations and charts for grouping tubes according to function and fields of application. Such charts and tabulations could be revised and expanded as the need developed, whereas a grouping incorporated in the type designation would be both incomplete and inflexible.

The straight numerical designation was chosen in place of arbitrary letter or letter-digit combination to avoid the garbled oral transmissions so common with similar letter sounds. This choice was made in spite of the fact that use of letters in place of digits would have provided enough

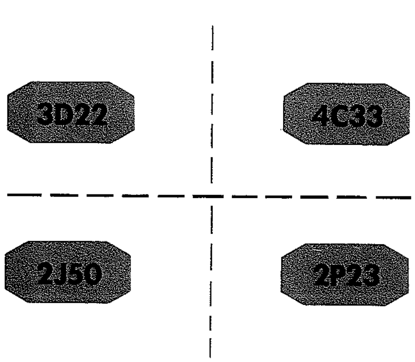


Fig. 5—As a war measure, a third type designation system was introduced to accommodate all tubes other than receiving and cathode-ray types.

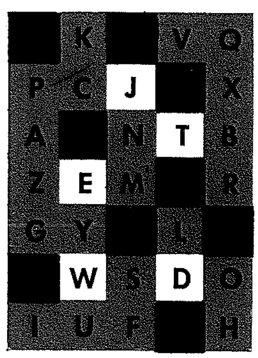


Fig. 6—A weakness of this system (Fig. 5) was the need of a new "class" letter for each new variety of device, regardless of its future importance.

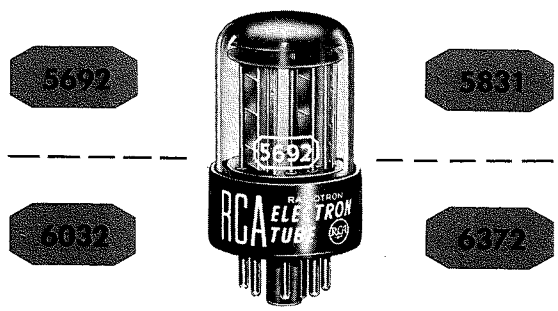


Fig. 7—The "JETEC" straight numeric system was adopted following the war in place of letter or "letter-digit" combinations.

combinations to have made it feasible to use a 3-letter designation system instead of the recommended 4-digit designation system.

JETEC SYSTEM FOR SOLID-STATE DEVICES

In the case of solid-state devices a system is being used which will identify this particular class of products and give some idea of their complications in terms of the element count. Difficulties cannot be minimized of writing definitions in such a new field; in addition, there are difficulties of writing rules which can be consistently interpreted and followed under expanding and as yet unforeseen situations.

USE OF SUFFIXES

Another and very important phase of this subject of type designations systems is the use of suffix letters to indicate modifications in the prototype. There are two schools of thought on this subject. One school puts emphasis on suffix letters; the other believes that suffix letters should be used primarily to indicate that the suffix version can completely replace the prototype in any application. The first school wants to use suffix letters chiefly to identify variants of the prototypes; in other words to identify types that are similar but with structural, electrical, or performance differences. The second school would confine its use of suffix letters to show that the new version will do everything that the prototype does plus something more.

"VARIANT" SUFFIXES

The first method, which may be called the variant-identification method, usually has its biggest vogue when a tube class is in its pioneering stage. At this stage, when tube and equipment manufacturers are still struggling with problems of evaluating and measuring performance, and of designing and building their products to give optimum results, there is a strong tendency for equipment manufacturers to design and build liberal tolerance for component variations into their products. In addition, at this stage, the user of the equipment has a strong tendency to be less critical of the performance of the new devices than he will later on.

As a result, the equipment itself, and its user will accept during this period tubes having in some cases rather large differences in electrical and mechanical characteristics, and in performance. An example of this kind of interchangeability has been the use of metal tubes and their G and GT counterparts interchangeably in radio receivers and other low-frequency equipment. It is highly unlikely, however, that such interchangeability would have been feasible had the receivers of the thirties included circuits as critical as those in television receivers or modern-day industrial and military equipment. Today, we are struggling with somewhat the same kind of a problem in picture tubes. Tomorrow, we will undoubtedly face similar problems with transistors.

In general, it can be assumed that the variant will work in the socket for which the prototype was designed, but that the degree to which the variant will replace the prototype will usually be a matter of personal opinion. Either the tube manufacturer expects that minor changes will have to be made in the equipment to accommodate his variant, or the tube user may have to accept a product different in his opinion in some respect from the prototype.

"MODIFICATION" SUFFIXES

The second method, the modification-identification method of assigning suffix letters, usually becomes important after the tube class and its associated equipment have passed their early pioneering stage and have entered what might be called the refinement stage. In such cases, the use of suffix letters to identify prototype modifications better adapted to the application, serves the useful purposes of preserving the family line, simplifying the replacement problem, and informing the user, that based on engineering judgment, the replacements will do everything the prototype would do in this particular socket and do it without adjustment not normal to the prototype. In this case, the user gets the same kind of performance that the prototype supplied although the new version may provide greater capability of performance.

BOTH METHODS HAVE MERIT

As has been pointed out, both methods can be used under appropriate circumstances. However, it is essential that the suffix letters used definitely identify which of the two methods applies. When the first method is involved, the user is entitled to know that the new version differs in some respect from the prototype and that he may not be getting a suitable replacement tube for his particular socket.

The more critical the application, the more important it is to observe this distinction between variants and actual superseding modifications. That is the chief reason why the JETEC

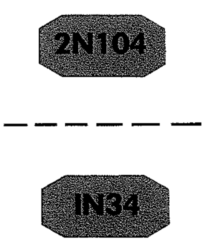


Fig. 8—Solid-state devices required special considerations to identify this class of product.

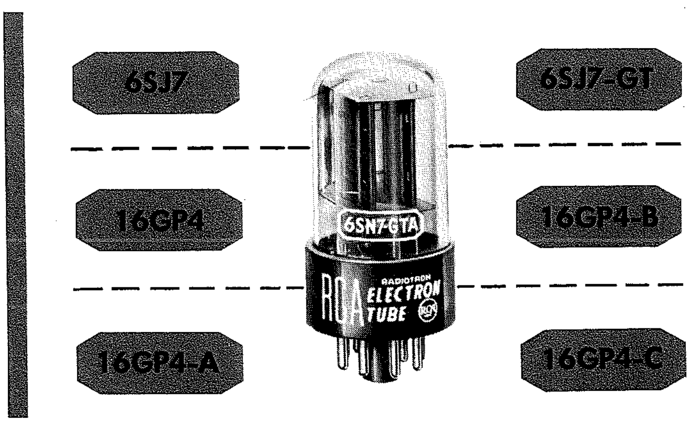


Fig. 9—"Variant" suffixes are used to signify that the variant will work in the prototype socket but may require equipment changes.

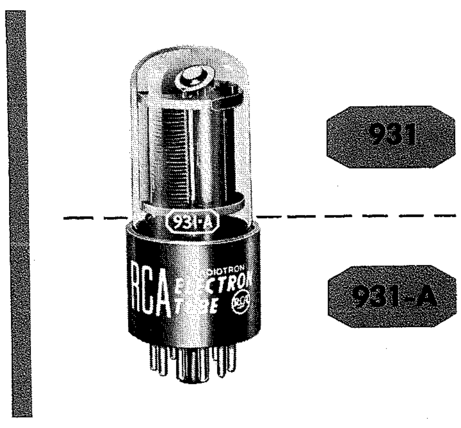


Fig. 10—"Modification" suffixes inform the user that the replacement will work in the prototype socket without equipment changes.

Type Designations Committee has been slow to give its whole-hearted support to the use of suffix letters with the numeric designation system.

SEPARATE AND DISTINCTIVE DESIGNATIONS FAVORED

As a general rule, it is safer when a variant version is involved to use a designation completely different from that of the prototype, because as soon as the prototype is accurately defined and the personal preference of the user properly evaluated, it will be apparent that two separate and distinct tube types are involved. In the case of variants, the assignment of separate and distinctive designations has the advantage of protecting tube manufacturers against mistakes in initial judgment. If the two types do turn out to be interchangeable, it is always possible to double brand the versions with both numbers, whereas a mistake in assigning a letter suffix is very difficult to correct and causes confusion for years.

This general rule of using distinctive designations for variant versions has been almost universally practiced by industry for many years. This rule applies in the cases of variants designed for special civilian applications requiring characteristics and performance not needed for normal application of the prototype. In such cases, which include "premium" versions, it is advisable to break the family line so far as the type designation is concerned.

"PREMIUM" TYPE CONSIDERATIONS

"Premium" types as a rule are specially designed, specially built, specially rated, specially priced, and specially distributed. They are not intended to be replacements in sockets for the home-entertainment applications for which the prototypes were originally designed and priced. In fact, it should be pointed out that the "premium" version may not give premium performance in the prototype socket, and may give in some sockets poorer performance than the prototype. For example, a cathode material chosen for a premium tube for a special service may not be the best cathode material for the prototype service. The more "premium" versions are refined to meet special requirements the less likely they will be successfully interchangeable in prototype sockets, or even for that matter in various "premium" sockets.

On this particular matter, the military point of view differs from the civilian point of view in that for procurement and distribution reasons the military services normally want a "premium" version which will completely eliminate the prototype. They, therefore, consider it very important to preserve the family line in the type designation of the "premium" version. Whether doing so will be feasible over a period of years of new developments may be questioned, but we should recognize that needs of the military services are not always compatible with needs of industry when the subject is type designations.

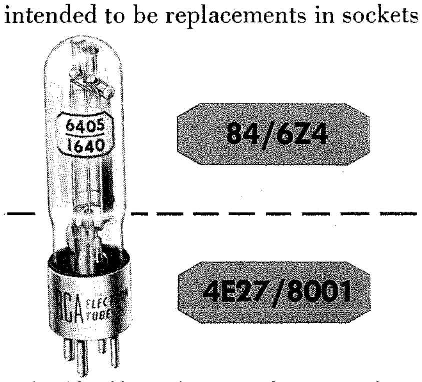


Fig. 11—The assignment of separate designations permits later "double-branding" when types prove to be interchangeable.

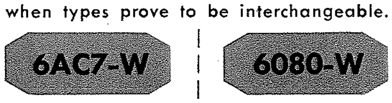


Fig. 12—The "W" suffix identifies the type as a military version subject only to military specifications.

THE "W" SUFFIX SOLVES A PROBLEM

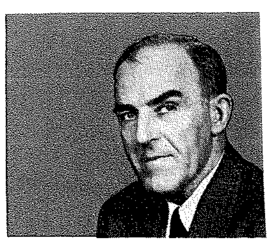
Another phase of the suffix-letter problem is the "W" suffix. Several times in this article the military services and their special needs have been mentioned. One of these is to be able to identify (from the type designation) a product made under a revised specification in order to segregate stocks and channel shipments.

To accomplish this, the services started the use of suffix letters A, B, C, etc. with disastrous results so far as commercial designations were concerned, since many changes did not affect products for civilian uses. As a result, our committee was faced with the problem of finding a solution which would give the Services the flexibility they desire and yet would not tie civilian products to the military kite.

The solution was the W-suffix which, when employed by the Services, identifies the type to which it is assigned as a military version subject only to military purchase specification for its further identification. Once having added the W-suffix, the Services can add suffix letters A, B, C, etc. at will to identify further modifications of the military version. To preserve the flexibility provided by the W-suffix, it is important that its use be reserved to types produced and sold against military specifications.

COMPLEXITY DEMANDS SIMPLE SYSTEMS

The preceding description has given you some idea of just how complicated and involved the formulation and administration of types designation system for industry use can be. We are dealing with an evolving philosophy in which the very multiplicity and complexity of electron devices are forcing us to greater and greater simplicity in our systems. The JETEC Committee considers that the paramount requirement is to be able to *assign simple distinctive designations quickly* and with a minimum of administrative problems and difficulties; that *stability and continuity are essential* ingredients of an industry designation system; and that descriptive information in the designation is desirable but only when it can be kept accurate and within the ability of the average tube user to remember the rules by which the information is coded into the designation. Currently, there are three such JETEC systems. Is the average tube user sufficiently interested to learn and remember more? Certainly, on that course, the committee is faced with the law of diminishing returns even if the supply of distinctive symbol combinations should prove adequate.



ROBERT S. BURNAP—Mr. Burnap received the S.B. degree from Massachusetts Institute of Technology in 1916, and continued as Research Assistant for the next year. From 1917 to 1930 he was employed by the Edison Lamp Works of the General Electric Company except for a year's service in the U.S. Signal Corps during World War I. Since 1930, he has been Manager of Commercial Engineering for the Tube Division. Mr. Burnap is a Fellow of the IRE, SMPTE, and the AIEE. He has been active over a long period in both professional and trade association standardization activities.

INTRODUCING......

DR. E. W. ENGSTROM

DR. E. W. ENGSTROM

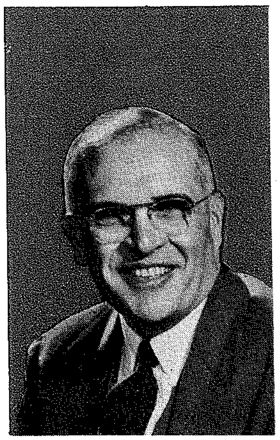
Dr. E. W. Engstrom, Executive Vice President, Research and Engineering, joined RCA in 1930. He received a B.S. in E.E. degree at the University of Minnesota in 1923.

In the early thirties, Dr. Engstrom directed RCA's television research toward a practical service. He was responsible for development and construction of apparatus used in field tests, and in the planning and coordination, which lead to the reality of black-and-white television. Since then, he and his associates have conducted research on television in color. Dr. Engstrom was a member of the NTSC at the time TV standards for broadcasting were established and a member of the Radio Technical Planning Board. He was a member of the NTSC which developed technical signal specifications for color television transmissions, adopted by the F.C.C. December 17, 1953.

In 1942 when all research activities of RCA were brought together at Princeton, N. J., Dr. Engstrom became Director of General Research and in 1943, Director of Research of RCA Laboratories. On December 7, 1945, he was elected Vice President in Charge of Research of the RCA Laboratories Division; on September 7, 1951, he was elected Vice President in Charge of RCA Laboratories Division; on January 11, 1954, he was elected Executive Vice President, RCA Laboratories Division; and on June 4, 1954, he was elected to his present position.

The honorary degree of Doctor of Science was conferred on Dr. Engstrom in June, 1949, by New York University. In August, 1949, Dr. Engstrom received a silver plaquette from the Royal Swedish Academy of Engineering Research. In October of 1950 he received the Outstanding Achievement Award gold medal from the University of Minnesota.

Dr. Engstrom is a member and past President of the Princeton Chapter of Sigma Xi, science research honor society; a Fellow of the IRE, of which he was a director in 1949, and of the AIEE.



DR. CHARLES B. JOLLIFFE

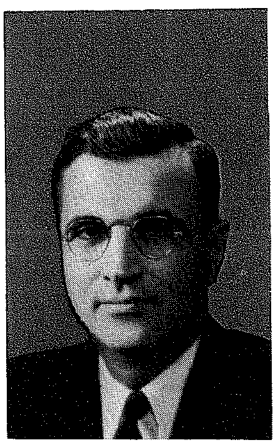
DR. CHARLES B. JOLLIFFE

In his post of Vice President and Technical Director, Dr. Jolliffe is responsible for development of long-range plans for pioneering and research projects.

Dr. Jolliffe assumed his present duties in September, 1951, after serving for nearly six years as Executive Vice President in Charge of RCA Laboratories Division. Dr. Jolliffe received his Bachelor of Science degree in 1915, his Master's degree in 1920 from West Virginia University, and his Ph.D. from Cornell in 1922. He was awarded an honorary LL.D. degree from West Virginia University in 1942.

In 1922, he joined the Radio Section of the Bureau of Standards and served as a physicist. In 1930, Dr. Jolliffe was appointed Chief Engineer of the Federal Radio Commission (later became FCC) and held that position until 1935, when he joined RCA.

Dr. Jolliffe has held the successive positions of Engineer in Charge, RCA Frequency Bureau; Chief Engineer, RCA Laboratories; Assistant to the President of RCA; Vice President and Chief Engineer of the RCA Victor Division, and Executive Vice President in Charge of the RCA Laboratories Division. Dr. Jolliffe is a member of Sigma Xi, Phi Beta Kappa, Fellow of the American Association for the Advancement of Science, AIEE, and the IRE.



DOMINIC F. SCHMIT

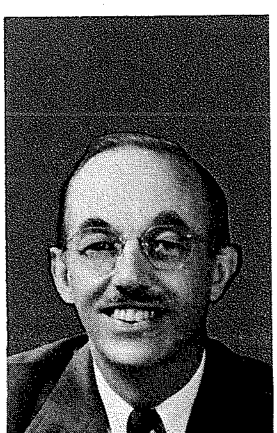
DOMINIC F. SCHMIT

Dominic F. Schmit, Vice President, Product Engineering, has held important engineering posts in RCA since he joined the Corporation in 1930.

A native of Port Washington, Wisc., Mr. Schmit graduated in 1923 from the University of Wisconsin with a B.S. in E.E. degree. Before joining RCA, he worked as an engineer with G.E. Co. and with the E. T. Cunningham Company of New York.

Upon joining RCA, Mr. Schmit became manager of Application Engineering and later became Manager of Research and Engineering in tube manufacture at Harrison, N. J. In 1939, he was named Manager of the New Products Division, and four years later was appointed Assistant Chief Engineer of the RCA Victor Division. He was closely associated with the development of RCA's first pre-war commercial television receivers. He was promoted to Director of Engineering in March, 1945 and was elected Vice President in Charge of the RCA Victor Division Engineering Dept. in March, 1946. High on the list of his post war projects were the RCA Victor "45" Record Player and Records. Mr. Schmit also directed development engineering work which placed RCA in the pioneering position in Compatible Color Television.

Mr. Schmit joined IRE as an Associate Member in 1925 and in 1951 received an IRE Fellow Award.



O. B. HANSON

O. B. HANSON

As Vice President, Operations Engineering, Mr. O. B. Hanson is responsible for engineering matters pertaining to broadcast and communications, and for the direction of the RCA Frequency Bureau.

Mr. Hanson's early education was acquired in England where he studied electrical engineering at Hillyer Institute. In 1915 he became a student at Marconi School (now RCA Institutes). In 1917, Mr. Hanson transferred to the Engineering Department of the Marconi factory. In 1921, Mr. Hanson entered the broadcasting field and operated and programmed WAAM, Newark, N. J. until 1922 when he joined the engineering staff of WEAF. Mr. Hanson became Plant Manager for WEAF and was active in developing the Red Network. In 1926 WEAF became a part of the newly formed National Broadcasting Co. and Mr. Hanson continued in his capacity of Plant Manager.

In 1934 Mr. Hanson became Chief Engineer and in 1937 was appointed Vice President and Chief Engineer of N.B.C. In this position he supervises technical developments and technical operations, including development of black and white and color television. On June 1954, Mr. Hanson assumed his present position.

Mr. Hanson has been a member of IRE since 1918 and a Fellow of IRE since 1941. He is also a Fellow of Acoustical Society of America, and of the Society of Motion Picture and Television Engineers. He is a member of the Radio Pioneers.