VOL. 2 APRIL 1945 NO. 3

RCA LABORATORIES NEWS

1945 RED CROSS CONTRIBUTION BY MEMBERS OF THE LABORATORIES

$1736.00

THIS EXCEEDS LAST YEAR'S CONTRIBUTION BY $300.00

IN ADDITION TO THE ABOVE CONTRIBUTIONS THE RADIO CORPORATION OF AMERICA HAS MADE A CONTRIBUTION TO THE PRINCETON CHAPTER OF THE AMERICAN RED CROSS.

RADIO CORPORATION OF AMERICA
PRINCETON N.J.

TO THE AUDITOR AS DEFINED
BY AN ENGINEER

(This is reprinted from a recent issue of "Sparks", the house organ of the Radiomarine Corporation of America. We are indebted to Mr. Amsler for calling this item to our attention.)

The typical auditor is a man past middle age, spare, wrinkled, intelligent, cold, passive, non-committal, with eyes like a codfish, polite in contact, but at the same time unresponsive, calm and damnable, composed as a concrete post or a plaster-of-paris cast; a human petrification with a heart of Feldspar and without charm or the friendly germs, minus passion, or a sense of humor. Happily, they never reproduce and all of them finally go to Hell.

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PERSONALS

There is great rivalry at the gate house as a result of the recent afternoon's target practice, with Walt Servis and Joe Meley as the feature attraction. Both men were very consistent in their scores, Walt managing to get the bull's eye four times, but Joe Meley coming in first when the final points were tallied up. Their manager, Tony Friel, promises a great future for these men as the rivalry grows hotter.

T. L. Maher was presented with a large gilded Bowling Ball by his teamates for his good work in keeping his team in the running Unfortunately they lost out in the last few games. Better luck next year, Chief!

HABLAN USTEDES ESPAÑOL?

In keeping with the good-neighbor policy, we have a couple of lovely senoritas (Sade McCafferty of Purchasing and Ginny Corio of the Mail Room) who have taken up the study of Spanish during the lunch hour. They are ably instructed by Jennie Cortese. Are these girls planning a post war expedition, or is it just a passing fancy?

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Edwin F. Creager, formerly of our Drafting Room, visited the laboratories on Monday, April 2 while home on furlough. Our congratulations to him on his promotion from Air Cadet to Ensign.

We welcomed the visit of John Wargo,Jr. of our Guards who stopped in to see his friends at the Laboratories on April 10, 1945 while on furlough.

We were all glad to have Pvt. Dorothy Rosenberg visit us on April 10, 1945 while on furlough from Holloran General Hospital where she is stationed.

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Miss Billie Jean Testerman and Mrs. Florence Bathie of Tube Assembly celebrated their birthdays together on Saturday, March 17th. Mrs. Bathie made two lovely cakes which the girls all enjoyed. We wish both Billie Jean and Florence many happy returns.

A warm welcome was received by Walter Tears of our Guards who is back on the job after undergoing an appendix operation in the Princeton Hospital.

Our best wishes are extended to Mr. and Mrs. Perrin C. Lockard of Model Shop and Tube Assembly who recently changed their residence from Trenton to the Community of Penns Neck.

ADDITIONS

A. J. LaBaw - Model Shop
L. Butterfoss - Model Shop
Miss W. M. Edwards - Personnel
Miss E. M. Hall - Research
Miss M. V. Mihelyi - Research
Miss C. L. Furman - Research
W. P. Heising - Research
Mrs. F. Q. Freda - Model Shop
E. G. May - Research

TRANSFERS

Miss H. Maginnis - Model Shop to Tube Assembly Room

Miss L. Semenchuk - Patent Department to Research

DEATHS

We report with regret the death on March 29, 1945, of Miss Catherine J. Freda, daughter of Mrs. G. A. Freda of our Model Shop. Miss Freda died from burns received while at work in a laboratory of the Thiokol Corporation in Trenton, New Jersey. Our deepest sympathy is extended to the bereaved family.

Mrs. Ettna C. Carter died February 21, 1945 in Princeton Hospital in her 68th year. She was the mother-in-law of Mr. L. F. Kraus of our guards. Mrs. Helen Kraus, Mrs. Carter's daughter, is known to many of us since she has substituted for Miss Terp in the Dispensary at times. We extend our sympathy to the family.

RCA LABORATORIES NEWS

ED. DICKEY - EDITOR

THE RELATION OF WAR-TIME ENGINEERING TO POST-WAR ENGINEERING*

by

C. B. Jolliffe

The radio engineer of today has a definite responsibility for the development of the radio industry of the post-war period. I want to refer briefly to the past to show the similarity, with respect to radio, which the post-war period of World War II will bear to the post-war period of World War I.

The period prior to World War I can be considered as the development period for radio. In those years radio was used primarily for communications in the maritime service and was important only in times of maritime disasters. The most significant event during that period was the invention and development of the three-electrode vacuum tube and that invention really marks the beginning of modern radio.

The war stimulated development of the vacuum tube and made possible many things which then seemed quite marvelous. An even more significant development, however, was the training of a body of men in the then new art of radio. The mystery of radio communications was rationalized and an engineering basis on which the radio art could proceed was developed. Industrial laboratories were organized and manufacturing facilities were created. Radio engineering came out of the last war as a profession; new tools and techniques and men trained in their use were available.

The immediate objective of the infant radio industry after that war was to develop long-distance radio communication. The Government stimulated this infant radio industry and made available the inventions made during the war. Looking forward at that time, the most promising field of expansion for radio was in radiotelegraph and radiotelephone services. No one could forsee or predict the development of broadcasting. Nevertheless, within two years after the end of World War I broadcasting was started and the explosive effect of the birth of this industry was one of the remarkable developments of the 1920's.

All the elements for a broadcast service were ready and the stimulation of public interest was all that was needed to get a service started. It was set off in a dramatic manner and for a long time it was completely out of control. Interest spread like wild-fire. There was every reason why broadcasting should have died as an industry and if present-day requirements for new radio services had been applied, it would have died. It took enthusiasm and imagination to develop this service. Fortunately, the young men and the young industry which had created the many new radio devices of World War I had the enthusiasm and imagination of youth, and they carried this new industry through many difficulties. The public wanted it and showed its desire by developing the radio broadcast industry into a billion dollar enterprise in less than two decades.

With the stimulus to research, development and design provided by broadcasting and other new radio services, it was found that radio was useful in many new fields and that still higher portions of the spectrum had application to communication and related fields.

How long this period of exploration would have continued under normal circumstances no person can predict. However, we did not have to wait; the research required for World War II has brought phenomenal advances and intensive developments of apparatus to use frequencies above 30 megacycles for such services as short-distance communication, radar, aids to air navigation, etc. Frequencies above 3000 megacycles are now in daily use. We have probably again crowded several decades of research, development and engineering into a very few years.

Here again, as at the close of World I, radio stands on the verge of enormous commercial developments. A new frequency spectrum, practically untouched for peace-time use, has been opened up, many new developments, techniques and tools which have been used for war purposes are waiting to be made useful for peace, and a huge body of men trained in the use of electronic equipment is available. The world is ready for and needs new industries.

What then can come out of this war for peace-time use? Radio engineers should think and plan seriously concerning these future uses. The future of our own jobs and the jobs of many thousands of men will depend on proper evaluation of the use of the new frequency spectrum and planning for its use for the greatest number of people. If the spark of public demand for new things is struck we will be in on a much larger explosion than that which occurred with the start of sound broadcasting.

The Federal Communications Commission has "high-lighted" the need for planning for the use of radio in the post-war period. The final allocation by FCC of all frequencies from 10 kilocycles to 30,000 megacycles will be one of the important milestones of radio history. It will determine the future of many possible uses of radio. In addition, there are other applications of radio frequency power that do not require FCC allocations or authorization before equipment can be designed and used.

Sound broadcasting revolutionized our ideas of entertainment and altered our way of life. Television can provide a second revolution of entertainment and effect our mode of living to an even greater degree. The application of electronics can revolutionize manufacturing. In air transportation the use of new developments in radio aids to navigation and communications will change our conception of the reliability of air transportation and make it a really true competitor to surface transportation. "Citizens' radio" is an entirely new concept of the use of radio communi-

*We give here excerpts from a lecture presented by Dr. Jolliffe before a joint meeting of the A.I.E.E. and I.R.E. in Indianapolis on March 23, 1945.

cations in everday life and it may extend enormously the use of radio equipment.

Each of these applications of radio may create a new industry which will affect other industries. What are the possible applications of war developments to peace-time activities and what are the steps that must be taken to convert these new techniques to products and systems which the people want?

Consider for a moment the subject of television. We are able to build transmitters, receivers and antennas that will give a very satisfactory television performance for the home. However, without definite frequency assignments or without organization of programs and distribution of programs through networks, these transmitters and receivers are of little value for public service. But with frequency allocations definitely set, with program sources organized, and with networks in operation -- in other words, with a system organized -- this one industry can completely revolutionize our way of living. It does not take much imagination to see this industry as a possible five or even ten billion dollar enterprise, employing thousands of men, either directly or indirectly. At the present moment all the instrumentalities are ready. However, they are unorganized and very few plans have been made. Industry must forget petty technical differences and get behind the organization of a prosperous television service.

I do not want to go into the merits of whether television should be below 300 megacycles or above 500 megacycles. The question which needs to be answered is whether we want television or not. If the public wants it, technically it can be produced below 300 megacycles. If we believe the public does not want it, then let us honestly postpone its inauguration and not hide behind the probability of possible new developments. Any radio service can be improved and most radio devices have gone through several cycles of improvement and obsolescence.

Extensive field tests in several large metropolitan areas have established the fact that very satisfactory entertainment can be provided by a television broadcasting service using 6-megacycle channels and carrier frequencies below 300 megacycles. Having obtained a television system with this degree of performance, the television engineer is faced with the problem of determining the extent to which television images must be improved before the public will be conscious of the improvement and be willing to pay a higher price for television receivers. What is the nature of the improvement which will be most acceptable to the television audience? Should we have pictures with greater definition, in color, in three dimensions, or should some new broadcast service be added, for example, the transmission of odors, good and bad? All of these additions may be desired by the public, but each improvement represents an increase in the cost of the receiving instruments and also requires an additional cost in terms of valuable space in the frequency spectrum. It has been quite apparent in recent years that there are many more uses for space in the frequency spectrum than there are frequencies which can be assigned to these services. The engineer therefore has the responsibility of making sure that the service for which he desires to use a portion of the frequency spectrum is in the best public interest and that the public gets maximum service with the most economical use of frequency space.

From this discussion I believe it is evident that the engineer is not only faced with the problem of developing equipment to improve performance, but must also make sure that the improvement justifies the additional cost to the public, both in dollars and in space in the frequency spectrum. It is the engineer's duty to simplify his engineering into definite facts and point the way for the development of the new systems which are created from his apparatus.

A few individuals can take the leadership and organize a television industry into an integral whole, thus providing a real industry and an outlet for both capital and labor. As this television industry develops, then engineers have the obligation to see that the public gets better and better service and that the new developments which will be brought about by the stimulation of use are integrated into an over-all system.

Engineers should not be satisfied that the television job is done until they have made it possible to project in the home, pictures of adequate size and in color, and also have made if possible for anyone to attend -- by television -- all major happenings wherever they occur, in the United States, or in any other part of the world. These objectives may be accomplished in a few years, or many years may be required. However, we do know how to produce pictures in the home and the technique of bringing sports and news events, drama, opera, etc., into the home has been developed to the stage where an extremely entertaining program can be produced, broadcast and received. The public can enjoy television now. Its support of present television will surely bring better television in the future. It should have the normal development of a new service, not hampered by restrictions or limitations.

The creation of a broadcast service of television is an engineering job; it is an engineering job of research, development, design, and manufacture of components. It is an engineering job to organize a system of mass communications into an acceptable service in the home. Each of us can contribute a part of this undertaking and all of us together must see that it develops to the full measure of its possibilities.

Another important field for radio is in aviation. During the war aviation has been our largest industry. If it is to continue its present importance after the war, it must develop into a transportation service, public and private, that can compete completely with surface transportation. Planes must be able to take off, fly and land safely, regardless of weather. Public service air transportation must be able to maintain schedules at all times. Instruments including radio principles and other electronic applications developed for war can make these things possible.

Radar has been publicized chiefly for its use as an instrument for increasing the destructive power of aircraft. It can be and is used, however, to guide and land planes under the poorest visibility conditions. Radio instruments can look ahead and warn the pilot of obstacles in the path of the plane and tell the pilot at all times the height of the plane above the ground. Vacuum tubes can make the operation of flight instruments more accurate and dependable. Radio communications, of course, can keep the pilot and passengers in touch with persons on the ground and in other planes. Radio can make flying a safe and reliable service; therefore it can be an important part of another big industry. Again, to be most useful, radio must be integrated into air navigation as an organized system. In this industry the opera-

tion of air lines and the Government regulatory bodies will specify the need and integrate radio into the aviation system.

"Citizens' Radio" is another use of radio that stimulates the imagination. For many years engineers have speculated on the possibility of personal radio communications. The war has shown the usefulness of the pack set and the walkie-talkie for infantry and artillery command, the tank set for the coordination of vehicles, and other special sets for various special jobs. There are counterparts for all of these uses in peace and the Federal Communications Commission has planned frequencies for these uses. In addition, regulations for this service will be so simple that anyone can use the apparatus without restriction; only simple licenses will be required. The Americans' desire to be in constant communication with other people will result in rapidly extending this use of radio. The engineer must be sure that he provides adequate tools.

There are other applications and uses of radio that are equally interesting -- police, forest protection, new public service communications are all due for rapid expansion. I cannot discuss each one, but there are two new applications that should be mentioned.

We are accustomed to think of telephone and telegraph traffic being carried by wires. Recent developments in ultra-high-frequency radio have shown that radio relays can also do the job. Directive beams in the ether can carry messages as well as wires. Using frequencies of 1000 megacycles or more it is possible to use the technique of wire communications without many of its limitations. The connection between terminals is as solid and as free of interference as a wire line. It is not fantastic to imagine long telephone and telegraph lines being replaced by lines of towers spaced 25 to 40 miles apart with small automatic radio transmitters and receivers carrying many messages simultaneously through the ether from coast to coast. A single communications channel may carry telegraph, telephone, and television messages or programs simultaneously with less maintenance or service than simple wire lines.

The second application, which promises great impact on industry, is the use of radio frequencies for heating, more commonly referred to as "electronic heating." This method can be used to form plywood, heat plastics for molding, cure rubber, etc. It has also been used to dry penicillin, requiring a few minutes to do a job that took days by other methods.

In the working of metals, another principle of radio frequencies is used. The "skin effect" or limitation of conduction of r-f current to the surface of a metal is well-known. By inducing r-f currents in metals, heat treatment of the surfaces can be accomplished without the heat penetrating into the body of the metal. This principle can be used to harden surfaces, weld joints, etc. The use of high-frequency currents will change processes and will have a profound effect on many industries not now using or acquainted with electronics.

I have stated before that there will come out of this war many men trained in the use and servicing of complicated radio equipment who will furnish a reservoir of manpower for the development of services the techniques of which are well developed. However, we will come out of the war with a definite deficiency at another level of our manpower. For three years the colleges and universities of this country have practically suspended technical training. Training of young men who are interested in research and development has been stopped for a period of at least three years and we are not getting normal replacements for the men who are the source of new ideas, new techniques, and new developments. There are relatively few men in the world who have the natural ability to do this kind of work. It takes long training, in addition to natural ability.

Unfortunately, the day the war ends we do not start turning trained men out of colleges. It takes a long period to train these men and build up a reservoir of information and ability which will bring out new ideas. Industry needs highly trained young men with the enthusiasm and daring of youth. It must be the responsibility of the engineering profession to encourage the training of these men and assist them in every way possible. This can be done by paying particular attention to the young men who show an aptitude for this type of work and a desire to increase their education and experience in order to get into creative engineering.

Finally, in still another field the engineers must realize an obligation and see that it is properly fulfilled. At the beginning of the present war the United States, the greatest industrial country in the world, was in effect caught "flatfooted" in technical developments for waging war. The airplane, rockets, mobile weapons, and the new developments which have come out of this war reduce the size of the world and we no longer have adequate protection against aggression by virtue of remoteness from other nations. This nation must be prepared to defend itself from any nation or group of nations using any type of weapons for attack. The basis of such protection is adequate technical preparation. The Government must be kept continuously aware of the developments which take place in all fields of science in all parts of the world.

There has recently been created the Research Board for National Security for the purpose of maintaining research and development in industry that would be useful for future defense and war. This is a very forward step in the development of a pattern for transferring information from industry to Government for its use for our protection. However, too often ideas conceived immediately following a war are allowed to deteriorate and become of little use or be regarded as of little importance to the nation. This must not happen to this new Board.

I feel that the lack of preparedness in the United States, particularly in the radio field, at the beginning of this war was, in part, the fault of the engineering profession, in part the fault of the Armed Services, and failure of the two to cooperate fully in the application of peace-time equipment and services to war use. Engineers must see that adequate planning goes on continuously and that the work necessary to keep it going on be considered of first importance. As the work of the new Research Board develops, some of you will be asked to participate in its planning. This work must be done and we must all consider it of first importance.

In conclusion, I want to emphasize again that we, as engineers, have a responsibility not only for the creation of the apparatus that is useful in new industries but also for the organization of this apparatus into systems and services that can be the basis for new industries and new employment. Also, in peace we must continue to recognize our responsibility to the Government as we have during this war, and do our part to provide adequate technical preparedness as a practical measure to insure the permanence of peace.

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POST-WAR STANDARDIZATION

by

J. B. Carswell, OBE

(Recently we received from Col. G. C. Irwin of the Signal Corps Standards Agency, a copy of this article which appeared in the October, 1944 issue of "Industrial Standardization" published by the American Standards Association. The article was originally presented before the Affiliated Engineering and Allied Societies in Toronto, Canada. Col. Irwin has suggested that the article be given wide circulation in industrial groups.)

STANDARDIZATION is distinctly a creative job. It might be defined as the art of determining, and establishing in use, the best design, quality, method or process, for performing a desired function.

Simplified practice, on the other hand, is an eliminating job. The job of dealing, as someone said, in tremendous trifles. It could be defined as the method of eliminating superflous variety through the voluntary action of an industrial or commercial group.

By pursuing these two movements, we arrive at Interchangeability, which results in conservation of materials and manpower, or negatively to the elimination of waste. The sum total spells out to Progress.

What forces are with us and what forces are against us, as we strive after the goals of universal standardization and complete simplification in practice?

We are faced with four great enemies. The first is Igornance, the second is Fear, the third is Selfishness; and the fourth is one for which I, personally, have a kind of sneaking regard. It is hard to give him a name. The best I can think of is Individuality.

On the other hand, we have fighting for us three great allies. The first is Common sense, the second is Economy, and the third is that intangible thing, which, again for the lack of a better name, I call Universal Brotherhood.

We need not spend much time analyzing our friendly allies. Everyone knows that universal standards and complete simplicity of practice are only common sense, and that the results would mean maximum economy in industry. And we all should know that if we ever reached that Fabian state of universal brotherhood, nothing but our own stupidity could prevent our reaching our goals in short order.

But what about our enemies? They must be sized up very carefully.

The first one -- Ignorance. Well! he is not so formidable. We are wearing him down right now. We have been wearing him down, for years back, by ordinary hard work. He is not an aggressive type of enemy. He is merely an obstruction that has to be whittled away to make room for progress.

The second enemy -- Fear -- is much more dangerous. It takes just such a war as the present one to bring into sharp focus the extent to which Fear, in the past, has blocked the progress of universal standardization.

You may say to me that everyone knows that the military authorities will not, at any price, have universal standardization, and that, for the time being, we must accept that. That was fine during the last century. It was not even serious up to the last war. We could simply by-pass these stupidly conservative military fellows and apply our efforts to the great civilian field. But today, when mechanized warfare has enlisted the complete field of engineering science, the situation becomes really serious.

Who can say today whether a ship, or an airplane, or a truck is a vehicle of war or a vehicle of peace? The line of demaraction has disappeared, and military fears are steadily encroaching on what used to be our purely civilian territory. We cannot by-pass this enemy any more, for he will attack us on the flank. He has to be reckoned with. I firmly believe that in the next few years, the progress of standardization must face this new problem with all the courage and energy at its command.

Surely, we could fight for an acceptance of common standards amongst the English-speaking nations of the world, leaving the universal problem to our children and our grandchildren. Is it not a frightful commentary on the common sense of the people on this North American continent that, when this war broke out, there was not a single gun or a single round of ammunition common to the U. S. and the Canadian forces. We made, and still make 0.303 cartridges. The U. S. made, and still makes, 0.30 cartridges. How in all the earth do we reconcile these miserable three one-thousands of an inch, and all the implications that follow in the wake, with our joint glowing tributes to the undefended frontier and the hundred years of peace and fellowship?

Canada, with the rest of the world, is about to establish an international air policy. If there is one great and growing industry in the world, shouting for the need of universal standardization, surely it is the aircraft industry. The airplane of tomorrow will be serviced in Moscow on Monday, in Berlin on Tuesday, in Lisbon on Wednesday, and in Toronto on Thursday; but will the aeronautical engineer be given free hand, or will the giant Fear whisper successfully in the ears of governments, "Look out now, these planes are carrying goods and passengers today, but it may be bombs and guns tomorrow?"

Only a few weeks ago, quite a lot of people lost their lives in a small but boisterous South American Republic, when some civilian planes were sent up in the air to drop explosives in aid of a revolting political party. These planes had been given to the republic by a friendly neighbor to assist in the peaceful pursuits of industry.

So you see, we are far from discussing a purely academic theory. In fact, phases of this problem are on my desk right now in connection with this new job which the Government has seen fit to give me.

But let us pass on to the third enemy, Selfishness. He is the brother of Fear. They work as a team.

I wonder how many of us realize that on September 3, 1939 (or if our American friends

please, December 7, 1941), two things happened. A war was declared, and an armistice was signed on the same day. Up until these dates, talking both domestically and internationally, we had been fighting, sometimes quite bitterly, to destroy each other's operating accounts. We called a halt on this gentlemanly war, and decided to go after the capital assets instead.

Now, when this war to destroy capital is over, the other war, naturally will start again, and once more we will be engaged on the interminable job of trying to steal an unwarrented proportion of the otherfellow's business. And then it is, when selfishness comes in for his innings. He whispers to the British industrialist, "Be careful now, if you start, adopting universal standards, you will jeopardize your foreign trade which is tied up now with your peculiar trade practices." Our friend and ally, common sense, may be whispering in the other ear "But don't you see, it will widen your market and everyone's market."

Personally, I am a little pessimistic on the outcome. We travel on to the last enemy -- that rather likeable fellow, Individuality.

He can be dealt with, if you recognize clearly his dual personality. His only argument is that you and I and every free-born citizen demand that we continue free to express our egos in the way we desire; that we do not want to be standardized; that standardization and regimentation are almost synonymous. He will ask you what you are fighting for. He will quote you the Four Freedoms. In fact, he will try to get you all confused.

The answer is quite clear. No one wants to see material production in this world so standardized that we cannot tell whether we are walking down Fifth Avenue, New York, or the Champs Elysees in Paris. The aesthetic things in life will never be standardized, but in the utilitarian things behind the scenes, what a field there is for progress; what a field for elimination of waste and useless duplication!

Standardization, like charity, really begins at home. When we think of our problem in national terms instead of international, how much simpler it all becomes. Today, at least on this continent, the educational battle has been won. We all accept the movement toward standardization and simplified practice as an imperative phase of industrial progress.

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PERSONNEL INFORMATION

RED CROSS BLOOD DONOR SERVICE

The Mobile Unit of the Red Cross Blood Bank will be in Princeton on May 1st, 2nd and 3rd. We have again been requested to furnish 60 or more donors for this visit. Appointments for Laboratories' personnel will be on Wednesday and Thursday, May 2nd and 3rd at 3:00 P.M. and 3:30 P.M. Any members of the Laboratories who wish to make donations should contact the Dispensary before April 21st. Transportation to and from Princeton will be arranged as usual. Those who donated in Cranbury will be eligible to donate at this time, since twelve weeks will have elapsed since their last donation.

We sincerely hope that as many members of the Laboratories as possible will volunteer for this worthy cause.

VICTORY GARDENS

From all appearances, 1945 will be an active year for the Victory Gardeners. About 200 plots 25' x 25' have been allocated to gardeners and at this writing planting is actively beginning in the plots. Plowing, harrowing and fertilizing of the area has been done again this year by the Laboratories and all indications point to a successful garden season. If any gardeners change plots among themselves they are requested to notify the Personnel Office of the changes so that the master plot plan can be kept correct.

SOFT BALL

The soft ball enthusiasts are off to an early start this year, with games being played during the noon-hour when weather permits. If enough interested men are available it is planned to have team competition between the various groups in the Laboratories again this year.

ARCHERY

Archery equipment has been purchased and will be made available to members of the Laboratories as soon as warm weather is here to stay. There have been several requests for this sport and all interested members are urged to participate. Croquet and badminton will also be available during the noon hour. Ping pong, darts and shuffleboard will continue to be available in the basement recreation area throughout the summer.

QUOITS AND HORSESHOES

The Quoit and Horseshoe courts are already receiving a heavy play this year. It is again planned to have several different types of Quoit and Horseshoe tournaments during the season.

RED CROSS CONTRIBUTION

Members of the Laboratories are to be complimented for the fine support they gave to the 1945 Red Cross War Fund drive. This year's contributions by Laboratories' members totaled $1,736.00, as compared with last year's contributions of $1,434.25. In addition to the contributions by the members of the Laboratories, the Radio Corporation of America has made a contribution directly to the Princeton Chapter of the American Red Cross. The following individuals made up the Red Cross Drive Committee for the Laboratories and were responsible for the success of the Drive:

George Adams	R. R. Law
Safford Adams	Joe Luther
Mary DiDomenico	L. MacClaskey
S. W. Dodge	T. L. Maher
H. L. Donley	C. A. Meneley
Jess Epstein	W. A. Murphy
W. D. Hershberger	George Parry
Walter Howarth	Louis Rieger
C. A. Hurford	Paul Rudnick

John Stonaker

RCAL DANCE COMMITTEE SPONSORS MARCH DANCE

The first of several Dance-Committee-sponsored dances was held Friday evening, March 23rd at the Nassau Tavern. Approximately 200 Laboratories' members and their guests enjoyed dancing to the music of Harold Rausch's orchestra of Newark. The success of the affair was indicated by the large number of enthusiastic dancers who remained until the curfew closing time. Arrangements for the affiar were made by the following Committee:

C. W. Mueller, Chairman
W. A. Murphy
F. H. Nicoll
J. Preston
P. C. Lockard
Adell Rzesutek
Sarah McCafferty
Gertrude Ellsworth
John Stonaker
Mary DiDomenico

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BECAUSE OF THE SUCCESS OF THIS AFFAIR ANOTHER COMMITTEE-SPONSORED INFORMAL DANCE IS TO BE HELD ON SATURDAY EVENING, MAY 5TH, FROM 8:30 to 11:45 P.M. AT THE NASSAU TAVERN. ADMISSION WILL BE THE SAME AS FOR THE MARCH DANCE, i.e., $1. PER PERSON INCLUDING TAX. MUSIC WILL BE FURNISHED BY THE SAME ORCHESTRA, ENLARGED TO SIX PIECES.

TUBE ROOM WINS BOWLING CHAMPIONSHIP

On Wednesday night, March 28th, the Tube Room annexed the 1944-45 Bowling Championship by defeating the Wiremen in a three-game roll-off at the Princeton Recreation Center. The Tube Room qualified for the finals by winning the First Half of the Bowling competition and the Wiremen captured the other final's spot by virtue of their winning the Second Half championship. Members of the winning Tube Room Team were:

S. Shuren, Captain
Mrs. E. Moonan
Miss M. Sharretts
W. Sullivan
W. Parfian

The Wiremen bowlers were:

A. Meneely, Captain
H. Dougherty
F. Howarth
W. Howarth
S. Miszkowski

Individual trophies will be awarded to the members of the winning team and it is also planned to award a Team Trophy.

The 1944-45 Season was a successful one, with about 70 bowlers competing during the 22-week season which started in October, 1944. The following are some of the outstanding scores made during the season:

Individual High Single Game

1.	Masterson	247
2.	Thompson	245
3.	Liptak	232

Individual High Series

Masterson	581

High Season Averages

1.	Tams	171
2.	Masterson	169
3.	Thompson	167
4.	Anderson	164
5.	Morley	156

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LETTERS FROM RCAL EMPLOYEES IN THE ARMED SERVICES

Below are published more of these letters, some of which were necessarily carried over from the date of our previous issue because of lack of space there.

Dear Friends:

I want to extend my thanks to all of you for your rememberance at Christmas time. It was very thoughtful of you to think of us who are in the service and we certainly appreciated it.

I was fortunate to get home for Christmas which made it a Merry one for me and I hope all of you had one too.

Thank you again and I wish all of you the best of luck for the New Year.

Sincerely,

Phyllis Tindall

Dear Mr. Maher:

This is a short note of thanks for the Seasons Greetings that were sent to me from the men and women who are working at RCA Laboratories. I hope that all of you had a Joyous Holiday Season.

At present I am studying Aerial Navigation here at Hondo. Hope to graduate from here in March as a Navigator.

However, I am also hoping that this war will be over soon so I can return to civilian life.

Thank you again for your thoughtfulness; thought you might like to know I invested your Christmas present in milk-shakes instead of cigarettes.

Very sincerely yours,

E. F. Bailey

Dear Chief Maher:

I am sorry I haven't written you sooner but I was sent to a new base night after Christmas and I am just getting around to answering my Christmas mail. I want to thank you for the Christmas gift I received because it was very much appreciated.

I am now flying in torpedo bombers and I expect to be sent overseas soon so I thought I had better thank you while I still had the chance. I sincerely hope that the new year will bring you all the luck and happiness possible.

Sincerely yours,

Fred K. Solomon

Employees of RCA:

I wish to express my sincere thanks to the employees of the RCA for the Christmas

gift I received.

It is a pleasure to be remembered at this time of the year.

Sincerely,

Bill Bathie

Dear Gang:

The Christmas check arrived in excellent shape and at a most apportune time.

I'm not nearly eloquent enough to express my thanks, but knowing me, you can understand that I'm grateful in more ways than one. It is very welcome for its monetary value, but more than that, it shows that you still think of li'l ole me. I think of you too, y'know, both individually and as a group with whom I've had a heck of a lot of fun -- and I hope to be back working with you (and having fun) again soon.

Sincerely,

Sugar (Dornfeld)

Gentlemen:

I know that I haven't been in contact with you since I left, but believe me, there is an honest reason for not writing. My work takes me away from my post for long periods and I never have time to get my mail or let it catch up to me, so I want to take this opportunity to thank you for your check, Christmas program and the note book. It makes a fellow feel great to know that he has not been forgotten by his friends. Please thank everyone that had a part in sending these items.

There is not much that I can tell you about my work, but as soon as I get my leave I will pay you and the laboratory a visit.

Thanking you again, I remain

Sincerely,

Ben Gendusi

Dear Mr. Engstrom:

I appreciate your sending me your "RCA Laboratory News" and "Radio Age", which were enjoyed not only by me but by my shipmates as well.

Your letter of January 9th and the enclosed Christmas gift check arrived. It was delayed a little in the mail, after being held up at my former base; and I want to thank you for your thinking of me in such a manner.

Sincerely yours,

Michael J. Fichera

Dear Chief:

I have just today received the letter from you and the fellows at RCA containing the check for Christmas. Thanks a million. I enjoyed the letter very much and most certainly appreciate the check. It is nice to be remembered by the fellows that I worked with -- hope to be back with you before long now.

We have taken part in the Leyte and Luzon invasions on the Phillipines. I wish that I could tell you all about them, but censorship will not allow that; I will just wait and tell you when I get back home.

Thanking you again for your kind rememberance -- I hope to spend next Christmas at home -- one out here is enough for me.

Sincerely,

Vincent Boccanfuso

Hi Chief and Gang:

Thanks for the Xmas gift. I received it here in California January 13th, it really traveled! I like it out here and did quite some sightseeing but now I'm in the 4th training unit for overseas duty and may be shovin' off right soon. Will write. Am as busy as a one armed paperhanger and I don't mean "Hitler". My regards to all. As always,

"Mac"- Catherine McGuinness

Dear Chief:

Just to let you know that I'm no longer at Great Lakes but a little ways south of there where you have to wear shorts instead of ear muffs to be comfortable.

I received the latest addition of Radio Age that you sent out a couple of weeks ago. Thanks a lot; it's great to know what is going on back in the States.

This dungaree navy sure is a big improvement over what I've seen of the regular line bases. You can at least step out the door after 4:30 without being restricted for a month for being out of uniform. Outside of that chow is good, the barracks are pretty nice and the liberty isn't bad, so what more can a guy ask for but salt water and that isn't far off either.

Here's hoping you are enjoying that March weather up north only half as much as I'm enhoying all of this sunshine down here.

Sincerely,

Karl (Kaufmann)

Hi Jennie:

I just received the RCA News Bulletin and I thought you might like to bring my address up to date.*

I have been home twice but haven't had a chance to see or visit RCA but I will get several days off in April so I'll be around to see all of you.

We are working right now in the wards and believe me we find plenty to do. Because we are still students though we work from 7 to 11 and from 1 to 5. Our instructors are Army nurses and some of them are really on the ball. Others are strictly n.g. But all of us love it.

Well, this is all for now. My "men" are calling for me. So so-long for now.

Sincerely,

Dot (Rosenberg)

p.s. Ask Ann Clayton if her right arm is broken!

Dot

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* See list of addresses elsewhere in this issue.

ADDRESS OF FORMER RCA LABORATORIES EMPLOYEES NOW IN THE SERVICE

For the benefit of their friends, we are listing below the latest addresses of our former employees who are now in the service.

A. C. Dornfeld
S. S. Alex Hrdlicka
Alcoa S. S. Company
c/o Postmaster
San Francesco, California

Pvt. Peter Ferrara, 32484151
391 Repl Co. 1st Depot
A.P.O. 761-R
c/o Postmaster
New York, New York

Karl Seiler S 2/c
Naval Research Laboratory
Washington, D. C.

Pvt. Frank W. Schuessler
32595501 Med. Detachment
Camp Callan
San Diego 14, California

Robert Servis, D.E. 399
U.S.S. Stockdale
c/o Fleet Post Office
New York, New York

Harry Myers, USNR. D.D. 516
U.S.S. Wadsworth
c/o Fleet Post Office
San Francisco, California

Evelyn Webster, S.A.
American Red Cross
A.P.O. 100 c/o Postmaster
New York, N. Y.

Morris Sprachman, M.M. 2/c
U.S.S. Sienna A.D. 18
7th Div. F.P.O.
San Francisco, California

Sgt. Jas. Hall, 32749793
Dept. of Patients, Ward 44-6
U. S. Hospital Plant 4118
APO 314, New York, N. Y.

Pvt. Campbell W. Fell, 42110197
APO 15480, Co. K Infantry
c/o Postmaster
New York, New York

PFC Fred Solomon, 892183
V.M.T.B. 943 MAG - 41
El Toro, Santa Ana, California

Michael J. Fichera, RT 3/c
Class 15-45-3
R.M.S. Naval Research Laboratory
Bellevue, Washington, D. C.

E. F. Bailey, 15315578
Class 45 N.T.G. 1, H.A.A.F.
Hondo, Texas

Ensign Edwin F. Creager
U.S.N.R.
Corry Field - NATB
Pensacola, Florida

Pvt. Ben Gendusi
1822 S.U. Camp
Alva, Oklahoma

Pvt. A.L. Lise, 42082652
Battery C-911 FA. Bn.
A.P.O. 450
c/o Postmaster,
New York, N. Y.

Vincent Boccanfuso, S 1/c
U.S.S. LCI (M) 1055
c/o Fleet Post Office
San Francisco, California

Pvt. D. Rosenberg, 226023
WAC Det. 1 - 1258th S.U.
Holloran General Hospital
Staten Island, New York

John T. Pluswick, 33,826,063
Roster R 1029
Bldg. 266, Area 2,
U. S. Army Reception Center
New Cumberland, Penna.

Paul Urbani, 42082221
Co. A. 69 ETS
Fort Lewis, Washington

Cpl. Catherine McGuinness
W.R. Staging Area, M.C.W.R.
Class 4, Section 1, M.C.B.
San Diego, California

A/c Wm. K. Dey - 32957430
Sq. S. Cl. 528 - 52
Keesler Field, Miss.

Lt. Martin R. Richmond
Naval Research Laboratory
Anacostia Station
Washington, D. C.

Karl G. Kaufmann, S 1/c
E-35, Bks 16, NATTC
Jacksonville, Florida

Joseph W. Hall, E.M. 3/c
U.S.S. Kephart
SPO 61, c/o Fleet Post Office
San Francisco, California

Phyllis Abry T-5
A225493, WAC Detach.
S.P.A.A.F.
Lubbock, Texas

Wm. Bathie, Jr. S 2/c 8128032
U.S.S. Renate (AKA-36) Div. B.
c/o Fleet Post Office
New York, New York

Rowland Marple, S 2/c S.P.G.
Class 8-45-B
Main Gunnery Range
Pensacola, Florida

John Wargo, Jr. 32954344
C.M.P. Det. S.
Huntsville Arsenal
Huntsville, Alabama

P. R. Tindall, PhM 3/c
USNR 768-80-60
U. S. Naval Hospital
Philadelphia, Pa.

H. W. Hutchinson, QM 2/c
U.S.S. L.S.M. 287
c/o Fleet Postmaster
New York, New York

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BIMONTHLY NEWS

Mr. Otto S. Schairer now Staff Vice President of RCA

Dr. C. B. Jolliffe now Vice President in charge of RCA Laboratories

RCA Laboratories might now be said to have progressed through the formative stage of its development as an organization within the company. Starting from very small beginnings, its growth has kept full pace with the phenomenal expansion of the radio industry. Much of its progress has been due, in large measure, to the efforts and foresight of Mr. Schairer, who fostered for many years the idea of a great center of radio and electronic research.

Shortly after his affiliation with RCA in 1929 as Director of the Patent Department, Mr. Schairer was placed in charge of the combined Patent and License Departments. In 1930 he was elected a Vice President of the Corporation. His program for a radio research center materialized in 1941 when construction of the RCA Laboratories at Princeton was started. As Vice President in charge of these laboratories, Mr. Schairer gave to the planning and construction of the building, great personal interest and attention.

Since the completion of the building in 1942, the many successful developments -- most of which were for war projects -- which have come out of these laboratories, have more than justified the thought and effort Mr. Schairer expended in their establishment. His inexhaustible enthusiasm, efficient leadership and sincere friendliness toward all have made him a most effective head

of the Laboratories, as well as one who is regarded with deep esteem by the men and women of the Laboratories, among whom he insists he is merely a fellow employee.

At the meeting of the RCA Board of Directors on March 2, 1945, Mr. Schairer was elected Staff Vice President of the Corporation. He will be consultant and advisor on matters pertaining to research, development, patents, trademarks and licenses, and on agreements relating thereto. Also among his new duties, Mr. Schairer will be chairman of the "RCA Planning Committee" which replaces the Planning Committee of RCA Laboratories and is created to formulate general programs for research and development, and for the commercial use of the results of research and development which involve the coordinated efforts of RCA Divisions and companies.

Dr. C. B. Jolliffe, Chief Engineer of the RCA Victor Division, was elected Vice President in Charge of RCA Laboratories at the March 2, 1945 meeting of the Board of Directors. Dr. Jolliffe was also appointed a member of the President's Advisory Council of RCA. He will continue to be a member of the Administrative Staff of the RCA Victor Division and Chairman of its New Products Committee. Dr. Jolliffe brings with him to his new position a long background of radio engineering experience, having been physicist in the radio section of the National Bureau of Standards (1922-1930) and Chief Engineer of the Federal Radio Commission and its successor the Federal Communications Commission (1930-1935). He joined the Radio Corporation of America as Engineer-in-charge of the RCA Frequency Bureau in 1935.

Dr. Lloyd P. Smith Appointed Associate Research Director

Dr. L. P. Smith, Professor of Physics at Cornell University, has been appointed Associate Research Director of RCA Laboratories. This appointment fills a vacancy caused by the death last July of Mr. B. J. Thompson who was killed while on a special mission for the Office of the Secretary of War. For the duration of the war, Dr. Smith will continue as a consultant on Government work being done at Cornell University, where he will serve as a member of the staff, but otherwise on full-time leave to RCA.

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LECTURES BY RCA LABORATORIES TECHNICAL STAFF

Before the Science Club at Princeton High School by J. Hillier on "The Electron Microscope" - March 16, 1945.

Before the Metropolitan Dairy Technologists at Rutgers University by J. Hillier on "The Electron Microscope" - March 20, 1945.

Before the Princeton Rotary Club by G. H. Brown on "Penicillin Dehydration" - March 20, 1945.

Before the Lyons Club of Trenton by C. N. Hoyler on "Some Aspects of Research at RCA Laboratories" - April 17, 1945.

Before a Symposium of the Society of Chemical Industry in New York City by E. W. Engstrom, G. H. Brown, W. D. Hershberger, J. Hillier, H. W. Leverenz and L. P. Smith on "Electronics in Relation to the Chemical Industry" - April 20, 1945.

Before Lehigh University at Bethelehem, Pa., by C. N. Hoyler on "Some Aspects of Research at the RCA Laboratories" - May 11, 1945.

Before Western Reserve University at Cleveland, Ohio by J. Hillier, two lectures in a series entitled "Frontiers in Colloid Chemistry" - May 11, 1945.

ACOUSTIC STETHOSCOPE

The Becton-Dickinson Company of Rutherford, New Jersey, one of the largest manufacturers of medical and surgical instruments in the United States, signed a license agreement with RCA to manufacture and sell the RCA acoustic stethoscope according to E. C. Anderson, Commercial Manager of RCA Laboratories. W. L. Rothenberger negotiated the agreement.

The acoustic stethoscope was developed by Dr. H. F. Olson and represents a major contribution to the medical field. Mr. J. Preston assisted in some of the work on this development.

The Charles L. Mayer
NATURE OF LIGHT AWARDS

The National Science Fund of the National Academy of Sciences announces the creation of the "Charles L. Mayer Nature of Light Awards", two prizes of $2,000 each to be presented in 1946 for outstanding contributions to our knowledge of the nature of light. The prizes will be awarded under the following conditions:

1. One prize of $2,000 will be awarded for a contribution published in the calendar years 1943, 1944 or 1945, or submitted in manuscript to the National Science Fund before January 1, 1946, with respect to our basic understanding of the nature of light and other electromagnetic phenomena. The contribution must provide, in terms intelligible to the community of scientists at large, a unified understanding of the two aspects of these phenomena which are at present jointly described by wave and by corpuscular theories.

2. One prize of $2,000 will be awarded for a contribution published in the calendar years 1943, 1944 or 1945, or submitted in manuscript to the National Science Fund before January 1, 1946, which is a comprehensive contribution to a logical, consistent theory of the interaction of charged particles with an electromagnetic field including the interaction of particles moving with high relative speeds.

3. All contributions for consideration of the Advisory Committee for the awards must be in their hands not later than January 1, 1946.

The Advisory Committee in charge of recommendations for the Charles L. Mayer Nature of Light Awards will include:

Dr. E. U. Condon, *Associate Director of the Research Laboratories, Westinghouse Electric & Manufacturing Company;*

Dr. Karl K. Darrow, *Technical Staff Member, Bell Telephone Laboratories;*

Dr. Robert A. Millikan, *Chairman of the Executive Council, California Institute of Technology;*

Dr. I. I. Rabi, *Professor of Physics, Columbia University.*

All communications with respect to the Charles

L. Mayer Nature of Light Awards should be addressed to:

Howland H. Sargeant, Executive Secretary,

National Science Fund of the National Academy of Sciences

2101 Constitution Avenue, N.W., Washington 25, D.C.

LIBRARY INFORMATION

Recent Articles in Library

The ellipsometer, an apparatus to measure thickness of thin surface films, Alexandre Rothen, Review of Scientific Instruments, February, 1945.

X-ray inspection with phosphors and photoelectric tubes, H. M. Smith, General Electric Review, March, 1945.

Some applications of ultrasonics in high-polymer research, H. Mark, Journal of the Acoustical Society of America, January, 1945.

Glass in electronic tubes, H. C. Steiner, American Ceramic Society Bulletin, February 15, 1945.

Chemically stabilized paper capacitors, D. A. McLean, Bell Laboratories Record, March, 1945.

A general-purpose impedance bridge simplified switching circuit, P. M. Honnell, Communications, February, 1945.

Organo-silicon compounds for insulation, T. A. Kauppi, G. L. Moses, Electrical Engineering, March, 1945.

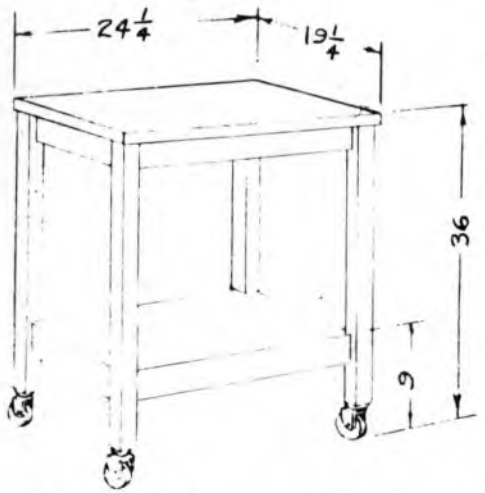
Sensitivity distribution among the grains of photographic emulsions, A.P.H. Trivelli, Franklin Institute Journal, February, 1945.

Small prism infra-red spectrometry, R. Bowling Barnes, Journal of Applied Physics, February, 1945.

Quantum theory of exposure tested extensively on photographic emulsions, L. Silberstein and A.P.H. Trivelli, Optical Society of America Journal, February, 1945.

STANDARD TEA WAGON

PRINCETON GRAY



ORDER BY DRAWING No. 216164

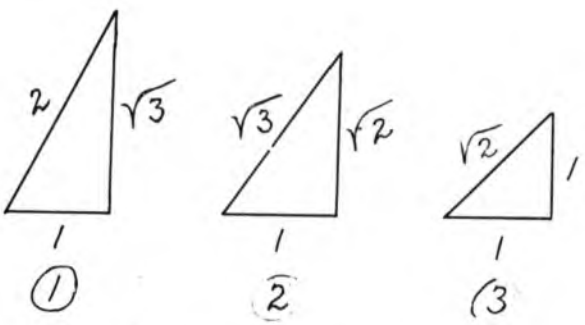
In the past, the Model Shop has been called upon by various groups to construct a wide variety of shapes and sizes of "tea wagons". It seemed desirable, where possible, to conserve time, effort and cost by having available drawings of a standard type of tea wagon which would meet a large percentage of the needs of those requiring these wagons.

Drawings have therefore been prepared for the design shown in the accompanying sketch. It is suggested that this wagon be used wherever it will be suitable.

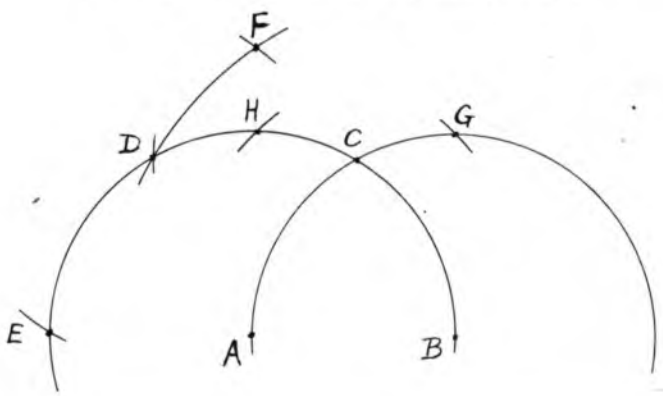
When this tea wagon will be satisfactory, it can be ordered by merely referring to its drawing number - No. 216164.

SOLUTION TO GEOMETRICAL PROBLEM IN FEBRUARY ISSUE

Three right triangles have to be found in the following order:



No. 3 gives the desired points, thus:



1 - Draw circles about A and B using AB as radius.
2 - Mark off cords BC, CD and DE using AB as radius.
3 - BDE is a 30°-90°-60° triangle and BD is $\sqrt{3}$ where AB is unity.
4 - Using BD as radius draw circles about B and E intersecting at F.
5 - ABF is a right triangle and side AF is $\sqrt{2}$, for BF is $\sqrt{3}$ and AB is unity.
6 - Draw circles about A and B using AF as radius. Intersections at H and G give two other points of the square ABGH.

TRICK WITH NUMBERS

The following trick may be familiar to some of our readers; others may find it of interest:

1 - Pick your favorite number from 1 through 9.
2 - Multiply it by 9.
3 - Take the product and multiply it by 12345679.
4 - Surprise?

BIRTHS

Congratulations to Mr. and Mrs. C. N. Hoyler who announce the birth of their third son - David William - on July 17, 1945 in the Princeton Hospital - weight 9 lbs.

Dr. and Mrs. R. F. Baker announce the birth of a daughter - Amelia Madeline - Born June 26, 1945 at Princeton Hospital - weight 7 lbs. 3 oz. Congratulations to the parents.

Congratulations to Dr. and Mrs. H. B. DeVore who announce the birth of a son - Richard Nuzum - weight 8 lbs., 4 oz. Born on Tuesday, July 10, 1945 at Princeton Hospital.

Mr. and Mrs. Harold Dougherty announce the birth of a daughter - Deanna - on Thursday, June 21, 1945 - weight 7 lbs., 5 oz. Congratulations to the proud parents.

We extend our congratulations to Mr. and Mrs. Harry Kihn who announce the birth of a son - Leslie Morris - (6 lbs., 12 1/2 oz.) - born on Thursday, July 5, 1945 at Mercer Hospital, Trenton, New Jersey.

Congratulations to Mr. and Mrs. R. P. Stone who announce the birth of a daughter - Mary Louise - born June 28, 1945, (weight 7 lbs., 11 oz.) at Princeton Hospital.

We extend congratulations to Mr. and Mrs. P. Rudnick who announce the birth of a daughter - Helen (weight 8 lbs., 6 oz.) - born July 18, 1945 in Princeton, New Jersey.

Mr. and Mrs. Ed. Dickey announce the birth of a son - David Thomas (weight 6 lbs., 14 3/4 oz.), on August 6, 1945 at the Hospital of the University of Pennsylvania, Philadelphia, Pa.

A son - Paul Millard - was born to Rev. and Mrs. Richard Hardy on July 8, 1945. Mrs. Hardy was formerly employed in the Research Section. Our sincere good wishes to the new parents.

ADDITIONS

A. C. Brearley - Guard
J. M. Blatt - Research
Miss C. K. Bandholz - Research
Fred Crouch - Model Shop
Miss Helen T. Connor - Tube Assembly
Mrs. Mildred E. Coughlin - Drafting
N. R. Davidson - Research
R. Doolen - Drafting
W. S. Ewart - Model Shop
Miss E. A. Hornyak - Research
J. Honore, Jr. - Drafting
C. J. Hassell - Model Shop
R. R. Kubinski - Drafting
W. E. Stalcup - Buildings & Grounds
M. L. Schultz - Research
H. D. Stives - Maintenance
J. E. Walter - Research
Miss C. Watz - Research
W. Wyss - Model Shop
Miss J. P. Wasko - Model Shop
P. Urbani - Guard
J. W. Doyle - Model Shop
R. R. Fisbane - Buildings & Grounds
Miss Anna M. Jackel - Purchasing
S. J. Ritter - Drafting

DEATHS

Our sympathy is extended to Mr. C. N. Hoyler of our Research Staff whose mother - Mrs. Clement Hoyler - died on Friday, August 31, 1945. She lived in Green Bay, Wisconsin. She was 72 years old.

We were sorry to learn of the death of Mrs. Amanda Kessler of Lafontaine, Indiana on Tuesday, July 17, 1945, grandmother of Mr. P. K. Weimer and Mrs. W. Rakestraw of our Research Staff.

Our sympathy is extended to Mr. R. R. Wright of our Model Shop whose uncle - Dr. Richard P. L. Ridgway - died on August 15, 1945 in Philadelphia, Pa. He was 70 years of age.

Our sympathy is extended to Mr. William P. Servis of our Maintenance Group whose sister-in-law - Mrs. George L. Bleger - died on June 29, 1945 in the Princeton Hospital. She was 79 years of age.

We were sorry to learn of the death of Mr. Michael Maggi on Friday, July 27, 1945, grandfather of Mr. Paul Urbani of our Guards, and Mrs. Margaret Urbani of our Mail Department.

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RCA LABORATORIES WINS NATIONAL SECURITY AWARD

The national Security Award of the U. S. Office of Civilian Defense was presented to RCA Laboratories on July 12, 1945, in recognition of assistance given by the Laboratories to the community through "the maintenance of a superior standard of protection and security."

The presentation was made by L. Beaumont Reed, Chairman, Civilian Defense Committee, West Windsor Township, Mercer County, N. J.; the Rev. G. A. Bensinger, Chairman of the Public Relations and Educational Committee, and William F. Short, Chairman of the War Service Committee.

Although 10,000 New Jersey plants are engaged in war work, according to the New Jersey Office of Civilian Defense, RCA Laboratories is one of only 35 to receive the OCD Award.

VOL. 2 AUGUST 1945 NO. 5

RCA LABORATORIES NEWS

RADIO CORPORATION OF AMERICA
RCA BUILDING
30 ROCKEFELLER PLAZA
NEW YORK

DAVID SARNOFF
PRESIDENT

August 15, 1945.

Dr. C. B. Jolliffe, Vice President In Charge Of
RCA Laboratories,
Princeton, New Jersey.

Dear Dr. Jolliffe:

On this first day of Peace, I wish to express personally and officially to you, and through you to all employees of the RCA Laboratories, sincerest thanks for a fine job, well done.

The significant contributions made by this organization to the victory achieved by our Nation and its Allies, in the world's greatest war, always will remain a bright page in the annals of the RCA. All members of the RCA family - of which RCA Laboratories is a vital part - have participated in this great effort and they can be justly proud. As one member of this family, I am happy to share in this pride.

With every good wish,

Sincerely yours,

David Sarnoff

President,
Radio Corporation of America.

RADIO CORPORATION OF AMERICA
PRINCETON N.J.

RCA LABORATORIES NEWS

ED. DICKEY - EDITOR

RADIO-FREQUENCY DEHYDRATION OF PENICILLIN SOLUTION*

by

G. H. Brown, R. A. Bierwirth and
C. N. Hoyler

Introduction

Late in 1943, many newspaper and magazine articles were published which told the story of the manufacture of penicillin. Particular emphasis was given to the problem of drying the product for packaging. Two points were stressed. First, penicillin in a water solution soon lost its bactericidal properties so it was necessary to thoroughly dry the product before storage or shipment. Secondly, penicillin solution was so sensitive to heat that it was necessary to keep the solution in a frozen condition before drying and even to dry in the frozen state. This freeze-drying process was expensive and took a long time. Our previous work in dehydration of materials by means of radio-frequency power, particularly the drying of rayon cakes in a vacuum, led us to speculate about the possibilities of contributing something to the penicillin production program by the application of radio-frequency power. The writers then suggested to the late Dr. George A. Harrop, Director of Squibb Biological Laboratories, that it might be possible to evaporate the water from the liquid state if the vacuum were such that the boiling point remained at about 50°F and the energy necessary for vaporization were supplied by a radio-frequency generator. Dr. Harrop expressed great interest in the possibilities and offered to cooperate in tests to determine whether such a procedure would harm the product. Before such tests could be made, other producers of penicillin heard of our ideas and wished to discuss the proposal. Some of these producers provided samples for test purposes.

Initial Experiments with Radio-Frequency Heating

With a few exceptions, the people connected with penicillin production assured us that it was extremely important to keep the solution frozen throughout the drying cycle. They warned that if this were not done the potency would be lost. The statements did not appear to be based on experience related to the method of drying which we proposed. Therefore, it seemed desirable to determine by experiment just what the effect would be.

To dry by conventional freeze-drying methods, it is necessary to maintain a vacuum of between 100 and 300 microns (0.1 to 0.3 millimeters of mercury). We were not interested in freeze-drying with radio-frequency power for a number of reasons. In the first place, if we were to contribute to the penicillin program by furnishing a faster and simpler system, the elimination of the expensive high-vacuum systems, complicated condensers, and elaborate refrigeration seemed to be the most important step. Secondly, for the same voltage or electric intensity, the residual atmosphere ionizes much more readily with a vacuum of 100 microns than it does at a vacuum of about 20 millimeters, which is the order of vacuum that we had in mind for our purpose. In addition to the fact that the air ionizes easier at 100 microns, the solution is frozen when under this vacuum. The electrical conductivity of frozen penicillin is so much lower than that of the liquid that much higher voltages must be used to generate the same power. This effect is very pronounced. When attempts were made to dry in the frozen state with radio-frequency power, it was necessary to reduce the radio-frequency voltages to such an extent that it became apparent that most of the heat of vaporization was being supplied by heat conduction from the warm air of the laboratory through the glass walls of the container.

Miss Veronica Moran Operating Penicillin Bulk Reducer.

*Excerpts from a paper to be published in the Proceedings of the I.R.E.

A number of samples of a weak solution of penicillin were submitted by the representatives of a penicillin producer. They were anxious that the tests be made in the frozen state so only one sample was subjected to the test which we wished to make. Each sample was a frozen solution weighing 1000 milligrams.

The tests indicated that the best results were achieved by boiling out the water at the relatively high pressure of 10 millimeters. Since this was not in accordance with the opinion of experts, it seemed desirable to verify this conclusion by further tests. Accordingly, four samples obtained from E. R. Squibb & Sons were treated. These samples were all frozen when placed in the drying apparatus. However, the pressures were high enough so that the material quickly melted.

The test results showed that no harmful effects appeared when the dehydration took place with vacuums of the order of 10 millimeters. These initial tents have been repeated many times, always with the same result ---no loss in potency.

A Radio-Frequency Bulk-Reducer for Penicillin

As a result of these initial successes, much interest was exhibited by a number of penicillin producers. It seemed extremely desirable to review the work and consider how best to fit radio-frequency power into the picture.

After the penicillin mold is grown and the penicillin harvested, the material goes through a number of complex chemical processes from which it finally emerges as a weak water solution of a sodium or calcium salt of penicillin, with varying amounts of impurities. At the time that we were interested in considering the situation, it was the practice to freeze or shell this solution on the walls of a number of large glass bottles which were then attached to a manifold of a vacuum system. The vacuum was maintained at about 100 microns. The only heat supplied was by conduction through the walls of the bottles. After many hours, the material was considered to be dry and was then scraped from the bottles and pulverized. A measurement of potency, in Oxford Units per milligram, was then made to determine the amount by weight that would be placed in the final ampoule or bottle. Since it was necessary to maintain a high degree of sterility, this operation was done in an air-conditioned box containing an analytical balance, a tray of penicillin powder, a rack of bottles, and the necessary loading tools. The operator manipulated the apparatus by inserting his arms into a pair of rubber gloves that were anchored to two openings in the box and by peeping through a small glass window in the wall of the box. This process was slow and expensive, as well as tedious and inaccurate.

We were told that most processors were considering a modification in which freeze-drying in the large bottles would be halted at a point where the activity of residue would be between 10,000 and 100,000 units per cubic centimeter. The material would then be allowed to melt and the liquid would be assayed for potency. Depending on the activity attained, between one and ten cubic centimeters of material could be accurately measured into each final container. Then a rack of final containers would be frozen and inserted in a large vacuum chamber and the pressure reduced to about 100 microns, for the final drying. Because of this change of procedure, it was decided that a radio-frequency bulk-reducer was first in order of importance. The bulk reducer could be used to remove sufficient water to concentrate to a potency of 100,000 units per cubic centimeter, after which one cubic centimeter of the material would be measured into each of the final containers and taken down to complete dryness by the freeze-drying high-vacuum chambers. The two-fold advantage of the radio-frequency bulk-reducer is that the expensive high-vacuum bulk reducer and refrigeration system is eliminated and the output of the final freeze-drying cabinets is increased because only one cubic centimeter of water is removed from each final container.

The first experiments in bulk reduction were conducted with a laboratory oscillator which could be readily changed to a number of frequencies. The frequencies investigated particularly corresponded to the frequencies of commercially available oscillators.

Attempts were made to operate at a frequency of ten megacycles, but we were not able to overcome sparking at the electrodes. Further experiment showed that at a frequency of twenty-eight megacycles there was little danger of electrode trouble, provided a concave bottom was used on the bottle.

Method of Handling Ampoules in Drying Chamber on Table Containing Six such Chambers is Illustrated by Miss Veronica Moran. Infrared Lamps Prevent Condensation on Cold Lids of Vacuum Chambers.

A Beach-Russ vacuum pump, of the wet type, with a capacity of six cubic feet per minute was used throughout the experiments with the bulk reducer and in the final model. The water vapor was passed into a water-cooled condenser so the pump was not forced to handle large quantities of vapor.

A large number of experiments were carried out to learn the necessary technique for a practical system. Further tests were necessary to determine the safe range of temperatures and pressures which could be used without harming the penicillin. The temperature at which water boils is, of course, a function of pressure. While much of our operation took place at a pressure between 10 and 20 millimeters of mercury, we have run the equipment

up to 40 millimeters without loss in potency of the penicillin.

A pilot unit was next constructed. The oscillator consisted of two RCA-833A vacuum tubes acting as a conventional oscillator at twenty-eight megacycles, with a power output of two kilowatts. Three large glass bottles provide room for foaming of the liquid when the vacuum is applied. (See accompanying photograph). Penicillin solution is extremely foamy so that our efforts in suppressing the foam were extensive. A baffle plate was inserted in the middle bottle. Also, a coil made of silver-plated copper tubing was inserted between the bottom and the middle bottles. Warm water (125°F) was passed through this coil. When the foam and bubbles rise and contact the warm coil, the part of the bubble in contact with the coil evaporates and the bubbles collapse. This arrangement has been extremely successful in the operation at the Squibb Laboratory.

In connection with the foaming problem, it might be mentioned that the excessive foaming difficulties were encountered at a time when most penicillin solution carried a large amount of impurities. Observations made recently show that the penicillin solution now being produced by most manufacturers has improved in characteristics to such an extent that neither the baffle plate nor the hot-water coil need be used. Actually, the most violent foaming only fills the lower half of the bottom flask.

In using the bulk-reducer, the sequence of operations is as follows. The hot water supply for the bubble-breaking coil and the cold water supply for the condenser is turned on and the vacuum pump started. When a liter of material is ready for treatment, a flask containing the solution is placed beneath the bottom bottle and the pet-cock is opened. The penicillin solution is thus sucked up into the bottle. The pet-cock is then closed and the oscillator turned on. With full power applied, 1000 cubic centimeters of liquid will be reduced to 100 cubic centimeters in eighteen minutes.

After turning off the oscillator, the vacuum pump is stopped and the relief valve is opened. Then the pet-cock below the bottom bottle is opened and the penicillin solution drained from the bottle. After this operation the pump is started and a new supply of penicillin is drawn into the bottle.

Drying in the Final Container

When attempts were made to dry in the final small bottle, it became apparent that it was almost impossible to keep all the material in the bottle because of the tendency of the liquid to bubble and splatter. Initial application of the vacuum usually resulted in loss of a certain amount of solution due to spattering. After the applications of power, severe bumping sometimes entirely emptied the bottle. Numerous expedients were resorted to in the attempt to solve this problem. Rotating the bottle at high speed during the evacuating and drying period revealed that this was a way to eliminate these difficulties. By rotation at 3000 r.p.m. the liquid and solids in the liquid are formed in a thin layer on the walls of the bottle. The force on the solids at this rotational speed is estimated to be at least one hundred times the force or gracity. When vacuum is applied, no material is lost. Then as radio-frequency power is applied, the material dries in a thin film on the side of the bottle with a rather pleasing appearance. Most of the water is removed in the first 60 seconds. The rate of drying progressively decreases as time passes. Measurements of the "Q" factor of the circuit taken during the drying cycle show that there is quite a change in loading of the oscillator during the drying period. At the end of three minutes, the moisture content is reduced to about four per cent. Application of radio-frequency power for longer periods will reduce the moisture content still further. However, by the time the moisture content has been reduced to four per cent, the material is very stable and will stand much higher temperatures than it does when in the liquid condition. This allows us to introduce another step which is important in the construction of final equipment since it permits the use of a minimum number of rotating cups. The bottles are transferred to metal plates which are heated by ordinary electric heaters. A bell jar is then placed over the heater plate and the system evacuated. Since the material is dried on the sides of the bottle in a thin film, heat conduction through the glass bottle to remove the last traces of moisture is efficient.

The Auxilliary Drying Chambers

The system to handle large numbers of bottles uses port hole frames as the vacuum chambers. Thirty-four plastic cups are mounted on the peripheries of the circles in each chamber. An electrode, insulated from ground is placed between two rings of bottles. An inner metal ring and the wall of the port form the two ground electrodes. Radio-frequency power is fed in through a vacuum-tight insulating bushing. Each of the plastic cups is individually gear driven at a speed of 3000 revolutions per minute.

An accompanying photograph shows a circular table which supports six of these chambers. Each chamber is subjected to radio-frequency power for three minutes. A rotary switch is used so that three chambers are connected to the oscillator at one time. One chamber is in the wet stage, that is, it is in the first third of its drying cycle. Another chamber is in the second third of its drying cycle, while a third chamber is in the last stage of the drying cycle. At the end of one minute the chamber containing dry bottles is switched from the oscillator and a fresh chamber is connected in the group. Thus, the oscillator remains essentially fully loaded at all times. While three chambers are being dried, the fourth is in the process of un-

loading, the fifth is being loaded, and the sixth is in the initial stages of evacuation. Since one chamber of thirty-four bottles is unloaded every minute, over two thousand bottles are processed each hour.

The bottles are next loaded into aluminum trays and the trays are placed on electrically heated bases. Metal domes are then closed over them and evacuated to about five millimeters of mercury. After one-half hour in these auxiliary domes, the bottles are removed. They are then closed with rubber stoppers and aluminum caps are pressed on to hold the stoppers in place. The bottles may then be stored for long periods of time until needed. At that time, sterile water is injected through the rubber stopper with a hypodermic syringe, the penicillin readily dissolves in the water, and the solution is withdrawn into the syringe.

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BONDING OF COMPONENT PARTS via SOLDERING AND BRAZING

by

F. L. Creager

The designation of such operations is often misapplied. Proper terminology is outlined herewith, together with suggestions covering proven designs and practices.

Soldering

This term is accepted to mean the employment of binary (tin-lead) alloys having a melting point less than 600°F. These are popularly known as "soft" solders.

"Soft" solder's most effective (and eutectic) ratio is tin 63 per cent, lead 37 per cent. In an effort to reduce cost, and recently under wartime restrictions, efforts are continually made to reduce the tin content. It is highly desirable to maintain at least a 50/50 tin-lead ratio, although 40/60 is being presently employed under Government rulings.

As the percentage of tin is reduced, the following performance changes are produced:

(a) Melting point is lowered.
(b) Plastic range is widened.
(c) Tensile strength is reduced.

Aside from the reduction in physical strength, a widening of the plastic range -- by lowered tin content -- tends to increase the number of "cold" solder joints found in production.

Heating Medium

"Soft" solders are generally applied with the aid of an electrically-heated soldering copper. Since the first function of the solder is to transmit heat between the irregular contacting surfaces of the copper tip and the work, a generous amount should be employed -- the excess being shaken off. This is much better than to use a small amount of solder and take a longer time to finally heat the work to a degree whereby the solder will "wet down" on same. The latter practice usually results in ruining any insulation which may be adjacent to the part being soldered due to heat absorbed from the conductor. In sealing vessels and parts of considerable cross-section, a gas torch is usually employed.

Fluxes

Standard wiring practice employs tinned terminals and conductors, thus permitting a mild flux to be used. This flux, in most cases, is rosin (abietic acid), although Burgundy flux has also been approved by the Camden Works (Standardizing Notice 71-3-1). The Camden Works has also employed levulinic acid for connections and citric acid for litz wires, although same are not recommended. These fluxes are not effective for nickel, zinc, steel or stainless steel.

Fluxes, other than the above, should not be employed for wiring connections as it is essential that no materials of a corrosive nature and/or producing a hydroscopic salt be employed.

For the junction of metal-to-metal parts in which the completed assembly may be thoroughly washed in neutralizing agents, it is permissible to employ more vigorous fluxes such as ammonium and zinc chlorides, and "Nokorode" (alleged) paste flux. "Nokorode" is approved by the Harrison Works, although containing zinc and ammonium chlorides and corrosive in action, solely for the purpose of soldering nickel-plated pins on tube bases and the like. They require immediate washing after soldering. These fluxes are highly corrosive and must always be neutralized immediately.

Brazing

This term embraces a considerably larger variety of alloys than "soldering". Siver brazing alloys vary in melting point from 1175°F to 1650°F, or approximately midway between the melting temperatures of solder and those of bronze welding. For this reason their greatest usefulness lies in joining

Table I

COMMERCIALLY USED "SOFT" SOLDERS

Content	Temperature Complete Liquefaction	Temperature Complete Solidification	Sheer Strength psi
Pure Tin	450°F	450°F	2865
63-37 Tin-Lead	359°F	359°F	6230
50-50 Tin-Lead	414°F	359°F	5740
40-60 Tin-Lead	460°F	359°F	4975

metals in the non-ferrous field. They are known as "hard" solders. These alloys are essentially brazing spelter (60% C_u, 40% Z_n) modified by the addition of silver and/or other elements to:

(a) obtain lower melting points.
(b) improve fluidity.
(c) improve tensile strength.

Brazing spelter has a melting point of 1620°F.

(This article will be continued in our October issue. - Ed.)

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LIBRARY INFORMATION

Recent Articles Available in the Library

Electronic blanching of vegetables, J. C. Moyer, Science, July 20, 1945.

Release and control procedures for engineering drawings, J. E. Thompson, Product Engineering, July, 1945.

Separating sound from vision in television reception, K. R. Sturley, Journal of the Television Society, V.4, No.5, 1945.

The frequency response of R. C. coupled amplifiers, K. R. Sturley, Electronic Engineering, July, 1945.

The unwritten laws of engineering, W. J. King, Reprinted from Mechanical Engineering, 1944.

Special Services Offered by the Library

Bibliographies are made up on requested subjects.

Translations from any language are made.

Telephone requests for information are answered.

Suggestions for the purchase of books and magazines to improve the Library collection are always welcomed by the Library. No formal request is needed. Make your suggestions known to the Library.

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PERSONNEL INFORMATION

RED CROSS BLOOD DONOR SERVICE

On July 24, 1945, the Red Cross Blood Donor Service was again in Cranbury, New Jersey. The following members of RCA Laboratories made donations:

H. C. Allen	Miss B. McGarry
R. C. Ballard	E. N. Metz
W. R. Ferris	A. Meneely
W. D. Hershberger	Miss M. Mihelyi
E. O. Keizer	A. J. Neumann
H. Kihn	W. Parfian
L. F. Kraus	W. I. Rogers
H. W. Leverenz	P. Rudnick
E. G. May	G. F. Werner

R. R. Wright

Mrs. May Shorten and Mrs. Edith Snedeker of the Cafeteria staff also donated.

With his donation at Cranbury on July 24th, 1945, L. F. Kraus has now become the second member of our Gallon Club.

1945 QUOITS

Class "A" Doubles Quoit Championship

The team of Lewallen and Fechter won the 1945 Class "A" Doubles Quoit Championship by defeating the team of W. Howarth and T. Maher in the final games of the tournament.

Lewallen and Fechter displayed a steady game throughout the final match, taking the three games. Howarth and Maher pitched steady games which kept them on top of the league until the last of the season, but they were no match for the winners in the final games.

Lewallen and Fechter got off to a poor start in the league, but after they began to click, no team could stop them.

Maher's comment was: "The best team won, or, I guess I'm slipping and heading for Class 'B'."

Final Standing of League

Team	Won	Lost
Lewallen and Fechter	21	9
W. Howarth and Maher	19	11
Luther and Coria	18	12
Tams and Cader	14	16
M. Cuomo and Friel	11	19
Thompson and F. Howarth	7	23

Class "B" Doubles

These teams are just in the process of finishing their series of games as we go to press. Their standings at this time are:

Team	Won	Lost
C. Sullivan and Hartz	24	9
Ellis and F. Howarth	28	9
Landis and Benbenek	28	14
Stalcup and W. Sullivan	23	19
Ferrara and Tantum	22	20
Walentine and McFadden	13	24
Adams and Stonaker	12	25
Edwards and Morris	8	34

Class "C" Doubles

The Class "C" tournament, like the Class "A", exhibited an upset in team standings near the end. McCool and Flauss worked up to first place in the final games of the season. The final standings of the teams were:

Team	Won	Lost
McCool and Flauss	21	8
A. Cuomo and Burnett	19	11
Cytowic and Scharf	19	11
Osgood and Parry	13	17
Legrum and Vandegrift	10	20
Lewis and Wright	7	23

Class "A" Singles

This singles group have been playing for several weeks and their standings as we go to press are:

Player	Won	Lost
Lewallen	17	5
W. Howarth	18	10
Friel	19	11
Walentine	12	9
Fechter	14	7
Maher	9	10
Cader	16	17
Thompson	8	17
Coria	10	19
M. Cuomo	4	9
Tams	3	11
Luther	3	7

Class "C" Singles

These players have just started singles for this season and their standings as we go to press are:

Player	Won	Lost
McCool	12	2
Lewis	9	7
Burnett	5	6
Flauss	7	6
Cytowic	3	7
Legrum	6	10
Osgood	2	3
Parry	1	2
Scharf	0	0
Wright	0	0
Vandegrift	2	3
A. Cuomo	0	0

1944 - 45 BOWLING LEAGUE CHAMPIONS

Left to right - W. I. Sullivan, Mrs. Ethel Moonan, Stephen Shuren, Jr., Miss Mary Sharretts, W. Parfian, members of the Tube Room Bowling Team who won the 1944-45 RCAL Bowling League Championship. The Tube Room Team won the championship by defeating the Wiremen in the final playoff.

Revised Addresses of Employees
in the Armed Services

Miss Dorothy A. Freeman, SA
National Headquarters
American Red Cross
Washington 13, D. C.

T/Sgt. John Tyrrell, 32953742
380th Bomb Group, 528th Sqdrn.
A.P.O. No. 337 - c/o Postmaster
San Francisco, California

Ens. L. Greenough
N.T.S. M.I.T.
470 Atlantic Avenue
Boston 10, Mass.

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RCA Laboratory Acquatics

During the warm weather a group of the more hardy RCA'ers enjoyed a daily noontime swim. Among those who went swimming frequently were: George Leck, Randall Ballard, Pete Wentworth, Louis Cuccia, Norman Davidson, Karl Wendt, Joseph Walentine, Madeline Mihelyi, Ernestine Hall, Tina Snook and Cecilia Watz.

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BIMONTHLY NEWS

TRIBUTE FROM THE SECRETARY OF THE NAVY

The following letter from Brigadier General David Sarnoff will be of interest to our readers.

September 5, 1945

Dr. C. B. Jolliffe, Vice President in Charge of
RCA Laboratories
Princetor, New Jersey

Dear Dr. Jolliffe:

The attached letter from Secretary of the Navy, James Forrestal, bespeaks the Navy's appreciation of the part that Radio Corporation of America played in equipping and serving the Navy with radio and electronic equipment. It is a salute to the many workers of RCA with whom the management shares a deep appreciation of this high recognition of the Company's wartime achievements. I know you will be happy to convey the message to your entire staff.

Sincerely yours,

(Signed) David Sarnoff

The letter from the Secretary of the Navy follows:

THE SECRETARY OF THE NAVY

Washington

1 September 1945

Dear Dave:

I am addressing this letter of appreciation to the Radio Corporation of America on the day of the surrender of the last of our enemies.

Our strategy of attack, with all the risks it implies, was made possible by our ability to build and to equip with the most modern devices a vast fleet ranging from aircraft carriers and battleships to small boats.

Among the companies which gave our fleet the power to attack, yours has been preeminent. You and all the men and women who have worked with you deserve, therefore, to carry into peace a special pride in a great national achievement.

On this day of final victory the Navy sends you its sincere thanks.

Sincerely yours,

(Signed) James Forrestal

David Sarnoff, Esq.,
President,
Radio Corporation of America,
30 Rockefeller Plaza
New York 20, N. Y.

General Sarnoff replied to this as follows:

September 5, 1945

The Honorable James Forrestal
Secretary of the Navy
Washington, D. C.

Dear Jim:

On behalf of Radio Corporation of America and its many workers, it is my pleasure to express to you sincere appreciation for your letter of September 1st.

It is most gratifying and encouraging to all of us to know that our resources and facilities in the hands of skilled men and women have, throughout the war years, produced results in service to the United States Navy, thereby contributing towards our Nation's victory in the world's greatest war. Your tribute provides us an inspiration, and we shall carry it with us into peace. Always it will be our aim to serve the Nation and its people with the same devotion that we have served the country and its Armed Forces in war.

With every good wish, I am

Sincerely yours,

(Signed) David Sarnoff

CONWAY P. COE ELECTED VICE PRESIDENT
OF RCA LABORATORIES

Conway P. Coe, formerly U. S. Commissioner of Patents, was elected Vice President in Charge of the Patent Department of RCA Laboratories at a meeting of the Board of Directors of the Radio Corporation of America, on July 6.

Mr. Coe, who was appointed Commissioner of Patents in 1933 by the late President Roosevelt, resigned from that position on June 15, 1945. He was a member of the examining corps of the Patent Office for three and a half years beginning in 1918, after graduation from Randolph-Macon College. He studied law at George Washington University and engaged in private practice in Akron, Ohio, and the District of Columbia from 1923 to 1933.

Mr. Coe served as Chairman of the American delegation to the International Conference for the Protection of Industrial Property held in London in 1934. He has been a member of the National Defense Research Committee and the National Inventors Council since the formation of these organizations, as well as Executive Secretary of the National Patent Planning Commission. He is a member of the American Patent Law Association and is a faculty member of the Law Department of George Washington University.

Mr. Coe was born at Dunkirk, Maryland on October 21, 1897. He served in the Field Artillery, United States Army during the first World War.

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RCA PIONEER IN RADAR RESEARCH AND MANUFACTURE

Working in close association with the naval and military services of the United States, the Radio Corporation of America pioneered many of the major developments in radar dating as far back as 1932.

With the Government's relaxation on August 15 of the ban on publication of facts concerning radar, it is possible to review the history of RCA's contributions -- in scientific research and in manufacturing -- to this almost-magical means of detecting and ranging both stationary and moving objects by radio and electronics.

RCA's pioneering work includes: original work during 1932 in microwave equipment which later was used in successful radar experiments; erection of equipment in 1934 for reflection tests made in cooperation with the U. S. Army Signal Corps; development in 1935 of an experimental wave pulse radar system which was demonstrated to the Army and Navy in 1936: development of airborne pulse radar equipment and its demonstration to the Army and Navy in 1937; development of a practical light weight altimeter employing FM principles in 1938; manufacture of the first radar equipment purchased by the U. S. Navy in 1938 and 1939; development and manufacture of radar apparatus especially suitable for destroyers and for submarines; design and manufacture of numerous radar tubes and cathode-ray tubes used as indicators; and continuing participation in numerous other avenues of radar development and manufacture.

Basic scientific research and advanced engineering development on apparatus and techniques of importance to radar have been carried on continuously by RCA Laboratories and the RCA Victor

Division since 1932. In 1934, RCA scientists erected equipment on the seashore, near Sandy Hook, for a series of reflection tests conducted in cooperation with the U. S. Army Signal Corps. Although the available equipment was limited in its effectiveness at that stage of development, tnose experiments gave definite proof that ships could be detected and located through the use of reflected microwaves.

From the information gained in those early investigations, RCA developed a form of microwave radar utilizing bursts or "pulses" of microwaves. This was a notable advance, the effectiveness of which was soon dem nstrated. For the practical tryouts, apparatus was installed on the roof of an RCA laboratory in Camden, N. J. Among the basic components were a special form of movable antenna and a cathode-ray indicator. As the antenna was swung from side to side, observers saw on the cathode-ray screen indications of the positions of buildings in Philadelphia and boats on the river between the two cities. This was one of the forerunners of the radar in wide use by the armed forces during the war.

Following this experiment, the Army and Navy, which had been kept fully informed of all RCA advances, requested the company to put all further work on a secret basis, which was done.

The next move was to adapt radar for airborne operation. This was accomplished experimentally by RCA in 1937. Through the instruments supplied the pilot, he was able to detect fixed obstacles such as mountains looming ahead of him, and by means of pulses transmitted vertically downward, he was provided with accurate indication of his elevation above ground. This accomplishment led to the perfection of the RCA pulse altimeter. This and the later-developed RCA FM altimeter have performed so well that they have become the standard altimeter equipment in use by the U. S. Army and Navy and the British.

One of the developments to which RCA contributed a part was "Loran", a long-range navigational aid which made it possible for night bombers and fighters to proceed to a designated target in Germany and return to their bases in England without depending on ground observation. RCA undertook the development of an improved airborne "Loran" receiver and was able to reduce the weight and number of tubes to one-half the previous value. Because of its effectiveness, this receiver was accepted as standard by the Army and Navy and British.

Another important RCA contribution in radar was the development of a tail-warning device to warn pilots of the approach of other air-craft from the rear. This device has been responsible for saving the lives of many pilots.

Speculation on the peace-time use of radar has reached to many fields. Some of the immediate and future applications envisaged by those most closely concerned with radar are in aviation and maritime operations. Radar FM and pulse altimeters would give the pilot his exact distance above terrain irrespective of its relation to sea level. Another form of radar would provide accurate "fixes" for transoceanic navigators when celestial navigation is prevented by clouds. Landings at airports in heavy weather will be greatly simplified by future developments in radar. Radar-equipped ships travelling the seas would no longer be hampered by fogs or faced by the dangers of collisions with icebergs, other vessels, and derelicts. RCA's experience and facilities will permit the company to play a leading role in the promotion of these and many other uses of radar principles and techniques.

RCA LABORATORIES AND NBC TO CONDUCT TELEVISION TESTS WITH NEW TRANSMITTER ATOP EMPIRE STATE BUILDING

Preparations are being made to conduct the first full-fledged field tests in the New York metropolitan area to study problems faced in using higher frequencies for television broadcasting. To date, the experimental antenna has been installed atop the Empire State Building and the transmission line leading to it is in position. The tests, which will be conducted in cooperation with engineers of the National Broadcasting Company, will employ a new television transmitter capable of developing 5 kilowatts of output power at 288 megacycles, a somewhat higher frequency than that assigned at the present time by the Federal Communications Commission for commercial television transmission. Research on the transmitter was done by Mr. R. D. Kell's group and the special transmitter tube for this high frequency was developed by Dr. L. P. Smith's group. The antenna and transmission line was developed by Dr. G. H. Brown's group.

The newly-installed antenna on the Empire State Building will in no way effect the regularly scheduled television broadcasts from there by NBC's pioneer station WNBT. The television audience in the area will be unable to pick up the test broadcasts which will be received only on specially-designed receivers in possession of the survey engineers.

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RCA's All-Electronic Penicillin Drying System to be Manufactured and Sold by Stokes Company

F. J. Stokes Machine Company, one of the oldest and foremost manufacturers of machinery for the drug manufacturing trade, signed a license agreement with the RCA Laboratories on June 20, 1945, to manufacture and sell radio-frequency dehydrating and bottle drying equipment for the processing of penicillin and other drugs. An article describing the technical features of this equipment will be found elsewhere in this issue.

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RCA Laboratories Represented on Nation-Wide Broadcast Concerning Radar

The first national broadcast on radar was held on September 3, from 1 to 1:30 p.m., at which time Mary Margaret McBride interviewed three members of our Laboratories staff. These were: Mr. E. W. Engstrom who directed the research and engineering which resulted in many of radar's wartime advances; Dr. I. Wolff whose work on radar dates back to 1932 when he began developing integral parts of the radar system; and Mr. John Evans who has the distinction of being the first civilian representative of a commercial organization to operate a radar set aboard a U.S. Navy ship.

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LECTURES BY RCA LABORATORIES TECHNICAL STAFF

Before the Naval Air Technical Training Center at Corpus Christi, Texas, by C. B. Jolliffe on "The Radio-Electronic World of Tomorrow" - August 20, 1945.

Before the Washington Section of I.R.E. by G. H. Brown and W. C. Morrison on "The RCA Antennalyzer, an Instrument Useful in

the Design of Directional Antenna Systems" - September 10, 1945.

Before the P.T.A. at the Township Public School in Princeton by A. V. Bedford on "Projection Television Receivers" - September 25, 1945.

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PERSONALS

In our last issue we reported the Meritorious Service Plaque received by Corporal Walter B. Liniewicz, brother of Miss Loretta Liniewicz of our Research Staff. Since then we are informed that he also has received five Bronze Stars for duties in connection with Air and Ground services.

Our congratulations to Mr. J. Krieger of our Maintenance Group who celebrated his Golden Anniversary on August 11, 1945 at Lawrence Lodge in Lawrenceville, New Jersey. He has been an American citizen since March, 1895. He was married on August 11, 1895, and has four children - 2 boys and 2 girls - and three grandchildren. This is the first Golden Anniversary to be celebrated at RCA Laboratories.

Cpl. Gennaro J. Valentino, brother of Patsy Valentino of our Maintenance Group came home recently on a 34-day furlough from Germany. He is in the 9th Air Force Air Engineering Squad, and has been stationed overseas for a period of 27 months. He was stationed in England for 15 months, 10 months in France and 2 months in Munich, Germany. While in Germany, he met Nicholas Rossi of 200 John Street, Princeton, New Jersey, a brother-in-law of Patsy.

Corporal Valentino's marriage took place on September 16, 1945 in Brooklyn, New York to Lucille Parascand of Brooklyn. He will report back for service to Tampa, Florida.

The following is an excerpt from a letter to Mr. DeJong from his son and will be of interest to friends of Phillis Tindall who was at the hospital where Frank DeJong was undergoing treatment. - Ed.

"Phyllis Tindall was in to see me in response to my request to see her. She is a Pharmacist's Mate Third Class in the U. S. Navy Reserve (Women). She had her boot training at Hunter College, New York, starting August 26, 1943. From there she went to Corps. School (for Pharmacist's Mates) in Sampson, New York in October, 1943. From there she went to active duty at the Philadelphia Naval Hospital from November 1, 1943 to January, 1944. Then she went to independent duty at the Philadelphia Navy Yard for 10 months. After that she put in a request for surgery at this hospital and after putting in six months training she is now a qualified technician. She likes the work very much and works very hard sometimes working from 7 one morning to 1:30 the next plus being on call all hours of the day or night for emergencies. She is going on leave next week (10 days). She is very modest and the way I got these facts was by just talking to her and making mental notes of what she said. The day I met her was June 21 while I was being operated on. She assisted in the operation and we talked about the Lab. while they were operating.

Frank (DeJong)"

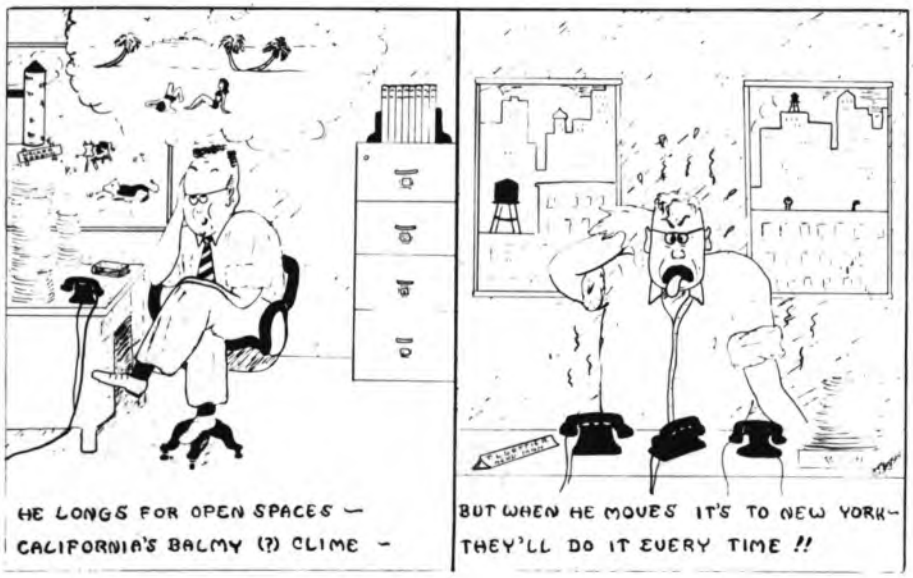
Mr. J. M. Blatt of our Research group was married to Miss Sylvia Ray Epstein on August 12, 1945 in Newark, New Jersey. Congratulations to the happy couple.

We extend our congratulations to Miss Mary I. Sharretts of the Accounting Department on her engagement to Jackson Reynolds of the U. S. Navy. The couple have no definite plans at present. As usual in these times, everything depends on "Uncle Sam". Mr. Reynolds is at present stationed in California.

BIRTHDAYS

Birthdays celebrated by girls of the Tube Assembly Room since our last issue included those of Shirley Lockead on June 25, Ethel Moonan on June 30 and Bernice McGarry on July 18. According to word we get from the Tube Room, the refreshments were very tasty.

Miss Loretta Liniewicz of our Research Staff celebrated her birthday on Saturday, June 16, 1945 by bringing in a lovely cake which was enjoyed by all her associates.



A farewell dinner party for Mr. T. L. Gottier was arranged by his friends in the Television Section on Tuesday evening, July 17, at Fowlers Restaurant on U.S. Route 1. During the dinner Mr. Gottier was presented with a sketch which we reproduce herewith for our readers. The artist is Miss Cora Benson who seems to have been hiding quite a lot of talent all this time.

HERE'S A PROBLEM FOR STAR GAZERS; NOT OF THE MOVIE VARIETY, HOWEVER*

By
E. W. Kellogg

A group of non-technical people were entertained one evening by a very informative paper by one of the members on astronomy. Among the points brought out are that most all of the stars we see are distributed throughout a pancacke shaped space whose diameter is of the order of 100,000 "light years" (light travels 186,000 miles in a second). We call this group our own "galaxy" or sometimes an "island universe."

But far outside this space are many other galaxies of comparable magnitude. These island universes have definite motions with respect to each other, and astronomers tell us that they are getting farther apart, the most distant ones having the greatest velocities away from us. They talk about this as "the expanding universe" and say that in thirteen hundred billion years all of the distances will have doubled.

This expanding universe idea gave rise to the following argument:

If these remote galaxies, already so far away that they can be studied only with the help of the most powerful telescopes, isn't it unfortunate to permit any cessation of work on the 200-inch reflector for Mt. Polomar, permitting them to get still farther away before we can begin studying them with this powerful new instrument? But some argued that it would work just the other way and the "seeing" would get better as time passes. They argued as follows:

Suppose, for example, that one of these galaxies, the Spiral Nebula of Andromeda, is now 720,000 light-years away. That means that we see it, not where it is now but where it was 720,000 years ago. Let us further suppose that in view of its rapid motion away from us, it will, by 1955, be 721,000 light-years away. Then the observers who look at it in 1955 will see it where it was 721,000 years prior to 1955, or 720,990 years ago, or 990 years earlier than the light left it which enters our telescope today and of course at that time it was much nearer the earth. So the astronomers of 1955 will get a closer view than we do.

---"---

*Reproduced from the September, 1945 issue of "RCA Family News", Indianapolis Edition.

ADDITIONS

Miss J. T. Magnani - Tube Assembly
Mrs. R. M. Eller - Tube Assembly
John Stasyszyn - Maintenance
H. E. Applegate - Research

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DEATHS

HUBERT N. HALL

Friends of Hubert N. Hall were shocked to learn of his death on Thursday night, October 18, 1945. He died at the Hospital of the University of Pennsylvania after a short illness.

Mr. Hall was born in Payson, Utah, April 2, 1915. He attended the University of California, majoring in physics and after receiving his degree in 1936 he was geophysical exploration engineer for the Continental Oil and Independent Exploration Companies.

He came with RCA in Camden in July, 1941 and moved to Princeton when the Laboratories opened here. While working with us, Mr. Hall took post graduate courses at night at both the University of Pennsylvania and Columbia University.

From the beginning of his connection with RCA he was associated with Dr. Olson's Acoustics Division. During this entire time Mr. Hall carried on research on the subject of underwater sound. He was a brilliant young engineer and his work in this field was outstanding.

Mr. Hall's sister, Miss Ernestine Hall, is also an employee of RCA Laboratories, being associated with Dr. L. P. Smith's Tube Division. Our deepest sympathy is extended to her and the other members of the family.

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VOL. 2 OCTOBER 1945 NO. 6

RCA LABORATORIES NEWS

Photo by Fairchild Aerial Surveys, Inc.

RADIO CORPORATION OF AMERICA
PRINCETON N.J.

RCA LABORATORIES NEWS

ED DICKEY - EDITOR

GRADIENT MICROPHONES*

By

Harry F. Olson

INTRODUCTION

Directional microphones may be divided into two classes as follows: first; wave-type microphones which depend for directivity upon wave interference, and second; gradient-type microphones which depend for directivity upon difference in pressure (or powers of the difference in pressure) between two points. In the first class of microphones, in which the directivity depends in some way upon wave interference, to obtain any semblance of directivity the dimensions of the microphone must be comparable to the wavelength. Typical microphones of this classification are reflector, lens, and line microphones. In the second class of microphones the most common example in use today is the velocity or gradient microphone. The directional characteristics of simple symmetrical pressure gradient microphones are bidirectional. The directional characteristics of combinations of gradient microphones of different orders or combinations of gradient elements and appropriate delay systems are unidirectional. It is the purpose of this paper to describe the characteristics of gradient microphones of various orders, combinations of gradient microphones of different orders, and combinations of gradient microphones with delay systems.

GRADIENT MICROPHONE OF ORDER ZERO

A gradient microphone of order zero is a microphone in which the electrical response corresponds to the pressure in the actuating sound wave. To illustrate the characteristics of gradient microphones it will be assumed that the elements of the gradient microphones are made up of units and that the voltage output of these units is proportional to the sound pressure, independent of the frequency for constant sound pressure, and in phase with the actuating sound pressure. The voltage output of an acoustic resistance-controlled magnetic or dynamic system or a stiffness-controlled condenser or crystal system is independent of the frequency for constant sound pressure.

At a fixed point, in a sound wave in which the pressure amplitude is independent of the frequency, the pressure available for actuating the vibrating system of the microphone is independent of the frequency. Figure 1. In these discussions it will be assumed that the dimensions of the systems are small compared to the wavelength. Therefore, the pressure which actuated the microphone is independent of the direction of the incident sound. Under these conditions the pressure microphone is nondirectional.

Under the above conditions a single unit constitutes a gradient microphone of order zero or, commonly termed a pressure microphone. The voltage response of this microphone is independent of the frequency as shown in Figure 2. Furthermore, the shape of the response frequency

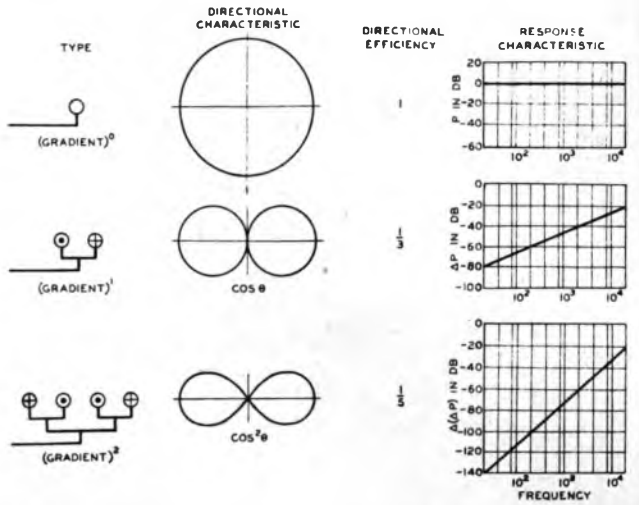

Fig. 1. The Directional characteristics, the directional efficiency, and the actuating pressure frequency characteristics of gradient microphones of orders zero, one and two.

characteristic is independent of the distance from the sound source.

GRADIENT MICROPHONE OF ORDER ONE

A gradient microphone of order one is a microphone in which the electrical response corresponds to the pressure gradient between two points.

At a fixed point in a sound wave, located a distance of several wavelengths from the source, the difference in pressure, for a constant sound pressure in the sound wave, is proportional to the frequency. That is, the pressure available

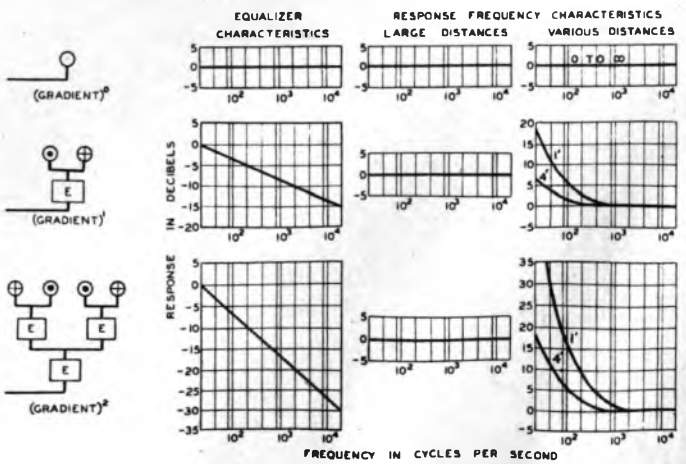

Fig. 2. The equalizer response frequency characteristics, and the response frequency characteristics of gradient microphones combined with equalizers, as a function of the distance.

*Excerpts from a paper to be published in the Journal of the Acoustical Society of America.

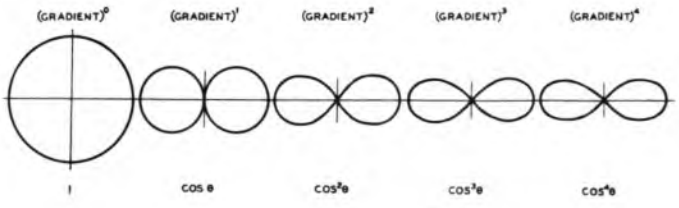

Fig. 3. The directional characteristics of gradient microphone of order zero, one, two, three and four.

for actuating the vibrating system is proportional to the frequency. Figure 1. The response of the microphone is proportional to the cosine of the angle between the direction of the incident sound and the line joining the two points. Figure 1.

A gradient microphone of order one may be made up of two oppositely phased units. See the preceding section for a description of the unit. The output of two units of opposite phase is proportional to the frequency. Therefore, to obtain a constant voltage pressure relationship which is independent of frequency a compensating system must be introduced in which the response is inversely proportional to the frequency. In the case of the velocity microphone, which is the outstanding example of a first-order gradient microphone, a uniform voltage pressure relationship is very simply accomplished by using a mass-controlled element. The response frequency characteristic with a compensating element is independent of the frequency when the distance between the microphone and the sound source is several wavelengths. Figure 2. Unlike the single-unit zero-order gradient or pressure microphone, the voltage response does not correspond to the sound pressure when the distance between the sound source and the microphone is small compared to the wavelength but is accentuated as the frequency or distance is decreased. The response as a function of the frequency for various distances is shown in Figure 2.

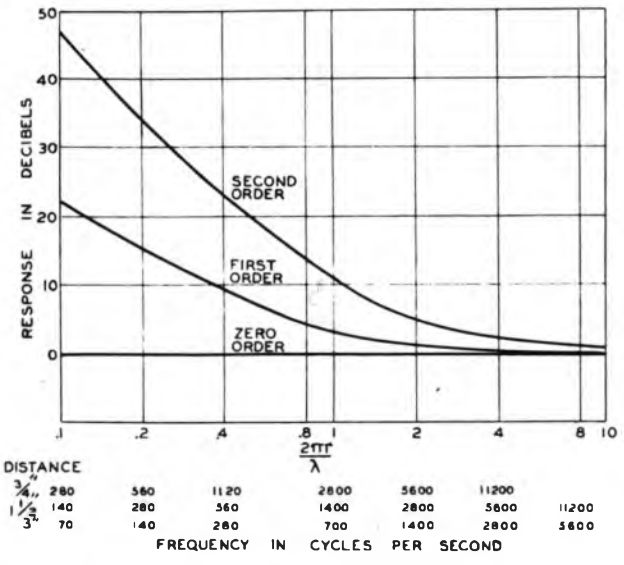

Fig. 4. Response of zero, first and second order gradient microphones to a small source as a function of $\frac{2\pi r}{\lambda}$ where r = distance and λ = wavelength. The response characteristic of all three are assumed to be independent of the frequency for a plane wave, that is $\frac{2\pi r}{\lambda} = \infty$. The frequency scales below the graph apply to three distances, namely: 3, 1½ and ¾ inches.

GRADIENT MICROPHONE OR ORDER TWO

A gradient microphone of order two is a microphone in which the response corresponds to the pressure gradient of the pressure gradient.

At a fixed distance in a sound wave located at a distance of a large number of wavelengths, the difference of the difference in pressure for a constant sound pressure in the sound wave is proportional to the square of the frequency. Figure 1. The response of the microphone is proportional to the square of the cosine of the angle between the direction of incident sound and the line joining the system of points. Figure 1.

A gradient microphone of order two may be made up of two pairs of oppositely phased units, the outputs of which are oppositely phased. Figure 1. In this case two compensating systems must be introduced in each of which the response is inversely proportional to the frequency, or

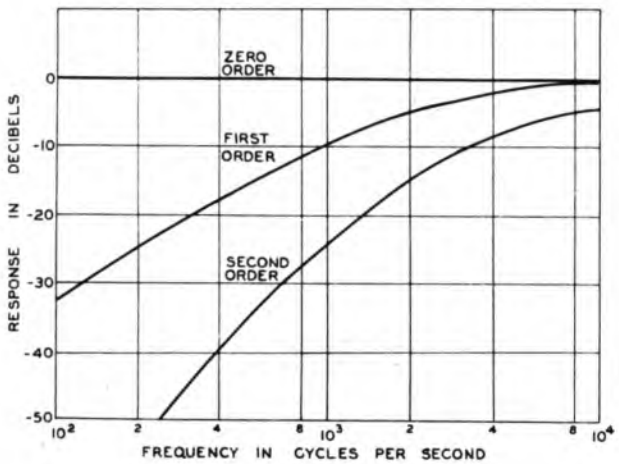

Fig. 5. Response frequency characteristics of zero, first and second order gradient microphones to a plane wave. The microphones are compensated so that the responses of all three are the same and independent of the frequency when operating at a distance of 3/4 inch from a small sound source.

a single compensating system the response of which is inversely proportional to the square of the frequency. The equalization characteristic required to obtain uniform response with respect to frequency is shown in Figure 2. The response frequency characteristic with a compensating element is independent of the frequency when the distance between the microphone and the sound source is several wavelengths. Figure 2. The response as a function of the frequency for various distances is shown in Figure 2. The accentuation of the response at the low frequencies when the distance between the sound is considerably more pronounced than in the case of the two-element system.

NOISE DISCRIMINATION OF GRADIENT MICROPHONES

As shown in Figure 3 gradient microphones of order one and higher are directional. Therefore, these microphones discriminate against sounds from random directions. The magnitude of discrimination as compared to a zero order or nondirectional microphone is given by the expression

$$D = \frac{2\pi \int_0^{\pi} R_n^2 \cos^{2n}\theta \sin\theta \, d\theta}{4\pi R_0^2}$$

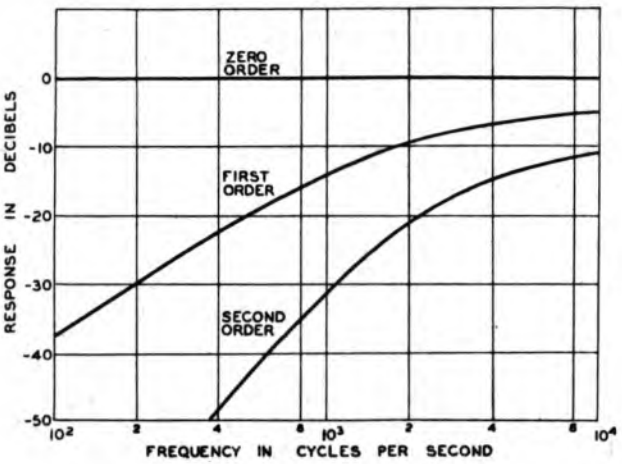

Fig. 6. Response frequency characteristics of zero, first and second order gradient microphones to random sounds originating at a distance. The microphones are compensated so that the responses of all three are the same and independent of the frequency when operating at a distance of 3/4 inch from a small sound source.

where R_n = response of the gradient microphone on the axis

n = order of the gradient microphone

Θ = angle between the axis of the gradient microphone and the direction of the incident sound and

R_o = response of the gradient microphone of order zero.

If the sensitivity of the gradient microphone of order zero is the same as that of the gradient microphone of order n, the above equation becomes

$$D = \frac{1}{2n - 1}$$

The above assumes that the distance between the origin of the sound and the microphone is greater than $n\lambda$ where λ is the wavelength of the incident sound. Referring to Figure 2 it will be seen that the response of a gradient microphone is accentuated when the distance between the sound source and the microphone becomes less than $n\lambda$. This feature of a gradient microphone may be used to obtain high discrimination against unwanted sounds. If the microphone is used as a close-talking microphone and the noises originate at a distance from the microphone, considerable discrimination against the noise can be obtained. For example, assume that the distance between the mouth and the microphone is 3/4 inch, which is an average distance for a close-talking microphone; then the response frequency characteristics of a zero, first and second-order gradient microphone as a function of the frequency are shown in Figure 4. The response of the gradient microphones is accentuated at the low frequencies. If compensation is introduced so that the response of all three becomes uniform with respect to frequency for the 3/4-inch distance, the response frequency characteristics for distant sounds will be as shown in Figure 5. These characteristics show the discrimination against distant axial sounds by the first and second order gradient microphones as compared to a pressure or zero-order gradient microphone. In general, noise and unwanted sounds originate in random directions. Under these conditions additional discrimination will be introduced by the directional pattern. The response of a zero, first and second-order microphone, compensated for uniform response at 3/4-inch distance, to distant sound originating in random directions is shown in Figure 6. The discrimination of the second-order microphone is tremendous. This has been substantiated by actual tests in which it is impossinle to drown out speech in a second-order gradient microphone for any noise which the normal ear can withstand without pain.

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BONDING OF COMPONENT PARTS via SOLDERING AND BRAZING

by

F. L. Creager

(Continued from last Issue)

Table III

MELTING POINT OF VARIOUS MATERIALS BRAZED

Material	Melting Point
Brass (free-cutting yellow)	1640°F
Muntz Metal	1660°F
Brass (yellow)	1690°F
Bronze (commercial)	1920°F
Copper	1980°F
Sheet Steel and Iron	2770°F

Heating Medium

The acetylene torch is ordinarily used with a neutral to reducing flame (slight excess of acetylene). The exception is in silver brazing of tough-pitch copper (not OFHC) when embrittlement occurs, and excess flux and an oxidizing flame must be employed.

Preheat away from the joint, using a soft (non-pointed) flame. Heat only to the temperature required to obtain free flow of the solder. Do not overheat. Avoid any direct flame contact on the alloy for an extended time. If sections are non-uniform, concentrate heat on the heavier section.

Flux

It is essential that all mating surfaces be thoroughly cleaned, preferably by pickling or sand-blasting prior to application of the flux.

The use of a good flux is important. Its function is to dissolve any oxides present as well as act as a blanket against further atmospheric oxidation. It also lowers the surface tension, permitting brazing alloy to "wet-down" on the work. Flux should be used over all of the joint and also the brazing alloy.

If required to restrict the area to be brazed, a stop-off paste of graphite and sodium

Table II

SILVER BRAZING ALLOYS
(Arranged in Order of Melting Points)

SPECIFICATION NO. ASTM (Spec. B-73-29)	H & H Symbol	Ag. %	Cu. %	Zn. %	Cd. %	Phos. %	Melting Point	Flow Point	Application
*---	Easy-Flo No.6	50	15	25	10	---	---	1200°F	Substitute for E-F No. 4 under WPB ruling; slow, with poor capillarity; not as corrosion resistant.
*---	Easy-Flo No.4	50	16	16	18	---	1150°F	1175°F	General purpose alloy; obtainable in either sheets or wire; fine flowing qualities; recommended for iron, steel, stainless steel, Monel metal, Iconel, Everdur, etc.; joints are ductile and withstand shock and vibration.
*---	Sil-Fos	15	80	--	--	5	1180°F	1290°F	The addition of phosphorus produces a free-flowing alloy, the phosphorus acting as a deoxidizer and flux; used on practically all copper-copper joints; self-fluxing on copper; suitable for brass when using flux; never use on steel; do not use on Monel, nickel or Iconel as phosphorus has embrittling effect.
*---	Easy-Flo No.3	50	?	?	?	---	1195°F	1270°F	Similar to No. 4; however, in addition to copper, zinc, cadmium, and silver it contains a small portion of nickel; flows freely, penetrates well, and is employed for brazing cemented carbide tool tips to tool shanks.
No. 4	DE	45	30	25	--	---	1250°F	1370°F	General purpose; strong joints on steel; used for band saws etc.
---	RT	60	25	15	--	---	1260°F	1325°F	Strong ductile joints on copper, nickel, and Monel.
No. 6	Easy	65	20	15	--	---	1280°F	1325°F	Sterling silver color match; excellent for Monel.
No. 5	ETX	50	34	16	--	---	1280°F	1425°F	Strong joints on both ferrous and non-ferrous metals; used on electrical and refrigeration equipment.
No. 7	Medium	70	20	10	--	---	1335°F	1390°F	Match sterling silver; extreme ductility.
---	ET	--	--	--	--	---	1340°F	---	General purpose; similar to DT with lower melting point.
No. 8	IT	80	16	4	--	---	1360°F	1460°F	High silver; strong and ductile; recommended for heavy strain such as rolling or drawing after brazing.
No. 2	AT	20	45	35	--	---	1430°F	1500°F	
No. 3	ATT	20	45	30	5	---	1430°F	1500°F	Economical; used for copper, brass, nickel, iron, steel; color match for brass.
---	SS	--	--	--	--	---	1435°F	---	Corrosion resistant for stainless.
*---	BT	--	--	--	--	---	1435°F	---	For progressive assembly preceding Easy-Flo No. 4.
---	Eutectic	72	28	--	--	---	1435°F	---	Used only when presence of zinc would give trouble.

SPECIFICATION NO. ASTM (Spec. B-73-29)	H & H Symbol	Ag. %	Cu. %	Zn. %	Cd. %	Phos. %	Melting Point	Flow Point	Application
---	DT	--	--	--	--	---	1445°F	---	For nickel silver but not color match; also ferrous and non-ferrous materials.
---	NT	--	--	--	--	---	1450°F	---	Intermediate solder for brass, copper and nickel silver.
No. 1	TL	10	52	38	--	---	1510°F	1600°F	Low price; strong joints on heavy parts where high melting point is not objectionable.
---	NE	--	--	--	--	---	---	1575°F	Strong with high melting point; used on nickel silver.

* Indicates stock material.

Assembly of OFHC to OFHC parts is also accomplished by hydrogen firing after a light silver plate.

---	Phos.-Copper	--	--	--	--	---	1304°F	1380°F	Self fluxing on copper; requires flux on brass or bronze.

silicate may be employed. It is easily removed after brazing.

H and H flux melts at 1200°F and may be used as a temperature indicator. Temperature colors are noted below:

Color	Temperature (Approx.)
First Visible Red	900°F
Dull Red	1200°F
Cherry Red	1400°F
Bright Red	1600°F

Borax and boric acid fluxes require temperatures of 1400 degrees or higher and are not fluid at normal working temperatures and hence do not protect the surface.

A hot water rinse or a cold water quench, after the brazed part has cooled sufficiently to set the alloy, will readily remove the flux.

Disassembly of brazed parts may be accomplished by raising the joint temperature slightly above the flow point of the alloy used. If parts are to be re-brazed, it is necessary that the joint be fluxed and new brazing alloy applied. This is due to the heat cycle volatilizing part of the original alloy, resulting in an increase in its brazing temperature.

Joint Design

Both soldering and brazing obtain their greatest strength with a small clearance, feeding the solder or alloy into junction by capillary attraction.

Butt joints are the weakest type one can employ. Roughly, a butt joint in cold rolled copper sheet or hard copper tube--silver-brazed--may be expected to develop a tensile strength of approximately 2000 psi. with an elongation of 10 per cent in two inches. If this joint is lapped or scarfed with a lap of 2T plus, a tensile strength of 30,000 - 33,000 psi. and an elongation of from 35 per cent may be attained, with failure occurring in the base metal and not at the joint. Longer laps are not correspondingly stronger and are sometimes weaker, due to the longer time that heat is on the work.

Fillets are wasteful and do not proportionately add to joint strength. Fitted, sheer or lapped joints, employing a thin film of alloy, are the most reliable as well as the easiest to braze. In general, as melting points increase a somewhat greater increase in flow point is observed and a reduction in fluidity. This should be compensated for by increasing the joint entrance clearance. Three or four degrees entrance clearance for low-melting-point alloys should be opened-up to ten to fifteen degrees when an alloy with a melting point over 1400°F is employed.

Laboratory tests indicate that the thinner the film of silver alloy the higher the tensile strength of the joint. However, practical designs indicate the necessity for sufficient clearance to permit the silver alloy, through capillarity, to penetrate all parts of the joint.

Clearances of .001" to .003" are preferred, although up to .005" may be employed dependent on the part size. Excessive clearances of .006" to .015" should be avoided as wasteful of brazing alloy and lowering of strength.

It is desirable to recess one part within another to obtain alignment register and eliminate the necessity for a jig at the time of brazing.

Slight chamfer of the edges permits more ready entrance of the molten alloy to the joint and at the same time reduces material waste and unsightly appearance through possible overflow of the alloy down the side of the part.

Joints between tubing and castings present the association of two pieces of unequal thickness. If possible, the joint should be designed so that the mass of the mating parts is approximately equal. The employment of a boss whose mean diameter approximates that of the tubing will result in material reduction of expansion cracks.

The strength of a silver-brazed joint decreases at elevated temperatures. At 600°F it approximates 50 per cent of that of normal room temperature. Sub-zero temperatures do not effect joint strengths.

Welding

This term generally applies to those cases in which the melting point of the parent metals is attained and fusion results between same and a filler rod. This subject will not be covered at this time.

PERSONNEL INFORMATION

BASEMENT RECREATION

Now that the weather is becoming undesirable for outside noon-time recreational activities, the interest in the recreational facilities in the basement area is increasing. Shuffle board, darts and ping pong are available for those who wish to participate in these games during the noon hour. These facilities are available for both men and women.

VICTORY GARDENS

With the gardening season drawing to a close, a good deal of clean up work is necessary in the gardens. Gardeners are urged to rid their plots of unsightly dead vegetables and weeds, so that the appearance of the garden area will be improved. It is important that this clean-up work be done before the ground freezes. Please place all debris in the aisles so that it can be picked up by the Laboratories' truck.

BOWLING LEAGUE

The RCAL Bowling League opened its 1945-1946 Season at the Princeton Recreation Center on the night of October 3, 1945, with twelve teams competing again this year. As of October 19th the Team standings were as follows:

	Points	Captained by
1..The Wiremen	11	S. Miszkowski
2. Engineers II	9	K. J. Magnusson
3. Maintenance	8	T. L. Maher
4. Model Shop Atoms	7	J. Luther
5. Drafting	6	W. E. Carpenter
6. Guards	6	A. E. Anderson
7. Office	6	T. T. Tams
8. Model Shop Big Six	5	M. Pfeiffer
9. The Chumps	4	L. Liniewicz
10. Engineers I	4	P. T. Smith
11. Model Shop Avengers	3	J. Bernath
12. Model Shop Gold	3	G. S. Lewis

Individual High Single Game

1. Parry (Office) 221
2. Summers (Office) 201
3. Butterfoss (Wiremen) 195

Individual High Three-Game Series

Parry (Office) 562

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LETTERS FROM RCAL EMPLOYEES IN THE ARMED SERVICES

October 7, 1945

Hello:

A few words to let you know I'm still alive and kicking. Also , will you please take good note of my new address. It causes a great delay in me getting your mail. Two weeks ago, I got the "Radio Age" and "News"; you should have seen the envelope. It seemed to me to have every post office mark of the Navy on the east and west coast. I should have notified you earlier. I'm very much interested in getting the mail from you as this last copy of the "News" had several articles of benefit to me. Especially one, it's the article on the klystron. I've been in a haze in understanding while working with it. It was of great help.

Thanking you,

Sincerely yours,

Michael Fichera

Gentlemen:

Thank you for the June edition of RCA Laboratory News. It seems like everything around RCA is about the same. I like to read the letters that are written in by employees in the service, and have learned that some of my friends have been taken into the service since I left.

Guess everyone at RCA is glad the war is over so they can go ahead with reconversion.

My APO is changed from 321 to 337 and my rank from Sgt. to T/Sgt.

Sincerely yours,

John Tyrrell

Hello Everybody:

Due to the fact that I am a very poor correspondent, I hope my friends have not forgotten me. It has been a very long time since my last letter. Surprisingly enough very little has occurred in all that time. Perhaps a little change in scenery now and then but everything else almost the same.

The only vital link that I have with the outside world is the mail. I have been getting the "Laboratories News" which keeps me up to date with the happenings at Princeton. They may be a long time in coming out here but it is always fresh news to me. I do enjoy and anxiously look forward to receiving them. Please keep-em-coming.

Being aboard a tender, I come in contact with a lot of ships. I am always on the lookout for a friend or a former RCA Labs. employee. So far no success.

Perhaps you may have noticed the change in rate. I have been advanced to first-class. The "S" attached to the rating means shop. That is to differentiate between the shop machinists and the engine-room force. We in the shop work our machine tools just as we did as civilians. With the extra hours we put in at times, I get that old civilian feeling.

At this time, I am working the grinding department of the machine shop. I spend my time between a cylindrical grinder and a surface grinder. Although things are a bit crowded and conditions are not perfect as they are in the Model Shop, accuracy is required. We have built up a good reputation as a repair ship with so little time out of the states.

How is your new productral scheduling board working out? It would be mighty nice for me if I was there to help with it. I doubt whether I'd be of any help or not, but it would be mighty nice

to just be able to be back there again in the same capacity I was a couple of years ago. I really did enjoy my work there and believe you me, there will be a day yet when I'll be back there beating at your door for a job at RCAL. I have not heard from anyone at the "Labs." for quite awhile now, so I am very lax on all the latest happenings at RCAL.

I hope you will excuse all my errors. Maybe it's because I cannot keep more than one eye open at a time, but I am sure a little sack duty will fix that, and it will not be very much longer before I'll be getting it either; that is, if I get to my sack before I fall asleep here.

Give my regards to the Model Shop "crew" and tell them to let me in on the news once in awhile with a letter or two. Thanks heaps for the letter. I am always glad to hear from you, so write when you find the time. Good luck to you and all at RCAL.

As Ever,

H. W. Hutchison

Hq. Co., 3rd Bn., 26th Infantry
Furth, Germany
September 29, 1945

Model Shop Gang

Hi ya Gang:

Just a few lines to let you know I'm still here in the ETO. Yes still here and wondering how soon I'll be back home. Hope I can make it by Christmas but I have my doubts.

I was in Schonback, Czech. when the war ended here in Europe. Stayed in Czech. until June 10th. From there we moved to Ausbach, Germany. Stayed there at a former German artillery barracks where we were engaged in the job of discharging German P.W's. Moved from there to Nurenburg on Aug. 14. While there we were busy setting up communications for the war crimes trials commission in the Palace of Justice Building. The jail where all the Nazi "big-shots" were quartered was directly behind the building we were using for billets but I never saw any of them. Moved from there to my present location here at Furth, about 5 miles from Nuremburg. Now I'm just operating a switchboard and "sweating out" getting home.

I don't know whether any of you have ever seen our (American printed) Germany money so I'm enclosing a one Mark piece worth 10 cents American money. They are also printed in ½, 5, 10, 20, 50 & 100 Mark denominations worth 5 cents, 50 cents, 1 buck, 2 bucks, 5 & 10 bucks respectively.

I have been overseas now for slightly over a year, having left Boston last Sept. 14 and arriving at Liverpool, England Sept. 22. It's been a long time and I want to get back now.

I joined this outfit on Nov. 20 and saw my first combat in Hurtgon Forest. A pretty rough time there. We were in a rest area at the time of the breakthrough last Dec. and they sent us up on line Dec. 17 and we remained right up front from there on until V-E day. This Div. has been slated for occupation and our particular regiment (26th) has the job of guarding in and around the Court House for the trials. Of course all the high point men have shipped out either to the States or to another outfit that is slated for the States in the near future. Just how soon I'll leave here and start home is the big question for me right now. It can't be too soon as far as I'm concerned. It sure will be good to be back and become a civilian again.

If any of you could manage to send me a nice gooey ice cream sundae or a quart of fresh milk, I'd sure appreciate it a lot. But that's out of the question so I guess I'll just have to wait till I get home.

This town of Furth is hardly touched as far as bombings and shellings go but Nuremburg was damaged quite a bit. I'm glad the damage was done here instead of to our homes there in the States. From the looks of things here in Germany they'll be years rebuilding it.

I guess that covers all the high spots in the news from here so I'll close with the wish that I'll be home soon and back to work at RCAL.

Yours

Camp. W. Fell

P.S. How about droping me a few lines. I've plenty of time to write now.

Sunday, 7 October, 1945

Dear Mr. Creager:

I wish to acknowledge and tell you how much I appreciate your letter of 16 July.

Personally I am well and I do hope all my friends at the Labs. are the same.

Things have been moving very fast for me since my last letter and I will try to bring you up to date.

At this writing, we are still at Jinsen but securing everything for sea. Tomorrow we are getting underway for Shanghi, China. As yet, we have no information as to what we can expect or what we are going to do down there. There has been very little repair work and no battle damage and we do not expect any more.

As for this port, I have had liberty twice and have seen all I want to. It is quite interesting at first but the slums, dirt, and poverty gets you after a time. The Japs who were in control are the only ones who look well-dressed and clean, which can be expected since they exploited the people.

We, as liberal-minded conquerors, the local populate finds very interesting and amusing at times. They take a keen interest in anything we wear or carry especially any equipment or uniform. The interest is very mutual.

As sovenier hunters we comb the place for appropiate things to buy. We exchange our money for Korean yen which is worth 6.7 cents a piece. So far, I have had very little success for everything is cheap Japanese junk. The real stuff such as samuori swords, pistols, etc. is in the hands of the Army boys who demand exhorbitant prices or will trade for a quart of good American whiskey. If anyone had the whiskey it would have been consumed long ago. Speaking about intoxicating beverages, the fellows buy a bottle of 'Sake' (a liter bottle) for only 10 yen. It was pretty potent stuff for a lot of the boys who drank it were unconcious of their doings after awhile. The smell of the stuff made me a bit sick. I indulged in three bottles of stateside beer sold at the Naval Shore Facilities canteen.

I have seen some very interesting local machine shops with a screw cutting lathe run by one-manpower. The lathe has a large hand wheel geared to the head-stock spindle which a man turns while another operates the lathe. It was a well built-fairly modern looking job at that. Manpower is cheaper than buying an electric motor for they do have electricity.

The more I saw of the place the more convinced I am that there is no place in the world to compare to the U.S. In fact, I formed that opinion when I first left the states in June, 1944.

According to the scuttlebutt (rumors), that have been passing around quite vigorously these past few days, we may see a real Christmas tree this year. Some supposidly well informed sources say that the "Good Ship Sierra" is due in San Diego by 10 December. All we can do is hope and pray it is so.

Not having been home since February, 1944 it would really be a very Merry Christmas at home this year. My points, as they stand at this writing amount to 39. The critical point score remains at 44 but it is bound to be lowered soon. I am figuring on having the required amount by the time I hit the states.

As you can very well imagine, how agonizing this waiting can be. I guess we must practice our patience for there is nothing else we can do.

I have no more news for this end so I will end here. Remember me to everyone.

As always,

Morris J. Sprachman

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Revised Addressed of Employees in the Armed Services

Morris J. Sprachman - MMS 1/c
U.S.S. Sierra (AD-18)
7th Div. - c/o F.P.O.
San Francisco, California

Michael Fichera - RT 2/c
906-23-65 U.S.N.R.
U.S.S. Rapidan (AO-18)
F.P.O. San Francisco, California

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We are grateful to Morris Sprachman for sending us the following story release describing the activities of his ship, the U.S.S. Sierra.

He also enclosed a photograph of the ship which is available in the editor's office for any who wish to see it. We regret that it is not a type of print which we can reproduce here.

"NEW DESTROYER TENDER IS FLOATING NAVY YARD"

A "Floating Navy Yard" could be the appropriate name given to a destroyer tender, since she renders a vast number of services to the fleet. Although, as the name implies, this type of ship is primarily designed to tend the destroyer fleets, she is frequently called upon to use her facilities for the repair of all units of the Navy ranging from landing craft to battleships. The U.S.S. Sierra, a destroyer tender assigned to the Pacific Fleet, is one of the 'fix-it-anything' vessels engaged in these activities.

In the yards of the Tampa Shipbuilding Company, Tampa, Florida, the U.S.S. SIERRA, named for the Sierra-Nevada Mountains, was commissioned on March 20, 1944. The crew, composed of specially trained artisans, CB units, SR units, supplemented by recruits, was assembled at Newport, Rhode Island and Tampa, Florida.

After fitting out and a brief shakedown in Chesapeake Bay, the SIERRA steamed her way through the Panama Canal and headed for the Hawaiian Islands, where at Pearl Harbor, a scant three months after commissioning, she was surrounded by a brood of destroyers just returned from the battle line. The new but well organized repair crews under the able guidance of Repair Officer Lieutenant Commander George B. Gandy, USNR, of Madison, Florida, worked 'round the clock to repair these destroyers and ready them for their return to the battle zones to hit the sons of heaven where it hurt the most. When a tally was made, the SIERRA was commended by the Commander Destroyers, Pacific Fleet, for performing 21,393 man-hours of work on 65 ships in a nine day period.

With the preparations for the invasion of the Philippines and the need for service units in the advanced areas, the SIERRA proceeded to Manus in the Admiralty Islands and assimilated a division of Commander Service Squadron TEN and Representative Commander Destroyers Pacific. The addition of these staff duties augmented this tender's regular activities to include the guidance of all service and repair functions for the fleet there at Seeadler Harbor. During her five month' stay at this harbor, the SIERRA performed her two most outstanding repair jobs, the replacement of a complete 5 inch twin-mount on the battleship, U.S.S. CALIFORNIA, and the complete rebuilding of the starboard stern on the destroyer, U.S.S. CLAXTON.

Port Purvis in the historic Solomon Islands was the site for the U.S.S. SIERRA's next assignment. In a five week period, this destroyer tender distinguished herself by replacing worn and damaged screws with divers substituting for drydock facilities, by rebuilding galley units, by rewinding and repairing hundreds of electric motors of various sizes, and by rendering other miscellaneous tender services to a fleet of LST's destined to carry troops and equipment for the invasion of Iwo Jima. At the completion of her assignment at Port Purvis, the SIERRA moved on for a brief stay at Ulithi Island and is now somewhere in the Western Pacific.

The business end of a destroyer tender, which is in addition to the services rendered by a fleet repair ship, is handled by the Supply Department and on the SIERRA it is 'big business' as proved by the figures for a recent three month' period. The Ship's Store, which sells articles of everyday use such as candy bars, soap, cigarettes, ice-cream and stationery, handled $139,846.00 worth of merchandise. Uniforms, socks, handkerchiefs, shoes and miscellaneous other articles of wear were sold for $81,469.00 to the crew of this ship and ships tended. Dry, fresh and frozen provisions in the amount of 1374 tons were issued to messes of this and other ships. The Cobbler Shop resoled and reheeled 1,303 pairs of shoes while the Barber Shop performed 10,000 haircuts. The Supply Department made 10,171 issues, a total of 61,026 items, from its stock of 18,000 varied items carried. The Post Office, which not only handles a large volume of business in mail and stamps, wrote $225,000 worth of money orders. In addition to directly assisting the war effort, the crew of

the U.S.S. SIERRA invested $48,000 in War Bonds during the same three month' period.

A miniature Naval Hospital, under the skillful supervision of Commander Hubbard P. Saunders, (MC), USNR, of Chicago, Illinois, is equipped with an operating room and the most modern facilities for protecting the health of this "floating city" of 1,100 men and provides dental care and special medical assistance to all ships tended.

Captain Elmer R. Runquist, U.S. Navy, of Long Beach, California, the commanding officer of the U.S.S. SIERRA says, "Surface operations against the enemy would be seriously impaired without the services of a destroyer tender. The specialists on board the SIERRA, whether they be Electricians' Mates, Cobblers, or Storekeepers, have the envied reputation of turning out high quality work in large quantities."

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Graduate Study at Princeton University leading to Doctorate

for Selected Members of RCA Laboratories Staff located at Princeton

During the war, Selective Service policies interrupted the formal university training of many young research scientists and engineers. Many of these young men, who have had from one to several years' experience in war research, desire to complete the requirements for their doctor's degrees. However, they hesitate to take up full-time study again because they do not wish to interrupt their practical research experience already well begun and because of the financial problems involved.

In order to meet the needs of those in this category who are now on our research staff or who might be employed from among those leaving temporary war research organizations, we have formulated with Princeton University a plan whereby a limited number of such persons might be employed at RCA Laboratories half-time and carry on graduate study at the University. Because of the proximity of RCA Laboratories to Princeton University, we expect that suitable scheduling of classes and work hours can be arranged. It is hoped that in as many cases as possible work assignments at the Laboratories will provide suitable material for the doctoral dissertation.

Employees selected to participate in this plan will be placed on a half-time basis at RCA Laboratories during periods of active study at the University and during such periods will be paid half of their basic salary or $150 per month, whichever amount is greater. The basic salaries of the participants will in the meantime be subject to review and increase in the usual way. It is expected that RCA will also provide for tuition and other University fees to the extent of about $350 per man per year.

The selection of those to be included in this program will be made by a committee consisting of the Research Director, the Associate Research Directors, and C. M. Burrill as Secretary. The basis of choice will be the probable value of the proposed graduate study in enhancing the career of the individual in research with RCA. Those accepted by RCA must also be accepted by Princeton University as candidates for the doctorate under this cooperative program, and continuance in the program will be dependent on the maintenance of satisfactory academic standing.

Informal applications for admission to this program should be made to C. M. Burrill without delay. He will be glad to discuss the plan with you and give you any further information regarding it which may later become available.

October 26, 1945

E. W. Engstrom,
Research Director

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LIBRARY INFORMATION

Timely Reading found on the Library Shelves:

Books:

Born, M. - Atomic physics. 1935
Born, M. - The constitution of matter, modern and electron theories, 1923.
Crowther, J. A. - Ions, electrons and ionizing radiations, 1934.
Darrow, K. K. - Introduction to contemporary physics. 1939.
Fermi, E. - Nuclear physics. 1941.
Gamow, G. - Mr. Tompkins explores the atom. 1944.
Haas, A. E. - Atomic theory. 1936.
Harnwell, G. P. - Experimental atomic physics. 1933.
Herzberg. G. - Atomspektren und atomstruktur. 1936.
Loeb, L. B. - Atomic structure. 1938.
Physical Society - Reports on progress in physics. 1937 to date.
Pollard, E. C. - Applied nuclear physics. 1942.
Rosetti, F. - Elements of nuclear physics. 1936.
Rice, O. K. - Electronic structure and chemical binding. 1940.
Rusk, R. D. - Forward with science. 1943.
Russell, B. - The ABC of atoms. 1924.
Stranathan, J. D. - Particles of modern physics. 1942.
Smyth, H. D. - Atomic energy. 1945.

Articles:

Atomic bomb development kept steel industry guessing for years, Iron Age, Aug. 9, 1945.
Atomic bomb sidelights, Iron Age, August 23, 1945.
Atomic energy harnessed in great scientific achievement, Chemical and Engineering News, August 10, 1945.
Canning uranium slugs, H. D. Smyth, Science, August 31, 1945.
Atom new source of energy, Electronics, September, 1945.
Facts about atomic power, Electronics, September, 1945.
Uranium ore supply, Chemical and Engineering News, August 10, 1945.
Atomic bombs, A. P. Peck, Scientific American, October, 1945.
The atom, new source of energy, The atomic frame of reference - or else, H. Powell, Aviation, September, 1945.
The atomic bomb, Nature, September 29, 1945.
Conquest of uranium and the atomic bomb, Chemical and Metallurgical Engineering, September, 1945.
The technical basis of atomic explosives, Electronics, October, 1945.
Generation of atomic power from elements, H. G. Shea, Electronic Industries, October, 1945.

New Employees at Princeton Laboratories.

In this issue, to assist us in recognizing new employees when we meet them, we are presenting this page of photographs of those who have come with our Princeton Laboratories during the past several months. With each following issue similar pages will appear to bring our readers up to date. If other Divisions of RCA Laboratories wish to send in photographs of their new employees we will be very glad to print them.

J. W. Doyle

Mrs. R.M. Eller

W. S. Ewart

R. R. Fiabane

C. J. Hassell

J. P. Honore, Jr.

H. L. Irvine

Miss A. Jackel

Miss J.T. Magnani

S. J. Ritter

J. Stasyszyn

P. A. Urbani

W. Wyss

RCA DEMONSTRATES NEW TELEVISION CAMERA TUBE OF REVOLUTIONARY SENSITIVITY

A new television camera tube of revolutionary sensitivity emerged from wartime secrecy on October 25 for exhibition by RCA in a series of studio and remote pickups in which it transmitted scenes illuminated only by candle and match light. Its ability to pick up scenes with infra-red rays in a blacked-out room was also demonstrated.

The new tube, known as the RCA Image Orthicon, was demonstrated to newspaper and magazine writers in a studio of the National Broadcasting Company, Radio City, with the cooperation of NBC's engineering and production staff. Ben Grauer, NBC announcer, acted as program commentator. In the exhibition, members of the audience saw themselves televised under lighting conditions that convincingly proved the super sensitivity of the new electronic "eye" which solves many of the major difficulties of illumination in television programming and makes possible 'round-the-clock television coverage of news and special events.

Further evidence of the tube's superiority came in the transmission of scenes from a special rodeo show arranged at Madison Square Garden for the visiting United States Navy Fleet. Exciting cowboy acts were picked up by the Image Orthicon and transmitted to the studio in a comparative demonstration showing its advantage over conventional television pickup tubes in providing greater depth of perception and clearer views under shifting light conditions.

The final demonstration involved blacking out the studio where the writers were assembled, and picking up television scenes in apparent darkness. Infra-red (black) lights were turned on, and to the eye it was so dark that a member of the audience could not see the person next to him. Then on the screens of television receivers in the studio appeared bright images of a dancer and other persons who were in the room. The Image Orthicon tube achieved this feat through its sensitivity to infra-red rays.

The Image Orthicon is approximately 100 times more sensitive than conventional pick-up tubes. Early models were built before the war in efforts of RCA television scientists and engineers to improve the quality of television transmission. When war came, the armed forces found urgent need for television applications, and throughout the conflict RCA research and development continued at an accelerated pace in response to military requirements.

Many advances were made. The Image Orthicon tube, for example, emerged in its present form much sooner than would normally have been the case. A military secret until now, it can be revealed that it makes use of the most advanced results of more than twenty years of research not only in television pick-up tubes but in electron optics, photo-emission processes, electron multipliers, and special materials. Many members of RCA's research staff contributed to this background of information and while the limits of this news item prevent us from listing the names of all these men, they, nonetheless, deserve recognition for the part they played in this development. Without them and the contributions they made, the development of this tube at this time would have been impossible.

The basic design of the tube was developed by three members of the RCA research staff: Dr. Albert Rose, Dr. Paul K. Weimer and Dr. Harold B. Law. Engineering for pilot production of the Image Orthicon for military purposes was carried on and completed at RCA Laboratories and was continued at the tube division plant at Lancaster.

Incorporation of the Image Orthicon in a new super-sensitive television camera to be manufactured by RCA Victor was announced and it was stated that deliveries on the camera were expected to be made to television broadcasters in about six months. Specific advantages in performance of the Image Orthicon may be listed as follows:

1. Improved sensitivity permits extension of the range of operations to practically all scenes of visual interest, particularly those under low-lighting conditions.

2. Improved sensitivity, permitting greater depth of field and inclusion of background that might otherwise be blurred.

3. Improved stability which protects images from interference due to exploding photo flash bulbs and other sudden bursts of brilliant light.

4. Smaller size of tube, facilitating use of telephoto lens.

5. Type of design that lends itself to use in lightweight, portable television camera equipment.

6. Inherent automatic gain control provides invarying transmission, despite wide fluctuations of light and shadow.

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NEWLY DEVELOPED RCA RADIO RELAY SYSTEM WILL BE USED IN VAST WESTERN UNION PLAN

During the week of October 22 the Radio Corporation of America and the Western Union Telegraph Company announced the development of a micro-wave radio relay system with which the latter company proposes to improve and speed its services between leading American cities.

The system already has one link in operation for test purposes between New York and Philadelphia. For this distance, two intermediate relay points are necessary; one near Bordentown, N. J. and one at 10-Mile Run near New Brunswick, N. J. Installation of two transmitters and two receivers at each relay point provides for simultaneous two-way operation. The relay stations are unattended and thus inexpensive to operate.

At each point of the New York-Philadelphia link a 100 ft. steel tower is erected on top of which is an 8 ft. square enclosed cabin. On the outside of the cabin are four bowl-shaped reflectors at the center of which are the tiny high-frequency antennas. One bowl-antenna on the East side of the tower is connected to the East-to-West receiver and the other to the West-to-East transmitter. The two-Bowl-Antennas on the West side of the tower are similarly connected, respectively to the West-to-East receiver and the East-to-West transmitter. The transmitters and receivers, together with the demodulating and modulating circuits are housed in the cabin. The transmitters in the present system put out about one-tenth of a watt. However, when it is considered that the antennas have a power gain of

900 (so that the receiver-antenna to transmitter-antenna gain is 810,000) it will be noted that the equivalent non-directive power is 81 kilowatts.

The system operates in the band of 3900--4450 megacycles. The channel width transmitted by the present system is 150 kilocycles. It has been estimated that this is sufficient for 270 multiplex or 1080 single, telegraph circuits. It could probably handle at least 25 ordinary telephone circuits, or if used for high-quality FM broadcast service, possibly eight channels. The present bandwidth is insufficient for television, but it is expected that new equipment, of higher power, which is soon to be available may provide the necessary 6 megacycle television bandwidth.

In its six months operation to date, this new radio circuit has performed admirably in the face of the rigid requirements of regular commercial operating practice. As a result of this experience the Western Union Company has filed an application with the Federal Communications Commission requesting permission to install equipment of a similar type in lines from New York to Pittsburgh, Pittsburgh to Washington, Washington to New York, and New York to Philadelphia. These are the first links of what Western Union has indicated will eventually be a nation-wide network.

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RCA MAKES GIFT OF $25,000 TO PRINCETON UNIVERSITY

On October 24, a luncheon was given by the RCA Education Committee and representatives of RCA Laboratories for Dr. Dodds, President of Princeton University and several of his associates. At this luncheon, Dr. Angell presented to Dr. Dodds a check for $25,000 as a gift from RCA to the University. In accepting and responding, Dr. Dodds commented upon the generosity, indicating that the money would be devoted to fields in which the University and RCA have interests. This is repeated in the following paragraph excerpted from a letter received from Dr. Dodds following the luncheon:

> "As I promised at the luncheon, the money will be devoted to fields in which the two organizations are mutually interested. While your check of $25,000 represents most substantial assistance we appreciate it also as an earnest of future relationships between the two institutions. Your contribution came as a complete surprise to us. It was a gracious and generous demonstration of good will, and we are very grateful."

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INTRA-STORE TELEVISION DEMONSTRATION TO BE GIVEN BY GIMBELS--PHILADELPHIA

An extensive demonstration of television was opened to the public on Wednesday, October 24 at the Philadelphia Gimbels store. The demonstration is designed to show the power of television as a department store selling medium and it will be used as a yardstick to measure the pulling power of television in building store traffic in selected selling areas.

The demonstration will continue for some time and the RCA Victor Division is cooperating by installing the equipment. The NBC is also cooperating by making available to the store, members of its television production staff. The experience gained at this location will serve as a test pattern for similar video projects to be presented by RCA Victor in department stores throughout the country.

In the Gimbel project, viewing centers will be installed on the seven floors of the store. Gimbel's auditorium will house the studio and control facilities, and an audience of 500 people will be able to see the television production in action at each showing. Shows will be produced every half hour for ten minute intervals with emphasis on dramatic presentations of the store's merchandise, supplemented by entertainment features.

Twenty TRK receivers and laboratory models of the postwar projection receiver will be supplied by RCA Victor and placed at advantageous positions throughout the store. In the street-level windows, facing Market Street, will be displayed a series of five television window exhibits which have been designed especially to give a graphic story in sequence of the evolution of television.

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Production Line-Up of RCA Manufacturing Plants

In a recent booklet issued by the Victor Division is given a list of the major products which will be produced by the various RCA plants. This information is printed below for the benefit of our readers.

Camden: Broadcast transmitters, communications equipment, electron microscopes, industrial electronic equipment, sound systems, home television receivers, industrial television equipment, records, export radio and many other products.

Indianapolis: Radio and television console sets, Victrolas, record changers, records, auto radios, receiving tubes.

Bloomington: Small radios and Victrolas of all types.

Harrison: Receiving and allied type tubes.

Lancaster: Power, cathode-ray, photo and special type tubes.

Saugerties: Tube mount assemblies.

Hollywood: Film and disc recording, manufacture of records.

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LECTURES BY RCA LABORATORIES TECHNICAL STAFF

Before the New York Section of the I.R.E. by S. W. Seeley on "Ratio Detectors for F-M Receivers" - October 3, 1945.

As part of a lecture course entitled "The Principles and Practice of Industrial Research" at New York University, E. W. Engstrom presented a lecture on "The Design and Operation of the Laboratory" - October 4, 1945.

Before a lecture course sponsored by the A.I.E.E. in New York City by G. H. Brown on "Introduction to and History of Induction and Dielectric Heating" - October 15, 1945.

Before the Montreal Section of the I.R.E. by G. H. Brown on "Radio-Frequency Dehydration of Penicillin Solution" - October 17, 1945.

Before the Panel on "Maritime Research" of the American Merchant Marine Conference sponsored by the Propeller Club in New York City by R. A. Hackley on "Sound Devices for the Merchant Marine" - October 17, 1945.

Before the Lehigh Valley Physics Club at Palmerton, Pa., by H. W. Leverenz on "Cathode Ray Tube Materials in War and Peace" - October 18, 1945.

Before the New York Section of the American Physical Society by A. Rose on "The Sensitivity of the Human Eye on an Absolute Scale" - November 9, 1945.

Before the New York Section of the American Physical Society by W. D. Hershberger on "The Absorption of Microwaves by Gasses" - November 10, 1945.

Before the New York Section of the American Physical Society by G. C. Sziklai and A. C. Schroeder on "Electronic Spectroscopy" - November 10, 1945.

Before the Cleveland Section of the Society of Automotive Engineers by E. W. Engstrom on "Radar" - November 12, 1945.

Before the Rochester Fall Meeting by E. W. Engstrom on "Television - a Review of Technical Status" - November 13, 1945.

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PERSONALS

MR. AND MRS. FERRARA CELEBRATE THE RETURN OF FIVE OF THEIR SEVEN SONS FROM SERVICE

Many families are proud, and justly so, to have had a son or daughter or perhaps two in the armed services, contributing toward the victorious conclusion of World War II. Mr. and Mrs. Lawrence Ferrara (Mr. Ferrara is a member of our Building and Grounds Group at RCAL) have unusual justification for such pride of family contribution. Their unique situation is ably described in the October 5 issue of THE PRINCETON HERALD from which we quote below:

"A soldier's homecoming is a wonderful and generally unique event in the lives of most American families, but Mr. and Mrs. Lawrence Ferrara, of 230 Witherspoon Street, have already celebrated the return of five sons and are awaiting daily the arrival of a sixth. A seventh son is still in Italy. Their younger daughter is a cadet nurse at St. Francis Hospital, Trenton.

"'Already we've had five parties, singing, dancing, good food and wine, all their friends

SURPRISE SHOWER GIVEN TO MISS SARA McCAFFERTY

Miss Sara E. McCafferty of the Purchasing Department recently became the bride of S/Sgt. Robert C. Hoffman of Princeton, New Jersey. The wedding took place on Saturday, September 22, 1945. S/Sgt. Hoffman recently returned after 16 months overseas in Europe. Mrs. Hoffman was given a surprise shower by the girls of the laboratories, and received many beautiful gifts. Refreshments were served and an enjoyable time was had by everyone present.

around,' Mrs. Ferrara told a representative of THE PRINCETON HERALD. 'Next month Vincent is coming from China. Thirty-six years ago I left Italy; now Peter, my oldest son, is there.'

"Private Peter Ferrara, 38, is the latest member of the family to receive a decoration. His unit, the 30th Signal Construction Battalion, has just received the Meritorious Service Unit Plaque for outstanding performance of duties in the Mediterranean Theatre. Mrs. Ferrara hinted that the party for Peter, when he returns, may also welcome his Italian fiancee.

"The next two children are the only ones not in the Armed Forces. Frank Ferrara, who was employed at the Raritan Arsenal and now has a bicycle shop in Princeton, was at one time called up and, if he had been taken, said his mother, would have been the only son to prefer the Navy; all the others have joined the Army or the Marines. However, Frank, married and the father of one son, was deferred.

"The Ferraras' elder daughter, Lucy, is now Mrs. Austin Brearley, and the mother of three-year-old Carol Ann.

"One of the first to receive a discharge was Lawrence, Jr., a Marine for over a year, married and the father of Betty Ann and Lawrence, III, born Sunday. Lawrence, as did all the other Ferrara children attended Princeton High School.

"Private First Class Anthony Ferrara, recently of the Air Corps, and a veteran of the New Guinea and Philippines campaigns, received a medical discharge last month. He is planning to study electrical engineering at a vocational school.

"At home now on furlough, Corporal Marino Ferrara, a paratrooper, arrived in England just before V-E Day. Marino, the first to enlist, has been in the Army for five years and thinks that his high point score will get him out soon.

"The Bronze Star, "for meritorious service," actually for running a mail service up to the front lines with complete disregard for his own safety, was awarded some months ago to Technician Fourth Class Armond Ferrara, of the 3rd Armored Division. Armond, holder also of the Purple Heart, went into Normandy ten days after D-Day. Landing in England in the previous fall, he found the Scotch and the Welsh particularly fine people and he told the HERALD representatives that he enjoyed nothing more than sitting in on a discussion where American, English, Canadian, Scotch and Welsh soldiers presented their viewpoints.

"'Everyone argued, but there were few basic differences in ideas and ideals,' Armond said. 'Now, in Germany--the people did seem to work hard and they are clean, neat, industrious people as far as I saw--but they just don't think along the same lines as we do.'

"Armond, discharged on high points last week, is planning to take a refresher course and to resume his profession as a teacher of commercial subjects.

"First Lieutenant Vincent Ferrara, for whose arrival next month the red-and-white bunting and "Welcome Home Our Boys" signs are remaining festooned to the Ferrara home, has been flying the Hump from India to China, often serving as a pilot in the transportation of crack Chinese troops to strategic areas. Enlisting in the Army at the beginning of the war, Vincent was trained as an aviation cadet. He has been awarded the Distinguished Flying Cross and the Air Medal with two clusters. His mother thinks he will want to stay in aviation after the war, although he may leave Princeton to live in Texas, where he met and married his wife. His wife and infant son, Michael, are now staying with his parents to await his arrival.

"Private First Class Joseph Ferrara, 19, late of the Marines, has resumed his studies at Princeton High School where he is a member of the Senior Class. Joseph, although the huskiest son of the entire brood, picked up a streptococchi germ during his boot training and never quite threw it off. After several bouts of sickness, including a six-months' stay at Brooklyn Naval Hospital, he received a medical discharge. He plans to go on to business college after high school.

"The youngest child, Gloria, is a cadet nurse at St. Francis Hospital in Trenton and has another year or more of training before her.

"Mr. Ferrara, who is with the Radio Corporation of America Laboratories, and Mrs. Ferrara came to America 36 years ago from Italy. The worries and troubles of raising nine children have scarcely lined their smiling faces. 'It was hard to see them all go off to war,' Mrs. Ferrara said. 'But we will never forget how lucky we are--they all got through without being hurt badly. That's why we have the parties--we are lucky people.'"

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OUTING OF MODEL SHOP AND CO-WORKERS

A stag affair was held on Thursday evening, July 26, 1945 at Squatters Grove, Princeton, N. J. with an attendance of about 45. Upon arrival at the picnic grounds the group were greeted by heavy rains which lasted for about an hour. Another difficulty soon developed through the food becoming lost but fortunately it was found after a search of nearly an hour. A pleasant evening was being enjoyed by all until the boys noticed the creek rising higher and higher due to the rain storm. Finally it overflowed.

Other mishaps of the affair included Mr. Oehme losing two of his teeth in an ear of corn, Mr. Thompson losing one of his shoes in the mud, cars getting stuck in the mud, etc.

Outside of these inconveniences the boys had a good time and are looking forward to another affair with better weather conditions.

Those who attended give credit to the Model Shop Committee and to Guard Kraus who all worked hard to make the affair a success.

---"---

Miss Billiejean Testerman of our Tube Assembly Room was married to Pfc. Claude V. Warren on October 3rd, 1945 at the Benham Community Church at Benham, Kentucky. Pfc. C. V. Warren is stationed at present at Drew Field, Florida. Congratulations to the happy couple.

Mrs. B. A. Denton whose birthday was on Sunday, October 14, 1945 celebrated it on the following day so as to share the delicious goodies with her co-workers of the Tube Assembly Room.


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ED. DICKEY - EDITOR

THE IMAGE ORTHICON
A SENSITIVE TELEVISION PICK-UP TUBE

by

Albert Rose, Paul K. Weimer, and
Harold B. Law

Introduction

The importance of sensitive pick-up tubes to the success of a well rounded television service needs little emphasis. One has only to be reminded that in so far as the television pick-up tube is called upon to replace the human observer, the sensitivity of the pick-up tube should match that of the human eye. The demands on a television service are often more stringent than the demands on news photography, for example. The latter can, within wider limits, select the times and conditions under which it will record pictures. The pick-up tube, once committed to transmitting an event, such as a football game, must steadily transmit pictures under the whole gamut of lighting conditions. It is, accordingly, highly desirable to have a pick-up tube which can transmit pictures both at very low and at very high light levels.

The iconoscope has transmitted excellent pictures at high light levels; the orthicon has operated best at medium light levels. The image orthicon extends the range still further towards lower illuminations by a factor of approximately one hundred. At the same time, the image orthicon can operate stably at medium and high light levels. Unlike the orthicon, it is not subject to transient loss of operation caused by sudden bursts of illumination. The use of the image orthicon in the higher light ranges is not, however, emphasized relative to the iconoscope or orthicon. The additional complexity of the tube, needed to provide its increased sensitivity, has not yet permitted pictures whose quality equals the best that the iconoscope or orthicon can transmit.

The present paper describes the construction operation and performance of the image orthicon. It is hoped to treat some of the electron optical and constructional problems in more detail in separate papers.

General Description of the Image Orthicon

The usual storage type of pick-up tube(fig.1) has an electron gun, a photo-sensitive insulated surface, referred to as target, and a means for deflecting the electron scanning beam. The scene to be transmitted is focused on the target on which it builds up by photo emission a charge pattern corresponding to the light and shade in the original scene. The beam of electrons, generated by the electron gun is made to scan the charge image in a series of parallel lines. While a constant stream of electrons approaches the target, the stream which leaves is modulated by the charge pattern. A signal plate located close to the target surface picks up the modulation by capacitance and feeds it into the grid of the first amplifier tube. The same video signal, however, appears in the modulated stream of electrons leaving the target and,

Doctors A. Rose, P. K. Weimer, and H. B. Law
Discussing the Image Orthicon

if these electrons could be collected on a single electrode, the signal could be fed through it into an amplifier.

The image orthicon (fig.2) has, in addition to the usual gun, deflection means and target, three parts that contribute to its sensitivity and stability. An electron multiplier, built into the tube near the gun, multiplies the modulated stream of electrons returning from the target before it is fed into an amplifier. Sensitivity gains of ten to a hundred are thereby made possible. The charge pattern on the target, instead of being generated by photo emission, is formed by secondary emission from an electron image focused on the target. The electron image is released by light from the scene to be transmitted falling on a conducting semi-transparent photo-cathode and is focused on the target by a uniform magnetic field. The combination of the higher photo-sensitivities that can be obtained for a conducting surface than for an insulated surface and the secondary emission gain of the electron image at the target provides another factor of about five-fold increase in sensitivity. The use of a separate conducting photocathode is made possible by a two-sided target in place of the usual one-sided target. The two-sided target allows the charge pattern to be formed on one side and the scanning to take place on the opposite side. Further, it permits the tube to operate stably over a large range of scene brightness.

The electron multiplier, two-sided target and electron image section will be recognized as elements whose incorporation into a pick-up tube and whose virtues have been frequently

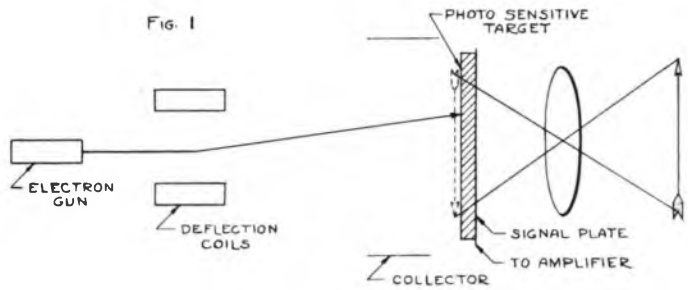

Fig. 1

discussed in the literature. The image orthicon represents one way of including all three elements into a useful, sensitive and stable pick-up tube.

Typical Operating Cycle

The scene to be transmitted is focused on the semi-transparent photo-cathode (fig.2). Photo electrons are released in direct proportion to the brightnesses of the various parts of the scene. The photo electrons are accelerated from the photo-cathode towards the target, by a uniform electric field and are focused on the target by a uniform magnetic field parallel to the axis of the tube. The paths of the electrons from photo-cathode to target are, except for emission velocities, substantially straight lines parallel to the axis. The electron image, accordingly, has unity magnification.

The photo electrons strike the target at about 300 volts at which potential the secondary emission ratio is greater than unity. Because more secondary electrons are emitted than there are incident photo electrons, a positive charge pattern is formed on the target, the high lights corresponding to the more positive areas. The secondary electrons are collected by the fine mesh screen.

At the same time that a charge pattern is being formed on one side of the target, a beam of electrons scans the opposite side. The scanning beam is of the low-velocity type already described for the orthicon. It starts at the thermionic cathode of the electron gun at zero potential and is accelerated by the gun to about 100 volts. From the gun to the target the beam is in an approximately uniform magnetic focusing field. As the beam electrons approach the target they are decelerated again to zero volts. If there is no positive charge on the target all the electrons are reflected and start to return towards the gun along their initial paths. If there is a positive charge pattern on the target, the beam electrons are deposited in sufficient numbers to neutralize the positive charges. The remaining electrons are reflected. In this way a stream of electrons, amplitude modulated by the charge pattern, is started on its way toward the gun.

The return beam not only starts back toward the gun, it actually arrives at the gun very near the defining aperture thru which it emerged. An electron beam will follow closely the lines of a magnetic field, under these conditions; the beam is initially directed along the magnetic lines; the beam velocity in volts does not greatly exceed the magnetic field strength in gausses; electric fields transverse to the magnetic field are small or absent; the magnetic lines do not bend sharply. All these conditions are fulfilled in the image orthicon. The beam is shot into the magnetic field parellel to its lines. The beam velocity in volts and magnetic field strength in gausses are each in the neighborhood of 100. The only prominent electric field is near the target and parallel to the magnetic field. The bends in the magnetic field caused by the transverse fields of the deflecting coils are well tapered.

The return beam accordingly strikes the gun in an area around the defining aperture which is small compared with the defining aperature disc but large compared with the defining aperture itself. Also, the return beam strikes this surface at about 200 volts and generates a larger number of secondary electrons than there were incident primary electrons. In short, the defining aperture disc is also the first stage of an electron multiplier. Succeeding stages of the multiplier are arranged symmetrically around and back of the first stage. Meantime, the secondary electrons are drawn from the first stage by suitable electric fields into the succeeding stages. The number of stages, as will be explained, need not be large to exhaust the useful gain of the multiplier. In its present form, the image orthicon uses five stages of electron multiplication.

The output current from the final stage of the multiplier is fed into a wide-band television amplifier in the usual manner. Be-

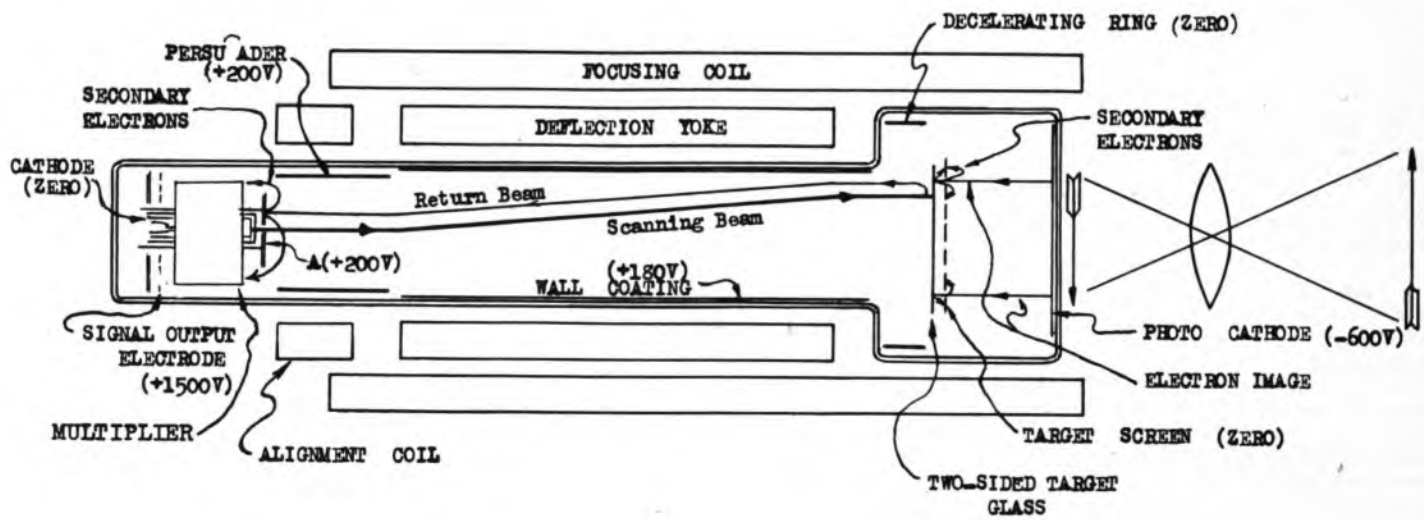

Fig. 2.

cause this output current is already at a high level, the required gain of the amplifier is small compared with that for an iconoscope or orthicon. The high-level output has other advantages. The performance of the tube, for example, is not critically dependent upon the noise characteristics and input circuit parameters of the pre-amplifier as is the case for iconoscope and orthicon.

The above operating cycle, while somewhat elaborate, is nevertheless easily traceable. On the other hand, the detailed operation of the parts of the tube does include some interesting and less obvious problems. These will be discussed below.

Electron Image Section

The semi-transparent conducting photocathode is a well known structure for getting photo emission from the side opposite to that from which the light enters. Photo-sensitivities several times higher than those for insulating mosaic surfaces can be obtained.

The use of a uniform magnetic field to focus the electron image is not only well known but is also one of the simplest methods of electron image formation. Unity magnification, erect image and good definition at low anode voltages are its characteristics.

Construction of the Two-sided Target

The two-sided target is perhaps one of the oldest and most frequently proposed structures for improving the sensitivity of a television pick-up tube. It makes possible the separation of charging and discharging processes so that the sensitizing procedures and electric fields appropriate to each may be incorporated in the tube without mutual interference. The two-sided target must conduct charges between its two surfaces but not along either surface. It should have a conducting element nearby to act as the common condenser plate for the separate picture elements.

Most of the attempts to fabricate two-sided targets have centered on a structure which had discrete conducting elements or "plugs" embedded in an insulating medium. These have been satisfactory for testing the properties of a two-sided target but have failed thus far to provide the uniformity necessary for a commercial tube.

The two-sided target used in the image orthicon is exceedingly simple and capable of a high degree of uniformity. It is a thin sheet of low resistivity glass. The resistivity is chosen low enough so that charges deposited on opposite sides of the glass are neutralized by conduction in a frame time (1/30 second). It is chosen thin enough so that these same charges do not spread latterally in a frame time sufficiently to impair the resolution of the charge pattern. Thicknesses of five to ten wavelengths of light have been found to be satisfactory.

The thin sheet of glass, about 1½ inches in diameter, is mounted flat to within a few thousandths of an inch and spaced about two thousandths of an inch from a similarly flat fine mesh screen. The mounting techniques to achieve these tolerances have been the subject of a considerable amount of work. The problem is especially accentuated when it is realized that the assembled structure must go thru a standard bake out schedule at about 400°C. Satisfactory assemblies were obtained only after the glass and screen were each mounted under tension on flat metal rings. The metal ring for the glass had to be carefully chosen so that the 400°C bakeout did not cause the glass either to break or to wrinkle on cooling.

The fine mesh screen mounted near the glass target to collect secondary electrons and to act as the common capacitive member for all of the picture elements has been itself a problem of appreciable magnitude. Because the electron image passes thru the screen and impresses the shadow of its wires on the picture, the screen had to be of extremely fine mesh and highly uniform. In addition, for efficient operation, it was desirable to have the percentage open area of the screen 50% or greater. The finest commercial screen, available during the early development of this tube, which had even reasonable uniformity was a 230 mesh per lineal inch, woven wire, stainless steel screen made by Tyler Co. It had 47% open area and could be etched to about 60% open area. The 230 mesh screen was however readily resolved in the transmitted picture and limited the resolution objectionably.

In contrast to this screen a technique was developed for making fine mesh screens with 500 to 1000 meshes per lineal inch, an open area of 50 to 75% and an accuracy of spacing comparable with that of a ruled optical grating. These screens have made possible the transmission of pictures with high definition and substantial freedom from spurious signals.

Operation of the Two-sided Target

Fig. (3) shows the potentials* of the two sides of the glass target during a typical charge-discharge cycle. In Fig. 3a the tube has been in the dark. The scanned side of the target has been brought to zero volts by the scanning beam. The picture side also is at zero volts as a result of leakage to the scanned side. The fine mesh screen for collecting secondary electrons is held at +1 volts. Fig. 3b shows the target potentials after exposure to light for a frame time. The picture side of the glass has been charged to +1 volts by the electron image. The scanned side of the target, also has been brought up to +1 volt by capacitive coupling to the picture side. In Fig. 3c, the beam has just scanned the target bringing the scanned side down to zero volts and the picture side down almost to zero volts by its capacitive coupling to the scanned side. The "almost" results from the fact that there is a positive charge on one side of the glass and a negative charge on the other, constituting a charged condenser. If, therefore, the scanned side is brought to zero volts the picture side must be positive by an amount equal to the picture charge divided by the capacitance between the two sides of the glass. This turns out to be small compared with the +1 volt to which the target as a whole had been charged. In particular it is shown to be 0.01 volts in the illustration chosen. During the next frame time the charges on the two sides of the glass unite by conduction to wipe out the potential difference between the two sides. Fig. 3d shows the potentials at this time and, by comparison with Fig. a, the target has re-

*For simplicity, the emission velocities of thermonic and secondary electrons are taken to be zero and the contact potentials of all surfaces are taken to be the same. Including finite emission velocities and contact potential differences would merely shift the values of the potentials shown in Fig. (3) without affecting the argument.

turned to its initial state ready for another cycle.

In the above cycle, the charging by the picture, discharging by the beam and leakage between the two sides of the glass were described as events in series. Actually, of course, all three events occur simultaneously and steadily.

It may be remarked, in passing, that the choice of a glass with too high a resistivity (that is, a leakage time constant greater than a frame time) tends to allow charge to accumulate on the picture side. For sufficiently high resistivities, an objectionable loss of signal, as well as spurious after images, is encountered.

Electron Multiplier

In spite of the variety of electron multipliers offered by the literature, it was thought desirable to add still another to the list - one which was more nearly suited to the requirements of the image orthicon. A brief consideration of the diffuse spray of secondary electrons emerging from the first multiplier stage (defining aperture disc) suggests immediately the difficulties of getting all of them to enter the relatively narrow mouth of the more conventional electron multipliers. This is particularly so because it was desirable, for other reasons, to retain the axial symmetry of the electric field in front of the first stage. To focus the secondary electrons into a narrow mouth multiplier might very well require objectionably strong assymetric electric fields. Once committed to the symmetry of fields, one is also committed to a relatively large entrance opening for the second stage of the multiplier because the secondary electrons spray out symmetrically or "fountain-wise" from the first stage.

It was found to be relatively easy to arrange for substantially all of the secondary electrons from the first stage to strike the large annular disc second stage shown in Fig.2. The arrangement consisted of surrounding the first stage with electrodes all at lower potential than the first stage with the one exception: the second stage. In this way the electrons were offered two alternatives: to return to their place of origin, the first stage, or to land on the second stage*. Energetically the electrons could return to the first stage since they were emitted from it with a few volts of spare energy. But to return to the first stage the electrons must approach it at nearly normal incidence or more accurately with all but their emission energy directed normal to the surface. The brief excursion of the electrons into the strong dispersing field provided by the more positive second stage makes the probability of such return small. The secondary electrons from the first stage accordingly quickly find their way to the second stage.

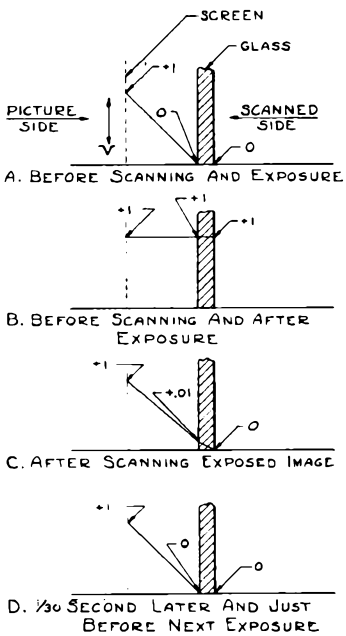

FIG. 3 CHARGE DISCHARGE CYCLE FOR CLOSE SPACED TARGET

Here the problem is to multiply the electrons again and send them on to a third stage and so on thru a number of stages to the final collector. The use of a series of parallel-screen multipliers is well suited geometrically to the problem but the efficiency of the screen-type multiplier is low. That is, for a secondary emission ratio of four the gain per stage is only about two. A substantial improvement in efficiency was obtained by a special design of multiplier. The operation of the multiplier was found to be uncritical to electrical adjustment and mechanical alignment. Both these features are highly desirable to simplify the construction and operation of an otherwise complex tube.

The operation of the multiplier was found to be uncritical to electrical adjustment and mechanical alignment. Both these features are highly desirable to simplify the construction and operation of an otherwise complex tube.

Total gains of 200 to 500 are readily obtained for the five-stage multiplier. These gains are usually more than sufficient to exhaust the sensitivity possibilities of electron multiplication. The "useful" gain obtainable with electron multiplication is discussed in the following section.

Sensitivity

The image orthicon derives its increased sensitivity over the iconoscope and orthicon from (1) its electron image section, and (2) the electron multiplier for its signal current. The gain from the image section is approximately five fold and is attributable mostly to the increased photo-sensitivity of a conducting photocathode relative to a photo-sensitive mosaic surface. The gain from the electron multiplier for the signal current depends upon the scene brightness as follows: The sensitivity of the image orthicon is limited by shot noise in the scanning beam. The sensitivity of iconoscope or orthicon is limited by shot noise in the first amplifier tube. The purpose of the multiplier is to raise the level of scanning beam shot noise up to the level of amplifier noise. Because the scanning beam current (and its associated noise) decreases for lower scene brightnesses while the noise of a television amplifier is independent of scene brightness, the gain from use of the multiplier varies with scene brightness. In particular it varies from about 20 for high light scenes to about 200 for very low light scenes. The overall sensitivity gain of the image orthicon, accordingly, varies from about 100 to about 1000.

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*The third possibility, that of retaining their freedom in space, is usually of negligably short duration.

Signal versus Light Characteristics

To summarize: in the low light range, the image orthicon acts like an orthicon; in the high light range, the transmitted picture is substantially independent of scene brightness, the contrast and half tone scale being maintained by redistributed secondary electrons on the picture side of the target. These redistributed electrons have also the property of tending to keep moving images in sharp focus.

Resolution

Starting at one end of the tube with a well focused image on the photocathode, the picture undergoes three transformations before emerging from the multiplier at the other end in the form of a modulated signal current. The transformations are, in order: optical image to electron image, electron image to charge pattern on the target, charge pattern to modulated stream of electrons in the scanning beam. Each transformation separately has been capable of resolving over 1000 lines per inch; the combination has resolved well over 500 lines per inch.

The resolution of the electron image is limited by the emission velocities of the photo electrons. The resolution of the charge pattern on the target is limited at high lights in part by the fine mesh screen and at low lights, in part by the leakage along the glass target. The ability of the scanning beam to resolve the charge pattern is controlled by a number

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FOAMED PLASTICS

By

F. L. Creager

Recently many low-density inflexible plastics have been employed either alone or as cores in so called "sandwich" structures for heat and/or sound insulation as well as for buoyancy.

Stiffness with a high bulk/weight factor is usually a desired attribute.

Those structures having also promising

Trade Name	Manufacturer	Availability	Density (lbs./cu.ft.)
"Pliofoam"	Goodyear Tire & Rubber Co. Akron, Ohio H. D. Herbert, Manager Air Foam Plastics Department	Large thick sheets or shredded, treated and untreated	Sheet: 0.6-0.85 Powdered: 2.0-2.8 Neoprene Pliofoam: 3.5
"CCA" (Cellular Cellulose	E. I. DuPont De Nemours & Co. 626 Schuyler Avenue Arlington, New Jersey H. W. Paine, Director Chemical Division Laboratories	4" x 1" x 120" 6" x 1/2" x 120"	4-5, 6-7, 7-8, and 8-9
"Flotofoam" (Type SS)	U. S. Rubber Company Mishawaka, Indiana D. W. Reed, Project Engineer	Slabs	3-7
"Cell-tite" (Hard)	The Sponge Rubber Products Co. Derby, Connecticut A. B. Hunn Sales-Service Department	Buna N. synthetic 20" x 36" x 1/2" to 1-1/2" thick	8-20
"Foamglas"	Pittsburgh Corning Corp. Pittsburgh 22, Penna. P. D. Japp	12" x 18" x 2,3,4, or 6" thick	10.5
"Textolite Foam"	General Electric Co. Schenectady, New York J. R. Stirrat, Dev. Eng. Plastics Sales	----	2-7
"Styrofoam"	Dow Chemical Company Midland, Michigan D. W. McCuaig Plastics Development Div.	10" x 30" x 2 or 3" thick 8" x 30" x 2 or 3" thick	1.0-2.0
"Foaming Resin" XRS-17564	Bakelite Corporation Carbide & Carbon Building 30 East 42nd Street J. H. Jones	----	0.05-0.12
"ERA" (Expanded Rubber Aluminum)	U. S. Rubber Company Mishawaka, Indiana D. W. Reed, Project Engineer	Bricks	5.6 and 7.0
"Airfoam"	Goodyear Tire & Rubber Co. Akron 16, Ohio P. S. Heskett, Airfoam Sales Dept. Chemicals Products Div.	43" x 53" x 1/8" to 6" thick	(-------)

of factors among which are: defining aperature diameter, thermionic emission velocities, angle of approach to the target and magnitude of the potential differences in the charge pattern. The magnetic field strength, once adjusted for focus, has no first order effect on the resolution of either the scanning beam or the electron image. On the other hand, the resolution of both the scanning beam and the electron image improves with increasing electric field strength on the scanned side of the target and in front of the photo cathode, respectively.

An expression has been derived for the limiting current density that may be focused by an electron gun into a spot on a target. This current density is proportional to the target potential and to the sine of the angle

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of convergence of the electrons approaching the target. Experience with oscilloscopes and kinescopes has led to high anode potentials, kilovolts and tens of kilovolts, for the purpose of getting small spots. It may accordingly appear surprising to find even smaller spot sizes attained in the image orthicon at a target potential of approximately zero volts. The smaller beam current densities used in the pick-up tube are only part of the explanation. The larger part is the difference in the convergence angles of the electrons approaching the pick up tube target and kinescope screen. For the orthicon type of pick up tube the sine of this angle is near unity while for the kinescope it is usually 10^{-3} to 10^{-4}. Thus, the low-velocity scanning beam makes up for its low velocity by its large convergence angle.

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electrical characteristics fall within the following classes:

(a) Foamed thermosetting (phenolic urea or copolymer) resin.
(b) Foamed thermoplastic (cellulose acetate or polystyrene) resin.
(c) Foamed rubber.
(d) Foamed glass.

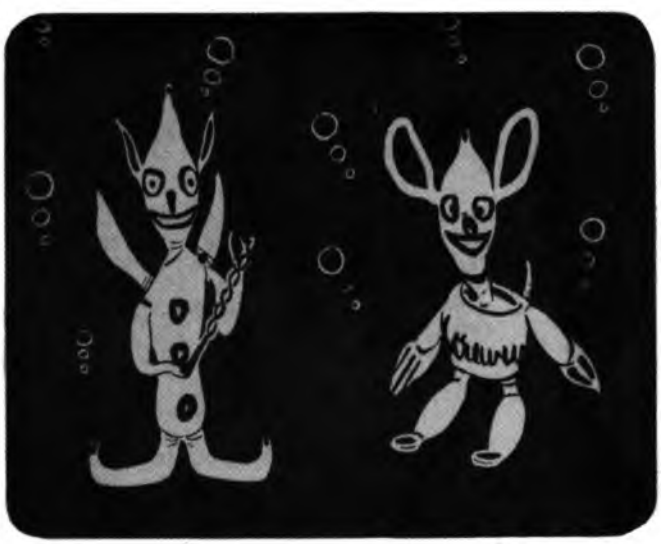
They are variously known as foamed, expanded, or multicellular structures and may have integral "skins" or be laminated with glass cloth, plastic sheet, metal, or wood surfaces cemented on one or both sides.

Specimens of the material listed below are available in the Model Shop for examination by interested parties.

Crushing Strength (lbs./sq.in.)	Structure	Application
----	Urea-formaldehyde polymer; closed bubbles in partial mutual contact with interstices empty and forming a continuous network.	Extremely light heat and sound insulation; not recommended at continuous temperatures over 170° F.
4-5 = 75 ± 15 6-7 = 125 ± 25 7-8 = 175 ± 25 8-9 = 300 ± 35	Unoriented, multicellular form of cellulose acetate with a small percentage of strengthening filler; no plasticizer.	A core structure in sandwich-type aircraft construction; may be plied with various cements and resins; sharp softening point within 380° - 395° F, may be shaped within this range.
----	----	Acoustic insulation.
450	Cellular ebonite, cells are non-connecting and filled with inert gas.	Temperature insulation in ranges of 290° to -60° F.
150	Minute glass cells containing sealed-in air.	Temperature insulation.
140	Thermosetting resin withstanding temperatures to 200° C.	----
5-20	Expanded polystyrene, non-permeable, multicellular structure, two types: large and small cell.	Life rafts and floats and low temperature insulation; safely used at temperatures to 170° F.
----	Developed from BRS-16631 formulation, a copolymer styrene modified, thermosetting-ester-type liquid.	Aircraft sandwich-type panels and domes.
----	Expanded aluminum-loaded latex.	----
Flexible	Foamed synthetic latex sponge; with interconnecting cells.	Vibration dampening and sound insulation; should not be exposed to light or temperature over 150° F.

PESTICUS LIBRARICUS*

Ladies and Gents, the subject of this evening's paper is a Report of a Scientific Investigation on Pesticus Libraricus. Silverfish Libraries and Termites are well known and methods of dealing with them have been discussed by more competent speakers than myself. See: Smith, J. L.: "Destruction of Paper and Books by Insects and Means of Fighting them," J. ECONOMIC ENTOMOLOGY, 35, 264-75 (1942). The speaker and staff have made an investigation of less publicized species. By strenuous effort and use of proper lures, we have been able to secure specimens of some of these and have had models produced, which we have here on display. The first specimen which I wish to bring to your attention is GREMLINIUS LIBRARICUS which I believe to be of the genus ANOPHELES WALKERI. His habitat is any collection of printed matter and he is found in all libraries but believed to be most prevalent in scientific collections, where he is associated with the species of Homo sapiens chemicus, subspecies mentis absentis. He is distinguished by an omnivorous appetite for all forms of printed matter, which tend to disappear completely in his presence, leaving no clues to their whereabouts. He is particularly attracted to weighty and valuable reference works. However, these appear to be too much for his digestion and eventually reappear. Smaller material such as patents and pamphlets are completely and irrevocably absorbed.



Anopheles Walkeri

Next most important is the SPHAEROIDES PACHYGASTER, commonly known as the Clipper Worm. This species of library pest does not absorb whole books but has a more selective appetite, removing certain articles or ads with its scissor-like jaws. This species may occasionally turn vicious and attack library personnel, as witness the speaker's right thumb.[1]

A less sinister but still annoying pest is the THEOBALIA INORATA which exists in two subspecies NIGROMACULUS and GRAPHOLITHIA. These pests do not actually consume the printed matter which is their habitat but make their homes within the books, disfiguring the pages with tracks and markings strongly suggestive of ink and pencil marks. Strangely enough, these marks sometimes appear to make sense and be definitely related to the subject on the printed page. This effect is occasionally beneficial.

The last species which we will consider, I have designated TRIBOLIUM CONFUSUM. This is the pest which is believed responsible for causing things to disappear from the places where they ought to be and to reappear in the wrong places.

Sphaeroides Pachygaster

We have tried various methods for the control of these pests, principally by turning the bright light of publicity upon them, but we regret to say that no method we have yet discovered is particularly effective. All species appear to be very hardy and while reduced by strenuous campaigns, tend to reappear in force as soon as vigilance is relaxed.

Theobalia Inorata

Tribolium Confusum

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*This is from a paper presented by Elizabeth H. Burkey and Juliet H. Walton of the Du Pont Company at the meeting of the Special Libraries Association in Buffalo on May 5, 1945. It is reprinted here with their permission to assist those using our library in avoiding these pests.

It has been thought worth while to bring these few thoughts and observations before this gathering with the hope that by concerted efforts, suitable methods of extermination may be devised.

1. The speaker's right thumb was actually broken and bandaged to a splint. There were subversive rumors that she had broken it as a result of shutting it in a file drawer, but this was no doubt false information circulated by TRIBOLIUM CONFUSUM.

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PERSONNEL INFORMATION

DANCE

On Friday Night, December 7th, the Dance Committee sponsored an informal dance at the Nassau Tavern in Princeton. This was the first of a series of such dances to be held throughout the winter season. Dancing was from nine to one to music by Charlie Windham's Orchestra. Arrangements for the dance were made by the following committee:

C. Mueller, Chairman
Mrs. S. Hoffman
Miss Adele Rzesutek
Miss Gertrude Ellsworth
F. Nicoll
W. Murphy
J. Kurshan
J. Stonaker
P. Peyton

BOWLING LEAGUE

The Bowling League swings into its ninth week of competition, as we go to press, with several teams vieing for the top honors. The Maintenance, Model Shop Big Six and The Wiremen are tied for first place with 19 points each. The Engineers II and the Guards follow up as close seconds with 18 points each. Three more weeks of competition remain before the first-half winner is decided.

Standings of the Teams to Date

1. Maintenance	7. M. S. Atoms
2. M. S. Big Six	8. The Chumps
3. The Wiremen	9. Engineers I
4. Engineers II	10. M. S. Avengers
5. Guards	11. M. S. Gold
6. Drafting	12. Office

The high single bowlers for the first half are: Edwards (222) Parry (221) and Pfeiffer (218). The high three-game series is held by G. Parry with a series of 562.

"OPEN HOUSE" AT RCA LABORATORIES

On Monday evening, November 26th, "Open House" was held at the Laboratories for members and their families. Approximately 900 people visited the Laboratories at this first "Open House" since the Laboratories started in Princeton. A few of the many exhibits enjoyed by the visitors were: television, facsimile, electronic sewing machine, electron microscope, FM altimeter, phosphors and the electronic counter. Visitors were particularly interested in seeing themselves in television, eating marshmallows toasted by radio-frequency heating and seeing the unseen through the electron microscope. Another favorite spot was the cafeteria where refreshments were served throughout the evening.

On the following evening, November 27th, the Laboratories held "Open House" for the Princeton Chapter of the Society of the Sigma Xi.

QUOITS

The playing off of the Championship Games closed the 1945 R.C.A. Laboratories Quoit League. During this noon hour recreation fifty men took part in the League Games. It is hoped that we can double this amount of players during the 1946 season. The games were also enjoyed by a considerable group of spectators.

Ellis and F. Howarth won the Class B Doubles by defeating C. Sullivan in the final games.

McCool won the Class C Singles. He took the lead at the start of the Tournament and displayed a steady game throughout the Tournament.

Benbenek won the Class B Singles. This Tournament was a good match between the leaders, Benbenek, Tantum, and Ferrara, but Benbenek's good pitching brought him through at the finish.

W. Howarth won the Class A Singles. This was a hard fought match between Lewallen and W. Howarth, each player holding the lead at some time during the Tournament. But Lewallen lost to Fechter in his final game and this gave Howarth the Championship.

A summary of the final results is as follows:

Championships Won By:

Class A Doubles - Lewallen and Fechter
Class B Doubles - Ellis and F. Howarth
Class C Doubles - McCool and Flauss

Class A Singles - W. Howarth
Class B Singles - J. Benbenek
Class C Singles - J. McCool

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LETTERS FROM RCAL EMPLOYEES IN THE ARMED SERVICES

Dear Mr. Creager:

Very glad to have received your letter of Nov. 6th.

Since my last letter I've started working at the Palace of Justice building in Nurenberg where the trials are being held. Not working hard, but I see and hear a number of interesting people and things. However, I'd gladly trade it all for the good old U.S.A. anytime.

I'll let you know where I stand just as soon as I find out, and you can bet it can't be too soon for me.

I've now achieved the noble rank of T/5, "A Model T Corporal", but even if they kept me in the Army and made me a M/Sgt. I still wouldn't like it. I'd much rather be "Mister Fell" and back working at RCAL than spend my time over here.

The office where I work is located in such a position that we can look out of the window and observe the prisoners taking their daily 20 minute walks in the courtyard of the jail. However, since the trials have started Goering, et al, do not take their daily constitutionals.

I was hoping I'd be home by Christmas, but it didn't work out that way. Too many fellows with more points are ahead of me. As for my getting home, that is the date I wouldn't even want to guess right now. The redeployment situation alternately blows hot and then cold, and the net result is that everyone has taken the attitude "Oh well, when it comes time for me to go home, they'll know where to find me." So we just go on "sweating it out" with the idea that every day does bring us closer to getting home, and that eventually we'll make it.

I guess that's about all the news now.

A Merry Christmas and a Happy New Year, and I'll be there some time in the not too far distant future.

Yours truly,

Campbell W. Fell

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BIMONTHLY NEWS

RCA ANNOUNCES PROMOTIONS

Election of E. W. Engstrom as Vice President in Charge of Research of RCA Laboratories Division and E. C. Anderson as Vice President in Charge of the Commercial Department of RCA Laboratories Division was announced on December 7, 1945 by Brigadier General David Sarnoff, President of the Radio Corporation of America, following a meeting of the Board of Directors. Dr. C. B. Jolliffe, Vice President in Charge of RCA Laboratories, was elevated to Executive Vice President in Charge of RCA Laboratories Division.

At the same time, five officials of the RCA Victor Division were elected Vice Presidents in charge of their respective Departments of RCA Victor. They are Joseph B. Elliott, Vice President in Charge of the RCA Victor Home Instruments; Meade Brunet, Vice President in Charge of the RCA Victor Engineering Products; L. W. Teegarden, Vice President in Charge of the RCA Tubes; J. W. Murray, Vice President in Charge of the RCA Victor Records, and J. H. McConnell, Vice President and General Attorney of RCA Victor.

Thompson H. Mitchell, at present Vice President and General Manager of RCA Communications, Inc., was elected Executive Vice President of RCA Communications.

ORGANIZATION NOTICES

November 19, 1945

Mr. M. E. Karns, who has been on leave of absence while serving as Director of Radio and Radar Division of the War Production Board, has returned to RCA. He will be Administrative Assistant to the Vice President in Charge of RCA Laboratories.

His office will be at Princeton, and he will carry out such duties as are assigned to him by me.

C. B. Jolliffe

December 5, 1945

Mr. George M. K. Baker, Lieutenant Commander USN, now being placed on the retired list of the U. S. Navy, has been employed by RCA. He will be Staff Assistant to the Vice President in Charge of RCA Laboratories Division and Manager of the RCA Review.

His office will be at Princeton. He will report directly to me and carry out such duties as are assigned to him.

C. B. Jolliffe

RCA REVIEW TO RECOMMENCE PUBLICATION; FIRST ISSUE IN MARCH

After a four-year wartime "blackout" the "RCA Review" will again be published shortly after the first of the year. For the information of newcomers to RCA Laboratories Division, the"RCA Review" is a quarterly electronic scientific research and engineering journal formerly published by RCA Institutes Technical Press. About a year ago, the responsibility for publishing the "RCA Review" was shifted to RCA Laboratories.

With the lifting of many of the wartime security restrictions and the lessening of the pressure which accompanied work on the war contracts, it is anticipated that more papers will be prepared by members of our technical staff. Plans for the new "RCA Review" are well along, and Mr. George M. K. Baker, the manager of the Review, reports that a publication date of about the middle of March, 1946 has been set for the first issue.

The objective set for the subscription list includes the top-ranking scientists and engineers both in the U.S. and abroad, as well as all reputable and applicable educational, research, engineering, and experimental groups and departments of the government. It is believed that this would eventually result in 8000 subscribers.

Mr. Baker has his office on the third floor south. His phone number is 424, and he will be glad to answer questions anyone has concerning the Review.

LATEST TELEVISION DEVELOPMENTS DEMONSTRATED TO THE PRESS AT RCA LABORATORIES

The latest developments in television, including vastly improved black-and-white pictures and color pictures in three dimensions, were demonstrated to representatives of the press on December 13 at RCA Laboratories in Princeton. The black-and-white pictures were transmitted by radio from WNBT, the National Broadcasting Company's station atop the Empire State Building in New York, a distance of 47 miles. These pictures featured greater detail, brilliancy and contrast than ever before achieved in television -- all of which have been made possible by receivers containing new and greatly improved Kinescopes, or picture tubes. In these tubes the fluorescent screen on which the image appears in black-and-white is backed up with a very thin coating of aluminum which permits the use of higher voltages than formerly. The aluminum film acts as a mirror preventing loss of

light inside the tube thereby greatly improving picture brilliance and contrast. The television pictures provided by these new tubes were bright enough to be seen in a fully lighted room.

The color pictures were transmitted by radio from RCA Laboratories to the Princeton Inn, two and a half miles away. Indoor studio scenes of live talent in action were picked up directly by the RCA color television camera, and transmitted through the air using a transmitter power of 1/20th of a watt on a frequency of 10,000 megacycles. The action was reproduced with all the hues and tints that would be viewed by the human eye. The television camera and receiver employed mechanically driven color filters.

Stereoscopic pictures in color clearly portrayed young women wearing bright-hued dresses and scarves. Special polaroid screens and a light splitter to give the two angles of view in the camera, synchronized polaroid screens at the receiver, and polaroid glasses worn by the spectators produced the three-dimensional effect.

Although the pictures reproduced by the mechanical color system show promise, it was pointed out that color television is still distinctly in the laboratory stage of development, with obvious shortcomings. There is much technical development that needs to be completed before a practical color television system will be ready for the home service to the public. It was estimated that this will require about five years.

On the other hand, the demonstration of the RCA black-and-white all-electronic television system clearly showed that it is now ready for the home. It presents sharp pictures on a screen as large as a newspaper page, with brilliancy, definition and contrast equal to motion pictures.

Commercial plans for production of receivers by the Victor Division were outlined as follows:

It is planned that television home-receivers will begin to come off the production line in the late spring or early summer of 1946. These instruments will be table models of the direct viewing type, that is, the observer will see the pictures directly as they appear on the face of the Kinescope. These sets, retailing from less than $200 to $300, will have screens ranging in size from 4½x6 inches to 6x8 inches, and will feature black-and-white pictures of improved contrast and brilliancy. Larger models in this line will also provide standard broadcast reception.

Some time later television receivers featuring pictures projected by lenses and mirrors on at least 15 x 20-inch screens will be available for about $500. These deluxe consoles will provide standard and FM broadcast programs as well as worldwide shortwave reception.

The plans of NBC in regard to television were announced as follows:

1. NBC will install, early in 1946, a new and improved transmitter at its pioneer television station WNBT, atop the Empire State Tower in New York City...NBC also will build a station in Washington, D. C. in 1946, followed by stations in Los Angeles, Cleveland and Chicago; subject to the FCC granting licenses for which applications have been filed.

2. NBC will operate a network between New York and Washington in 1946...and a New York-Boston network in 1947. As soon as practicable other regional networks will be established, using Chicago, Cleveland and Los Angeles as key stations.

3. NBC will improve and enlarge its program service in New York, which currently includes on-the-spot views of news and special events alternated with major sports events and a wide variety of studio programs.

4. NBC will solicit the support and cooperation of sponsors and their advertising agencies in producing programs to serve the television audience.

5. When a color television system has reached the stage of practicability and availability that is now true of the black-and-white television system, NBC will bring color to the American home.

RETIREMENTS

On November 30, Bill Borton retired from active service with the Radio Corporation of America. Back in the early 1900's Bill started as a tool maker with the Victor Talking Machine Company in Camden. He has been with the Model Shop of RCA Laboratories ever since they were moved to Princeton.

A farewell dinner was held for Bill at Fowler's Inn on Thursday, November 27, when his many friends made him a gift of a travelling bag.

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Four members of the Buildings and Grounds organization also were retired from active service with Radio Corporation of America on November 30, 1945: Vincenzo Sasso, who came with us on July 21, 1943; William H. Tantum, who started with the Laboratories on February 17, 1943; William P. Servis, who started September 22, 1942 and Joseph Krieger, who came with us March 22, 1943.

Three members of the RCA Laboratories group at Rocky Point, L. I., also were retired from active service with the RCA on November 30, 1945: Frank Gerecke, model maker in the shop, who joined us on November 12, 1934; M. B. Larsen, guard, who came with us on April 18, 1944; and W. A. Kliene, janitor and grounds man, who started on March 8, 1943.

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Those who know C. M. Griffith of the RCA Laboratories group at 66 Broad St., New York City will be sorry to learn that because of ill health he retired on November 1. A surprise send-off was given him by his friends in the Broad Street, Riverhead and Rocky Point offices on October 31 at 62 Broad Street, New York City. A buffet lunch was served and "Griff" was presented with an Elgin wrist watch and a pen and pencil set to commemorate the occasion.

LECTURES BY RCA LABORATORIES TECHNICAL STAFF

Before the Bronx County Dental Society in New York City by J. Hillier on "The Electron Microscope" - October 18, 1945. Papers on this same subject were also given by Dr. Hillier before: The Masonic Lodge in Princeton on November 12, the International Food Technologists in New York on November 15, the American Chemical Society in Wilmington on November 21, the Toilet Goods Association in New York on December 6, the New York Medical Academy on December 10, and the Metal Science Club in New York on December 21.

Before the Princeton Old Guard by G.H.Brown on "Broadcast Antennas" - November 14, 1945.

Before a Seminar in the Frick Chemical Laboratory at Princeton University by F. E. Williams on "Critical Survey of the Theories of the Luminescence of Solids" - November 19, 1945.

Before the Electron Microscope Society of America in Princeton by J. Hillier on "Further Improvement in the Resolving Power of the Electron Microscope" - November 30, 1945.

Before the Electron Microscope Society of America in Princeton by J. Hillier on "A Study of Distortion in Electron Microscope Projection Lenses" - November 30, 1945.

Before the Princeton Present Day Club by H. W. Leverenz on "Research in Black Magic" - December 12, 1945.

Before the Physics Club of the Princeton High School by R. E. Shrader on "Phosphors" - December 14, 1945.

Before the American Physical Society in New York City by F. E. Williams on "Mechanism of the Luminescence of Solids" - January, 1946.

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INDUSTRY SERVICE DIVISION GET-TO-GETHER

On Saturday, October 20th, the members of the Industry Service Division gathered at Stu Seeley's home in Norgate, Roslyn Heights, L. I.

In the afternoon an exciting game of baseball was enjoyed as well as volley ball, pipe

Watching the Ball Game

After the Game

Everybody Busy

Men's Beauty Contest

race, three-legged race, egg throw and tug of war. The losers of the tug of war cleaned up the ball field and the winners rushed to the house to be the first served to a delicious dinner.

The evening was spent in bingo, stunts and dancing and the highlight of the evening was the men's beauty contest.

A number of photographs were taken of the occasion, but unfortunately we only have room for a few.

Outside of a few creaking bones and lame muscles, everyone declared they had had a perfect time and hopes for a repeat performance were expressed.

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INTUITIVE CONCEPTS

Mr. V. D. Landon has called our attention to the following example of what appears to be a growing tendency,among some scientists who are generally considered of high rank in their profession, to ignore our commonly accepted intuitive concepts where these are not subject to rigorous proof:

"The mechanism by which the future affects the past is illuminated by considering a system of three or more charges in the light of the half-advanced, half-retarded fields of the theory of action at a distance. The retarded field produced by the acceleration of a affects b; the advanced field of b sets c in motion; and c generates a field the advanced part of which affects a before the moment of its acceleration. By an extension of this line of reasoning it is apparent that the past and future of all particles are tied together by a maze of interconnections. The happenings in neither division of time can be considered to be independent of those in the other."

This quotation comes from an article entitled "Interaction with the Absorber as the Mechanism of Radiation" by J. A. Wheeler and R. P. Feynman in the "Review of Modern Physics" for April and July 1945, page 181. Mr. Landon points out that the opinions of these men are not to be dismissed lightly. Nevertheless, he believes that most people, including physicists, will agree that this is one case where the intuitive concept should not be dismissed quite so lightly.

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P E R S O N A L S

A bridal shower was held for Elsie Fowler on December 3, preceding her marriage to Mr. Milton Probasco which took place on December 8. The wedding was a candle-light ceremony at the Plainsboro Presbyterian Church followed by a reception at Cranbury Inn.

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Thelma Lockard and Juanita Patterson of the Tube Assembly Room celebrated their birthdays by having a party at lunch-time on November 27.

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On December 8,Connie Fanget had a birthday which she celebrated on Dec. 7 with a delicious birthday cake.

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Bebe Denton returned recently from Chicago bringing with her her husband who has received his discharge from the Navy.

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The Special Tube Assembly Room - E-225 - has three new additions: - Goldfish.

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Difficulty in obtaining film on the market at present has prevented us from having any photographs of new employees to present in this issue. We hope this situation will have been remedied by the time our next issue goes to press.

Editor

BIRTHS

8 LBS. 3 OZS.	DEC. 1, 1945 10:44 P M	PAULINE & GEORGE PARRY PRESENT -: Their First Howling Success :- "IT'S A GIRL" STARRING PHYLLIS ANN PARRY Directed by A. D. Summers, M. D. Princeton Hospital, Princeton, N.J.	

Congratulations to Mr. and Mrs. C. A. Hurford who announce the birth of a son - Ronald Owen - on November 20, 1945 in the Princeton Hospital - weight 8 lbs., 2 oz.

Dr. and Mrs. M. L. Schultz announce the birth of a son - John Clayton - born November 30, 1945 at the Presbyterian Hospital, New York City - weight 7½ lbs. Congratulations to the parents.

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ADDITIONS

Thomas Cook - Photo Studio
James Takacs - Model Shop
J. W. Moore - Research
R..C. Webb - Research
Miss Irene H. Henzler - Sec'y. to S. DeMerett
A. J. Pehta - Research
John Wargo, Jr. - Guard
Mrs. I. S. Van House - Sec'y. to C. J. Young
Mrs. E. C. MacLeod - Sec'y. to E. T. Dickey
A. T. Forrester - Research
Paul J. Messenio - Research
R. R. Hole - Model Shop
N. N. Gregory - Drafting
H. E. Huley - Building and Grounds
J. C. Bleazey - Research
M. A. Colacello - Tube Assembly
Morris Maple III - Drafting
J. J. Remlinger - Drafting
E. S. Rogers - Research
Philip R. Celmer - Research
F. H. Corregan - Model Shop
Miss H. J. Gataroska - Mail Room
W. M. Elsasser - Research

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BETTER AND BETTER OFF

The world would be better off, if people tried to become better. And people would become better, if they stopped trying to be better off. For when everybody tries to become better off, nobody is better off. But when everybody tries to become better, everybody is better off. Everybody would be rich, if nobody tried to become richer. And nobody would be poor, if everybody tried to be the poorest. And everybody would be what he ought to be, if everybody tried to be what he wants the other fellow to be.

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PATENTS RECENTLY ISSUED TO RCA

August 1

Crosby, M.G.	2,354,799	Phase Modulation
Deal, H. B.	2,354,800	Multiple Frequency Source
Goldstine, H.E.	2,354,809	Transmission Line Load for High Frequencies
Peterson, H.O.	2,354,827	Frequency Control

August 7

Crosby, D. R.	2,381,724	Resistor
Crosby, M. G.	2,380,947	Wave Length Modulator and Control Means

Crosby, M. G.	2,380,948	Electronic Motor Control
Dimmick, G. L.	2,381,728	Interferometer
Hansell, C. W.	2,381,444	Radio System
Hansell, C. W.	2,381,445	Pulse Transmission System
Hansell, C. W.	2,381,496	Method of Generating Currents for Nonsignaling Purposes
MacLean, K. G.	2,381,173	Crystal Oscillator and Mounting
Price, T. H.	2,381,181	Radio Transmitter
Wendt, K. R.	2,381,238	Television System

August 14

Bollinger, W.P.	2,382,198	Oscillator Stabilizing Circuit
Cockerell, C.S.	2,382,366	Holder for Piezoelectric Crystals
Donley, H. L.	2,382,615	Oscillator Tuning System
Hansell, C. W.	2,382,414	Radio Relaying System
Hollingsworth, "R." Lee	2,382,567	Signaling System
Purington, E.S.	2,382,097	Selective Control Circuit
Roberts, W. vB.	2,381,928	Frequency Modulated Pulse Signaling
Schade, O. H.	2,382,822	Cathode Ray Beam Deflecting Circuits
Usselman, G.L.	2,382,590	Frequency Modulation Receiver

August 21

Artzt, M.	2,383,360	Synchronizing Device
Beers, G. L.	2,383,286	Loop Input System for Radio Receivers
Beers, G. L.	2,383,365	Television Pickup Control System
Hathaway, J.L.	2,383,309	Automatic Voltage Regulator
Hollingsworth, "R" Lee	2,383,126	Spaced Wave Keying
Koch, W. R.	2,383,322	Multiband Receiver with Band Spread
Newman, W. E.	2,383,338	Remote Control System for Radio Receivers
Seiler, K., 3rd.	2,383,345	Reflex Converter Circuit
Smith, J. E.	2,383,351	Phase Inverter Circuit

August 28

Crawley, J.B.	2,383,846	Self-Balancing Inverter Circuit
Crosby, M. G.	2,383,847	Frequency Modulation Receiver
Crosby, M. G.	2,383,848	Reactance Control Circuit
Grosdoff, I. E.	2,383,600	Vacuum Gauge Indicator System
Hansell, C. W.	2,383,855	Potential Ratio-Controlled Amplifier
Koch, W. R.	2,383,867	Power Output Amplifier Circuit
Price, T. H.	2,383,888	Amplifier Circuit Arrangement
Schlesinger, K.	2,383,822	Oscillation Generator

September 4

Goodrich, R. R.	2,384,087	Current Limiter
Beers, G. L.	2,384,232	Television View Finder
Quimby, E. J.	2,384,259	Viewing Device
Goldsmith, A. N.	2,384,260	Television Apparatus
Schlesinger, K.	2,384,263	Video Amplifier

September 11

Heller, H. P.	2,384,619	Solid Solution of Vinyl Aromatic Polymer and Hydrogenated Vinyl Aromatic Polymer
Markowski, W. T.	2,384,633	Article Storing Album
Blain, A.	2,384,722	Facsimile Recorder

September 18

Winlund, E. S.	2,384,868	Reverberation Meter
Pare, V. T.	2,384,958	Method of and Apparatus for Making Fibrous Articles
Garthwaite, E.	2,385,131	Tuning Device for Radio Circuits
Bayless, J. W.	2,385,186	Test Method and System for Variable Gain Amplifiers

September 25

Badmaieff, A.	2,385,324	Push-Pull Sound Reproducing Method and System
Underhill, J. L.	2,385,479	Film Reel Spindle
Beers, G. L.	2,385,563	Deflection Control System
Peterson, H. O.	2,385,641	Automatic Recording System

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