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THE TABULAR VIEW

TECHNOLOGY will forge ahead!" Thus began an editorial in the Boston *Evening Transcript* of October 15, the day following PRESIDENT COMPTON'S presentation to the Corporation (page 15) of his comprehensive and courageous plan for expanding the facilities and services of the Institute. Continued the *Transcript:* "The President and Trustees have canvassed the Institute's whole present situation and future outlook. They have carefully determined what are the most pressing requirements, to sustain the Institute's progress and enlarge still further its usefulness. The needs being clear, Technology now goes forth to raise the funds to supply them, supremely confident that where there's a will there's a way. M.I.T. seems justified in that faith. . . . Simply to hold back and postpone current efforts because the goals of the future may be difficult to attain is the way to make no progress at all. Now as ever the road to advancement can be traveled only by those who set their feet firmly on an onward course, take the first steps courageously, and then continue the journey with everlasting persistence."

AS scientific big-game hunters whose armory consists mainly of spectrographs, DONALD H. MENZEL and JOSEPH C. BOYCE are intent on tracking down obscurities in our knowledge of the sun. In 1933 they joined forces, as astrophysicist and physicist, to study the spectra of gaseous nebulae and it was natural that they should again collaborate in a study of the 1936 eclipse even though it took them packing to Russia for dear life, as they narrate in their article beginning on page 19. Dr. Menzel is Associate Professor of Astronomy at the Harvard Observatory; Dr. Boyce, Assistant Professor of Physics at the Institute.

WE are happy to announce that two of the contributors to this issue, PHILIP M. MORSE (page 9) and SAMUEL V. CHAMBERLAIN, '18 (page 27), are joining the Staff of The Review as Editorial Associates, which means that they will regularly contribute signed and unsigned articles to our pages. Dr. Morse is an Assistant Professor in Technology's Department of Physics and a skillful expositor of the mysteries of his field. Mr. Chamberlain, who will cover the fine arts, is a distinguished etcher who latterly has added photography to the various other mediums in which he captures in permanent form the beauty he sees about him. At the present he is giving a series of lectures on print making in the School of Architecture. ¶ DONALD G. FINK, '33 (page 31), is Associate Editor of *Electronics.* Before joining the staff of that journal in 1934 he was a research assistant at the Institute, dividing his allegiance between Geology (doing large-scale electrical prospecting) and Electrical Engineering (working on the development of the cinema integraph). While an undergraduate he was Editor of *The Tech Engineering News* "to which experience," he writes, "I owe a great deal." ¶ PAUL COHEN '35, (page 13), was Editor of *The Tech* as an undergraduate, and like Mr. Fink, is turning that experience to good account.

MAIL RETURNS

Let There Be Light

Prompted by Malcolm G. Davis' recent article on electric utility rates, many letters were received by the Editor. We present below one of the letters which gives a viewpoint other than that set forth by Mr. Davis. To this letter we invited Mr. Davis to reply, and his answer will be found immediately after that of his critic.

From GREGORY M. DEXTER, '08:

The article in The Review for last May by Malcolm G. Davis on "The Story Behind Your Light Bill" has had my attention. Perhaps, in the interests of broad social policy, you will permit me to comment. He has presented a mathematical analysis but neglected to discuss those human reactions on which government policies are more likely to be based. He has, in addition, made several slips in reasoning which lead to doubt as to the soundness of his conclusions.

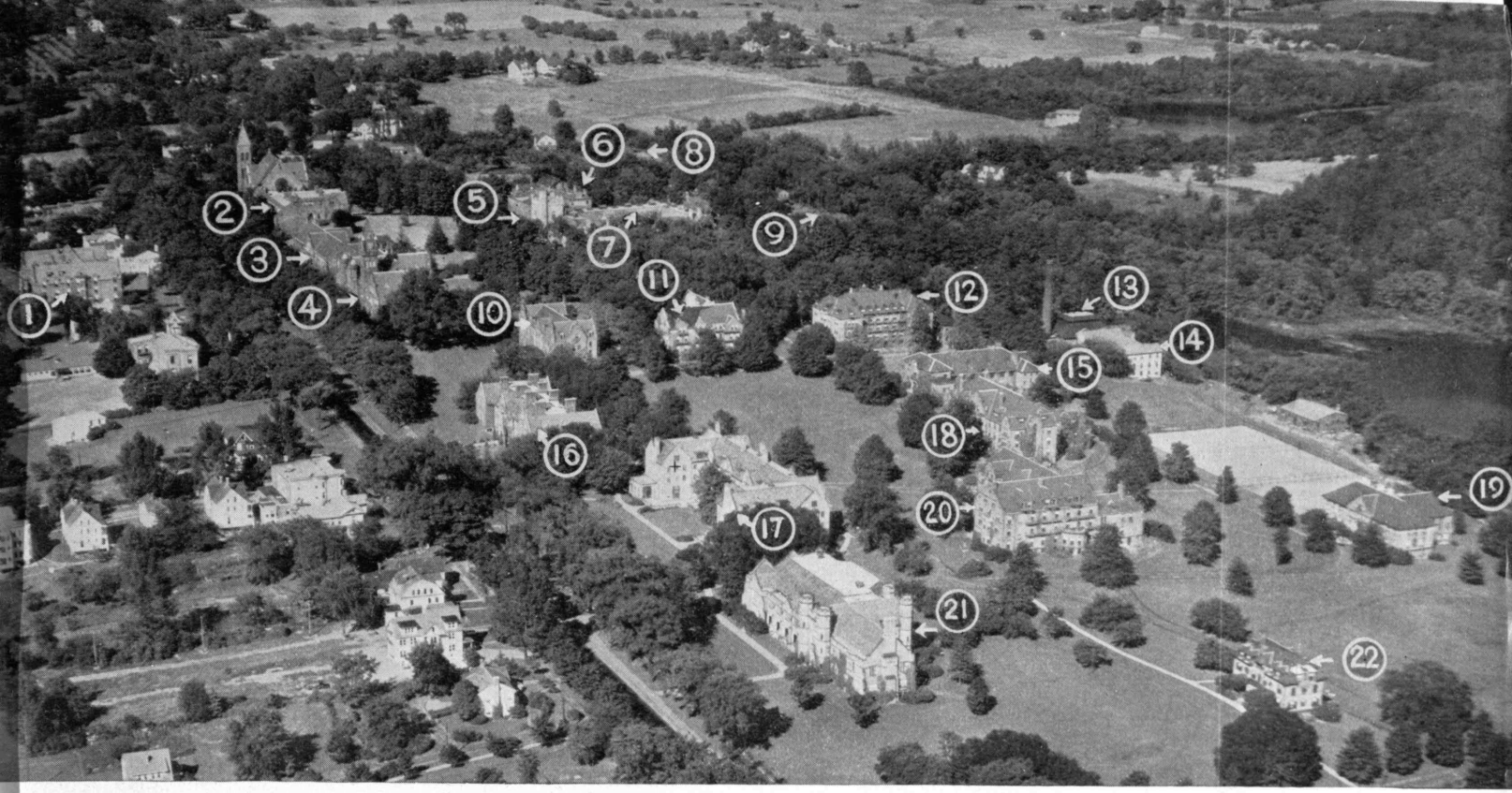
Much has been heard of late about the rights of investors in public utilities, but very little about obligations to the public. The management of a public utility is not a private enterprise but a trusteeship in which the rights of the public to as low rates as are economically possible are as important as the rights of investors to adequate returns. The two rights are in juxtaposition. Public utility executives have all too frequently favored the rights of the latter by taking advantage of every engineering, legal, political, and advertising trick at their command. Numerous investigations by state authorities, as in New York, and by Federal authorities have shown over and over again that this is so. Such a policy is likely to pay any executive in its effect on his salary while the opposite is only too likely to go unrewarded for a long time. That executives should do this is not surprising since no man can serve two masters. Unless this general disregard of their public trust by utility executives and their investors is overcome, increasing public ownership is certain in the face of any mathematical analysis.

Many rate cases are taken up with testimony by engineers and accountants in the employ of public utilities which is so unreasonable as to bring down on them the criticism of public service commissions and even the United States Supreme Court, as well as creating unfavorable public reaction. A public utility executive who tolerates such testimony violates his trusteeship, and the professional men who are parties to it lower their status to that of horse traders. Aside from this, rate cases are almost invariably long drawn out at the expense of the consumer, whoever wins. No wonder some voters are turning to municipal ownership as a solution.

Very little check is ever made by a public service commission of charges by a public utility to operating expenses, as in alterations of a distribution system which are really capital expenditures. There is some reason to believe that an appreciable percentage of the capital investment in our public utilities has been paid for as operating expenses by the public in the rates it was charged for service, although the public utilities have ever afterwards demanded a fair return on that investment. The New York Public Service Commission has sought for years sufficient funds to make a field check of charges to operating expenses as well as to capital. Public utility executives who were also trustees could coöperate with the commission to see that such funds were appropriated.

The accounting system in use by public utilities is open to criticism as inadequate for determination of distribution costs. Yet opposition by their executives to any change is common. It is often so phrased as to show no comprehension of the point at issue: cost accounting as a manufacturing executive knows it. Herein lies one secret of lower rates for domestic consumers.

The city manager form of government is now in force in several hundred communities. These city managers are, in general, high-grade, technically trained men who are thoroughly capable of running a municipal lighting plant. They seek opportunities to save their communities money, to raise the standard of living, and, at the same time, furnish better street lighting and more beautiful streets. Only the exceptionally well-managed and conservatively financed public utility can meet the competition which these men can offer. The monopoly on knowledge and skill which public utilities have claimed is no longer possible with the self-contained and even (*Continued on page 4*)



MOUNT HOLYOKE COLLEGE

Fairchild Aerial Surveys

CENTRAL HEAT CONTROL FOR 22 COLLEGE BUILDINGS

Webster Moderator System at Mount Holyoke First Large Installation of its Kind

CONTROL-BY-THE-WEATHER

In 1934, Mount Holyoke College, South Hadley, Mass., completed an extensive modernization of steam using facilities, including a Webster Moderator System for central heat control of 22 existing buildings of various age and equipment, many one-pipe, some two-pipe and two hot water installations.

"Control-by-the-Weather" is provided by automatic Outdoor Thermostats, supplemented by a central control (shown at right) including (a) lights to indicate functioning of control valves and accumulation of water in key radiators, (b) switches for remote shut-off, (c) Variators to increase or decrease steam delivery to any zone. This central control eliminates "cruising" of the campus by the operating force and permits observance of a definite operating schedule for each building.

A test demonstrated that the control system provides adequate facilities for effecting a 25 per cent reduction in heating expense. Further experience during 1935-36 has proved the value of the Webster Moderator System in effecting minimum steam consumption with minimum operating force and adequate heating.

While Webster Moderator Control has been employed for smaller groups of buildings, this is the first large installation of its kind. It has been inspected and commented on by many leading engineers and operators. Results warrant the prediction that coordinated central control of the heating of large institutional groups will rapidly supplant past methods of uncoordinated control of separate buildings.

The control contract was executed by Warren Webster & Company, under the direction of Clyde W. Colby and the Office of Hollis French, associated consulting engineers for the college authorities. Fred T. Ley & Co., Inc., was the general contractor. Steam fitting was done by Holyoke Valve and Hydrant Company, prominent Massachusetts heating contractors.

The installation was described recently in HEATING AND VENTILATING, leading technical publication, in an article entitled "Economy of Unique Control System Demonstrated at Mt. Holyoke College Plant." Reprints of this informative article will be furnished gladly to anyone interested in further details.

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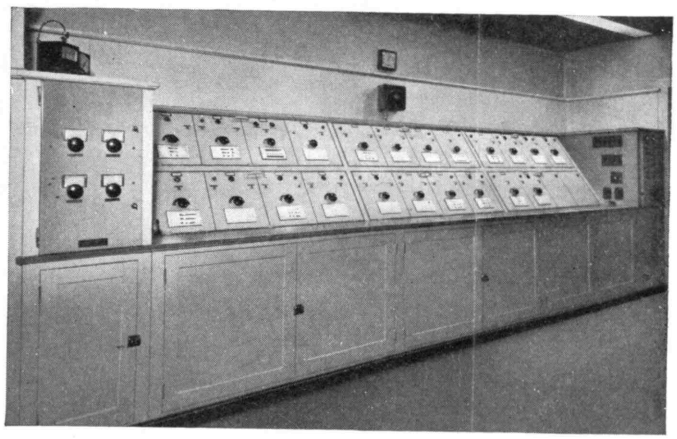


CENTRAL HEATING CONTROL

MAIL RETURNS

(*Continued from page 2*)

automatically operated plants which are now coming on the market. A municipal plant can be operated just as efficiently as the taxpayers desire, and good government is by no means such a rarity, particularly in the smaller communities, as public utility executives apparently believe.

Much is made of the point that any possible saving to each consumer from a municipal plant is small. The real point is that such saving multiplied by the number of consumers in the community often makes a very large sum which would go far in paying for more paved highways, better schools, larger water supply, parks, and so on. My own village could save $80,000 yearly at once and increase it over $100,000 in a few years although paying all the overhead charges of a public utility. It is not an unusual circumstance.

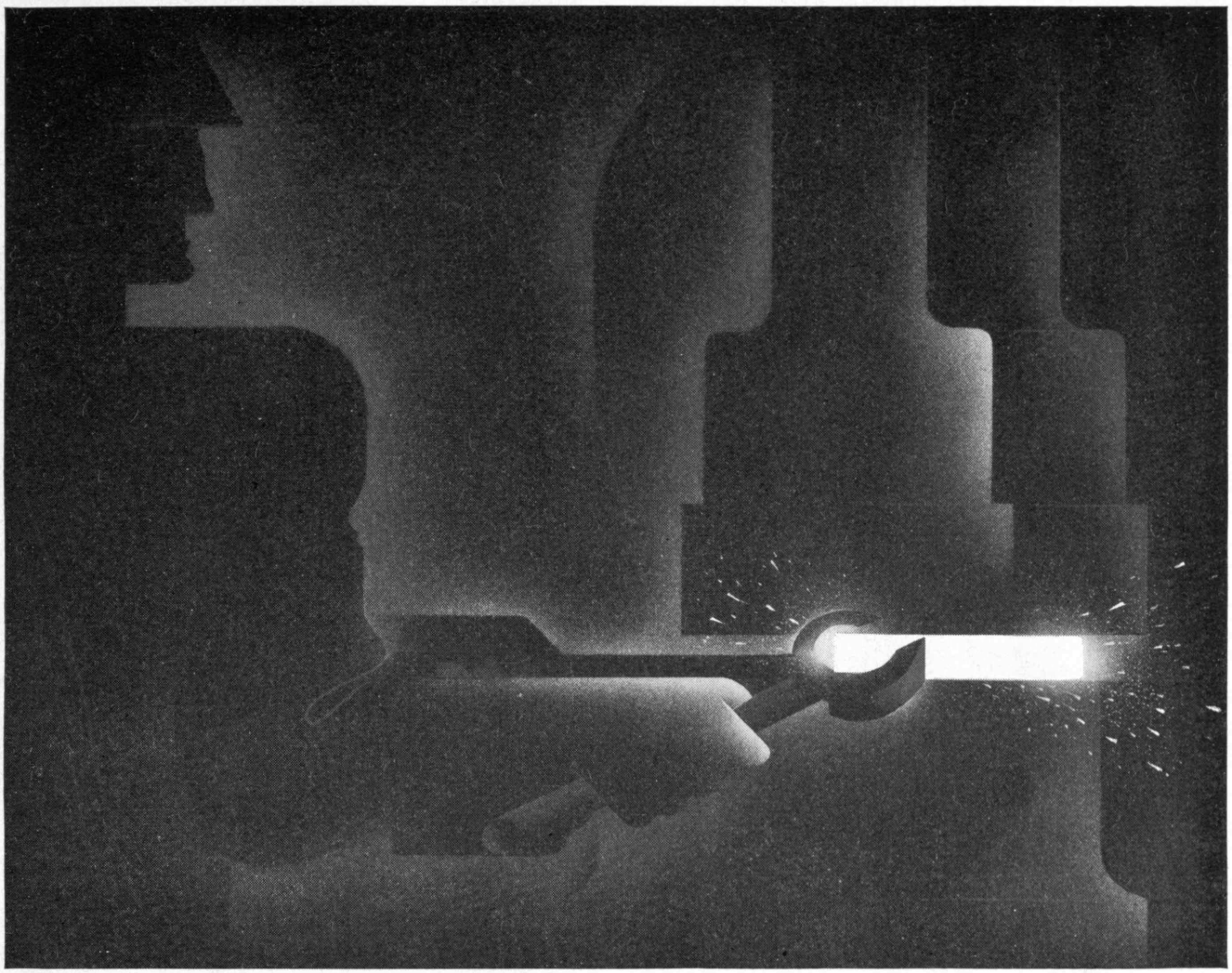
About 170 municipal lighting plants have come into existence since 1929. That indicates dissatisfaction by a good many voters and shows a trend to the condition in the waterworks field where about 90% of cities over 500,000 in population and about 80% of all communities under 10,000 control their water supply. Such ownership came about largely through failure of the privately owned water companies to keep abreast of demands for service at low cost which gave good fire protection, filtration of water, and ample supplies even in drought. Such ownership may come in electric light and power plants through failure to reduce rates as much and as promptly as technical progress makes possible and through failure to recognize the low differential costs for adequate and even beautiful street lighting which are possible with a municipal plant. Bargain rates at off-peak hours for domestic uses are possible under differential costs to an extent not yet understood and much less practiced.

More might be said as to the human reactions which Mr. Davis has overlooked in his analysis. Now for some of the slips in his reasoning: His argument is based on averages, although every engineer knows that the course of an industry is determined by the low-cost producer. It is only generally a question of average cost but always of how cheaply can the product be sold in comparison with what is now paid. That is the question in my village of 3,000 consumers, 80 miles of streets, and an average domestic consumption of 1,700 kilowatt hours yearly with no industrial load. We paid an average of 5.7 cents in 1935 and in 1937 we will pay an average of 5.0 cents. Yet a Diesel-engine lighting plant and distribution system could be built here for less than $1,000,000. We could pay five per cent interest on the investment, retire the entire cost in 25 years, set aside 16% of the present revenues of the public utility from electricity in the village for taxes, and yet sell electricity for 3.5 cents per kilowatt hour. This is the sort of condition which leads to exasperation with both public service commissions and public utilities. It is only too common. Failure to cure it is bound to force more municipal lighting plants.

Many public utilities are burdened with long transmission lines which prevent in many cases the economic sale of electricity. The day of the isolated power plant has returned. The large central power station which served a large area was an economic necessity some years ago but is not today. Averages based on costs determined by such a set-up are misleading as to the possibilities of lower rates with a municipal plant serving a small community. Studies will frequently show today that more central stations are needed. See the article in *Electrical World* for April 13, 1935, by Alfred Iddles on "Planning New Capacity."

A comparison has been made between small municipal plants and small privately owned plants in a large system. Anybody who has had the pleasure of comparing some of the latter which are not in a very few large systems might reach a different conclusion as to the relative efficiency of the small municipal plant. A study, furthermore, of the power plants and distribution systems of our largest public utilities will show considerable obsolete equipment carried on the books for which there is little economic justification. Greater New York has several of these plants which should have been extensively remodelled or scrapped years ago.

The attempt has been made to show that the average rates of municipal plants are actually higher than those of privately owned plants. Many municipal plants, however, (*Continued on page 48*)



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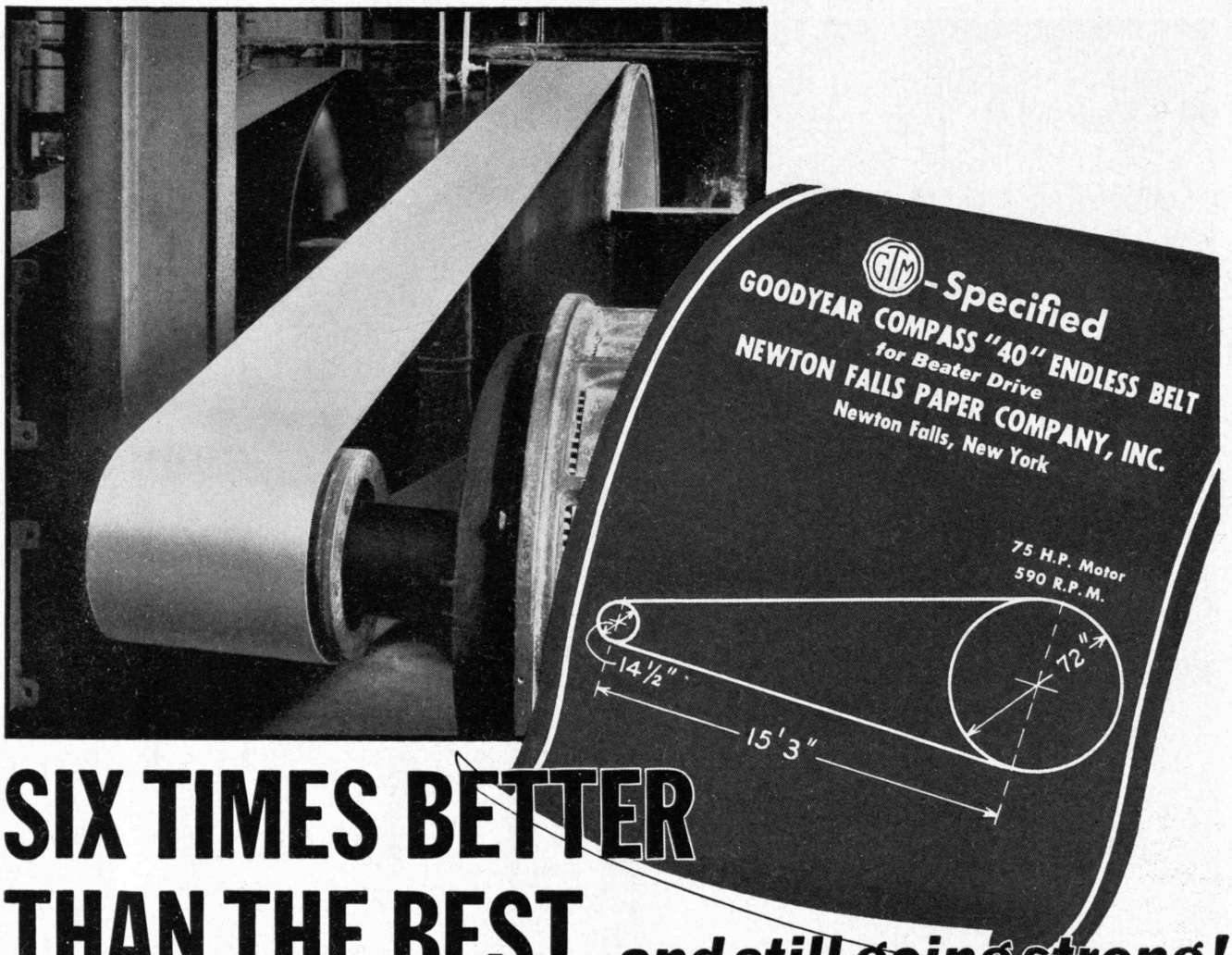
CUTS COSTS CLIMAX Mo-lyb-den-um CREATES SALES

MOLY



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THE Goodyear COMPASS "40" Endless Belt pictured here was installed on this heavy duty, paper mill beater drive in December, 1933 on specification by the G.T.M.—Goodyear Technical Man. The best record of any previous belt on this drive had been six months' service—that's how tough it is!

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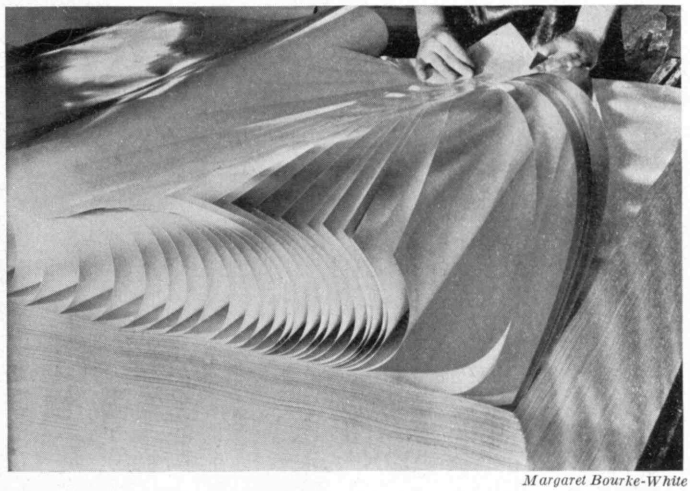

The play of light on coated printing paper as sheets are inspected fresh from the coating machine

Margaret Bourke-White

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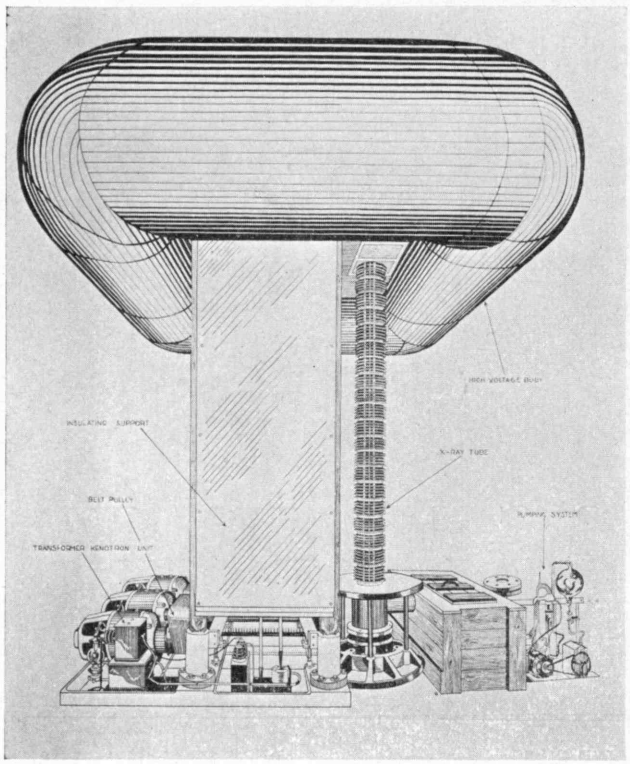
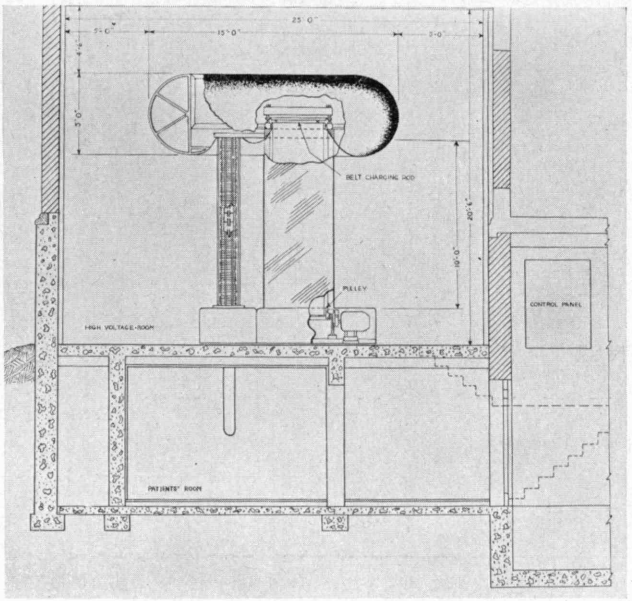


As the adjacent drawings show, the big cascade-type x-ray tube is attached to the generator in a vertical position and parallel to the insulating column, the upper end being in contact with the lower side of the aluminum terminal, while the lower end projects into an underground treatment room directly beneath the generator

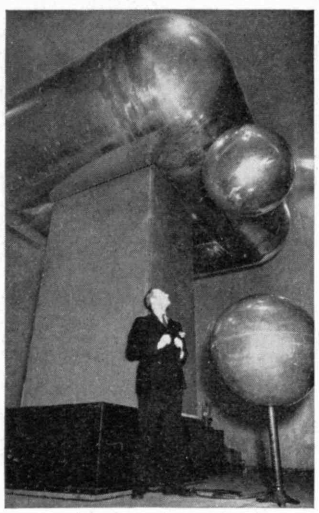


GREATER THAN ALL THE AVAILABLE RADIUM

ABOVE are presented the first published drawings of the new electrostatic generator, capable of producing penetrating short-wave x-rays at a potential of one million volts for medical research and treatment of malignant disease, which is nearing completion at the Collis P. Huntington Memorial Hospital in Boston. Announcement of this new tool of medical science, which was designed by Professor John G. Trump, '33, of Technology and built under his supervision, was made last month by Dr. Richard Dresser of the Huntington Hospital.

The new generator, which is expected to be ready for operation this winter, possesses two distinct advantages over existing equipment: First, it will make possible the treatment of deep-seated malignancy because high-voltage x-rays have greater penetrability than low-voltage rays. It is expected that many types of malignant disease which cannot be treated effectively with equipment now in use will yield to the more penetrating short-wave rays produced by the new machine.

A second advantage is indicated by accumulated evidence that high-voltage x-rays are more specific in their action on diseased tissue than the relatively low-voltage rays now in general use. In this respect the effects of high-voltage x-rays are similar to those of the gamma rays of radium. The new x-ray generator, however, will be capable of producing a greater intensity of these rays than the combined output of all the available radium in the world. The generator will be equipped with current and voltage control so that the potential can be regulated over the full range from two hundred thousand to one million volts.



The x-ray tube is made up of 20 porcelain sections of about 12 inches diameter, totaling 10 feet in length. Diaphragms are provided between sections to focus the high-speed electron stream in its passage from the upper end of the tube to the target and also to break up the total potential which must be insulated between the two ends of the tube. The base of the porcelain assembly is supported by a steel cylinder, which projects through the floor of the generator room into the treatment room, the arrangement being continuously evacuated by the high-speed pumping system. The filament assembly is located on the upper end of the porcelain column and is so arranged that replacement of a filament will involve only a short interruption in service.

A demountable, water-cooled target of gold upon which the high-speed electrons impinge is attached to the bottom of the steel cylinder. Both cylinder and target are at ground potential and are surrounded by a thick armor of lead for shielding against direct radiation. The beam of penetrating x-rays emerges through a port in the lead shielding in the direction of the patient being treated.

The total power input of about 15 kilowatts required by this x-ray generator is small compared with other types of high-voltage x-ray installations, and since the target is to be at ground potential, it will be possible to treat patients with complete safety at various distances from the target down to the minimum of about one centimeter. Dr. Dresser, who is primarily responsible for the installation in Huntington Memorial Hospital, will have charge of the x-ray machine's operation for research and treatment.