LIFE IN A LARGE MANUFACTURING PLANT

CHARLES M RIPLEY

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IN A LARGE
MANUFACTURING PLANT

By
CHARLES M. RIPLEY
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"Romance of a Great Factory"

With Introduction by
E. W. RICE, Jr.
President of General Electric Company

GENERAL ELECTRIC COMPANY
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BUSINESS IS BUSINESS

"Business is business," but men are men,
Loving and working, dreaming,
Toiling with pencil or spade or pen,
Roistering, planning, scheming.

"Business is business," but he's a fool
Whose business has grown to smother
His faith in men and the golden rule,
His love for a friend and brother.

"Business is business," but life is life;
Though we're all in the game to win it,
Let's rest sometime from the heat and strife
And try to be friends for a minute.

Let's seek to be comrades now and then,
And slip from our golden tether;
"Business is business," but men are men,
And we're all good pals together!

BERTON BRALEY.

Through Courtesy of George H. Doran Co.

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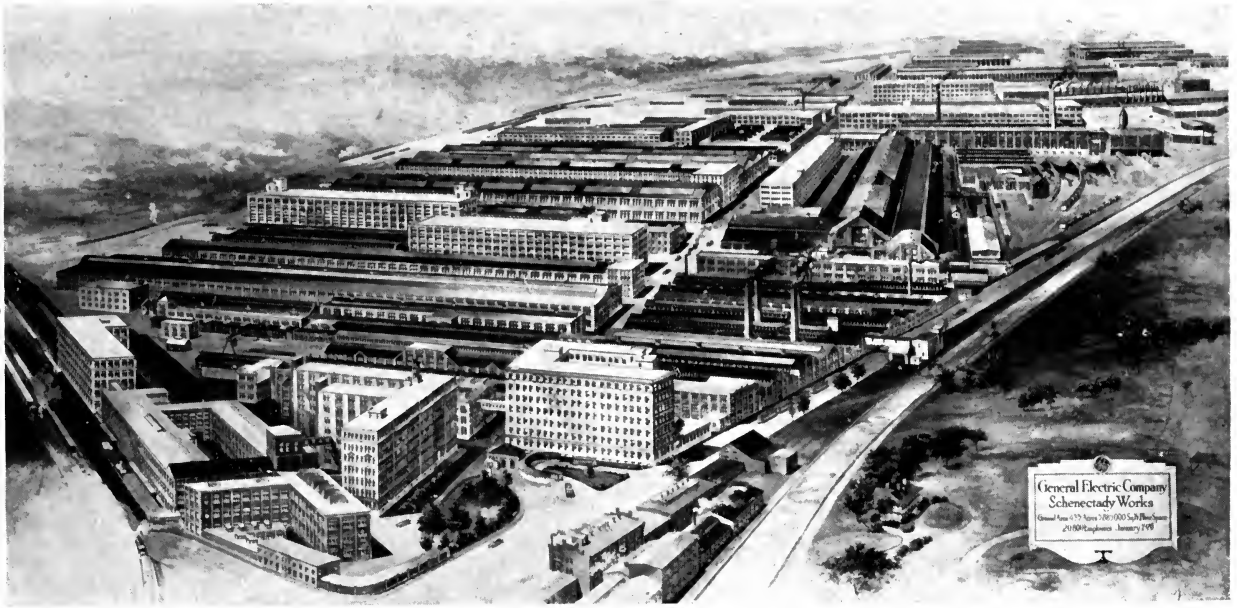


SCHENECTADY WORKS OF GENERAL ELECTRIC COMPANY

INTRODUCTION

By E. W. RICE, Jr.
President of General Electric Company

THE series of articles brought together in this book were first prepared by the author for the GENERAL ELECTRIC REVIEW and appeared, during the year 1917, in that journal. They were so full of matters of human interest that they were widely copied by magazines and papers throughout this country and in many foreign lands. The demand for copies became so great that it was considered desirable to reprint the entire series in the more compact and permanent form of this modest volume.

The title of the book is most expressive, as it strikes the key-note of the author's message. The fitness of the word "Life" is evident, when one realizes that, after deducting Sundays, holidays and hours spent in sleep, about one half of what remains for those engaged in industry is spent in the workshop. As labor occupies so large a portion of the time, happiness and success are largely dependent upon their work and their attitude towards it. Health, education, and mental and spiritual development are all strongly influenced, for good or ill, by our environment, and conditions which make for moral, physical and mental betterment are bound to add to the zest of our interest and enjoyment in our work and in our play alike.

The various activities described in this book have not sprung into existence at one time, but have grown in a natural manner to meet the conditions of a changing and expanding enterprise. None of them are perfect, none of them are finished, but have been and will continue to be subject to growth, change and adaptation, with changing times and circumstances.

As the writer of this introduction has been associated with this enterprise since its beginning, and has seen the start and growth of all the activities described, he was urged to say something about them.

We always like to know the reason why anything is done. This question is often asked concerning the activities described in this book: "What is the motive; what was the spirit which actuated the management?" Whatever it was, it was not philanthrophy or paternalism!

It did not require much intelligence to realize that workers in industry were more important than tools or buildings. It was natural, therefore, to do everything possible to increase their value by improving

conditions of life during working hours. It would be useless for an industry to provide fine tools, buildings and the best of materials unless it could attract and hold workers with sound bodies and intelligent and educated minds.

Hospitals, medical service, safety devices, sanitary surroundings, rest rooms and restaurants, where wholesome food at reasonable prices could be obtained, all obviously justified their existence.

As the electrical business was highly technical, and inventions and discoveries advanced more rapidly than general educational facilities of the country, we were early led to undertake special educational methods of our own—such as the "test course," which began with our beginning in 1880, and has been continued ever since, with modifications adapted to changed conditions of business and education. Our apprentice course has a similar origin and history.

Many of the activities described had their origin with the management. Many, however, originated among the workers, and where agreeable to them, assistance was rendered by the Company. Many organizations are managed and operated solely by the employees—notable instances being the various Mutual Benefit Associations, the athletic, social and musical clubs which have prospered and helped to make life more interesting to thousands of workers.

Those of us who have been associated together with the Company for many years feel a natural pride in the position which it has made for itself in its own field, in this country, and throughout the world. We believe that we have, each in his own way, contributed something to its success, and we are conscious that the achievements of the organization have been brought about by the joint effort of many workers. We take great satisfaction, not only in the technical, commercial and financial strength of our Company, but even greater satisfaction in the knowledge that we have, to a considerable degree, made possible, by our joint efforts, the great electrical industry, which has done so much for the benefit of the world.

Many important electrical discoveries or inventions have had their origin, either with our Company or with its predecessors—for example, the electric light, the trolley car, transmission of power, electric welding, and so on. We may all join in the satisfying thought that the world has been made happier, better and richer, in every sense, because of the "Life" which we have spent in our great electrical workshop.

Life in a Large Manufacturing Plant

CHAPTER I

CONTINUITY OF SERVICE

In his "History of Civilization" Buckle points out that the peoples of nations situated in extremely hot and in extremely cold climates are inferior to those in the temperate zone, because their continuity of employment is less. In hot countries steady work is impossible due to the extreme heat of the day, and in extremely cold climates steady work is impossible due both to the severity of the winter and to the diminished sunlight; for the "lands of the midnight sun" are, in winter, the lands of the noonday shade. Buckle states that the peoples of the temperate zone are less fickle, more energetic, and further advanced in all lines of human endeavor, because they work more continuously; i.e., with less breaks in their industry.

A business organization is very similar to a nation in that its strength and its characteristics are but the summation of the strength and characteristics of the individuals composing it.

Since steady work makes a nation great because its individuals become competent and expert, it would naturally follow that an industrial concern whose employees are steady workers, would be a stronger and better organization than if its personnel were largely composed of "floaters."

Lack of steady work weakens the character of the individual, and individuals of weak character find it difficult to obtain steady work; so it is apparent that there exists a vicious circle, and that the money losses are cumulative; moreover this money loss is mutual with employee and employer, inasmuch as both suffer through lack of steady productive work.

LONG SERVICE RECORDS

Let us visit the gatekeeper at the main entrance of the Schenectady Works of the General Electric Company and view the great army of industrial workers which pours out here at the end of the day. In less than three quarters of an hour most of the 22,000 people leave the Works—in round numbers an average of 500 per minute. How many of the 500 are "old" employees?

250 are "5-year men," of whom
100 are "10-year men," and
15 are "25-year men"

Think what this means—four long-service men pass out every second, for the better part of an hour.

Fig. 1 shows the continuity of service of the Schenectady employees.
Half the individuals have been steadily employed five years or longer.
One out of every five has been employed ten years or longer.
One out of every 34 has been steadily employed 25 years or longer.
The details of these service records are:

No. of Employees	Years of Service	No. of Employees	Years of Service
1	39	26	33 or more
3	38 or more	314	29 or more
8	37 or more	632	26 or more
9	36 or more	660	25 or more
14	35 or more	4,309	10 or more
21	34 or more	11,102	5 or more

The lower end of this curve, covering the period between 25 and 39 years of continuous service, was easily obtained from the records of the

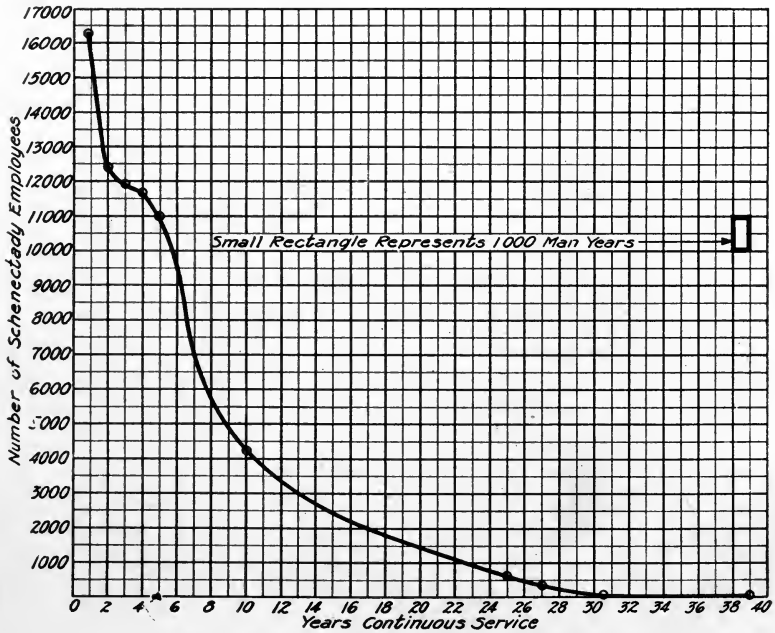


Fig. 1. SERVICE RECORD, SCHENECTADY WORKS

Quarter Century Club in Schenectady. The 660 members of the Schenectady Quarter Century Club have served a total of 19,000 man-years; i.e., their total years of service if represented by the life of one man would amount to 19,000 years.

The five-year point was obtained from the records of those who receive the 5 per cent supplementary compensation, described later in the chapter. The ten-year point was obtained from the records of the factory employees on the wage basis who receive the one week's vacation with full pay after ten years of service, supplemented by the ten-year salaried employees in the General Office and Works.

The upper portion of this curve, showing how many employees have rendered less than five years of service was difficult to obtain, for it involved the inspection of 20,000 records—one for each employee.

The figures from pay rolls 5, 10, and 25 years ago show that the number of five-year men now on the pay roll is 56½ per cent of the total pay roll five years ago. Similarly, neglecting transfer to and from Schenectady, 39 per cent of those employed ten years ago remained on the pay roll July 1, 1918; and of the total of approximately 2600 employees at Schenectady 25 years ago, 660 or 25 per cent are still working in the Schenectady Works.

The General Electric Company recognizes that steady work is of value to all concerned, and has instituted the following measures to promote it and to reward those employees who have long records of continuous service:

FIVE PER CENT SUPPLEMENTARY COMPENSATION

In addition to the 10 per cent bonus of over $5,000,000, paid to their employees in 1917, the General Electric Company distributed supplementary compensation in the year 1917 amounting to over $1,330,000 to employees who had rendered five years or more of continuous service up to that time. This supplementary compensation will continue to be paid until further notice to all employees who have rendered five years or more of continuous service. In 1917 this figure for the entire organization reached nearly 22,000 employees, including shop workers, clerks, engineers, commercial men, and office boys. This supplementary compensation is paid semi-annually and is equivalent to 5 per cent of the wage or salary during the preceding term.

The distribution of this supplementary compensation is shown in the following table which lists the different factories, and the number of employees in each who received this bonus:

Schenectady Works	11,102
Lynn Works	4,364
Pittsfield Works	1,938
Erie Works	311
Fort Wayne Works	734
Edison Lamp Division	982
National Lamp Division	1,266

At the present writing the number of employees who are eligible to participate is increasing at every six-month period.

VACATIONS WITH FULL PAY

No radical departures have been made in regard to the vacation granted salaried employees; but in the field of shop labor, a decidedly novel move has been inaugurated which has most interesting developments as possible or even probable in the future. Already the wage earners, or those on the daily or hourly basis in the shops, receive one week's vacation with pay after they have rendered ten years of continuous service. The following table will be of interest as it shows how many ten-year men are now employed in the shops on the wage basis:

Schenectady	3300
Lynn	1482
Pittsfield	250
Fort Wayne	192

THE PENSION SYSTEM

The pension system provides for retirement upon a pension at the age of 70, of all employees who have rendered 20 or more years of continuous service. Employees who have been continuously in the service for 20 or more years and who become incapacitated may be retired upon

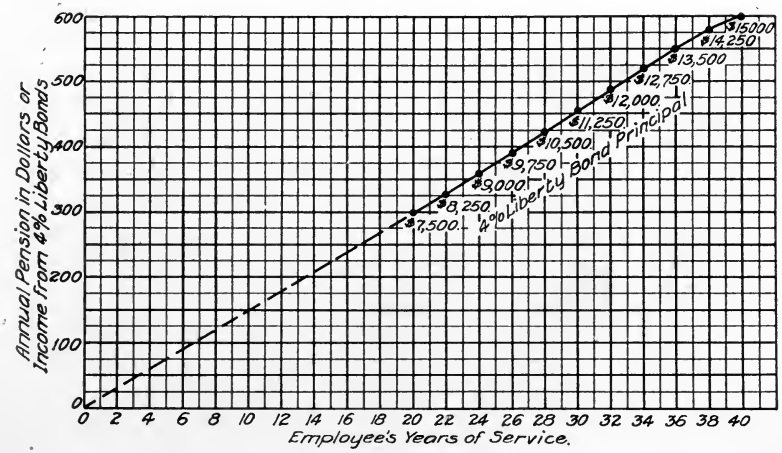


Fig. 2. PENSION RATE PER $1000 AVERAGE WAGES FOR VARIOUS PERIODS OF SERVICE

a pension with the approval of the pension board. Men must be retired at the age of 70, and women at the age of 60, unless special arrangements have been made with the pension board.

This pension is based upon the average annual wages for ten years prior to retirement, and the total number of years of continuous service.

HOW THE PENSION IS FIGURED

After 33 years of continuous service, an employee's pension equals 49½ per cent of his annual earnings.

The exact formula for computing the pension is as follows:

The average annual wages for ten years prior to retirement, multiplied by the number of years in service, multiplied by 1½ per cent. For example, for one whose service has been continuous for 30 years and whose average earnings for the last ten years have been $2500 per annum, the annual pension upon retirement would be $1125; or figured per day, it would be $3.08 per day including Sundays and holidays. Such an employee, retiring at the age of 70 and living to the age of 80, would receive a total sum in pensions of $11,250 according to the schedule in force at the present time. The pensions are paid monthly by check.

COMPARISON OF PENSIONS WITH LIBERTY BOND INCOME

The table is prepared to show not only the annual pension received by employees who have rendered between 20 and 40 years of continuous service, but the last column shows also the capitalization of this pension. For instance, a man who draws a pension of $300 per year until death, receives an income which is equivalent to that from $7500 in Liberty Bonds bearing 4 per cent interest; that is, his pension would be equal to his income if he owned $7500 of the 4 per cent Liberty Bonds. An employee rendering 40 years of service would for each $1000 of annual earnings, receive $600 annually, or the equivalent of the income on $15,000 of 4 per cent Liberty Bonds. Obviously, if his earnings averaged $2000 for the last ten years, he would receive twice that much, or $1200 per annum—the equivalent of the entire income of $30,000 worth of Liberty Bonds at 4 per cent interest. For the purpose of permitting rapid calculations, the following table and discussion are based on average annual earnings of $1000 per year.

The curve, Fig. 2, shows graphically the pension received by retired employees according to different periods of continuous service between 20 and 40 years. The figures under the curves show the amount in Liberty Bonds which a man would have to possess in order that the income from them would equal his pension.

No. of Years	Annual Pension Until Death	Capitalization in 4 Per Cent Liberty Bonds	No. of Years	Annual Pension Until Death	Capitalization in 4 Per Cent Liberty Bonds
20	$300	$7,500	32	$480	$12,000
22	330	8,250	34	510	12,750
24	360	9,000	36	540	13,500
26	390	9,750	38	570	14,250
28	420	10,500	40	600	15,000
30	450	11,250			

NOTE.—For retired employees whose earnings were more than $1000 per year the pension and the capitalization are each increased proportionately.

An interesting and instructive feature of this diagram is the dotted section of the curve. It may be commented upon as follows:

An employee who has worked less than 20 years should appreciate that already a considerable sum of money has been set aside to provide for his pension, but that by resigning his position before the end of 20 years' service, he is forfeiting this asset which he has created by his continuous service. This asset for the $1000 per year man with only a ten-year service, already amounts to the income from $3750 Liberty Bonds for the rest of his life; and for the $2000 per year man amounts to $7500 in Liberty Bonds; and both of these will be doubled when the full 20-year record is complete. In other words, by continuing in his present position for ten years more he will be able to make secure this doubled asset; whereas by resigning from his position he throws away this much capital, the income from which he would begin to receive at the time of his retirement and which he would continue to receive until his death. Similarly those who have served a greater or lesser period can consult this curve to ascertain what has been set aside for them; but all should bear in mind that the figures are based on annual earnings of only $1000 per year and should be increased proportionately for higher earnings.

Note.—Following extracts from Pension ruling may be of interest:

Any male employee who has reached the age of seventy years and who has been twenty or more years in the service shall be retired and shall receive a pension, unless at the request of the employee and with the approval of the Pension Board some later date be fixed for such retirement.

Any female employee who has reached the age of sixty years and who has been twenty or more years in the service shall be retired and shall receive a pension unless at the request of the employee and with the approval of the Pension Board some later date be fixed for such retirement.

Any employee who has been twenty or more years in the service and who becomes permanently incapacitated for further work may at the discretion of the Pension Board be retired from active service and receive a pension.

WHAT IS "CONTINUOUS SERVICE?"

In connection with the pension system, the supplementary compensation plan, and the ten-year factory service vacation, the expression "continuous service" is used. The rules governing the determination of each employee's service record are:

(1) Temporary absence and temporary layoff on account of illness or because of reduction in force will not be considered as a break in the continuity of service, but when such absence exceeds six consecutive months it will be deducted in computing length of active service.

(2) If any employee, after leaving the service of the Company, shall be re-employed, he shall be considered as a new employee.

(3) Leaving the service, as referred to in rule 2, is defined as follows:

(*a*) When an employee leaves voluntarily or is definitely discharged.

(*b*) When an employee absents himself from duty for two consecutive weeks or longer, without satisfactory explanation.

(*c*) When an employee, originally laid off because of reduction in force, fails to apply for re-employment within six months, or, being notified that he may return, fails to do so within two weeks of the date of such notice without satisfactory explanation.

(*d*) When an employee originally laid off because of illness fails to keep his department head informed monthly, or otherwise obtain approval of his absence.

(4) Leave of absence without pay may be granted individual employees, at the discretion of managers, but in every case it must be arranged in advance. If such absence exceeds three months it must be approved by the Supplementary Compensation Committee in advance, and the time, if it exceeds six months, shall be deducted in computing the net term of service.

(5) Leave of absence, without pay, for the purpose of securing a higher education and subsequently returning to active service in this Company, shall not be considered as a break in service provided arrangements are made in advance. If such absence is to exceed three months, it must be approved by the Supplementary Compensation Committee, and the time, if it exceeds six months, shall be deducted in computing the net term of service.

(6) Military service, both State and National, is not necessarily a break in the continuity of service. If an employee enters any branch of military service, either as the result of draft or voluntarily with the consent of the Company, and at the date of enlistment he shall have been in the service of the Company six months or longer, the Company will, after his honorable discharge from the service in the Army or Navy, and if he applies for employment, endeavor to re-employ him whenever possible, either in his original position or in such other capacity as may be found practicable. When again so employed, after military service, the employee's service with the Company for the purpose of computing pensions and other benefits will be held to have been continuous; i.e., his term of service with the Company will be inclusive of the time spent in military service.

(7) Supplementary compensation for five-year service shall be calculated only on the regular and overtime pay roll earnings for service actually performed, as will also the 10 per cent or any other bonus paid coincidently with regular wage or salary payments.

CHAPTER II

CLUBS AND ASSOCIATIONS

Though much has been written about the electrical industry comparatively little is generally known about the electrical fraternity. One of the factors which has contributed largely to the rapid development of the electrical industry has been the spirit of comradeship which animates and inspires the workers. This fraternal spirit manifests itself in the voluntary formation of clubs and associations all over the country. This chapter will briefly describe some of the more important clubs and associations at 12 different locations, having a total of over 33,000 members. The membership or ownership of these clubs is exclusively among the men and women of the General Electric Company.

MEN'S SOCIAL CLUBS AND ASSOCIATIONS

	Members
Quarter Century Club	1198
Edison Club at Schenectady	600
General Electric Club of New York	170
General Electric Club of Boston	130
Firemen's Association at Schenectady	130
Firemen's Association at Lynn	108
Thomson Club at Lynn	100
Mazda Club at Harrison	175
Coin and Stamp Club at Lynn	47
Volunteer Firemen's Association at Fort Wayne	36

THE EDISON CLUB

The Edison Club was formed in 1904 as a result of a petition which was signed by 183 college graduates who were taking the test course at the Schenectady Works. Today there are over 600 members, mostly graduates from American and foreign colleges. These young men have all pursued the same studies, have undergone the same training in the test course, and have lived the same life while being initiated into the electrical industry. The "camaraderie" exists not only between the younger members, but the various social and athletic activities offer opportunities for the student engineers to be brought in contact with many of the officials and engineers of the Company. The Club has a real "University Spirit" and contributes largely toward making the life of the test man in Schenectady not only wholesome but happy. The six photographs illustrate the three club buildings on a plot 90 ft. by 369 ft., and suggest good times of various kinds.

Among the aquatic sports canoe racing leads, and the club is affiliated with the American Canoe Association and participates in the races of the "Big League" in Schenectady and other neighboring cities. A score

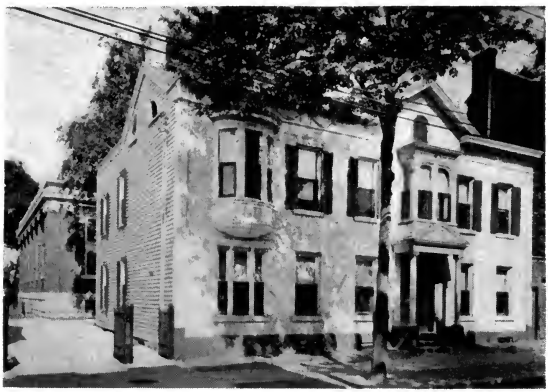


Fig. 3. THE EDISON CLUB AT SCHENECTADY IS THE RENDEZVOUS FOR THE TEST MEN FROM TECHNICAL COLLEGES AND UNIVERSITIES FROM ALL OVER THE WORLD. IT MIGHT WELL BE CALLED THE "COSMOPOLITAN UNIVERSITY CLUB"

Fig. 4. EDISON HALL CONTAINS AN ASSEMBLY HALL, SEATING 400 PEOPLE; FOUR BOWLING ALLEYS, SHOWER BATHS, MOTION-PICTURE MACHINE, AND KITCHENETTE. THE MEETINGS OF THE A.I.E.E. AND OTHER ENGINEERING SOCIETIES ARE HELD HERE AND BY REMOVING THE PORTABLE CHAIRS A BEAUTIFUL BALLROOM FLOOR IS AVAILABLE FOR DANCING

or more of silver cups and other trophies have been won, and the Edison Club boys stand for all that is good, clean, fair, and manly in the realm of aquatic sports.

One hundred and twenty-five members of the Club, ranging from the newest test man to the heads of departments in the general offices, have formed the highly successful Intercollegiate Bowling League which meets regularly throughout the year.

Fig. 5. READING ROOM OF EDISON CLUB AT SCHENECTADY. THE CLUB IS USED NIGHT AND DAY BY THE TEST MEN. POOL AND BILLIARD TABLES, CARD ROOM, AND LIBRARY ARE IN GREAT DEMAND

Fig. 6. BOWLING ALLEYS OF THE EDISON CLUB WITH THEIR AUTOMATIC PIN-SETTING EQUIPMENT. INTERCOLLEGIATE BOWLING TEAMS HAVE ROUSING TIMES IN THEIR MATCHES

Fencing, boxing, bag punching, hand and medicine ball, basketball, and tennis are among the other sports.

Members who are musically inclined have formed an orchestra, mandolin club, minstrels, and brass band.

Each year the members of the Club who are far away from home gather together for a Christmas dinner at the Mohawk Golf Club.

Fig. 7. THE CONCRETE BOATHOUSE ON THE BANKS OF THE MOHAWK RIVER IN THE REAR OF EDISON CLUB AND HALL. A DOUBLE TRACK IS PROVIDED FOR RUNNING THE 200 CANOES IN AND OUT OF THE FIREPROOF BOATHOUSE

Fig. 8. ONE OF THE REGATTAS OF THE AMERICAN CANOE ASSOCIATION. THE EDISON CLUB TEAM HAS WON MANY TROPHIES IN MEETS ON THE MOHAWK RIVER AND ELSEWHERE

Addresses are given by Mr. E. W. Rice, Jr., Dr. Charles P. Steinmetz, and other officials of the Company.

A salaried superintendent is in charge of the Edison Club.

LYNN SECTION, QUARTER CENTURY CLUB

THE FOREMEN'S ASSOCIATION AT SCHENECTADY ON ONE OF THEIR ANNUAL OUTINGS. CLAM BAKES, THREE-LEGGED RACES, BASEBALL GAMES, AND OTHER SPORTS ARE KEENLY ENJOYED

The Thomson Club was organized largely for the benefit of the college men who entered into the organization, and has a normal membership of 100.

Fig. 9. THE THOMSON CLUB IN LYNN FILLS THE SAME NEEDS AS THE EDISON CLUB IN SCHENECTADY. THERE IS A MEETING ROOM, DINING ROOM, LIBRARY, ETC., DOWNSTAIRS. IT IS AN EASY WALK FROM THE FACTORY TO THE CLUB HOUSE

Fig. 10. MEETING ROOM OF THE RIFLE AND REVOLVER CLUB. THIS, TOGETHER WITH THE GIRLS' GYMNASIUM, THE BOWLING CLUB, THE APPRENTICE ALUMNI CLUB, AND THE FOREMEN'S ASSOCIATION, ARE ALL LOCATED IN THE RECREATION BUILDING WHICH IS ALSO HEADQUARTERS FOR THE ATHLETIC ASSOCIATION

The photographs show interior and exterior views of the club house, including one of the many sleeping rooms which accommodate 25 of the members.

Fig. 11. SLEEPING ROOMS ARE PROVIDED AT THE THOMSON CLUB FOR THE ACCOMMODATION OF 25 MEMBERS. MOST OF THESE YOUNG MEN ARE COLLEGE GRADUATES WHO ARE GETTING THEIR PRACTICAL TRAINING IN THE SHOPS OF THE COMPANY

Fig. 12. GIRLS' GYMNASIUM AT LYNN, ATTENDED REGULARLY BY 40 GIRLS. THE EQUIPMENT AND INSTRUCTOR ARE PROVIDED BY THE COMPANY AND THERE IS A REST AND LUNCH ROOM NEAR BY

With sleeping accommodations for 20 members, this club includes in its membership superintendents and department heads as well as

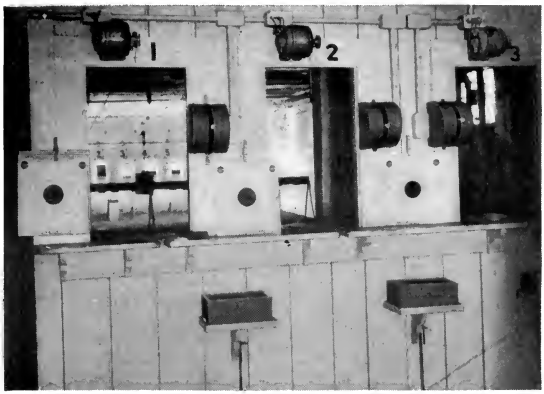


Fig. 13. RIFLE RANGE EQUIPPED WITH ELECTRICALLY DRIVEN TARGETS WHICH PERMIT CONTESTANTS TO CHANGE TARGETS RAPIDLY WITHOUT ANYONE SERVING IN PITS. ELECTRIC MOTORS WHISK THE TARGETS BACK AND FORTH LYNN WORKS

Fig. 14. ALLEYS OF THE BOWLING CLUB AT LYNN. LOCAL CHAMPIONSHIP GAMES ARE HELD HERE AND THE CLUB OWNS MANY TROPHIES WON IN COMPETITION WITH OTHER LOCAL TEAMS

engineers. About 35 members take their meals here. The equipment includes three billiard tables, bowling alleys, and two sets of tennis courts on the property. The members have also formed a club orchestra.

THE QUARTER CENTURY CLUB

The General Electric Quarter Century Club was organized in 1914 and its membership is limited to those who have spent a quarter century or more in the employ of the Company. The membership is divided as follows:

Schenectady	653
Lynn	318
District Offices	114
Fort Wayne	52
Harrison	27
Pittsfield	17
Sprague	12
Erie	5
Total	1198

The total years of service rendered by the 1198 members reaches the staggering figure of considerably over 33,000 years; and if expressed in the terms of one man's life, would extend from 11,000 B.C. to 22,000 A.D.

The Club has annual outings, banquets, and athletic events. The button worn by the members is attractive and is no doubt familiar to tens of thousands of workers in the electrical industry.

WOMEN'S SOCIAL CLUBS AND ASSOCIATIONS

	Members
Woman's Club at Schenectady	250
Girls' Gymnasium at Lynn	40
Women's Club of New York	90
Girls' Minstrel Club at Pittsfield	100
Elex Club at Fort Wayne	100

GENERAL ELECTRIC WOMAN'S CLUB

The General Electric Woman's Club at Schenectady has a beautiful clubhouse, of which some pictures are shown. The cultural studies, the social events, and wartime activities of this Club are the admiration of all women and men who have had the opportunity of being brought in contact with them.

The equipment includes dining room for daily luncheon and dinner, sleeping rooms, library, piano, victrola, etc. Tennis, canoeing, picnics, and corn roasts are popular in the summer, and the glee club, dancing classes, parties, recitals, and lectures are chief among the winter entertainments. Wednesday and Sunday the members may invite their men friends. A competent steward and stewardess are in charge of the clubhouse.

The Gamma Epsilon Society at Harrison, the Elex Club at Fort Wayne, the General Electric Women's Club at New York, and the yearly get-together of the girls in the San Francisco office are typical of the club spirit which exists among the girl workers.

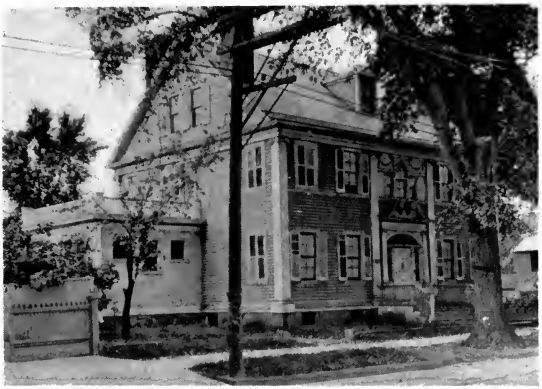


Fig. 15. THE WOMAN'S CLUB NESTLES AMID A WEALTH OF FOLIAGE AND SHRUBBERY. THE YOUNG BUSINESS WOMEN FIND REST AFTER THE BUSY DAY IN THIS OASIS OF INDUSTRIOUS SCHENECTADY

Fig. 16. IT IS A HANDSOME BUILDING, FORMERLY THE RESIDENCE OF ONE OF THE OFFICIALS OF THE COMPANY. THE PROPERTY EXTENDS DOWN TO THE MOHAWK RIVER

The Girl Minstrels at Pittsfield, with a chorus of 28, have attracted considerable attention at their two public performances. Songs, dances, jokes, tableaux, and male impersonations were intermingled on these occasions.

VACATION CLUBS

	Members
Girls' Vacation Camp at French Point, Lake George	500
Camp Claverack at Association Island, Lake Ontario	1000
Camp Nela, Cleveland	270
Camp Edison	115
Camp National	110
Marshall Outing Club at Harrison	61

Fig. 17. LIBRARY AT THE WOMAN'S CLUB WITH CORNER OF DINING ROOM IN BACKGROUND. LUNCHEON AND DINNER ARE SERVED DAILY

Fig. 18. THE GIRLS AT FRENCH POINT CAMP SLEEP IN 25 RAINPROOF TENTS WITH WOODEN FLOORS AND TWO COTS EACH. EACH TENT COMMANDS A VIEW ACROSS LAKE GEORGE

GIRLS' VACATION CAMP

The fascinating kodak views of the General Electric outdoor girls are sufficient to suggest the good times which approximately 500 girls enjoy annually at Lake George. French Point Camp comprises

42 acres, and is equipped with private dock, boathouse, icehouse, running water, rainproof tents, unsinkable row boats, motor boats, piano, victrola, rustic smokehouse, Dutch ovens, rustic seats, basketball and volleyball courts, hammocks and swings, games, and books. On rainy days the girls gather around the cobblestone fireplace of the "rendezvous" and in the evening dance on the piazza.

Delightful trails lead up into the mountain nearly 2000 feet above sea level. A swimming instructor and physical director look out for the girls' health. Any girl employed by the Company in the factories in nine cities or in any of the district offices may spend her vacation on this beautiful lake at a cost of less than $1 a day.

CAMP CLAVERACK

Camp Claverack covering 65 acres is located on Association Island, Lake Ontario. It is owned by the "Association Island Corporation" composed of men prominent in the electrical industry—nearly all of whom are employed by the General Electric Company. The open-air life is available not only to the men of the Company, but also to their families and friends. Camp Edison and Camp National are also located on Association Island.

CAMP NELA

Camp Nela at Cleveland, Ohio, is an electrical community for summer vacations and week-end trips. The camp contains swimming pool, ten tennis courts, two clubhouses, four bowling alleys, football field, grandstand, basketball court, gymnasium, library, auditorium, kitchen, two pianos, three victrolas, rifle and revolver range, lockers and shower baths. The architectural features of the camp suggest the Roycrofters' art, especially the two outdoor rustic amphitheaters.

ATHLETIC CLUBS AND ASSOCIATIONS

	Members
Athletic Association at Schenectady	300
Nela Athletic Association at Cleveland	400
Athletic Association at Erie	125
Rifle Club at Lynn	125
G-E Rifle Club at Fort Wayne	85
Rifle Club at Erie	10
Bowling Club at Schenectady (Shop League)	200
Bowling League (Edison Club)	125
Bowling Club at Lynn	200
Bowling Club at Erie	20
Football Club at Lynn	50

THE GENERAL ELECTRIC ATHLETIC ASSOCIATION

To attend an Athletic Association field day is to witness an afternoon of sport which will compare favorably with many inter-collegiate events.

The equipment of these athletic associations in general include a clubhouse with lunch room, bowling alleys, training quarters, lockers and shower baths, pool and billiard tables, basketball court, gymnasium, library, auditorium, meeting rooms, with piano and victrola, and also

Fig. 19. THE GIRLS' CAMP LIES AT THE VERY FOOT OF TONGUE MOUNTAIN WHICH RISES ABOUT 1800 FEET ABOVE SEA LEVEL. A HIKE UP THE MOUNTAIN, WITH A PICNIC LUNCH ON THE TOP, MAKES A GOOD DAY'S SPORT

Fig. 20. MEETING THE BOAT AT THE PRIVATE DOCK OF THE GIRLS' CAMP. SINCE THE BOATS STOP AT THE DOCK THE GIRLS ARE LANDED RIGHT *IN* THE CAMP, THUS MAKING THE JOURNEY PLEASANT AND INEXPENSIVE

a rifle and revolver range, baseball diamond, racing track, athletic field, football field, cricket field, tennis courts, and grandstand. Many members of the athletic teams are college men, and it has been found that the college man is pretty evenly matched against the shop worker in running, jumping, and other track and field events.

The bowling, baseball, and football teams and rowing crews in some of the cities are local champions, and they are the proud possessors of many trophies.

Fig. 21. THE PITTSFIELD BAND IN THEIR SMART UNIFORMS NOT ONLY GIVE OUTDOOR CONCERTS IN THE WARM WEATHER BUT ARE ENGAGED TO LEAD AND PARTICIPATE IN ALL BIG PARADES AND SIMILAR TO MUNICIPAL CELEBRATIONS

Fig. 22. BASEBALL DIAMOND, TRACK, FIELD, AND GRANDSTAND OF THE ATHLETIC ASSOCIATION AT SCHENECTADY. BASEBALL, FOOTBALL AND OTHER CONTESTS ARE HELD AT FREQUENT INTERVALS DURING THE SPRING AND SUMMER

These associations are practically self-sustaining with small annual dues.

At the Lynn Works an entire building is appropriated for athletic and social activities. It is known as the "Recreation Building" and is available to any club or society that may apply for quarters in it.

MUSICAL CLUBS

	Members
Schenectady Band	50
G-E Chorus at Fort Wayne	55
Fort Wayne Band	35
Pittsfield Band	28
Erie Band	18
Coupler Glee Club at Erie	128
Chorus Club at Erie	40
Glee Club at Lynn	32

THE BANDS

It is a familiar, but none the less inspiring, event when the stirring airs of martial music reverberate between the great buildings of the General Electric factories. The brass band welcomed Secretary Daniels and Governor Whitman at the Schenectady Works during the present

Fig. 23. TENNIS IS A POPULAR GAME AMONG THE MEMBERS OF THE SCHENECTADY ATHLETIC ASSOCIATION. THE COURTS ARE LESS THAN TEN MINUTES' WALK FROM THE GENERAL ELECTRIC WORKS

year; the Liberty Loan parades are always headed by the General Electric Band; the summer concerts are regular events in many of the factories; and many city parades and meetings engage these bands for special occasions.

The Erie Chorus and Minstrel Club last February gave two performances to "SRO" audiences at the Park Opera House. The string quartet, black-faced comedians, musical, and fancy dancing numbers vied with the Japanese girls, the soloists, and the tableaux.

DEPARTMENTAL ASSOCIATIONS

	Members
Foremen's Association at Schenectady	225
Foremen's Association at Erie	225
Draughtsmen's Association at Schenectady	400
Electro Technique Club at Fort Wayne	400
Cost Accountants' Association at Schenectady	123
Apprentice Club at Schenectady	112
Apprentice Club at Lynn	80
Order & Stock Department Association at Schenectady	56
Power & Mining Department Bowling Club at Schenectady	48
Power & Mining Department Girls' Bowling Club at Schenectady	13
Foreign Department Bowling Association at Schenectady	20
Building Maintenance Department Club at Erie	20

Whether chiefly for education or recreation, these Departmental Associations add much to the spirit of co-operation in their several spheres of influence. The Apprentice Clubs have an annual outing and picnic; others have banquets, motor trips, clambakes, amateur theatricals, etc.

WAR GARDEN CLUBS

	Members	Acres
Schenectady War Garden Club	1100	95
Erie War Garden Club	250	55
Fort Wayne War Garden Club	118	6.5
Pittsfield "Allen Farm"	300	37
N.E.L.A. War Gardens at Cleveland	125	4.5

Officials, engineers, foremen, mechanics, and electricians—all put their hand to the hoe and spade in this patriotic, economic, and health-giving activity. Motor ploughs and harrows prepared the soil in advance so as to lighten the preliminary work, and sheds were provided for storing the garden tools overnight.

The effect of the new daylight-saving law in lengthening the play-time after working hours, will doubtless be taken advantage of during the coming season by the amateur gardeners. As early as March, 1918, 1000 applications had been received at Schenectady alone for garden plots to be cultivated during the summer.

CHAPTER III

MUTUAL BENEFIT ASSOCIATION

An employees' organization largely under their own management, with financial transactions totaling close to $200,000 per year and with 23,000 voluntary members in six different cities—this is the General Electric Mutual Benefit Association.

The purpose of this chapter is to describe this Association, telling what it costs and what it affords the members, and how and when it was organized; to explain its scheme of operation and management and its various sources of income; and lastly, briefly to review the main essential points of its organization.

An enthusiastic member made the following comment on the protection afforded by the Mutual Benefit Association:

"The great health and accident insurance companies of this country have several different policies compensating for accidents and several different policies compensating for sickness; but the 'accident' policies do not recompense for sickness and the 'health' policies which protect against sickness do not recompense for accidents.

"An exception to this is a combined health and sickness policy which costs considerably more than either of the above. Many of these policies, however, which do protect against both accident and sickness, do not pay any death benefit.

"The General Electric Mutual Benefit Association, however, protects against both accident and sickness and, in addition to this, pays a death benefit to the members.

"Therefore, it may be seen that the protection and benefits of the General Electric Mutual Benefit Association are more comprehensive and liberal than those of the companies who conduct their business for a profit. This would naturally be expected, since the General Electric Mutual Benefit Association is not conducted for profit, and has no rent nor salaries to pay; even its stationery and printed forms are provided free of expense."

PROTECTION

Briefly stated, the protection consists of a death benefit and a weekly indemnity while sick or disabled. The death benefit paid out of the treasury of the Mutual Benefit Association is $100, but the General Electric Company supplements this by another payment of $100; thus, in effect, making the death benefit $200. This is payable at once in cash to the beneficiary of the deceased member.

The weekly disability payment in case of sickness is $6 per week for men and $5 per week for women. Payment is continued for fourteen weeks during any twelve consecutive months. In all periods of disability members are excused from paying dues. A visiting committee is formed in each case to call upon the sick member, and in many cases the Company's nurse likewise calls upon the patient.

The liberality of the arrangement is shown by the fact that even though a member leave the employ of the General Electric Company while disabled through sickness or accident, his right to receive payment of the benefits to the full amount is not annulled for a period of two years from the beginning of the disability, provided that he has not in the meantime recovered from the disability or secured remunerative employment. Putting it differently, the weekly benefits are limited to fourteen weeks in twelve months, and the right to receive them is extended over a period of two years from date of such disability without regard to service in the General Electric Company. Similarly, if the disability should result in death, the death benefit would be paid any time during a two-year period, even though the member had left the employ of the General Electric Company. The Association follows the wisely established practice of most fraternal organizations by omitting the benefit for the first week of disability.

MEMBERS ARE STEADY WORKERS

An interesting fact in connection with the Mutual Benefit Association is that during hard times, when business is slack, the percentage of employees who are members of the Association increases rather sharply. In other words, it appears from the record that the members of the Association are more steadily employed than those who are not members. This does not indicate that when work is slack, members of the Association are carried through the hard times because they are members of the Association; but it does indicate that the steadiest and most far-sighted employees who are interested in their work are those who have already joined the Mutual Benefit Association; and these are retained on the pay roll because of their ability, and not because they are members of the Mutual Benefit Association.

OVER FOUR MILLIONS LIFE INSURANCE

Last year the Schenectady, Lynn, and Pittsfield Mutual Benefit Associations paid benefits to members amounting to approximately $80,000. The total of death and sick benefits in the various factories of the General Electric Company approximates $100,000 per year. The amount of life insurance carried by all these Associations is over $4,500,000.

The cost of this triple protection against death, sickness, and accident varies from nothing a year in some sections, up to a maximum of $5.20 per year. The cost per member averaged $4.07 at Lynn in 1916; and the average at Schenectady was but $3.97 in 1917.

It would not be fair to health and accident insurance companies to compare their cost and the protection offered with the cost and protection offered by the General Electric Mutual Benefit Association, as the latter, it might be said, is literally "in business for its health." The fundamental idea of the Mutual Benefit Association is to help one another and not to make a profit. The administration expenses, including

FIELD DAY, PITTSFIELD WORKS SECTION, GENERAL ELECTRIC COMPANY MUTUAL BENEFIT ASSOCIATION

stationery and blank forms, are paid by the General Electric Company, and these with the auxiliary $100 benefit, amount to approximately $18,000 for the year 1916.

The combination of health, accident, and life insurance purchased from corporations engaged in this enterprise is expensive. Factory workers are not inclined to invest a large sum of money in advance for such purposes; therefore, the method pursued by this Association in collecting its dues of ten cents every week has been largely responsible for its phenomenal growth. However, for industrial managers who care to go into this question, it would be interesting to obtain data on death, accident, and life insurance and see if any protection could be purchased for $4 per year! It will be obvious that an internal organization can

perform a service among fellow employees which it would be practically impossible for an outside corporation to carry on at a profit, or even at cost under existing conditions. In other words, there are thousands of employees who would not have any protection against the contingencies of accident, were it not for this Association, formed and conducted by fellow employees. This recalls the fact, shown in one of the following chapters dealing with fire protection in the General Electric Company, that a decided advantage results from adopting the plan of mutual fire insurance; and just so the mutual life, health, and accident insurance has proved a wonderful success.

OTHER SOURCES OF INCOME

The total receipts of the various Mutual Benefit Associations are approximately $100,000 per year. In addition to the dues from members, the Association has other small sources of income, principally the annual field days held at Lynn, Schenectady, and Pittsfield. The receipts from these field days are turned into the treasury of the Mutual Benefit Association. Dances are held from time to time; and other entertainments, more or less impromptu in their nature, assist in swelling the treasury fund and in reducing the dues paid by the members. These events meet with hearty response from the members, for the money paid for admission to the various entertainments and amusements is practically refunded to them by a lessening of their dues. This results in a large attendance at such events, an illustration of which is seen in the 1917 Schenectady field day, for which over 13,000 tickets were sold.

The slogan adopted for this fourth annual field day which appeared on posters displayed throughout the plant, was: "Suspend assessments to the death benefit fund. Twenty thousand tickets to be sold—two tickets per member. Buy now and cancel later payments."

Good-natured rivalry was shown in the ticket-selling contests between sections, and $75 was divided as first and second prizes for the two sections selling the greatest number of tickets. In preparing for this field day a special committee was appointed, and one of the indirect benefits which resulted was a wider acquaintanceship between those sharing in the management of the event.

The receipts for the last field day were $1400. After expenses were deducted for the prizes, etc., a net balance of $1125 was added to the death benefit fund.

It might be well to mention that these field days are under the direct auspices of the Mutual Benefit Association and are separate and distinct from the General Electric Athletic Association.

The attendance at the Mutual Benefit Association field day at Lynn was over 30,000, and the total proceeds of last year's entertainments were $2836.

At Pittsfield special stress is laid upon the social features of the Mutual Benefit Association and the fraternal spirit developed by the various entertainments.

SCENES AT 1917 ANNUAL FIELD DAY AND PARADE OF LYNN WORKS SECTION, G-E MUTUAL BENEFIT ASSOCIATION

"The Mikado" was reproduced by members of the Association at the Colonial Theater and the attendance was 1418 and included about 100 outsiders. All of the performers were members, and the rehearsals and various negotiations connected with the management

of the affair contributed in developing executive ability among the employees.

An electrical fair was participated in by the members of the Association, and the dance, attended by 1200 young people, netted a profit of nearly $200.

FIELD DAY, SCHENECTADY WORKS SECTION, G-E MUTUAL BENEFIT ASSOCIATION

FINANCIAL STATISTICS

The financial operations of the Mutual Benefit Association in Schenectady over the period of four and a half years which it has been in existence, may be summarized in round numbers:

Total receipts	$86,800
Total disbursements	68,700
Balance on hand	$18,100
Number of sickness claims	2,494
Total sickness benefits	49,630
Death benefits:	
(Mutual Benefit Association)	$10,500
(General Electric Company)	7,800
Total	$18,300

ESTABLISHED FOR 17 YEARS

The plan of organization and management of the six Mutual Benefit Associations of the General Electric Company is practically identical with the original plan conceived in the Lynn Works in 1902. It is fitting to record that these great activities sprung from one man's idea, whose faith in the success of the plan was so great that he personally loaned a sum of money to form the nucleus of the Lynn Association.

It is impossible to estimate the amount of distress which has been alleviated by this altruistic deed and the idea which time has proved so successful.

SCENES AT RECENT G-E MUTUAL BENEFIT ASSOCIATION FIELD DAY, LYNN SECTION

SCHEME OF OPERATION

If the Schenectady death benefit fund is equal to $3000 or more, no assessments are levied against the section treasuries; but when the death benefit fund, owing to payment to families of deceased members,

falls to $1500 or less, monthly assessments are made on each section equivalent to ten cents for each member of the section. This minimum and maximum of the death fund varies in the different associations, according to their size. In some associations $1000 is the maximum and others $2000, etc. Similarly, when the treasury of each section shows a balance of $300 or more, the payment of dues by members is suspended until such time as the balance is reduced by the payment of sick benefits to $200, when the maximum assessment of ten cents per week is levied upon each member.

From this it will be seen how a payment of over $2800 into the death benefit fund, resulting from the annual field day and other entertainments at Lynn last year, resulted in a direct suspension of dues from the members. Each section of the Association collects its own dues and compensates its own members for disability.

The advantage of the subdivision into sections not only makes the work of collection easier, but groups together, for mutual aid, the employees in a department. It establishes, therefore, a community of active interest in each small group. New employees of the department, when approached with a request to join, will usually be attracted to an organization composed of fellow workers in the same department, while they might hesitate to join a large organization of the whole Works. On account of the acquaintanceship among the members, the genuineness of the disability claims can readily be established, and fraudulent practices are, therefore, easily prevented. Finally, by a subdivision of the Association into groups, the Company is given a better opportunity of coming into touch with individual members than would otherwise be the case.

MEMBERSHIP

Membership begins with the payment of an initiation fee of 50 cents and the first week's dues of ten cents. Thereafter, ten cents is payable and collected every week in advance and no member can be obliged to make any further contribution. As previously stated this payment is suspended altogether for shorter or longer periods when the section treasury shows a balance of $300 or more. This provision stimulates economical administration of the funds in each section, and establishes a wholesome rivalry among the various sections. It arouses the interest of the members themselves, who have it largely in their power to secure inexpensive insurance for themselves by maintaining a full quota of membership in their section, and by carefully but sympathetically scrutinizing all claims for disability payments, to the end that only just claims shall be allowed. Finally, it prevents the accumulation of unnecessarily large funds in the treasuries.

Many sections have thus been enabled to suspend payment of dues for a part of the year; some have even afforded their members full insurance for the whole year at no cost whatsoever!

SIZE AND GROWTH

With a membership of 22,675 in the summer of 1917, the Mutual Benefit Association stands in an enviable position among co-operative employees' associations. Some large corporations have benefit associa-

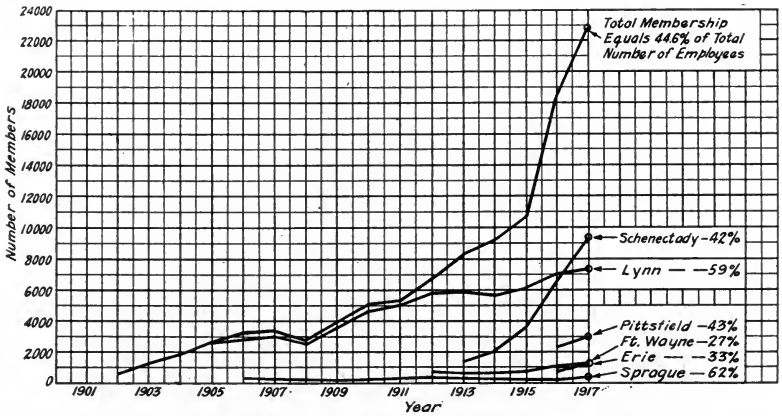


Fig. 23a. CURVES SHOWING GROWTH OF MEMBERSHIP OF GENERAL ELECTRIC MUTUAL BENEFIT ASSOCIATION

tions whose membership is compulsory; so the success of this Association is all the more gratifying because membership is voluntary. It will be recalled that the idea was first conceived in Lynn, Mass. Fifteen years ago there were but 656 members and, as seen in the curves of membership, the growth was quite gradual during the first ten years. However, the membership in the past two years has increased very rapidly—81 per cent —as shown in Fig. 23a.

Only in the year 1917 did the Schenectady Association, organized four years and a half ago, in March, 1913, exceed in size the Association at the Lynn Works. The Lynn Association, however, can boast of a larger percentage of membership, 58.7 per cent of the employees being members in 1917, against 42 per cent in the Schenectady Association during this its greatest year.

The Association at the Sprague Works has the largest percentage of employees as members, and the Pittsfield Association shows a greater proportionate development in point of time than others, it being but two years old and having 43 per cent of the employees as members.

Fig. 24 permits a careful study of the fluctuation in the total number of employees and members at the Lynn Works. As mentioned earlier in this chapter, when periods of depression occur, such as in 1908 and 1915, a sharp increase is noted in the percentage of employees who are members of the Mutual Benefit Association. In 1915, 72 per cent of the total number of employees were members of the Association.

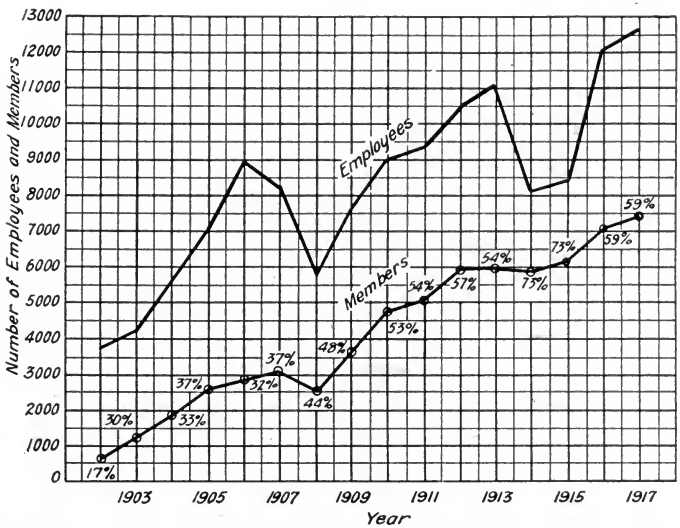


Fig. 24. NUMBER OF EMPLOYEES AND MEMBERSHIP OF MUTUAL BENEFIT ASSOCIATION, LYNN WORKS

A study of Fig. 29, which gives the same information for the Sprague Works, reveals the same situation to an even more pronounced degree, for here it is clearly shown that during the 1908 depression the membership was 79 per cent, and during the 1915 slump it rose to 82 per cent of the total number of employees in the Works. Very few of those who were laid off were members of the Association.

Fig. 25 shows the phenomenal growth of the Association's percentage at the Schenectady Works during its comparatively recent existence—four and a half years.

Similarly, Figs. 26, 27, and 28 show respectively the situation at the Erie, Pittsfield, and Fort Wayne Works, and it will be noted that the progress of the Association clearly proves that the idea upon which it was founded has finally met with a most enthusiastic reception on the part of General Electric employees as a whole.

The mutual features in connection with the Association are of two kinds, viz., mutual advantages to the employees themselves, and mutual

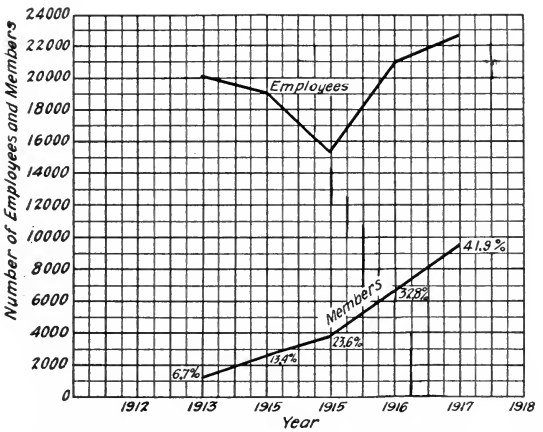


Fig. 25. EMPLOYEES AND MEMBERSHIP, SCHENECTADY WORKS

advantages in the relations between the employees and the Company. The mutuality among the employees has already been discussed in connection with protection, acquaintanceship, and entertainments. The relation between the Company and the employees is almost entirely

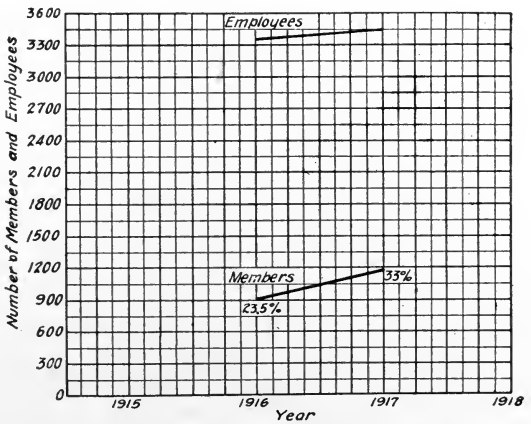


Fig. 26. EMPLOYEES AND MEMBERSHIP, ERIE WORKS

indirect and psychological, but none the less important. The fact that few of the members of the Association are laid off during the slack times is one indication that the members of the Association are able and trustworthy employees. And, since the Company encourages the

Mutual Benefit Association it may be inferred that the executives in charge of its affairs consider such activities on the part of the employees as really mutual with respect to the Company's welfare.

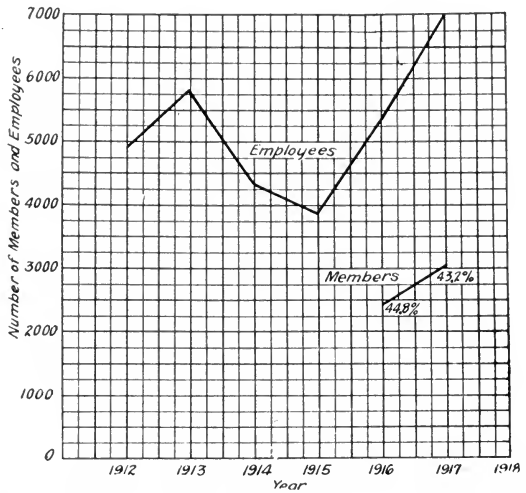


Fig. 27. EMPLOYEES AND MEMBERSHIP, PITTSFIELD WORKS

EXTENSIONS

TABLE OF MEMBERSHIP

Year	Schenectady	Lynn	Sprague	Fort Wayne	Pittsfield	Erie	Total No. Members
1902		656					656
1903		1,285					1,285
1904		1,856					1,856
1905		2,591					2,591
1906		2,874	300				3,174
1907		3,076	305				3,381
1908		2,524	200				2,724
1909		3,684	200				3,884
1910		4,785	250				5,035
1911		5,040	275				5,315
1912		5,911	310	492			6,713
1913	1,346	5,963	315	601			8,225
1914	2,256	5,857	300	751			9,164
1915	3,620	6,143	250	777			10,790
1916	6,875	7,093	325	994	2,410	900	18,597
1917	9,460	7,408	400	1,205	3,052	1,150	22,675
Total No. of employees in 1917	22,600	12,644	650	4,372	7,050	3,500	

Grand total number of employees in General Electric factories above..... 50,816
Grand total number of members in Mutual Benefit Association..... 222,675
Percentage of employees who are members of Mutual Benefit Association. 44.6 per cent

At the Lynn Works the Mutual Benefit Association activities are extended to include additional features as follows:

1. Additional emergency benefits payable to disabled members in such amounts and manner as the committee in charge of the emergency fund may allow.

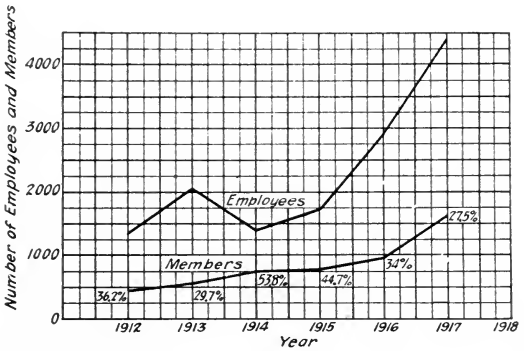


Fig. 28. EMPLOYEES AND MEMBERSHIP, FORT WAYNE WORKS

2. Temporary loans at no interest charge or other extra cost which the loan fund committee may decide to grant to any member of more than one year's standing.

3. Banquets attended by officers, committees, and members of sections. These are held in the large, new restaurant, which is admirably adapted to such events.

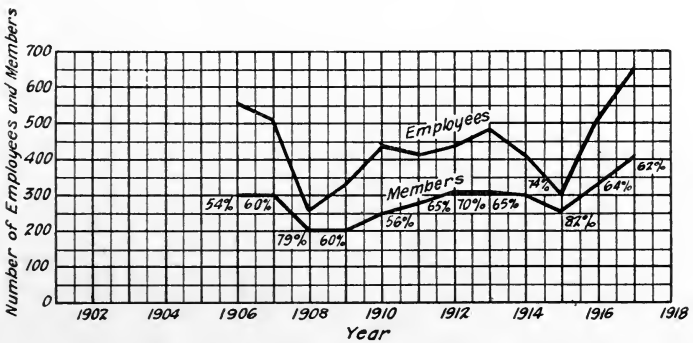


Fig. 29. EMPLOYEES AND MEMBERSHIP, SPRAGUE WORKS

At Pittsfield the presentation of theatrical entertainments, such as the "Mikado," is a step in advance in fostering the social and fraternal spirit.

ESSENTIAL POINTS OF ORGANIZATION

A study of the structural organization suggests clearly five features as important factors in the achievement of success. They are:

1. Subdivision of the Association into small, self-acting and self-administering though closely connected bodies—the sections.

2. Management of these subdivisions by the members themselves, with only a general supervision of all by a representative of the Company.

3. Limitation of the trust funds in the treasuries to such amounts as, under ordinary circumstances, would seem sufficient for the payment of all guaranteed benefits.

4. Utilization of practically all contributed moneys for the purpose for which they are contributed—sickness, accident, and life insurance.

5. Simplicity of administration.

These principles and the method of their application have proved efficacious and afford the employees the cheapest insurance against disability and death, consistent with safe and sane management; and at the same time develop contentment among the members, and relations of mutual loyalty between the employees and the Works' management.

CHAPTER IV

SAFETY WORK OR THE PREVENTION OF ACCIDENTS

In these days when the conservation of all our national resources is given serious thought by all true lovers of America, the conservation of man-power through the prevention of accidents is a subject of first importance.

It is the purpose of this article to point out the methods pursued and the results accomplished by the Safety Committee of the General Electric Company to reduce the number of accidents to employees. While complete figures are not available for all of the factories of the Company at this writing, an indication of the results accomplished by the campaign for accident prevention is afforded by the adjacent figures.

The growing tendency of the employee to have minor injuries treated at the emergency hospital, in order that the danger of blood-poisoning may be lessened, has resulted in a large increase in the number of first aid cases treated, with a corresponding decrease in the number of infections. The large number of new employees in 1916, many of whom were inexperienced, resulted in many injuries which in all probability would not have happened to older and more experienced workmen working under normal conditions.

HOW THE RESULTS WERE ACCOMPLISHED

A blank form was provided, on which particulars of all accidents, however slight, were reported to the Safety Committee by the foreman. These reports showed that most accidents resulted from a few causes.

The study of these records was supplemented by a check on individual cases until it was established beyond doubt that the statistics represented general conditions.

The methods of preventing specific kinds of accidents will be discussed extensively later; but some interesting high lights revealed by these statistics will be mentioned first.

PITTSFIELD WORKS

Year	No. of Employees	No. of Lost Time Accidents	Percentage of Employees Meeting with Accidents
1912	4,913	1,850	37.6
1913	5,852	1,353	23.1
1914	4,385	573	13.06
1915	3,904	353	9.04
1916	5,378	721	13.4

LYNN WORKS

Year	No. of Employees	No. of Lost Time Accidents	Percentage of Employees Meeting with Accidents
1913	12,272	777	6.3
1914	10,895	513	4.7
1915	8,499	719	8.5
1916	10,562	1,096	10.4

SCHENECTADY WORKS

1913	19,977	1,284	6.4
1914	16,823	829	4.9
1915	14,347	662	4.3
1916	20,985	1,355	6.5

NOTE.—A "lost time" accident is one causing a loss of time of five hours or more.

INTERESTING FACTS DEVELOPED AT PITTSFIELD

The most careful age was found to be 37 years.

The ages showing most accidents in proportion to number of employees were between 22 and 26 years, and 50 years and over.

The hour showing most accidents was from 9 to 10 a.m.

Fifty per cent of the accidents occur to new employees, or those who have been less than six months in one position.

Contrary to general belief, the foreign born employees are quick in acquiring the safety habit, if taught.

More accidents occur on Monday than on any other day.

More accidents occur in the hot season than in the cold.

Over 80 per cent of the accidents are due to carelessness.

The average woman on the same kind of work meets with an accident only one third as frequently as the average man.

THE EDUCATIONAL CAMPAIGN

A competent executive was engaged at Pittsfield to instruct the employees inside the Works, as well as to extend the propaganda to the entire population of the city.

INSIDE THE WORKS

While collecting the statistics, photographs were taken showing the causes and results of specific accidents. Lantern slides were made from these photographs, and these together with the data collected formed the bases for lectures. The last half of the noon hour was frequently employed to give these lectures, and the "horrible example" of those who had been injured either through their own carelessness or that of others was forcibly shown by the photographs and description.

The foremen served to radiate the general information, as well as to personally instruct employees in certain processes which had been found hazardous. As a result of this campaign, employees have been

urged to report carelessness in others, and those who show habitual carelessness are encouraged to seek less dangerous fields of work, and if they fail to improve are subject to discharge.

A magazine containing items of general interest but always some article about safety is printed at each of the factories and distributed gratis among the employees. These articles are made to supplement the lectures, and in some of the factories the head of the safety work is editor of the paper.

Safety literature is distributed among the men, and a series of posters, almost half of them illustrated with photographs or artists' drawings, are designed and posted in prominent places throughout the Works. These posters are changed semi-monthly, and are written in strong, simple English, in many cases the pictures telling the story.

OUTSIDE THE WORKS

The local newspapers gave prominence to the safety worker's activities, and even commented editorially upon the value of his services to the community.

Lectures were given in halls and schools and to the Boy Scouts, so that the habit of carefulness could be instilled in the youth as well as the skilled workman. The Y. M. C. A. co-operated generously, donating its auditorium as a meeting place for many of these lectures, discussions, and demonstrations.

MECHANICAL AND ELECTRICAL SAFEGUARDS

Supplementing the educational activities, the Company's engineers and production experts, upon recommendations of the safety committee, spent large sums for safeguards. A lengthy discussion of these will be omitted because of their technical nature, but in general, wherever a machine could be instantly stopped by an electrical pushbutton or by other means, and human life and limb thus made safer, the appropriation was forthcoming for these devices.

Those responsible for the safety work in the various factories give their first attention to providing proper safeguards on those machines which present the greatest hazard to the workmen. For instance, punch presses are recognized as dangerous machines unless properly guarded. Accidents are likely to occur with this class of machinery from the press repeating while the hands of the operator are under the die, in the act of either placing or removing the work. Special attention was given to eliminating this danger, in many cases the presses being changed from foot tripping operation to a mode of operation which requires that both hands be removed from under the die before the press can be operated. In other cases non-repeating tripping devices were attached which would

only permit one stroke of the press at a time. Automatic mechanical and pneumatic feeding devices have been developed for presses working on long strips or rolls, which make it unnecessary to place the hands under the die. Where large numbers of small pieces are required, a magazine feed has been developed, so that the operator has only to feed a large

LIGHT AND VENTILATION IN BLACKSMITH SHOP

hopper. In fact, wherever the work will permit some rearrangement of the work or of the machines is made, or some type of guard is used which will obviate the necessity of the hand being placed under the die, or the press is made inoperative while the hand is there. Where guards are not practical, pliers are used for placing the work and a jet of air is employed for removing it. The care which has been taken to eliminate the danger incident to the use of this class of machinery has reduced the number of accidents to a minimum.

The majority of protective devices for machines consists of belt and gear guards of great variety, and much constructive ingenuity has been displayed in avoiding interference with the operation of the machines and at the same time affording adequate protection to the operator. It was found that in numerous cases where it was necessary to remove the guard to make adjustments to the machine, the operator

would neglect to replace it, with the result that accidents occurred from this form of carelessness. To obviate accidents of this kind, the belt and gear guards are made part of the machine. They are rigidly constructed, and doors are placed so that the removal of the guards is unnecessary for making adjustments.

The operation of grinding wheels would be dangerous, due to bursting from excessive speed or to a fracture in the wheel, if proper pre-

BATTERY OF PUNCH PRESSES EQUIPPED WITH "SIMPLICITY" GUARD IN OPERATION. PRESS CANNOT BE OPERATED WHILE GUARD IS UP

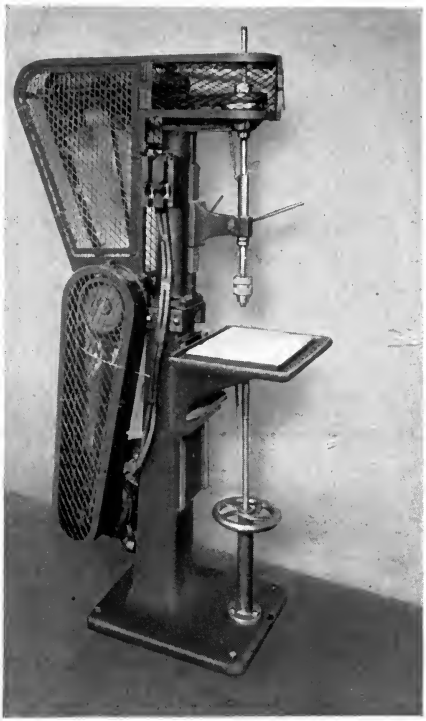
cautions were not taken to safeguard them. Experiments were made which resulted in a reduction of the grinding speeds, and the wheels have been completely enclosed, except that portion actually necessary for performing the work. The results obtained by these precautions have been very gratifying, as accidents from grinding wheels have been entirely eliminated.

OTHER SCHEMES FOR ACCIDENT PREVENTION

In one building at the Schenectady Works, every week 3,000,000 screws are made, and 2,000,000 are used in wiring devices. Most of the screwdriving is done by power, and in this building over 300 electrically driven screwdrivers are being operated by girls. The

principal feature of this device is the auto-start and auto-stop mechanism. The screwdriver does not begin to rotate until the work has been brought in contact with it, and after the screw has been driven home the screwdriver ceases to rotate, through the operation of a cleverly devised slipping clutch.

In metal spinning, spring making, and on kick presses for light punching and perforating, metal saws, milling machines, and a score of



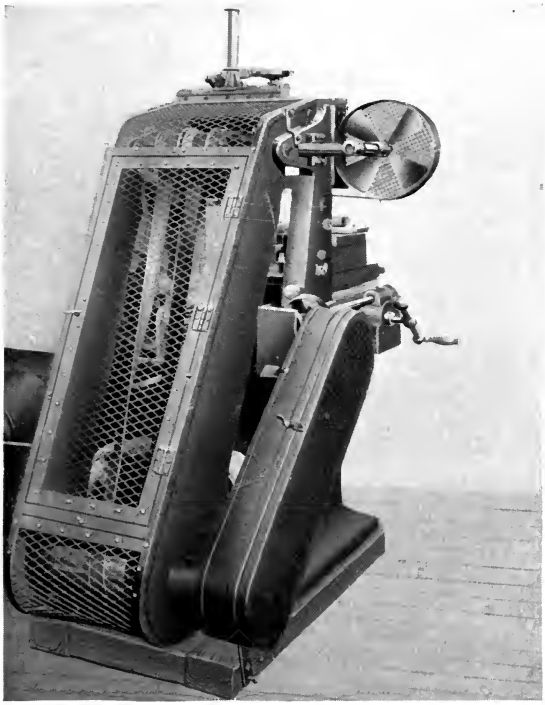
TYPE OF EXPANDED METAL GUARD USED ON DRILL PRESSES

other machines, all dangerous moving parts are completely enclosed. This has been done so thoroughly that one girl voiced her appreciation in the following comment: "Everything that is movable cannot be touched, and anything that can be touched is not movable."

In walking through the Schenectady Works one is impressed with the miles of ventilating pipes which convey dust, offensive odors, and injurious gases to the external air. These ventilating systems are motor-driven, and they give the observer a new appreciation of electricity, for little motors hardly larger than a quart bottle are faithfully protecting the health of hundreds of workers. Many rooms in which manufacturing processes are being carried on, such as melting wax, spraying lacquer, or

handling powders, were found to be entirely free from odors or dust. This result was accomplished by providing large metal hoods into which the objectionable materials were carried by the inrushing air of the ventilating system.

A thing of interest was a metal finger used to indicate the precise point at which melted sealing wax was being dropped from a melting pot. As one man remarked: "That one metal finger has saved many a burned thumb."



BELT GUARD ON PROFILER

On many of the small kick-presses for light perforating work, a metal finger attached to a swivel guard automatically pushes aside the hand of the operator before the ram descends to pierce the metal. One girl operator said: "This machine is almost human, for if I were to forget and leave my hand in danger I would not only be saved from injury, but likewise slapped on the wrist for my carelessness."

Some of the processes involve the cutting of millions of little strips of metal from ribbons of zinc. These ribbons are fed into the machine through a narrow slot scarcely larger than the metal itself, and no part of the operator's body can get into the danger zone by accident.

On the stamping machines which are power-driven this method of protection is used, as well as another which makes it necessary for both of the operator's hands to be clear of the material being worked before the ram descends upon it. The trigger releasing the machinery is also the safety device itself, for in order to make the machine operate it is necessary to pull down the guard. This is not a case of adding a safety device to a machine, but of redesigning a machine so that a vital portion of the operating mechanism is the safety device.

OPERATOR WEARING RESPIRATOR WHICH IS USED IN PLACES WHERE VENTILATING OR EXHAUSTING SYSTEMS CANNOT SUCCESSFULLY REMOVE INJURIOUS DUST

An interesting variation of punch press operation consists in having a revolving table carry the work under the punch press; sometimes the metal is worked upon by the tool at as great a distance as 18 inches from the operator's hand.

A general principle observed by the safety experts of the General Electric Company is: "Bring the work to the tool and not the tool to the work." By this means the number of possible combinations of movements is materially lessened; because with a moving tool and a moving hand the possibility of lack of co-ordination is increased. This practice has been specially followed in tapping machines where a jig holds the work secure and the jig is then brought to the tap.

The same practice is followed in most soldering processes and has prevented numerous burned fingers. The electrically heated soldering

iron is permanently fixed at the proper angle and the parts to be soldered are brought into contact with the hot point. Identical methods are employed for melting sealing wax.

In a few cases where a variety of soldering is to be done, the weight of the soldering iron is carried by a helical spring—taking advantage of the well-known fact that if the strength of the operator is conserved and fatigue is lessened, inaccuracies are minimized. Where intermittent soldering processes are performed, a rack is provided to hold the iron

HELMET USED BY ARC WELDERS, PROVIDED WITH WINDOWS OF SPECIAL GLASS WHICH SHIELD THE OPERATOR NOT ONLY FROM INJURIOUS LIGHT RAYS BUT ALSO FROM THE HEAT RAYS

when not in use—thus preventing fires and needless damage and interruptions. One young lady solders 7000 electric light sockets every day.

Anyone who has handled solder is familiar with the fact that the metal when melted has practically the same appearance as when cold. To guard against burns from this cause each electrically heated soldering pot is provided with a pilot light; when the light is burning it serves as a warning that the metal is hot.

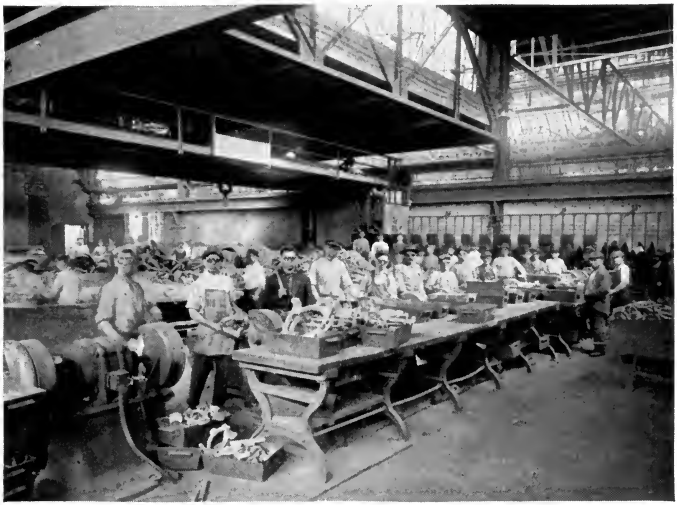
The Company provides the girls with a becoming cap to be worn when operating machinery having exposed moving parts which might entangle the hair and cause an accident.

One of the details in safety work consists in fixing a plate of sheet iron to the inside rim of an exposed "flying" pulley, thus shielding the spokes and making it impossible for metal rods or clothing to be drawn into the machinery.

Safety and efficiency are sometimes closely related: when one man with a machine can drive thousands of nails by electricity every hour

and never touch one of the nails it is obviously a safe process as well as an efficient one.

The same thing can be said of electric motor trucks which go all through the buildings, up and down the elevators—they need no rails or trolley wires, carry very heavy loads, and require but one man to operate them. When we consider that 47 per cent of the accidents which occurred in 1916 were due to handling of materials, it is again evident that safety and efficiency can be made natural running mates.



SAFETY WORK AT THE ERIE PLANT. THE GRINDING MACHINES ARE FITTED WITH GUARDS AND THE MEN ARE IMPRESSED WITH THE NEED FOR WEARING GOGGLES TO SHIELD THE EYES FROM FLYING PARTICLES

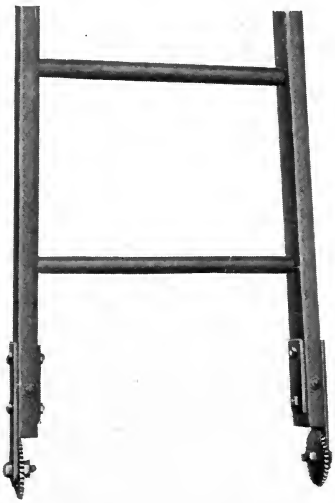
Elaborate automatic electric stops have been devised for overhead cranes, and large sums spent for fire prevention, detection, and fighting, and both automatic and hand apparatus is supplied extensively in all buildings. An organized fire department is maintained in each of the Works.

The devices designed to prevent electric shock have been so successful that only one quarter of one per cent of the major accidents in Pittsfield in 1916 were due to this cause.

FIGHTING SPECIFIC ACCIDENTS

The study and ingenuity displayed in the safety bulletins and other educational phases of safety work will be illustrated in the following pages.

A machinist is shown what kind of a cravat he should *not* wear, and a foundryman what kind of shoes he *should* wear. New employees are taught just how to pile pipes, castings, heavy timbers, etc.; special methods are devised for preventing blindness by acids, metal, sawdust, stone dust, and by the weird "ultra-violet and actinic" light rays. Instruction is given in how to avoid burns from steam, molten metal, gas, acids, and electricity; how to handle a ladder; how to keep tools in condition; how to choose a hammer; how to protect the lungs from dust; how to prevent nail punctures of the feet—a wealth of detail which to those with an interest in his fellow man reads like a revelation. Think



NON-SLIP DEVICE FOR LADDERS. SHARP TOOTHED WHEEL MAY BE ADJUSTED WHEN TEETH BECOME WORN

of grown men being taught how to lift so as to avoid ruptures; how to drink water; how often to bathe in warm water; how to attend to a scratch on his finger; why he should clean up rubbish; how to carry tools up a ladder; what kind of sleeves he should have; and whether his jacket should be on the inside or outside of his overalls!

Surprising as these statements may sound to the laymen, they are nevertheless some of the problems with which the captains of industry are grappling, and in the solution of which they are engaging able executives whose entire time is spent in teaching safety habits.

THE MAIN CAUSES OF ACCIDENTS

The duties of the safety committee are becoming more and more of an educational nature, as the factories are now generously equipped

with mechanical and electrical safeguards. This is clearly pointed out in a report recently issued in which an analysis is made of the causes of accidents at the Schenectady Works in 1916:

"A little less than ten per cent of the Schenectady Works accidents last year were classed as 'machine' accidents, and only about two and

DEVICES FOR HANDLING ACID CARBOYS. THE DESTRUCTIVE ACTION OF ACID MAY LEAD TO THE CASE BECOMING ROTTEN, SO TONGS ARE PROVIDED WHICH REACH UNDER THE BOX AND WOULD PREVENT THE BOTTLE FALLING EVEN IF THE BOTTOM CAME AWAY ENTIRELY. WHEN SMALL QUANTITIES ARE REQUIRED THE CARBOY IS HELD IN AN INCLINATOR WHICH IS EASILY TIPPED WITHOUT DANGER

one half per cent of that number might have been prevented by guards or were due to worn-out or defective apparatus or equipment.

"Forty-seven per cent were due to handling of materials; 12 per cent to the slipping of hand tools, such as wrenches, chisels, hammers, etc.; 12½ per cent to stepping on chips, scrap, nails, etc., or striking

SHIELD FOR FOUNDRY LADLE

some part of the body against some object; ten per cent to machine accidents; about four per cent to slipping and falling; one per cent to locomotives, cars, or cranes; one per cent to electrical shocks and burns; and the remainder to miscellaneous causes."

TIME LOST IN 1916 WAS ¼ OF 1 PER CENT

"Exclusive of two fatal cases, the aggregate amount of time lost on account of accidents in 1916 at Schenectady Works was 2647 weeks, or 50 years and 47 weeks. This amounts to only ¼ of 1 per cent of the total time of the 20,000 employees at Schenectady. This lost time can be classified according to causes as follows:

888 weeks or about 17 years due to cuts and bruises.
507 weeks or about 9¾ years on account of fractures.
338 weeks or about 6½ years on account of infections.
287 weeks or about 5½ years due to amputations or loss of eyes.
179 weeks or about 3½ years due to burns of various kinds such as acid, electric, emery wheel, flame, friction, gas, metal, oil, pitch, potash, soda, solder, vitriol, and hot water.
136 weeks or about 2⅔ years on account of sprains.
130 weeks or about 2⅔ years on account of ruptures.
120 weeks or about 2⅓ years due to miscellaneous eye injuries, other than loss of eyes or sight.
62 weeks or a little over a year on account of miscellaneous causes.

"During 1916 there were 1490 accidents which resulted in loss of time or required attention other than could be given by the Emergency Hospital. Those were classified by causes as follows:

975 accidents, 1553 weeks or about 30 years, accidental.
255 accidents, 513 weeks or about 10 years, carelessness on part of injured.
57 accidents, 147 weeks or about 2½ years, carelessness on part of other than injured person.
118 accidents, 172 weeks or about 3 years, failure to have slight injuries treated promptly, resulting in blood poisoning.
34 accidents, 37 weeks or about three quarters of a year, failure to wear safety goggles.
13 accidents, 62 weeks or a little over a year, defective and wornout apparatus or might have been prevented by guards.
38 accidents, 163 weeks or about 3 years, miscellaneous causes, for most of which it was impossible definitely to decide.

"Based on experience it is reasonable to expect that this record can be materially improved."

It is the study of such statistics as these that indicates to the safety committee along what lines they should conduct their educational campaign so as to bring the greatest return to corporation and employee alike.

Now that the safety work of the General Electric Company has become chiefly educational in nature, in order to outline the main present activities a digest is given of some of the bulletins which tell their story every day to 61,000 employees. These are classified according to the specific types of accidents which are being combated.

FALLS FROM ELEVATIONS

The safety committee directed that all old-style ladders should be replaced with those having iron shoes or shoes of special design to prevent slipping on wooden, iron, brick, and other flooring. This precaution, supplemented by regular inspection, has materially curtailed accidents.

The bulletins continually remind the men that they should examine the ladders for structural defects, nails, or sharp projections; and further, that the ground support of the ladder should be tested and all made secure before ascending.

Other bulletins show how scaffolding should be made, and even the details of the sizes of planks and the number of timbers have been carefully worked out. The story is emphasized by statistics taken from the building trade, showing the number of men killed and injured because of defective scaffolding.

THINGS FALLING ON MEN

Photographs show how to pile material neatly and so as not to obstruct passageways. The men are warned not to pile these materials too high.

IMPROPER CLOTHING

Eight posters and eight illustrations are devoted to showing the dangers from burns and nail punctures due to improper shoes; men are warned not to wear four-in-hand or flowing neckties about machines. It is pointed out that jumper sleeves should be tight fitting at the wrist and that the jumper should be worn inside of the overall bib, because loose clothing is dangerous. The men are reminded that the wearing of gloves and finger rings is dangerous when working about machines, and that such superfluous things should be removed.

In one poster a striking photograph shows how an accident was luckily avoided by a young man who wore a dangling necktie which caught in the rolls of his machine, drawing him closer and closer. Fortunately the machine was stopped in time to prevent a serious injury; as it was, his tie and shirt were caught and torn off his body.

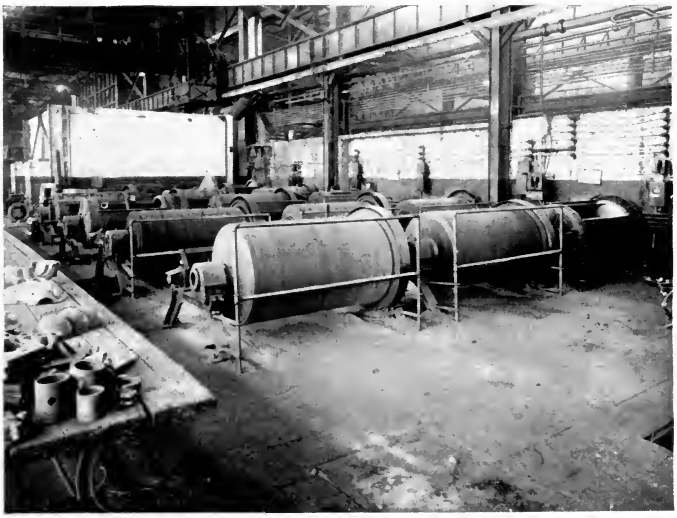
Celluloid collars are made the subject of a separate poster, and a case is mentioned where a man narrowly missed serious injury when this composition of guncotton caught fire and could not be removed.

INFECTION OF SMALL INJURIES

The importance of this subject may be judged from the fact that seven posters and two illustrations were devoted to explaining the necessity for going to the Works' physician for immediate treatment. One case in particular was described, in which a man tried to dig a speck of dirt out of another's eye. Blood poisoning resulted and the eye had to be removed. Newspaper clippings were reproduced on the bulletin, recounting how citizens in different parts of the country had suffered from blood poisoning and lockjaw as a result of neglecting slight injuries such as scratches, pricks of the skin, nail punctures, and small cuts.

In addition to foot burns in the foundry, which were previously discussed, the educational campaign deals with burns by steam, gas, gasolene torches, acid, and electricity. To prevent steam burns, large red tags are tied to steam valves which, if opened, would scald a man at work near the outlet of the pipe. On the tag are the words "Danger! Do not open this valve without permission of the foreman."

One poster shows the photograph of a badly burned arm, and the incident was told of a man who was told to get an extension light from a work bench, but lighted a match instead. The gasolene tank he was cleaning exploded.



GUARDS ERECTED IN FRONT OF ROTATING MACHINERY

Regarding gasolene torches: Other posters instruct the men to examine torches for leaks before lighting, pointing out that they should never loosen the filling plug while any flame can be seen. Others are warned, "If you do not use torches, keep away from them."

Burns by acids are the subject of other posters. The handling of acids, especially in large quantities, presents hazards if proper precautions are not taken. The destructive action of the acid on the wooden containers housing the carboys is likely to cause a carboy of acid to be dropped and broken, with disastrous results. Experience has taught that the best preventive measure in such work is the provision of tongs for handling the carboys, of such a construction that they will reach under the boxes, so that if the wood is entirely rotted the carboy of acid

will not drop to the ground. Where only small quantities of acids are being handled, the carboy is placed in an inclinator which permits it to be tipped without danger of spilling the acid. Rubber gloves and rubber-mounted goggles are provided for employees handling acid where there is a chance of the acid spattering on the hands or in the eyes.

In general, the precautions taken to guard against electrical hazards are the placing of all live parts in such positions that no employee can inadvertently come into contact with them, the provision of grounded metal guards, and ample insulation wherever necessary.

The most practical way of guarding against electrical burns is to keep all unauthorized people away from every danger zone. Warning signs are therefore placed near any locality where dangerous voltages exist, and all passages, etc., leading to such places are marked with danger signs.

BLINDNESS

Blindness due to flying particles of metal, wood, emery, etc., can be almost eliminated by the use of goggles. These are furnished by the Company wherever needed; as are also gloves, helmets, leggings, etc. Nevertheless it requires considerable advertising sometimes to persuade a man to use them. Some posters show photographs and give the names of men whose eyes have been saved by goggles, as well as other photographs and names of men who have become partially or totally blind because of the neglect of this simple precaution. As soon as goggles become broken from any cause whatsoever the Company replaces them with a new pair without expense.

Goggles of scientifically colored glass, which make it impossible for ultra-violet and actinic rays emanating from electric or oxy-acetylene work to injure the optic nerve, are especially valuable. In some cases complete helmets are provided for this purpose.

NAIL INJURIES

Four posters and two illustrations tell strikingly the danger of stepping on protruding nails. The men are urged to turn down the nails and prevent lockjaw.

RUPTURE

How to lift heavy weights is shown in two posters and two illustrations. Men are cautioned not to try muscular feats beyond their strength, but to await the service of the electric cranes and hoists when very heavy objects must be moved. They are also warned not to wear tight belts, and considerable discussion is given to personal hygiene and exercises that have a tendency to prevent hernia.

ACCIDENTS FROM MACHINERY AND TOOLS

Fourteen posters and nine illustrations point out the necessity for extreme care in handling machine tools and choosing hand tools. Repairing or oiling machines and adjusting work while machines are in motion, are shown to be dangerous. Actual incidents are mentioned, and the loss in wages of men who have been injured through neglect of these rules is shown. Men are warned not to start a machine when it is tagged "Out of order—do not start."

They are urged to keep the protecting guards in place and to immediately report when damages are repaired. Statistics are given of the number of men in one state who were injured while cleaning their machines while in motion.

Other posters remind the men that they should never sling a hammer or sledge which has a loose handle. Likewise, a photograph is shown on many hundreds of bulletin boards illustrating how a man should stand when using a sledge so as to avoid injuring his companion who holds the bar or cold chisel.

It is pointed out that when striking case-hardened material, such as drills, reamers, cutting tools, etc., only lead or copper hammers should be used so as to prevent chipping of the hardened metal and injury of fellow workmen.

TRIPPING OVER RUBBISH AND JUNK

Two posters and two illustrations emphasize the danger of obstructing floors and passageways with refuse, waste material, and junk. A disorderly workshop contributes to accidents.

UNSANITARY HABITS

A fairly complete course in personal hygiene is contained in a series of posters. These treat of headache, eyestrain, hunger, bad ventilation, etc., and urge plenty of sleep, good care of the teeth, adequate bathing, plenty of fresh air, and even cleanliness of the hands. Spitting on the floor is forbidden, and even such details as how to drink out of the fountain come in for their share in the educational campaign.

ALCOHOL

One poster shows the extravagance of the drinker and, by suggesting a plan by which a married man shall appoint his wife as his exclusive bar tender, illustrates how she could make money which would go far toward paying the household expenses.

Fifty-one posters and 18 illustrations are directed against the chance-taker and the practical joker who deals in "horse play." Examples are shown where men have lost their lives, or have caused the death of another because of foolish scuffling.

The doctrine of carefulness is taught in every possible way, whether it relates to going up and down a ladder carelessly, or throwing shovels, brooms, and tools where others might be damaged by them.

Arguments against hurry and extravagance and in favor of deliberation and thrift show the range of the educational campaign.

SAFETY EXTENSION

The Company has extended the idea of safety to the benefit of the users of the electrical apparatus manufactured by the Company, as well as that of the employees of the Company in its factories. Safety switchboards, safety switches, safety controllers, "foolproof" motors, transformers, etc., have been devised, and while definite statistics are not available it is quite reasonable to assume that accidents from electric shock are being minimized in public service corporations, and among the general public who operate electrical devices in the home.

CHAPTER V

MEDICAL WORK AND HOSPITALS

No one questions the wisdom of the medical examination when enlisting for military duty; and just so when enrolling with the armies of industry—the physical examination is becoming a matter of course. You, as an army recruit, do not feel insulted when Uncle Sam examines your teeth, and thumps your chest, and tests your vision; you do not feel that the army physician's services are to be classed as charity or philanthropy—you know it is efficiency, the greatest good for the greatest number, that dictates the policy of the physical examination. Therefore, to maintain the same high standard in the industrial army, every new employee must be examined—even consulting engineers. This has been the procedure in the General Electric Company's organization since 1914—without exception or favoritism.

It is for this good reason that we, in the great industrials of today, welcome the plan and take a keen interest in the details of the maintenance of "*Health en masse*"—which is the big idea back of both armies and corporations.

It would be a great source of comfort to feel that there is no taint of tuberculosis or infectious disease among one's business associates. And from a more altruistic point of view many of our less fortunate brothers have had the way pointed out to them for the complete recovery of their health—due to an expert's diagnosis at the time of the medical examination.

PHYSICAL EXAMINATION

In the year 1916, there were 13,716 examinations made at the offices and Works in Schenectady. Many men and women have practically had their eyesight saved because they have taken the advice of the Company's physician and taken steps to correct the dangerous drift. A similar situation has arisen in regard to men either ruptured or on the verge.

LIFE EXTENSION

In this connection, Mr. A. L. Rohrer, the Supervisor of Medical Examinations, recently remarked:

"The day of preventive measures and medicines has dawned, and everyone is now thinking how disease can be prevented instead of waiting until the disease has developed. Our medical examinations have revealed the beginnings of troubles unknown to the person examined; attention was called to them and advice given. In many cases the progress of the disease was checked. Everyone who has some reason to suspect that there is anything wrong, should get medical advice and get it early. The medical men who have studied the records agree that several years will be added to the average span of life by periodic medical examinations."

We are all appreciating more every year that the better suited we are *to* our work the more suited we will be *with* our work. Now that these examinations have been started, we see that their object is not to keep us out of employment but to direct us away from that kind of employment which may damage our health.

If a man had weak eyesight, the modern industrial company would never give him work near rapidly moving machinery; or, if his lungs were weak, he would not be permitted to do any work of a dusty nature which would soon aggravate the condition of his lungs.

In speaking of this dusty work, the fact should not pass unnoticed that there are periodical examinations of all those who are working in dusty rooms. Likewise anyone who has the appearance of lung trouble, or other disease, which may be aggravated by his occupation, is given a special additional examination in order to detect and therefore prevent any tendency toward disease. If such is discovered, necessary precautions to safeguard his health are advised, or the nature of his work is changed. Think of the sufferings of the past, when no such provisions were made! The expression, "the scrap pile of humanity," formerly applied to the workers in large industrial plants, is no longer applicable.

RUNNING THE GAUNTLET

In fact, by the time we have got fully into the swing of *life in a large manufacturing plant*, we realize that unwittingly we have "run the gauntlet"—mentally, physically, morally, and industrially. This being the case, and all having passed the various tests of fitness, we find that our fellow workers are anything but candidates for the scrap pile. The reverse is the case, and in the sense that each one of us has been selected for fitness, it can easily be seen that the organization amounts to a picked crew.

It is of interest to note that the rejections vary from 3½ to 6 per cent, the greater number being due to hernia and defective eyesight. Many cases of arrested development of the eye are noticed, and it is remarkable that so many applicants have not discovered prior to these examinations that they were practically blind in one eye. Frequently the sight can be immediately improved by proper glasses, this being particularly true in cases of short-sightedness. Several applicants have confessed that when standing on the curb they couldn't see a trolley car pass, and the simple expedient of providing proper glasses has surely saved many lives from street accidents.

All employees who are absent for two months or longer come back as new employees and have to pass a medical examination before re-employment.

There is another very important provision in which preventive measures are supplied for maintaining health *en masse*—i.e., the hospital —the ally of hygiene and enemy of suffering. Splendid records have been

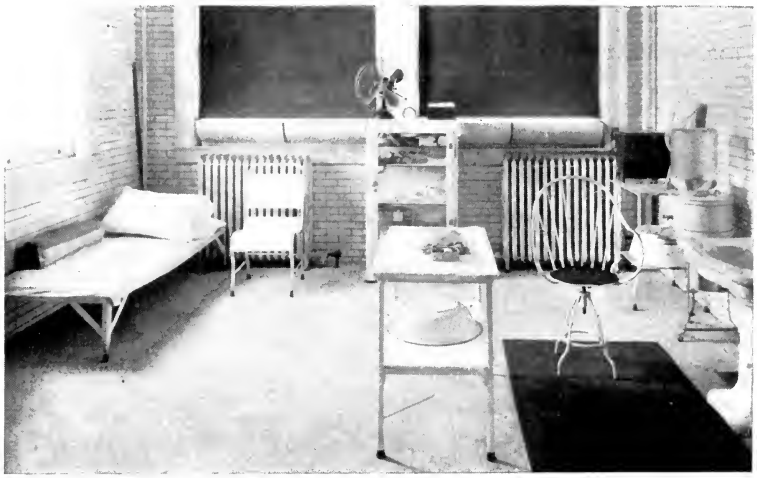
Fig. 30. THE SCHENECTADY HOSPITAL

Fig. 31. THE MEN'S WARD OF THE EMERGENCY HOSPITAL AT THE ERIE WORKS

kept ever since the establishment of the hospitals. The history of the achievements of the medical men of this staff is written in the record, and some very striking facts stand out from among what some people might call plain statistics.

MOST ACCIDENTS IN SUMMER

Accidents unfortunately occur everywhere, on the street, in the home, and in the factory. Their number, by the laws of chance, is likely to be in proportion to the population of a town or to the number of



Figs. 32 and 33. THE PITTSFIELD WORKS HOSPITAL

Hospital facilities are provided at all of the numerous Works of the General Electric Company. Some of these hospitals are quite large, the number of employees in some of the plants equaling the population of a good sized city.

In the case of serious accidents, first treatment is given in the emergency hospital before the employee is sent home or to the hospital, and daily treatment or dressing is given as necessary. Employees are encouraged to report even the smallest injury, as this policy often prevents an insignificant scratch from developing into a serious case.

employees in a factory. So as our organization grew and the number of employees increased from hundreds to thousands, facilities for taking care of them became necessary. It has been the spirit of the Company to keep these facilities well abreast of the needs, and today our hospital

Fig. 34. MEN'S WAITING ROOM AND DRESSING BOOTHS AT SCHENECTADY

Fig. 35. AN APPLICANT TAKING THE FIRST TEST FOR EYESIGHT IN THE EXAMINATION ROOM. WOMEN APPLICANTS ARE EXAMINED BY A WOMAN PHYSICIAN

facilities for emergency cases are larger than those of many towns, for the simple reason that our industrial army is larger than the population of many towns. The presence of emergency hospitals in a factory does not denote that the work is hazardous; indeed, the majority of accidents

can be traced to carelessness, and no small part of the work in connection with factory hospitals is educational work—trying to teach the vital lesson of Safety First. Such educational work is made more difficult by the fact that many foreigners are employed who cannot speak English.

Fig. 36. DOCTOR'S OFFICE WHERE THESE EXAMINATIONS ARE MADE

Fig. 37. WOMEN'S MEDICAL ROOM ADJOINING THE DOCTOR'S OFFICE, WHERE MINOR AILMENTS AND INJURIES ARE TREATED

All applicants for employment must pass a medical examination, which frequently results in the discovery and correction of unsuspected defective eyesight and other ailments.

All of us are human and there is one characteristic which is particularly noticeable in us all, namely, our willingness to assume risks if we

can save a little time. This trait is in daily evidence at all our busy street corners where pedestrians disregard the warnings and rules of traffic officers, and persist in crossing the street or railway tracks at unsafe

Fig. 38. AMBULANCE AT THE PITTSFIELD WORKS

Fig. 39. CLOSED AUTOMOBILES ARE USED FOR TAKING HOME SICK OR INJURED EMPLOYEES, WHO DO NOT REQUIRE THE SERVICE OF AN AMBULANCE. THIS ILLUSTRATION SHOWS A CAR USED FOR THIS PURPOSE AT THE SCHENECTADY WORKS

moments, being willing to risk injury for the saving of a fraction of a minute. In the same way it has been found that workmen in the shops will frequently assume risks in order to save a second or two; and there-

fore we shall always have accidents, and the larger the number of employees the larger the number of accidents.

One of the strange facts developed from a study of these records is:

Nearly 64 per cent of the major accidents of the year take place in the six warm months, May to October inclusive.

Medical men and executives and statisticians are all baffled by this mystery. Not one has been able to explain satisfactorily why 64 per cent of the accidents occur in warm weather and only 36 per cent occur in cold weather, year after year.

There is still another mystery:

Why do most of the major accidents take place either early in the morning or late in the afternoon? No one knows.

Fig. 40. CLASS FOR FIRST AID INSTRUCTION AT THE PITTSFIELD WORKS
Everything possible is done for the comfort of the sick and injured at the various Works.

These two curious facts are undeniably true—they are medical history—and right here in these two unexplained facts lie some of the problems on which high-type executives, engineers, and surgeons are devoting serious thought. They will clear up these mysteries in time, and their solution will probably result in some special instructions for us to follow at the beginning and close of the day; and we shall be glad to do so, for all of us are anxious to avoid even a scratch.

WHAT IS AN "ACCIDENT"?

An accident is an accident even if it is only a scratch. This may seem a cranky idea, but it is based on long study, experience, and observation. It is the positive conclusion of the physicians and surgeons

that a wound, no matter how trifling—even if only a scratch—should be given a proper dressing immediately after the accident occurs; for it has been found that infection of a slight wound in many cases gives more pain and is more dangerous than the fracture of a bone.

In 1916, there were 11,427 accidents at the Schenectady Works, but only 36 were serious enough to be classed as bed cases, and only 11 were serious enough to require an ambulance call. Out of practically 21,000 men working with steam and electricity, operating ponderous machinery weighing hundreds of tons, only two men died as the result of accidents, including electric shock, scalding from steam, fires, and railroad accidents; for it should be understood that the great factory of today has indoor and outdoor railways and streets the same

Fig. 41. REST ROOM OF THE NEW YORK DISTRICT OFFICE

as cities—even with motor busses and trolleys. There are few cities in which the accidental death statistics are so low. Automobiles alone killed 140 people in Philadelphia in 1916.

DIMINISHING FATALITIES

Remarkably complete records are kept showing the history of every accident for the full decade, 1906 to 1916 inclusive. In the first half of the last decade, there were 12 fatal accidents at the Schenectady Works, an average of 2.4 per year.

In the last half of the past decade, the fatalities decreased to an average of only two per year—this for the years 1912 to 1916 inclusive. Another bit of history which makes the above achievement all the more remarkable is the fact that in the last five years there were 25 per cent more employees in Schenectady than in the first half of the decade. In

other words, between 1907 and 1911, one man out of 6100 met with a fatal accident, while in the past five years only one in every 9000 was so unfortunate. In 1916 it was only one man in 10,100.

Fig. 42. THE WOMEN'S REST ROOM OF THE CHICAGO DISTRICT OFFICE

Fig. 43. THE REST ROOM AT THE PHILADELPHIA OFFICE. IN THIS CASE THE REST ROOM IS ON THE TOP OF THE BUILDING IN WHICH THE OFFICE IS LOCATED, AND THE ROOF HAS BEEN MADE INTO A PROMENADE WHERE THE GIRLS CAN TAKE FRESH AIR AND EXERCISE

Rest rooms for women employees are provided at most of the district and local offices, as well as at the various Works of the Company. In these rooms provision is frequently made for preparing simple lunches which avoids the necessity of going out in bad weather.

Thus the fatal accidents at the Schenectady Works for the last ten years have averaged 0.136 per thousand. To fully grasp the magnitude

of this notable record, we reproduce the following table from page 6 of the U. S. Dept. of Labor's Bulletin No. 157 on "Industrial Accident Statistics" dated March, 1915:

TABLE I

ESTIMATE OF FATAL INDUSTRIAL ACCIDENTS IN THE UNITED STATES IN 1913, BY INDUSTRY GROUPS

Industry Group	No. of Employees	Fatal Industrial Accidents	Rate Per 1000
Males			
Metal mining	170,000	680	4.00
Coal mining	750,000	2,625	3.50
Fisheries	150,000	450	3.00
Navigation	150,000	450	3.00
Railroad employees	1,750,000	4,200	2.40
Electricians (light and power)	68,000	153	2.25
Navy and marine corps	62,000	115	1.85
Quarrying	150,000	255	1.70
Lumber Industry	531,000	797	1.50
Soldiers, United States Army	73,000	109	1.49
Building and construction	1,500,000	1,875	1.25
Draymen, teamsters, etc	686,000	686	1.00
Steet railway employees	320,000	320	1.00
Watchmen, policemen, firemen	200,000	150	.75
Telephone and telegraph (including linemen)	245,000	123	.50
Agricultural pursuits, (including forestry and animal husbandry)	12,000,000	4,200	.35
Manufacturing (general)	7,277,000	1,819	.25
All other occupied males	4,678,000	3,508	.75
All occupied males	30,760,000	22,515	.73
All occupied females	7,200,000	540	.075
GENERAL ELECTRIC COMPANY, SCHENECTADY WORKS IN 1916	20,985	2	.099
GENERAL ELECTRIC COMPANY, SCHENECTADY WORKS AVERAGE FOR TEN YEARS			.136

Other interesting facts will be seen by studying the following figures; and the amount of effort and attention which they represent may be gathered from the fact that in the year of 1916 alone the hospital made 55,362 dressings and treatments. The average worker who meets with an accident receives three additional dressings.

Year	No. of Employees on Schenectady Payroll	Total Accidents (Including Scratches)	Per Cent
1907	15,544	1,832	1.18
1908	11,359	1,229	1.08
1909	13,361	1,706	1.27
1910	16,462	2,729	1.66
1911	16,107	3,075	1.91
1912	17,487	4,174	2.39
1913	19,977	5,670	2.84
1914	16,823	4,261	2.54
1915	15,347	5,476	3.69
1916	20,985	11,427 *	5.69 *

* In 1916 *all* injuries, including even slight scratches, were reported, whereas the record of previous years includes only the more serious accidents.

EYE CASES

Among the 1916 accidents, 5,575 pertained to the eye—cinders, sawdust, chips, emery, dust, etc. It is to the credit of the hospital that the first treatments of these were made so successfully that only 171 of them were referred to an eye specialist in the city; one man lost the sight of one eye, and not a single man became blind. The Company has made it a practice in the past to pay the doctor's bill of all workers sent from the hospital to the city specialist.

WORKS HOSPITALS

It would be tedious to describe in detail all the hospitals in our many factories, but a brief review of hospital work at the Schenectady Works will give an idea of this necessary adjunct to modern manufacturing.

This work began with the employment of a medical student whose services were sought for first aid before sending the patient to the city hospital. Later it became essential to have some one in each department who understood first aid treatment, and a series of talks on "first aid," by a leading surgeon, with demonstrations on actual dressings, was given to a class made up of the foremen, assistant foremen, and shop clerks of each department.

In 1899 first aid chests containing the necessary materials were prepared and placed in each department on the recommendation of the Works physician collaborating with well-known surgeons. This outfit has been quite extensively adopted in manufacturing plants.

It was soon found that the treatment of accidents in the shops caused confusion and did not result in systematic treatment, so it was decided to establish a real emergency hospital, where a trained hospital steward could administer treatment and be responsible for the dressing of wounds under the best conditions. The hospital staff includes a steward and four assistants.

Careful records are kept of each case. The majority of treatments are of a very minor nature, and any increase in the number of treatments bears testimony to a more rigid enforcement of the regulations on the part of the organizations and a better spirit of co-operation on the part of the employees in conforming to the general wish that the merest scratch shall receive proper treatment to avoid infection.

In the hospital work, emphasis has been placed upon the fact that efficiency in surgery depends upon the individual who applies the first dressing, and the stewards thoroughly understand that the aim of "first aid" is to apply an antiseptic dressing that will prevent infection of the wound.

No wounds are now dressed in the shops; all injured are immediately sent to the hospital, the major cases being transported on stretchers conveniently located in each department. All major eye cases are treated by one of the eye specialists of the city, the injured being conveyed by automobile.

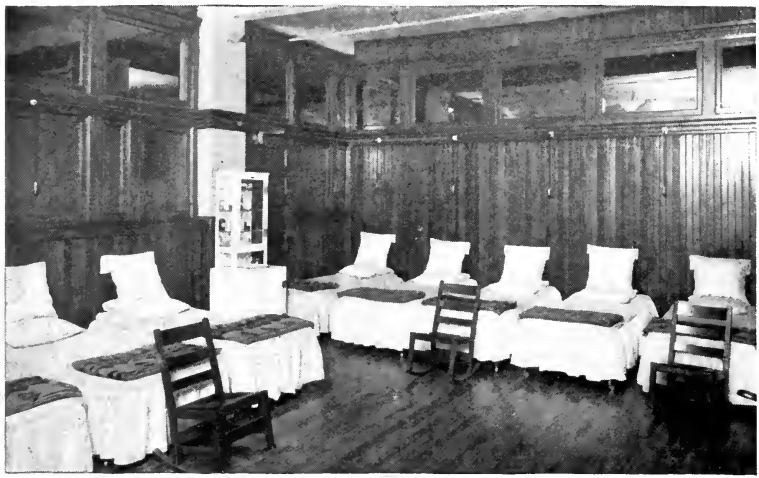


Fig. 44. MEDICAL ROOM AT THE SCHENECTADY WORKS. THIS IS UNDER THE CARE OF A TRAINED NURSE AND COMMUNICATES WITH THE REST ROOM

Fig. 45. WHERE SHORT PERIODS OF REST MAY BE TAKEN. THESE ROOMS ARE UNDER THE CHARGE OF A MATRON WHO LOOKS AFTER THE WELFARE OF THOSE USING THE ROOMS

A woman physician devotes her entire time to the care of the women and girl employees. Her office is fitted with booths for medical examination, and connects with the women's rest room which is equipped with cots, where the girls from the factory can be made comfortable. All women or girls who are too ill to work are sent by the foreman to this office by automobile. Many of them after an hour or two in the rest room feel able to return to their work. Those who are too ill to work are sent home by automobile, and those who remain in the rest room are given such simple treatment as will give them relief.

Fig. 46. WOMEN'S EMERGENCY HOSPITAL AT THE PITTSFIELD WORKS

In addition to the medical services provided at all the Works, rest rooms for women are maintained throughout the organization, where simple remedies may be obtained in case of slight indisposition.

In one month, 155 girls came to this office for treatment, and 127 of them returned to work the same day. In addition to the treatments given, the doctor suggests preventive measures, such as diet, exercise, etc. At intervals, during the noon hour, the woman physician gives talks to the girls in the various departmental rest rooms in the shops.

GIRLS' REST ROOMS

All of the factories have provided adequate facilities in this regard.

There are 36 rest rooms for girls at the Schenectady Works, classified as follows:

Twenty-two secondary rest rooms, seven in charge of matrons, four in charge of doctors, one in charge of a nurse, and one in the main office building.

Simple treatments are afforded which permit most of the girls to return to work after one or two hours of rest. Books are provided, as well as individual instruction, teaching how best to preserve their health. Those few who are not able to go back to work are taken to their homes in the Company's automobiles.

RED CROSS CLASSES

Seven enthusiastic classes have been formed to teach the girls first aid; these are called "Schools for Red Cross Nurses." The girls attend these classes on their own time.

NO STOOLS

Six or seven years ago all the girl workers sat on stools while they were working, but now all have chairs with backs.

Cold statistics cannot show the amount of suffering and disease which are prevented by medical examinations when applying for work, educational work in personal hygiene, and other preventive measures.

It should be noted that most of the work described above was undertaken and well under way before the New York State Workmen's Compensation Act was passed by the Legislature.

CHAPTER VI

FIRE PROTECTION

The cost of a man's life insurance is a measure of his security from early death; the cost of a manufacturing plant's fire insurance is a measure of the plant's security from fire.

It is a very rare occurrence for the cost of a man's life insurance to grow less; for even though he improves his health (his resistance to disease) he nevertheless grows older; but the manufacturing plant can grow older and at the same time reduce its fire insurance rate by improving its resistance to fire.

This has been proved to be true to a surprising degree by the experience of the General Electric Company in its various plants. At the Schenectady Works, for example, the cost of each $100 fire insurance in 1893 was 75 cents as compared with an average of less than 10 cents for the last ten years. In this chapter we will describe the provisions that were made which have brought about this remarkable reduction in insurance cost, and the corresponding decrease in the fire hazard.

These improved conditions have benefited the Company, the employees, and the public in the following respects:

The Company:
- Maximum safety from loss of property.
- Maximum safety from loss of profits.

The Employees:
- Maximum safety from loss of life.
- Maximum safety from loss of wages.

The Public:
- Maximum assurance of prompt deliveries, due to minimum interruptions.
- Maximum safety from fire as the result of using electrical devices.

The actual fire losses year by year for the past ten years in the Schenectady Works are given in the table.

In the first eight months of 1917 there were 50 fires in the Schenectady Works with a total property loss of $588. Since this represents an average loss of approximately $11 per fire, it can readily be seen that: first, the fire department is operated efficiently; and second, the employee's loss in wages is trifling.

Year	No. of Fires	Fire Loss	Average Loss per Fire
1907	43	$1,904	$24.00
1908	36	462	12.00
1909	19	284	14.00
1910	17	76	4.00
1911	53	1,836	34.00
1912	73	3,435	47.00
1913	57	3,366	59.00
1914	62	827	13.00
1915	62	817	13.00
1916	66	7,021	106.00
Total for 10 years	488	$19,173	$39.00

MUTUAL INSURANCE CONTRACT

For over 20 years the General Electric Company has placed its insurance with a mutual fire insurance company. The business is handled by this company at cost, i.e., no profits and no agents. The cost includes expenses of management, service, inspections, and losses.

This insurance contract requires that all the member manufacturing companies have their properties built according to certain specified standards of fireproof or slow-burning mill construction, and equipped with standard sprinkler systems, individual water supply plants, etc. In all the plants of the General Electric Company there are installed about 250,000 automatic sprinkler heads which adequately cover approximately 15,500,000 square feet of floor space.

Mr. M. F. Westover, Secretary of the General Electric Company, in charge of matters relating to fire insurance, stated recently that the architectural and engineering advice received from the insurance company in connection with new building construction was alone worth the money paid out in premiums.

BUILDING CONSTRUCTION

Wherever possible the factory buildings are subdivided into sections by fireproof walls, designed to prevent the spreading of a fire. The openings in these fire walls are provided with self-closing fire doors which are held open by a fusible link of alloy of such a character that when the temperature rises to a predetermined point the alloy melts and the door automatically shuts. These doors are hung on wheels which run on an inclined track, and when released by the melting of the alloy the force of gravity propels the door down the track until it is firmly shut. These doors are constructed of metal and other fireproof material, and at regular intervals the operating mechanism is inspected and tested.

In all modern buildings throughout the various factories special stair towers are erected. These are also provided with fireproof doors and windows, and serve a double purpose, viz., to prevent a possible fire from sweeping up the stairway and spreading to additional floors, and to serve as fireproof and smoke-proof exits for employees. The location of these stairs has been carefully worked out by the various experts of the insurance companies and the State Factory Inspection Department. As a general rule they are provided at both ends of the building and in the middle of the building. By this arrangement a large number of exits

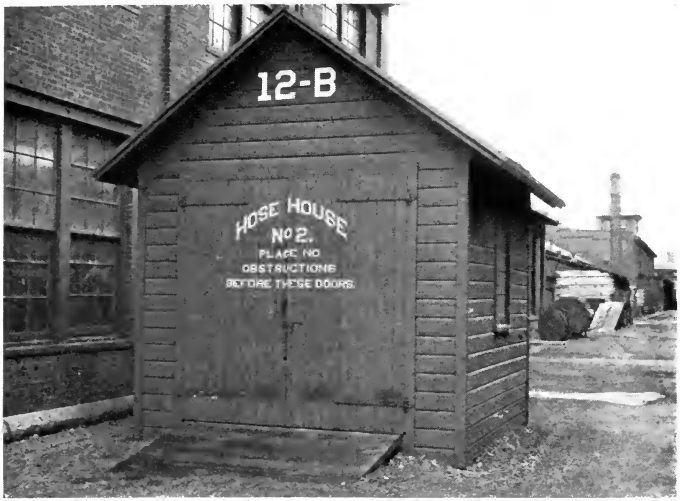
GIVING FIRE ALARM FROM MASTER BOX

are provided; if a fire were to break out at one end of the building the employees could use the stairways at the other end and in the middle, or if a fire were to break out in the middle of the building the stairs at both ends would be available.

The same arrangement is used in the large office buildings; for instance, in the main office building at Schenectady each wing is isolated by fireproof walls and doors and is served by an enclosed stairs at the end, which is shut off from the halls by fireproof doors. In addition there is a main staircase at the middle of the building.

Exits are clearly marked by red signs and at night by red lights. All fire alarm boxes are marked by blue lights, and all fire hose lines inside the buildings are indicated by green lights.

Each building is provided with an elaborate equipment for preventing, detecting, and extinguishing fires, night and day. A standard fire



TYPICAL HOSE HOUSE

INTERIOR OF HOSE HOUSE, SHOWING FOUR-WAY HYDRANT, HOSE, AND OTHER EQUIPMENT

alarm system is used, to which are connected 82 fire alarm boxes on four separate circuits. The number of the box corresponds to the number of the building in which it is installed. Fire gongs operated from the

central station announce the existence of a fire to all buildings in the vicinity. For a first alarm only certain designated companies respond; but on a second alarm all companies respond.

Each floor of the buildings is supplied with 1½-in. hose lines permanently connected to the water system. There are over ten miles of these shop lines in the Schenectady Works alone; 3326 water pails are distributed throughout the works, as well as numerous other pails containing sand, sawdust, and wet bags for extinguishing oil and electrical fires.

Automatic sprinklers, numbering almost 75,000 in the Schenectady Works, are the standard means employed for automatically extinguishing fires at their inception. These are placed eight feet apart at the ceiling. Here again the skill of the metallurgist is employed, as in the case of the fire doors, for when the temperature rises to a dangerous degree at any point it melts the alloy of the sprinkler, and the surrounding walls, partitions, floors, and contents of the building are drenched. The fact that only those sprinklers close to the fire are put in operation results in a great saving of property, as much unnecessary flooding is thus avoided. The auto-sprinkler both discovers and extinguishes a fire, as it is first on the scene.

Each building is further supplied with fire ladders, thus making it unnecessary for the ladder companies to carry extra long ladders for the high factory buildings.

It has been found that two of the main sources of fire are spontaneous combustion and careless smokers, and special precautions are taken to obviate these hazards. Oily waste must be thrown in metal cans specially provided and emptied at regular intervals. Smoking is prohibited in the factory buildings at all times, and in the yards and streets except during the noon hour. Certain men are made responsible for preventing accumulations of rubbish, dust, greasy overalls, etc.

HANDLING INFLAMMABLE MATERIALS

In manufacturing electrical apparatus there is more opportunity for fires than in some other lines of work. Certain departments require special care on the part of the employees against this danger. They include the painting and japanning departments, where benzine or other solvents are used that are very inflammable, and under certain conditions explosive; the insulating departments, where linseed oil, varnish, benzine, alcohol, and other highly inflammable materials are used; departments in which cotton, numerous soldering irons, lead melting pots, etc., are required; and testing departments and all other places where electric wiring, much of it carrying current at high voltage, is to be found.

In departments that use japan, varnish, and oil tanks, and in baking ovens where special risk is involved, special equipment for putting out fires has been provided. Some of the ovens are connected with steam pipes

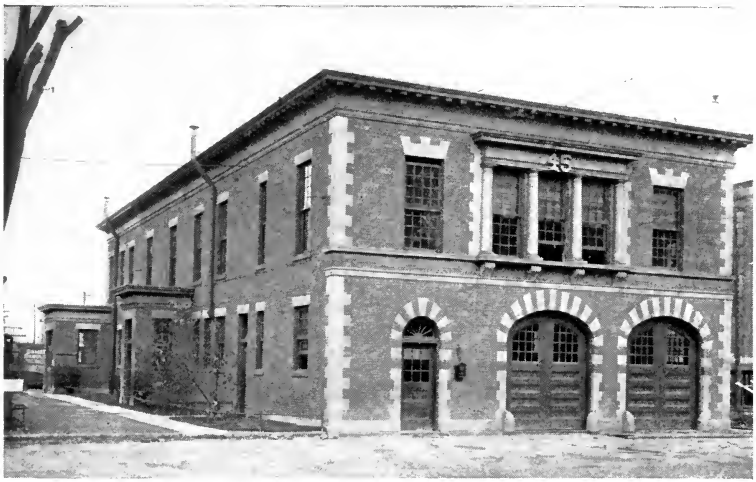


Fig. 47. FIRE STATION, SCHENECTADY WORKS

Fig. 48. INTERIOR OF FIRE STATION

to smother fires; some of the testing departments have a supply of carbon dioxide for putting out oil fires in closed tanks. In some places sawdust boxes for smothering japan, varnish, or benzine fires have been installed.

The idea of the fusible plug used in the sprinkler system can be carried still further and used to advantage in automatically smothering fires that start in dripping tanks. Iron doors, hinged and swung beyond the center of gravity, are held in place by fusible links which melt in case of fire and close the lids.

CENTRAL FIRE STATION EQUIPMENT AND WATER SYSTEM

The fire headquarters building is shown in one of the illustrations. Hose companies 3 and 7 (the latter the night company) and the ladder company are quartered in this building. The fire chief also has his office here. The emergency hospital occupies the rear. Its work was described and illustrated in a previous chapter.

This station contains the following apparatus: one automobile hose wagon carrying 1500 ft. of 2½-in. hose, play pipes, extinguishers, two deluge sets, one rubber cover, axes, rakes, forks, shovels, door opener, hose lines, and life line; seven two-wheeled hose reels, each carrying 500 ft. of 2½-in. hose, play pipes, axe, and pipe holder; two ladder trucks, carrying ladders, axes, forks, shovels, extinguishers, and rubber covers; and three spare hose reels to replace regular equipment when repairs are to be made, one of the spare reels being fully equipped so that it can be pressed into service at any time.

There are 125 hydrants in service in the Works, 41 of these having hose houses over them, in each of which is installed 200 feet of 2½-in. hose (100 ft. connected to the hydrant and 100 ft. in reserve), two play pipes, one pipe holder, one axe, two spanners, and hydrant wrenches. There are almost 14 miles of fire hose in service, disposed of as follows: 5000 ft. of 2½-in. hose carried on fire apparatus; 8200 ft. of 2½-in. hose in hydrant hose houses; and 57,950 ft. on fire plugs in the buildings.

The pressure on the water system is maintained by both gravity and pumps. In the main pumping station (Buildings 13 and 13A) are installed one Snow pump of 6,000,000 gallons capacity daily, one Drane pump of 3,000,000 gallons, and two Worthington fire pumps of 2,160,000 gallons. In Building 61 there are two Worthington fire pumps of 4,320,000 gallons capacity, and in Building 118 one Alberger pump of 7,000,000 gallons capacity, making a total daily pumping capacity of 22,480,000 gallons. The tank on the hill in Bellevue at the back of the Works contains 1,036,000 gallons of water. The water for the system is taken from the Mohawk River and the old Erie Canal and is distributed through 14½ miles of yard mains. The mains are interconnected and arranged in such a way that a rupture at any point in the system can be quickly isolated by valves and will affect only a very small part of the system. Additional protection is afforded by connection to the city water system, which will enable city water to be utilized in the event of a breakdown

of the whole of the Company's pumping plant. The average daily consumption for factory purposes is 8,650,857 gallons. This does not include water for drinking purposes which is obtained from the city mains.

Fig. 49. FIRE DRILL WITH HOSE EQUIPMENT

Fig. 50. FIRE DRILL FOR EMPLOYEES

An entire department consisting of 400 employees is regularly emptied in one and one half minutes. Another complete floor with 500 workers requires an average of two minutes to vacate.

THE ORGANIZATION

The fire organization was formed during the summer of 1889, and consisted of 40 men. Its present strength (in 1917) is 176 men, formed

into eight hose companies and one ladder company, each with its own quarters and apparatus.

It is significant of the efficiency of the present fire-fighting system and organization that during this period of 29 years, in which the Schenectady Works has increased in size from 144,000 square feet of floor space to 5,333,000 square feet, the fire department has been enlarged only 4.4 times and is protecting a space 38½ times as large.

The permanent professional fire fighters of the Schenectady Department consist of a fire chief, who is a member of the International Association of Fire Engineers and the New York State Fire Chiefs' Association, assistant chief, two inspectors, and the captain of the night fire company. The night fire company consists of two officers and ten men located at the central fire station. These men sleep in the station and the Company furnishes them with lodging, supper, and breakfast. Each member is on duty from 5:30 p.m. until 6:30 a.m., and with the exception of the captain, all are regularly employed in the shops during the day. They are allowed one night off in three and are the busiest fire company in the department. They responded to 59 fire alarms in 1916.

FIRE CREW FOR EACH BUILDING

The other members of the department are termed "call men," who are selected from the shops on the recommendation of the foremen. Men are preferred who have had experience as professional fire fighters. These men receive one week of vacation in the summer and other perquisites.

Each building is served by a definite number of firemen, who are assigned to certain departments or floors. They are formed into companies and are put in charge of a hose house, where they report upon the first fire alarm. These companies average 15 men each, and are organized with a captain, lieutenant, and senior hoseman. Each member of the company is responsible for the fire equipment in his department or section of the building under his care, and he makes daily inspections of the sprinkler system, fire hose, pails, fire alarm gongs, etc. The cleanliness and general good order within the buildings are also looked after by these men.

Each man is furnished with a helmet, coat, rubber boots, and other items that make up a fireman's equipment. This paraphernalia is kept in a metal locker close by his station in the shop. He is supplied with a fire department badge which admits him to the works at all times.

FIRE DEPARTMENT DRILLS

Under the direction of the chief, the fire department is drilled 20 times a year, each drill being entirely unannounced. When responding to this alarm no one but the chief is aware of the fact that

it is a drill; and thus the surprise element keeps every member on the *qui vive*. At all fire drills a second alarm is sounded, which calls the entire department into action.

Hose races are held once a year to determine which company has the greatest speed. The night patrol men are drilled once a month on hose duty, sprinkler valve duty, and shop fire protection. In the winter instructions are given to the whole department by the fire chief. These lectures and discussions are held in the gymnasium of the central fire station.

FIREMEN'S QUARTERS IN FIRE STATION

Regular inspections are being made constantly. The buildings and grounds are inspected by the chief and assistant chief, and the sprinkler valves by the assistant chief and inspectors. The inspectors also inspect all of the indicator post valves on the sprinkler system, the hydrants, yard valves, hydrant hose houses, hose companies, and apparatus.

These inspections are conducted weekly, and are in addition to the inspection of the buildings and departments by the other members of the fire department.

EXIT DRILLS

Exit drills for employees are given once a month. A complete organization is formed in the shops at each drill, consisting of leaders, stairway guards, firemen, searchers, and power men. These exit drills are conducted by the foreman of each department, who has a regular corps of assistants. It is the duty of the leaders to form the line for the march to the various exits and to lead the way out. The stair guards

are stationed on the landing at the top of the stairs and on intermediate landings to direct and assist the employees in leaving the building. The duty of the searchers is to search the building for anyone who may have been left behind, due to injury or faintness. The searchers are the last people to leave the building. In the meantime the power men shut off all power and stop all machinery in the building, and the firemen turn in the alarm and use the inside hose lines, extinguishers, buckets, etc., every possible means being employed to extinguish the fire while the fire department is responding. An alarm is provided on every floor, consisting of an air whistle of distinctive tone which can be heard distinctly over the entire floor.

FIREMEN'S CLUB FACILITIES

On the second floor of the fire central station is a pool room, reading room, gymnasium, and shower bath room for the convenience and recreation of all members of the fire department. The dormitory for the night company is in the same building.

A relief association is formed among the members of the fire department, and an assessment of ten cents a week is paid by each member. A benefit of $9 per week for 13 weeks is paid members of the association on account of illness or disability. This organization is a flourishing one, has a good substantial surplus in the treasury, and since the association was organized in 1904 has paid a substantial dividend to the members.

A TYPICAL YEAR'S WORK

During the year 1915 the fire department responded to 62 alarms of fire, 22 bell alarms, and 40 still alarms. The fire loss was $817.29, the largest individual loss being $300. Twenty-five fires were extinguished with 1½-in. shop lines, 15 with fire pails, 11 with extinguishers, six with 2⅝-in. house lines, six with sprinklers, four with sand, one with wet bags, and one with pyrene.

The longest fire with which the Schenectady Works fire department has fought lasted three months. A pile of soft coal 500 feet long, 40 feet wide, and 25 feet high caught fire from spontaneous combustion. From one to five streams of water were played night and day upon this coal fire for ninety days. But this was not sufficient, as it was found necessary to turn over the coal so that the water could penetrate all portions of this huge pile. The expense of doing this with skilled firemen and high-class mechanics soon became such an item that foreign laborers with shovels were employed to perform the work. Forty pairs of rubber boots were worn out in extinguishing this one fire.

It is a peculiar fact in the life of members of the fire department that the more efficiently they do their work the less exciting the work becomes. The members do not feel, however, that their work is less interesting, as there is nothing that gives an ambitious man greater satisfaction than the feeling that he has done his work well; that by doing so he has benefited others. The record of the Schenectady Works Fire Department is one of which they can feel justly proud; there are few fire departments which can boast that the average loss per fire is only $11.

The activities of the General Electric Company in fire prevention are not limited to the protection of its manufacturing plants and its employees; its work in this direction has been extended to the benefit of the public by careful study of all its products with the view of minimizing the chance of fire through their use. Some of the devices that are more commonly used by the public that receive special attention in this respect include electric lamp sockets, flatirons, snap and push switches, small motors, and domestic heating devices. Frequent conferences are held between the company's engineers and representatives of the National Board of Underwriters with the purpose of adopting designs that insure the greatest security from electrical fires.

The foregoing description relates particularly to the fire department of the Schenectady Works, as this is the largest organization of the kind in the Company. The Company's other plants have each a well-organized fire department that resembles in most respects, though on a smaller scale, the department at Schenectady.

A FIRE

In this plant may put
every man out of work.

Guard the property
against Fire, and protect
YOUR JOB

NO SMOKING

FIRE PROTECTION

Have you planned what you would do in case of fire? Do you know where the nearest fire alarm box is? Do you know how to send in an alarm?

Do you know all the means of escape from your building? Are they clear and usable?

Do you know if the fire doors will work automatically? Have you provided for prompt closing of all doors and windows in case of fire?

Do you know where the fire apparatus in your building is kept? Do you know how to use it?

Do you know where the nearest hydrants are and do you know how to get out the hose?

If you haven't thought of these things, now is the time to begin.

CHAPTER VII

RESTAURANTS

MENU

Roast Beef — Mashed Potatoes

Stewed Tomatoes — Bread and Butter

Milk (or Coffee)

Cocoanut Pudding

Price 25 cents

This bill of fare is typical of the noonday meal that is being served today to employees of the Schenectady Works of the General Electric Company. It is a full equivalent of the meals that were served in this restaurant five years ago, despite the steep increase in the cost of all food stuffs during this period. The ability to serve this meal today at the price in force five years ago is the result of skillful application of engineering principles in the kitchen and in the method of serving customers.

The following table, which was prepared by a food expert, shows that this midday meal provides one third of the nourishment required for a day's hard work:

CALORIES IN TYPICAL 25-CENT MIDDAY MEAL

Dish	Amount Oz.	Calories Protein	Calories Fat	Calories Carbohydrates	Total Calories
Roast beef	2.4	69	81	0	150
Gravy (brown sauce)	2	7	24	19	50
Mashed potatoes	5	13	80	75	168
Stewed tomatoes	2	5	2	18	25
Coconut pudding	3	17	46	45	108
Bread	2.25	20	8	112	140
Butter	0.5	0	100	0	100
Mug of milk	8	30	88	47	165
Sugar	0.136	0	0	150	150
Total	25.286	161	429	466	1056

Average calories needed daily by a man employing muscular strength 3250

Number of calories in the noonday meal at the General Electric Schenectady restaurant ..... 1056 or 32½%

OVER A MILLION MEALS A YEAR

The figures below show that the popularity of this restaurant is increasing, owing as much to the improved facilities as to war conditions.

Year	Number of Employees in Schenectady Works	Number of Customers Served Annually
1908	11,359	324,377
1909	11,361	467,779
1910	16,462	626,178
1911	16,107	592,765
1912	17,487	611,525
1913	19,977	710,570
1914	16,823	580,081
1915	15,347	499,706
1916	20,985	707,415
1917 (9 months)	21,000	619,201

The meals for 1917 will probably amount to 800,000, as almost 20,000 meals were being served every week during September 1917. If this rate is kept up without any further increase the year 1918 will show over 1,000,000 customers.

CENTRALIZED PURCHASING

It will be inferred that such a restaurant has probably established favorable relations with markets, packing establishments, fisheries, and grocers, and that rock-bottom prices should result because of the loyalty of the supply houses to one of their largest spot cash customers. The dealers in Schenectady alone sell $50,000 worth of provisions every year to this restaurant.

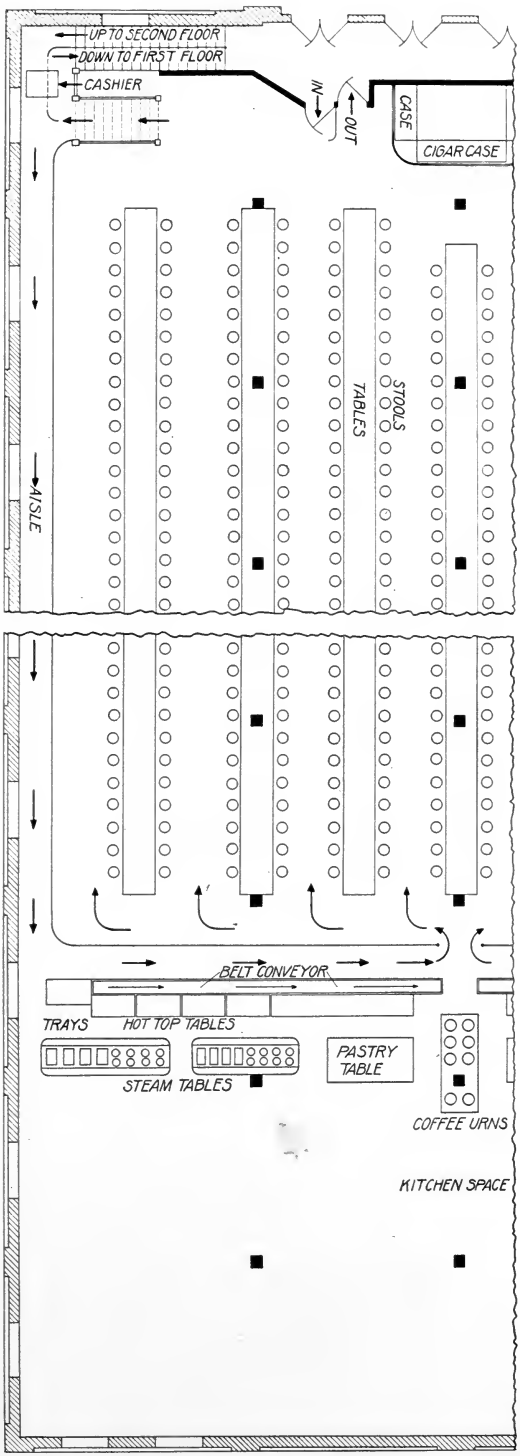
The meat is bought direct from a Chicago packing house, and the fish from Boston. In purchasing the groceries, vegetables, etc., the policy is followed of first obtaining the best products possible, and then giving the business to the firms who, service considered, quote the best prices.

QUANTITY PRODUCTION

All the meats, vegetables, etc., are prepared in the kitchen; the puddings are made here, and also 700 pies and 600 loaves of bread are baked daily. By providing facilities for these cooking operations the cost has been reduced to the minimum.

KITCHEN EQUIPMENT

The kitchen is equipped with aluminum pots, kettles, and other utensils, for although it has been found that these utensils cost more, their durability and the ease with which they can be kept clean justifies this initial extra expense. From the standpoint of the chef the aluminum kettle will stay hot longer than a copper kettle, and will also produce



PLAN OF PORTION OF FIRST FLOOR OF SCHENECTADY WORK'S RESTAURANT, SHOWING ARRANGEMENT OF TABLES, BELT CONVEYORS, KITCHEN, AND ROUTE OF PATRONS

more satisfactory food. For the same reason aluminum trays are used in the restaurant; they are light in weight, rugged, and easy to keep clean, Wherever possible the mechanical processes, such as cutting bread

Fig. 51. SCHENECTADY WORKS RESTAURANT

Fig. 52. PITTSFIELD WORKS RESTAURANT

chopping meat and vegetables, artificial refrigeration, etc., are performed by electric motors.

Another example of thrift is found in the simple fact that the flour is not purchased in barrels but in bags; for each flour bag, after being emptied, furnishes two cleaning cloths for use by the restaurant employees.

Of the 3500 meals served daily, 500 are breakfasts, 200 are midnight lunches, 300 are suppers, and 800 meals are delivered to the

Fig. 53. KITCHEN IN SCHENECTADY WORKS RESTAURANT

Fig. 54. ELECTRIC KITCHEN IN PITTSFIELD WORKS RESTAURANT

shops. Thus 1700 meals are served during the noon hour in the main restaurant building. This situation involves mechanical difficulties which can be economically met only by mechanical means.

In 1916 the seating capacity of this restaurant was 802 and the maximum meals possible to serve during the luncheon hour was 950. In 1917 the seating capacity was increased to 1110, and 1400 meals have

been served in half an hour. The maximum number which can be served during the entire noon hour has not yet been ascertained in practice, as the new system has never been worked to its full capacity. In fact, the second floor is serving practically as many meals as were served in the entire building before the improvements were made.

This increase in seating and serving capacity has already been accompanied by an increase of 1000 meals served per week without any addition to the restaurant payroll. This largely accounts for the fact that the restaurant is self-supporting at the extreme prices prevailing for food products.

ENGINEERING IN RESTAURANT SERVICE

The increase in seating capacity was a simple architectural detail; but the increased serving capacity required the skill of the engineer for its solution—a problem of quantity distribution in limited time. The essential feature of the new service was the installation of a "serve-self" system, expedited by four conveyor belts. Before the adoption of the serve-self plan in 1917, it had been opposed on the grounds that one slow man can delay a hundred who are waiting the opportunity to serve themselves. But the conveyors are so arranged that they not only eliminate all physical efforts in connection with serving oneself, but they likewise speed up the process and avoid the objection of the slow man delaying those behind him.

When operating under the old plan, 50 waitresses served approximately 1000 meals, each waitress delivering food for 20 customers. With the new arrangement 1700 men serve 1700 meals, thus making each person serve only one meal. Obviously, one person can serve one meal quicker and better than one person can serve twenty meals. The progress of the restaurant patrons is routed so that there is no retracing of steps or doubling back. The traffic does not interfere with the serving, as was the case when waitresses were moving back and forth with heavily loaded trays. Looking at the matter in a different way, the serve-self system brings the man to the food, whereas the waitress was compelled under the old system to bring food to 20 men.

MEALS SERVED IN ONE MINUTE

The average time required by a customer, from the pay-as-you-enter cash desk until he is served and seated, is less than one minute. The progress is as follows:

Promptly upon the blowing of the whistle at noon, four lines of men form in front of four cash registers to purchase their luncheon tickets. Few of us have ever had the opportunity of watching a cashier make change and sell 29 tickets per minute, yet this is the rate of speed at

which each of the four cashiers operates. Anyone who hears the clang of a cash register bell every half second can appreciate how rapid must be the food distribution necessary to keep pace. After the men file past

Fig. 55. SCHENECTADY WORK'S RESTAURANT, SHOWING TABLES AND SEATING ARRANGEMENT

Fig. 56. CONVEYOR BELT AND STEAM TABLES, SCHENECTADY WORKS RESTAURANT

the cash register, they approach at right angles to the end of one of the four belt conveyors. Adjacent to the nearer end of the belt conveyor the ticket is exchanged for an aluminum tray which is laid on the conveyor belt. These belts travel at the rate of 65 feet per minute and allow 15

seconds for the customer to select his food. Following his tray he helps himself to either meat or fish; then potatoes, tomatoes, pudding or pie, and milk or coffee, all awaiting him on a hot steam table, parallel to the

Fig. 57. DINING ROOM, ADMINISTRATION BUILDING, WEST LYNN WORKS

Fig. 58. FOREMEN'S DINING ROOM, WEST LYNN WORKS

belt. By this time his tray is within five or six feet of the end of the belt, where the checker o.k's the contents of his tray.

After removing his tray from the conveyor belt the diner takes it to his seat. It is perfectly proper to say that he takes it to his reserved seat, because tickets are only sold up to seating capacity; but the capacity of the restaurant is much greater than would be indicated by the number

of seats, because many men have finished their luncheon by 12:10 p.m., and the process of removing the dishes begins immediately. At 12:10 service again begins in the restaurant until all comers have been fed.

Fig. 59. DINING ROOM, MAIN OFFICE BUILDING, SCHENECTADY WORKS

Fig. 60. DINING ROOM, HARRISON WORKS

The intermittent plan of service assures a seat for all who have entered and thus prevents congestion. One of the benefits of this system is the fact that the trays, dishes, silver, and glasses used by the early arrivals are promptly washed and used by the late comers. Thus it is possible for 1700 people to be served within an hour with only 1300 trays,

glasses, and sets of silver and dishes. Incredible as it may seem, so many men complete their meal and leave the restaurant in 10 minutes that their dishes can be washed and dried and used by the second set of diners who begin serving themselves at 12:10—ten minutes after the blowing of the factory whistle.

Fig. 61. ERIE WORKS RESTAURANT

Fig. 62. LUNCH COUNTER, OFFICE BUILDING RESTAURANT, SCHENECTADY WORKS

Each of these conveyors serve from 30 to 40 people per minute, and since there are four of them 120 to 160 meals can be served each minute during the noon period. Thus the opportunity has not yet appeared for testing the new arrangement at its maximum number of meals.

To form a conception of this service imagine a file of soldiers, standing at the regulation distance of 40 inches from each other, reaching up Fifth Avenue, New York, from 26th Street to 50th Street; these 1700 men—more than a regiment—could be served in less than 10 minutes.

REDUCTION IN PAYROLL

In 1916, under the old system, 150 employees were required to serve approximately 950 regular meals. In 1917 the number of employees has been reduced to 66, and despite this economy 1400 regular meals are served quicker and better. It is this increased speed of the mechanical serve-self system which has lessened the unit cost of the noonday meal to an extent exceeding the fondest expectations of the advocates of the conveyor installation.

OFFICE BUILDING RESTAURANT

In the basement of the main office building of the Schenectady Works is another restaurant which served over 500,000 customers last year. All of the cooking is done electrically, and the following equipment is installed:

16 electric toasters,
2 large electric toasters—hotel size,
13 electric ovens for baking and roasting,
12 electric stoves for boiling, stewing, and grilling,
6 electric coffee urns,
3 electric exhaust fans with ventilating ducts to the roof,
2 electric dishwashers,
1 electric hot table,
1 electric dough mixer,
1 electric potato peeler,
1 electric potato masher,
1 electric food chopper,
1 electric aluminum soup kettle—the largest electric kettle ever manufactured,
1 electric machine for ice and refrigeration.

With such modern equipment as this the cuisine is of the best. This restaurant is not only of great convenience to the office employees, but it provides a ready and agreeable means of entertaining visitors and customers.

LYNN WORKS

At the Lynn Works there are four restaurants. One of these is located in the Administration Building, where the department heads, engineers, and other office employees have their noonday meal. In

another building is the foremen's dining room, which is patronized also by the foremen's assistants, clerks, etc. There is also a lunch room serving meals on the serve-self plan, which can accommodate from 1500 to 2000 employees during the noon hour. In the West Lynn Works there is a girls' cafeteria serving soup, light sandwiches, ice cream, and hot cocoa. In all of these restaurants the same quality of food is served to all.

PITTSFIELD RESTAURANT

At the Pittsfield Works the restaurant conditions are somewhat different. Owing to the proximity of the homes of many of the employees

Fig. 63. FACTORY RESTAURANT, WEST LYNN WORKS

the demand for meals is not so great as in the case of some of the other factories. However, as electric cooking devices form an important part of the product manufactured at the Pittsfield Works, it was found desirable to equip a small restaurant where electric cooking devices could be shown in actual operation and where a first-class meal could be served at practically cost.

The Pittsfield restaurant is furnished with a large electric kitchen, the ranges, bake ovens, broilers, and toasters being operated electrically. The meat cutters, dishwasher, potato peeler, and refrigerating equipment are all driven by electric motors.

HARRISON LAMP WORKS

Due to space restrictions at the Harrison Works three types of service are rendered. There is an office and staff dining room accommodating 125 employees, where a substantial course dinner is served at

noon. A factory cafeteria is maintained, serving from 200 to 400 people, and a considerable number of meals are delivered on trays to manufacturing departments.

The food service is identical in all cases and it is sold at the lowest possible prices, the average cost per person being under sixteen cents. Meat and potatoes, with bread and butter, for instance, cost the employee ten cents; ice cream cones, three cents; milk and soup, two cents, etc.

AT THE OTHER PLANTS OF THE COMPANY

All of the other Works of the Company have ample restaurant facilities, but those described are typical and further description would only lead to repetition.

CHAPTER VIII

THE APPRENTICESHIP COURSES

One of the problems facing most boys of 16 who are trying to choose a profession is:

1st. If I start work now I cannot get a good education.

2nd. If I get a good education I cannot start work now.

As a matter of fact, they can do *both*.

Many boys feel discouraged because they cannot go to college for four years. It is a mistake for them to think that such an education is absolutely necessary in order to get along well in the world.

Thomas A. Edison, the greatest inventor of all time, and a man whose inventions and engineering work represent nearly $8,000,000,000 invested capital in this country, never went to college.

Herbert Spencer, one of the greatest scientists and philosophers that ever lived, was a practical mechanical engineer and inventor, but he was not a college man.

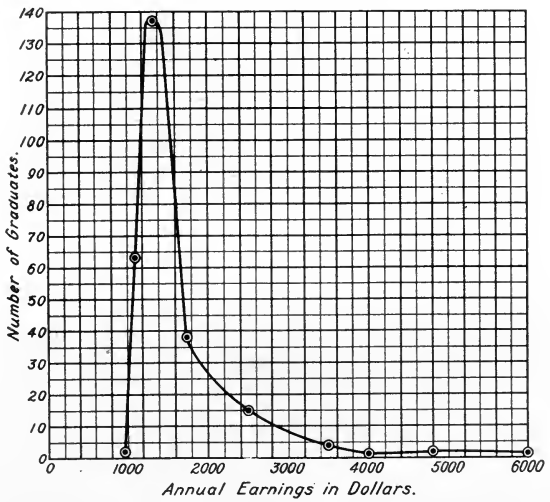
Also, the following world-famous inventors, engineers, and scientists were not college men:

Sir Henry Bessemer, inventor of Bessemer steel process.
Benjamin Franklin.
Robert Fulton, inventor of the steamboat.
Sir Hiram S. Maxim, explosives and firearms.
Hudson Maxim, explosives and firearms.
Henry L. Doherty, power plant financier and manager.
Michael Faraday, scientist and early electrical experimenter.
Alessandro Volta, scientist and early electrical experimenter.
Elihu Thomson, electrical inventor.
James Watt, steam engine inventor.
James Buchanan Eads, builder of the great bridge at St. Louis.
Isaac M. Singer, sewing machine inventor.
Elias Howe, sewing machine inventor.
William Herschel, famous scientist and astronomer.
Thomas H. Huxley, scientist.
Samuel Colt, inventor of the Colt system of firearms.
Henry Ford, intensive manufacturer.
Cyrus Hall McCormick, inventor of agricultural machinery.
Edward Weston, electrical instruments.
Alfred Bernard Nobel, inventor of dynamite.
John Tyndall, scientist.
Richard J. Gatling, inventor of the Gatling gun.
John Ericsson, inventor of torpedoes, submarines, and monitors.

In this chapter we will describe how boys may obtain a four-year job now, and at the end of the term, in addition to having received a good practical education, will have earned approximately $3,000. What is perhaps more important still, they will have learned three important things which are not taught in college, viz.: First, the value of a dollar;

second, the independence which comes from earning one's own living; and third, the strength of character developed by working with men.

The usual college student does not receive pay while he is being educated, but the members of the General Electric apprentice courses are regularly paid while they are being educated. In these courses the young boys of America have had created for them a superb opportunity to learn to do by doing, and at the same time learn to do by being taught. It is not generally known that the General Electric Company has spent on its apprentice departments in six factories, east and west, close to $750,000 in buildings, machinery, tools, instruments, class rooms, and laboratory equipment, where boys 16 years and up are initiated into the wonderful electrical manufacturing industry.



CURVE SHOWING PRESENT EARNINGS OF G-E APPRENTICE GRADUATES FROM LYNN WORKS

Boys should appreciate that what they learn in *practical* work they can use *right away*, and at the end of the four-year course, in addition to having earned between $1200 and $3200, they will be full-fledged journeymen, possessed of a trade. The present graduates not only are capable of earning, but are actually employed in positions now paying not less than 40 cents an hour—a minimum of $3.20 per day.

We will describe point by point the value to a youth of establishing relations with a great company, his pay and his play, the classroom instructions, the homework which is expected of him, the practice afforded him by which he learns to make drawings and read blue prints, and the shop work which he does—the great variety of processes he learns to carry on, upon a great variety of machines, and with a great variety of tools.

Of the 66 boys graduated in 1916 from the apprentice course at the Schenectady Works, eight entered the service of the U. S. Government

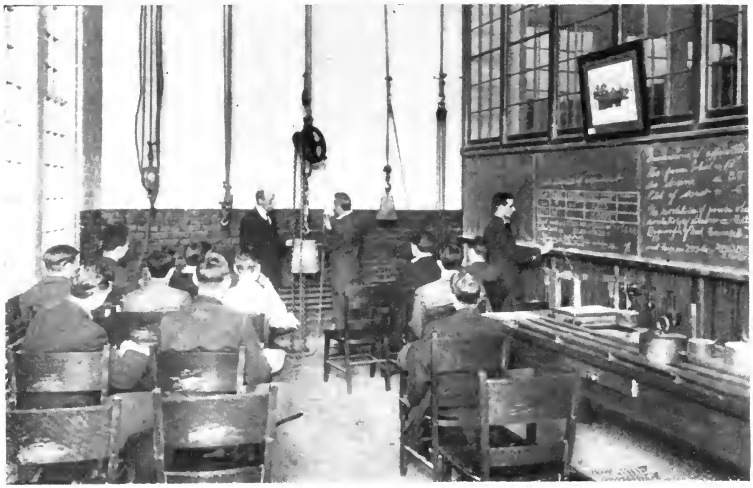


Fig. 64. CLASS IN MECHANICS, SCHENECTADY WORKS

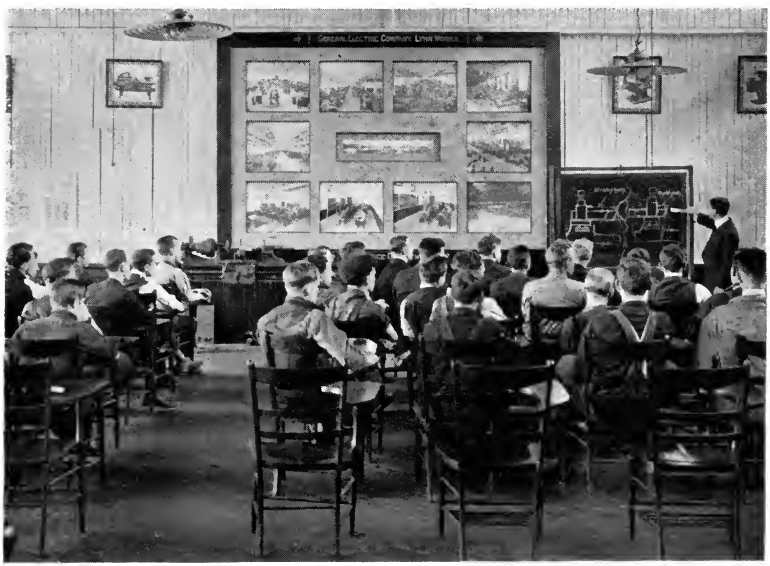


Fig. 65. INSTRUCTION IN MACHINE WORK AT LYNN WORKS

and 50 are still working for the General Electric Company at not less than 40 cents—and most of them are earning from 50 to 55 cents—

per hour, and working nine hours a day. Think what it means to these boys, who in 1912 had no trade or profession and only a grammar school education, and yet who today are making $4.50 a day as

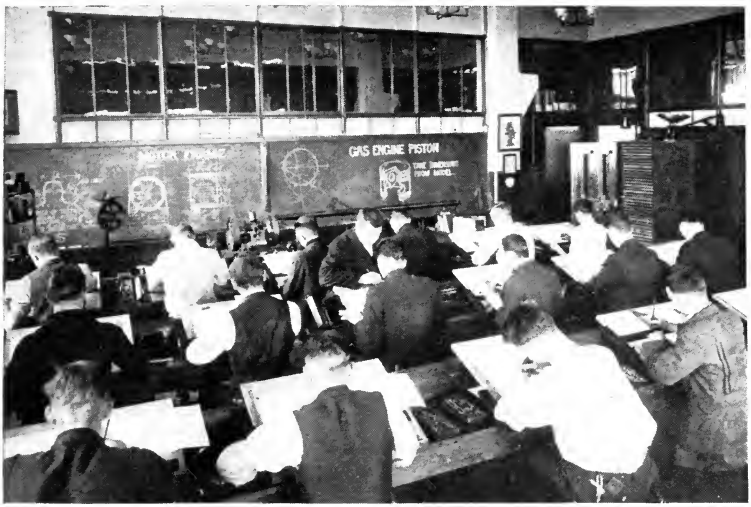


Fig. 66. CLASS IN MACHINE DESIGN, ERIE WORKS

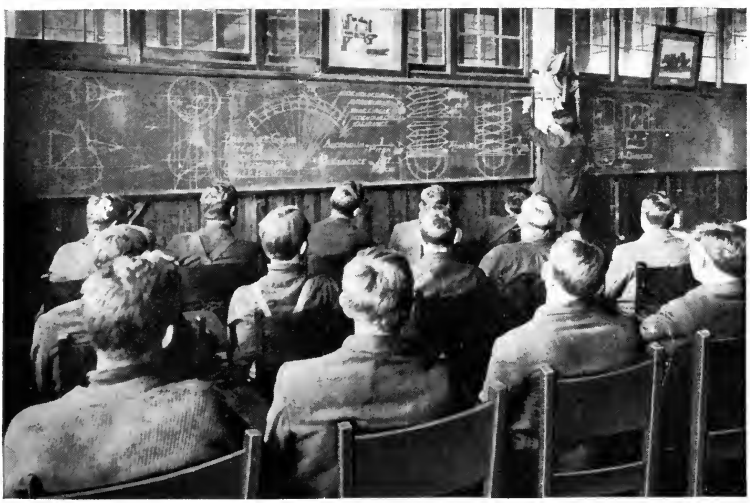


Fig. 67. CLASS IN MECHANICS, SCHENECTADY WORKS

established journeymen, all-around machinists, special tool makers, expert molders, full-fledged pattern makers, and technical draftsmen! Even as important as this is, a further very significant fact is that

they are in line for promotion to positions of foremen, bosses, or other executive positions.

The record of all the young men who were graduated at Schenectady shows that 65 per cent of them are now employed by the General Electric Company.

GRADUATES FROM APPRENTICE COURSES

UP TO THE FALL OF 1917

Schenectady	980
Lynn	502
Pittsfield	80
Erie	28
Fort Wayne	8
Total	1598

COMPARISON OF EARNINGS

The following table, copied from a trade journal published just before the war, shows the average wages in cents per hour in various countries in Europe. A careful study of this will prove the phenomenal opportunity which now exists in the General Electric Company for boys of 16 years to earn from 50 to 55 cents per hour and to become well-educated technical men in a period of only four years.

AVERAGE WAGES IN CENTS PER HOUR

	Machinists
Italy	8 to 13
Switzerland	12 to 17
Germany:	
Bavaria	13 to 15
Saxony	13 to 16
Berlin	17.5 to 20
Magdeburg	14.5 to 19
Great Britain	16 to 19
Belgium	11.5 to 18

On piecework these rates may be increased 30 to 50 per cent.

WHAT FOUR YEARS WILL DO

As someone aptly remarked: "Four years is a long while for a boy to look forward to, but it is a mere trifle for a man to look back upon."

How true this is will be emphasized by considering the results of four years of combined work and instruction.

LYNN WORKS

Of the 502 graduates from the Lynn Works apprentice course, the majority of them are still known to their instructors, and accurate records are kept of their present earnings.

Of these graduates:

1 is earning $6,000 per year.
2 are earning $5,000 per year.
5 are earning between $3,000 and $4,000 per year.
15 are earning between $2,000 and $3,000 per year.
38 are earning between $1,500 and $2,000 per year.
137 are earning between $1,200 and $1,500 per year.
63 are earning between $1,000 and $1,200 per year.
2 are earning less than $1,000 per year.
239—salary unknown.
502

PITTSFIELD WORKS

An investigation of the 82 graduates from the apprentice course from that factory since 1911 discloses the fact that the earnings of 36 who are working there vary from $1150 up to $1650 per year.

FORT WAYNE WORKS

The Fort Wayne apprentice system began in 1913, and of the first eight students who were graduated this year, one is with the United States Navy and seven are employed as tool makers with an income of between $1300 and $1400 per year.

ERIE WORKS

The apprentice system at the Erie Works was established and standardized about 1910, and has graduated 28 young men. Of these seven have left, six others are employed in the United States Army or Navy, and 15 are with the Company earning from $4 to $6 per day.

We have considered only the wages or salaries of the graduates, but to obtain a better comprehension of the standing of these young men the positions held with the General Electric Company should be pointed out.

POSITIONS HELD BY APPRENTICE GRADUATES

4 are managers or superintendents.
35 are foremen.
18 are instructors.
15 are division leaders or assistants.
13 are tool designers.
5 are inspectors.
4 are commercial engineers.
3 are assistant engineers.
2 are designing draftsmen.
2 are gang bosses.
1 is a supervisor.
1 is in charge of a section.
1 is a designing engineer.
102 are in the U. S. Government service, mostly in arsenals and navy yards, serving as skilled mechanics.

From this it might be reasonably concluded that these young men, who but a few years previous were in the grammar school, are now well established in the great electrical manufacturing business as the result of their industry and their ability to grasp the opportunity afforded them.

Professor Robert G. Wall, in a recent address, said: "Imagine 100 men, all 25 years old, and all fully equipped mentally and physically. Tell them to seek their fortunes in the world and report back to you at the age of 65. In 40 years' time 34 of these men will be dead, 56 will be dependent upon relatives or charitable organizations, five will

Fig. 68. CLASS IN MECHANICAL ENGINEERING, ERIE WORKS

Fig. 69. PATTERN MAKER APPRENTICES, LYNN WORKS

still be earning their daily b[illegible]ur will be wealthy, and one will be rich. These are facts, statistics compiled by the insurance companies!"

It is quite probable that among one hundred average men, many of them never thoroughly learn any one trade; some of them probably

Fig. 70. PATTERN MAKER APPRENTICES, SCHENECTADY WORKS

Fig. 71. MOLDER APPRENTICES IN FOUNDRY, SCHENECTADY WORKS

learn a trade which will become obsolete, such as truck driving, a "trade" which is being displaced by the automobile; or the operation of steam pumps, a trade being rendered obsolete by the general use of electricity.

Among other obsolescent trades are horseshoeing, the trade of the cobbler, and those connected with kerosene, gasolene, and gas lighting. It is dangerous for the future of a young man to learn a trade which will practically cease to exist during his lifetime. For instance, no one would think of learning the trade of grinding wheat by hand or setting type by hand, as automatic machines do this kind of work far cheaper and better.

If the horse, the steam engine, and the steam locomotive were to vanish from the face of the earth we could rest assured that some kind of machinery would do the work of transportation for the world—and it is not dangerous to prophesy that machinery in one form or another will not only carry on our transportation, but will become more and more used in industry, commerce, and in the home. For this reason the boy who becomes a mechanic or engineer, whether electrical or mechanical, can rest assured that that trade will not become obsolete during his lifetime—nor for that matter during the lifetime of his great-great grandchildren.

For example, should all transportation of the future be conducted by airplane, mechanics would be needed to build air craft by the million, and probably electrical engineers would build their motors, even though the power would be supplied to them by wireless. So no matter how great the progress the world may make along these lines, a young man is making no mistake in learning the mechanical or electrical trade, both of which will be needed to turn the wheels of industry and commerce in the future.

Hence, the young man who enters the electrical profession has a better opportunity to be self-supporting at the age of 65 than in almost any other profession imaginable, because America, and, in fact, the entire world, is entering upon an electrical epoch comparable in significance with the stone age, the bronze age, the iron age, and the steam age, through which it has passed successively up to the present. Therefore, our apprentice graduates need have little fear of being classed as "dependent" if they studiously pursue the fascinating work of electrical engineering and production.

CLASSROOM INSTRUCTION

From the illustrations it will be seen that these apprentice courses include classroom instruction and practical work with intricate machine tools in modern machine shops, foundries, pattern shops, drafting rooms, etc. There is nothing more fascinating to the growing youth than to see this practical work link up with the theoretical classroom instruction and vice versa. There is no joy in a student's life greater than an appreciation of the fact that what he learns in the classroom—algebra, plane and solid geometry, logarithms, trigonometry, descriptive geom-

etry, etc., is of direct assistance to him in shop practice. Here is that union between the work of the head and the work of the hand which makes for great industrial nations a place in the commerce and industry of the world, and which, moreover, has been found so necessary in carrying on the great war.

HOME WORK

The home work of the apprentice pattern maker and machinist consists in making 28 complete mechanical drawings, including lettering, dimensions, and details; and they must solve mathematical problems in order to be able to recite in the classrooms. The draftsman apprentices have more home work than either of the two mentioned, as they are not only required to prepare the 28 drawings, but have to go into higher mathematics, which is necessary for the calculations of designing engineers.

The apprentice boys in the molder's course may be considered as the highest paid of all, because in their fourth year they receive the regular journeyman's wage, which at the present time is 50 cents per hour for an eight-hour day. There is no home work in this course, but the classroom work is after working hours, which, in a measure, equalizes their advantages in the higher rate of wages.

PERSONAL INSTRUCTION

The element of personal instruction in these apprentice courses is carefully provided for in three ways:

1. *Classroom Instruction*—The classes are kept small, generally not exceeding 20 in number, and some classes have less than 12 students. Considerable latitude is allowed in the asking of questions and the explaining of possible obscure points. In some courses the classroom instruction is ten hours in every 50-hour week.

2. *Personal Attention in Training Shops*—For all beginners in the trades—molder, pattern maker, draftsman, and machinist—there are provided special training shops where they are given individual instruction under competent men engaged for that purpose.

3. *Personal Attention in the Shops*—As the students become more advanced they are transferred to the regular shops where their education is continued under the direction of the foreman of that department and his assistants.

MASTERING THE USE OF TOOLS AND MACHINERY

At the end of the course in the machinists trade the boy, who slightly over four years ago was in the grammar school, has become a full-fledged journeyman and is fully competent to operate the machinery found in

the ordinary machine shop, such as drill presses, lathes, planers, shapers, boring machines, universal grinders, gear cutters, and threading and

Fig. 72. TRAINING ROOM FOR MACHINIST APPRENTICES, FORT WAYNE WORKS

Fig. 73. TRAINING ROOM FOR MACHINIST APPRENTICES, LYNN WORKS

milling machines. In addition to these machines, the boy is able to work successfully on the bench with file, hammer, and chisel.

Equally skilled in the use of the tools of their trade are the graduates from the molder's course, pattern maker's course, draftsman's course, and blacksmith's course. Thus men are trained to design machinery

Fig. 74. TRAINING ROOM FOR MACHINIST AND TOOL MAKER APPRENTICES
ERIE WORKS

Fig. 75. TRAINING ROOM FOR MACHINIST AND TOOL MAKER APPRENTICES
SCHENECTADY WORKS

and perform the necessary calculations; others to make the patterns and the molds in the foundry and pour in the molten metal, to machine the castings to dimensions accurate within one thousandth of an inch;

while still others are working the steam hammers for making forgings or delicately tempering certain parts, or making tools for turning out other parts. Such is the complete scope of the training of apprentices in electrical manufacturing.

We will omit a detailed description of the practical shop work and the classroom instruction, as this can be supplied to all inquirers in the form of a separate illustrated booklet treating the different courses in detail and showing photographs of the work which the apprentice boys turn out before their graduation.

SPECIAL COURSES

In addition to the apprentice courses mentioned there are, at the Lynn Works, other training courses for electrical test men, technical clerks, cost accountants, and engineering courses of a special nature. These are maintained to train young men for efficient service in the various branches of the Company's complex activities, or in power and lighting stations, transportation companies, and other industrial establishments using electrical machinery and steam apparatus.

There is also a course for those desiring to learn the business of installing and erecting electrical and steam machinery. These latter apprentice courses last but three years and a complete high school education is necessary in order to be eligible. The graduates of the electrical testing course are eligible to a special student engineering course of two years—amounting practically to a postgraduate training.

A novelty in apprentice training has been introduced at Lynn, known as the co-operative course with the Massachusetts Institute of Technology, in which the students alternate three months with the "Boston Tech." and three months in the apprentice shops. This course has been arranged to cover a period of two years.

At the Erie Works, which specializes in the manufacture and design of electrical railway equipment, considerable stress is laid in the apprentice courses on railway equipment; and in the mechanical and electrical classrooms, in addition to the regular equipment, are air compressors, cylinders, safety valves, motorman's valves, air tanks, strainers, mufflers, etc.—all to familiarize the apprentice with the operation and fundamental principles of electric passenger and freight locomotives and trolley cars.

At the Pittsfield Works a new course of a postgraduate nature has recently been instituted in which young men graduating from the regular apprentice courses may take up advanced work and enter the transformer engineering department and the testing department. The advantage of this graduate course is that it covers a gap which formerly existed between the apprentice course and the course given the test men.

With the former system it was impossible for an ambitious young man, unless a college graduate, to enter the engineering department. With the new system he is enabled, if ambitious, to reach any position in the engineering department. This work brings the student in contact with the problems associated with the transmission of power for long distances at high voltage.

NUMBER OF APPRENTICES

DECEMBER, 1917

Lynn	335
Schenectady	302
Pittsfield	113
Erie	85
Fort Wayne	82
Harrison	20
Total	937

EQUIPMENT AND FACILITIES

There has been invested in buildings, machinery, tools and classroom equipment, over $650,000 to provide for the training of apprentices. This investment has been divided among the six different factories named in the table. The most elaborate facilities are found at the Lynn Works, where the machinists' training room alone occupies 3600 sq. ft. in one building, a space 80 ft. wide by 450 ft. long. An avenue block on New York City is only 200 ft. long, and from this fact and the view shown in Fig. 10, a conception may be gained of the importance which this work occupies in the General Electric organization. This section is filled with intricate machines of all kinds, many of them automatic, and all with individual electric motor drive. To the average citizen the operation of any one of these machines would be considerably more baffling than a Chinese puzzle, and yet the graduates master their every detail, and soon learn to turn out finished machinery with only 0.7 of 1 per cent spoilage. They learn to shape cast iron and wrought iron, steel, brass, copper, and even cotton compressed into gear blanks—all of these materials are milled, turned, cut, ground, threaded, polished, and scraped by boys in their teens.

At Fort Wayne, where the apprentice course is a comparatively new institution, there are already installed 14 lathes, three milling machines, two shapers, two grinders, one planer, one gear cutter, three bench lathes, five drill presses, and one arbor press.

At Erie the drawing classroom is provided with machine parts of every description, which are cut in many different ways showing cross-sectional views. There is also a complete 1-kw. gasolene generating set.

The mechanical and electrical classrooms are equipped with a machine board arranged with levers, pulleys, scales and beams, an electrical table with switchboard on which is a lamp bank, resistance coils, voltmeters and ammeters, rheostat, and a mercury arc rectifier;

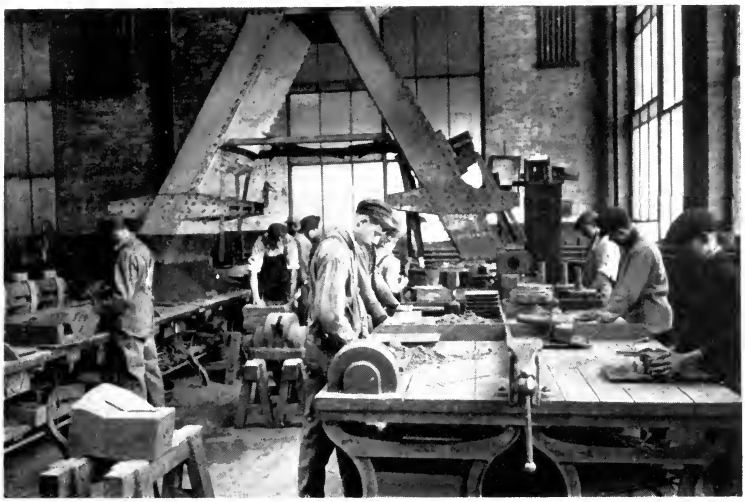


Fig. 76. MOLDER APPRENTICES, ERIE WORKS

Fig. 77. APPRENTICE LAYING OUT WORK IN SHOP

and a mechanic's table with apparatus illustrating an inclined plane, a platform scale, etc. All electrical, air, water, and steam apparatus is connected up, with all pipes painted standard colors.

The Schenectady Works has a slightly different scheme for handling the apprentice students, as they are more rapidly sent into the shops. All classrooms have equipment similar to that which is found in the laboratories of many technical schools. Hoists, inclined planes for

Fig. 78. NOON HOUR, MACHINIST APPRENTICE DEPARTMENT

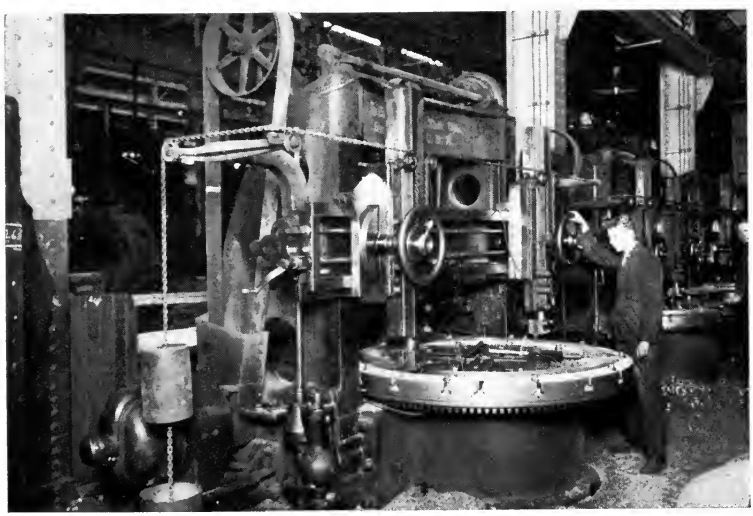


Fig. 79. MACHINIST APPRENTICES OPERATING LARGE BORING MILLS SCHENECTADY WORKS

demonstrating the principles of friction, weighted cords for studying the principle of the resolution of forces, sections of steam engines for studying valve systems—all these are part of the classroom equipment.

There is much to be said regarding the personal life of the boys in the apprentice courses, and the character of the cities in which the facfories are located.

Schenectady, a city of 97,000 population, has no "red light district." On the contrary, it has plenty of good entertainment which is more available here than in larger cities. For instance, the American Institute of Electrical Engineers has meetings twice a month which are addressed by prominent men such as Simon Lake the submarine inventor, Samuel Insull, Alex Dow, W. L. R. Emmet, Chas. P. Steinmetz, and other national authorities on electrical and mechanical subjects. There is a Y. M. C. A., Apprentice Alumni Association, Athletic Association, Mutual Benefit Association, a band and other musical organizations, and social opportunities exclusively for General Electric Company employees. The apprentices are eligible and welcome to most of the entertainments arranged.

Lynn, Mass., has a population of 102,000 and is a "dry" city. A rifle club, bowling club, coin and stamp club, as well as the General Electric Apprentice Fraternity, the Y. M. C. A., the Apprentice Alumni Association and band—all afford ample opportunities for social life among the young men.

Pittsfield, Mass., has a population of 38,000 and is located in the Berkshire Mountains. The climate is ideal. Various entertainments are provided by the Mutual Benefit Association, such as amateur theatricals, field days, picnics, electrical fairs, etc.

Fort Wayne, Ind., has a population of 90,000 and is approximately 100 miles from Chicago, Ill., and Detroit, Mich.

Erie, Pa., is located on Lake Erie and has a population of 75,000. Both Erie and Fort Wayne apprentices have a Club, an Alumni Association, and an annual picnic. All of the Clubs mentioned above are composed exclusively of General Electric Company men.

Thus, in these five cities, distributed along a distance of 880 miles in almost a straight line, there are opportunities for boys in the Middle West, along the Atlantic Seaboard, and in New England to work their way through these educational courses and yet not go too far from home. Lynn is practically on salt water; Pittsfield is in the Berkshire Mountains; Schenectady, amid the hills of the Mohawk Valley, lies close to the beautiful Hudson River and between the Catskill and Adriondack Mountains; while the city of Erie is situated on Lake Erie, and Fort Wayne is not far from Lake Michigan.

In all of the Works one or more complete libraries are available to the apprentices. Opportunity for baseball and boating in summer, football in the fall, skating and skiing in the winter, and track meets in the spring—all are open to all apprentices with athletic leanings.

CHAPTER IX

GENERAL EDUCATIONAL FACILITIES

In the preceding chapter was described the Apprentice Course of the General Electric Company for boys of sixteen years and older having only a grammar school education. In the chapter following this, a complete description will be given of the Student Engineers' Course for technical college graduates. But between the elementary apprentice course and the advanced student engineers' course there exists an intermediate field in which are many educational facilities, some of them novel and all of them important. This chapter outlines the various departmental, vocational, and night schools, and the college courses, lectures, publications and libraries constituting these intermediate or miscellaneous educational facilities that are open to employees of the General Electric Company.

That the school facilities are being utilized is evidenced by the record of the number of students registered in Schenectady during the school year 1917–18.

Testing Department Schools	65
Switchboard Department Schools	49
Evening Vocational Schools	318
Municipal Night Schools	877
Union College Evening Classes	142
Comptometer School	30
Total	1481

DEPARTMENTAL SCHOOLS

To boys from 18 to 20 years of age who have a high school education or equivalent training, but who are unable to go to college, the General Electric Company offers two specialized educational courses in departmental schools.

TESTING DEPARTMENT SCHOOL

The largest departmental school is the Testing Department where, at the Schenectady Works, 55 boys are now in attendance. In this two-year course boys can earn $1350 while being taught, if they attend regularly and are always on time.

Six months after the students enter the course they are assisting in measuring electricity a thousand times more accurately than a coal

dealer weighs coal, a hundred times more accurately than a grocer weighs sugar, and ten times more accurately than a jeweler weighs diamonds. This skill and precision, this familiarity with the tools of the electrical engineer, is the beginning of the boys' electrical education.

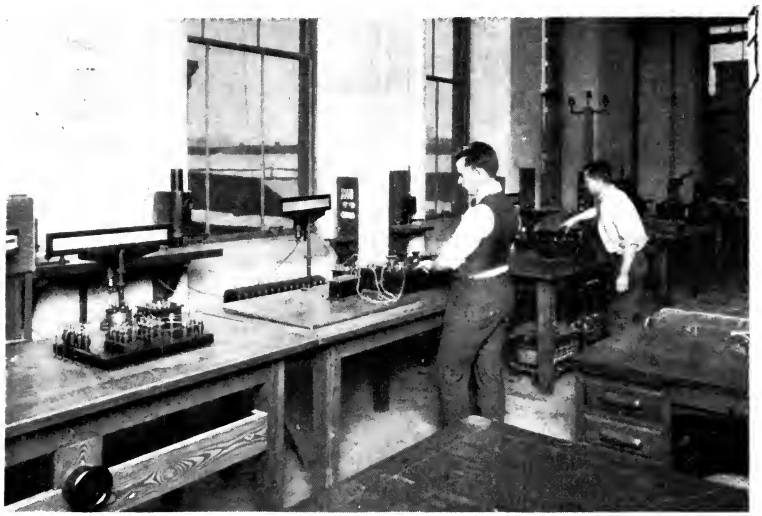


Fig. 80. LEARNING TO USE DELICATE ELECTRICAL INSTRUMENTS

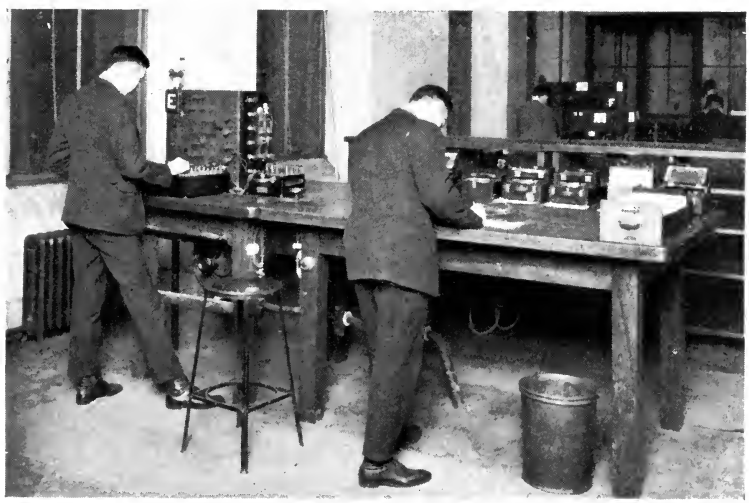


Fig. 81. CALIBRATING AMMETERS AND VOLTMETERS

It is acquired in the Standardizing Laboratory amid agreeable surroundings.

In this laboratory there are 8500 electrical instruments of 500 different types and capacities, and every one is kept accurate within a fraction of 1 per cent. The students learn how to select the proper instruments for various uses; how to calibrate, adjust, and repair them;

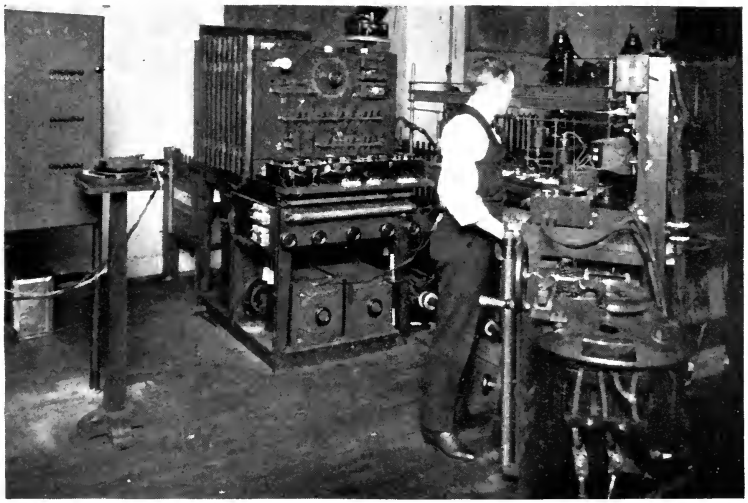


Fig. 82. DETERMINING RATIO AND PHASE ANGLE OF INSTRUMENT TRANSFORMERS

Fig. 83. COMMERCIAL TEST OF DIRECT-CURRENT MACHINES

how to use them to measure electrical quantities; and during the six months that they are being instructed in this work they are being paid.

CLASSROOM STUDIES

The course consists partly of work in the shop where the boys are under individual instructors, and partly of classroom instruction of one hour or more each week. These classes include lectures on direct- and alternating-current theory, and instruction in the use of machines and instruments for testing and the slide rule for rapid engineering calculations.

Besides the classes which are attended on the Company's time, the students are urged to attend night school, the vocational schools, or the Union College courses, all of which are described later in this chapter. Fifty out of 65 of these students attend one or more of the night courses.

The boys spend 50 hours a week in the shops, attend classroom one hour a week, and are paid for 51 hours per week. For every week in which their time record is perfect they are paid for 52 hours, that is, a bonus of one hour's extra pay.

In addition to these classes held during business hours, the boys are taken on inspection trips through the shops, examinations are held to test their powers of memory, observation, and reasoning, and special care is taken to guide their reading in proper channels and to keep them interested in good literature and engineering books.

For the classroom work there are two instructors, and two instructors each for the work in the shops and in the Standardizing Laboratory.

SHOP TRAINING

In the armature department the students are not required to wind armatures or field coils, nor to perform any of the processes of manufacture; they are put here solely to become thoroughly acquainted with the various methods of design, construction, and manufacture in this department.

Attention is invited here to the difference between the apprentice course and this departmental school. While an apprentice is working upon a machine tool as a machinist, these students are studying and testing the winding of armatures, learning the theory of electric motors and dynamos, and are grasping far more knowledge regarding electricity *per se* than the apprentice does in the same length of time. These students test the insulation and measure the resistance of field spools, stator coils, motor rotors, and stators of both alternating- and direct-current machines of various types. This portion of their training is conducted in many different buildings, and there is always some new illustration in the shop of what has previously been discussed in the classroom. This adds interest to the work and assists the students to a clearer comprehension of what electricity will do.

SHOP INSTRUCTIONS AND OBSERVATIONS

An important feature of this shop training is the method used to train the students' powers of observation and develop their memory. A few of the examination questions, selected at random from the complete list, are given below. It would be an interesting experiment to find out how many of these questions a college man could answer on the day of his graduation. Each graduate of the Testing Department's school must know how to answer over 100 of these questions correctly, and his knowledge of the subjects is obtained not only in the classroom from textbooks and blackboard demonstrations, but from the actual operation of the machine itself, supplemented by information imparted to him personally by instructors in the shops.

SOME EXAMINATION QUESTIONS REGARDING DIRECT-CURRENT MOTOR FIELDS

1. What is meant by shunt fields? Series fields? Interpole fields? Compensated fields? Accumulative fields? Differential fields?
2. What is a ventilated field spool?
3. Why is cast iron, cast steel, or laminated structure used in different frames?
4. Why are shims used between pole pieces and frames?
5. Why is a pole piece usually of laminated iron?

SOME EXAMINATION QUESTIONS REGARDING ARMATURES AND COMMUTATORS

1. What kind of material is used in armature cores?
2. Why is it not solid casting or forging?
3. How is the core assembled? What operations are necessary before ready to receive coils?
4. Why do some armatures have spider construction?
5. Why are holes or ducts provided: At what peripheral speed do armatures run?

These questions only suggest how the boys can make the most of their opportunities for obtaining knowledge of electrical designing and construction details. It is expected that they will become familiar with the kinds of material used, and how these are made up ready for assembly. They are encouraged to learn how the materials are treated and why, how they are assembled in motors, generators, and synchronous converters. The students must be familiar with the forming of armature and field coils; they must know how these are taped, insulated and assembled in the machines, and how the machines are connected up with the electrical circuits from the power stations.

All these questions are practical, and the boys are provided ample time and opportunity—one might say as privileged characters—to ask any questions they desire on how machines are constructed and why.

"SHOOTING TROUBLE"

The technical term for discovering defects is "shooting trouble." A trouble shooter is a valuable man in an engineering organization, be it a telephone, lighting, or traction company, or a large industrial plant. A prominent commercial engineer once gained an important customer

Fig. 84. MEASURING RESISTANCE OF INDUCTION MOTORS

for his Company because he was able to discover why some of the factory machinery would not work, and pointed out to the operating man the slight readjustment that would restore the machinery to full operation. There is no telling when an intimate knowledge of the interior construction and working of electrical machinery will solve some problem in an emergency and help to establish a man's reputation as a thoroughgoing electrical expert.

During all this period the classroom shows the "why" of the shopwork, and the shopwork shows the utility of the classroom theory. For this shopwork on armatures, motors, commutators, fields, etc., a year is considered sufficient.

The remaining six months of the course are spent partly in testing safeguarding devices which automatically cut off the electric power from machinery that is overloaded or badly handled, and partly in the switchboard department learning how electricity is distributed and controlled. Engineers harness the waterfalls and make them generate electricity; but it is then necessary for other engineers to harness the electricity so that it can be transformed, transmitted, distributed, and controlled to work in the service of mankind.

Fig. 85. LEARNING HOW TO TEST A MOTOR ARMATURE

Another feature of the classroom work is the explanation of the workings of electric circuits. The boys are taught how direct and alternating current passes through the wires; how electricity may be sent in one direction to one machine where it will do one duty; and how, by the mere turning of a switch, it can be sent hundreds of miles in another direction to do duty on another kind of machine. Thus the boys obtain what may be called a practical working knowledge of electricity and electrical machines, and the general principles of safeguarding and controlling that wonderful power with which we can accomplish so much for mankind.

HIGH VOLTAGE WORK

In testing insulation pressures as high as 100,000 volts are finally employed by these boys, and the safety precautions connected with this work are thoroughly learned through personal instruction and experience.

ROUTINE TEST

After this two years' course has been completed, the boys are started as routine test men for six months. Regular and prompt attend-

Fig. 86. INSTRUCTION IN TESTING ROTOR OF ALTERNATOR

ance during this additional period increases the high school graduate's total earnings to $1765—all within two and one half years after his start in the electrical industry!

In the routine test the boys are taught how to wire up machinery to the controllers and the line, and to test such apparatus as compensators and controllers for steel mill motors and mine hoists; how to set up and operate the controlling devices of electric trains, as well as of machines for transforming one kind of electricity into another entirely different kind of electricity. During this advanced six months' course

the weekly classroom work is continued as before. The operation of machines is demonstrated in test, and then inspection trips are taken to show the actual performance in service of the motors, controllers, and the various devices which have been studied and tested in the preceding months.

After this schooling, these young men are given a final examination and those who pass become regular test men at increased pay. After an additional year of testing, of a more advanced and expert order, they are then ready for work in the engineering or commercial departments, or for construction on the road, or for engineering or commercial work in the various district offices of the Company in the United States and abroad.

SWITCHBOARD DEPARTMENT SCHOOL

Another school is conducted for the young men of the testing and inspection sections of the Switchboard Department, and is called the Instruction Course for Switchboard Department Test Men. Those who have been accepted for this course, but who have not actually been graduated from high school, are expected to attend some of the night schools mentioned later in order to get instruction in the indispensable preparatory mathematics.

On January 1, 1918, 40 young men were registered in this instruction course. The curriculum is quite rigid and provides for two hours each week of classroom instruction on the Company's time. Every student must prepare the work required and master the subjects given. If a man misses two or more lectures in succession without a satisfactory excuse, he will be automatically dropped from the rolls. If he is absent from four or more classroom sessions during the entire course, he must pass a special examination on the work missed. The engineers in charge of these classes, however, are available an extra hour every week for giving advice, answering questions, and consulting with the students.

In the first six months of classroom work the students are given simple problems teaching the elements and applications of electricity, and the elements of trigonometry. After passing an examination on this work, they enter a second six months' class dealing with problems of electrical measurements, switchboard design and mechanisms, and applications of alternating current.

After passing examination on these subjects the students enter a third class, likewise of six months, and take up the study of switchboard materials, methods of machining, specifications, stocks, business organization, the essentials of economics and the fundamentals of salesmanship. Following graduation from this third class, they are prepared to enter the work of the Switchboard Department. Any student who after two

years has not shown particular aptitude or liking for switchboard work will, on request, be shifted to the routine test in the Testing Department.

The salaries earned by the students in this course, and the number of hours which they work and attend classes, are identical with the schedule of the Testing Department's preparatory school.

Of course, it is evident that neither of these courses begins to give the equivalent of a college education with its training in advanced mathematics, mechanics, languages, hydraulics, chemistry, and cultural studies; but after having satisfactorily completed the work laid out, these students will have obtained a practical working knowledge of electricity and electrical apparatus, comparable probably to that of a man entering his senior year in the average technical college.

Everything else being equal, the high school graduate with aptitude for mathematics will ultimately be given greater responsibilities and will earn more in the electrical industry than will those who lack the high school training. Although some apprentices, exceptional men, have made extraordinary headway, the average high school man will fare better than the average apprentice. The young men who creditably complete these two courses and continue their studies should rise to positions as designing, construction, and commercial engineers, frequently with apprentice graduates working under their direction. The mathematics which the students obtain in the high school becomes a real asset in future years.

To sum up: The young men learn to handle expertly a great variety of electrical instruments and apparatus, and understand their applications in industry; they learn in classes the theory of electricity; and at all times they are in touch with a great organization where they gain first-hand knowledge of mechanical and electrical engineering and manufacturing processes.

Other classes for high school graduates are conducted in the Lynn, Erie, Fort Wayne, and Pittsfield Works. Young men with a complete high school education who have an aptitude for technical work, may obtain training which will fit them to become competent electrical and steam turbine testers, manufacturing and electrical engineers, or cost accountants. The classroom education is of an advanced character, and deals with advanced algebra, plane trigonometry, analytic geometry, mechanics and mechanisms, mechanics of material, magnetism and electricity, machine and dynamo design, heat and heat engines, chemistry and metallurgy, mechanical drawing, and business English.

After a two months' trial period, during which they receive regular compensation, those students are selected who have the requisite characteristics.

Training courses for electrical test men, technical clerks, and cost accountants require three years, and afford extended experience in assembling various classes of apparatus. Where practicable, a short assignment in the cost and production departments is included.

These courses are maintained to train young men for efficient service in the various branches of the Company's complex activities, or in power and lighting stations, transportation companies, and other industrial establishments using electrical machinery and steam apparatus; or for those desiring to learn the business of installing and erecting electrical and steam machinery.

The advantage of these courses is that they cover a gap which formerly existed between the apprentice course and the test course given to technical college graduates.

GENERAL EDUCATIONAL FACILITIES

The vocational schools offer schooling in General Electric methods. They are open to all with a good education. The vocational schools at Schenectady are conducted inside the Works, are exclusively for employees, and convene immediately after the close of the working day. They are under the joint jurisdiction of the Company and the City Board of Education. The tuition and use of the books cost nothing if the students attend 80 per cent of the sessions.

The courses of study offered in the Schenectady vocational schools are as follows:

Business Arithmetic
English
Commercial Law
Elementary Bookkeeping
Short Course in Accountancy
Accountancy and Business Administration
Touch Typewriting
Stenography
Phonograph Dictation

Last year 217 students enrolled, of whom 27 were girls. That the students meant business is shown by the fact that two thirds of last year's students attended 80 per cent or more of the sessions, and 90 students satisfactorily passed in the subjects studied. The average age of the students registered was 25 years, although the minimum age limit is 16 years. Nine courses were offered in 1917–1918, and a total of 318 employees enrolled.

Further information relative to these courses—the subjects treated, books furnished, time and grade required—is given in a booklet published annually.

The Fort Wayne Works have almost parallel courses in their evening classes, and in addition have courses in factory routine and in English exclusively for girls. The Indiana University has an extension at Fort Wayne, so that any employee who desires can take a course in mathematics, economics, foreign languages, and advanced English.

MUNICIPAL NIGHT SCHOOLS

Still other classes, to all of which General Electric employees are eligible, are held in the evening at three Schenectady Schools and at the High School. Tuition and use of books in all of these courses are free of charge to all students. Partly because of encouragement from the Company, 877 employees enrolled—two thirds of some of the classes being composed of General Electric employees.

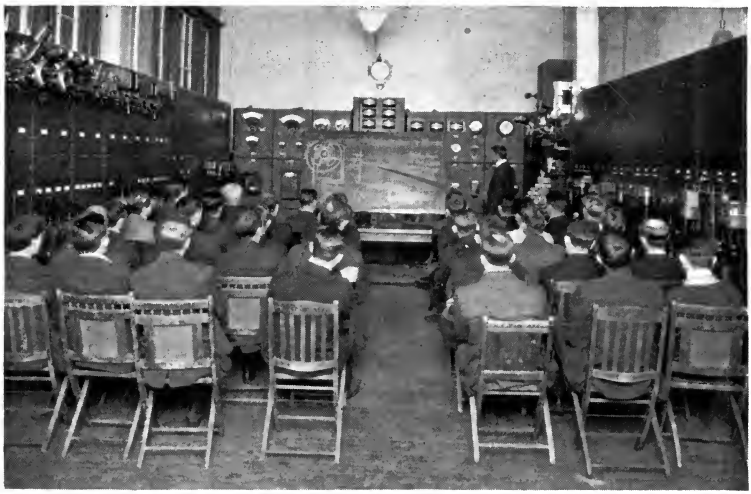


Fig. 87. SWITCHBOARD DEPARTMENT LECTURE

The elementary courses are for boys between the ages of 14 and 16 years who, under the Compulsory Education School Law, must attend 50 nights a year. English, spelling, civics, history, and arithmetic are studied here.

The High School classes are held two to four nights a week and provide the following courses:

Spanish
French
German
Algebra
Plane and Solid Geometry
Trigonometry
Mechanics
Applied Electricity
Electrical Engineering
Chemistry
Mechanical Drawing
Architectural Drawing
Shop Mathematics
United States History

(For girls only):
Cooking
Dressmaking
Millinery
Physical Training

Also at the High School there is a three-year commercial course, meeting four evenings a week, which is the equal of the average night business college, and covers bookkeeping, business arithmetic, English, business writing, shorthand, and typewriting.

COLLEGE COURSES

UNION COLLEGE

In the 1917-1918 college year, 85 per cent of the total number of evening students were General Electric employees—142 having enrolled.

Students are here afforded the opportunity of studying under instructors and professors in a real college atmosphere and learn higher mathematics, physics, chemistry, elementary electricity, electrical engineering, Spanish, French, and advanced English.

Fig. 88. TESTING SWITCHBOARD CIRCUIT BREAKERS AND RELAYS

The Company refunds half of the tuition fees of those employees whose attendance record is 80 per cent.

Union College, established in 1795, is rich in traditions, and its standing among universities is of the highest order.

Attractive booklets describing these Union College courses are published annually by the General Electric Company and circulated among the employees.

UNIVERSITY EXTENSION COURSE AT LYNN

At the Lynn Works a university extension course is conducted under the direction of the Massachusetts State Board of Education. The Company encourages the employees to enroll in these courses, which are advertised within the Works. The subjects offered are practical electricity, practical applied mathematics, commercial correspondence, and gas and oil engines.

Evening classes are conducted at the Massachusetts Institute of Technology, Boston University and Wentworth Institute and other schools in Boston, which are attended by employees of the General Electric Works at Lynn, seventeen miles distant.

EVENING WORK AT PITTSFIELD

The Pittsfield Works conducts a series of evening classes attended by over 100 employees. They embrace instruction in algebra, geometry, elementary drawing, advanced electricity, advanced mathematics,

Fig. 89. STUDYING ILLUMINATION AT PITTSFIELD WORKS

advanced drawing, jig and tool design, elementary electricity, mechanics, English, and a course in Spanish.

ADVANCED ELECTRICITY AT PITTSFIELD

From the class in advanced electricity the past year, two men were promoted to testing work—work formerly done by college men—and a third man from the evening classes was selected as an assistant to the head of the educational department.

It will be noted from the accompanying photographs that the equipment provided for the students' laboratory work is similar to that used in the regular laboratory and in testing work. Some trigonometry, analytical geometry, and the first principles of calculus are taught in the advanced electricity course; and altogether a very good idea of alternating current theory is obtained.

As an illustration: In the Engineering Department is a young man who in three years' time has passed from office boy to junior engineer. During this time he moved about from position to position in the shop, where he engaged in regular factory operations and at the same time took advantage of all the evening classes in electricity and mathematics.

At present over 100 students are enrolled in the evening technical classes—in fact, about the same number of students as are enrolled in the apprentice courses. A fee of $5 is charged for these classes, but the fee is refunded with a passing mark of 75 per cent.

Fig. 90. MECHANICAL DRAWING CLASS

LECTURES

DEPARTMENTAL LECTURES

Primarily for their technical and commercial educational value, the departmental lecture system was introduced in the various factories and district offices; and a happy by-product of these lectures has been their effect on the *esprit de corps*. Many of these lectures are of such importance and value that they are reprinted for the confidential information of the General Electric engineers and the commercial men throughout the world. Department managers, section heads, and prominent men from other departments deliver these lectures.

The attendance at the Switchboard Departments' lectures is drawn from the design ng, requisition, commercial, and production divisions of the office force, and from the foremen and assistant foremen of the factory force. The lectures describe the details of the Company's organization, the relation of the Switchboard Department to the organization,

and the manufacture, application, and operation of the equipment manufactured by the department or controlled by switchboards.

Lectures on strictly engineering subjects are delivered once a week for six months to the newly employed engineers, most of whom are college graduates and have been through the test course.

All members of the Power and Mining Engineering Department are expected to attend the weekly lectures of the department, which cover such subjects as production, patents, advertising, sugar mills, voltage regulators, transformers, rotary converters, lightning arresters, high tension bushings, and electric furnaces.

The Research Laboratory lecture is held weekly through the winter. It is intended primarily for employees of the department, but other employees are welcome. The purpose of the lectures is to acquaint all members of the laboratory with what is being done in the field of research, both within and without the laboratory. They embrace such subjects as: The Second Law of Thermodynamics; The Theory of Heterogeneous Reactions; Spectrum Series; Over-voltage; Radium Work of the Bureau of Mines; Magnetic Amplifier for Radiotelephony; Mechanism of Cell Permeability; X-ray and Cancer; X-ray Spectra; Permeability and Cell Life; Constitution of Rubber Molecule; Absolute Zero; Liquefaction of Air and Separation of Constituents; Chemical Reactions at Low Pressures; X-ray and Crystals; Ionization; Ferro-magnetic Alloys; Physical Chemistry of the Blood; Spectroscopy of Extreme Ultra-violet; Dielectric Phenomena; Luminescence; The Beaver as an Engineer.

The Publication Bureau also has weekly lecture courses for all members of the department, the object of which is to acquaint the members of the Bureau with the activities of the different sections, and to consider ways of co-operating with other departments of the Company in the preparation of publications, bulletins, handbooks, technical letters, and all the multiplicity of publications required by a large manufacturing organization such as the General Electric Company.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

Another prominent educational feature in the various cities where large factories of the General Electric Company are situated is the bi-weekly section meeting of the American Institute of Electrical Engineers. The Lynn Section, with over 1600 members, is the largest of the 31 sections of this Institute, and the Schenectady Section is second largest, its membership numbering approximately 1200.

Anyone interested in the study, manufacture, or application of electrical apparatus and resident in the vicinity, is eligible to membership. The local section is, therefore, open to all factory and office employees of the General Electric Company.

Last year's addresses at the Schenectady Section included the following papers:

The Electrically-driven Gyroscope and Its Uses.
Regulation of Public Utilities.
The Illumination of the Panama-Pacific International Exposition.
Railway Electrification.
Paper Industry.
Electrically Driven Ship Propellers.
The Engineer at the Battle of Verdun.
The Art and Science of Illumination.
Production of Steam from Coal.
The "Amphibious" Submarine.
High-speed Electric Locomotives.
Niagara Power or a Real Coal Shortage.

Other associations which have sections or branches in Schenectady and hold frequent meetings are: The American Society of Mechanical Engineers, The Society of Engineers of Eastern New York, The National Electric Light Association, The Illuminating Engineering Society, The American Chemical Society, and The Edison Club.

PUBLICATIONS

A great variety of publications are available, many of which are for the exclusive use of the employees.

The technical letters are confidential and are not for public distribution.

Instruction books are issued showing how electrical machinery should be shipped; how the foundations should be prepared; how the machines should be assembled and set up in the field; and how all the electrical connections should be made.

Illustrated bulletins are available in which are described and pictured the thousands of applications of electricity to hundreds of different industries. For example, in the paper and pulp industry, the various uses of electricity are described and illustrated, from the cutting of the logs in the forest to the completion of the roll of paper ready to ship to the newspaper office. The function of the electric motor in cutting, grinding, chipping, and beating the wood to a pulp, and changing this watery pulp into finished paper, are interestingly and clearly described.

Throughout all the Works of the General Electric Company are a thousand bulletin boards. Every week a new safety bulletin is posted showing means of preventing accidents and the sad results of carelessness. The safety work of the General Electric Company was described in the chapter: "Prevention of Accidents."

LIBRARIES

Some nations know how to amass wealth, but their economic system is unable to distribute it properly.

Some libraries are storehouses where knowledge is amassed—neatly segregated, indexed, classified, and then merely *stored.* Other libraries not only store knowledge but condense it, fabricate it into convenient forms, do it up in attractive packages, and distribute it to a selected list of "ultimate consumers."

MAIN LIBRARY

The General Electric main library at Schenectady is among the latter class. In fact, this library is a tool of the industry, actually serving the factory, the department heads, research investigators, scientists,

Fig. 91. A CORNER IN THE MAIN SCHENECTADY LIBRARY

commercial, production, and accounting departments with the latest news from current periodicals, transactions of scientific and engineering societies, and reviews and translations of books printed in all languages.

It might be said that this library combines the functions of the editorial and circulation departments of a newspaper, for it reads and selects the news, featuring the important points, and then circulates the information to its subscribers. A semi-monthly Library Notice informs all recipients regarding the contents of new articles and books. In this sense the Library is education plus—it becomes a regular service department as opposed to a place for semi-occasional "little journeys" of an educational nature. In these days of modern business only rare

individuals go to the library—pressure of twentieth century life demands that the library be brought to the individual.

Our modern technical librarian can now give us just what we want, when we want it, in a convenient form, and in hundreds of cases without our asking for it. Hence the modern industrial library has ceased to be a thing apart from the business of the plant; it is no longer a disregarded adjunct. From a storage vault it has become a manufactory, changing the raw material into the accessible finished product.

RESEARCH LABORATORY LIBRARY

Here also the service work is not limited to the mere business of bulletin board notices of new books received, new periodicals on file, and current society business and conventions: the accessions are read and

Fig. 92. RESEARCH LABORATORY LIBRARY AT SCHENECTADY

digested. In some cases the complete article is sent to, or called to the attention of, interested individuals. Where requested, digests or translations are made and are sent to those engaged in lines of work kindred to the subjects treated in the new books and periodicals. This library has a file of lantern slides showing tabulated data, formulæ, photographs or drawings, novel installations and apparatus. These lantern slides can be chosen as needed for lectures.

The up-to-date corporation librarian has the intelligence to select important matter, and the initiative to authorize reprints for distribution within the organization; the authority to approve the appropriation and a knowledge of who would be interested in the subjects treated.

It requires intelligence of a high order to prepare bibliographies of such subjects as the latest developments throughout the world in the nitrogen industries, in X-rays, high explosives, or submarines, and separate the wheat from the chaff!

The Library has its commercial aspects as well. The time of high-salaried experts need not be taken up in answering questions when complete and detailed information can be obtained from the specialized librarian. Inquirers do not consume hours of the time of "the man who knows," at $25 a day, when more exhaustive and detailed information can be obtained from books standing idle on the library shelves. Modern corporation life has taught us not to ask the librarian for a book on chemistry when we desire information on boronized copper, for we save time by inquiring definitely about boronized copper. If we wish to read a paper on pure electron discharge in radio-telephony, delivered before a society, we ask for that paper and not for the mailing address of the society in New York or Chicago; for the pamphlet is on file and possibly a score of extra copies, for—*mirabile dictu!*—our demand has been anticipated!

These facilities could be elaborated to include the Boston Public Library, only 16 miles from the West Lynn Works; and the New State Library at Albany, with a capacity of 2,000,000 volumes, is only 17 miles from Schenectady. Many other small libraries are omitted from this account as they are too specialized to be of general interest.

In many respects a similar account could be written of the educational facilities and libraries in the other plants of the General Electric Company.

	Books and Bound Periodicals	Pamphlets	Current Periodicals
Main General Electric Library (Schenectady)	4,000	800	100
General Electric Law Library	4,000		
*Research Laboratory Library	2,775	1,300	90
Testing Laboratory Library	475		10
Power and Mining Department Library	190		
*Illuminating Laboratory Library	450	4,000	20
*Consulting Engineering Laboratory Library	100		2
*Patent Department	2,000	250,000	22
*Publication Bureau Data Section		7,500	
Union College Library	51,000		59
Schenectady Public Library	40,000		158
New York State Library (Albany)	428,000	150,000	
New York Office	350		30
Boston Office	225	75	31

* Partly confidential.

CORRESPONDENCE SCHOOLS

The leading correspondence schools of the country report enrollments of General Electric employees totalling 2000.

CHAPTER X

THE ELECTRICAL TESTING COURSE

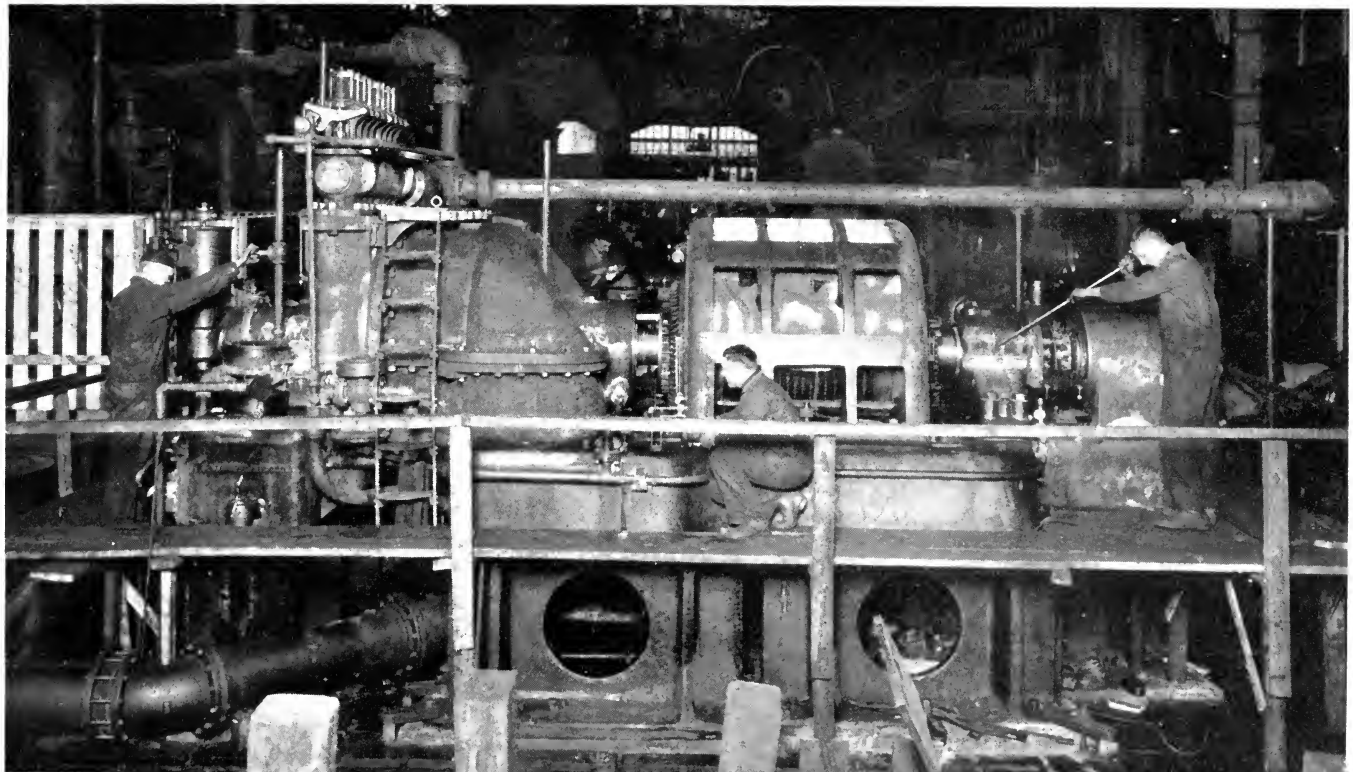
There still exists the type of college man who fancies that the world is waiting with outstretched arms to receive him, and that his career in business will be merely coasting pleasantly down from the heights which he attained at college. Fortunately, in the engineering colleges especially, this type of man is being succeeded by men having a better outlook—men who have had practical experience during their summer vacations. They have few misconceptions regarding the magic power of the sheepskin to obtain for them a place in the world without hard work. On the contrary, more and more they are appreciating that what they learn with their sleeves rolled up is invaluable to their future success, whether they are destined to be engineers, executives, or sales managers. And there is no period of their life upon which they will look back with so much sentiment and gratitude as upon the days of practical work, when they learned among other things the democracy of overalls and a flannel shirt.

This chapter will describe the life of the college graduate who enters the General Electric Company's Test Course, and will trace the careers of almost 2200 of those who have completed the training.

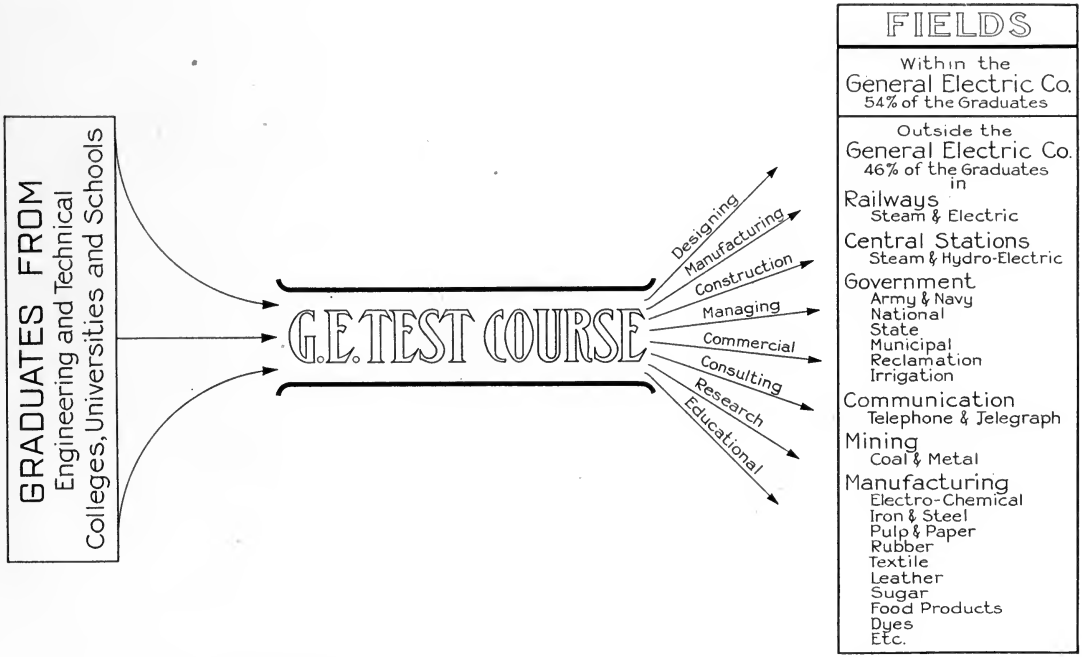
The diagram on the opposite page shows that the General Electric Company's Test Course is an open door to the electrical industry; it suggests some of the activities for which the men will be especially trained; and it shows the various fields in which the college graduates will work out their own destinies.

It might be stated that, just as the temper of steel makes the tool hold its edge and just as the chemical of the photographer fixes the picture on the negative, just so does this practical training whet to a keen edge, fix, indelibly stamp on their memories, and crystalize in their minds the knowledge of electricity which they gained in their university training. Or to cite another parallel, it is similar to the medical student who, as an interne in a great metropolitan hospital, gets the practice which is necessary in order that he acquire the technique of his profession.

But before discussing this diagram and describing the careers of these young men, it would be well to suggest the magnitude of the future electrical industry and the increasing call for trained men to fill its responsible executive and engineering positions.



STUDENT ENGINEERS CONDUCTING TEST ON TURBO-GENERATOR SET



THE CAREERS OPEN TO TECHNICAL GRADUATES THROUGH THE TEST COURSE

ELECTRIFICATION HAS ONLY BEGUN

Not over a tenth of the possible water power of this country has been developed; less than 1 per cent of the steam railroads have been electrified to date; 500 miles of new track and 1000 new street cars are put in service annually; 15,000,000 houses are not lighted electrically; less than 1 per cent are wired for complete electric service. The electrical industry was practically born in 1879 when Thomas A. Edison invented the incandescent lamp, and was put on a commercial basis by Edison's three-wire system about 1882—barely a generation ago! Twelve billion dollars is already invested in the electrical industry in this country. Last year $23 was spent per capita for electrical service and material. The annual gross income is over $2,500,000,000. The employees number approximately 1,000,000. But the money to be spent in the next 38 years and the size of the industry in 1956 stagger the imagination. The executives and the engineers who will direct the great electrification corporations of the next generation are in college today—many perhaps are reading this article.

Referring again to the diagram, attention is invited to the fact that the test course is indicated as a path between college and business. The average time required for the college man to traverse this pathway is 15 months. His average earnings for this time at the Schenectady Works are $1277.15.

FOREIGN FIELDS

Before fully describing the Test Course let us review the electrical industry both inside and outside of the Company's organization, and find what positions are held today by the graduates of the Test Course in the past—at the same time bearing in mind that when we speak of the past in the electrical industry, we speak of an absurdly short space of time. The reader should appreciate that these young men are scattered over the four quarters of the globe, doing their share in the fascinating work of electrifying China, harnessing waterfalls in India, installing electrical drive in sugar mills in the West Indies, substituting electricity for steam or hand labor in the mines of Alaska and South Africa, building railways in Australia and refrigerating plants in the Philippine Islands.

CAREERS OF EX-TEST MEN

It is a difficult matter to make a survey of the careers of these young men. It was thought that perhaps the best method would be to ascertain how many of the old test men were members of the American Institute of Electrical Engineers. By checking one list against the other,

it was found that the names of nearly 1000 graduates appeared on the membership list of the Institute, with present address, position, and title. Of this number about 350 hold positions with the General Electric Company and 122 are in foreign countries. One man remarked upon glancing over this list: "This thoroughly proves that for the test man the world is his field and the sky is his limit."

It should be stated in connection with this list (Table V) that many engineers and executives of the Company are not members of the National body of the American Institute of Electrical Engineers, but of local sections existing at Fort Wayne, Pittsfield, Lynn, Schenectady, Philadelphia, Chicago, Boston, and other cities throughout the country.

The field of activity includes: railways, central stations, governmental work, hydro-electrical development, signaling, army and navy, power transmission, electro-chemistry, manufacturing, and finance.

MINING, STEEL, AND RAILWAY ENGINEERS

Many test men engaged in mining, railway work, and the iron and steel industry, etc., are members of related societies. For instance, the list of members of the Association of Iron and Steel Electrical Engineers shows that 14 former test men are members of this Association, eight of whom are still with the Company. McGraw's 1917 list of railway officials (Table I) shows that the following positions are held by General Electric test men in the electric railway field:

TABLE I

ELECTRIC RAILWAY OFFICIALS FORMERLY GENERAL ELECTRIC TEST MEN

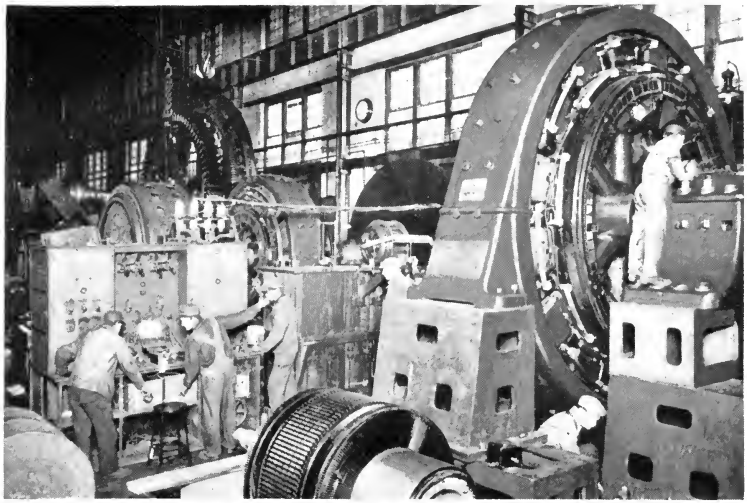
Presidents	12
Vice Presidents	27
Secretaries	15
Treasurers	18
Auditors	24
General Managers	18
Managers	12
Engineers and Superintendents	42
Inspectors	3
Master Mechanics	6
Purchasing Agents	3
Claim Agents	3
Land Commissioners	3
	186

TEST MEN IN ENGINEERING DEPARTMENTS

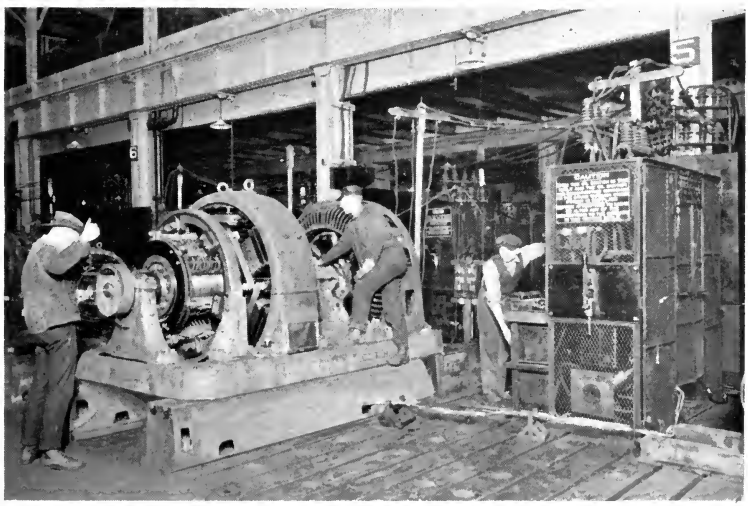
The extent to which test men are employed in the various factories and district offices of the Company is shown in Table VI, representing 63 General Electric engineering departments. This accounts for 577 ex-test men.

Since test men constitute 52 per cent of the engineering personnel, and probably 90 per cent of the technical force, more than one conclusion can be drawn:

1st. A large number of ex-test men are employed in the engineering departments of the General Electric Company.



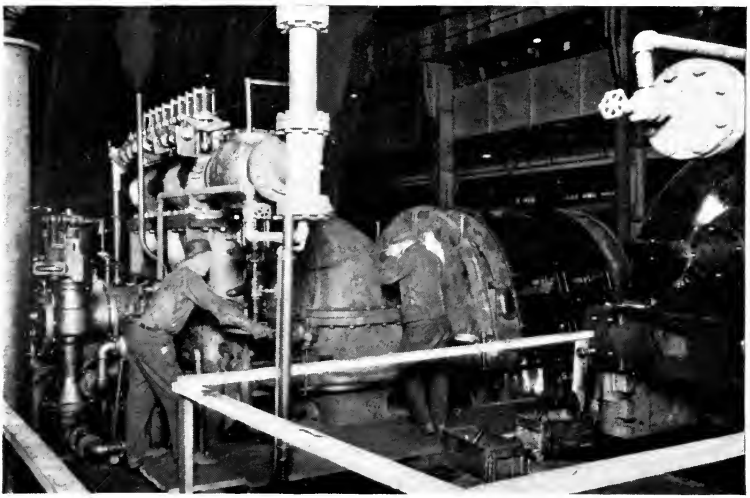
MINE HOIST EQUIPMENT UNDER TEST



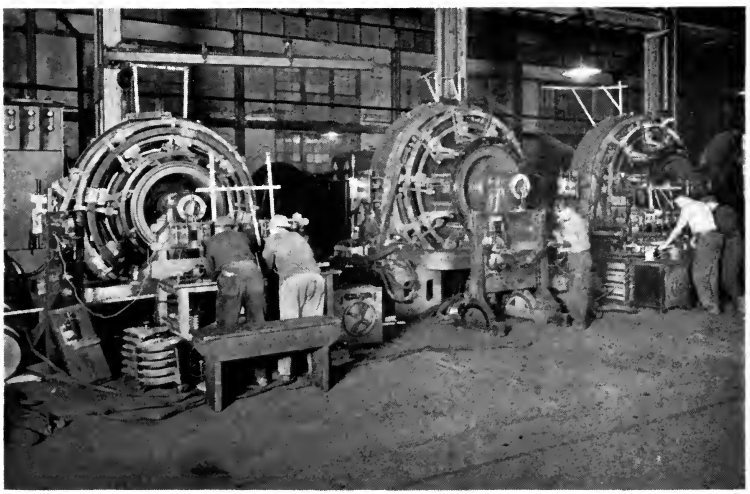
MOTOR GENERATOR TEST IN BUILDING NO. 11 AT SCHENECTADY

2nd. For a college graduate the Test Course is the best if not the only route by which he can arrive at responsible positions in these engineering departments.

This census, dealing with 63 of the engineering departments, could be supplemented by another census dealing with 105 or more commercial departments and sections of the Company in the above factories



STEAM TURBINE TEST



TESTING LARGE SYNCHRONOUS CONVERTERS AT SCHENECTADY

and in nearly 100 cities throughout the world. This additional census has not been made, but a cursory survey apparently justifies the belief that the percentage of test men in the commercial work of the Company

is even greater than in the engineering. And scores of student engineers enter the Construction, Administrative, and Manufacturing Departments, Laboratories, etc.

HIGH POSITIONS ATTAINED

Table VII shows the percentage of the Company's officers, managers, specialists, etc., who passed through the preliminary practical training in the shops "with their sleeves rolled up."

In addition, there are hundreds of engineers and business men, ex-test men, all over the country, not with the General Electric Company, who have branched off into the automobile business, who are proprietors and managers of power plants and various industries, officers in electrical jobbing concerns, etc. It would appear, therefore, that the young men develop versatility as a result of their theoretical and practical education.

COSMOPOLITANISM

The students who enter this course are practically a picked crew from the graduates of over 100 engineering colleges in the United States—north, south, east, and west.

A total of 257 students have been accepted from colleges in over 22 foreign countries. These foreign graduates can be grouped as follows:

	Students
China	38
South American Countries	34
England	30
Japan	29
India	18
Australia	17
South Africa	17
Canada	10
West Indies	10
France	6
Other Countries	48
Total	257

Therefore, it may be said without exaggeration that the test men are a cosmopolitan, highly educated group of young men.

COLLEGE PROFESSORS AND INSTRUCTORS

The instructive value of the Test Course is indicated by the fact that instructors and professors from many technical colleges have found it of advantage to spend their summer vacations in the Testing Department of the Company, in order to keep in touch with practical manufacturing methods and to learn more of the design and operating characteristics of the latest electrical machinery and appliances. A number served in test regularly after graduation.

THE TESTING DEPARTMENT

The Testing Department is as distinctly a department of the Company as is the Production, Purchasing, or any other; and its work must be conducted on a strictly manufacturing basis—time and cost records being kept and compared with existing standards.

The great outstanding difference between the Testing Department and other departments is that it occupies space in a great many different buildings and deals with an enormous variety of apparatus. Hence, it is ideal for developing a knowledge of the Company's products. In Schenectady, for instance, the Testing Department has permanent headquarters in 14 different locations distributed throughout the Works. The reason for this scattering is that the apparatus is tested where it is manufactured. In a typical building the rough castings are received at one end, where they are machined; they are assembled at about the middle of the building and, after being tested, are painted near the far end of the building and are boxed and loaded on railroad cars inside the extreme end of the same building. It is thus seen that the men in the Testing Department are under the same roof where complete manufacturing processes are conducted.

TABLE III

KV-A. CAPACITY OF APPARATUS USED IN TESTING

	Motors	Generators	Transformers	Total Kv-a.	Power Supply
Schenectady	32,000	78,000	30,000	140,000	37,000
Fort Wayne	3,163	1,535	2,552	7,250	4,325
Erie	5,117	3,595	4,943	13,655	9,000
Lynn	3,684	4,724	4,955	13,363	12,000
Sprague	1,500	300	200	2,000	
Pittsfield	12,000	30,000	29,000	71,000	7,200
Total	57,464	118,154	71,650	247,268	69,525

MAGNITUDE OF THE TESTING DEPARTMENT

The Testing Department of the General Electric Company occupies 732,486 sq. ft. of space. This area in down-town New York would cover nearly 15 city blocks, each the size of that occupied by the Equitable Building, which is bounded by Broadway, Nassau, Cedar, and Pine Streets. It is 29 per cent greater than the entire rentable area of the Woolworth Building. Or in Chicago, this space is 238 per cent as large as the entire rentable area of the Railway Exchange Building on Michigan Avenue and Jackson Boulevard.

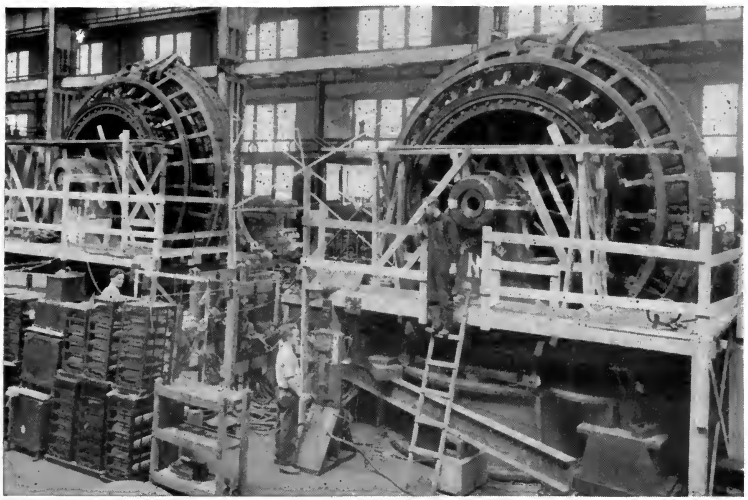
This space is distributed among the different factories as follows:

TABLE IV

	Sq. Ft.
Schenectady	428,458
Pittsfield	64,000
Fort Wayne	47,070
Lynn	131,958
Erie	50,000
Sprague	11,000
Total	732,485

ENORMOUS CAPACITY OF TESTING APPARATUS

Would you believe it possible that the General Electric Company should set aside and reserve merely for testing purposes electrical



TESTING LARGE CONVERTERS

apparatus totaling almost 250,000 kv-a.? This statement is, however, a conservative figure, since it does not include the power stations—a certain portion of which is used for testing purposes. The capacity of this apparatus is half as great as all of the power generating apparatus at Niagara Falls.

Table III shows the capacity of apparatus used for testing.

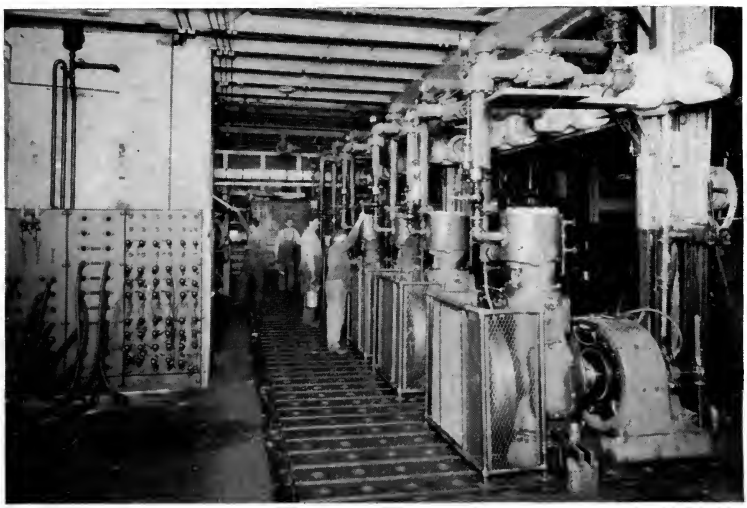
MACHINES HELP TO TEST EACH OTHER

Inspection of Table III brings out some very interesting facts. For instance, at Pittsfield the power station has only one tenth the capacity of the Testing Department! The total capacity of apparatus reserved for testing in each factory is greater than the capacity of its power supply. This situation is largely due to the "feeding back"

method, by which two motors, both under test, are used for testing each other—one running as a generator and the other as a motor, thus saving floor space, power, and generating capacity. By this last "feeding back" method, testing can be done on an enormous scale with the use of a comparatively trifling amount of coal, as the machines being tested supply most of the electricity required for testing them, only the losses being supplied from the power station.

OPERATING KNOWLEDGE

What may be considered as a by-product of the knowledge gained in the Testing Course at the Schenectady, Lynn, and Fort Wayne Works is the fact that there are no operators to take charge of this huge aggrega-



STUDENT ENGINEERS TESTING MARINE ENGINE SETS

tion of electrical testing apparatus, because the student engineers themselves operate the machines which are used for testing the Company's product. With this operating experience, a graduate of the Test Course can enter almost any main station, substation, or switchhouse and take charge of its electrical operation.

The efficiency of modern electrical protective devices is well demonstrated here, for all this apparatus runs year after year under varying conditions, in charge of a shifting crew of student engineers (excepting the Pittsfield room shown in the photograph).

WIDE VARIETY OF WORK

The fact is not as generally understood as it should be, that the student engineers are continually shifted from one kind of work to

another, and are consulted regarding the sort of work they desire to specialize in and also what class of testing they desire to take up month after month.

For example, if a student engineer has expressed a preference for turbine work, he can spend 50 per cent or more of his time testing large and small turbo-generator sets. Turbines are tested non-condensing and with vacua up to 29 inches, and the student becomes familiar with the properties of steam ranging from 200 degrees superheat down to 20 per cent moisture.

STEAM ENGINEERING

Turbines for the latest power plants operate with steam at 250 degrees superheat and 29 inches vacuum on the exhaust. The students gain a working familiarity with boiler steam that is hot enough to melt tin and get a knowledge of the types of piping, fittings, gaskets, valves, etc., required to resist such temperatures.

Among the variations in turbine testing are the ship propulsion units being manufactured. Some of these are being fitted with the Alquist flexible reduction gears, while others employ direct electric drive—both developments of the Company.

In connection with the testing of generating apparatus, attention is directed to the photographs of turbine and marine steam engine testing, which show a great amount of high pressure and low pressure piping to turbines, engines, condensers, pumps, etc. One of the surprises in store for the student engineer who enters this course is the vast amount of information which he secures in regard to steam. With the central stations calling for higher and still higher efficiencies, the General Electric Company has co-operated with the boiler industry on the one hand and the condenser industry on the other—to produce higher pressures and higher superheat from the one, higher vacua from the other, and greater capacity from both.

The student engineer lives in an atmosphere of practical thermodynamics while he is in contact with turbine and marine engine tests. An indication of the scale on which this mechanical-electrical phase of the Company's testing has been developed is shown by the fact that recently a condenser equipment was placed in Building 60 at an expense of $300,000, and a steam equipment is being installed in Building 49 at a further expense of $200,000—both solely for testing purposes. Such is practical turbine testing today. In comparison with this work the little jet and barometric condensers in the old college "lab" are but cunning toys.

An idea of the variety of apparatus operated and tested by these young men is given by the following schedule:

APPARATUS TESTED BY STUDENT ENGINEERS

(Schenectady Course)

Building 11—Motor-generator sets up to 500 kw., synchronous converters, planer panel equipment, lighting generators, government motors, developmental work.

Building 12—Railway motors, mill, mine, and crane motors.

Building 18—Induction motors up to 150 h.p., direct-current motors and generators, motor-generators up to 300 kw.

Building 60—Steam turbine alternating-current and direct-current generating sets, ship propulsion turbines for gear and electric drive.

Building 40—Induction motor starting compensators.

Building 52—Industrial control devices, field and starting rheostats, control panels, industria appliances.

Building 16—Motor generators above 500 kw., synchronous converters 500 kw., frequency changers 500 kw., large waterwheel generators, synchronous motors, steel mill equipment, flywheel sets, double-speed tests.

Building 52—Induction motors above 150 h.p., speed-regulating sets variable speed alternating-current motors.

Building 60—Train control panels, mill and mine hoist panels, controllers—all kinds, contactors and insulators.

Building 61—Efficiency tests on turbines, steam flow meters, special tests on large apparatus from other buildings.

Building 32—Voltage regulators, contact making voltmeters.

Building 28—High voltage tests up to 750,000 volts.

Test Track and Building 203—Railway developmental work.

At Pittsfield—Power transformers, feeder regulators, alternating-current motors.

FIRST TO OPERATE BIG INSTALLATIONS

This wide variety of apparatus illustrates the breadth and scope of the test man's work; for it embraces the latest, and hence the most interesting, electrical and mechanical devices manufactured. When the engineer of a Chicago, Milwaukee and St. Paul electric locomotive throws his controller handle one notch ahead, he but duplicates what an electrical test man had previously done. When an operator of the great locks of the Panama Canal throws the switches which permit a 32,000-ton battleship to pass through, he also merely operates what the student engineer had previously tested and adjusted. And in the great steel mills, central stations, mines, and battleships, and in the thousand and one other places where electricity is used, every piece of electrical apparatus has been tested previously by student engineers. This follows from the fact that no machine can be shipped unless o.k'd by the Testing Department.

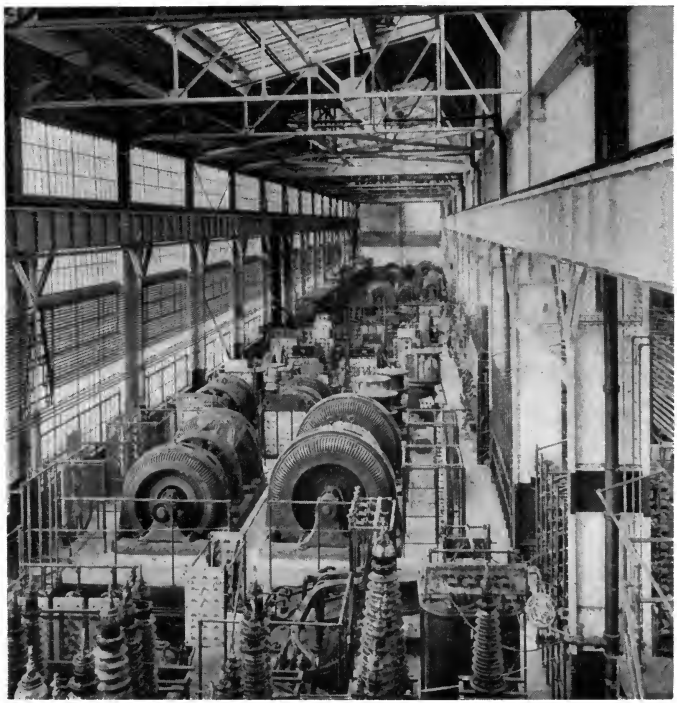
WHAT ARE THE FACTS?

The student engineers are not told what specifications and efficiencies the machines are guaranteed to fulfill; they are instructed as to what standard and special tests should be made. Thus they make all the

electrical preparations, observations, and measurements, calculate efficiencies and plot curves of performance, all of which are checked and compared with the guarantees by those who are responsible for the decision as to when a machine is ready to be shipped.

RESPONSIBILITY

In all of this shop work the student engineers are temporarily a part of the well-organized Testing Department, and they become personally responsible for the conduct of the tests of which they have charge. No



POWER EQUIPMENT FOR TESTING TRANSFORMERS AT PITTSFIELD

matter in which of the above buildings they are working, they are under the direction of the 75 men of the permanent Testing Department. These men show the student engineers how to make rapid diagnoses of unexpected performance by any kind of apparatus or device. This suggests to the inquiring mind that the test man becomes an expert "trouble shooter," and that wherever he may encounter electrical machinery of any kind, he will probably be fully capable of adjusting the connections, controllers, brushes, poles, armatures, bearings, or founda-

tions, or to otherwise diagnose trouble, restore the machinery to full operation, and instruct the operator how to obtain continuous satisfactory performance.

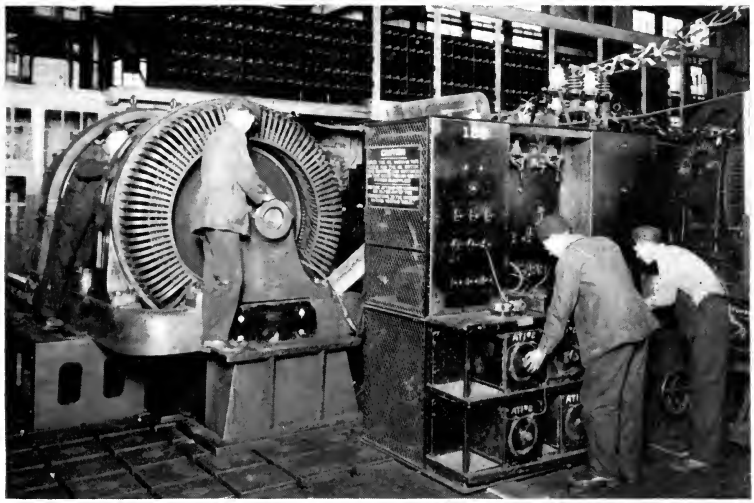
As not over 10 per cent of the electrical and steam installations sold by the General Electric Company are erected by the Company's construction department, it is apparent that the remaining 90 per cent, when shipped, must be ready to operate. Thus the customer's engineers or electricians set the apparatus on the foundation according to drawings and instructions of the Company, make the wiring connections according to the diagram furnished with the machinery, and expect the new installation to start up and operate without a hitch when the switch is thrown. If the test men have done their duty properly, there will be no trouble when the customer follows directions. Since the cost of satisfying customers' complaints has been reduced to a negligible per cent of the cost of the apparatus, it would appear that the test men had thoroughly mastered the details and intricacies of the electrical machinery and controlling devices, and properly adjusted everything—even to the smallest relay.

GOVERNMENT WORK

As to the broad knowledge of the test men, let us consider only one phase of the testing work of today—government work. Seventy-five hundred horse power motors are being built to propel some of our latest battleships; as are also the turbo-generators which supply electricity to these motors; the Curtis turbines which will propel so many of our new emergency fleet; the gears which will transmit the power from these turbines to the propeller shaft; the motors which rotate the turrets of battleships and hoist the ammunition; the generators for the wireless; and the small marine steam engine-driven lighting units. All of this apparatus, whether of 30,000 kv-a. or 2½-kw. capacity, is tested, adjusted, and studied by the student engineers before it is shipped.

To maintain perfect operation of these machines so vitally necessary to modern warfare, who would be so well fitted as the man who originally tested them or identical machines? The Army and Navy Departments in selecting officers to take charge of the electrical equipment of our great war vessels were quick to grasp the opportunity of engaging test men as chief electricians, chief engineers, wireless operators, etc. Can you imagine the delight in the heart of a young naval officer when he goes to his post of duty on a battleship, cruiser, destroyer, or submarine and finds there some machines which he himself had tested and adjusted in the old days at Schenectady or Lynn! He understands their language. They respond to his touch and will faithfully perform their heroic tasks in partnership with him.

That the United States Government recognizes the value of practical testing work has been demonstrated in at least two ways:



USE OF HIGH POTENTIAL PORTABLE TEST TABLE. HIGH-VOLTAGE DISTRIBUTING BOARD IN TOP BACKGROUND, SCHENECTADY WORKS

TESTING MOTOR-GENERATOR SETS AND INDUCTION MOTORS

In 1917, in the midst of their test course, 252 student engineers left to enter military service. Of the 150 who left Schenectady, 90 per cent

have already received commissions; as have 10 out of 13 who left Fort Wayne—some holding offices in the army, as high as major or captain, and in the navy, such rank as ensign, lieutenant, chief electrician, etc., all in less than one year!

Among the hundreds who went to war, only those who left during the Test Course have been included in this survey.

CIVIL SERVICE REQUIREMENTS

But government recognition is not limited to military matters. The United States Civil Service Commission's printed form No. 2204, issued in 1917, in speaking of educational training and experience which applicants must have for Civil Service positions, mentions:

> "and at least one year's additional experience in testing electrical machinery."

Civil Service Form No. 1785, issued in 1917, especially mentions among the necessary qualifications of experience and training:

> "one year's experience in the testing of electrical machinery and apparatus."
>
> "five years' experience in inspection and testing of electrical machinery and apparatus, two years of which must have been work on the test floor of an electrical manufacturing company."
>
> "three years' engineering experience in installation or manufacture of electrical machinery, one year of which must have been inspection or testing."

CLASSROOM INSTRUCTION

LECTURES

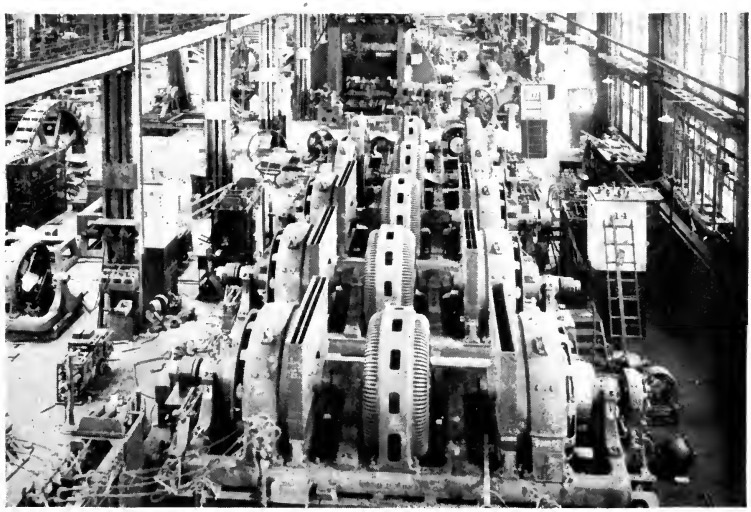
The theoretical phase of the training is taken care of by an extensive series of lectures which are given to the student engineers by prominent designing, research, and production engineers, and commercial managers of the Company. Not only are these lectures free, but the students are paid full time while attending them. Attendance is not compulsory and the student may attend one or two each week as desired. These lectures are given between 4:30 and 5:30 p.m., after the close of the working day. In order to render them as valuable as possible and to afford opportunity for the asking and answering of questions, the engineers give each lecture several times so that the attendance at each class can be kept small and the lectures entirely informal. This has an added advantage in that those students who have missed a lecture may be able to make it up later.

PREVENTING "OVER SPECIALIZATION"

The purpose of these lectures is to round out the student's knowledge of the Company's product as well as develop his versatility. The young

men are encouraged in their desire to become specialists, but are prevented from becoming narrow-minded by the broad fields of knowledge that are opened up to them by these various lectures. For example, if a

TESTING SMALL SYNCHRONOUS CONVERTERS



FIVE MOTOR-GENERATOR SETS FOR ELECTRIFYING STEAM RAILROADS OVER THE ROCKY MOUNTAINS

student engineer desires to become a commercial man, these lectures give him information of a technical character which will make him a better commercial man; if he desires to become a designing engineer, they

give him a knowledge of many of the Company's commercial methods; should he believe that his future career will lie entirely along operating and managing lines, he will derive a knowledge of cost accounting, production, welfare work, research developments, safety campaigns, factory methods, toolmaking, industrial education, etc. Altogether there are 50 lectures at Schenectady, 25 at Pittsfield, 20 at Lynn, and 17 at Fort Wayne.

Bearing in mind the varied careers of the ex-test men, it will be seen from the number of presidents, general managers, executives, consulting engineers, directors, superintendents, commercial engineers, etc., that there is great demand for versatile men with a wide field of knowledge, as well as an intensive knowledge of one kind of work or apparatus. It is the old question of which is better:

To know something about everything, or

To know everything about something.

Attentive attendance at these lectures will help the young men to know something about everything electrical, and will also indicate the way and the individuals through whom they can learn everything about something.

Students may attend each of these lectures more than once if they desire.

POSTGRADUATE COURSE AT UNION COLLEGE

Student engineers who have completed a four-year college course or equivalent, with B.S. degree, and who wish to continue their electrical education from the theoretical standpoint, can obtain their advanced Master's degree at Union College. The Company refunds over 50 per cent of the matriculation and tuition fees to those who have secured their degree. The classes are held every Friday morning on the Company's time, thus making the student engineers' working week practically five days only.

This postgraduate work is a two-year course and is a comparatively new development, inasmuch as it was organized in 1916. There are now 35 students enrolled, ten of whom, it is expected, will be graduated in 1918 with the degree of Master of Science.

The post graduate course consists largely of lectures and demonstrations, although numerous problems are given for home work.

CURRICULUM

I. *Advanced Electricity, by Prof. E. J. Berg.*

II. *Mathematics of Electrical Theory, by Prof. Vedder.*

III. *Lectures on Electron Theory; Electrical Properties of Gases and Liquids, by Prof. Kleeman.*

A co-operative course between the General Electrical Company and the Massachusetts Institute of Technology is described in the Institute's catalogue.

ADVANCEMENT

The college men enrolled in the test course, it might be correctly stated, are a floating population—they are in a continuous state of flux. A few weeks after their arrival, they begin their migrations, emigrating from one department and immigrating into another.

TRANSFERS

Every week from 20 to 40 men are transferred to a new kind of work. There is no stagnation, no routine, no winding of armatures and field coils, very little if any repetition of any kind of work beyond the point where it ceases to be interesting to the average man. As long as a young man with an active mind is doing something different from what he did last week, or better than he did it yesterday, his knowledge is broadened. Six months passes more rapidly in this fascinating work than six weeks does in the dull details of routine. Every student who stays in the course is transferred. If he can keep up with the procession, he moves along; if he cannot keep up with it, it is suggested that he is probably better fitted for other lines of work.

At regular intervals the student is given a blank entitled "Application for Transfer" in which he indicates a preference for the line of work which he is to undertake next.

Thus the student engineer is directing and designing his career by selecting the several different tests which he desires to undertake. This brings up the fact that there is no set curriculum, *all* of which he must follow, but that among the fourteen classes of apparatus to be tested he can have his choice, as far as production conditions permit.

The student engineer makes out several of these applications for transfer during the time spent in the test course and, at the bottom of each, the head of the section where he has been working grades him according to the following qualifications:

Technical ability	Accuracy
Industry	Ability to push things
Neatness	Personality

These gradings are then posted upon a card, so it can be seen at a glance whether he is excellent, good, fair, or poor in any or all of the six qualifications. These cards are available for each man's inspection, but otherwise are confidential. Good marks in regard to personality are especially necessary for those desiring commercial work in the future.

At the end of six months other events take place which will affect his future career. Every student receives a letter from the Superintendent of the Testing Department as follows:

"Positions in the various departments of the Company are continually opening up, and in order to fill these most satisfactorily it is necessary to know the nature of employment each man desires and feels he is best fitted for.

"With this idea in view, and to cause each man to consider well the line of work he wants, this note is being sent to men who have been on test six months.

"No man will be recommended for employment until he has filled out the attached slip and turned it in to the test office in person."

Thus again the individual's personal choice and ambitions, together with such business relations as he may have established before entering the test course, are taken into consideration before he expresses a preference as to his future work.

OFFICE TRAINING

After six months or more have elapsed since the college man entered the test course, another variation presents itself to those who have made a good record. The Superintendent of the Testing Department selects men for a three months' assignment to the various offices in the engineering and commercial departments, at the end of which training they return to the Testing Department. This sample of what designing and commercial engineering work really is, is afforded so that they may more fully appreciate the value of the testing work, and also that they will be better able to decide on the kind of work for which they are adapted—and possibly revise their choice as shown on their preference blank.

PROMOTION

Promotion from the Testing Department is not haphazard; it is not for the star members only; it is universal. For, as stated above, those who remain in the test course will be promoted, and those who will not be promoted do not complete the test course. Every week approximately seven men complete the test—four being promoted and three leaving for positions for which they have been recommended, outside the Company.

TRIAL PERIOD

The first step in the promotion of a man is the "trial period" of three months in the department where permanent employment is anticipated.

By this means the department heads will have the privilege of trying out a man in order to be certain that his personal qualifications and temperament are suited for the position. This is just as important to the test man as it is to the department head and to the whole organization; and right here in this policy will be found one of the secrets of the success of the General Electric Company: Every man is peculiarly fitted by practical experience for the work which he does.

Hundreds of examples could be cited to prove that the unromantic work of repairing engines and generators and even inspecting boilers is a valuable asset to an engineering career in the electrical industry. For instance Mr. W. B. Potter, Engineer of the Railway and Traction Engineering Department, took a position in the Testing Department at

THE TESTING GANG AT LYNN IN THE OLD DAYS

the Lynn Works in 1887 and has preserved the original letters leading up to his engagement. These form an interesting parallel to later correspondence in which he stated:

"My shop experience and the knowledge of electric and steam practice has continually proved of inestimable value."

And Mr. E. E. Boyer, who holds a high executive position in the Lynn Works, entered the Testing Department there in 1885. The following paragraph is abstracted from a letter written to him by the superintendent, April 17, 1885:

"Our requirements are that each applicant must serve a certain period in the workshop building the different parts of our apparatus, then serve awhile in the assembling room, and finally in the testing room the time occupied being from four to six months. The pay during this period is but sufficient to provide for your board, and would be $1 per day."

(Signed) E. W. Rice, Jr.,
Superintendent.

This discloses the fact that the idea of building an organization on the foundation of practical training was put into effect 33 years ago by the superintendent, now President, of the Company.

BUILDING AN ORGANIZATION

Mr. Thomas A. Edison says:

"Problems in human engineering will receive during the coming years the same genius and attention which the nineteenth century gave to the more material forms of engineering."

The great idea of human engineering, with which is associated vocational training and wisely managed employment departments, is a product of the twentieth century; and yet the letter signed by the superintendent in 1885 would indicate that there were some individuals living in the nineteenth century who fully appreciated this point in forming the nucleus of a business staff now second to none.

ADDITIONAL INFORMATION

In a booklet entitled "Practical Training for Engineering Graduates," the social opportunities of the student engineers are outlined, and photographs included showing exterior and interior views of the Edison Club, Edison Hall, and the Boat Club in Schenectady; also the Thomson Club at Lynn, and aquatic sports at Pittsfield and Schenectady. Other information is given regarding athletics, home life, cost of room and board within walking distance of the Works, climate, topography of the country, and size of the various Works of the Company.

TABLE V

POSITIONS NOW HELD BY EX-TEST MEN AS ASCERTAINED FROM NATIONAL MEMBERSHIP LIST OF A.I.E.E.

	In G-E Company	In other Companies
Abroad in Business	15	107
General Officers		
Presidents	1	10
Vice Presidents and Assistants	1	15
Secretaries and Assistants	..	6
Treasurers	..	3
Managers		
General Sales	2	..
Advertising	1	..
General	..	25
Assistant General	..	4
Works	..	..
District	2	6
Assistant District Dept.	2	..
Local	10	2
Department Sales	7	..
Directing	1	1
Department	14	2
Contract	1	1
Business	..	1
Employment	1	1
Assistants	2	2
No designation	..	16
Superintendents		
General	..	7
Of Motive Power	..	3
Division or District	..	2
Assistant General	..	2
Assistant Electrical	2	..
Assistant	2	4
Welfare and Assistant	2	..
Technical	1	..
Construction	1	2
Meter	..	1
Mechanical	..	2
Commercial	..	3
Electrical	2	6
Not designated	..	18
Electrical Engineers	251	338
Miscellaneous	33	218

TABLE VI

PERCENTAGE OF TEST MEN IN ENGINEERING DEPARTMENTS

SCHENECTADY

Departments	Per Cent
Alternating-current Engineering	70
Construction	37
Construction Engineering	20
Direct-current Engineering	95
Direct-current Motor Engineering	80
Flow Meter	57
Induction Motor	70
Industrial Control	70
Industrial Heating Device	75
Insulation Engineering	29
Lighting	95
Power and Mining	89
Publication Bureau	24
Purchasing	0
Railway and Traction	83
Railway Equipment	71
Railway Locomotive	50
Railway Motor	69
Regulator	66
Research Laboratory	40
Searchlight	20
Standardizing Laboratory	40
Switchboard	41
Testing Laboratory	25
Turbine	63
Wiring Supplies	50
Test men in above 26 departments average	51 per cent

LYNN

Automobile Motors	75
Fabroil Gear and Pinion	33
Gear and Pinion	100
Meter and Instrument	18
Motor	75
Rectifier Tube	75
Street Lighting	55
Transformer	80
Turbine	57
Wire and Insulation	67
Test men in above ten departments average	63.5 per cent

PITTSFIELD

Lightning Arrester	91
Motor	33
Transformer	83
Test men in above three departments average	69 per cent

FORT WAYNE

Departments	Per Cent
Alternating-current and direct-current Apparatus	57
Automobile Accessories	50
Fractional H.P. Motor	58
Meter	20
Rock Drill	0
Transformer	78
Test men in above six departments average	44 per cent

SPRAGUE

Conduit Products	0
Hoist	33
Motor and Generator	33
Ozonator	100
Switchboard and Panelboard	0
Test men in above five departments average	33 per cent

ERIE

Air Brake	17
Gas Engine	20
Power and Mining Loco	43
Test men in above three departments average	27 per cent

DISTRICT OFFICES

Atlanta	60
Boston	64
Chicago	75
Cincinnati	50
Dallas	0
Denver	67
New York	77
Pacific Coast	50
Philadelphia	50
St. Louis	47

Test men in above District Engineering Offices average ..... 54 per cent

AVERAGE in above 63 departments, ... 52 per cent

TABLE VII

PERCENTAGE OF GENERAL ELECTRIC OFFICIALS, MANAGERS, SPECIALISTS, ETC., WHO ARE EX-TEST MEN

	Percentage
Power and Mining Eng. Dept. Section Heads	100
Local Supply Dept. Mgrs.	100
District Power and Mining Dept. Mgrs.	100
District Lighting Dept. Mgrs.	100
Transformer Specialists	92
Switchboard Specialists	89
General Office Commercial Dept. Ass't Mgrs.	83
Local Small Motors Dept. Mgrs.	83
District Engineers	80
Schenectady Designing Engineers	78
Local Engineers	75
Resident Agents	74
General Office Dept. Mgrs.	73
Local Managers	72
General Office Commercial Dept.	71
Local Apparatus Dept. Mgrs.	67
Meter Specialists	64
General Office Supply Dept. Section Heads	63
Schenectady Designing Engineers (Supplementary)	62
District Railway Dept. Mgrs.	60
Foreign Sales Offices	56
District Small Motors Dept. Mgrs.	50
District Apparatus Dept. Mgrs.	43
District Supply Dept. Mgrs.	43
Heads of Laboratories	43
Works Managers	40
District Managers	40
General Office Commercial Dept. Mgrs.	39
General Office Administrative Dept. Mgr. (Supplementary)	33
Heating Device Specialists	31
Railway Supply Section Heads	30
Local Chief Clerks	27
District Fort Wayne Dept. Mgrs.	25
General Office Administrative Dept. Mgr.	20
District Order Dept. Mgrs. and Clerks	20
General Officers	20
Production Managers	17
Domestic Device Specialists	6
General Office Accounting Dept Section Heads	0
Works Accounting Dept.	0
Local Auditors	0
District Auditors	0

Among 42 lists of officers, etc., average per cent of ex-test men...51 per cent

"Taking Speed Curve"

P.T.M. discovers that his plugging from board B. is OK.

CARTOONS FROM SOUVENIR MENU AT TEST MEN'S CHRISTMAS BANQUET

INDEX