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Inductive Interference of Power Lines With Telephone Lines.

A Few Words To Senior Engineers.

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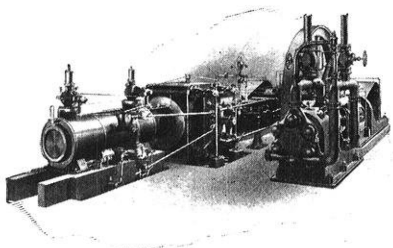

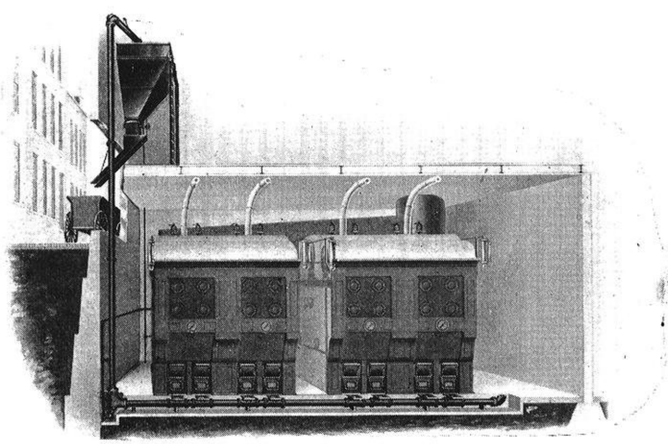

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VOL. XXI MAY, 1917, NO. 8.

THE PREPARATION OF UNIT PRICES FOR VALUING PUBLIC UTILITY PROPERTIES IN WAR TIMES

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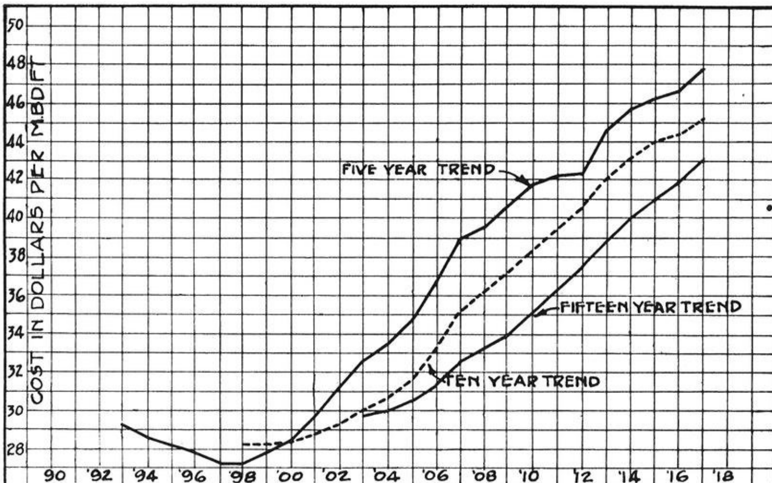
As prices of all commodities continue to soar, the problem of fixing costs becomes more and more complicated in valuation work. Cement has increased thirty per cent in the past year in most localities; lumber, which sold for twenty-six dollars per thousand board feet, has risen to thirty-two dollars per thousand in the past four or five months; all metals used in public utility construction are selling at phenomenal prices. Confronted with such prices of material, and increased labor costs, the engineer, who has a set of unit costs to make up, must select the proper prices which will be fair to both the utility and to the public. It is not the purpose of this article to enter into the general discussion of valuation of a complete public utility plant, for there are so many branches of such a property that it would require much research and effort to present the matter in an acceptable manner. Only a few of the important steps in the process of fixing unit costs for use in valuing public utilities will be presented, along with examples of how war prices have affected unit costs for valuation purposes.

To find out how difficult it is to decide on what methods to use in compiling unit cost according to the theory of cost of production, a person need only refer to the recent paper published by the American Society of Civil Engineers on "Valuation of Public Utilities." The fact that there exists such disagreement among engineers in regard to a "uniform conception of reproduction, casts some doubt on the real worth of cost of reproduction as one of the measures of value." However, it is stated on page 1719 of the paper "that normal present conditions shall determine the prices and methods" for estimating the cost of reproducing an identical property rather than a substitute property, with due consideration to the history of the particular plant. Another theory on which unit costs are based is the investment or original cost theory of valuation. Investment cost, as the name implies, is the value of the plant as represented by the books of the company. It is obvious that if the accounting system used by the company shows in detail the various work orders and invoices, if the unit prices for material and labor do not appear excessive, that these figures provide the engineer with first class information on the cost of building such a property. Recently the Illinois Public Utilities Commission has ventured to present another theory, that of normal cost. The definition is not clear and from an analysis of the unit costs used, it appears that their so-called normal cost theory resembles the original or investment cost whenever the cost of the items of property can be found on the books.

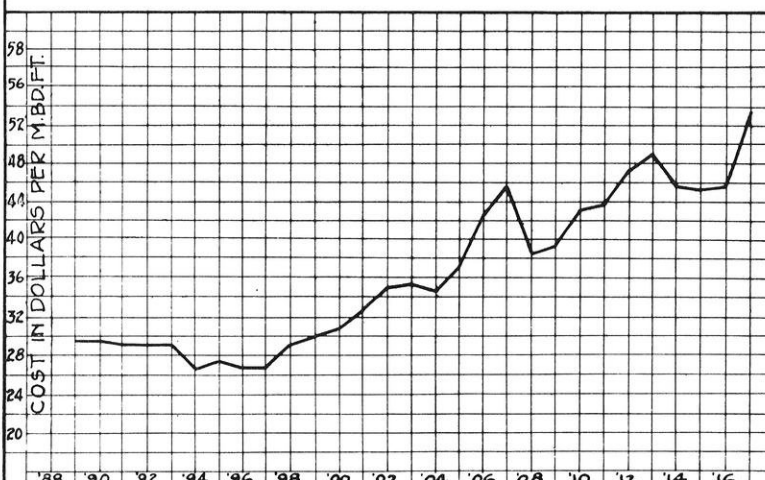
There are disadvantages to all three methods and the selection of any particular system depends upon the book records of the company, the market condition of the country, and the use to which the valuation is to be placed. In all new construction work the company has to pay the market prices for material and labor. For that reason the friends of the utility may argue that in using a cost of reproduction theory the estimator should use actual market quotations of the date of the valuation. However, to provide a more substantial basis, the estimator should average the prices of material and labor over a short period of time previous to the date of the valuation. The valuation obtained in this manner will not be out of date by the time it is completed and will contain an average of the high prices of the date of completion of the reproduced plant and the prices prevalent at the time when the contracts for this plant would have been let. To obtain information on the costs of material and labor, recent contracts entered into by the company, contractors employed by the public utility, and machinery houses furnish the most reliable sources. In addition to these sources, historical data of the nature usually found in government publications, trade journals, and hand books provide excellent material on which the estimator is able to construct trend curves and piece together price quotations for years or months that are missing.

In many cases the engineer will find that items of the existing property cannot be reproduced today without expending a great deal more money than it would cost to furnish a good commercial substitute. For instance, white pine is practically out of the market for heavy warehouse or office building construction. Lumber dealers for the past fifteen years have substituted the name of "Northern" pine for white pine and have mixed Norway pine, jack pine and hemlock to make up their product. Natural cement was replaced by Portland cement about 1895 and an estimator is certainly justified in using the prices of Portland cement in making up his unit costs on the theory of reproduction. It also seems reasonable to assume unit costs of mass concrete as the cost of replacing heavy dimension stone in foundations. Certain metals as cast iron and copper fluctuate to such an extent that averages over certain periods of time should be taken. Labor has had a decided upward trend and if prices of material delivered at the plant are to be averaged, the labor cost of putting them in place should be averaged.

It is obvious that construction done in small units must cost more than wholesale construction, and when valuing a property which has been built in this manner it seems fair to give some weight to the unit prices obtained from a study of the cost of piecemeal construction as compared with wholesale construction. However, it does not appear proper for an engineer to add to a unit cost, already in excess of the actual cost, an item which, he explains, is an addition for piecemeal construction. It is especially necessary for an estimator to study the original cost of construction regardless of what theory is to be used finally. Prices obtained from contractors and other sources, should be tabulated so as to compare them with prices obtained from the books of the company. A comparison of hourly wage scales, of discounts on material for certain dates appearing in the records, should be adjusted to suit the period over which an average is being taken. The officers of the company, contractors and equipment dealers should be consulted in regard to particular



CURVES SHOWING TREND AVERAGES 1893-1917
BASED ON DATA SHOWN IN YEARLY AVERAGE COST CURVE



CURVE SHOWING YEARLY AVERAGE COSTS 1889-1917
YELLOW PINE, NO.1 DIMENSION, 2"×4", DR'S'D, PER M.BD.FT. IN PLACE
KANSAS CITY, MO.

features of construction which the records show to be unreasonably high. It may be found that certain parts of these unit costs should be included in overhead charges.

In using the investment cost theory the accounting system should show invoices in detail and a proper distribution of work orders. If these records are distributed over a sufficient length of time there is no doubt that high prices, during certain construction periods will be offset by low prices during periods of depression. In some cases, well kept records also disclose contractor's profit and any contingencies incurred during construction.

As a general rule contractor's profit amounts to five to twenty-five per cent. Some engineers include their allowance for contractor's profit in their unit costs; others add it as an overhead cost which they include as a lump sum. Interviews with numerous contractors disclose the fact that in ordinary times, when competition is keen, the contractor is satisfied with a small profit on labor and a still smaller profit on material, while in the past eighteen months the contractors have been receiving good profits on material and a better profit on labor. A fair profit on work that is not considered hazardous is estimated to be about ten to fifteen per cent. In large cities where a union scale of wage prevails, some contractors who have considerable work on hand the year round, are in the custom of taking a smaller percentage profit. This can be explained by the fact that there are a number of men on their pay roll obtaining less than a union scale of wage but at the same time enjoying a more permanent position. This is a difficult obstacle for the engineer to overcome in estimating the allowance for contractor's profit and about the best way to avoid the difficulty is to estimate that a fair profit has been made on a slightly reduced wage scale.

A table is given showing the different steps in the computation of unit costs for yellow pine, 2″ x 4″ studing in place, Kansas City, Mo., and averages over five, ten and fifteen years have been taken to set out the method of computing unit prices to give a more stable valuation. The data in this table illustrate, also, the methods of pricing items of an inventory if the theory of investment cost is to be used.

TABLE SHOWING YEARLY COSTS 1889 - 1917 AND PERIOD AVERAGES OF YELLOW PINE NO.1.DIMENSION 2" x 4", DRESSED, PLACED IN STUD PARTITION WALLS, KANSAS CITY, MO.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
						Carpenter Wages						Period Averages		
Date	Yellow Pine 2" x 4" per M. bd.ft.	Gross Retail Profit per M. bd.ft	Retail Cost per M. bd.ft	Construction Waste per M.bd.ft.	Cost of Nails per M bd.ft.	Carpenter per hr.	Helper per hour	Labor Cost per M bd.ft.	Cost in Place not including Profit	Contractors Profit per M. bd.ft.	Total Cost in Wall per M. bd.ft. incl. Profit	5 yrs.	10 yrs.	15 yrs.
1889	13.50	3.50	17.00	1.70	1.00	.30	.25	7.25	26.95	2.70	29.65	--	--	--
1890	13.50	3.50	17.00	1.70	1.00	.30	.25	7.25	26.95	2.70	29.65	--	--	--
1891	13.00	3.50	16.50	1.65	1.00	.30	.25	7.25	26.40	2.64	29.04	--	--	--
1892	13.00	3.50	16.50	1.65	1.00	.30	.25	7.25	26.40	2.64	29.04	--	--	--
1893	13.00	3.50	16.50	1.65	1.00	.30	.25	7.25	26.40	2.64	29.04	29.28	--	--
1894	11.50	3.00	14.50	1.45	1.00	.30	.25	7.25	24.20	2.42	26.62	28.68	--	--
1895	12.00	3.00	15.00	1.50	1.00	.30	.25	7.25	24.75	2.48	27.23	28.19	--	--
1896	11.50	3.00	14.50	1.45	1.00	.30	.25	7.25	24.20	2.42	26.62	27.71	--	--
1897	11.50	3.00	14.50	1.45	1.00	.30	.25	7.25	24.20	2.42	26.62	27.23	--	--
1898	13.00	3.50	16.50	1.65	1.00	.30	.25	7.25	26.40	2.64	29.04	27.23	28.26	--
1899	13.50	3.50	17.00	1.70	1.25	.30	.25	7.25	27.80	2.72	29.92	27.89	28.28	--
1900	13.00	3.50	16.50	1.65	1.50	.35	.25	8.25	27.90	2.79	30.69	28.58	28.39	--
1901	14.50	3.50	18.00	1.80	1.50	.35	.25	8.25	29.55	2.96	32.51	29.76	28.73	--
1902	15.50	4.00	19.50	1.95	1.25	.38	.25	8.85	31.55	3.16	34.71	31.37	29.30	--
1903	15.50	4.00	19.50	1.95	1.00	.40	.30	9.50	31.95	3.20	35.15	32.60	29.91	29.70
1904	15.00	4.00	19.00	1.90	1.00	.40	.30	9.50	31.40	3.14	34.54	33.52	30.70	30.03
1905	17.00	4.00	21.00	2.10	1.00	.40	.30	9.50	33.60	3.36	36.96	34.77	31.68	30.52
1906	20.50	5.00	25.50	2.55	1.00	.40	.30	9.50	38.55	3.86	42.41	36.75	33.26	31.41
1907	22.50	5.50	28.00	2.80	1.00	.42	.30	9.90	41.70	4.17	45.87	38.99	35.18	32.53
1908	17.50	4.50	22.00	2.20	1.00	.40	.30	9.50	34.70	3.47	38.17	39.59	36.09	33.14
1909	18.50	4.50	23.00	2.30	1.00	.40	.30	9.50	35.80	3.58	39.38	40.56	37.04	33.99
1910	19.00	5.00	24.00	2.40	1.00	.50	.40	12.00	39.40	3.94	43.34	41.83	38.30	35.06
1911	19.00	5.00	24.00	2.40	1.00	.52	.40	12.40	39.80	3.98	43.78	42.11	39.43	36.21
1912	21.00	5.00	26.00	2.60	1.25	.55	.40	13.00	42.85	4.28	47.13	42.36	40.67	37.57
1913	22.00	5.50	27.50	2.75	1.25	.55	.40	13.00	44.50	4.45	48.95	44.52	42.05	38.90
1914	19.00	5.00	24.00	2.40	1.25	.60	.40	14.00	41.65	4.16	45.81	45.80	43.18	39.96
1915	18.00	4.50	22.50	2.25	1.25	.65	.45	15.25	41.25	4.12	45.37	46.21	44.02	40.94
1916	18.00	4.50	22.50	2.25	1.50	.65	.45	15.25	41.50	4.15	45.65	46.58	44.34	41.81
1917	22.00	5.50	27.50	2.75	2.00	.70	.50	16.50	48.75	4.88	53.63	47.88	45.12	43.07

See explanation in text for full detail of each column. Final totals to be used to nearest $.50

The columns are explained as follows:

Column 1. Based on actual sales at the southern mills and f. o. b. cars at Kansas City, obtained from Part IV, "Lumber Industry," published by the Bureau of Corporations, also, from data on actual sales in the files of the Forest Products Laboratory. Figures shown are f. o. b. cars, Kansas City.

Column 2. An estimate based on data published in Report No. 114, "Some Public and Economic Aspects of the Lumber Industry," by William B. Greeley, Assistant Forester.

Column 3. Sum of column 1 and column 2.

Column 4. Obtained from contractors, handbooks, etc.

Column 5. Based on the estimate of 25 lbs. of nails per M. bd. ft. at $.04 per lb. during years 1903–1911, inclusive.

Column 6. Obtained from charts furnished by E. M. Craig, 808 Chamber of Commerce, Chicago, and 1904 report of Commissioner of Labor.

Column 7. Obtained from contractors and handbooks.

Column 8. Based on estimates obtained from numerous contractors and handbooks. A carpenter (working 20 hours) and helper 5 hours will place about M. bd. ft. of 2" x 4" studding.

Column 9. Totals of columns 3, 4, 5 & 8.

Column 10. Based on information obtained from records of public utility companies, contractors, engineers and handbooks.

Column 11. Total of columns 9 & 10.

Column 12. Average over five year period.

Column 13. Average over ten year year period.

Column 14. Average over fifteen year period.

INDUCTIVE INTERFERENCE OF POWER LINES WITH TELEPHONE LINES

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Though the subject of inductive interference from power transmission lines has been widely discussed in recent years, much of the discussion has been unfruitful, because of the failure to make correct application of the fundamental laws of induction. The writer, therefore, takes this opportunity of calling attention to these laws and pointing out, in a qualitative way, their bearing on the subject of inductive interference.

Let us consider first electrostatic induction in grounded telephone lines. Whenever an electric conductor, as the sphere A (fig. 1), has an electric charge imparted to it, any uninsulated conductor, B, placed near it will have a negative charge induced on it. During the time that A is being charged a current of electricity will flow from B to the ground. The difference of potential between B and the earth will be dependent on the difference of potential between A and the earth and the relative capacity of B to A and to the earth. Since, for a given potential between A and the earth, the potential between B and the earth is dependent on the ratio of the capacities of B to A and to the earth, the same conditions will hold for conductors of any length in a direction perpendicular to the paper. This figure can then be assumed to represent a cross section of a grounded telephone line and a neighboring disturbing wire.

The current flowing in the conductor connecting B with the earth will be proportional to the rate of charge of the voltage of A with respect to the earth. When A is the wire of a ground return telephone line this induction gives rise to cross talk, which is commonly of considerable magnitude between circuits on the same pole line. When A is a trolley wire, a direct current arc circuit wire, or an alternating current power circuit wire, the disturbance is of considerable magnitude, giving rise to a distinct hum in the telephone receiver. The pitch of the hum is dependent on the frequency of the variation of the potential between A and the ground.

When the telephone line is metallic, the condition is as shown in Figure 2; both lines are insulated from the earth but in metallic connection with each other. Line B will have a negative charge induced on it and line C a positive charge. Whenever the potential between A and the ground varies, there will be a current flowing in the connection between B and C. This current will have a frequency determined by the frequency of the variation of the potential between A and the earth. The potential difference between the two lines will be dependent on the difference in the ratio of the capacities of B to A and to the earth and C, to A and to the earth. Since the lines are customarily close together in comparison with their distance from the earth, the difference in these ratios is numerically small in comparison with one of the ratios. The disturbance is, therefore, much less for a metallic line than for a grounded line.

The disturbance can be practically eliminated by making the ratio of the capacities of B to A and to the earth equal to the ratio of the capacities of C to A and to the earth. This can be most easily accomplished by interchanging the positions of B and C at such points in the exposure to the disturbing wire that equal length of B and C are in each position. The interchanging of the wire position is known as cutting in a transposition. A transposed line having a single transposition is shown in figure 3, and one having three transpositions is shown in figure 4.

An inspection of these figures shows that a portion of each telephone wire receives a positive charge, while the adjoining portion in the other position receives a negative charge. When these charges are being given to the wires, there will be a current flowing in each wire at the cross-over point and also through each receiver. These currents will divide in inverse proportion to the receiver and wire impedances. Transposition can therefore never entirely overcome interferences due to static induction; but it serves to reduce it to a negligible amount if the distances between transposition sections are so short that the impedance of the wire in one of these sections is small in comparison with the impedance of the telephone. The customary distance between transposition points in open wire lines is from one-quarter of a mile to two miles.

Another way to reduce the static induction on a metallic circuit is to place the two wires of the circuit close together. This distance is customarily ten inches in open wire lines, as a smaller separation allows the wires to swing together. The wires may have the distance between them reduced to a very small amount where cables are used. The use of cables made up of twisted pairs reduces the interference to an entirely neglegible amount.

The neutralization of static induction by means of transpo-

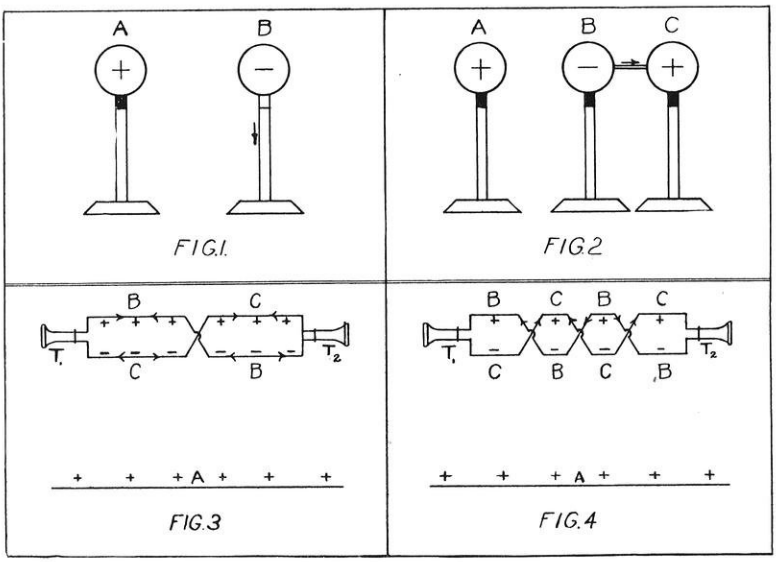

FIG. 1. FIG. 2. FIG. 3. FIG. 4.

sition requires that the telephone circuit be perfectly insulated; for the potential between a single wire and the ground is the same for a metallic circuit as for a grounded circuit. The grounding of one wire will therefore reduce a metallic circuit to the equivalent of a grounded one, as far as electrostatic induction is concerned.

Consider next insulated disturbing circuit such as grounded telephone circuit—when the disturbing circuit consists of two wires, A and A′ (fig. 5), one of the wires will be positive to ground and the other will be negative to ground. The charge on B will therefore be much reduced; it being the difference of the charges which would be produced by either of the potentials of A or A′ to ground acting alone. This neutralization to be most effective requires that the wires A and A′ be near together and be at the same potential to ground, except that one is positive when the other is negative. This condition can be met in alternating current lines only in case that the lines A and A′ have equal capacity to earth or else have the neutral point of the transformers connecting them to earth. The interference can be still further reduced by transposing the two conductors of the power transmission line, as shown in figure 6. Precaution must be taken to locate the transposition point or points so that the length of the exposure is divided up into an even number of parts.

When the power line is a three phase line, as shown in figure 7, the problem of balancing the line becomes more difficult, necessitating the transposition of the power transposition line throughout its entire length in order to make the capacity of each conductor to ground equal to that of the others.

Transpositions along the exposure must be so placed that the distance is divided equally in multiples of three. The neutralization of the disturbance due to a single phase tap, without an insulating transformer, on a three phase system, cannot be made so complete as in the case of an isolated single phase line; because the phases of the two potentials to ground differ by less than 180 degrees.

Interference from static induction due to insulated power lines can be reduced by making the telephone line metallic and transposing the telephone wires just as in the case of a grounded power line. Care must be taken in planning the transposition that the transposition points of the two systems be co-ordinated. The transposition points of the telephone line must be so located that each length of the parallel between power line transposition points will be divided into an even number of equal sections by the transposition points on the telephone line. In general, it is advisable to have no transpositions of the power line within the exposure unless it has a length of from six to ten miles.

Whenever an electric circuit carries a current it is surrounded by a magnetic field which varies in intensity with the current producing it. A neighboring circuit cut by this field will have an electromotive force induced in its as shown in figure 8.

The magnitude of the interference due to electromagnetic induction varies directly with the magnitude of the current,

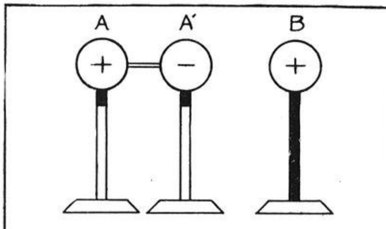

FIG 5

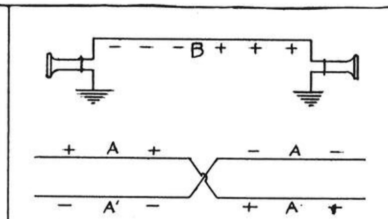

FIG.6

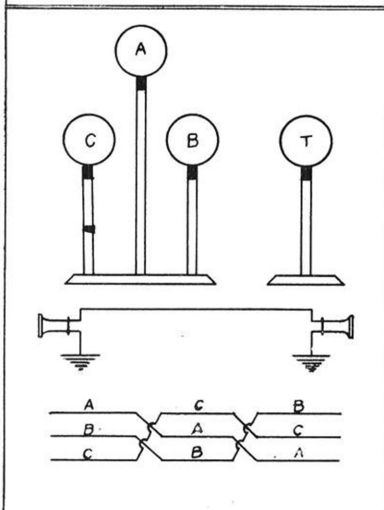

FIG 7

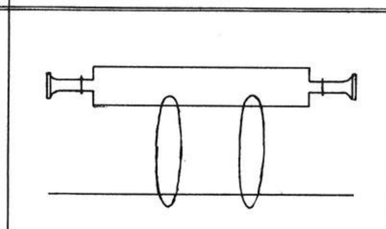

FIG 8

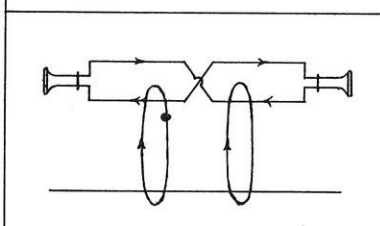

FIG. 9

and the separation of the wires of each circuit and inversely with the separation of circuits. It can be overcome by transposing the circuits in the same manner as is required to overcome static induction. This is shown in figure 9 where it is seen that the magnetism set up by the power line threads through one end of the telephone circuit in one direction and through the other end of the circuit in the opposite direction, thus producing electromotive forces which exactly neutralize each other.

It is to be noted in passing that the effects of electromagnetic induction are small in value compared with the effects of electrostatic induction, unless the power being transmitted over the line is such that the line current is very large.

When both power and telephone lines are complete metallic circuits it is advisable to distinguish between voltages which exist between the different conductors of a circuit and between the conductors and the earth. The voltage between the conductors of the power circuit is called the balanced voltage. This can be made of small effect on a neighboring telephone circuit by keeping the power wires close together. The vector sum of the voltages between the power wires and the earth is known as the residual voltage. It can be kept small by having the capacities of the power wires to earth equal to each other. Residual voltage is particularly objectionable because it acts as though it existed between the power wires and their electrical images in the earth, and therefore between two wires which are far apart. Two induced voltages in the telephone circuit are to be distinguished: the transverse voltage, which acts to set up currents through the telephone, and the longitudinal voltage, which raises the potential of all the telephone lines above that of the earth. The transverse voltage is the one which produces interference directly. It can be reduced by increasing the separation of the circuits and decreasing the separation of the telephone wires. The longitudinal voltage produces interference only when the telephone wires are unbalanced as to resistance or capacity to ground. It can be reduced by increasing the separation of the power and the telephone circuits and increasing the capacity of the telephone circuit to the ground.

The pitch of the hum produced by a telephone connected to a line paralled by a power line is determined by the frequency of the alternating current in the power line. Frequencies of either twenty-five or sixty cycles per second are the common values. It is a well known fact, however, that a large number of electric generators give electromotive force waves which are not simple harmonics, but which contain the odd-numbered harmonics of the fundamental. A sample electromotive force wave of such a machine is shown at A in figure 10, where it may be compared with a sample harmonic electromotive force wave of a machine having essentially a simple harmonic wave as shown at B of figure 10.

The interference of a steady hum with conversation is a factor of the pitch, being a maximum for a pitch somewhere between 600 and 800 cycles per second. The interference with speech produced by a generator having the wave for shown at

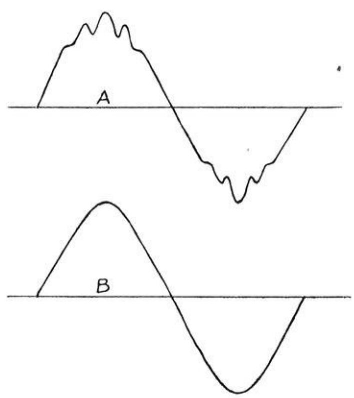

FIG 10

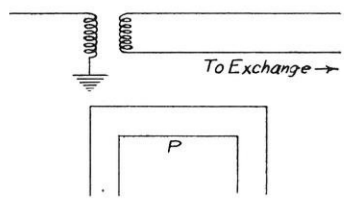

FIG 11

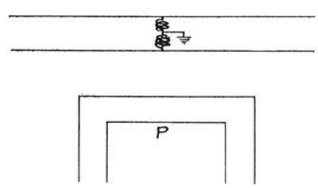

FIG 12

(Fig. 10—A) will therefore be much greater than the interference produced by a generator having a wave form as shown in (Fig. 10—B), when they deliver power to the same circuit. It is, therefore, advisable to use generators having wave forms as nearly a simple harmonic as possible. In fact, a twenty-five cycle generator giving simple harmonic waves causes practically no objectionable interference with a neighboring telephone line.

We may conclude then that inductive interference is practically always present when telephone lines and power lines parallel each other for distances of one mile or more at separations of fifty feet or less, this being the customary separation of the circuits where both follow the country roads.

Inductive interference with grounded telephone lines can be much reduced by transposing the power lines throughout their length, so that all wires have the same capacity to earth, and then transposing the power wires within the limits of the parallel so as to produce a number of sections of power line of equal length and divisible by three, in the case of a three phase line and two in the case of a single phase line.

Another way to reduce the interference with ground return lines is to make them metallic throughout the parallel, with repeating coils at the ends of the parallel, as shown in figure 11.

This cannot be used on heavily loaded party lines because of the inability of the ringing generator to ring the bells through such a coil.

Still another way to reduce the interference is to string a second wire parallel to and near the line wire throughout the parallel and connect the two wires by a drainage coil having the center point connected to the earth, as shown in figure 12.

This drainage coil acts as a low impedance shunt to charges induced on both lines at once, but has a high impedance to currents passing along a single line wire.

Where the exposure is between a power line and a metallic circuit telephone line, the power line should be transposed throughout its length so that each wire will have the same capacity to earth as the other wires, there being no transpositions within the limits of the parallel, unless the parallel has a length greater than six or eight miles. The telephone line should be transposed within the parallel at such points as to cut it up into an even number of sections having equal lengths.

The transposition requirements for reducing interference with a ground return line are such that if they are met by transposing the power line the necessary transposition in a parallel metallic circuit telephone line will be greatly increased. Where both ground return and metallic circuit telephone lines are involved in the same parallel, it is well to make a careful estimate of the comparative cost of transposing the power line and metallic circuit telephone lines, and of making the ground return telephone lines metallic. It may frequently happen that the cheaper way to get satisfactory service will be to make the ground return lines metallic if they are few in number in comparison with the metallic lines.

The insulation of both the power line and the telephone line should be as nearly perfect as possible. No connections should be made between the telephone line and earth, except such as are made at the center of an impedance coil.

The reduction of inductive interference with grounded telephone lines to a point where such lines are entirely satisfactory for toll service has not yet been accomplished, so all lines which are to be used for long distance toll service should be made metallic when they parallel high potential power lines.

A FEW WORDS TO SENIOR ENGINEERS

FREDERICK A. DELAY, e '02
Head Lecturer, Chicago Central Station Institute

The end of the College Course is close at hand and the senior engineering student begins to feel the burden of the future, if burden it may be called. Fortunate is the young man who feels mentally and physically fit; who is anxiously awaiting the opportunity that will soon be his, to show those who are interested in him, that he is going to make good from the start. The old adage that "Well begun is half done" applies especially to a "life's work" but it is not clear as to where and how to begin.

The motives which prompt students to enter and pursue engineering courses are varied. Some do so because their parents or friends urge it upon them, others because they believe it will prove a very remunerative line of work; still others because they naturally like it, especially research work, construction and operation of machinery; they like to create and use their natural engineering ability to solve the problems that fall to the lot of the engineer.

It is safe to say that only those who pursue engineering because they naturally like it better than anything else, are the only ones who will acquire fame or fortune, or both. It is also safe to say that the man who thinks the least about fortune and the most about his work, will be the first to achieve both fame and fortune.

To the senior engineering student, who is contemplating starting into what he may be pleased to call his "life's work," I would say—The most important thing to do is to settle, once for all if possible, the two following points: First, whether or not you are going to continue along engineering lines; second, if so, which branch, of the many open to you, are you going to choose.

As to the first point: Think over your four years' training carefully and reason out, if you can, whether or not your makeup and engineering work have an affinity for each other, or whether it partakes of the nature of an oil and water mixture.

If the former is the case, stick to it; if the latter, then the sooner you change to something else the better.

Your four years engineering training will be a benefit to you no matter what line of work you engage in, because engineering training is broadening and beneficient always. If you think you are not cut out for an engineer, or possibly lacking in some of its essentials, talk it over carefully with one of your professors and he will undoubtedly tell you the truth, which will be a great help to you. The writer did this once and to the everlasting credit of the professor, be it said, he gave advice, which being followed, is resulting in a life of pleasurable and profitable work to his former student. And here is what the writer believes to be the keynote of success—a busy life at pleasurable work.

If you are sure that you are interested in a certain line of work to such a degree that you can become enthusiastic over it, that you can go to work each day with pleasure and leave it at night looking forward with enthusiasm at the prospect of returning in the morning, then without doubt, you will be successful, no matter what the line of work may be.

Some persons are so fortunate that they find interest in every thing and can become enthusiastic over anything they enter into. Such people usually succeed no matter what they attempt. Others are so unfortunate that they are never enthusiastically interested in anything. Such people are to be pitied, for they seldom, if ever, succeed in life. If you are of this class try with every fiber of your being to find some kind of business that will interest you, for that is your only chance of success.

If you finally decide to continue along engineering lines then the second important point should be considered and that is: What branch of engineering will you choose? The young engineer soon finds out that it requires years of experience before he can become a real engineer. Consequently it is wise to decide as soon as possible what branch he wishes to follow as his life's work.

In almost all branches of engineering, chemical, civil, electrical, mechanical or others, there are two general lines open, one pure engineering, the actual solving of engineering problems and the doing of engineering work; the other a combination of engineering and commercial work.

Generally the men attracted to engineering are decidedly lacking in commercial ability; however, the engineer will find it worth a great effort to learn as much about the commercial side of life as possible for he can develop more rapidly and reach his goal sooner if he is well balanced. A study of subjects such as salesmanship, merchandising, advertising, are all valuable and well worth attention. Special stress should be laid upon salesmanship, for even though one is in pure engineering work he has something to sell. He at least must sell his services and cannot do this unless he understands and practices the fundamental principles of salesmanship.

Combinations of engineering and commercial work will be found both interesting and valuable, for they are bound to be very broadening and a man cannot be too broad. These combinations are also more likely to lead to executive positions than either alone, as the executive must be a broad man, one who understands his problem from both engineering and commercial view-points. Designers of stations and substations can easily design an ideal station or substation, if they have unlimited space and unlimited funds. But to design a good station or substation within commercial limits of space and funds, is quite another proposition. Inventors of many meritorious devices fail to realize anything from them because the inventor lacks in commercial ability. Much of this can be developed, and certainly is well worth cultivation.

Not many years ago, it was generally believed that in order to succeed in life, a man should specialize and the narrower his specialty and the more highly developed he became, the greater would be his success. The same general statement can be made with truth today, but specializing must not mean narrowing, because no narrow man can be a success in the full meaning of the term. Let those men specialize narrowly who cannot learn to do more than one thing, and those who desire and have the ability to specialize broadly, do so with all their might, for therein lies their greatest chance for success.

The commercial engineer is often expected to design and sell articles, or service, that require not only an engineering knowledge, but also a broad knowledge of commercial application.

Many such positions are open for men just out of college. We do not believe that a technical graduate should expect to be a salesman all of his life, although as a matter of dollars and cents, the salesman is often far ahead of the engineer. Selling experience is very essential to the man who hopes to be a manager, superintendent or higher executive, in any organization selling merchandise or service.

The Central Station field is one in which there are many opportunities for technical graduates, opportunities of all kinds from purely engineering to purely commercial. Combinations of engineering and commercial are especially promising.

In the larger Central Station companies a man may be an illumination expert, designing installations and selling to his prospects; he may be a power man, making applications of motors to all manner of industrial apparatus; or a specialist on isolated plant work, selling central station service to isolated plant owners; a refrigeration expert, selling central station service to ice and refrigeration plants; an estimating engineer, estimating costs of light and power installations and selling such installation to his prospects; a vehicle expert, educating the public to the value of electric pleasure and commercial vehicles; or a heating appliance man, making applications of electric heating ideas to the industries. These and many others require combinations of electrical engineering and commercial knowledge and all are stepping stones to excellent positions in one of the best fields open to technical men.

Many manufacturing companies of mechanical and electrical apparatus offer equally good combinations that are worthy of your most serious consideration.

Some engineering graduates find that nature supplied them with a larger share of commercial than engineering ability. Such men should not enter purely commercial work, but look for some branch in which the need for commercial knowledge and ability is more essential than the knowledge of engineering. Success then is usually only a question of time.

And right here, let it be said, that success is largely a question of time in all cases. College men are often severely criticised for being so anxious to succeed that they flit about from one position to another, not giving themselves, or their employer, a fair chance. Better stay at your first job a little too long, rather than leave too soon, for it makes a bad looking record if your stays are short. The prospective employer always asks where you were before, and how long you stayed; in fact, he wants your complete history, from the time you left college. So be very careful to select a desirable position and then endeavor to give it a good try-out.

Your value to the business or the value of the business to you, usually increases or decreases about as the square of the time you stay by it. Look into any well established business and you find that the men at the top are, as a rule, the men who have stuck by the business through thick and thin. An employer likes to know that he can depend upon you, and that you are going to stay with him before he can, in justice to himself, offer you a higher or better position; and so if things are half way right—Stick.

ALUMNI LETTERS

JUST OUT

Dow Harvey, m '16
Allied Machinery Company of America, New York City

PERSONAL EXPERIENCES

Upon viewing my request for a letter entitled, "Just Out," my first trouble was to find something about which to write. Upon reading on, however, I discovered that the graduates' letters contained advice, suggestions, and personal experiences. Advice, or even suggestions, seemed rather beyond the sphere of the "Just Out" man who has not yet reached the age at which we turn from receivers to givers of advice. By the process of elimination only personal experiences are left; so you shall get them even though they bore you to death. The hardest part about writing one's own personal experiences is to know where to stop. Therefore, if incidents of interest only to the writer have been included, you may skip them with a clear conscience.

Upon graduation I was in the same position as a great many other engineers who have no particularly strong interest in any one line. The great majority of us must experiment more or less before fixing upon any one industry or business.

After looking over a number of propositions, none of which exactly suited me, I secured a temporary job in Chicago during the summer months. While in the city most of my spare time was spent investigating every new opening that came to my attention. In this manner a great many different lines of work were eliminated from consideration.

At this time the varied activities of the American International Corporation were brought to my attention. For those who are not familiar with these, I will state that the corporation was organized about fifteen months ago by the National City Bank of New York for the purpose of placing American foreign trade upon a modern economic basis where it could successfully compete with the large European trade combinations. The activities of the company, which include almost every line except banking, are conducted through subsidiary companies. I became intensely interested in the work of this company, which is doing pioneer work in its field, and decided to make an eastern trip in order to see whether they had any work for engineering graduates. After several interviews, the matter was settled and I was told to return on October 1 ready to work.

Inasmuch as there was no definite place open at the time named, I spent two weeks running errands in company with a law school graduate. Needless to say, I was careful not to repeat our law school yell.

At the end of two weeks I was temporarily transferred to one of the subsidiary companies to help install new correspondence and filing systems. This company, recently bought by the corporation, had been for many years duplicating its letters on a letter press and filing all correspondence in the old book form letter files.

Being by this time more familiar with the work of the corporation, my preference became more marked. Therefore, a month later when an opportunity came to enter the Allied Machinery Company, I asked to be transferred. My work since then has so far been largely educational. The work of three technical graduates who left for Paris this month will illustrate the course of education. These men joined the company in June and worked about one month in each of eight different factories. As our company sells all kinds of machine tools, these men were given one month in a representative factory of each line. For example, they spent one month in a milling machine plant, another in a grinder factory, and so on. They were given as much practical experience as possible in operating, assembling, and repairing each machine. Since November my work has followed these lines, except for several weeks spent tracing freight cars from Chicago to New York. The aim of the company is to combine the foreign selling and shipping of a large number of manufacturers into one organization to cut down the exporting cost.

When in New York I have attended some very interesting luncheons of the Wisconsin Alumni Club. We meet every Tues day noon and generally have a very good short talk. The engineers are well represented with four of last year's class in the city, in addition to many more older graduates.

ONE YEAR OUT

F. C. Ellis, e '15
Commercial Agent, Idaho Power Co., Twin Falls, Idaho

CAPABILITIES

Mine has been a pretty steady grind ever since I landed here, but I am very well satisfied with results in that I have succeeded in at last obtaining the line of work I have always wanted. I came here three days ago to take charge of the new business department of this company for this division and now am busy in devising ways and means of separating the people from their money and in pushing everything electrical.

As you may recall, I came here as private secretary to the General Manager, who hired me in Kansas City because I agreed to "keep my eyes open and my mouth shut." As I profited by that policy I feel sure the same advice might be of value to others when first starting out. Further, I took the job of private secretary without knowing a character of short-hand or being able efficiently to operate a typewriter. I suffered a great deal of embarrassment and criticism when this was found out, but by working night and day and giving an over-abundance of service during the first few months I got by. So while I am giving advice (which is what I presume all of the old ones do) I would say to the beginner that he should, perhaps, over-estimate his capabilities when striking for a job and then underestimate them after obtaining the job and give all he has got. And I wouldn't hesitate to ask for anything I thought I honestly had coming. You know, you may just be overlooked in some niche. I did not like being a secretary and struck for a job at commercial work and was given this one, which is the best one on the system. I am satisfied with the past so far and the future looks better. I am, therefore, eminently happy and sincerely trust everyone else is the same.

TWO YEARS OUT

HENRY REKERSDRES, m '14
General Foreman, American Blower Co., Detroit, Mich.

SHOP EXPERIENCES

Arriving here from a wonderful summer vacation—tennis, swimming, canoeing, etc.,—I felt myself thrown from paradise into oblivion. It was the beginning of hard work in a city unknown to me.

With bare subsistence wages to begin, I climbed into overalls and nursed my milling machine along side of rows of other "fellow sufferers" in the machine shop of the American Blower Company. Meanwhile I took up Taylor, Gautt, Emerson, etc., on shop efficiency and management. After several weeks of shop work I asked to go into time-study. This I worked at enthusiastically for several months because I took a liking to the work. In fact Prof. Goddard's course and *The Engineering Magazine* gave me my first real perspective along this line.

Later an opportunity presented itself and I took it,—foreman of lathe and planer department. This was "some" responsibility, I know. The experience I gained here has proved invaluable. Hard work; but lots and lots of chances to learn.

After about seven months of this work I had a chance to analyze the manager's cost reports covering three preceding years. This gave me a comprehensive insight into the distribution of direct and indirect costs of manufacturing.

Standardizing bills of materials used in building of steam engines and traps made me very familiar with the manufacture of these and other products, so that after a while I became production clerk of the machine shop. This has led to the position of general foreman of this machine shop controlling foundry production with an efficient staff of assistants.

Detroit is a city of opportunities. The training one receives dodging autos and Fords is equalled only by the warlike usefulness of trolleys in Brooklyn. College men and pretty girls are plentiful here. So with lots of sports and parties we manage to make life miserable.

Prexy's commencement advice still rings clear: "Punctuality, Accuracy, Reliability."

THREE YEARS OUT

DOUGLAS C. CORNER, min '13
Mining Engineer, American Zinc Co., Carilage, Mo.

KEEPING NOTES

Your letter reached me in the midst of our sixth move in three years, hence the delay in answering it. I was trying at the moment to decide whether or not to part with some of the engineering catalogs and wealth of other material accumulated during my college course, and it occurred to me to wish that someone had impressed upon me the desirability of starting a loose-leaf note book system containing all material of interest obtained from catalogs or secured from other sources along various lines. Having helped move this material six times, my wife most heartily subscribes to this suggestion. Having been out so short a time this is all the advice I feel qualified to give.

As for business history, I have held various positions with the American Zinc Company in Wisconsin and in Missouri and am at present ground superintendent of their Carterville district.

For personal history: I have often heard it said that an engineer should not marry. In my case, however, it has been disproved for my wife (May Walker, U. W. ex '13) has been a great help to me in my work and we are both very proud of our two embryo mining engineers.

FOUR YEARS OUT

W. C. GRAETZ, e '12
Assistant Superintendent, Sefton Manufacturing Corporation, Chicago, Ill.

THE DEMAND FOR INDUSTRIAL ENGINEERS

During the last semester of my senior year at Wisconsin, I was in considerable doubt as to the branch of engineering I ought to specialize in after leaving college, hence, in order to postpone the decision for another year, I accepted an assistant instructorship in electrical engineering at Columbia University, New York

City, for the academic year 1912–13. As a preparation for my duties as an assistant, I was in the apprenticeship course on the testing floor at the General Electric Company, Schenectady, New York, for the summer of 1912.

After my year at Columbia University, I obtained a position with the Crocker–Wheeler Company, Ampere, New Jersey. I entered the manufacturing division, and was first employed in the rate department, then after six months was made head of a production department, and finally departmental head and foreman. In March, 1916, I left the Crocker–Wheeler Company and entered the employ of the Sefton Manufacturing Corporation, Chicago, Illinois, and thus changed from the electrical to the paper industry.

In changing from electrical engineering to the production division of manufacturing concerns, I noticed that comparatively few engineers were to be found in production. The engineer because of his intensive training and ability to visualize facts should occupy a prominent place in manufacturing, and it seems to me that many of our technical graduates overlook the opportunities to be found in work leading to executive positions with manufacturing companies. Great progress has been made in the last decade in the application of the principles of scientific management along line and functional control, and at the close of the present war, when both foreign and domestic competition becomes keener, the duties and responsibilities of the industrial engineer or scientific management expert will be greatly increased.

Perhaps one of the reasons why so few technical graduates enter the profession of industrial engineering is due to the fact that very few colleges offer a comprehensive course in scientific management, consequently the industrial engineer will usually be found to be a man who obtained his factory training by hard knocks with various concerns and supplemented his technical knowledge by evening courses in works management, accounting, commercial law, and allied subjects. Some of the leading colleges of the East are offering courses in industrial engineering, and their graduates are to be found not only in concerns manufacturing machinery, but also with the cotton, silk, paper mills, and various other manufacturing enterprises, for a technical man who is grounded in the fundamentals of scientific management has a greater choice of employers. Then, again, some men with thorough experience enter the consulting practice, and here the technical man with his powers of accurate and impartial analysis can present facts and recommendations graphically and in a forcible manner to the management of the different concerns by whom he is retained in an advisory capacity.

It has often occurred to me since I left Madison, that our College of Engineering ought to give a thorough four years' course in industrial engineering and that the opportunities in manufacturing should be called to the student's attention. A combination of engineering and commercial subjects, with the addition of fundamental scientific management subjects, would make an ideal course, and I hope the engineering faculty will consider the advisability of offering such a course.

FIVE YEARS OUT

A. R. White, ch '11
Secretary and General Manager, Michigan Electro-Chemical Co., Menominee, Mich.

EXPERIENCES

I have been delaying the answering of your letter in the hope that in the interim I might think of some interesting personal experience in the five years since I left the University. During the last week it even occurred to me that I might offer a few suggestions and a little advice to the undergraduate when it came time to write this letter. At this, the time of writing, I find that my experience has been without thrills and probably very similar to that of a great many of the other boys of the class of 1911, and therefore not especially interesting reading. As for suggestions and advice, it now seems to me that it would be more proper for this to come from those who write you under the title "Ten Years Out."

I have been somewhat of a rolling stone since leaving the University, having worked for three different interests. Two of my changes occurred the first year and a half, leaving something over four years to my credit with the group of men that constitute my present employers. I am somewhat proud of the fact that I was able to make my changes without losing a day's pay.

I am now with the Michigan Electrochemical Company of Menominee, Michigan, as Secretary and General Manager. We manufacture bleaching powder and caustic soda, which products are in very great demand at the present time.

I was very sorry not to be able to attend the reunion of my class in June of last year as I would certainly liked to have renewed friendships with many members of the illustrious class of 1911.

SIX YEARS OUT

O. W. Storey, ch '10, Ch E '13
C. F. Burgess Laboratories, Madison, Wis.

A WORD TO THE WISE

Six years of experience along engineering lines have shown me several things which tend to hinder an engineer's progress. A few will be enumerated in the hope that undergraduates will receive some help in avoiding these pitfalls in the future.

First: Inability to express oneself clearly and effectively. The emphasis that has been put upon this in the alumni letters shows its importance. I again wish to emphasize the importance of a more thorough study of English for engineers. My work calls for the writing of many reports that must be clear, effective, and concise. A poorly written report or letter is of little value and receives little consideration as compared to one well written. A course in Freshman English merely helps to lay the necessary foundation for a study that should not only continue throughout the university career but also after leaving the university. Care at all times in both writing and speaking gives the necessary practice to attain the desired goal.

Second: Lack of confidence in oneself. A college graduate will often leave school and approach his new work with a lack of confidence in his ability. Too often he has taken too seriously the statement that he must start all over again after graduating. The engineering graduate has received a training that should make him capable of holding positions that at first appeared to be beyond him. I remember how I probably lost a ten or fifteen dollar raise in salary during my "first week out" due to a lack of confidence in my own ability. I do not wish to encourage unscrupulous "bluffing" but I think the average graduate should not lack the courage to accept a position that may require him to progress more rapidly than he had anticipated.

Third: Inability to use a library. Every graduate in engineering should know how to use a library. Familiarity with standard reference works, technical periodicals, and indexes is a requirement of a successful engineer. A large amount of unnecessary duplication may be avoided by a thorough study of the literature before attacking a new problem. The engineer must be able to distinguish between reliable and unreliable sources of information and he can do this only by learning to know the character of the different books and publications. The engineers at Wisconsin have an excellent opportunity to become familiar with engineering literature. This is due not only to the excellent library but also to the librarian, Mr. Volk, who is willing to give all possible information and help in using the library.

Fourth: Failure to "mix". The engineering graduate usually finds himself a stranger in a strange place when he starts out in his career. Often he must live in a small industrial town or city where the living conditions are poor. Under those conditions it is easy for him to feel pretty "blue" at times and even the "movies" will fail to entertain. If he does not get some recreation his frame of mind is reflected in his work, he becomes dissatisfied, loses interest, and is usually a failure. I advise all engineers, when they find themselves strangers in strange places, to try to enter the social life of the community by the various channels that are open to all. One will then find that life is very enjoyable even in a Pennsylvania mill town.

SEVEN YEARS OUT

H. E. McWethy, e '09

Engineer, Wisconsin Railroad Commission, Madison, Wis.

DETERMINING FACTORS FOR FUTURE WORK

I am glad to add my "bit" to the "experience meetings" which are being held monthly in the pages of your valued publication.

The idea which I wish to offer applies equally well to the high school student about to enter the university, the freshman, junior or senior in that institution. Placed in the form of a personal question, it is this: "In the selection of the work upon which I am about to enter am I giving due weight to the value to me of the work in which I have already had experience, or am I casting aside my experience to enter some line of work the prospects of which look rosy but in which I have had no experience?"

To illustrate with my own case: Before coming to the University I had had some two years' experience as manager, troubleman, etc., of a small telephone company; I thought I had had enough of the telephone game and in my senior year I cast aside the opportunity to elect the course in telephony at that time connected by Mr. Lowe. Two years after graduation I found myself in that line of work which I have pursued up to the present time, viz., that of telephone appraisal and rate engineering. I feel now that I was in error in treating so lightly during my engineering course the telephone experience which I gained before entering the university, limited though that experience was.

The point which I wish to make I think is apparent. We should weigh well whether or not it will be possible to make the work which we have had experience in count for us in our future work.

EIGHT YEARS OUT

W. C. LINDEMANN, m '08
Assistant Superintendent, A. J. Lindemann and Hoverson Co., Milwaukee, Wis.

ENGINEERS IN INDUSTRY

In the first place time goes by so fast that it is only at rare intervals that one takes time to realize when we left school and what we have been doing since that time.

After leaving U. W. I took a post graduate course at the University of Charlottenburg, Germany. Returning to Milwaukee I took a position as chief engineer and superintendent of the A. J. Lindemann & Hoverson Co., which work has kept me busy ever since. We employ between 1000 and 1500 people and it keeps all executives hustling day and night to run properly and efficiently. It is a constant surprise to me to see daily how much real genuine engineering is involved in a manufacturing industry. Problems in mechanical, electrical and civil engineering are before us continually every minute of the time, and must be solved and executed immediately. A manufacturing plant is not an experimental bureau and all problems must be solved from a permanent mercantile as well as good engineering standpoint. Efficiency is not only measured in percentage but almosst exclusively in dollars and cents on the expense record. The above is the work I enjoy, and although it gets pretty thick at times, the love for real work is the only factor that pulls for success. There is one idea that may be of benefit to the boys at Madison which I would like to set before them. In the strenuous and agitated times which we are living in today, when we are at war on one hand, and on the other hand we have labor strikes, labor troubles and high costs of materials such as this country has never before experienced, and when a large number of the people keep talking at random on any and all subjects, there seems to me only one real solution for all, and that is:

"Each one of us must have thorough and accurate knowledge of whatever we undertake, and especially base our judgment only on correct fundamental principles and follow our undertaking by persistent endeavor and hard work."

NINE YEARS OUT

OWEN W. MIDDLETON, g '07
Publicity Manager, American Steel Foundaries, Chicago, Ill.

THE HUMAN SIDE OF ENGINEERING

While I am not now in strictly engineering work, there is one though which I believe the engineer in particular should give special attention, and that is the human side of his profession. The man who is in college and the man who is out wants to "get on"—to be a success. How is he to do it? Of course, he must develop within himself a power which someone has need of. However, whether he be an engineer, or a doctor, an employer or an employee, he must deal with many other people. Recognizing that one must constantly deal with other men, the value of knowing human nature is most important, and the way to know human nature is to mix in with human beings. Technical knowledge is essential, and even for a general business training there is no better course than the engineering course, but technical training is only a tool—the real work is to "get on" with other men. After having been out of college some ten years, it seems to me that failure to recognize this fact has prevented some from obtaining the highest degree of success possible.

Frequently, a man who is not a bright and shining star in college turns out to be very successful in later years. I believe that if such a man's life could be analyzed it would be found that he had a deep understanding of his fellowmen, acquired by intimate contact with them, and so was able to give full measure of such talent as he had. Such an understanding is only obtained by giving freely of one's efforts to help some person or some cause, by enlarging one's acquaintance and by getting the other fellow's viewpoint. The man who gets a good start in this direction, while at college, is collecting valuable information which he won't get in the curriculum. That is why whole-hearted participation in all sorts of college activities helps to give a broader training, and should be strongly encouraged.

The engineer must study and get acquainted with his fellowmen, for he will have to depend a whole lot on them in the business world.

TEN YEARS OUT

HENRY J. HUNT, c '06
Hydraulic and Structural Engineer, Mead and Seastone, Madison, Wis.

SUGGESTIONS FOR THE ENGINEER

Ten years out and still in the game. During this period I naturally have formed some opinions as to the nature of studies. I would recommend for an engineering student the mastering of English has always been my greatest obstacle. Unless a man is preparing for foreign service, I would recommend that more English and Rhetoric be required in place of foreign languages. I have never had occasion to use my one and a half years of German and feel that my time spent on same was lost. The four years Latin in high school has been of much more value to me.

In actual experience, one of the most useful assets an engineer can develop is a handy loose leaf note book, in which may be filed small sketches, curves, tables and data, so that any subject may be looked up at a moments notice. The data can be put in shape convenient for filing at leisure times. As for obtaining data I feel that I have had a better opportunity perhaps than a great many engineers, due to the fact that I have been employed for the past ten years in Daniel W. Mead and Charles V. Seastone's consulting engineers' office and as a result have been brought in touch with a greater variety of subjects than is ordinarily the case. My work has been both in office and field on hydro-electric plants, transmission lines, filter plants, pumping stations, irrigation, valuation and many minor problems common to a general consulting engineer's office. For a varied line of experience this type of position seems preferable. If, however, a person desires to specialize on any one line, other positions would undoubtedly appeal to him.

In any line an engineer may select, the chief object is to seek the facts and determine the solution of the problem encountered.

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EDITORIAL

With the publication of this last issue, another page in the history of the Wisconsin Engineer will be closed. We, who edit the magazine, have had the purpose in mind to make THE WISCONSIN ENGINEER a factor which holds the engineering students together and to keep the alumni in touch with their alma mater.

We feel that, if we have succeeded in any measure to accomplish our purpose, to aid "Old Wisconsin," that our time and effort spent in this connection have not been lost.

We highly respect those who have opposed our methods, for we feel that you too cherish the same high ideals, but that you hope to accomplish them by a different method.

It is difficult to realize that we are saying good-by to so many of our friends of the last four years. Already a number of our classmates have left the so-called family circle and have gone to prepare themselves for the service of the nation. We, who are left and who also must separate within a short space of time, hesitate to think under what conditions we may meet again.

To the loyal alumni who have the interest of the college at heart and to the many friends of this publication we extend our sincere appreciation. You are the men who have made good and it is to be hoped that as we leave this university, we too may set up a high standard of character to serve as guide-posts for those who are to follow.

To those who are soon to follow and occupy our places as seniors we have tried to be comrades and hope that in the time to come you may derive some few benefits from your association with us.

Soon we are to be separated—many of us never to visit the old school together again. Many a time we will long to hear the old familiar voices that so fervently cussed the long lessons handed out by some "prof". We have had our scraps, we have derided the "Laws", we have cussed our report courses; but as we leave we part with a feeling of affection for the dear old college which has done so much to mould our perspective and our character.

Few of us have any idea what line of work we may find ourselves in in a few years; some of us may be driving a bunch of dagos at work in a ditch, others may be "roughing" it in a construction camp and still others may be engaged in business enterprises; but the thought of the pleasant memories will always linger with us and encourage us to renew the fellowships of our college days. We go out with high hopes trusting that our endeavors will be of nature as to give us much satisfaction and joy.

THE "CUT AND DRIED" REPORT SYSTEM

Some of the engineering departments require a detailed outline to be followed in writing engineering reports, and in addition to this often demand elaborate sketches. After the finished report is handed in, it is usually accepted and laid away until the student graduates.

Meeting these requirements consumes much of the student's time; and when we remember that the student spends $500 a year, and the state $250 more, we see that the student's time is valuable. We students would have no objection to the time consumed on the reports if the benefits to be gained justified it. But do they?

The result of the system is that the student has little chance to develop individuality. He becomes a mere clerk. Originality is practically killed.

Now suppose the departments from the very beginning should emphasize the general purpose of an engineering report. Instead of handing out stereotyped outlines to be followed and demanding elaborate sketches, why should they not merely state the general purpose of an engineering report, and let the student work out the details, giving him a good deal of credit for original thinking, even though he may be wrong. Instead of accepting the report in the usual manner, suppose a generous amount of intelligent criticism be given upon the write up, method and form.

The suggested treatment of engineering reports will develop originality instead of killing it, and save much time.

As a result, the students would learn to write presentable, original reports; and we should no longer hear the old complaint of practical engineers about the lack of originality of students and their inability to write decent reports.

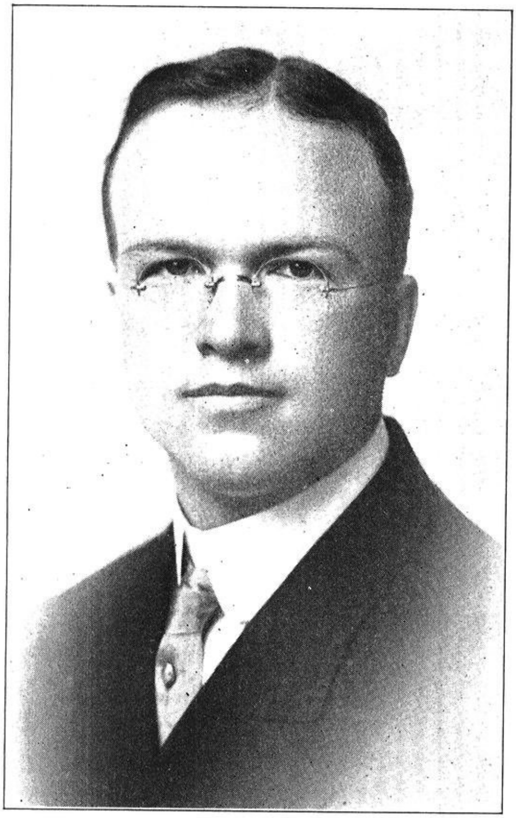
Members of the faculty keep this fact constantly dinning in our ears. We students realize and admit that the charge is only too true; we wonder, however, if the faculty are doing all that could be reasonably expected on their part to better the present deficiency.

—J. M. W.

SUCCESSFUL WISCONSIN ENGINEERS

E. E. HUNNER, c '00, C E '07

If a list of successful engineers were compiled, it should contain the names of the men whose achievements have been of the



most benefit to the welfare of their fellowmen, high in the list of Wisconsin's representatives would come the name of E. E. Hunner. His engineering career has been unusually brilliant. Even before his graduation from the University he had spent several years in the West doing railroad and mining work besides some geological surveying. In December, 1902, he started work on the Missabe range as mining engineer in charge of the engineering work for the Oliver Iron Mining Co. In 1905 he was promoted to chief engineer for the Hibbing and Chisholm Districts. During the period of time he held this position, the Oliver Company was operating about fifteen mines in some of which the development was very rapid. The developed plans for the opening of some of the largest open pits on the Range among them being the noted Hull-Rust mine, which shipped seven and a half million tons of iron ore last season. During two of the years that Hunner held this position the engineering staff contained about fifty men. In 1909, another advancement made him assistant general mining engineer with his office at Duluth. His principal work was standardizing the engineering methods used by the various district engineering departments. The fourteen months from June, 1912, to August, 1913, were spent as chief mining engineer for the Great Northern Iron Ore Properties. At present he is general superintendent of the same organization, and is likewise consulting mining engineer for the Great Northern Railway Company. He is engaged in looking after the operations of the six mines developed by the Oliver Company and turned back to the Great Northern Ore Properties with the abrogation of the Hill lease. He has helped to develop three new underground mines and four new open pit properties. From three of the open pit properties a total of approximately fifteen million cubic yards of stripping has been removed in the past four years.

Earl E. Hunner was born in Eau Claire on June 18, 1876. His common school education was obtained in that city. He attended Madison High school for two and a half years and spent six months at what was then known as the Wisconsin Academy before entering the University. Hunner has the honor of being one of the charter members of the U. W. Engineers' Club. He is a member of Delta Upsilon Fraternity.

WILLIAM SPALDING

May 27, 1882–March 2, 1917

On the afternoon of March 2, 1917, death claimed the life of William Spaulding, e. '03. Early last fall his health began to fail and upon the advice of his physician he went to Chicago so that he might be under the care of an old friend, who immediately diagnosed his case as arterial nephritis. Since conditions did not improve he entered the Mercy Hospital of Chicago for a course of treatment. As he met with no success he returned to Marshfield, Wisconsin, to spend the last few weeks of his life at home with his mother.

Mr. Spalding gained his early education and grew to manhood in Oshkosh, the home of his birth. After graduating from the city high school he entered the University of Wisconsin and in 1903 completed the course in electrical engineering. The first two or three years after graduation were spent with several Illinois firms with whom he gained much practical engineering experience. Even when in school he was ambitious to live in the West and in 1906 he took a position in Portland with the Portland Railroad, Light and Power Company, with whom he remained for about three years. He then became manager of the electric light plant at Tillamook, Oregon, where he remained five years before returning again to Portland. While in Portland he did an extensive business as a dealer of electric vehicles until he was compelled to leave because of his health.

His many friends will remember him as a man of noble qualities of disposition and character and will mourn the loss of a man of such promise.

ALUMNI NOTES

H. W. Drew, g '09, has changed his address to 61 Lathrop Ave., Detroit.

C. A. Hendee, e '14, has forsaken electrical engineering temporarily and has been mining in Idaho Springs, a small town about thirty-seven miles northwest of Denver. Recently he enlisted in the Navy as an electrical engineer and as soon as notified will leave for Mares Island, San Francisco.

M. Johnson, e '11, is now with the electrical department of the Minnesota Steel Company of Duluth.

J. H. Johnson, e '11, is chief electrician of the Billings Factory of the Great Western Sugar Company, Billings, Montana.

M. J. Halliday, m '08, is salesman for the Canadian Northwest Steel Company. His business address is, P. O. Box 430, Vancouver, British Columbia.

R. C. Caughlin, e '16, is employed by the B. F. Sturtevant Company at 530 South Clinton Street, Chicago. He is connected with the sales department at present.

George Andrae, e '16, is taking the Graduate Student Course with Westinghouse. All letters sent to him should be directed to Westinghouse Electric and Manufacturing Co., East Pittsburg, Pa., care Educational Department.

E. L. Andrew, e '16, likewise is working for Westinghouse, but is working in the publicity department of the Tacoma, Washington, branch.

C. F. Urbutt, c. '09, is assistant engineer for the C., M. & St. P. Ry. For the past few months he has been in charge of the

St. Paul Pass Tunnel lining at Roland, Idaho. His business address is 1347 Railway Exchange Bldg., Chicago, Illinois.

A. L. B. Moser, c '06, is assistant engineer on a large piece of concrete viaduct construction work. His address is 308 Tramway Bldg., Denver, Colorado.

M. J. Musser, e '04, is one of a number who have found it more profitable to enter the business world than to practice pure engineering. He is now secretary of the Southern Illinois Light and Power Company and likewise the Saline Electric Company of St. Louis, Missouri.

A. E. Nance, c. '15, is office manager of the Adelaide Plant of the Pittsburgh Wood Preserving Company, Adelaide, Pa.

A recent promotion has made B. V. E. Nordberg, m '07, manager of the oil engine department of the Nordberg Manufacturing Company, Milwaukee.

A. J. Quigley, e '03, is selling insurance for the Connecticut Mutual Life Insurance Company. His place of business is at 709 White Building, Seattle.

B. S. Reynolds, g '09, is here in Madison at the C. F. Burgess Laboratories.

The directory contains no information concerning T. M. Reynolds, but we have recently learned that he is assistant division engineer for the Wisconsin Highway Commission at La Crosse.

H. H. Rogers, ch '12, is secretary and treasurer for the Modern Power Appliance Company at Rockford, Illinois.

W. R. Rosenstengel, m '87, has recently been promoted to assistant superintendent of the mechanical department of the Curtis Aeroplane Company, Buffalo, New York.

Edward Schildhauer, e '97, is in a position where he can reap some of the war profits as he is president of the Artillery Fuse Company and general manager of the Newcastle Construction Company at Wilmington, Delaware.

J. F. Simpson, g '08, is a member of Vance and Company, 1 Royal Insurance Building, Chicago, Illinois. The firm is a member of the Board of Trade Clearing House and carries on a profitable commission business.

We have recently been informed that J. R. Smith, m '05, is an estimator and engineer for the Freeman Sweet Company, a firm of contracting engineers. His address is 608 S. Dearborn Street, Chicago.

B. T. Stevens, m '14, is sales correspondent for the B. F. Goodrich Rubber Company, Akron, Ohio.

C. P. Stivers, c '13, is a second lieutenant in the Sixth Infantry. Mail should be sent care war department, as there is no certainty where he is now located.

E. R. Stivers is an instructor in civil engineering at the University of Florida. His address is 300 W. University Avenue, Gainesville, Florida.

Ray Palmer, c '01, has recently been made president of the New York and Queens Electric Light and Power Company of Long Island City, New York.

Arthur King, m '01, E E '15, and F. J. Bachelder, c '15, have formed the Illinois Appraisal Co., located in the Hartford Building in Chicago.

CAMPUS NOTES

Mr. J. N. Cadby of the Engineering Division of the Railroad Commission spoke before the Engineers' Club on May 4. His subject was "The Regulation of the Gas and Electric Service by the Railroad Commission."

Mr. Read of the Engineering Department of the Westinghouse Electric and Manufacturing Company spoke to a large audience in the engineering auditorium. His talk was illustrated and was entitled "The Design and Application of Circuit Breakers."

At the last meeting of the A. S. M. E. the members of the society were treated to an illustrated talk by Prof. W. J. Meade of the Geology Department of the University. His subject was "Landslides."

Dr. Maximillan Toch, the eminent authority on paints and paint technology, delivered an address before the Wisconsin section of the American Chemical Society, April 18th, 1917. Dr. Toch during his talk, traced the development of paints from those used about 3,400 B. C. in the tombs of the early Egyptian monarchs down to those used at present. At first paints were used merely for decorative purposes, but within the last few hundred years the use of paints for protective purposes has become of paramount importance. With the advent of modern steel construction and growing atmospheric pollution, paints were necessary for the prevention of corrosion. A number have been developed which has proved quite satisfactory. As an example of the almost perfect protection afforded steel by a proper paint film. Dr. Toch cited the case of the Maine, whose mast after being exposed to the action of the salt water for almost twenty years, was almost free from corrosion, due to the protection afforded by seventeen coats of "battleship gray." The growing use of concrete has necessitated the development of an entirely new type of paints to prevent loss by abrasion "dusting," as well as to fill the minute cracks which are prone to develop in the surface where exposed to the weather and which cause rapid disintegration.

Professor Bridgeman of Harvard delivered a series of two lectures before the Physicists on the results of his investigations on high pressure phenomena. Professor Bridgeman described the apparatus and methods used in the work which made possible the attainment and measurement to an accuracy of one-tenth of one per cent of pressures up to 20,000 atmospheres. The work has been very fruitful and has already thrown some little light on the method of conduction of electricity in solids and has led to the conclusion that atoms are not spherical as has been tacitly assumed, but are spheroidal. At the higher pressures a remarkable change in the physical characteristics of substances can be observed, such as rubber being forced into steel, paraffine of such great viscosity that when flowing, it will actually corrode steel. At the high pressures many bodies undergo allotropic changes, for instance phosphorus at a pressure of 10,000 atmospheres, changes into a black allotropic form, which is stable at ordinary temperatures and pressures and looks like graphite.

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