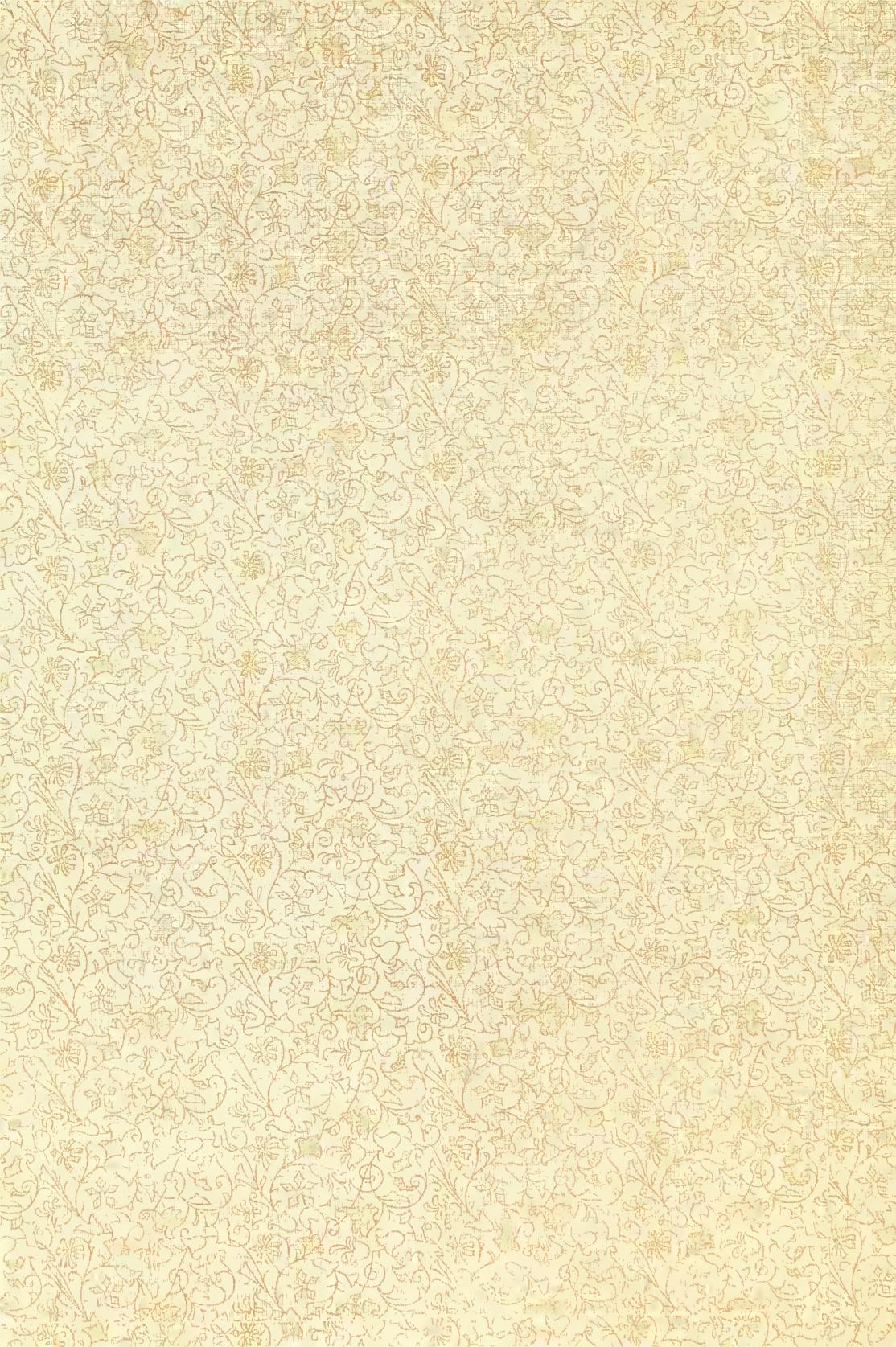


A COMPARATIVE TEST
OF
INTEGRATING WATTMETERS
BY
M. J. ANDERSON and A. B. CORNWELL

Armeur Institute of Technology

1903

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Anderson, M. J.
Comparative test of
integrating wattmeters

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A COMPARATIVE TEST
OF
INTEGRATING WATTMETERS

A THESIS

PRESENTED BY

MARION J. ANDERSON
AND
AUGUSTUS B. CORNWELL

TO THE
PRESIDENT AND FACULTY

OF

ARMOUR INSTITUTE OF TECHNOLOGY

FOR THE DEGREE OF
BACHELOR OF SCIENCE IN ELECTRICAL ENGINEERING

HAVING COMPLETED THE PRESCRIBED COURSE OF STUDY IN

ELECTRICAL ENGINEERING

June 1st, 1908

ILLINOIS INSTITUTE OF TECHNOLOGY
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S. S. Foote
Prof. of Elec. Eng.
H. M. Maywood
Dean of Eng.

L. D. Morris
Chairman

A Comparative Test of Integrating Wattmeters.

The object of this thesis is to determine the per cent accuracy of the meters tested when operated on loads varying from no load to 150 % load with voltages varying from 10 % below to 10 % above normal voltage, with different frequencies, and with different power factors; also to determine the phase relation of the series and pressure fluxes of each meter.

The following apparatus was used for this test:-

- 1- Weston Voltmeter. A.C. & D.C. (0-120).
- 2- Thomson Ammeters. A.C. (0-5) & (0-25).
- 1- Weston Wattmeter. (10 ampere).
- 3- Frequency Meters. (25-60-125 cycles)
- 1- Dynamometer.
- 1- Stop Watch.
- 1- Counter.
- 1- Variable Inductance.
- Lamp Bank.
- Two Phase Alternator. (60 cycles).
- Single Phase Alternators.(25-60-125 cycles)
- Storage Battery.

A Court to give effect to the principles

of arbitration of all disputes left to decide on the
basis of merit between parties and to do away with the
arbitrator of the party to be decided on merit under law or
under which it is selected. It must ensure that a flow
of merit based decisions will determine the rules of procedure
and the system so as to assist in expediting the process of
dispute resolution.

It is also proposed to make the following changes:

(a) CBI-1) .0.0. & .0.A I- case law / Arbitrator.

(b) CBI-2) 2.0.0) .0.A I- Discretionary power -2

(c) CBI-3) 2.0.0) .0.A I- Selection of arbitrator.

(d) CBI-4) 2.0.0-2.0-2.0 I- Discretionary power -3

I- Discretionary power -4

I- Discretionary power -5

I- Discretionary power -6

I- Discretionary power -7

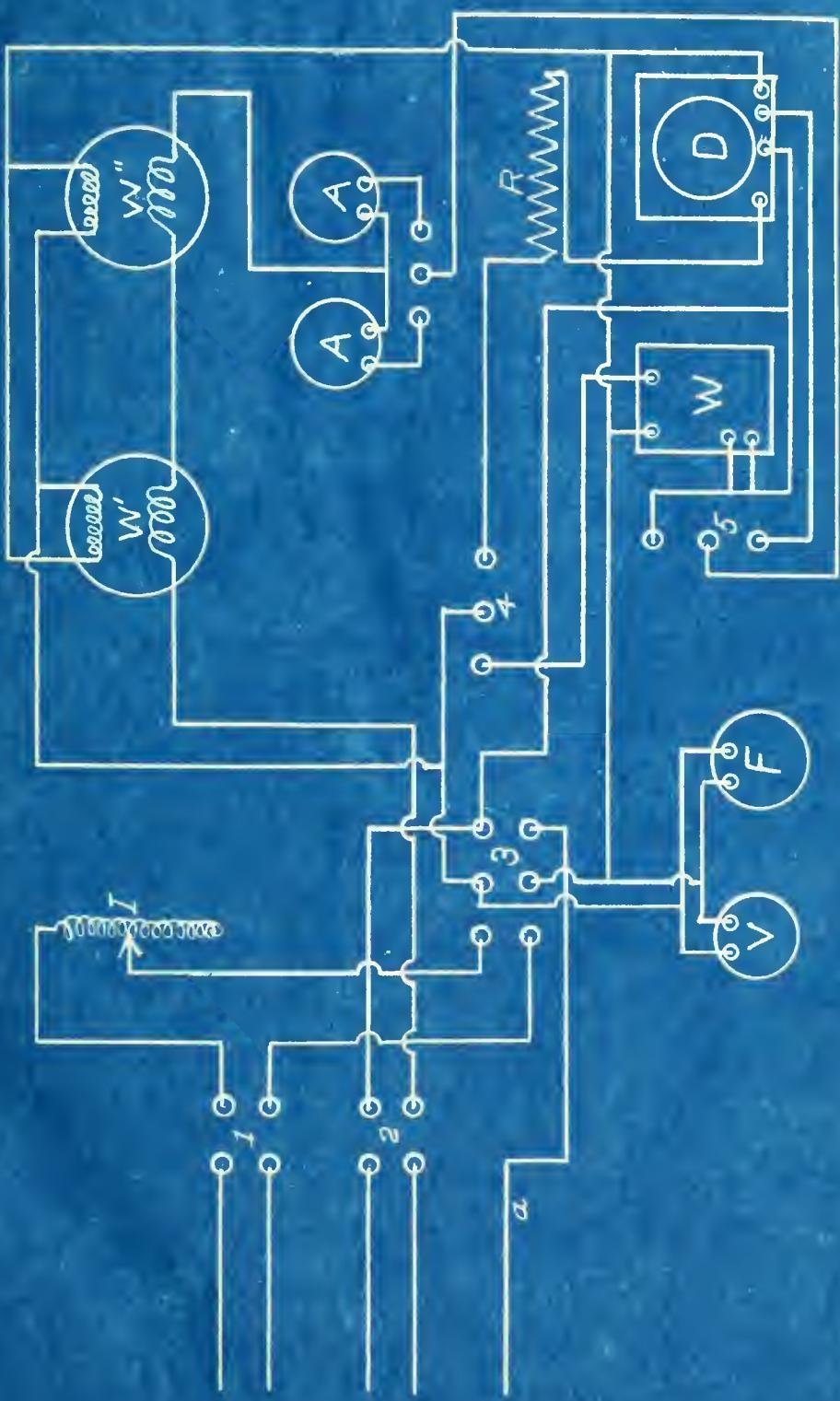
Tempo 2. Mr.

1. (a) CBI-1) .0.0. & .0.A I- case law / Arbitrator.

(b) CBI-2) 2.0.0) .0.A I- Discretionary power -2

I- Discretionary power -3

SCHEME of CONNECTIONS
for
Integrating Wattmeter Test



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On the preceding blue print is shown a scheme of the connections used. The leads from switch 1 are connected directly to one phase of a two phase alternator. The leads from switch 2 connect to the series posts of the lamp bank; the lower lead "a" connects directly to one side of the second phase and the upper lead of switch 2 connects to the other side of the second phase, thus giving the pressure of the second phase on the right hand posts of switch 3 when switch 2 is closed. V and F are the voltmeter and the frequency meter. W is the Weston wattmeter. D is the dynamometer. R is a non-inductive resistance in series with the pressure coil of the dynamometer. By means of the double throw switches 4 and 5 either the wattmeter or the dynamometer may be connected in the circuit. A and A' represent the high and low reading ammeters, either of which may be connected to the line by means of the double throw switch 6. W' and W" are the watt hour meters under test. I is a variable inductance connected in series in one of the leads of the upper phase, for the purpose of adjusting the phase relation of the currents in these two phases. By throwing switch 3 to the right all pressure apparatus is connected to the lower phase, and by throwing it to the left all pressure apparatus is connected to the upper phase.

In order to obtain good results in this test it

was necessary that the load, the voltage and the frequency be maintained constant during the run. This was accomplished by operating the motors, to which the generators were attached, from a 60 cell storage battery. The field rheostats of both motor and generator were placed by the testing table to give convenient control of the frequency and the voltage.

The method of procedure was as follows:- First all instruments to be used were calibrated by comparing their readings with those of the standard instruments of the laboratory of Armour Institute of Technology. The voltmeter used was made for A.C. and D.C. and it was calibrated by comparing its readings directly with those of the standard D.C. voltmeter. In making this comparison two readings were made in determining each point of the calibration, one with the current in one direction and the other with the current in the reverse direction, the average being taken for the true reading, thus eliminating any effect of stray magnetic fields. The dynamometer, to be used in the determination of the flux phase relation, was calibrated as a wattmeter by comparing its readings with the standard volt-amperes. For the calibration of the A.C. ammeters it was necessary to first calibrate a dynamometer as an ammeter by comparing its readings with those of the standard ammeter, direct current being used for this calibration, and then to calibrate the ammeters by

the most common form of the disease is the primary type, characterized by the presence of a primary tumor in the lung, which may be accompanied by metastases to other organs. The second type is the secondary type, characterized by the presence of multiple metastases throughout the body, often preceded by a primary tumor in the lung.

comparing their readings with those of the dynamometer, alternating current being used in this second calibration. The Weston wattmeter was calibrated by comparing its readings with the product of those of the calibrated ammeter and voltmeter.

When an integrating meter was placed on the testing board and connections made as shown in the above scheme, the meter was first tested to ascertain if it were running at correct speed with full load current, unity power factor, normal frequency, and normal voltage. The number of revolutions made by the disc in about two minutes was counted. This number multiplied by the disc constant and divided by the time required to make this number of revolutions gives the watts recorded, which corresponds to the watts given by the Weston wattmeter if the integrating meter is running at the correct speed. In case the meter ran too fast or too slow under these normal conditions the position of the damping magnet was adjusted until the proper speed was obtained. In this manner all the meters tested were adjusted to record within $2\frac{1}{2}$ of the true watts when operating under normal conditions at full load.

In cases where the disc constant was not given the recording train was removed and the ratio of the revolutions of the disc to the revolutions of the first dial was determined by counting the number of revolutions

· a demon myd silt to escort their signifiers silent until a com
· munity of the chosen light mi does united the same entities. The
· art of their signs up before itself a new community mother earth
· before itself - sent to escort to territory of the new signifiers
· . tetemtov into the metem
· silt no less if a new nation comes together in the new
· epochs silt mi works as a bridge connecting the coming signs greatest
· th if master of Beasts from the nation of ,
· themselves of the first new signs the connection of the coming signs more
· . powerful function in , whom are known as the nation's power which
· funds mi signs silt of the signifiers to medium effect
· to be enlightened . whom silt . nations and customs out
· of Beasts or omis silt of nations by Christians said silt
· , who were added with a new signifier to medium silt whom
· nations silt the moving culture silt of aborigines whom
· silt the culture in their land together off in a + and
· cool to cool cool in motion with each other . been a good
· silt to medium all signifiers function as medium who
· bands together and links together now temporal entities
· that medium silt the common silt of . I said a
· add on said all to a nation silt of Beasts . and
· of all the signifiers function without silt who in
· this form can the names said - & exists others all
· to other silt the Beasts and mi of signifiers out
· until all to signifiers said of said silt to signifiers
· signifiers to medium odd qualities of said silt a said

made by an intermediate gear, usually the one that meshed with the gear on the spindle, to one revolution of the first dial, and then determining the ratio between this gear and the one on the spindle. From these the disc constant can be determined directly.

After an accurate adjustment had been obtained a run was made with normal frequency, normal voltage and unity power factor, about seven or eight readings being taken as the load was varied from no load to 150 % load. Then like runs were made with approximately 10 % above and 10 % below normal voltage.

The meter was next tested for accuracy with different power factors. The variable inductance I was disconnected from the upper phase, as shown in the scheme, and connected in series with the load on the lower phase, being placed in the lower lead of switch 2, which is the load side of the meters. With the inductance in this particular lead we were able to vary the power factor without changing the voltage impressed upon the instruments. Readings were taken for the determination of the per cent accuracy with normal voltage, normal frequency, constant full load current and power factors varying from unity to about .500.

A test was next made to determine the phase relation of the series and pressure fluxes. The connections were as shown in the scheme, switches 1 and 2 being closed, switch 3 being thrown to the left and

Since the main purpose of the committee is to coordinate the work of the various
constituent committees, it is important that the members of the committee be
able to work together effectively. This can be done by establishing a
clear understanding of the responsibilities of each member and by
ensuring that all members are fully informed about the progress of the
work of the committee. It is also important that the members be
able to communicate effectively with each other and with the
various constituent committees.

... so I follow it up with a few more words like this:

switches 4 and 5 being thrown so that the Weston wattmeter was connected in the circuit. With the switches in these positions all pressure circuits are connected to one phase and all series circuits are connected to the other phase of the two phase alternator. The load was adjusted until the desired current was obtained and this current was then maintained constant thru-out this particular test. The inductance I was adjusted until the phase difference between the currents in the two circuits was approximately 90 degrees, as indicated by the very low reading of the Weston wattmeter and by the very slow movement of the disc of the integrating meter. Switches 4 and 5 were now thrown so as to connect the dynamometer in the circuit. A reading was made on the dynamometer and the speed at which the disc was rotating was determined by noting, with a stop watch, the time required for a point on the disc to pass between two noted points on the stationary portion of the meter, as for example across the width of the damping magnet. It was not necessary to know the exact speed of the disc in revolutions per minute but simply to know the speed relative to some fixed part of the meter in order that the disc could be given the exact same speed when the flux phase relation was readjusted. Two more readings were made on the dynamometer with this same speed and direction of

rotation of the disc, the inductance I being readjusted previous to each reading, and the watts corresponding to the average of these first three readings was taken as the true watts for this phase relation of the series and pressure currents. The true watts divided by the apparent watts gives the cosine of the angle between these currents. The position of the core of the inductance was now changed until the disc was rotating in the opposite direction with a speed equal to that at which it was revolving in the first direction. Three readings were taken on the dynamometer for this direction of rotation of the disc and the watts corresponding to the average of these readings was taken as the true watts for this phase relation of the series and pressure currents. These true watts divided by the apparent watts gives the cosine of the angle between these currents for the second position of the core of the inductance.coil. If it was necessary to reverse the connections of the dynamometer to get a positive reading when the inductance was adjusted so as to change the direction of rotation of the disc then one of the readings was considered positive and the other negative, indicating that one of the angles was less than 90 degrees and the other was greater than 90 degrees. In the meters of the induction type the phase angle from a quadrature relation of the series and pressure fluxes

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uninformed add on .said on none of amonetary
method new said on some think want to say now one of
author set to noisitor said first not allow want off as
set to Bobivib sette want off .authorise summing him
now said off to emiso said never after thosday
off to ones off to noisitor off .authorise said
emitter new said off him begin :e now a new comacterized
it is of large breed a fowl multo said otisonglo off in
noisitor said off in never saw ti said w
and not rotone any off no next drew signif er said
off off off off said off to noisitor to noisitor
new signif er said off now off of unisörper
to noit for their first not attit said off a man
add w said said .authorise summing him before said
and off enies off devle said in that off off to Bobivib
noit off knowed off not stacuse said heaved off
vi reason off off off .like when don't off to ones off to
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when used with a single phase current, is equal to the average of the phase angles from quadrature as obtained from these two sets of readings. In the meters not of the induction type the phase angle between the series and pressure fluxes is equal to the average of the phase angles from quadrature obtained from these two sets of readings.

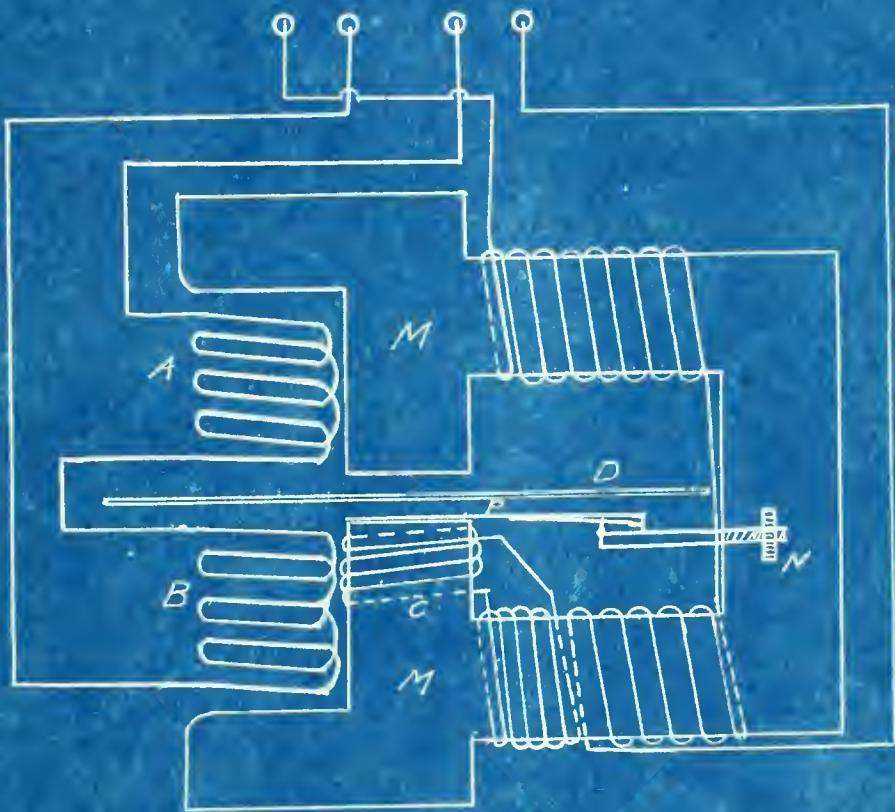
There is a small error in this method of determining the flux phase relation due to the fact that the meters are compensated for friction and this compensation aids the movement of the disc in a forward direction and resists movement in a backward direction. With high torque meters this error will be small and that it is small in this case is shown by the fact that the per cent accuracy of these meters with different power factors as calculated from this flux phase determination agrees very closely with that determined directly by the use of these different power factors as described above.

Tests were next made with frequencies of 25 and 120 cycles, the connections being first made to the 25 cycle alternator. Adjustments were made for the change of frequency if such adjustments were required and the meter was tested for correct speed with normal voltage, unity power factor and full load current and was adjusted to run at correct speed if such adjustment was required. An accuracy test was made with normal voltage and 25 cycles with loads varying from no load

to 150 % load. Similiarly, the apparatus was connected to a 120 cycle circuit and, after all necessary adjustments had been made, the meter was tested for accuracy with normal voltage and 120 cycles thru-out the same range of loads.

to 150 & long. Similarly, the letter was composed
to ISO office director Mr. H. Letter II mentioned a different
route may need change, the route was found to be correct.
With normal volt age the 150 ampere limit will
last 60 pages.

Diagram of
The Fort Wayne Integrating Wattmeter
Type W No. 252944.



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The Fort Wayne Integrating Wattmeter.

Type W. No. 252944.

Volts 110. Amperes 10. Cycles 60.

The Fort Wayne watt hour meter is of the induction type. An outline of the meter with circuit diagram is given on the preceding blue print. The series circuit consists of the two coils A and B, one being just above the disc and the other just below it. The pressure circuit consists of the two coils P and P' wound on the yoke of the laminated magnet M. The moving system consists of a light shaft carrying the disc D which rotates between the poles of the laminated magnet M and between the poles of the damping magnet. Speed adjustment is obtained by changing the position of the copper bracket P by means of the knurled nut N. On one leg of the laminated magnet M is wound a small coil C, the object of which is to increase the lag of the pressure flux behind its E.M.F., thus aiding in the production of the quadrature relation between the series and pressure fluxes. The phase relation of the E.M.F. and currents of the different circuits of this meter may be best explained by reference to the following vector diagrams, the first figure being for a non-inductive load and the second one for an inductive load.

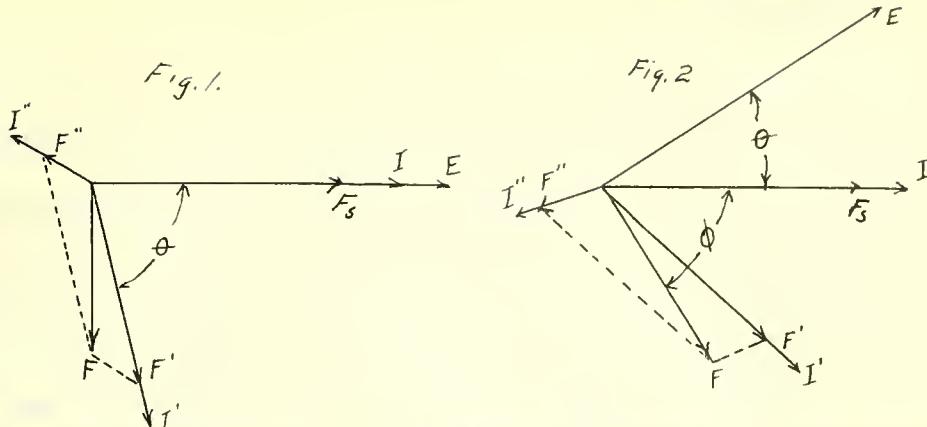
Let E represent the impressed E.M.F., and I the current in the series coil in phase with the E.M.F.

and not distinguishable only if both are

more than 1000 ft apart.

So what is the maximum distance between two

points such that the difference in time of travel along the same path is less than 1000 ft? This is a classic problem in physics. If we assume that the speed of light is constant, then the time taken by light to travel from one point to another is given by the formula $t = \frac{d}{c}$, where d is the distance between the points and c is the speed of light. Now, if we want to measure the time taken by light to travel from one point to another, we need to know the distance between the points. This can be done using various methods, such as triangulation or laser ranging. However, the most accurate method is to use atomic clocks. These are extremely accurate timekeepers that can measure time intervals to within a few nanoseconds. By comparing the time taken by light to travel between two points using two different atomic clocks, we can determine the distance between the points with great precision. This is how the distance between two points is measured in modern physics.

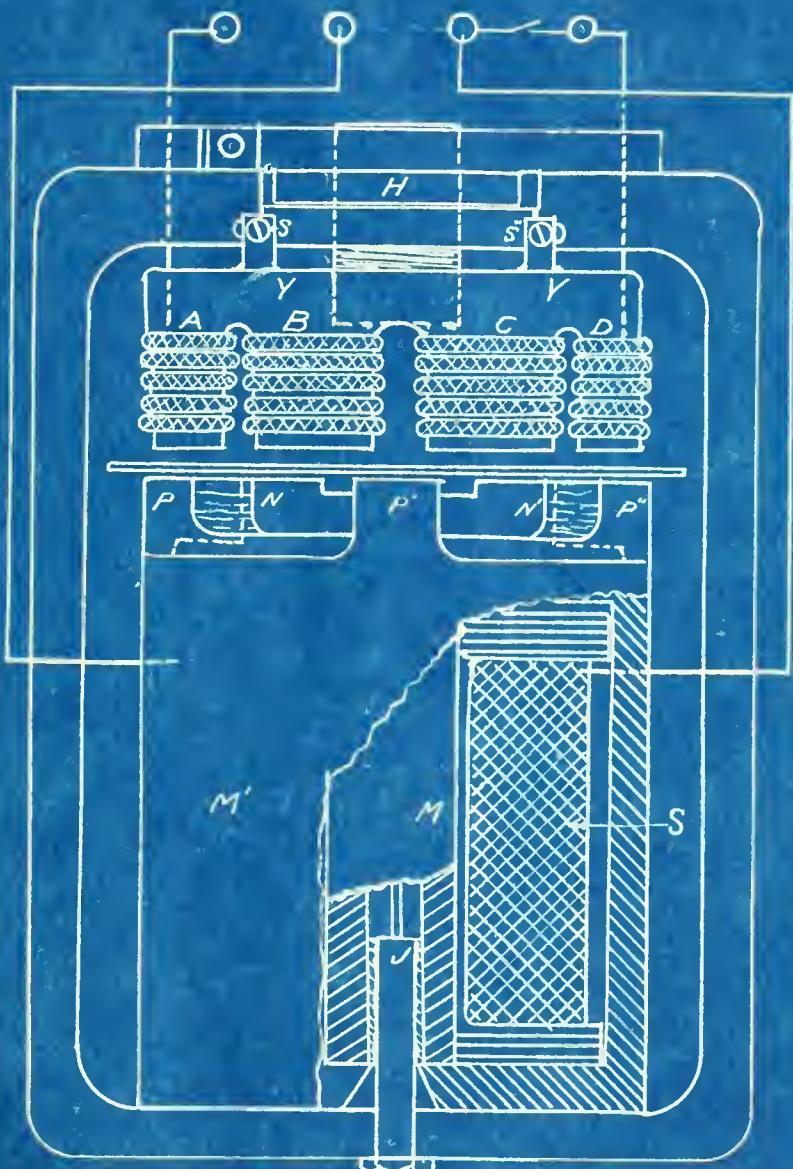


I' is the pressure current which, because of the self inductance of the pressure circuit, lags by an angle which is a little less than 90° behind the impressed E.M.F. There will be induced in the auxiliary coil C an E.M.F. which will lag 90° behind the pressure flux which produces it. This E.M.F. will cause a current to flow in the coil C which will lag slightly behind its E.M.F. because of the self inductance of the coil. The current in the coil C is represented by the vector I'' . The flux F'' due to the current I'' is in phase with I'' , and the flux F' due to the current I' is in phase with I' . By properly adjusting the resistance of the auxiliary coil C the value of the flux F'' may be made such that the resultant of F' and F'' will be practically in quadrature with the series flux. The torque upon the disc is proportional to the product of the two fluxes and the sine of the angle between them, hence it is proportional to the product of the impressed E.M.F. and the current in the series coil when the load is non-inductive. If the load is inductive and the current lags by an angle θ behind the impressed E.M.F., the

torque will be proportional to the product of the E.M.F. and the series current and the sine of the angle between the series and pressure fluxes, or the sine of the angle θ as given in the second vector diagram. The sine of the angle between these fluxes is equal to the cosine of 90° degrees minus this angle which is equal to the cosine of the angle of lag of the series current if the meter is correctly adjusted for a quadrature relation between the series and pressure fluxes with a non-inductive load. Hence the torque is proportional to the true power for all loads when the meter is properly adjusted as described above.

The results of the test for the determination of the flux phase relation show the angle between the series and pressure fluxes to be $91^\circ 15.25'$. This inaccurate adjustment of the meter for quadrature will make an error of 4 % with a power factor of .500, as shown by the data calculated from this flux phase determination. The error as determined experimentally with a power factor of .508 was about 4.5 %. This meter gives practically the same results with normal voltage and with 10 % high and 10 % low voltage. With a load of one ampere the meter is about 18 % slow. With loads from 5 amperes to 15 amperes this meter gave good results. The Fort Wayne meter now on the market can not be judged by these results as the type K instead of the type W is now manufactured by the Fort Wayne company.

THE FERRANTI INTEGRATING WATTMETER
No. 222322
DIAGRAM OF CIRCUITS.



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The Ferranti Integrating Wattmeter.

No.222522. Volts 110. Amperes 10. Cycles 60.

The Ferranti watt hour meter is of the induction type. A general outline of this meter with circuit diagram and sectional view of the pressure coil and magnet is shown on the preceding blue print. This meter is an English make and differs considerably in appearance and construction from the American make of induction meters. It is small and very compact. The series circuit of this meter consists of four small coils, A,B, C, and D, wound on poles formed by slotting the iron yoke Y. The shunt circuit consists of a single coil, S, wound in the form of a bobbin on the tubular core M, and which is surrounded by the semi-cylindrical magnet M', an extension of the core M. The magnet M' has three inwardly projecting poles P, P', and P'', and the core M has two poles N, and N' which project radially between the poles P, P', and P'', as shown on the blue print. These projecting poles of the shunt magnet are directly under the slots between the poles of the series magnet. The revolving element consists of an aluminum disc mounted on a light vertical spindle which rests on a jewel bearing J. The disc rotates in the air gap between the poles of the pressure and series magnets, and between the poles of the permanent magnet which is mounted in the back of the meter. The reaction of the field, due to the eddy currents induced

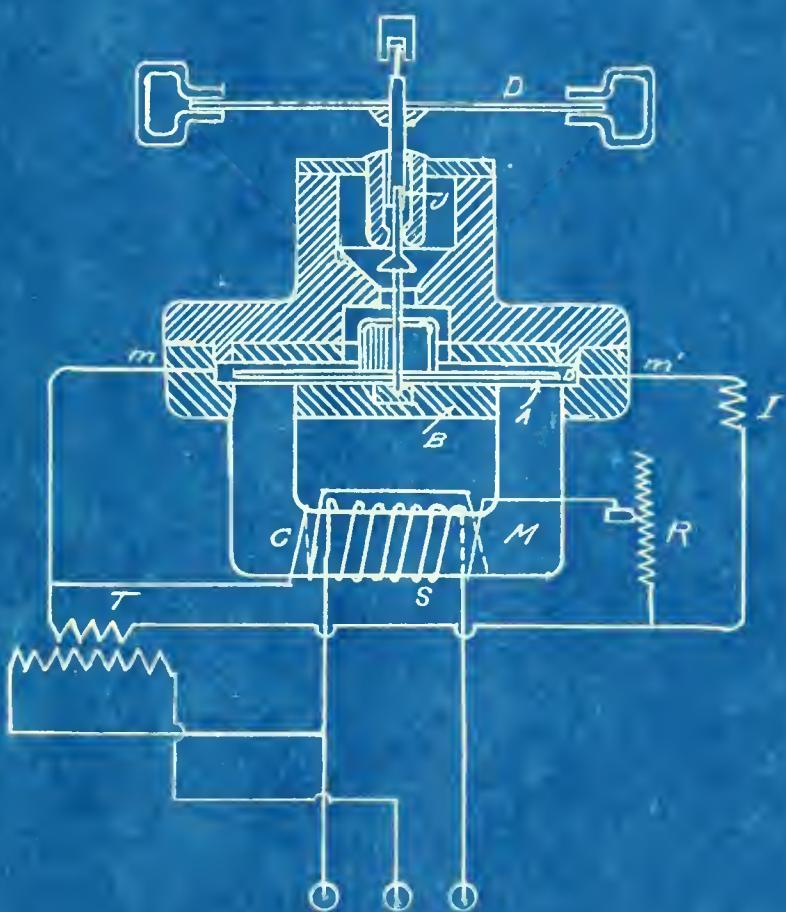
The first part of the project will involve the collection of data from various sources. This will include the use of sensors to monitor the environment, such as temperature and humidity sensors, and the use of cameras to capture images of the scene. The collected data will be used to train a machine learning model to predict the future state of the environment based on the current state and historical data. The model will be trained using a semi-supervised learning approach, where it will be provided with both labeled and unlabeled data. The labeled data will be used to teach the model what it is looking for, while the unlabeled data will be used to help the model learn patterns and relationships between different variables. Once the model is trained, it can be used to make predictions about the future state of the environment, which can then be used to inform decision-making processes. For example, if the model predicts that the temperature is likely to rise in the future, it could trigger an alert or automatically turn on a cooling system to prevent damage. The final output of the project will be a user-friendly interface that allows users to interact with the system and receive real-time updates on the environment's status. This interface will be designed to be intuitive and easy to use, making it accessible to people with varying levels of technical knowledge. Overall, the goal of this project is to develop a reliable and accurate environmental monitoring system that can help protect our planet and ensure a sustainable future.

in the disc by the pressure flux, upon the series flux gives to the disc a torque which is proportional to the product of the series flux and the pressure flux, and hence to the true watts. Friction compensation on light loads is effected by turning the series coils about the axis of rotation of the disc by means of the screws 'S' and S". If the series magnet be displaced in one direction the disc will tend to revolve in the opposite direction and vice versa. The speed adjustment is obtained by raising or lowering the series magnets by turning the nut H. This varies the length of the air gap and hence varies the strength of the series field. When running at correct speed with full load the disc makes 40 revolutions per minute.

The results of the test for the determination of the flux phase relation show the angle between the series and pressure fluxes to be $91^\circ 1.5'$. This variation of $1^\circ 1.5'$ from quadrature will make an error of 3% when the meter is operated on a power factor of .500, as shown by the data calculated from this flux phase determination. The per cent accuracy as determined by these tests is practically the same for normal voltage and for 10% high and low voltage. With a current of one ampere the meter is 15% slow. This meter gave very good results with 25 cycles, but the per cent accuracy obtained for this run can be considered only relatively as no adjustment was made when the meter was placed on the 25 cycle circuit.

and series of the boundary of the polygonal area of the figure. The figure is divided into two parts by the diagonal line segment connecting the vertices of the polygon. The first part is a triangle with vertices at the top-left corner of the polygon, the bottom-left corner, and the midpoint of the bottom edge. The second part is a trapezoid with vertices at the top-right corner of the polygon, the bottom-right corner, and the midpoint of the top edge. The trapezoid is further divided into two smaller triangles by the diagonal line segment connecting the midpoints of the top and bottom edges. The area of the trapezoid is given by the formula $A = \frac{1}{2} (b_1 + b_2) h$, where b_1 and b_2 are the lengths of the parallel bases, and h is the height between them. The area of the first triangle is given by the formula $A = \frac{1}{2} b_1 h$, where b_1 is the length of the base and h is the height from the base to the vertex. The area of the second triangle is given by the formula $A = \frac{1}{2} b_2 h$, where b_2 is the length of the base and h is the height from the base to the vertex. The total area of the polygon is the sum of the areas of the three triangles.

Diagram of
The Sangamo Integrating Wattmeter
Type E⁺ No. 66151.



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The Sangamo Integrating Wattmeter.

Type E. No. 66151.

Volts 110. Amperes 10. Frequency any.

This Sangamo meter is of the mercury type. On the preceding blue print is given a partial vertical section together with an outline of the meter. The moving system consists of a light shaft carrying two discs, D and D'. The upper disc, D, rotates between the poles of two permanent magnets as shown in the upper part of the diagram. The lower disc, D', is enclosed in the chamber A which is filled with mercury. The shaft and the discs are buoyed up by the mercury and the upper end of the shaft bears against a jewel bearing J. The two poles of the series magnet M project thru the casing of the mercury chamber and are close to the under side of the disc D'. The series circuit consists of the single coil S wound on the laminated magnet M. T is a small, low potential, step-down transformer, the primary of which consists of a large number of turns of fine wire and is connected directly to the pressure posts of the meter. The secondary winding consists of only a few and in this case of only two turns of heavy wire. The small inductance coil I and the mercury chamber A connected in series constitute the main circuit of the secondary of this transformer. The secondary E.M.F. of this transformer is small but the secondary current is large because the inductance and resistance

Statement of the Committee on the Budget

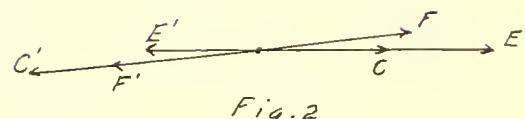
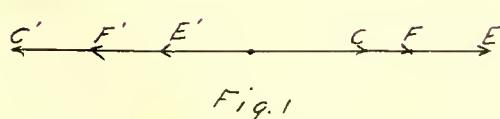
Tables II

Wolfe J.W. Ambrose J.W. Leverage W.L.

Can you get me motor oil or the mineral stuff? Gf

of the circuit are exceedingly small. This large secondary current enters one side of the mercury chamber A, flows across the disc D' and leaves at the opposite side of the mercury chamber. In passing across the disc this current flows past the poles of the series magnet M and the reaction between the series flux and the flux due to the secondary current produces the necessary torque. Friction compensation is obtained by means of the small coil C, which is connected thru the variable resistance R to the secondary terminals of the transformer T.

The phase relation of the various currents may be best explained by reference to the following vector diagrams. The first diagram disregards any lag of the currents or fluxes due to the effect of the coils and the iron in the circuits of the meter. The second diagram takes this into consideration. The magnetizing components of the currents in the transformer are so small that they are neglected in both cases.



Let E represent the E.M.F. impressed upon the primary of the potential transformer, and E' the secondary E.M.F. of this transformer. Let C be the current in the series

to the office of the
Second Vice Consul at
the Consulate General of
the United States in
the city of Manila, Philippines,
on the 1st day of April, 1901.
The Consul General,
John C. Tamm, Esq.,
is hereby authorized to
make such arrangements
as may be necessary
for the delivery of
the following documents
to the Consul General
of the United States
in the city of Manila,
Philippines,
on the 1st day of April, 1901:
A copy of the
Circular Letter
of the Secretary
of State, dated
March 20, 1901,
concerning
the
protection
of
American
citizens
in
the
Philippines,
and
a copy of the
Circular Letter
of the Secretary
of State, dated
March 20, 1901,
concerning
the
protection
of
American
citizens
in
the
Philippines.

W. H. W. gebraucht ein Modell, das die Beziehungen zwischen den verschiedenen Teilen des Körpers darstellt. Es ist eine Art von „Körpermodell“.

coil for a non-inductive load. Neglecting any effect due to inductance and hysteresis, the current in the series coil and the flux due to it will be in phase with the impressed E.M.F. Since the secondary circuit of the transformer is non-inductive, neglecting the effect of the inductance coil I for the first vector diagram, the secondary current C' will be in phase with its E.M.F., or 180 degrees out of phase with the series current. By making proper connections to the secondary terminals of the transformer, the pressure current vector C' may be considered to be in phase with the series current. The torque produced in the disc will, therefore, be proportional to the product of the pressure current and the series flux, which is proportional to the true watts.

The second vector diagram takes into consideration the fact that the series flux lags slightly behind the current due to the hysteretic effect of the iron core of the series magnet. In this diagram the vectors E, E', and C represent the same quantities as in the first diagram. F represents the series flux lagging slightly behind the series current due to the hysteresis in the series magnet. The small inductance coil I, see blue print, gives a slight lag to the pressure current bringing it into phase opposition with the series flux. We now have practically the same conditions

containing the main body of the document, which is the letter itself. The letter begins with a salutation from Mr. T. M. L. Deneen, the Minister of Finance, dated October 10, 1911, addressed to the Honorable George H. V. Borden, the Minister of Trade and Commerce. The letter discusses the proposed legislation to amend the Customs Act to allow for the importation of certain goods duty-free. It states that the proposed changes would facilitate trade by simplifying the customs procedures and reducing costs. The letter also mentions the need for a bill to be introduced into Parliament to implement these changes. The letter concludes with a signature of Mr. Deneen.

The second sector of the economy is the construction industry which includes building materials, engineering, mining, quarrying, and construction services. This sector is dominated by foreign-owned companies such as Lafarge, Holcim, and Cemex. It is also influenced by local contractors and subcontractors. The third sector is the service industry, which includes trade, restaurants, hotels, tourism, and financial services. This sector is highly diversified and includes both domestic and international companies.

as in the preceding case, the pressure current being in phase with the series flux when proper connections are made. The torque will, therefore, as in the first case, be proportional to the true watts.

The results obtained in the determination of the flux phase relation show the angle between the pressure current and the series to be 53'. This will make an error of 2.7 % with a power factor of .500. The error as determined experimentally with a power factor of .514 was between 2 % and 3 %. This meter gives nearly the same results with normal voltage and with 10 % high and 10 % low voltage, except with large overload. The per cent error with a current of 1.5 amperes is about 5 %. With 150 % load the greatest accuracy was obtained with the lowest voltage. With 10 % low voltage the meter is practically correct at 150% load, while with normal voltage there is an error about 3.5 %, and with 10 % high voltage there is an error of about 6.5 % with this same load. Taken as a whole the percent accuracy of this meter is very good. It will operate successfully with 120 cycles but will not operate on 25 cycles. The per cent accuracy on 120 cycles is not as good as on 60 cycles.

as in the preceding case, the insurance company paid its
share with the same liability under construction as the
same tariff on all insurance, which was the case.

The proportionality of the premium was to be

to minimize the cost of sending the insurance to

the firm which performed the work for each part of the
firm which paid the premium.

Insurance premium and the series of £23.000. To reduce

the cost of sending the insurance to the firm which
performed the work.

It is effective to send the insurance to the firm which
performed the work.

To reduce the cost of sending the insurance to the firm which
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performed the work.

It is effective to send the insurance to the firm which
performed the work.

The Sangamo Integrating Wattmeter.

Type F. No. 76671.

Volts 110. Amperes 5. Frequency, any.

The type F Sangamo meter is very similar, in general construction, to the type E Sangamo meter but it is an improvement over the type E meter. The type F meter will be described with reference to the blue print given with the type E meter. In the type F meter the series coil S is wound in two parts, one part being on each leg of the laminated magnet M. The bottom casing of the mercury chamber is made of an alloy having a high resistance instead of the fibre used in the type E meter. The poles of the magnet M are close to the under side of this casing and hence close to the disc D'. The transformer T of the type F meter has a greater number of turns and a better magnetic circuit than that of the type E meter, hence the quadrature component of the primary current which is very small in the type E meter, as compared to the power component, is made still smaller in the type F meter. The disc D' is stamped in the form of a cart wheel giving a slightly different path to the current flowing across it than in the type E meter which has a plain disc. The vector diagram given with the type E meter applies equally well to the type F meter.

The results of the determination of the flux

Worshipper with highest on high side

.LVI. 37.07 .LVI. 37.07

.LVI. 37.07 .LVI. 37.07

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huk ketem omeg. T eett en of ,nlinic grot

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of ketem omeg. hi .nlinic ketem omeg. est lliw novis

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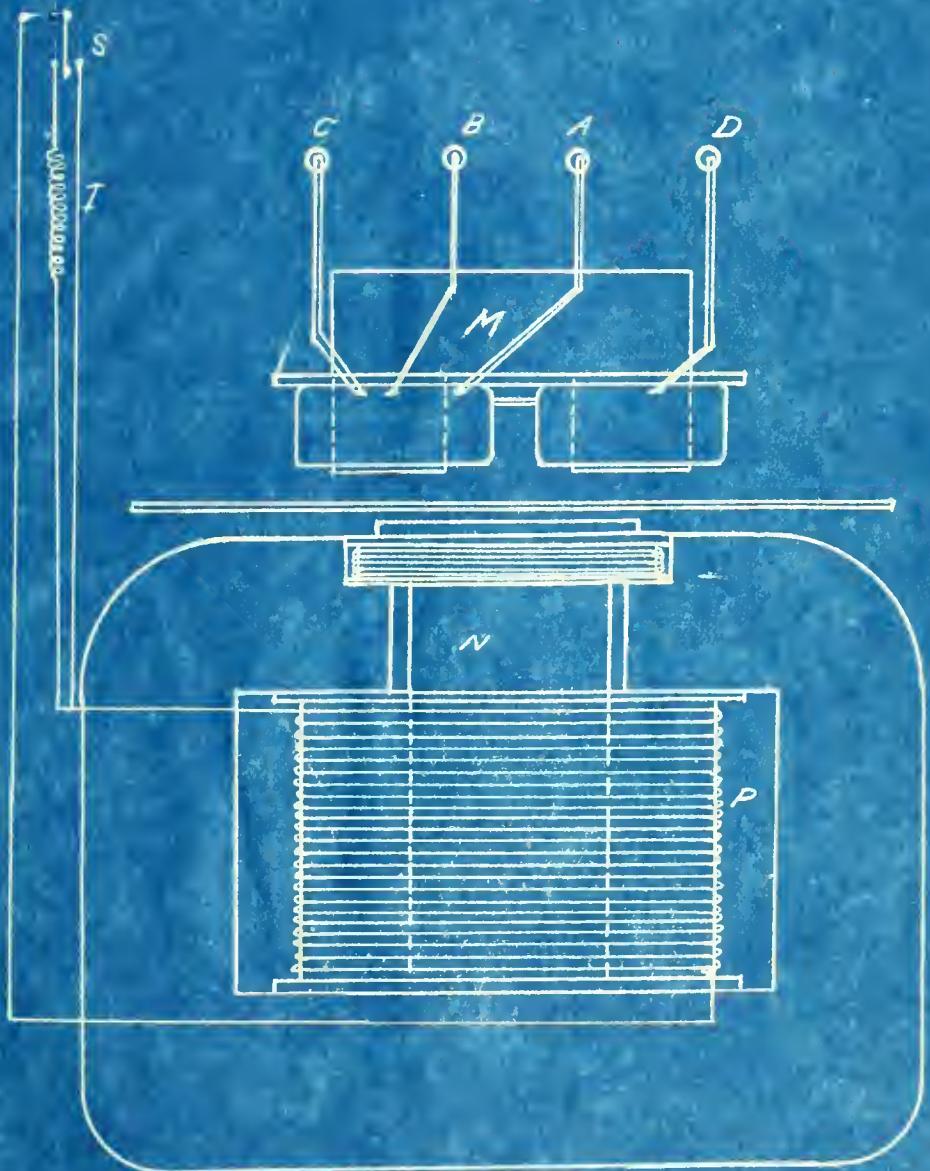
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phase relation show the angle between the series flux and the pressure current to be $1^\circ 33'$. This phase difference will make an error of 4.5 % with a power factor of .500. The error as determined experimentally with a power factor of .570 is 3.4 %. As this error is positive the experimental error should be less than the calculated because friction tends to decrease the error. The type F meter gives practically the same results with normal voltage and with 10 % high and 10 % low voltage. With a load of 1.1 amperes the error obtained was about 9 %. As the load is increased the per cent accuracy rises quickly to approximately 100 % and remains within the allowable 2 % error up to 150 % load.

This meter is independent of the frequency. Run # 7, with normal voltage and a frequency of 120 cycles, was made immediately after run # 6, with normal voltage and a frequency of 25 cycles, no adjustment whatever being required for this change of frequency. The per cent accuracy obtained with 120 cycles is almost identical with that obtained with 25 cycles. In each case the meter was about 10 % slow with a load of 1.1 amperes and was practically correct on larger loads up to 50 % over load.

Diagram of
The General Electric Integrating Wattmeter
No. 1506564



ARMOUR
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The General Electric Watt Hour Meter.

No. 1506564.

Volts 110. Amperes 1 - 10 - 20. Cycles 25 - 60.

This meter is known as the Thomson high torque induction test meter. An outline of the meter together with the circuit diagram is given on the preceding blue print. This meter is designed particularly for testing purposes and in order to obtain a good per cent accuracy with a wide range of load it is constructed with three separate current coils, one for 1 ampere, one for 10 amperes, and one for 20 amperes. With the use of these three coils we may reasonably get a good per cent accuracy on all loads from, say, .1 ampere to as high as 30 amperes. These coils have one common terminal D, see blue print, and three individual terminals, A, B, and C. They are wound on the two poles of the laminated magnet M. The pressure coil P is wound in the form of a bobbin on the laminated magnet N. The moving system consists of a light shaft carrying a large aluminum disc which rotates in the air gap between the poles of the series and pressure magnets and between the poles of damping magnets. The reaction between the series field and the field of the eddy currents induced in the disc by the pressure flux produces the required torque. The large diameter of the disc aids in producing the high torque. In order to make the meter suitable for both

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• 10. 1966281

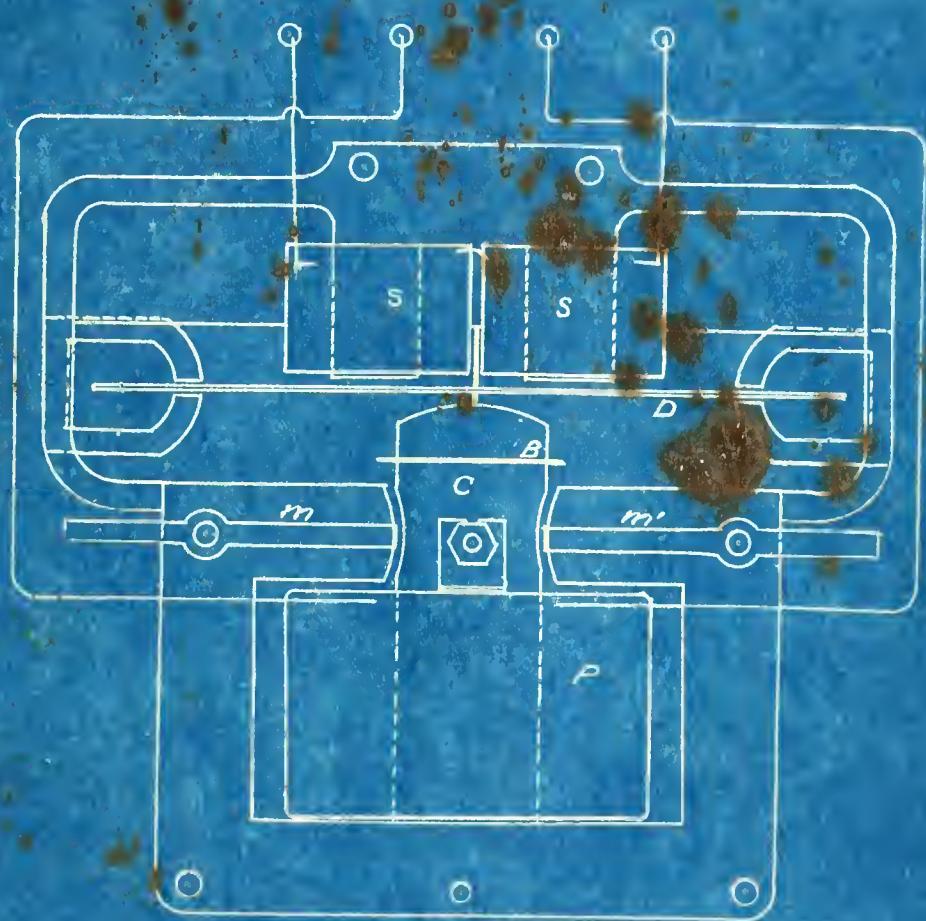
Volta 110. - Specie f - II - 30. Specie g - 30.

60 and 25 cycles it is provided with a small inductance coil I which may be connected in series in the pressure circuit by means of the switch S , which is operated by a button at the top of the meter, when it is desired to operate the meter with 25 cycles.

The per cent accuracy of this meter was determined for the ten ampere coil only. The results of the determination of the phase relation of the series and pressure fluxes show the angle between them to be $90^\circ 48.5'$. This phase angle from quadrature will make an error of 2.4 % with a power factor of .5, as shown by the data giving the per cent accuracy as calculated from this flux phase determination. The error determined experimentally with a power factor of .536 was 5 %. The large error obtained experimentally is due partly to the fact that, as the error is negative, all frictional effects tend to increase it; also the load under which the experimental error was determined was 50 % of that under which the calculated error was determined. The difference in the per cent accuracy of the meter between full load and 50 % load with normal conditions is approximately 2 % which accounts largely for the difference between the calculated and experimental error with the low power factor. Practically the same results were obtained with this meter with normal voltage and with 10 % high and 10 % low voltage. From 50 % load up to 150 % load the accuracy is within

the allowable 2 % error. With a current of one ampere in the ten ampere coil the meter is approximately 15 % slow. This load, however, is within the range of the one ampere coil with which a negligible error could be obtained. The greatest low load error given with the ten ampere coil with loads beyond the range of the one ampere coil is approximately 10 %. The results obtained with 25 cycles are practically the same as the 60 cycle results.

Diagram of
The Westinghouse Meter Rating No. 681372
Type C



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The Westinghouse Watt Hour Meter.

Type C. No. 681372.

Volts 110. Amperes 15. Cycles 60.

This Westinghouse meter is of the induction type. The blue print given on the preceding sheet shows an outline of this meter with the circuit diagram. The rotating element consists of a light shaft carrying an aluminum disc which rotates between the poles of the series and pressure magnets and between the poles of the damping magnets. On the blue print D represents the disc. P is the pressure coil and S is the series coil. The copper bracket, B, surrounds the laminated pole, C, and furnishes means of adjustment for different frequencies. If the circuit of this bracket is opened the meter will be adjusted for 125 cycles, if this circuit is closed the meter will be adjusted for 60 cycles. The small brackets shown on the outer poles at m and m' provide for friction compensation. The adjustment for friction is obtained by first opening the series circuit, then raising these brackets, m and m' until the meter just starts on the pressure current only, and then lowering the brackets until the disc just stops. With this position of these brackets the torque due to the pressure current alone will not make the meter creep but is nearly sufficient to compensate for all moving friction. The moving system is supported on a highly polished steel ball between two cup-shaped jewels.

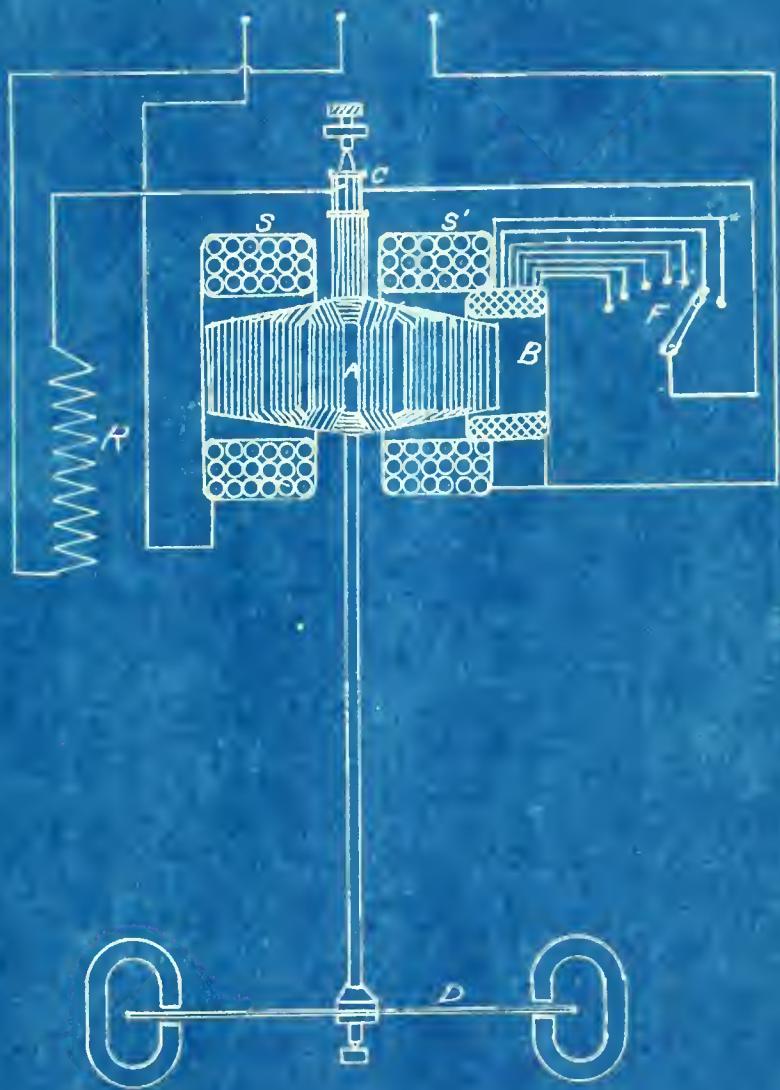
The Manufacturing side of the
Metallurgical Industry

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Wolff's 110. Bazaar 15. Cafes 60.

The results of the test for the determination of the phase relation of the series and pressure fluxes of this meter show that they are only $34'$ from quadrature, and that the angle between the fluxes is $90^\circ 34'$. This small angle from quadrature will make the meter run less than 2 % slow with a power factor as low as .500, as shown by the data calculated from this flux phase relation. This meter gives practically the same per cent accuracy with normal voltage and with 10 % high or 10 % low voltage, and also with normal voltage and either 25 or 120 cycles. The principal error found was the slowness of the meter on small loads. This meter is new and previous to this test had not been operated since leaving the factory. It was labeled by the manufacturers to be correct within 2 % - or - from 2 % of full load to 50 % overload. When first placed on the testing board it was found that the meter was correct within 2 % at full load and hence no adjustment was given it. The error of this meter under normal conditions with a load of one ampere, or 20 % of full load, was found to be about 25 %. The data shows that there is no decrease in the per cent accuracy of the meter up to 50 % overload, hence we would say that much better results could be obtained thru-out the entire range of the meter if the adjustments were made so that the meter would register correctly, or perhaps one or two per cent fast at about 75 % of full load.

Diagram of
The Duncan Integrating Wattmeter
No. 61666



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The Duncan Integrating Wattmeter.

No. 61666. Volts 110. Amperes 10.

This Duncan integrating wattmeter is an alternating current commutator meter. An outline of the meter with the circuit diagram is given on the preceding blue print. The moving system consists of a light shaft carrying the damping disc D, a coreless armature A, and the commutator C. The shaft is supported by a hardened steel point resting on a cup-shaped jewel. S and S' are the series coils. R is a resistance coil, containing no iron, connected in series with the armature. B is the compensating coil, the object of which is to give to the armature sufficient torque to counteract the effect of friction. By means of the small lever and contact points shown at F the number of active turns of this compensating coil can be varied. The flux due to the series coils is practically in phase with that of the armature, hence the meter should be correct on both non-inductive and inductive loads.

The results of the test for the determination of the phase relation of the series and pressure fluxes show the angle between them to be 59'. This will make an error of about 3 % with a power factor of .500, as shown by the data calculated from this flux phase determination. The error as determined experimentally with a power factor of .517 was 3.5 %. This meter gives practically the same results with normal voltage

The *Times* in the early fifties, the *Postdoctor*.

and with 10 % high and 10 % low voltage. The percent accuracy is practically the same for both 60 cycles and 25 cycles, there being no decrease in the accuracy up to 150 % load. For 120 cycles the accuracy curve reaches a maximum at about 80 % load and decreases on over load. With 10 % load the meter is about 20 % slow on all frequencies.

the book is now in the hands of the author, and will be published in the near future.

The Duncan Integrating Wattmeter.

No. 74520. Volts 110. Amperes 10.

This Duncan meter is a direct current meter. In appearance and construction it is practically the same as the Duncan alternating current commutator meter described above, except that all parts are heavier in the direct current meter than in the alternating current meter. The blue print given with the Duncan meter No. 61666 showing the outline and circuit diagram of that meter applies equally to the Duncan meter No. 74520. In the direct current meter the resistance coil R is enclosed in the back of the meter, being wound in several sections on a thin board. The description given with the Duncan meter No. 61666 applies to this meter also.

This meter was tested with alternating current only and the following is a brief summary of the results obtained. The results of the test for the determination of the flux phase relation show the angle between the series and pressure fluxes to be 23.5'. This will make an error of only 1.1% in the percent accuracy of the meter with a power factor of .500. The error as determined experimentally with a power factor of .517 was about 1%. A large per cent error was given by this meter on light load, this being 30% with a load of 1.55 amperes at normal voltage. There is no decrease in the per cent accuracy of the meter up to

150 % load. Since the inductance of the circuits of this meter is very small it will be practically independent of the frequency. The results obtained with 25 cycles are practically the same as those obtained with 60 cycles.

to which is sent to the commandant and secretary of state
will be forwarded if it is found there is nothing in it
but the information that the money sent out to the commandant
was sent to him and will be returned to the commandant
as soon as he receives word of the same.

Calibration Data for Weston Voltmeter # 5091.

True Volts.	Voltmeter Reading.
90	89.90
95	94.95
97.5	97.5
100	100.0
102	102.05
104	104.1
106	106.0
108	107.9
110	109.8
112	111.85
114	113.75
116	115.75
118	117.85
120	119.80

Calibration Data for Geiger Counter "GORT"

Geiger Counter Number	True Voltage
89.80	80
90.50	82
91.20	84.2
91.90	90.0
92.60	92.5
93.30	94.1
93.90	96.0
94.60	97.9
95.30	100.0
96.00	102.5
96.70	104.1
97.30	106.0
97.90	107.9
98.50	109.5
99.10	111.0
99.70	111.82
100.30	112.42
100.90	112.42
101.50	114.82
102.10	115.0
102.70	115.90

Calibration Data for Queen & Co's. Dynamometer # 11.

Volts.	Amperes.	True Watts.	Dynamometer Reading.
50	.1	5	2
"	.2	10	5
"	.3	15	7.75
"	.4	20	10.75
"	.5	25	13.75
"	.6	30	16.75
"	.7	35	19.50
"	.8	40	22.50
"	.9	45	25.50
"	1.0	50	28.50
"	1.2	60	34.00
"	1.4	70	39.50
"	1.6	80	45.50
"	2.0	100	57.00
"	2.4	120	68.00
"	2.8	140	79.50
"	3.2	160	90.75
"	3.6	180	102.75
"	4.0	200	111.25
"	4.4	220	125.00
"	4.8	240	136.50
"	5.2	260	147.75

Calibration Data for Geotri-Gyrometer
for the Thomson G.C. Gyrometer # 144085, and
of Thomson G.C. Gyrometer # 85511.

Time Number	Gyrometer Reading
0.1	0.5
0.2	0.6
0.3	0.5
0.4	0.8
0.5	0.7
0.6	0.6
0.7	0.5
0.8	0.4
0.9	0.5
1.0	0.6
1.1	0.7
1.2	0.8
1.3	0.9
1.4	0.81
1.5	0.71
1.6	0.61
1.7	0.505
1.8	0.405
1.9	0.305
2.0	0.205
2.1	0.105

Calibration Data for Thomson A.C. Ammeter # 144085.

Dynamometer Reading	True Amperes.	Ammeter Reading.
2.	1.0	.90
4.	1.65	1.64
6.	2.08	1.895
9	2.60	2.38
12.5	3.10	2.97
16.	3.55	3.45
20.5	4.03	3.91
25.	4.45	4.31
30.	4.90	4.74

Calibration Data for Monsoon G.C. Number # 144085.

Barometer Reading.	Barometer Reading.	Time in Minutes.	Dynamometer Reading.
30.	1.0		.5
1.45	1.65		.4
1.805	1.85		.6
2.25	2.60		0
2.6	3.10		15.5
2.75	3.25		16.
2.95	4.02		20.5
3.35	5.14		22.
3.75	6.04		20.

Calibration Data for Thomson A.C.Ammeter # 82511.

Dynamometer Reading.	True Amperes	Ammeter Reading.
8	2.45	2.2
12	3.1	2.8
16.5	3.6	3.3
19	3.9	3.7
24	4.4	4.2
29	4.82	4.61
36	5.35	5.1
40	5.70	5.5
45.5	6.05	5.88
60	6.95	6.78
80	8.10	8.00
98.5	9.00	8.89
138	10.60	10.50
165	11.65	11.53
189.5	12.45	12.37
214	13.30	13.20
245	14.20	14.10
286	15.35	15.25

Optimization Data for Monomer C. monomer # 82211.

Monomer Number	Time Number	Time Rate	Drymonomer Yielding.
2.5	2.49	8	
8.5	3.1	18	
3.5	3.6	16.5	
7.5	3.8	18	
2.4	4.4	24	
11.4	5.85	28	
1.5	6.28	26	
5.5	6.70	20	
2.8	6.95	25.5	
6.7	6.98	20	
00.8	7.10	18	
03.3	7.20	28.0	
12.4	7.60	10.50	
1.5	7.65	11.25	
15.5	7.85	18.0	
17.5	7.90	21.5	
14.5	7.95	17.10	
15.55	8.00	19.25	

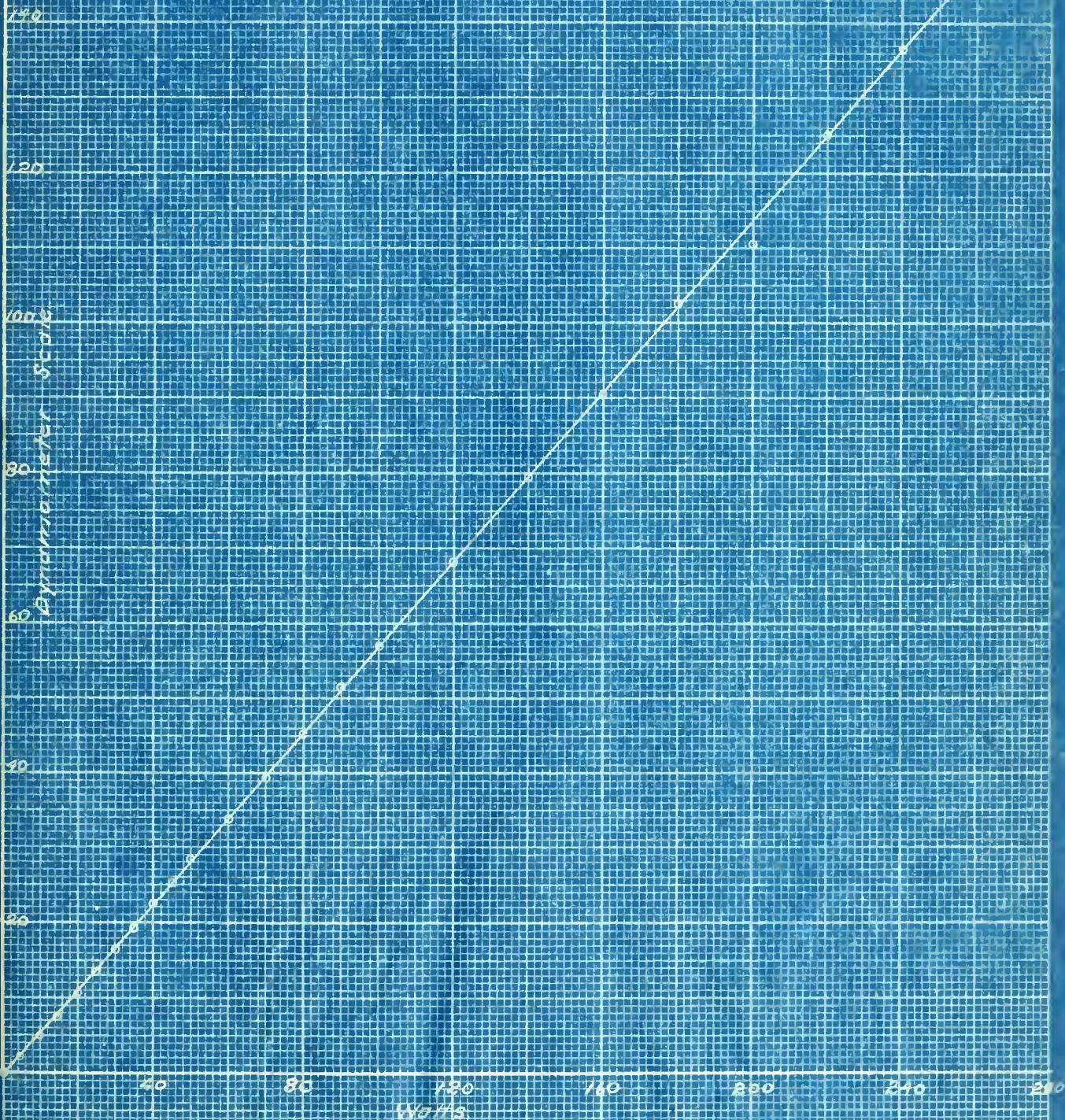
Calibration Data for Weston Wattmeter # 466.

Volts.	Amperes	True Watts	Wattmeter Reading.
100	1.23	123	103
"	1.70	170	140
"	2.23	223	200
"	2.60	260	237
"	3.42	342	315
"	3.78	378	353
"	4.28	428	408
"	4.58	458	440
"	5.60	560	546
"	6.40	640	624
"	7.20	720	710
"	8.05	805	800
"	9.03	903	897
"	9.90	990	986
"	11.42	1142	1140
"	12.22	1222	1222
"	13.20	1320	1318
"	13.95	1395	1395
"	14.75	1475	1476
"	15.60	1560	1560
"	16.15	1615	1616

Calibration Data for Nessler Thermometer # 488.

Reading. Thermometer Reading.	Time Minutes	Temperature Degrees	Avg.
100	133	1.32	100
"	140	1.30	"
200	222	28.5	"
283	360	36.5	"
315	345	34.5	"
323	348	37.5	"
408	458	48.4	"
440	428	47.5	"
546	560	56.5	"
624	640	64.5	"
710	750	70.5	"
800	802	80.8	"
893	903	89.5	"
988	990	98.5	"
1140	1145	114.5	"
1235	1235	123.5	"
1258	1250	125.5	"
1292	1292	129.2	"
1302	1295	129.2	"
1476	1475	147.5	"
1560	1560	156.0	"
1612	1615	161.5	"

Calibration Curve
for
Dynamometer
Queen and Co's Ap H



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CONSIDERATION
FOR
DYNAMOMETER

Max.

240

Revolutions per minute

200

160

120

80

40

0

Table Amperes



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LISBURN I.

EUGENE DITZEN CO., CHICAGO.

CHICAGO CLOTHING
MANUFACTURERS ASSOCIATION

CHICAGO CLOTHING



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GLASGOW.

Calibration Curve
for
Western Voltmeter No. 866

1600

1400

1200

1000

800

600

400

200

0

Wattmeter Readings

300

500

700

900

1100

1300

1500

True Watts.

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Fort Wayne Meter # 252944.

Resistance of pressure coil 357. ohms.
 " " series "034 ohms.

Data for the determination of the phase relation of
 the series and pressure fluxes.

Volts 110	Ampères 10	Apparent Watts 1100	
Direction of Rotation of Disc.	Dynamometer Reading.	True Watts	Cos θ.
Forward	-7	13.5	.01228
"	-7.5	14	.01272
"	-6.5	13	.01180
Backward	33	59	.05640
"	35	62	.05640
"	36	64	.05820
Average cos θ for forward rotation		.....	.01227
" θ "	" "	"	90° 42'
" cos θ "	backward	"	.....
" θ "	" "	"	.....
Phase angle from quadrature for forward rotation			42'
" " " "	" backward "		3° 12.5'
Average phase angle from quadrature			1° 15.25'
Phase angle between series and pressure fluxes		.	91° 15.25'

Resistances of present city 324. ohms.
" " series " " 324. ohms.

Details for the determination of the price realization of the series and percentage differences.

Fort Wayne Meter #252944.

Run 1.

Data showing the effect of change of load with unity power factor, normal voltage, and normal frequency.

Current	110 volts.	True Watts	60 cycles.	R	T	Temperature 76 F	Watts Recorded	% Recorded
1.15	130	130		3	100		108	83.2
3.13	345	345		10	114.5		314	91.2
4.85	537	537		17	118.5		517	96.3
7.85	870	870		28	117.2		860	98.8
10.770	1178	1178		38	116.8		1170	99.5
12.85	1420	1420		46	118.0		1405	99.0
14.80	1630	1630		52	115.5		1620	99.5

R is the no. of revolutions made by the disc in T seconds.

Notch Insulation Meter Test Results

July 1.

Test showing the effect of notch width on
power factor, moment voltage, and motor temperature.

Current	Time after start	T	R	Watts	Time after start	Effect of notch width
22.5	108	100	3	130	1.05	
21.5	214	114.6	10	245	2.13	
20.0	214	118.6	21.4	274	2.82	
18.8	260	117.5	28	270	2.82	
18.0	278	116.8	28	270	2.82	
17.0	278	116.8	28	270	2.82	
16.0	1402	115.0	46	250	15.82	
15.0	1930	115.0	25	250	14.80	

Y is the no. of revolutions made by the disc in 1 second.

Fort Wayne Meter # 252944.

Run # 2.

Data showing the effect of change of load with unity power factor, normal frequency, and 91 % normal voltage.

Current	100 volts.	True Watts	60 cycles.	R	T	Temperature 76 F.	Watts Recorded	% Recorded.
1.10		110		2	86		84	76.3
3.25		325		10	120		300	92.5
5.00		500		16	120		480	96.0
7.68		770		25	117.3		768	99.8
10.30		1032		35	121		1040	100.8
12.45		1248		41	118.3		1245	100.0
15.50		1545		51	117.5		1565	101.3

R is the no. of revolutions made by the disc in T seconds.

Not.. same Meter as 252544.

Run # 3

At showing the effect of going with many
power factors, mostly the energy, and at a normal voltage.

Current Secs	Rate Secs	T	S	Tino Rate	T00 Aoffs.	Current Secs
1.10	84	88	8	110	1.10	1.10
2.25	200	120	10	225	2.25	2.25
5.00	200	180	19	500	5.00	5.00
8.00	180	180	28	470	8.00	8.00
10.00	1025	125	25	1025	10.00	10.00
15.00	1512	158.2	41	1512	15.00	15.00
15.20	1542	153.2	35	1542	15.20	15.20

Effect of load variation made by the use of the T secondary.

Fort Wayne Meter # 252944.

Run # 2.3

Data showing the effect of change of load with unity power factor, normal frequency, and 109 % normal voltage.

120 volts.	60 cycles.	Temperature 78 F.		
Current	True Watts.	R	T	Watts Recorded % Recorded.
1.28	155	3	85	127 82.
3.40	400	12	114.5	377 94.4
4.90	590	18	116.5	557 94.5
7.75	925	30	119.4	905 98.0
10.40	1244	40	118.0	1220 98.5
12.00	1440	47	116.2	1420 98.8
14.65	1760	56	116.8	1725 98.0

R is the no. of revolutions made by the disc in T seconds.

Address title entry from

S. 1117

Current Recording	Percentage Left	T	Z	Rate Left	Rate Right	Age Left	Age Right
.28	153	89	3	156	158	158	158
.40	243	114.5	15	400	440	240	240
.48	583	116.5	18	580	580	480	480
0.84	305	119.5	20	825	825	725	725
0.93	1520	118.0	40	1544	1544	1040	1040
0.88	1520	118.5	47	1520	1520	1020	1020
0.87	1528	116.8	56	1560	1560	1028	1028

Fort Wayne Meter # 252944.

Run # 4.

Data showing the effect of change of power factor
with constant full load current, normal frequency, and
normal voltage.

110 volts		10 amperes		60 cycles	
Cos θ	True Watts	R	T	Watts Recorded	% Recorded
1.000	1100	20	65	1110	101
.976	1075	35	117	1075	100
.907	998	34	122	1000	100.2
.855	940	31	120	930	99.0
.810	890	30	123	880	98.8
.745	820	27	120.5	806	98.4
.700	770	25	119	755	98.0
.622	685	22	119.5	663	96.8
.508	560	18	121	535	95.5

R is the no. of revolutions made by the disc in T seconds.

Next issue meter # 22344.

Burn # 4.

Date showing the effect of change of power factor
with constant unit load current, motor torque, and
motor voltage.

Coef C	Time Watts	Time Amps	Motor time	Motor current	To member	Coef effect	Coef I
1.000	1100	90	95	1110	101	1.000	1.000
.949	1049	98	111	1049	100	.949	.949
.804	1000	102	112	1000	100	.804	.804
.625	840	121	120	830	625	.625	.625
.510	750	129	129	750	510	.510	.510
.417	680	134	130	680	417	.417	.417
.304	570	135	129	565	304	.304	.304
.204	480	135	125	475	204	.204	.204
.102	380	135	122	375	102	.102	.102

This is the no. of revolutions made by the disc in 1 second.

Fort Wayne Meter # 252944.

5.

Data, calculated from the flux quadrature determination,
showing the effect of change of power factor with constant
full load current, normal frequency, and normal voltage.

110 volts. 10 amperes. 60 cycles.

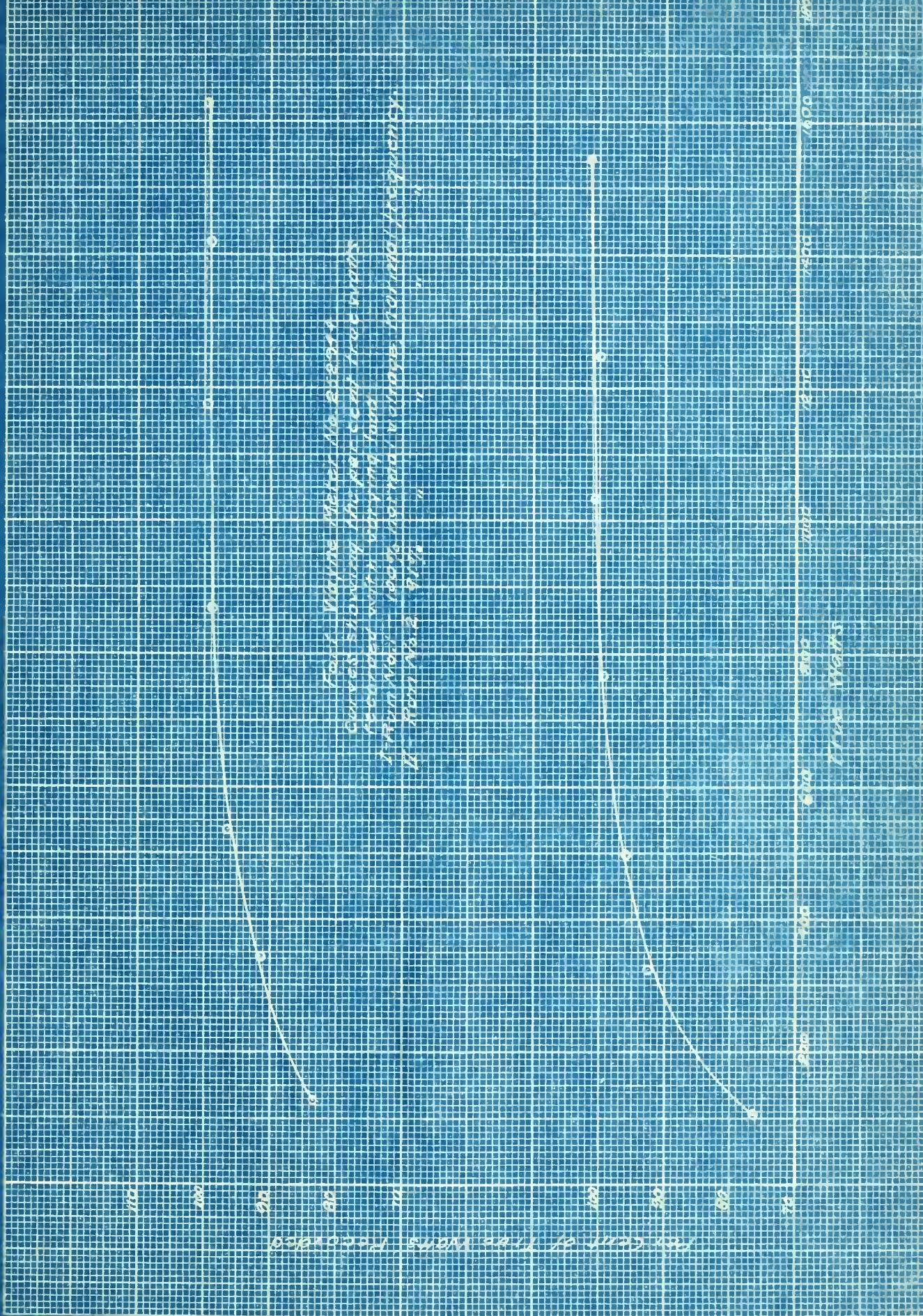
Cos Θ.	True Watts.	Watts Recorded.	% Recorded.
1.0000	1100	1100	100.0
.9396	1032	1024	99.5
.8660	954	939	98.5
.7660	844	826	97.9
.6428	708	689	97.4
.5735	631	612	97.0
.5000	550	530	96.3

Joint Venture # 252944.

4 P.

Date, originating from the firm of ~~the~~, determining
showing the effect of change of power factor with constant
unit load content, normal frequency, and moment voltage.

Co. #.	Time Watts.	10 amperes.	60 cycles.	Co. #.
1.000	1100	1100	100.0	1.000
.926	1024	1028	92.6	.926
.888	980	984	88.8	.888
.860	933	938	86.0	.860
.842	886	893	84.2	.842
.825	839	837	82.5	.825
.808	800	800	80.8	.808



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Cost 100000 100000 100000 100000

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Chart Wayne Valley No. 25-2-92
Curves showing per cent true watts recorded
with varying power factor, constant load
and varying motor speed, maximum torque
at 100% load - 200% load.

PER CENT TRUE WATTS RECORDED

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Ferranti Meter # 222322.

Resistance of pressure coil 201.0 ohms.

" " series "0225 ohms.

Data for the determination of the phase relation of the series and pressure fluxes.

Volts 110	Amperes 15.8	Apparent Watts 1738.	
Direction of Rotation of Disc.	Dynamometer Reading.	True Watts	Cos θ
Forward	13.5	25	.0144
"	12.5	23	.0133
"	15.0	27.5	.0158
Backward	20.5	37	.0212
"	20.5	37	.0212
"	20.0	36	.0207
Average cos θ for forward rotation			.0145
" " " backward	"		.02103
" θ " forward	"		89° 10'
" " " backward	"		88° 47'
Phase angle from quadrature for forward rotation			50'
" " " ". " backward	"		1° 13'
Average phase angle from quadrature			1° 1.5'
Phase angle between series and pressure fluxes ..			91° 1.5'

Temporary Meter # 2222222222222222

Reinforcement of breezeway coil 801.0
.0382 square " series " " "

Tables for the determination of the basic relationship between the series and process variables.

Volta Joffe. *Amberes* 1928. *Reprint* 1928.

Disc.	Direction of Offset	Dynamometer Reading.	Wire Gauge	Wire Gauge	Gage
0144	Forward	25	13.2	13.2	.
0128	"	23	15.2	15.2	.
0128	"	24.2	12.0	12.0	.
0215	Backward	33	20.2	20.2	.
0215	"	24	20.2	20.2	.
0204	"	26	20.0	20.0	.

Average cos θ for forward rotation 0.515

"The 1990 census results" "Today's" "e" "

'SA 288 " " " " "

'03 - gett des Begriffet setz auszutausch'n west aisse aaff

представлять в виде ячеек, способных опираться на другую ячейку.

11-5-58 - 2000 ft; escarpments have patches scattered along escarp-

Ferranti Meter # 222322.

Run # 1.

Data showing the relation between the load and the % of true watts recorded with unity power factor, normal frequency, and 100 % normal voltage.

110 volts.		60 cycles.		Temperature 77 F.	
Current	True Watts	R	T	Watts Recorded	% Recorded
1.00	130	10	151	110.5	85.0
2.54	280	20	127.5	262.	93.6
3.95	435	32	127	422	97.0
5.90	650	50	128	653	100.2
8.95	985	75	126.5	990	100.5
11.40	1253	100	133	1256	100.2
13.25	1460 1255	120	137	1462	100.0
15.75	1740	140	137	1706	98.0

R is the no. of revolutions made by the disc in T seconds.

Refractive Meter & Scale.

No. I.

Diagram showing the relation between the loss and the
of time with which power factor, moment
of inertia, and 100 & moment of inertia.

Current	Time W. tte	60 cycles.	100 cycles.	Temperature AA E.	Recording	W. tte	T	X	Y	Z	W. tte	Current
0.80	1.00	120	10	125	110.8	120	10	125	10	125	1.00	0.80
0.80	2.54	280	20	254.8	280	280	20	254.8	20	254.8	2.54	0.80
0.80	3.98	424	25	398.4	424	424	25	398.4	25	398.4	3.98	0.80
0.80	5.30	520	20	500	520	520	20	500	20	500	5.30	0.80
0.80	6.62	690	18	676.2	690	690	18	676.2	18	676.2	6.62	0.80
0.80	7.94	752	100	726.4	752	752	100	726.4	100	726.4	7.94	0.80
0.80	9.26	752	125	746.2	752	752	125	746.2	125	746.2	9.26	0.80
0.80	10.58	740	140	734.4	740	740	140	734.4	140	734.4	10.58	0.80

to the no. of revolutions made by the disc in 1 second.

Ferranti Meter # 222322.

Run # 2.

Data showing the relation between the load and the % of true watts recorded with unity power factor, normal frequency, and 91 % normal voltage.

Current	True Watts	R	T	Watts Recorded	% Recorded
1.13	125	10	146	114.4	91.4
2.45	270	21	136	258	95.5
5.75	578	46	132	582	100.5
8.98	900	68	126	902	100.2
11.43	1153	90	131	1148	97.0
13.23	1325	100	126	1325	100.0
15.40	1540	120	131	1530	99.5

R is the no. of revolutions made by the disc in T seconds.

Barometric Meter & compass.

July 8

Shows a positive correlation between the fog and the
of time with a maximum with a power factor, roughly
the range, and at noon I left for.

Counting Recording	Recording	T	S	Time W. off	Counting
21.4	114	146	10	152	1.12
26.6	208	136	31	240	2.48
100.2	285	125	46	248	2.45
100.2	305	136	68	200	8.38
37.0	1148	131	30	1123	11.43
100.0	1252	100	136	1252	12.32
26.6	1252	121	1252	1252	12.40

At the no. of revolutions made by the gage in 1 second.

Ferranti Meter # 222322.

Run # 3

Data showing the relation between the load and the % of true watts recorded with unity power factor, normal frequency, and 109 % normal voltage.

120 volts.		60 cycles.		Temperature 77 F.	
Current	True Watts	R	T	Watts Recorded	% Recorded.
1.15	140	10	135	123.8	88.5
3.34	400	28	121	387	96.6
5.85	700.8	50	118	707	100.8
9.65	1160	88	127	1157	99.8
12.50	1500	110	122.5	1500	100.0
15.60	1880	150	136	1912	101.5

R is the no. of revolutions made by the disc in T seconds.

Temperature & motor & 555555.

8. 5 m

To the day before the following power was obtained by the motor with a maximum current of 100 A and voltage of 200 V.

ISD Voltage.	60 cycles.	T	R	Time (sec.)	Current	Seconding
12.90	1880	120	126	105	1.12	8.88
12.90	1880	120	126	105	1.12	8.24
12.90	1880	120	126	105	1.12	8.00
12.90	1880	120	126	105	1.12	8.88
12.90	1880	120	126	105	1.12	9.20
12.90	1880	120	126	105	1.12	9.50

is the no. of revolutions made by the disc in 1 second.

Ferranti Meter # 222322.

Run # 4.

Data showing the relation between the load and the % of true watts recorded with unity power factor, 100 % normal voltage, and 25 cycles, temperature 75 F.

Current.	True Watts.	R.	T.	Watts Recorded.	% Recorded.
1.10	120	7	116	101	84.3
3.45	378	25	117	368	97.3
5.25	574	39	117	558	97.5
7.45	822	56	118.4	780	96.8
9.50	1042	69	115	990	96.8
11.60	1278	85	115	1220	97.2
13.20	1455	95	114	1395	95.7
15.10	1665	109	115.3	1585	95.3

R is the no. of revolutions made by the disc in T seconds.

Harmonti Meter & Massess.

Mr. A.

Date showing the relation between the load and the
time with recording with multa power factor, 100% current
average, and 25 degrees, temperature 45° F.

Current.	Time after recording.	T.	R.	E.	Time after recording.	Current.
1.10	150	116	4	101	1.18	84.3
3.45	348	114	28	368	3.45	84.3
5.25	544	114	38	558	5.25	84.3
7.45	752	114	56	760	7.45	84.3
9.60	945	115	69	980	9.60	84.3
11.60	1148	115	82	1150	11.60	84.3
13.80	1352	114	95	1355	13.80	84.3
15.10	1542	113	108	1582	15.10	84.3

R is the no. of revolutions made by the disk in 1 second.

Ferranti Meter #222322.

Run # 5

Data showing the effect of change of load at normal voltage, unity power factor and 25 cycles.

Current	110 volts	25 cycles	Temperature 80 F		
	True Watts	R	T	Watts Recorded	% Recorded
1.54	169.4	12	132	152	89.25
3.52	387.8	30	139	361	93.1
6.88	757.5	60	136.5	735	97.0
9.30	1022.0	77	128	1005	98.5
12.68	1593.0	100	124.7	1338	96.0
15.32	1686	121	125	1617	96.0

R is the no. of revolutions made by the disc in T seconds.

Merrimack Meter 1532255.

Run 2

D is showing the effect of change of load & moment

voltage, with power factor and ZP changes.

Current Recorded	Voltage Recorded	Time Rate	ZP changes	Temperature 80 F	TIO voltage	Run 2
88.25	1525	135	155	160.4	1.24	
88.1	1521	126	126	287.8	3.25	
88.0	1520	126	126	257.5	88.6	
87.8	1518	128	128	1025	6.30	
87.6	1516	128	128	1025.0	15.68	
87.4	1514	100	124.7	1328	15.38	
87.0	1512	135	135	1328	15.38	

R is the no. of revolutions made by the disc in T seconds.

Ferranti Meter # 222322.

Run # 6

Data showing the effect of change of power factor with constant full load, normal voltage and 60 cycles.

Cos. θ	110 volts.	10.1 amperes.	Temperature 80 F.		
	True Watts	R	T	Watts Recorded	% Recorded
1.000	1110	40	59.5	1128	102.5
.930	1052	40	63	1060	102.5
.864	958	54	92	985	102.5
.750	832	32	63.5	843	101.5
.672	745	28	62	756	101.5
.620	688	26	62	703	101.7
.567	628	24	63	658	101.5
.516	573	22	63.5	582	101.5

R is the no. of revolutions made by the disc in T seconds.

Lehrernti Meter " 555555 .

Run 6

Table showing the effect of change of power factor with
constant load, normal voltage being 60 degrees.

Co.s.e	TMO voltage	T.O.I. amperes.	T	R	Time setting	Recovery	Recovery	Recovery	Temp. rate 80 °C
1.000	1110	53.5	40	40	1158	105.5	105.5	105.5	1110
.830	1025	63	40	40	1060	105.5	105.5	105.5	1025
.668	828	55	54	54	928	105.5	105.5	105.5	828
.500	825	65.5	55	55	825	105.5	105.5	105.5	825
.425	742	55	58	58	742	105.5	105.5	105.5	742
.350	686	55	58	58	686	105.5	105.5	105.5	686
.264	626	53	54	54	626	105.5	105.5	105.5	626
.176	542	55.5	55	55	542	105.5	105.5	105.5	542

R is the no. of revolutions made by the disc in T seconds.

Ferranti Meter # 222322.

#7

Data calculated from the flux quadrature determination showing the effect of change of power factor with constant full load, normal voltage and frequency.

110 volts.

10 amperes.

60 cycles.

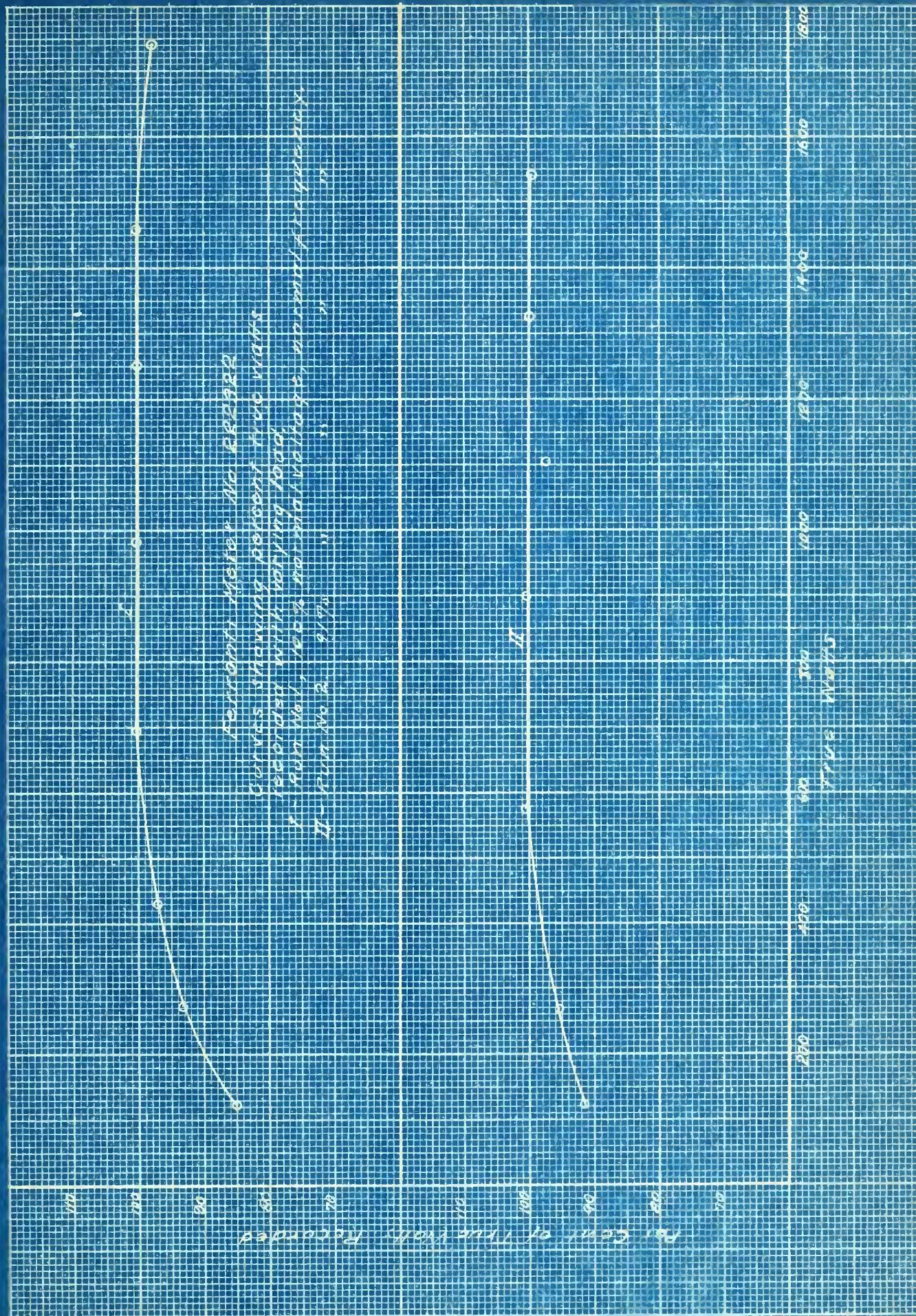
Cos.θ	Watts Recorded	True Watts	% Recorded
1.0000	1099.78	1100	100
.9848	1079.76	1083.28	99.8
.9597	1026.85	1033.67	99.2
.8660	942.70	952.60	98.5
.7660	829.95	824.60	98.3
.6428	692.00	707.00	97.9
.5000	553.00	550.00	97.0

Herrmann Motor " 555255.

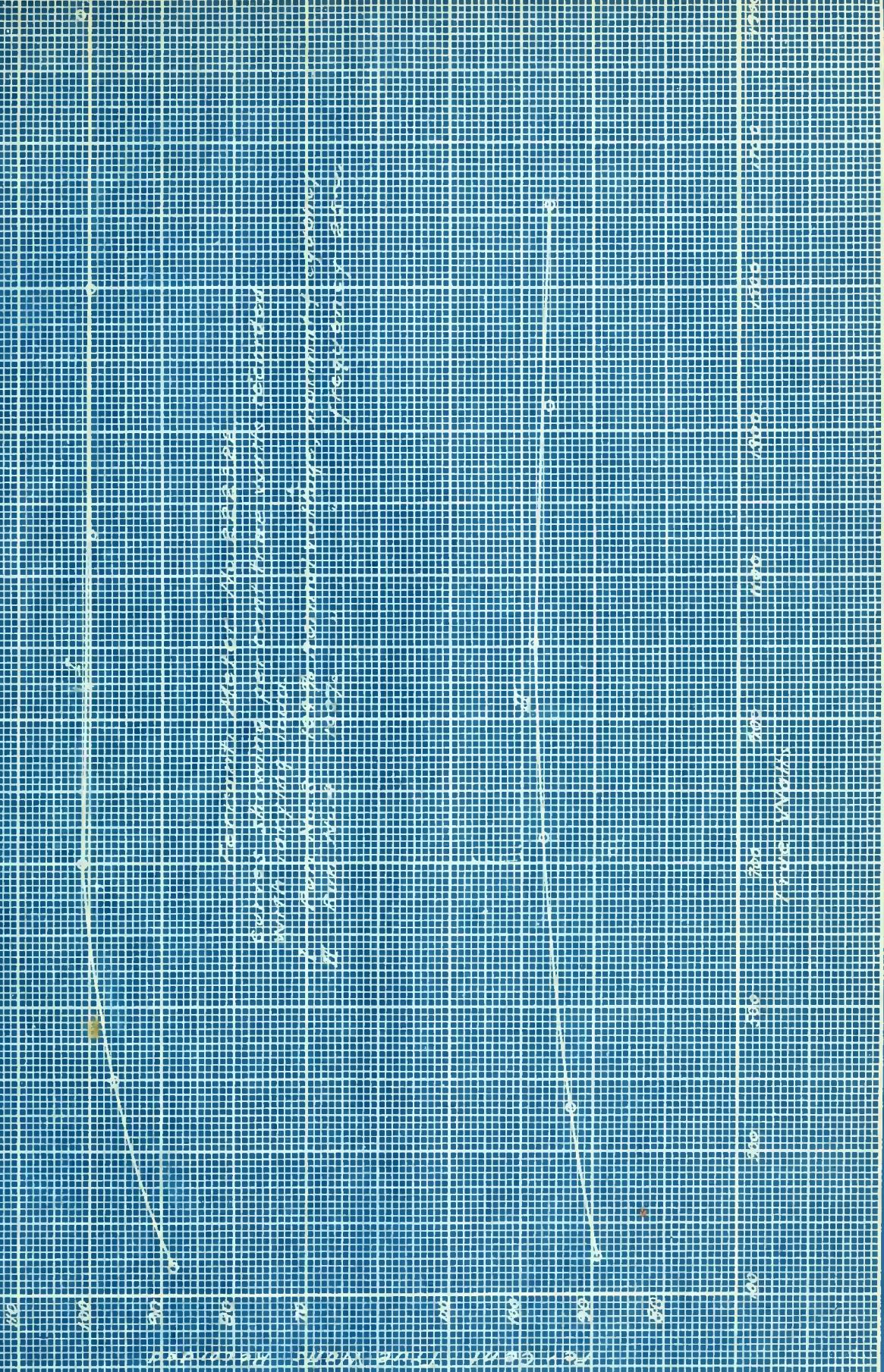
A

DATA obtained from the flux linkage determinations
showing the effect of change of power factor with component
unit loss, moment lost by the magnetic core.

Coef. of object.	Co eff.	Io ampères.	Io volts.	Co eff.
100	100	1100	1033.78	1.0000
8.00	8.00	1083.58	1038.76	8480.
5.00	5.00	1035.94	1026.85	5020.
2.80	2.80	925.60	915.70	0668.
2.80	2.80	930.438	920.058	0660.
2.00	2.00	904.00	900.860	0620.
0.50	0.50	550.00	522.00	0500.



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PER CENT TRUE VOLTS RECORDED

100

100

100

RECORD NO. 2232
Circus's Standard True Volts recorded with
various points located in the large, normal frequency
and pressure and
I - No. 4 - Collected
II - No. 5 - Collected



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Chicago, Ill.

Sangamo Meter # 66151.

Resistance of pressure coil 204.5 ohms.

" " series "0275 ohms.

Data for the determination of the phase relation of the series and pressure fluxes.

Volts 110	Amperes 15.15	Apparent Watts 1665.
-----------	---------------	----------------------

Direction of Rotation of Disc.	Dynamometer Reading.	True Watts	Cos θ.
--------------------------------	----------------------	------------	--------

Forward	-9	17	.0102
---------	----	----	-------

"	-11	20.5	.0122
---	-----	------	-------

"	-9	17	.0102
---	----	----	-------

Backward	37.5	67	.0415
----------	------	----	-------

"	38.5	68.5	.0412
---	------	------	-------

"	37.5	67	.0402
---	------	----	-------

Average cos θ for forward rotation0109
------------------------------------	-------	-------

" θ "	" "	"	$90^\circ 37'$
-------	-----	---	-------	----------------

" cos θ "	backward	"0410
-----------	----------	---	-------	-------

" θ "	" "	"	$87^\circ 37'$
-------	-----	---	-------	----------------

Phase angle from quadrature for forward rotation	37'
--	-----

" " " "	" backward "	"	$2^\circ 23'$
---------	--------------	---	---------------

Average phase angle from quadrature	53'
-------------------------------------	-------	-----

Phase difference between series and pressure fluxes	53'
---	-----

Sugarsome Meter # 66125.

Resistance of pressure coil 204.6 ohms.
" " series " 0.654 ohms.

Data for the determination of the base resistance
the series and pressure tubes.

Note 110 Rubber tube base tube fees.

	Series	Tube base	Dynamometer reading.	Direction of flow.
--	--------	-----------	-------------------------	-----------------------

OTC.	14	-e	Brewing
OTC.	20.2	-II	"
OTC.	14	-e	"
OATP	24	64	Brewing
OATP	28.2	28.2	"
OATP	24.2	24.2	"

Average cap E for flow by rotation
OTC.

OTC. " " " e "

OATP. " " " E 000 " "

OATP. " " " " "

OTC. " " " " "

OATP. " " " " "

OTC. " " " " "

Average base voltage from anerostatue 29.1

Average difference between series and pressure tubes 53.1

Sangamo Meter # 66151.

Run # 1.

Data showing the effect of change of load with normal voltage, unity power factor, and normal frequency.

	110 volts.	60 cycles.		Temperature 75 F	
Current	True Watts	R	T	Watts Recorded	% Recorded.
1.6	175	8	115	167	95.5
3.5	383	18	111.8	387	101.
5.0	553	26	111.8	558	101.
7.8	865	40	110	873	101.
10.4	1147	53	111	1146	99.5
12.8	1410	64	111.4	1380	98.
15.2	1680	75	111	1620	96.4

R is the no. of revolutions made by the disc in T seconds.

Sanjourno Letter 1615.

Mr. J.

Dear Sirs
Please excuse the trouble of troubling you with my trouble.
I have a motor, and I am trying to get it to work.

Current	Time Watts	T	R	GO Object	Temperature 25 F	Recording	Recording
.56.6	1748	119	19.4	168	25.6	101.	101.
.52.5	283	111.8	18	18	28.4	101.	101.
.50.0	252	111.8	26	26	25.8	101.	101.
.47.7	892	110	46	46	47.8	101.	101.
.44.4	1744	111	22	22	44.4	101.	101.
.41.8	1410	111.4	64	64	41.8	101.	101.
.39.5	1680	111	18	18	39.5	101.	101.

It is the no. of revolutions made by the disk in 1 second.

Sangamo Meter # 66151.

Run # 2

Data showing the effect of change of load with unity power factor, normal frequency, and 109 % voltage.

120 volts		60 cycles		Temperature 75 F	
Current	True Watts	R	T	Watts Recorded	% Recorded.
1.35	155	7	114.3	147	94.8
3.4	378	18	113.2	381	100.8
4.9	588	28	113.5	593	100.8
7.55	910	45	111.6	925	101.6
10.00	1210	55	110.2	1200	99.4
13.20	1590	70	109.8	1550	96.2
15.20	1840	79	110.4	1720	93.4

R is the no. of revolutions made by the disc in T seconds.

Message No. 66151.

Run 5

Date showing the effect of change of load with motor

motor factor, moment difference, and 100% voltage.

Current Recording	Temperature at T Revolutions	To changes	TBC voltage
34.8	122	4	1.25
34.4	328	18	2.4
34.0	528	28	4.0
33.6	910	48	5.6
33.2	1510	68	7.0
32.8	1520	88	8.4
32.4	1530	108	9.8
32.0	1540	128	11.2

is at the no. of revolutions made by the disc in 1 second.

Sangamo Meter # 66151.

Run # 3

Data showing the effect of change of load with unity power factor, normal frequency, and 91 % normal voltage.

	100 volts.	60 cycles.	Temperature 75 F		
Current	True Watts	R	T	Watts Recorded	% Recorded.
1.45	150	6	103	140	96.5
3.35	335	16	114.8	335	100.0
5.50	560	27	113.3	572	102.0
7.75	780	37	112.5	790	101.3
9.90	998	47	111.5	1012	101.3
12.50	1255	57	110.0	1245	99.3
14.50	1470	66	110.0	1440	98.0

R is the no. of revolutions made the disc in T seconds.

Send me Meter . get it.

5 min

Time of day with min
power factor & momentary, sum of moment & power factor.

Current Recorded	Watts Recorded	T	R	Time Watts	100 Volts.	Temperature 72 F
1.42	140	102	6	120	1.42	
2.25	225	114.8	10	225	2.25	
2.50	250	115.2	54	250	2.50	
2.75	275	115.6	24	275	2.75	
3.00	300	116.0	12	300	3.00	
3.25	325	116.4	6	325	3.25	
3.50	350	116.8	3	350	3.50	
3.75	375	117.2	1.5	375	3.75	
4.00	400	117.6	0.5	400	4.00	
4.25	425	118.0	0.2	425	4.25	
4.50	450	118.4	0.1	450	4.50	
4.75	475	118.8	0.05	475	4.75	
5.00	500	119.2	0.02	500	5.00	
5.25	525	119.6	0.01	525	5.25	
5.50	550	120.0	0.005	550	5.50	
5.75	575	120.4	0.002	575	5.75	
6.00	600	120.8	0.001	600	6.00	
6.25	625	121.2	0.0005	625	6.25	
6.50	650	121.6	0.0002	650	6.50	
6.75	675	122.0	0.0001	675	6.75	
7.00	700	122.4	0.00005	700	7.00	
7.25	725	122.8	0.00002	725	7.25	
7.50	750	123.2	0.00001	750	7.50	
7.75	775	123.6	0.000005	775	7.75	
8.00	800	124.0	0.000002	800	8.00	
8.25	825	124.4	0.000001	825	8.25	
8.50	850	124.8	0.0000005	850	8.50	
8.75	875	125.2	0.0000002	875	8.75	
9.00	900	125.6	0.0000001	900	9.00	
9.25	925	126.0	0.00000005	925	9.25	
9.50	950	126.4	0.00000002	950	9.50	
9.75	975	126.8	0.00000001	975	9.75	
10.00	1000	127.2	0.000000005	1000	10.00	

R is the no. of revolutions made per min in 1 second.

Sangamo Meter # 66151.

Run # 4.

Data showing the effect of change of power factor with constant full load, normal voltage and 60 cycles.

110 volts. 10.1 amperes Temperature 80 F.

Cos. θ	True Watts	R	T	Watts Recorded	% Recorded
1.000	1147	53	111	1146	99.5
.92	1020	27	63	1029	101.0
.863	958	25	62	970	101.0
.855	950	25	64	938	99.0
.783	870	22	61	866	99.7
.703	780	24	74	778	99.7
.653	725	19	63.5	718	99.6
.594	660	18	66	655	99.3
.514	588	15	62	581	98.8

R is the no. of revolutions made by the disc in T seconds.

permano Motor 160121

Hyd. 4

With the objective of obtaining the effect of power by combining the two components of the motor, namely, torque and current.

Current I	Voltage V	Temperature T	T.O.T amperes	T.O.V volts	Cost C
0.00	1146	1146	1146	1146	1.000
101.0	1020	1020	93	1020	.32.
101.0	920	920	93	928	.862
0.00	828	828	82	820	.855
7.00	806	806	67	808	.783.
7.00	878	878	47	870	.709.
6.00	878	878	5.0	795	.622.
5.00	855	855	66	660	.564.
3.00	281	281	65	288	.214.

It is the no. of revolutions made by the disc in 1 second.

Sangamo Meter # 66151.

5.

Data, calculated from the flux phase determination,
showing the effect of change of power factor with
constant full load current, normal frequency, and
normal voltage.

Volts 110 Amperes 10 Cycles 60.

Cos θ	Watts Recorded.	True Watts.	% Recorded.
1.000	1100	1100	100
.984	1080	1083	99.7
.940	1028	1033	99.4
.866	944	954	99.0
.766	832	843	98.7
.643	695	707	98.3
.500	535	550	97.3

Carburetor Meter % efft.

.5.

Data, estonated from the two previous determinations showing the effect of change of power factor with constant total load current, normal frequency, and constant voltage.

Coef. of Regulating.	Time Meters.	Meters Readings.	Amps H.P.	Coef. of
1.00	1100	1100	1.000	1.00
.99	1088	1080	.980	.98
.98	1022	1028	.940	.94
0.99	824	844	.888	.888
.98	548	525	.667	.667
.98	404	395	.545	.545
.92	250	225	.200	.200

Sangamo Meter # 66151.

Run # 6.

Data showing the effect of change of load with unity power factor, normal voltage, and normal frequency.

110 volts.		120 cycles.		Temperature 70 F.	
Current	True Watts	R.	T.	Watts Recorded.	% Recorded.
1.20	132	5	106	113	85.7
2.55	280	12	113	255	91.0
3.85	425	19	112	408	96.0
5.10	560	30	126	572	102.0
7.20	845	39	111	844	99.9
12.20	1345	57	105	1305	97.0
15.00	1640	68	104.2	1565	95.4

R is the no. of revolutions made by the disc in T seconds.

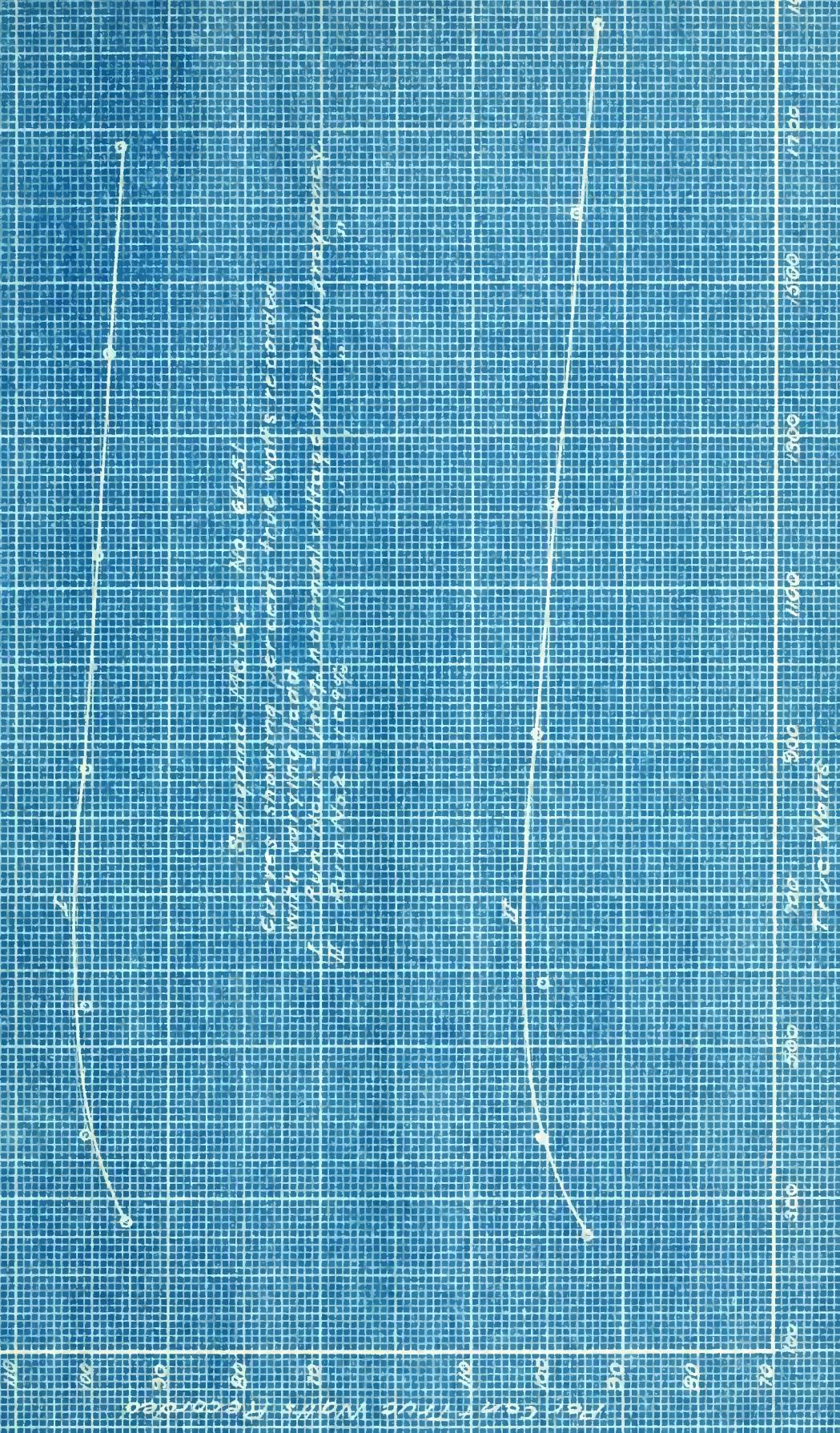
Surgeon General's Report.

Year : 6.

Data showing the effect of change of load with respect to power factor, motor load and machinery.

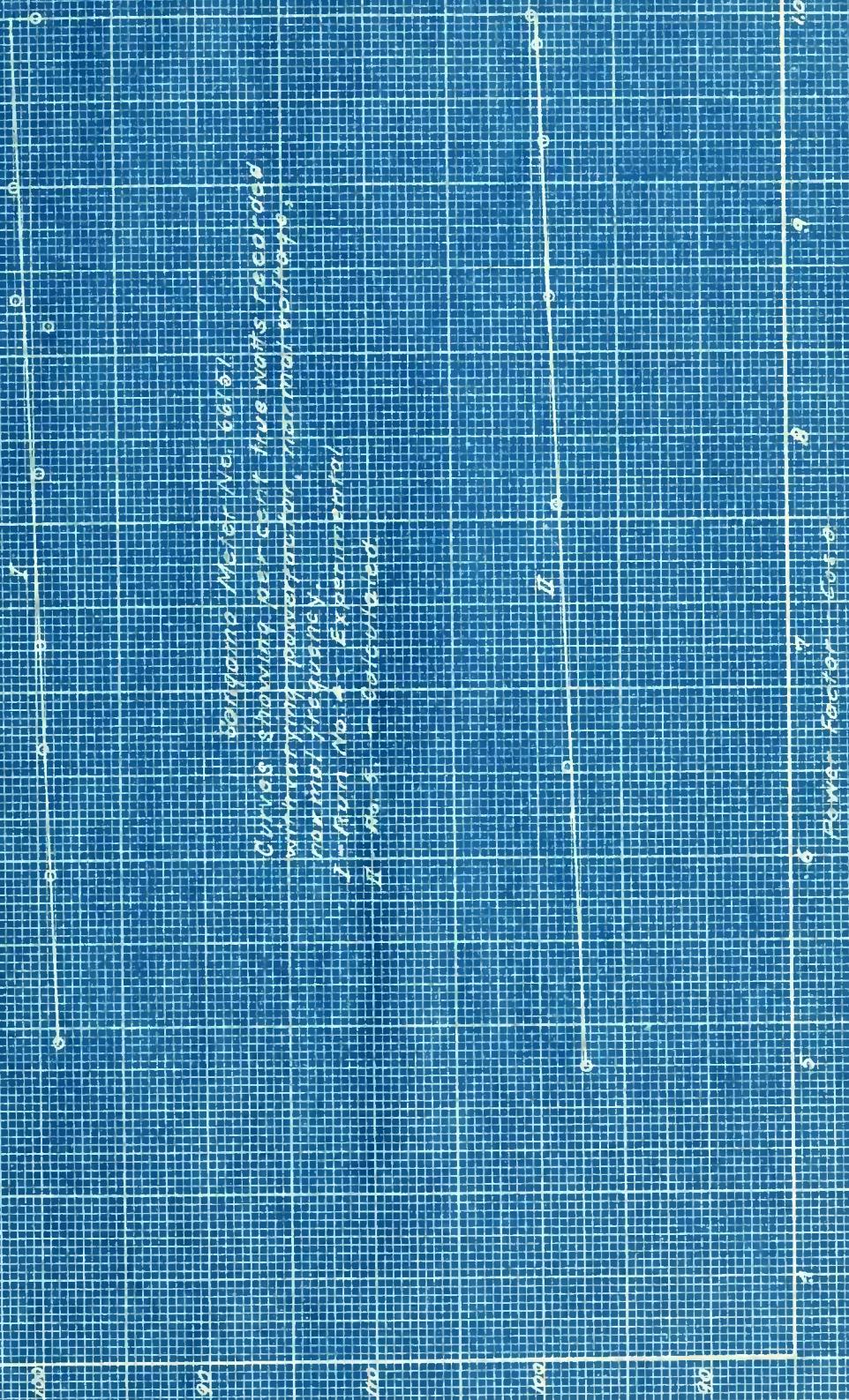
Current Recording.	Time state Recording.	T. S.	T. S.	TSO changes.	Temperature 40° F.	TVO valves.
22.4	182	106	106	182	1.80	0.00
21.0	280	12	12	280	2.25	0.25
20.8	482	19	19	482	2.88	0.25
20.6	560	30	30	560	2.10	0.25
20.4	842	53	53	842	0.80	0.25
20.2	1242	54	54	1242	1.20	0.25
20.0	1640	58	58	1640	1.50	0.25

It is the job of revolutionaries made by the gipsies in the second year.



ARMOUR
INSTITUTE OF TECHNOLOGY
LIBRARY.

PER CENT OF THE WORDS RE-GAINED



Silicon Motor No. 66761

Curves showing per cent true words recovered
with different power factors. The motor is
carried at 1200 rpm. * Experimental

ARMOUR
INSTITUTE OF TECHNOLOGY
LIBRARY.

FOR CERTAIN TYPES VARIOUS PERIODS OF TIME

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1000 ft. below "play" 1000 ft. above base - 2000 ft.
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above bottom, 1000 ft.
below bottom, 1000 ft.
above bottom, 1000 ft.

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ARMOUR
INSTITUTE OF TECHNOLOGY
ILLINOIS,

Sangamo Meter # 76671.

Resistance of pressure coil 317. ohms.
 " " series "04 ohms.

Data for the determination of the phase relation of
 the series and pressure fluxes.

Volts 110	Amperes 5	Apparent Watts 550.	
Direction of Rotation of Disc.	Dynamometer Reading.	True Watts	Cos θ.
Forward	14	26	.0473
"	14	26	.0473
"	14	26	.0473
Backward	1	2.8	.0051
"	1	2.8	.0051
"	2	5.0	.0091
Average cos θ for forward rotation .....		.0473	
" θ " "	"	.....	87° 17'
" cosθ " backward "	"	.....	.0064
" θ " "	"	.....	89° 38'
Phase angle from quadrature for forward rotation 2° 43'			
" " " " " backward " "			22'
Average phase angle from quadrature		1° 33'	
Phase difference between series and pressure fluxes		1° 33'	

2000 Meter $\frac{1}{2}$ Age At

Dots for the determination of the basic reflexes.

Sangamo Meter # 76671.

Run $\frac{1}{4}$ 1.

Data showing the relation between the load and the % of true watts recorded with unity power factor, normal frequency, and normal voltage.

110 volts.	60 cycles.	Temperature 76 F.			
Current.	True Watts.	R	T	Watts Recorded.	% Recorded.
1.1	120	5	82.5	109	91.8
1.78	195	11	105.3	188	96.4
2.50	275	16	105.3	274	99.7
3.00	330	19	102.8	333	100.8
3.85	422	28	118.0	427.5	101.0
4.80	528	30	100.4	538	101.7
5.65	622	37	106.3	625	100.5
7.40	812	47	104.3	810	99.8

R is the no. of revolutions made by the disc in T seconds.

Sandusky Meter Co. 1967.

Run I.

Table showing the relationship between the load and the time waste recording with multi power factor, moment frequency and moment voltage.

Current.	Time waste.	60 cycles.	110 Volts.	Temperature.
0.10	150	82.5	110	1.1
0.18	125	102.5	111	1.78
0.26	95	102.5	116	2.26
0.30	720	105.8	233	2.30
0.38	520	118.0	191.0	2.38
0.46	428	118.0	191.0	2.46
0.50	328	100.4	238	2.50
0.58	228	106.3	625	2.58
0.62	125	104.3	810	2.62
0.66	65	104.3	810	2.66

R is the no. of revolutions made by the disc in T seconds.

Sangamo Meter # 76671.

Run # 2

Data showing the relation between the load and the % of true watts recorded with unity power factor, normal frequency, and 91% of normal voltage.

Current.	100 volts.	True Watts	60 cycles.	R	T	Temperature 76 F	Watts Recorded	% Recorded.
1.1		115		6	105.5		102.5	89.0
2.25		225		13	111.		211	93.6
3.15		317		19	108.		316	99.7
4.15		415		25	108.		416	100.2
5.18		518		31	106.2		525	101.2
6.25		626		36	103.5		626	100.0
7.50		752		45	107.6		752	100.0

R is the no. of revolutions made by the disc in T seconds.

Sanjour letter to AGFA.

2 min

Shows the following for 100 sec and the
of time waste recording with multivibrator. moment
threshold, and 35% of moment voltage.

Counting	Time waste	GO cycles	100 volt.	Membrane life
Recording	eff.	T	Z	%
0.0	112	6	102.5	102.5
0.25	222	12	111.	111.
0.5	314	19	108.	108.
1.0	412	25	108.	108.
2.0	518	31	106.5	106.5
4.0	656	36	102.5	102.5
8.0	725	41	102.5	102.5

on. of revolution made by the disc in T seconds.

Sangamo Meter # 76671.

Run # 3.

Data showing the relation between the load and the % of true watts recorded, unity power factor, normal frequency, and 109 % normal voltage.

120 volts. 60 cycles. Temperature 76 F.

Current.	True Watts	R	T	Watts Recorded	% Recorded.
1.12	135	7	102.5	123	91
2.05	247	14	107.2	235	95.2
2.85	340	20	106.2	338	99.5
3.65	433	26	107.5	435	100.5
4.52	544	32	105.2	547	100.7
5.50	660	38	104.0	658	99.75
6.40	770	45	106.0	765	99.4
7.40	888	51	105.0	875	98.5

R is the no. of revolutions made by the disc in T seconds.

Conductance Meter & 3663J.

. 5. 1. 1.

* The following table shows the relationship between the voltage across the meter and the current flowing through it, assuming a constant resistance of 10 ohms. The current values are given in milliamperes, and the voltage values in millivolts.

Current. milliamperes	Temperature AC E.		60 degrees.		150 Volts.	
	Recording degrees	at 25°	T	S	at 15°	at 25°
1.15	25	125	103.2	4	125	1.15
2.02	25	242	103.5	14	242	2.02
2.99	25	240	103.5	20	240	2.99
5.00	25	485	103.5	485	485	5.00
7.00	25	544	103.5	544	544	7.00
9.00	25	660	103.6	660	660	9.00
11.00	25	777	103.6	777	777	11.00
13.00	25	888	103.6	888	888	13.00

The following table shows the relationship between the voltage across the meter and the current flowing through it, assuming a constant resistance of 10 ohms. The current values are given in milliamperes, and the voltage values in millivolts.

Sangamo Meter # 76671.

Run # 4.

Data showing the effect of change of power factor
with constant full load current, normal voltage, and
normal frequency.

110 volts. 60 cycles. 5 amperes. Temperature 76 F.

Cos.θ.	True Watts.	R.	T.	Watts Recorded.	% Recorded.
1.000	550	32	103.	560	101.5
.928	510	30	104.2	518	101.5
.850	468	28	105.5	478	102.2
.763	420	27	111.5	436	103.7
.695	382	25	114.	395	103.4
.570	313	23	128.	324	103.4

R is the no. of revolutions made by the disc in T seconds.

same meter # 76671.

. A m

showing the effect of change of power factor
with constant load voltage, being
constant the power.

Co. No.	Time after	Co. before	Co. after	Time after	Co. before	Co. after
1.000	220	28	28	220	28	28
.888	210	30	30	210	30	30
.850	218	32	32	218	32	32
.828	204.5	34	34	204.5	34	34
.800	195.5	36	36	195.5	36	36
.766	190.5	38	38	190.5	38	38
.733	185.5	40	40	185.5	40	40
.700	180.5	42	42	180.5	42	42
.667	175.5	44	44	175.5	44	44
.625	170.5	46	46	170.5	46	46
.583	165.5	48	48	165.5	48	48
.541	160.5	50	50	160.5	50	50
.500	155.5	52	52	155.5	52	52
.458	150.5	54	54	150.5	54	54
.428	145.5	56	56	145.5	56	56
.400	140.5	58	58	140.5	58	58
.375	135.5	60	60	135.5	60	60
.350	130.5	62	62	130.5	62	62
.325	125.5	64	64	125.5	64	64
.300	120.5	66	66	120.5	66	66
.275	115.5	68	68	115.5	68	68
.250	110.5	70	70	110.5	70	70
.225	105.5	72	72	105.5	72	72
.200	100.5	74	74	100.5	74	74
.175	95.5	76	76	95.5	76	76
.150	90.5	78	78	90.5	78	78
.125	85.5	80	80	85.5	80	80
.100	80.5	82	82	80.5	82	82
.075	75.5	84	84	75.5	84	84
.050	70.5	86	86	70.5	86	86
.025	65.5	88	88	65.5	88	88
.000	60.5	90	90	60.5	90	90

is the no. of revolutions made by the disc in 1 second.

Sangamo Meter # 76671.

5.

Data, calculated from the flux phase determination,
showing the effect of change of power factor with
normal frequency, normal voltage, and constant full
load current.

Volts 110	Amperes 5.	Cycles 60.	
Cos θ	True Watts	Watts Recorded	% Recorded.
1.0000	550	550	100.0
.9848	542	544	100.5
.9400	517	522	100.8
.8660	477	483	101.2
.7660	422	431	102.0
.6430	354	364.5	103.0
.5000	275	287.5	104.5

Carboneo Letter 1. 1964.

5.

Data, obtained from the flux balance determination showing the effect of change of power factor with current intensity, moment of inertia, and orientation of the load current.

Current I	Number 5.	Number 6	Voltage 110
100.0	250	250	1.0000
100.5	244	243	.9848.
100.8	235	234	.9900.
101.2	223	224	.8880.
101.5	211	212	.7660.
102.0	200	202	.6430.
104.0	184.5	184.5	.0000.

Sangamo Meter # 76671.

Run # 6

Data showing the effect of change of load with unity power factor, normal voltage ,and normal frequency.

110 volts.		25 cycles.		Temperature 70 F.	
Current.	True Watts.	R.	T.	Watts Recorded.	% Recorded.
1.16	128	7	110.2	114	89.2
1.55	170	10	114.0	158	93.0
2.50	275	17	113.0	271	98.5
3.50	383	26	122.0	384	100.2
4.50	495	32	116.0	497	100.3
5.80	640	41	114.5	645	100.6
7.30	805	53	119.5	800	99.4

R is the no. of revolutions made by the disc in T seconds.

Gauge No. 4664T.

July 6

Shows a slight increase of load with time
due to loss of voltage from I transformer.
Power factor, moment voltage, and current.

Current. Ampereage.	Voltage. Volts.	Temperature A° F.			Sag values.		IIO value.
		I	E	S	T		
3.00	345	114	114.5	115	116	128	1.16
4.00	348	114	114.0	114	115	128	1.22
5.00	345	114	113.0	113	114	127	1.25
6.00	382	126	125	125	126	132	1.26
7.00	384	126	125.0	125	126	132	1.26
8.00	402	125	124	124	125	130	1.26
9.00	403	125	124.5	124	125	130	1.26
10.00	405	125	124.2	124	125	130	1.26
11.00	400	125	124.2	124	125	130	1.26

Shows a slight increase of load with time due to loss of I second.

Sangamo Meter # 76671.

Run # 7.

Data showing the effect of change of load with unity power factor, normal voltage, and normal frequency.

110 volts.		120 cycles.		Temperature 70 F.	
Current	True Watts	R.	T.	Watts Recorded.	% Recorded.
1.10	120	6	100.5	107.5	89.7
1.55	170	10	114	158	93.0
2.50	277	16	106	272	98.3
3.40	375	22	106	374	99.8
4.45	490	24	87	495	101.0
4.95	545	36	119	545	100.0
7.25	795	40	91	792	99.6

R is the no. of revolutions made by the disc in T seconds.

same two letters as negative.

Year 1 A.

Data showing the effect of change of load with varying
power factor, normal voltage, by moment method.

Current	Time setting	Time setting	ISO values	ISO values	110 volt
80.4	120.5	120.5	6	6	110
97.0	110	110	10	10	115
88.2	94.4	94.4	106	106	120
8.00	24.2	24.2	22	22	24.0
107.0	49.0	49.0	34	34	44.5
100.0	54.5	54.5	36	36	50.5
8.00	28.2	28.2	31	31	38.5

It is the no. of revolutions made per sec in the second.

卷之三

“I am not a good man,” he said. “I have done many bad things. I have lied, I have been unkind, I have been mean. But I am sorry for what I have done. I want to be a better person.”

100% 100% 100%

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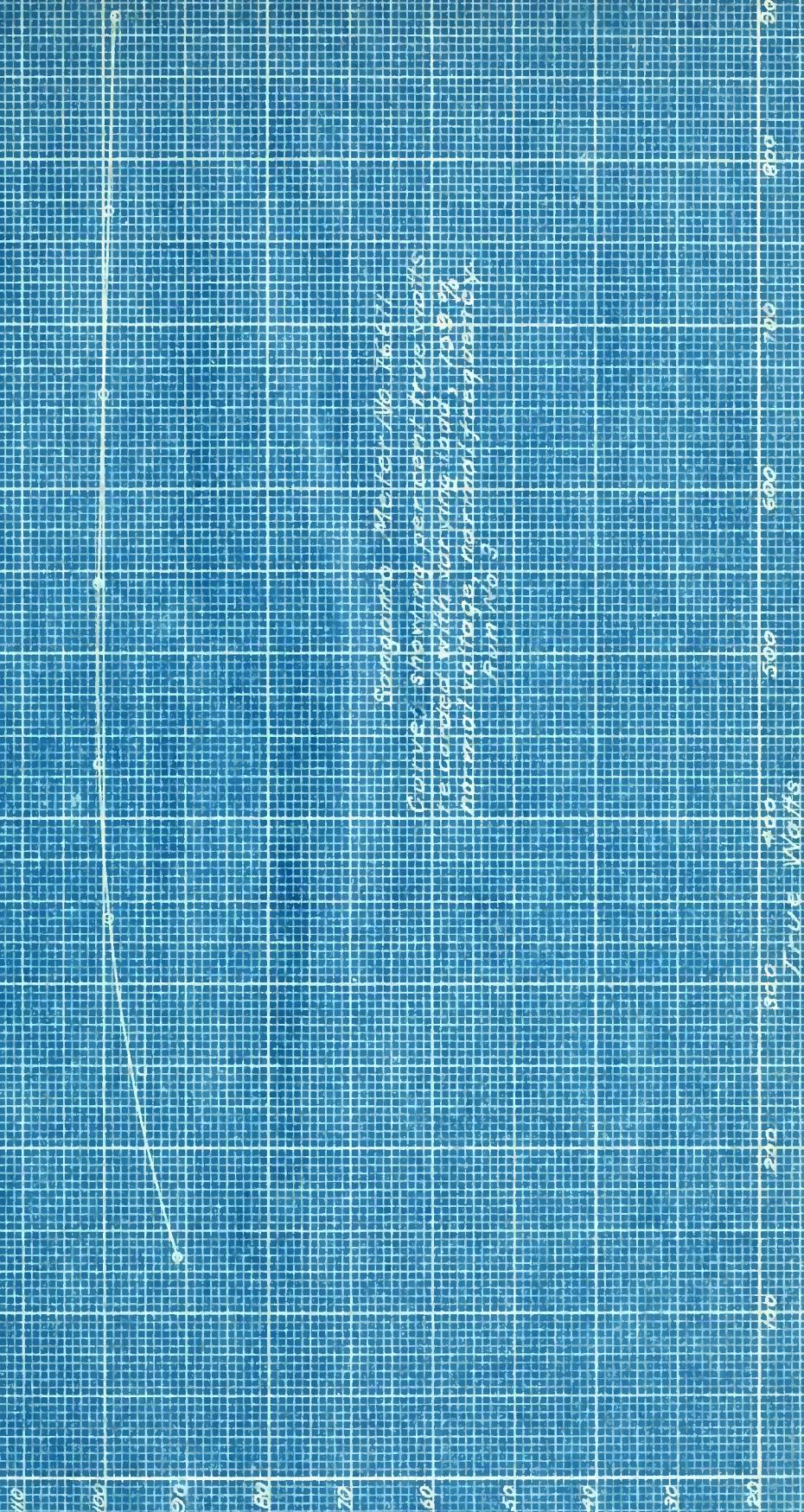
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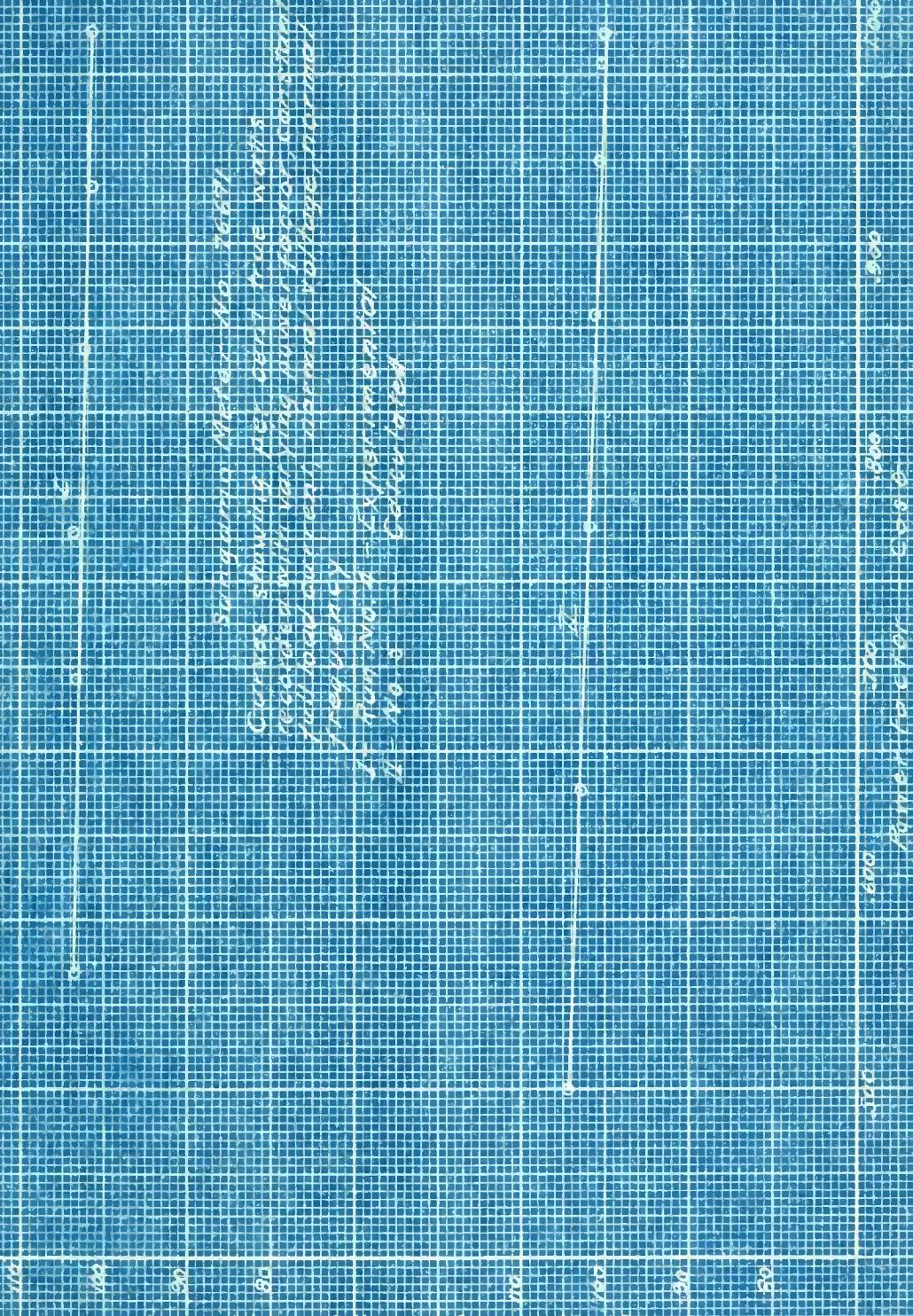
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20. *Calostoma* *luteum* (Nees) R. Br. var. *luteum*



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ALBANY.

100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100 2200 2300 2400 2500 2600 2700 2800 2900 3000 3100 3200 3300 3400 3500 3600 3700 3800 3900 4000 4100 4200 4300 4400 4500 4600 4700 4800 4900 5000 5100 5200 5300 5400 5500 5600 5700 5800 5900 6000 6100 6200 6300 6400 6500 6600 6700 6800 6900 7000 7100 7200 7300 7400 7500 7600 7700 7800 7900 8000 8100 8200 8300 8400 8500 8600 8700 8800 8900 9000 9100 9200 9300 9400 9500 9600 9700 9800 9900 10000 10100 10200 10300 10400 10500 10600 10700 10800 10900 11000 11100 11200 11300 11400 11500 11600 11700 11800 11900 12000 12100 12200 12300 12400 12500 12600 12700 12800 12900 13000 13100 13200 13300 13400 13500 13600 13700 13800 13900 14000 14100 14200 14300 14400 14500 14600 14700 14800 14900 15000 15100 15200 15300 15400 15500 15600 15700 15800 15900 16000 16100 16200 16300 16400 16500 16600 16700 16800 16900 17000 17100 17200 17300 17400 17500 17600 17700 17800 17900 18000 18100 18200 18300 18400 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35100 35200 35300 35400 35500 35600 35700 35800 35900 36000 36100 36200 36300 36400 36500 36600 36700 36800 36900 37000 37100 37200 37300 37400 37500 37600 37700 37800 37900 38000 38100 38200 38300 38400 38500 38600 38700 38800 38900 39000 39100 39200 39300 39400 39500 39600 39700 39800 39900 40000 40100 40200 40300 40400 40500 40600 40700 40800 40900 41000 41100 41200 41300 41400 41500 41600 41700 41800 41900 42000 42100 42200 42300 42400 42500 42600 42700 42800 42900 43000 43100 43200 43300 43400 43500 43600 43700 43800 43900 44000 44100 44200 44300 44400 44500 44600 44700 44800 44900 45000 45100 45200 45300 45400 45500 45600 45700 45800 45900 46000 46100 46200 46300 46400 46500 46600 46700 46800 46900 47000 47100 47200 47300 47400 47500 47600 47700 47800 47900 48000 48100 48200 48300 48400 48500 48600 48700 48800 48900 49000 49100 49200 49300 49400 49500 49600 49700 49800 49900 50000 50100 50200 50300 50400 50500 50600 50700 50800 50900 51000 51100 51200 51300 51400 51500 51600 51700 51800 51900 52000 52100 52200 52300 52400 52500 52600 52700 52800 52900 53000 53100 53200 53300 53400 53500 53600 53700 53800 53900 54000 54100 54200 54300 54400 54500 54600 54700 54800 54900 55000 55100 55200 55300 55400 55500 55600 55700 55800 55900 55000 55100 55200 55300 55400 55500 55600 55700 55800 55900 56000 56100 56200 56300 56400 56500 56600 56700 56800 56900 57000 57100 57200 57300 57400 57500 57600 57700 57800 57900 58000 58100 58200 58300 58400 58500 58600 58700 58800 58900 58000 58100 58200 58300 58400 58500 58600 58700 58800 58900 59000 59100 59200 59300 59400 59500 59600 59700 59800 59900 59000 59100 59200 59300 59400 59500 59600 59700 59800 59900 60000 60100 60200 60300 60400 60500 60600 60700 60800 60900 61000 61100 61200 61300 61400 61500 61600 61700 61800 61900 62000 62100 62200 62300 62400 62500 62600 62700 62800 62900 63000 63100 63200 63300 63400 63500 63600 63700 63800 63900 64000 64100 64200 64300 64400 64500 64600 64700 64800 64900 65000 65100 65200 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80900 81000 81100 81200 81300 81400 81500 81600 81700 81800 81900 82000 82100 82200 82300 82400 82500 82600 82700 82800 82900 83000 83100 83200 83300 83400 83500 83600 83700 83800 83900 84000 84100 84200 84300 84400 84500 84600 84700 84800 84900 85000 85100 85200 85300 85400 85500 85600 85700 85800 85900 86000 86100 86200 86300 86400 86500 86600 86700 86800 86900 87000 87100 87200 87300 87400 87500 87600 87700 87800 87900 88000 88100 88200 88300 88400 88500 88600 88700 88800 88900 89000 89100 89200 89300 89400 89500 89600 89700 89800 89900 90000 90100 90200 90300 90400 90500 90600 90700 90800 90900 91000 91100 91200 91300 91400 91500 91600 91700 91800 91900 92000 92100 92200 92300 92400 92500 92600 92700 92800 92900 93000 93100 93200 93300 93400 93500 93600 93700 93800 93900 94000 94100 94200 94300 94400 94500 94600 94700 94800 94900 95000 95100 95200 95300 95400 95500 95600 95700 95800 95900 96000 96100 96200 96300 96400 96500 96600 96700 96800 96900 97000 97100 97200 97300 97400 97500 97600 97700 97800 97900 98000 98100 98200 98300 98400 98500 98600 98700 98800 98900 98000 98100 98200 98300 98400 98500 98600 98700 98800 98900 99000 99100 99200 99300 99400 99500 99600 99700 99800 99900 100000

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General Electric Meter # 1506564.

Resistance of 60 cycle pressure coil	679.5 ohms.
" " 25 " "	132.5 " .
" " 10 ampere series coil .....	.027 ohms.

Data for the determination of the phase relation of the series and pressure fluxes.

Volts 110.	Amperes 10.	Apparent Watts 1100.
------------	-------------	----------------------

Direction of Rotation of Disc.	Dynamometer Reading.	True Watts.	Cos θ.
Forward	-19	34	.0309
Backward	+2	4.5	.0041
Forward	-21	38	.0345
Backward	+2	4.5	.0041
Forward	-18.5	33	.0300
Backward	+2	4.5	.0041
Average cos θ for forward rotation .....		.0318	
" θ " "	"	.....	88° 10'
" cos θ " backward "	"	.....	.0041
" θ " "	"	.....	90° 13'
Phase angle from quadrature for forward rotation			13'
" " " " " backward "	"		1° 50'
Average phase angle from quadrature			48.5'
Phase difference between series and pressure fluxes			90° 48.5'

General Effective meter " 1500pcA.

the series and pressure filters.

Volta 100. Volta 100. Volta 100.

Disso.	Direction of Rotation	Dynamometer Reading.	Time 17.44 A.M.	Gas E.
0268	Forward	-13	0218	
0041	Reversing	-8		
0257	Forward	-51		
0041	Reversing	-8		
0260	Forward	18.5		
0041	Reversing	-8		
0261	Forward	-51		
0041	Reversing	-8		
0260	Forward	18.5		
0041	Reversing	-8		
0218	Forward	18.5		
I 88	"	"	"	"
I 00	"	"	"	"
I 00	"	"	"	"
I	Please give time for forward rotation			
I	Please give time for reverse rotation			

General Electric Meter # 1506564.

Run # 1.

Data showing the effect of change of load with unity power factor, 100 % normal voltage, and normal frequency.

110 volts. 60 cycles. Temperature 73 F.

Watts	Watt hours Recorded.	T	True Watt hours	% Recorded
120	3	106.5	3.54	85.
325	10	116.0	10.46	95.8
545	20	134.5	20.35	98.4
825	27	119.0	27.25	99.0
1050	35	120.0	35.00	100.0
1279	45	127.0	45.00	100.0
1440	45	114.0	45.70	98.7

T is the time in seconds.

General Motors " 1906PP4.

Run # 1.

Data showing the effect of change of load with unit power factor, 100 % normal voltage, 115 V. A.C.

Temperature at 73 °F.

Revolving Speed	Time in Mins	T	60 Cycles.	110 Volts.	at
					Revolving Speed
82	2.54	106.5	3	150	
88	10.46	116.0	10	222	
98	20.35	134.5	20	242	
100	25.25	139.0	22	252	
100.0	25.00	150.0	25	1050	
100.1	24.84	154.0	25	1240	
102	23.74	171.0	25	1440	

T is the time in seconds.

General Electric Meter # 1506564.

Run # 2.

Data showing the effect of change of load with unity power factor, normal frequency, and 109 % normal voltage.

120 volts.	60 cycles.	Temperature 73 F.		
Watts	Watt hours Recorded.	T	True Watt hours	% Recorded.
145	4	116	4.67	85.7
333	11	123	11.40	97.0
602	19	113	18.90	100.5
885	28	114	27.7	100.2
1203	38	113.7	38.00	100.0
1523	47	112.5	47.60	99.0
1800	54	111.4	55.70	99.0

T is the duration of each run in seconds.

General Motors # 1506567.

Series

Data showing the effect of load with varying power factor, moment of inertia, and load frequency, and to show the effect of load with varying power factor, moment of inertia, and load frequency.

Series	Number of Tests	Time of each test	Time of each test	Time of each test	Time of each test	Time of each test
142	142	4.4	11.6	11.6	11.6	11.6
333	333	11.1	11.1	11.1	11.1	11.1
605	605	11.1	11.1	11.1	11.1	11.1
888	888	11.1	11.1	11.1	11.1	11.1
1302	1302	11.1	11.1	11.1	11.1	11.1
1323	1323	11.1	11.1	11.1	11.1	11.1
1300	1300	11.1	11.1	11.1	11.1	11.1

This is the distribution of time in seconds.

General Electric Meter # 1506564.

Run # 3.

Data showing the relation between the load and the % of true watt hours recorded with varying load ,normal frequency, unity power factor, and 91 % normal voltage.

100 volts. 60 cycles. Temperature 73 F.

Watts	Watt hours Recorded	T	True Watt hours.	% Recorded.
105	3	126.5	3.69	81.4
350	10	116.0	11.3	88.5
490	16	119.0	16.2	98.8
773	26	121.0	26.0	100.0
990	32	114.3	31.4	101.8
1145	36	113.3	36.0	100.0
1370	42	111.7	42.2	99.8
1560	50	116.0	50.4	99.3

T is the time in seconds.

General Electric Letter 1906564

Run 3.

Diagram showing the relation between the load and the time
 over which recording was carried out, from 100 to 1000
 units power factor, and 30 & 60 volt A.C.

Time in seconds.	Number of cycles.	100 Volts.	60 Cycles.	30 Cycles.	100 Volts.
8.88	3	156.0	3.88	81.4	102
8.88	10	116.0	11.2	28.0	250
8.88	16	119.0	19.8	49.0	490
100.0	26	181.0	28.0	74.3	743
101.8	25	174.2	21.2	69.0	990
114.2	39	118.3	36.0	100.0	1142
124.0	48	111.3	45.8	8.88	1240
126.0	50	116.0	46.4	3.88	1260

T is the time in seconds.

General Electric Meter # 1506564.

Run # 4.

Data showing the relation between the load and the % of true watts recorded with normal frequency, unity power factor, and 100 % normal voltage.

110 volts.	25 cycles	Temperature 73 F.		
Watts	Watt hours Recorded.	T	True Watt hours	% Recorded.
120	3	104.0	3.46	86.8
335	9	101.0	9.4	95.8
545	19	128.0	19.4	98.0
833	25	109.0	25.2	99.3
1050	30	104.0	30.4	98.8
1283	43	122.0	43.5	98.8
1460	47	117.5	47.8	98.4
1675	47	104.0	48.4	97.2

T is the time in seconds.

General Information Sheet 1 PROGECI

Run # 4.

is off the day before the letter was posted to the post office. This is the date of the letter's recording with respect to the power of attorney, and 100% moment voltage.

Recording	Date	Time	T	SP Change	100% Voltage
8.88	8.88	2.48	104.0	3	150
8.89	8.89	4.0	101.0	0	200
0.89	4.11	0.81	120.0	10	242
0.89	5.25	0.20	103.0	20	893
8.90	4.00	0.40	104.0	20	1020
8.90	5.35	0.55	125.0	40	1583
4.80	8.74	5.74	114.0	40	1460
5.76	4.84	0.40	104.0	40	1635

This is the time in seconds.

General Electric Meter # 1506564.

Run # 5

Data showing the effect of change of power factor
with constant full load current, normal frequency, and
normal voltage.

110 volts. 10 amperes. 60 cycles Temperature 75 F.

Cos θ	Watt hours Recorded.	T	True Watt hours	% Recorded.
1.000	35	114.5	35	100
.981	37	124	37.2	99.5
.855	35	136	35.5	98.6
.781	30	127	30.4	98.5
.691	25	120	25.4	98.4
.622	24	129.5	24.62	97.3
.536	20	129	21.1	95.0

T is the duration of each run in seconds.

General Telephone Meter No 1506564.

Run # 5

Dates showing the effect of change of power factor
with constant full load current, normal frequency, and
normal voltage.

Revolving	Revolving	Time	T	60 cycles	To amperes.	To Volts.
100	85	25	114.2	35	35	1.000
.99.5	85	24.5	134	33	33	.181.
.98	85	25.5	128	35	35	.255.
.98	85	25.4	154	30	30	.181.
.98	85	25.4	150	35	35	.161.
.98	85	25.5	150	35	35	.161.
.98	85	25.5	150	35	35	.161.
0.98	85	25.5	150	35	35	.161.

To the question of how much in seconds.

General Electric Meter #1506564.

#6.

Data, calculated from the flux quadrature determination,
showing the effect of change of power factor with constant
full load current, normal frequency and normal voltage.

110 volts. 10 amperes. 60 cycles.

Cos θ.	True Watts.	Watts Recorded.	% Recorded.
1.0000	1100	1100	100.0
.9396	1032	1028	99.6
.8660	954	946	99.3
.7660	844	834	98.7
.6428	707	695	98.3
.5735	631	618	98.0
.5000	550	538	97.6

General Description Meter 11506264.

.6

Date, self-adjusting from the time and distance of refraction, showing the effect of change of power before with constant, total load current and moment voltage.

Coil	Time after records.	10 subsecs.	10 volts.
100.0	1100	1100	1.0000
2.00	1028	1028	0.9998
8.00	346	346	0.9990
7.00	458	448	0.9990
2.80	692	707	0.9988
0.80	818	631	0.9982
0.70	828	560	0.9980

General Electric Meter No. 150-502
Curves showing per cent true reading recorded
with varying load
Point No. 1 10% normal voltage, normal frequency
Point No. 2 133%

Per cent error with load's recorded

10 20 30 40 50 60 70 80 90 100 110 120 130 140 150 160 170 180 190 200

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95
92
88
86
84
82
80
78
76
74
72
70

Time (min)
Time (min)

100 90 80 70 60 50 40 30 20 10 0

100 90 80 70 60 50 40 30 20 10 0

Demands of the different categories
of vehicles during the period of observation
and time intervals



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ALBION X.

Westinghouse Meter # 681372.

Resistance of pressure coil	427 ohms.
" " series "	.0775 ohms.

Data for the determination of the phase relation of the series and pressure fluxes.

Volts 100	Amperes 5	Apparent Watts 500.	
Direction of Rotation of Disc.	Dynamometer Reading.	True Watts	Cos θ.
Forward	4	8	.016
"	5	10	.020
"	4.5	9	.018
Backward	0	1	.0002
"	0	1	.0002
"	1	2.5	.0050
Average cos θ for forward rotation .....		.018	
" θ " "	" "	.....	88° 58'
" cos θ " backward "	" "	.....	.0018
" θ " "	" "	.....	89° 54'
Phase angle from quadrature for forward rotation	1° 2'		
" " " " " backward "			6'
Average phase angle from quadrature			34'
Phase angle between series and pressure fluxes ..	90° 34'		

Westinghouse Meter # 681372

Run # 1.

Data showing the effect of change of load with unity power factor, normal voltage, and normal frequency.

100 volts.		60 cycles.		Temperature 82 F	
Current	True Watts	R	T	Watts Recorded	% Recorded
1.00	100	6	98.3	73.3	73.3
1.45	140	11	111.	119.	85.0
1.88	210	18	111.	195.	92.8
3.12	314	29	114.	306.	97.4
4.15	415	36	105.	412	99.4
5.00	480	48	114	505	101.0
6.20	620	61	119	616	99.5
7.50	735	71	116	735	100.0

R is the no. of revolutions made by the disc in T seconds.

Wavelengths Meter " E8124S

Run # 1.

Data showing the effect of change of job with multi
power factor, moment voltage, and motor frequency.

Current	Time Elapse	100 Volts	60 Cycles	Emberature SS T	Recording	Recording	Watts	T	R	60 Cycles	100 Volts
1.00											
1.12											
1.25											
1.38											
1.50											
1.62											
1.75											
1.88											
2.00											
2.12											
2.25											
2.38											
2.50											
2.62											
2.75											
2.88											
3.00											
3.12											
3.25											
3.38											
3.50											
3.62											
3.75											
3.88											
4.00											
4.12											
4.25											
4.38											
4.50											
4.62											
4.75											
4.88											
5.00											
5.12											
5.25											
5.38											
5.50											
5.62											
5.75											
5.88											
6.00											
6.12											
6.25											
6.38											
6.50											
6.62											
6.75											
6.88											
7.00											
7.12											
7.25											
7.38											
7.50											
7.62											
7.75											
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8.00											
8.12											
8.25											
8.38											
8.50											
8.62											
8.75											
8.88											
9.00											
9.12											
9.25											
9.38											
9.50											
9.62											
9.75											
9.88											
10.00											

K is the no. of revolutions made by the disc in 1 second.

Westinghouse Meter # 681372

Run # 2

Data showing the effect of change of load with unity power factor, 110% voltage , and normal frequency.

110 volts		60 cycles		Temperature 82 F		
Current	True Watts	R	T	Watts Recorded	% Recorded	
.90	100	7	99.2	77.8	77.8	
1.20	130	10	115.3	114.5	88.0	
2.25	240	22	113.2	233.0	94	
3.05	335	30	109.6	328	97.7	
4.05	444	40	109.3	440	99.2	
5.00	550	53	115	554	100.5	
6.40	700	67	115.3	697	99.5	
7.40	800	79	116.7	814	100	

R is the no. of revolutions made by the disc in T seconds.

negative letter 198125

Mr. H. M.

Diagram showing the effect of change of load with varying power factor, 100 volt-ampere transformer.

Temperature 85° F

Current	Time in sec.	R	T	Current	Time in sec.	R	T	Current	Time in sec.	R	T
8.74	8.74	5.00	9.5	4	100	100	0.00	0.00	0.00	0.00	0.00
0.83	8.14	115.0	115.0	10	120	120	0.00	0.00	0.00	0.00	0.00
0.4	0.33	233.0	115.0	25	240	240	0.00	0.00	0.00	0.00	0.00
0.25	0.25	288	108.0	30	320	320	0.00	0.00	0.00	0.00	0.00
0.125	0.125	440	108.0	40	440	440	0.00	0.00	0.00	0.00	0.00
0.0625	0.0625	880	115.0	50	550	550	0.00	0.00	0.00	0.00	0.00
0.03125	0.03125	174	115.0	60	600	600	0.00	0.00	0.00	0.00	0.00
0.015625	0.015625	348	115.0	70	800	800	0.00	0.00	0.00	0.00	0.00

is the sum of recoverable energy per unit of time in seconds.

Westinghouse Meter #681372.

Run # 3

Data showing the effect of change of load with unity power factor, 90% normal voltage, and normal frequency.

90 volts		60 cycles		Temperature 82 F	
Current	True Watts	R	T	Watts Recorded	% Recorded
1.00	90	7	119	70.5	78.4
1.35	125	12	119	121.0	84.0
2.30	210	19	116	196	93.5
3.45	315	28	110.5	302	96.5
4.30	595	36	110.3	372	99.3
5.50	500	48	114	506	101.0
6.50	595	50	105.4	570	99.5
7.60	690	65	114	685	99.2

R is the no. of revolutions made by the disc in T seconds.

negative pressure meter "GOTIOL".

Run # 3

Data showing the effect of load with initial
power factor, 0.9, normal voltage, and momentary interruptions.

Run #	Temperature °C	60 cycles	60 cycles	Current	Time after
4.8	24.0	116	4	90	1.0
5.10	0.0	118	15	152	1.3
5.20	210	116	12	110	2.0
5.30	215	110.5	28	115	2.45
5.32	215	110.2	26	110	2.8
5.40	206	114	48	100	3.50
5.45	205	114	50	90	4.20
5.50	200	114	48	80	4.80
5.55	200	114	48	70	5.40
5.60	200	114	48	60	6.00

A. Effect of load variations made by the change in T seconds.

Westinghouse Meter # 681372.

Run # 4

Data showing the effect of change of load with unity power factor, normal voltage, and 25 cycles.

100 Volts	25 cycles.	Temperature 82 F.			
Current	True Watts	R	T	Watts Recorded	% Recorded.
1.10	115	7	86	97.7	85.
2.25	227	18	104.5	203.8	94.8
3.17	315	27	104.5	310.0	98.4
4.10	410	35	103.	407.0	99.2
5.20	520	44	101.5	520.0	100.0
6.40	646	55	102.5	645.0	100.0
7.60	760	70	110.5	760.0	100.0

R is the no. of revolutions made by the disc in T seconds.

Measuring meter 681245.

No. 4

Defining the effect of load with multimeter
power factor, moment voltage, and 50 cycles.

Current recording	Recording	T	E	S	Time sets	100 Amperes	Temperature 85°
.89.	3.70	88	88	4	112	1.10	
8.40	8.303	104.5	18	28	224	8.22	
8.84	0.712	104.5	24	310.0	3.74		
8.99	0.710	103.	28	404.0	4.10		
0.00	0.00	101.5	44	520	220		
0.00	0.0	102.5	55	645	640		
0.00	0.000	110.5	70	760	760		

R is the no. of revolutions made per second in T seconds.

Westinghouse Meter # 681372.

Run # 5

Data showing the effect of change of power factor
with normal voltage, normal frequency, and 100 % load.

100 volts.		5 amperes.		60 cycles.	
Cos θ	True Watts	R	T	Watts Recorded	% Recorded.
.94	470	46	118.2	475	101.
.84	420	38	108.0	422	100.3
.76	380	38	100.5	382	100.5
.67	335	30	109.0	330	98.5
.58	290	25	107.0	281.5	97.0

R is the no. of revolutions made by the disc in Tnseconds.

Measuring House Meter 1681345.

Run 12

Data showing the effect of change of power factor
with normal voltage, using 100 v. load.

Coil 0 Revolutions.	Revolving Rate	T Sec.	X Sec.	Z Sec.	P amperes.	Temperature at A °C.	100 Volts.
100.0	525	108.0	38	28	480	470	48.
100.2	525	100.5	38	380	480	48.	47.
100.5	525	103.0	30	325	480	48.	46.
100.8	525	104.0	28	300	480	48.	45.

X at the no. of revolutions made by the disc in T seconds.

Westinghouse Meter # 681372.

6

Data, calculated from the flux quadrature determination,
showing the effect of change of power factor with constant
full load, normal voltage, and normal frequency.

100 volts.	5 amperes.	60 cycles.	Temperature
Cos θ	True Watts	Watts Recorded	% Recorded
1.0000	500	500	100.
.9397	470	468	99.6
.8660	433	431	99.4
.7660	383	380	99.3
.6428	322	318	99.0
.5000	250	245.8	98.3

"saturation Meter at 68°FAS.

16

Data obtained from the first saturation determination
showing the change of color & of feet with constant
current voltage, and moment difference.

Temperature	at 68°FAS	Sample No.	100 Volts
% Recorded		Time of Recording	Color
100.	500	500	1.000
.99	498	470	750.
.98	471	453	8660.
.99	382	382	8570.
.99	378	355	8428.
.98	345.8	350	8000.

Westinghouse Meter # 681372.

Run # 7.

Data showing the relation between the load and the % of true watts recorded with unity power factor, normal voltage, and a frequency of 120 cycles.

110 volts.	120 cycles.	Temperature 70 F.			
Current	True Watts	R.	T.	Watts Recorded.	% Recorded.
1.15	125	10	105	114.2	91.5
2.14	235	20	108	220	94.5
3.45	380	28	89	378	99.4
5.00	550	36	120.6	558	101.4
6.50	715	57	95	720	102.0

R is the no. of revolutions made by the disc in T seconds.

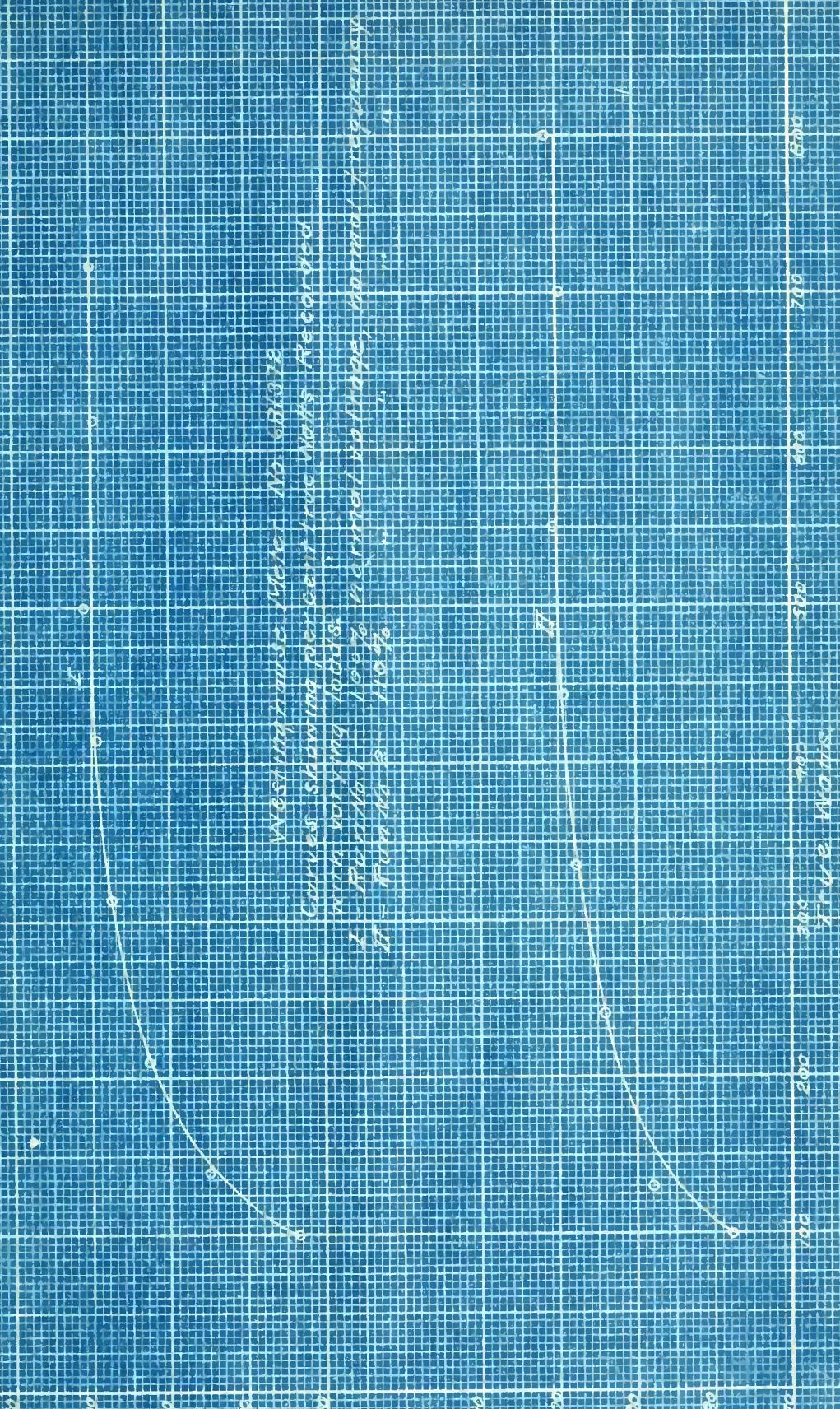
• 28128 • Motor & Generator Test.

• 28128 •

• 28128 •
The following table gives the results of a test made on a motor having a 100 volt
secondary winding with a 100 ampere primary power factor, moment
of 1000 ampere turns per square centimeter, and a voltage of 100
volts, using a resistance of 10 ohms.

Current	Voltage	Resistance	Current	Voltage	Resistance	Current	Voltage	Resistance
1.12	112	100	1.12	112	100	1.12	112	100
2.24	224	100	2.24	224	100	2.24	224	100
4.48	448	100	4.48	448	100	4.48	448	100
8.96	896	100	8.96	896	100	8.96	896	100
17.92	1792	100	17.92	1792	100	17.92	1792	100
35.84	3584	100	35.84	3584	100	35.84	3584	100
71.68	7168	100	71.68	7168	100	71.68	7168	100
143.36	14336	100	143.36	14336	100	143.36	14336	100
286.72	28672	100	286.72	28672	100	286.72	28672	100
573.44	57344	100	573.44	57344	100	573.44	57344	100
1146.88	114688	100	1146.88	114688	100	1146.88	114688	100
2293.76	229376	100	2293.76	229376	100	2293.76	229376	100
4587.52	458752	100	4587.52	458752	100	4587.52	458752	100
9175.04	917504	100	9175.04	917504	100	9175.04	917504	100
18350.08	1835008	100	18350.08	1835008	100	18350.08	1835008	100
36700.16	3670016	100	36700.16	3670016	100	36700.16	3670016	100
73400.32	7340032	100	73400.32	7340032	100	73400.32	7340032	100
146800.64	14680064	100	146800.64	14680064	100	146800.64	14680064	100
293601.28	29360128	100	293601.28	29360128	100	293601.28	29360128	100
587202.56	58720256	100	587202.56	58720256	100	587202.56	58720256	100
1174405.12	117440512	100	1174405.12	117440512	100	1174405.12	117440512	100
2348810.24	234881024	100	2348810.24	234881024	100	2348810.24	234881024	100
4697620.48	469762048	100	4697620.48	469762048	100	4697620.48	469762048	100
9395240.96	939524096	100	9395240.96	939524096	100	9395240.96	939524096	100
18790481.92	1879048192	100	18790481.92	1879048192	100	18790481.92	1879048192	100
37580963.84	3758096384	100	37580963.84	3758096384	100	37580963.84	3758096384	100
75161927.68	7516192768	100	75161927.68	7516192768	100	75161927.68	7516192768	100
150323855.36	15032385536	100	150323855.36	15032385536	100	150323855.36	15032385536	100
300647710.72	30064771072	100	300647710.72	30064771072	100	300647710.72	30064771072	100
601295421.44	60129542144	100	601295421.44	60129542144	100	601295421.44	60129542144	100
1202590842.88	120259084288	100	1202590842.88	120259084288	100	1202590842.88	120259084288	100
2405181685.76	240518168576	100	2405181685.76	240518168576	100	2405181685.76	240518168576	100
4810363371.52	481036337152	100	4810363371.52	481036337152	100	4810363371.52	481036337152	100
9620726743.04	962072674304	100	9620726743.04	962072674304	100	9620726743.04	962072674304	100
19241453486.08	1924145348608	100	19241453486.08	1924145348608	100	19241453486.08	1924145348608	100
38482906972.16	3848290697216	100	38482906972.16	3848290697216	100	38482906972.16	3848290697216	100
76965813944.32	7696581394432	100	76965813944.32	7696581394432	100	76965813944.32	7696581394432	100
153931627888.64	15393162788864	100	153931627888.64	15393162788864	100	153931627888.64	15393162788864	100
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1231453023109.12	123145302310912	100	1231453023109.12	123145302310912	100	1231453023109.12	123145302310912	100
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4925812092436.48	492581209243648	100	4925812092436.48	492581209243648	100	4925812092436.48	492581209243648	100
9851624184872.96	985162418487296	100	9851624184872.96	985162418487296	100	9851624184872.96	985162418487296	100
19703248369745.92	1970324836974592	100	19703248369745.92	1970324836974592	100	19703248369745.92	1970324836974592	100
39406496739491.84	3940649673949184	100	39406496739491.84	3940649673949184	100	39406496739491.84	3940649673949184	100
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157625986957967.36	15762598695796736	100	157625986957967.36	15762598695796736	100	157625986957967.36	15762598695796736	100
315251973915934.72	31525197391593472	100	315251973915934.72	31525197391593472	100	315251973915934.72	31525197391593472	100
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100880631653103.04	10088063165310304	100	100880631653103.04	10088063165310304	100	100880631653103.04	10088063165310304	100
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258254417031949.76	25825441703194976	100	258254417031949.76	25825441703194976	100	258254417031949.76	25825441703194976	100
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103301766812799.04	10330176681279904	100	103301766812799.04	10330176681279904	100	103301766812799.04	10330176681279904	100
206603533625598.08	20660353362559808	100	206603533625598.08	20660353362559808	100	206603533625598.08	20660353362559808	100
413207067251196.16	41320706725119616	100	413207067251196.16	41320706725119616	100	413207067251196.16	41320706725119616	100
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132226261520382.88	13222626152038288	100	132226261520382.88	13222626152038288	100	132226261520382.88	13222626152038288	100
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676998458984357.12	67699845898435712	100	676998458984357.12	67699845898435712	100	676998458984357.12	67699845898435712	100
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270799383593748.48	27079938359374848	100	270799383593748.48	27079938359374848	100	270799383593748.48	27079938359374848	100
541598767187496.96	54159876718749696	100	541598767187496.96	54159876718749696	100	541598767187496.96	54159876718749696	100
108319753437493.92	10831975343749392	100	108319753437493.92	10831975343749392	100	108319753437493.92	10831975343749392	100
216639506874987.84	21663950687498784	100	216639506874987.84	216639506874				

Per cent of the total precipitation



Investigation No. 10872
Concerning Severe Weather Reports Recorded
in the Northern United States
in 1936

$$T = \frac{1}{2} \ln \left(\frac{R}{R_0} \right) - 10\%$$

ARMOUR
INSTITUTE OF TECHNOLOGY
LILBURN, GA.

1990-1991
Yearbook
Yearbook
Yearbook

Concessions obtained from the three men who ordered the
robbery were as follows:

10-09-12

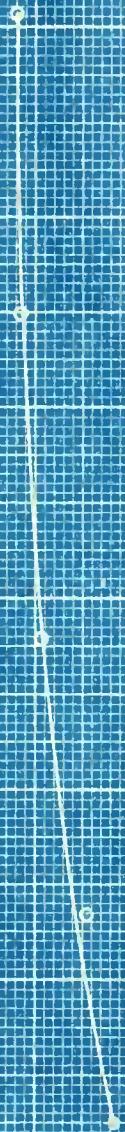
ARMOUR
INSTITUTE OF TECHNOLOGY
LIBRARY.

After several trials various methods

ARMOUR
INSTITUTE OF TECHNOLOGY
LIBRARY.

RECEIVED FROM WOODWARD

Wastehouse dist No 1453
Cir 3000 ft above sea level
Sect 19 in townsite recorded 1911



ARMOUR
INSTITUTE OF TECHNOLOGY
ILLINOIS,

Duncan Meter # 61666.

Resistance of pressure coil 2780. ohms.
 " " series "0575 ohms.

Data for the determination of the phase relation of
 the series and pressure fluxes.

Volts 110	Amperes 10	Apparent Watts 1100.	
Direction of Rotation of Disc.	Dynamometer Reading.	True Watts	Cos θ.
Forward	- 24	42	.0382
"	- 22	40	.0364
"	- 26	44	.0400
Backward	+ 2	4	.00364
"	+ 2	4	.00364
"	+ 2	4	.00364
Average cos θ for forward rotation .....		.0382	
" θ " "	"	.....	87° 49'
" cos θ " backward "	"	.....	.00364
" θ " " "	"	.....	90° 13'
Phase angle from quadrature for forward rotation 2° 11'			
" " " " " backward "	"		13'
Average phase angle from quadrature		X	59'
Phase difference between series and pressure fluxes X			59'.

During a "softener" stage.

Reactivation of presentee city \$480.00
" series " " " "

Dates for the determination of the phase relations of the series and pressure figures.

Notes 110 Number of subjects with systolic blood pressure.

Duncan Meter # 61666.

Run # 1.

Data showing the effect of change of load with unity power factor, 100 % normal voltage, and normal frequency.

110 volts.	60 cycles.	Temperature 84 F.			
Current	True Watts.	R	T	Watts Recorded	% Recorded.
1.05	115	6	121	89.5	88.0
3.50	385	24	124.5	345.	90.0
5.05	555	35	117.	505.	91.0
8.50	935	60	116.	932.	99.7
11.50	1262	84	120.	1260	99.9
13.25	1465	100	121.	1490	101.8
15.30	1690	115	120.5	1720	102.0

R is the no. of revolutions made by the disc in T seconds.

Dynisco Meter 1 CTEG.

Mr. J.

It is showing the effect of change of load with varying
power factor, 100% moment voltage, and moment the same.

Current Recorded	Voltage Recorded	T Setting	R Setting	Curren t setting	110 Volts.	60 Volts.	Temperature 84 F.
1.80	88.2	151	6	112	112	112	112
3.60	282	24	134.5	242	240	240	240
5.00	252	23	114.	208	208	208	208
6.80	222	112.	112.	222	222	222	222
8.80	192	60	60	192	192	192	192
11.20	152	84	84	152	152	152	152
13.60	1462	100	101.	1460	101.8	101.8	101.8
15.00	1360	112	112	1360	102.0	102.0	102.0

R is the no. of revolutions made by the disc in the second.

Duncan Meter No 61666.

Run No 2.

Data showing the effect of change of load with unity power factor, 91 % normal voltage, and normal frequency.

100 volts.	60 cycles.	Temperature 84 F.		
Current	True Watts	R	T	Watts Recorded % Recorded.
1.54	155	8	120	120 77.5
3.15	316	20	120	300 95.0
4.90	490	30	113	478 97.5
7.50	750	50	119	757 101.0
9.70	973	70	127	992 102.0
13.50	1345	93	122.5	1366 101.5
15.60	1565	108	122	1595 101.8

R is the no. of revolutions made by the disc in T seconds.

January Letter of 1998.

S. M.

It is shown that the effect of load with unity power factor, at a constant voltage, and moment of inertia.

Current Recording	Recording Rate	T	R	Time Rate	100 Volts	Temperature 84° F
1.24	120	8	125	125	1.24	43.2
3.12	30	30	316	316	3.12	32.0
4.30	20	20	430	430	4.30	27.2
7.20	20	20	750	750	7.20	101.0
9.20	20	20	973	973	9.20	105.0
13.20	20	20	1366	1366	13.20	101.2
19.60	20	20	1998	1998	19.60	101.8

A is the no. of revolutions made by the disc in T seconds.

Duncan Meter # 61666.

Run # 3.

Data showing the effect of change of load with unity power factor, 109 % normal voltage, and normal frequency.

120 volts.		60 cycles.		Temperature 84 F	
Current	True Watts	R	T	Watts Recorded	% Recorded.
1.20	145	7	110	115	79.0
3.20	385	25	115	360	93.6
5.00	600	36	112	578	96.3
7.60	910	57	113	910	100.0
9.40	1125	71	115	1111	99.0
11.30	1366	95	124.5	1372	100.4
13.60	1630	105	117	1615	99.2
15.50	1880	123	119	1860	99.0

R is the no. of revolutions made by the disc in T seconds.

Moscow Meter • GTEG

Run #2.

Set showing the effect of change of load with multimeter factor, 100 & moment voltage, only moment measured.

Temperature 84 F
150 volts.

Current Recording.	Watts Recording	T	X	Time Watts	150 volts.
1.50	142	4	110	142	1.50
2.50	282	22	112	260	2.50
3.00	360	26	113	248	3.00
3.60	400	29	113	288	3.60
4.00	450	29	113	340	4.00
4.50	472	45	112	377	4.50
5.00	526	39	112	424	5.00
5.50	566	39	124.8	574.5	5.50
6.00	626	39	162.5	625	6.00
6.50	686	112	162.5	686	6.50

It is the no. of revolutions made in the disc in 1 second.

Duncan Meter # 61666.

Run # 4

Data showing the effect of change of power factor with
constant full load, 100 % normal voltage, and normal frequency.

110 volts. 10.1 amperes. 60 cycles Temperature 84 F

Cos.θ.	True Watts.	R	T	Watts Recorded	% Recorded.
.965	1065	38	65	1052	99.0
.914	1005	35	63	1000	99.0
.838	932	33	64	928	99.6
.770	854	30	64	845	99.0
.657	730	25	63.5	710	97.5
.517	574	21	69	548	96.5

R is the no. of revolutions made by the disc in T seconds.

Dynamic Member of IEEE.

JUN 1 4 1978

Effect of change of power factor and frequency on motor voltage, 100 KVA motor test load constant full load.

Temperature of motor	Temperature of motor	Efficiency	I.O.I. member	I.O.I. voltage	Co.s.e.
0.00	100S	65	28	1082	.362
0.00	1000	65	25	1002	.354
5.00	820	46	32	928	.808.
0.00	848	65	20	824	.077.
5.00	616	65.5	416	580	.624.
0.00	549	60	21	574	.274.

Effect of load variation when D.A. is given in the second stage.

Duncan Meter # 61666.

Run # 5

Data showing the effect of change of load with unity power factor, 100 % normal voltage, and 25 cycles.

110 volts.

25 cycles.

Temperature 80 F.

Current.	True Watts.	R	T	Watts Recorded	% Recorded.
1.1	120	4	71	101.2	84.5
3.45	382	12	60	360.	94.3
5.20	570	19	61.6	556.	97.2
7.55	832	27	60	811.	97.7
10.22	1115	37	59.7	1115.	100.0
12.70	1400	47	60	1410.	100.7
14.95	1650	55	60.3	1640	99.5

R is the no. of revolutions made by the disc in T seconds.

Diameter Meter = 67666.

Run # 5

Data showing the effect of change of load with varying power factor, 100% motor I voltage, and 25 degrees. Temperature 80° F.

Recording.	Recording	Watts	R	Time Watts.	Output.
84.2	101.8	75	4	180	1.1
84.2	260.	60	15	385	2.45
84.2	256.	61.6	19	270	2.80
84.2	251.	60	24	825	4.25
100.0	1115.	24	29.4	1115.	10.25
100.0	1100	24	60	1110.	10.2
14.25	1650	25	60.2	1640	14.25

Y is the no. of revolutions made per the time in 2 seconds.

Duncan Meter # 61666.

Run # 6.

Data showing the effect of change of load with unity power factor, normal voltage, and 120 cycles.

110 volts.		120 cycles.		Temperature 77 F.	
Current	True Watts	R	T	Watts Recorded.	% Recorded.
1.1	120	6	114.5	94.5	78.6
2.1	228	12	108.	200.	87.8
3.75	422	24	107.	404.	95.8
5.2	574	35	113.	558	97.3
7.8	788	50	116.	777	98.6
10.2	1125	71	117	1100.	97.0
12.3	1350	86	118	1312.	97.2
14.9	1640	101	116	1565.	95.5

R is the no. of revolutions made by the disc in T seconds.

Dinner Meter 100cc.

Run # 6.

With varying degree of change in the effect of the motor with varying power output, normal voltage, and 100 voltage.

Current	Volt	100 Volts							
Current	Volt	100 Volts							
6.87	24.8	114.5	6	180	180	1.1			
8.48	.00	108.	12	288	288	2.1			
8.98	.40	104.	24	480	480	2.72			
9.73	28	113.	22	544	544	3.5			
9.89	77	116.	20	788	788	3.7			
9.98	100.	111.	41	1122	1122	4.05			
9.98	125	118	38	1290	1290	4.3			
9.98	160	103	18	1562	1562	4.6			

R is the no. of revolutions made by the disc in T seconds.

Duncan Meter # 61666.

7.

Data calculated from the flux phase determination showing the effect of change of power factor with normal frequency, normal voltage, and constant full load current.

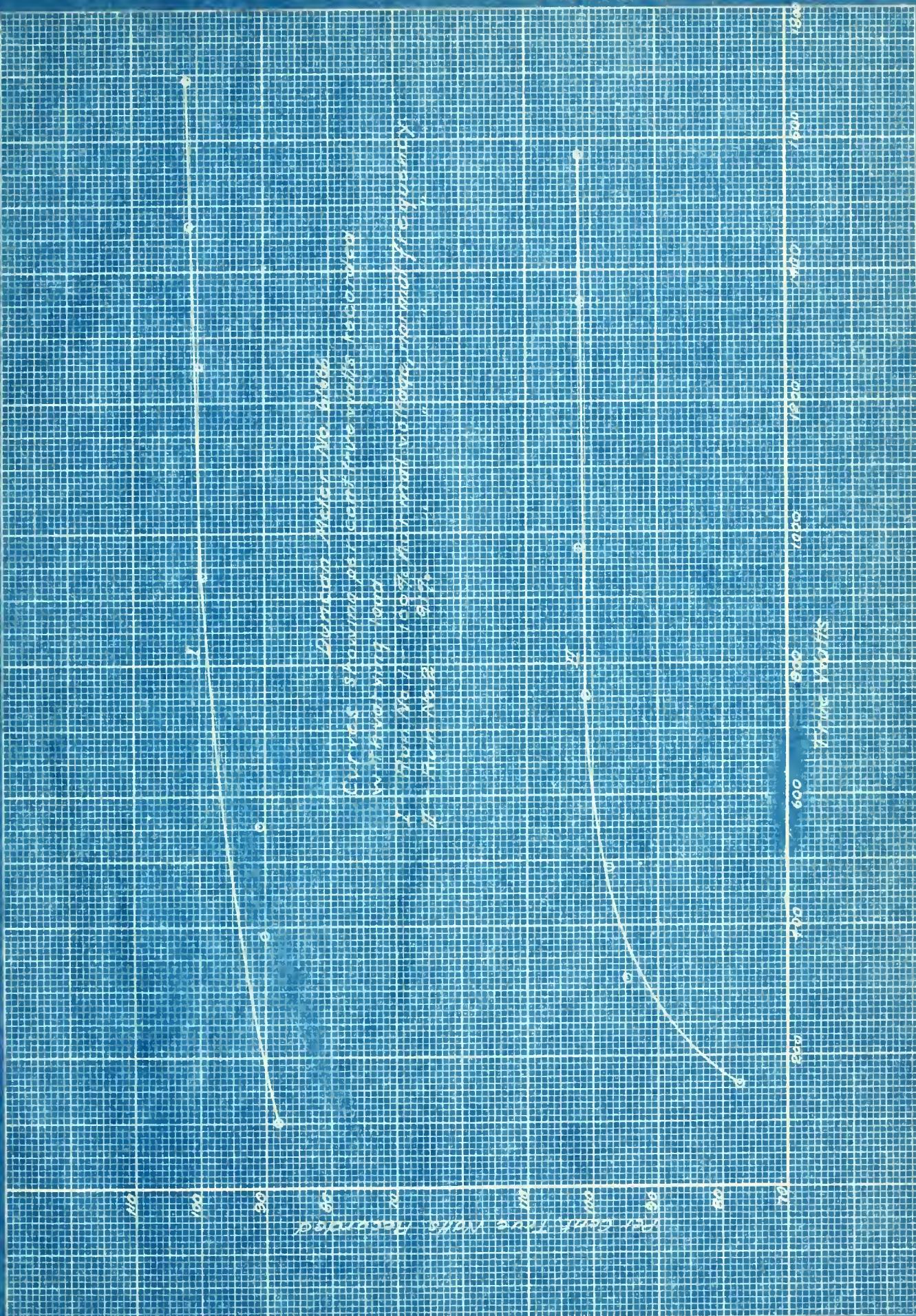
Volts 110	Amperes 10	Cycles 60.	
Cos θ	True Watts	Watts Recorded	% Recorded.
1.000	1100	1100	100.0
.966	1061	1057	99.6
.866	953	944	99.1
.766	844	831	98.5
.656	723	708	98.0
.500	550	534	97.2

Damaged Meter # 61666.

5.4

Data collected from the first phase determination
showing the effect of change of power factor with
normal load, motor load, and constant unit
load current.

Angle 110 Gage no.	Number 10 # Recorded	Angle 110 # Recorded	Angle 110 # Recorded	Angle 110 # Recorded
100.0	1100	1100	1100	1000
8.99	1024	1061	1024	986
1.99	944	982	944	886
2.89	821	844	821	786
0.89	708	732	708	696
5.99	224	250	224	200



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Revolving Valve Model Recurder

100 90 80 70 60 50 40 30 20 10

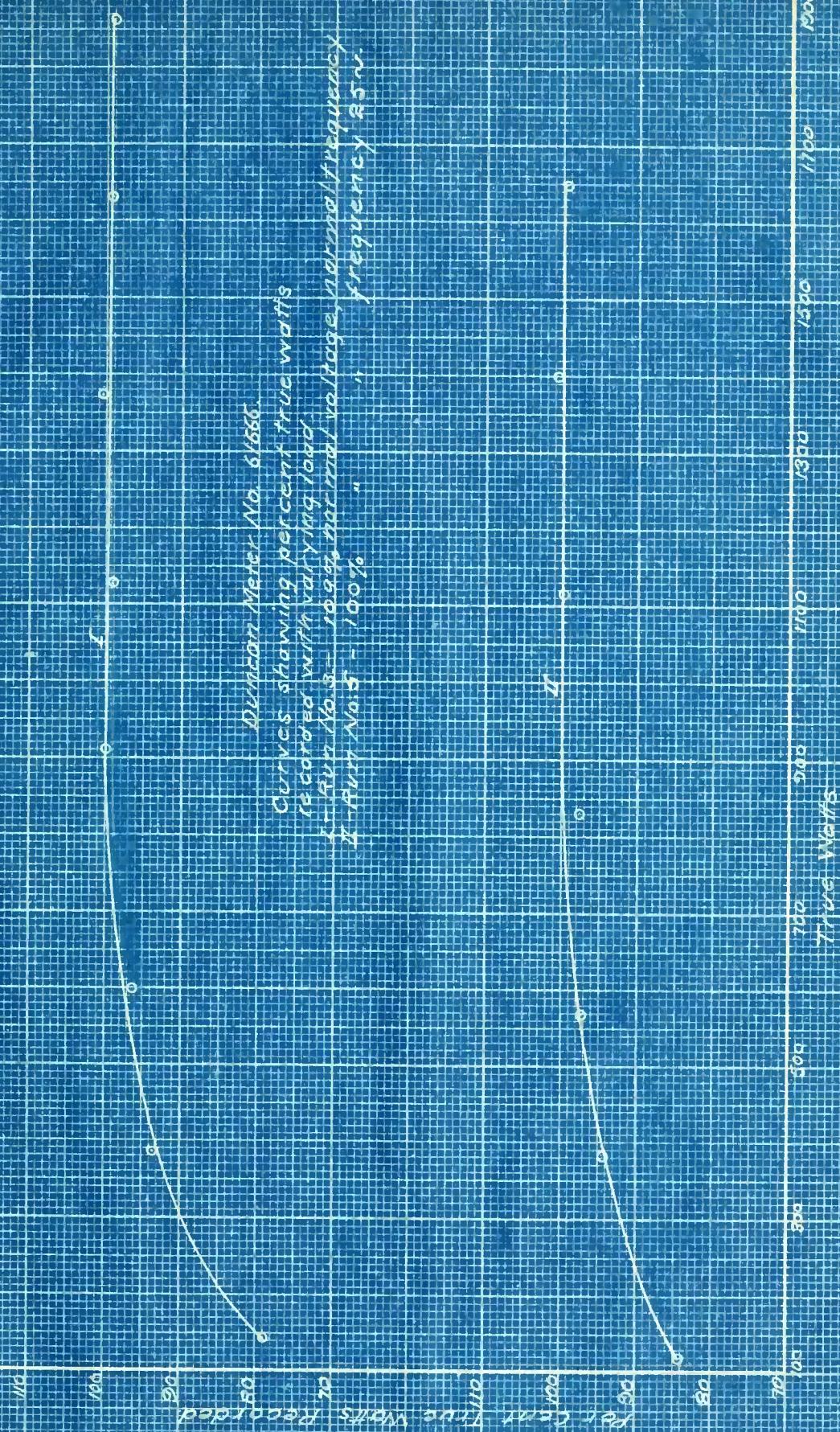
2000 1800 1600
Gauge showing pressure in inches of water recorded
in manometer, 1800 ft. above sea level.

200 180 160 140 120 100 80 60 40 20 0

Total 142.75

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Dudson Meter No. 61665
Curves showing percent true watts
corrected with varying load
1 - $A_1 = 160 \pm 10\%$, no load voltage, normal frequency 25 n.
2 - $A_{17} = 10.5 \pm 10\%$ "



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Cost of Standard 1000 ft.

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A HISTORY
OF
LITERATURE IN
PHILOLOGY
and
the
Humanities.

Duncan Meter # 74520.

Resistance of pressure coil 2295. ohms.

" " series "0875 ohms.

Data for the determination of the phase relation of the series and pressure fluxes.

Volts 110.	Amperes 10.	Apparent Watts 1100.
------------	-------------	----------------------

Direction of Rotation of Disc.	Dynamometer Reading.	True Watts	Cos θ.
Forward	- 13	24	.0218
"	- 12	22	.0200
"	- 12.5	23	.0209
Backward	+ 4	8	.00726
"	+ 4	8	.00726
"	+ 4	8	.00726
Average cos θ for forward rotation		.....	.0209
" θ " "	" "	.....	88° 48'
" cos θ " backward "	" "	.....	.00726
" θ " "	" "	.....	90° 25'
Phase angle from quadrature for forward rotation		1° 12'	
" " " " " backward "	"	25'	
Average phase angle from quadrature		.....	23.5'
Phase angle between series and pressure fluxes .			23.5'

Resistances of breaker coil 225 ohms.
0848 ohms. " series " .

Data for the determination of the phase relation of
the series and bypass resistors.

Voltmeter scale 1100. Ammeter scale 1100.

Dis. of Rotator	Dumecy Resistor	Time scale	Time interval	Series of Coil	Amperes of Breaker
Forward	-15	-15	15	0818	44
"	-15	-15	15	0820	22
"	-15.5	-15.5	15.5	0824	22
Backward	+4	+4	4	0826	8
"	+4	+4	4	0826	8
"	+4	+4	4	0826	8
Reverse cos θ for forward rotation				0826	
88° 88°	"	"	"	8	8
"	"	"	"	"	"
"	"	"	"	"	"
"	"	"	"	"	"
Phase angle from distances for forward rotation if 1.15.	"	"	"		
"	"	"	"		
"	"	"	"		
Phase angle between series and bypass resistors .	SS.5	SS.5	5.5		
Phase angle from distances	SS.5	SS.5	5.5		
Phase angle between series and bypass resistors .	SS.5	SS.5	5.5		

Duncan Meter # 74520

Run # 1

Data showing the effect of change of load with unity power factor, 100 % normal voltage, and normal frequency.

110 volts.

60 cycles.

Temperature 73 F.

Current.	True Watts	R.	T	Watts Recorded	% Recorded.
1.55	173	8	118.7	122	70.5
3.00	328	20	128.	281	85.8
5.20	573	35	118.	534	92.0
7.95	875	57	121.2	848	96.8
10.85	1195	79	121.5	1170	98.0
13.25	1455	97	121.5	1435	98.5
15.50	1700	113	120.8	1685	99.0

R is the no. of revolutions made by the disc in T seconds.

Dynamometer # 44930

HR = T

Details showing the effects of load with varying power factor, 100% motor load condition.

Current.	Time	HR	T	Efficiency	Watts	HR	Current.
1.00	142	1.2	118.4	128	128	1.2	1.00
0.88	228	0.9	128.0	281	281	0.9	0.88
0.80	243	0.8	118.2	294	294	0.8	0.80
0.68	272	0.7	115.2	348	348	0.7	0.68
0.60	312	0.6	113.0	374	374	0.6	0.60
0.50	352	0.5	112.5	425	425	0.5	0.50
0.40	400	0.4	111.0	482	482	0.4	0.40

R is the no. of revolutions made per unit of time in seconds.

Duncan Meter # 74520.

Run # 2.

Data showing the effect of change of load with unity power factor, 109 % normal voltage, and normal frequency.

Current	120 volts.	True Watts	60 cycles.	R	T	Temperature 73 F	Watts Recorded	% Recorded.
1.10		130		7	128.5		98.5	77.0
3.25		388		22	122.7		323.0	83.2
4.85		585		36	122.		531.	90.5
8.10		970		62	121.6		918.	94.7
10.50		1258		81	119.		1225	97.4
13.10		1570		100	116.		1550	98.8
15.50		1850		122	120		1830	99.0

R is the no. of revolutions made by the disc in T seconds.

Damon Meter # 44833.

Run 3.

Graph showing the effect of change of load with varying power factor, 100 C. M. M. V. A. difference.

Current Reading.	Rate Reading	Watts	T	Z	60 ohms.	100 ohms.
0.70	0.80	188.0	4	4	188.0	170
3.28	0.80	252.0	155.4	25	288	228
6.00	0.80	291.0	166.0	26	282	482
7.40	0.80	218.0	181.6	25	240	8.10
10.20	1258	91	113.	122	1258	10.20
8.88	1250	100	116.	120	1250	8.88
6.00	1250	180	1820	188	1250	6.00

R is the no. of revolutions made by the disc in T seconds.

Duncan Meter # 74520.

Run # 3.

Data showing the effect of change of load with unity power factor, 91% normal voltage, and normal frequency.

100 volts.	60 cycles.	Temperature 73 F.			
Current	True Watts	R	T	Watts Recorded	% Recorded.
1.35	140	6	123.7	87.3	62.3
3.15	315	17	113.	271.	86.0
4.93	495	28	111.2	453.	91.5
9.40	940	57	112.	916.	97.5
11.50	1140	69	112.	1110	97.5
13.00	1298	78	109.2	1286	99.0
15.00	1510	90	108.5	1495	99.1

R is the no. of revolutions made by the disc in T seconds.

Dodge Meter # 24950.

Run 13.

Set showing the effect of change of load with multa
boner factor, if moment voltage, and moment the change.

Recording	Recording	T	S	Time effect	Run
Members	Members	180	6	140	138
0.88	84.8	4	180.4	140	138
0.68	74.8	14	112.8	812	3.12
0.58	64.8	28	111.8	162	4.02
0.48	54.8	56	111.8	240	0.40
0.38	44.8	64	111.8	1110	11.20
0.28	34.8	68	111.8	1110	11.20
0.18	24.8	80	108.8	1380	13.00
0.08	14.8	108.8	102.8	1380	13.00
0.00	0.0	108.8	102.8	1380	13.00

It is to note that the differences made by the load in the second.

Duncan Meter # 74520.

Run #4.

Data showing the effect of change of load with unity power factor, 100 % normal voltage, and 25 cycles.

110 volts.	25 cycles.	Temperature 80.F.			
Current.	True Watts.	R	T	Watts Recorded	% Recorded.
1.1	120	3	59	91.5	76.1
3.15	345	11	62.8	315.	91.4
5.75	628	20	60	600	97.0
7.75	848	28	61.2	826	97.5
10.15	1115	38	62.	1105	99.5
12.90	1420	47	60.3	1405	99.0
15.00	1650	55	60.5	1635	99.0

R is the no. of revolutions made by the disc in T seconds.

Danger Meter # 44250.

Ran #4.

Data showing the effect of change of load with multi
power factor, 100 % motor load, and 25 ohms.
Temperature 80.0°. 110 volt.

Current.	Time Watts.	R	I	Eff	Recorded	Recorded	A
1.1	180	3	26	25.2	1.1	1.1	1.1
2.12	342	11	25.8	25.2	2.12	2.12	2.12
2.45	628	20	20	20.0	2.45	2.45	2.45
2.72	848	28	28	25.6	2.72	2.72	2.72
3.02	1112	38	38	25.0	3.02	3.02	3.02
3.32	1402	47	47	24.3	3.32	3.32	3.32
3.62	1625	56	56	23.6	3.62	3.62	3.62

Y is the no. of revolutions made by the disc in 1 second.

Duncan Meter # 74520.

Run # 5.

Data showing the effect of change of power factor with constant full load current, normal frequency, and normal voltage.

110 volts. 10 amperes. 60 cycles. Temperature 75 F.

Cos θ.	True Watts	R	T	Watts Recorded	% Recorded.
1.000	1110	38	61.8	1115	100.5
.945	1040	58	100.0	1045	100.5
.880	970	65	120.5	970	100.0
.764	840	48	102.0	846	100.7
.710	780	46	104.0	790	101.0
.595	655	41	111.5	660	100.8
.517	570	32	100.0	576	101.0

R is the no. of revolutions made by the disc in T seconds.

Dungen Meter # 44260.

Run # 5.

Date showing the effect of change of power factor
with constant total load current, normal reference, and
normal voltage.

To Volts. To amperes. Gage. Gage. To amperes. To Volts.

Coil	Time	A	%	Rate	Revolving	Coil
100.0	1110	28	61.8	1110	100.0	1.000
100.0	1040	28	100.0	1040	100.0	.945
100.0	270	25	180.0	270	100.0	100.0
100.0	840	28	102.0	840	100.0	.784
100.0	380	46	104.0	380	100.0	.710
100.0	625	41	111.0	625	100.0	.595
100.0	540	35	100.0	540	100.0	.512

It is the no. of revolutions made in the gage in the second.

Duncan Meter # 74520.

6

Data calculated from the flux phase determination showing the effect of change of power factor with normal frequency, normal voltage, and constant full load current.

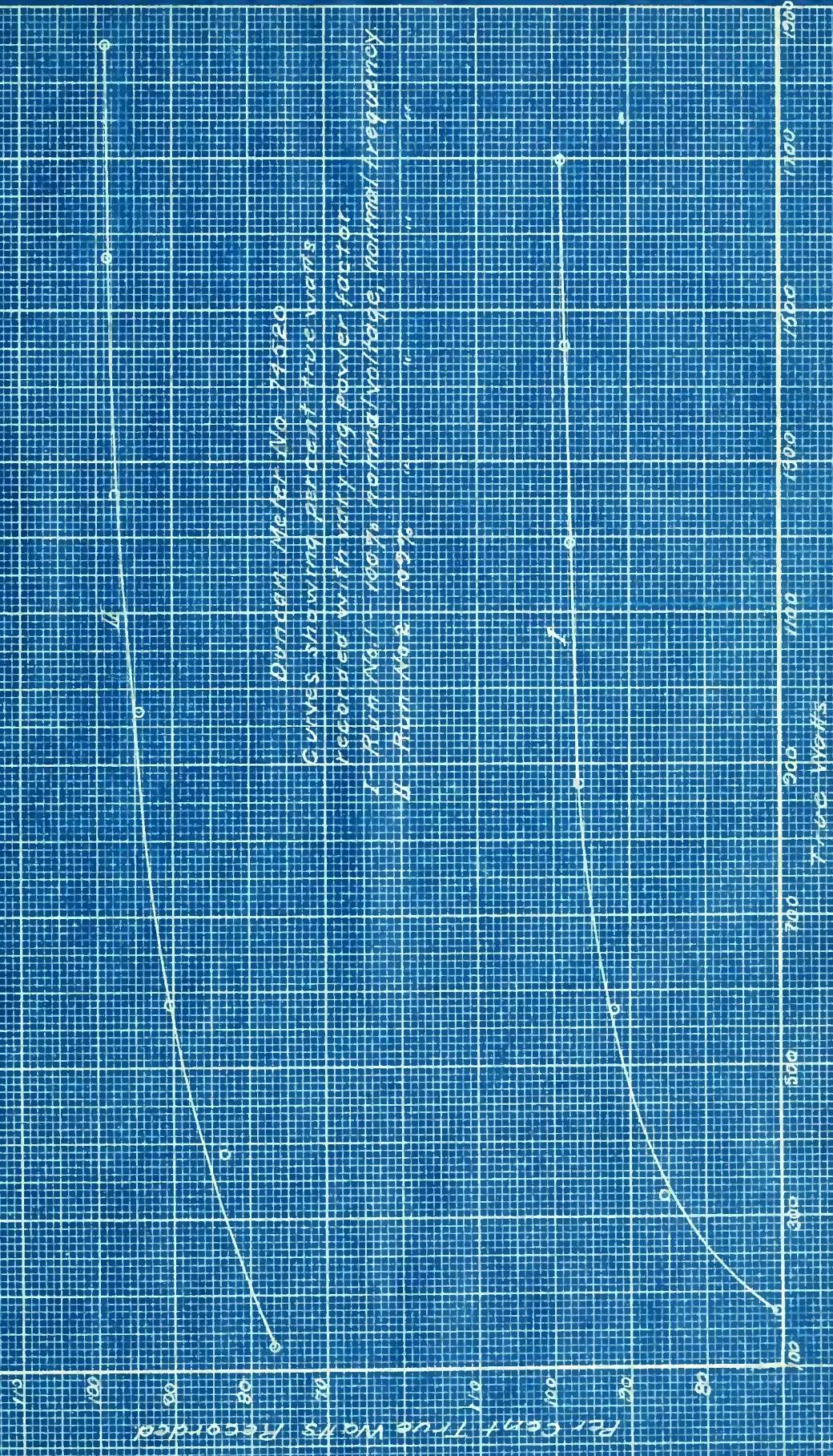
Volts 110	Amperes 10	Cycles 60	
Cos θ.	True Watts	Watts Recorded.	% Recorded
1.000	1100	1100	100
.966	1061	1062	100.1
.866	954	957	100.3
.766	844	848	100.5
.642	707	714	100.8
.500	550	557	101.1

Dodgeon Meter No. 44250.

46

Data collected from the first phase determination
showing the effect of change of power factor with
normal load current, normal voltage, and constant total
load current.

Volts 110	Ampere 16	Ampere 10	Currents 10	Currents 60
.902	.902	.902	.902	.902
1.000	1.000	1.000	1.000	1.000
1.001	1.001	1.001	1.001	1.001
1.002	1.002	1.002	1.002	1.002
1.003	1.003	1.003	1.003	1.003
1.004	1.004	1.004	1.004	1.004
1.005	1.005	1.005	1.005	1.005
1.006	1.006	1.006	1.006	1.006
1.007	1.007	1.007	1.007	1.007
1.008	1.008	1.008	1.008	1.008
1.009	1.009	1.009	1.009	1.009
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Diamond Meter No 23520

Cuttings sample of cuttings made yesterday

City Building road
Lodging house
Benton Nov 1 1915
for open dry sand

PER CENT FINE MATERIALS RECORDED

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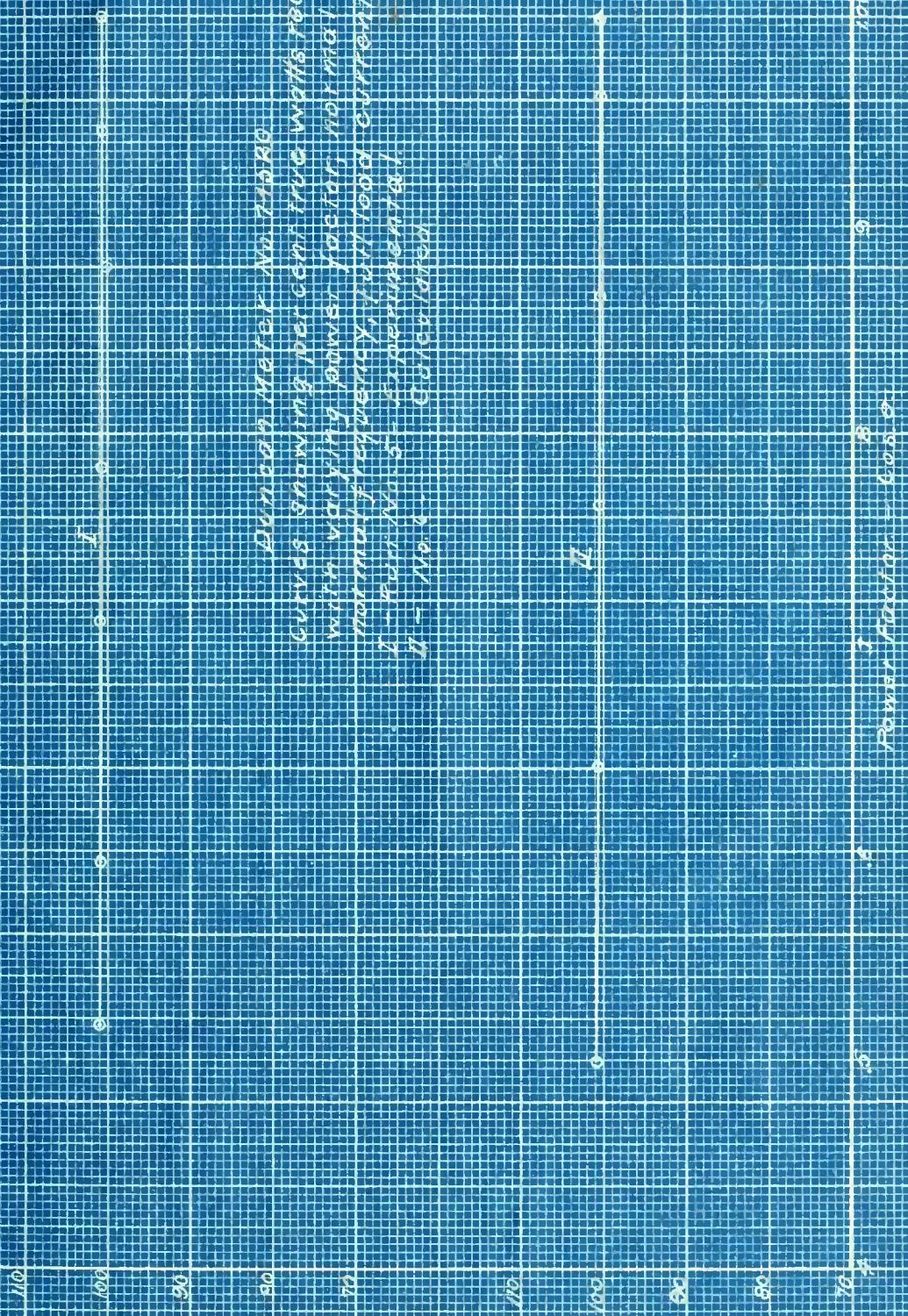
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ALLSTATE

Per cent of the watts received.



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INSTITUTE OF TECHNOLOGY
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