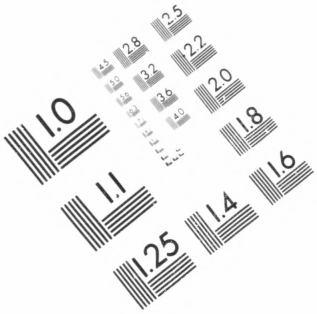

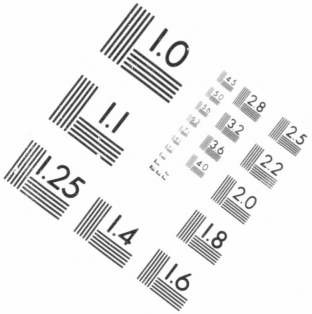

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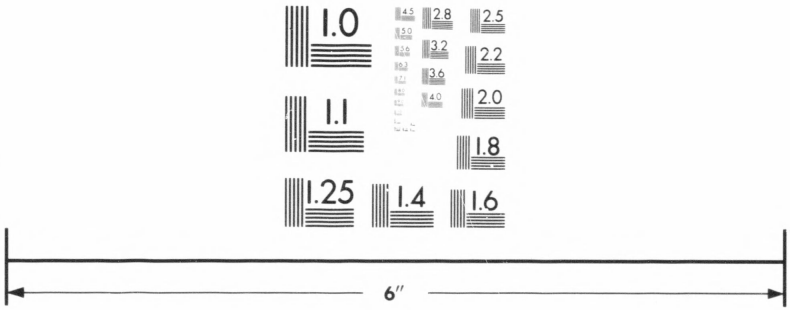

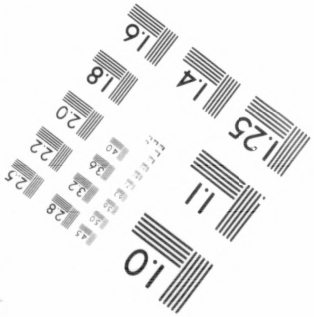

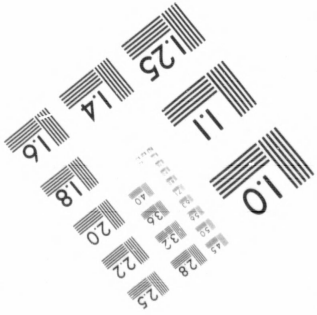

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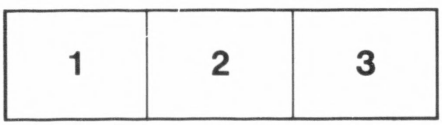

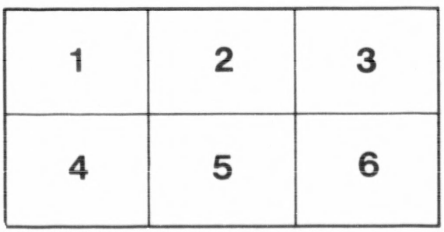

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A TREATISE

ON

TIME AND ITS NOTATION

FOR THE USE OF SCHOOLS

IN THE

DOMINION OF CANADA.

ISSUED UNDER THE AUTHORITY OF

THE CANADIAN INSTITUTE,

TORONTO.

1888.

OTTAWA:
PRINTED BY MACLEAN, ROGER & CO., WELLINGTON STREET.
1888.

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CANADIAN INSTITUTE,

TORONTO, 15th March, 1888.

TO THE HONORABLE G. W. ROSS,
Minister of Education, Province of Ontario.

SIR,—On behalf of the Canadian Institute, we have the honour to invite your attention to the accompanying Treatise on "Time and its Notation."

The Canadian Institute, as a body, has always taken a deep interest in the subject considered in this publication, believing that the question is one which concerns the common good of the community generally.

The Council of the Institute are satisfied that the movement for reforming our Time system will be effectually promoted by bringing the subject in its educational bearing before the youth of the country.

Having this object in view, it has been deemed advisable to issue the Treatise, which is taken from the published writings of Mr. Sandford Fleming, an honorary member of the Institute. The hope is entertained that, as the head of an important educational system, you will be good enough to assent to its use and direct how it can best be brought to the attention of the schools under your supervision.

The Council venture to think that the work will be found useful, and they are encouraged to hope that you will enjoin Teachers to give special lectures and lessons on the principles which it sets forth, to the pupils attending the schools.

Through the medium of the schools, it is believed that in a few years the great mass of the people will have their minds familiarized with the subject, and be prepared to accept the new Notation in ordinary life.

We have the honour to mention that similar means are being taken to inform all those of school age throughout the United States.

We have the honour further to state that a similar communication will be addressed to the Superintendents of Education in each of the Provinces of the Dominion.

We beg leave to request that you will be good enough to inform us how many copies of the Treatise we may be permitted to forward to you. A limited number will be furnished free of charge, and the Institute will be happy to supply any additional copies at the cost of paper and press work.

We have the honour to be, Sir,
Your obedient servants,

CHARLES CARPMAEL, M.A., F.R.A.S., F.R.S.C.,
President.
ALAN MACDOUGALL, M. Inst. C.E., F.R.S. Edin.,
Secretary

CANADIAN INSTITUTE,

RICHMOND STREET, TORONTO,

March 31st, 1888.

The Minister of Education having expressed his willingness to receive further personal explanations on the subject, on the 27th of March last, a deputation representing the Institute waited upon Mr. Ross. The whole matter was discussed, especially the object which the publication was designed to attain and the means suggested to introduce the Treatise into use in the Public Schools.

The Minister was pleased to intimate that generally he assented to the views expressed, and that he would without delay take initiatory steps to promote the movement. Within a few hours the following letter was received by the President :

EDUCATION DEPARTMENT, ONTARIO,

TORONTO, March 27th, 1888.

MY DEAR SIR,

Acting on the suggestion of the deputation that waited upon me this morning respecting "Time and its Notation". Will you kindly place at the disposal of this Department, five hundred copies of Mr. Sandford Fleming's pamphlet, for distribution to the Inspectors of Public Schools, and the Head Masters of High Schools throughout the Province. I shall be pleased to aid the movement for reforming our Time system.

Yours truly,

G. W. ROSS.

CHARLES CARPMAEL, ESQ., M.A.,
Meteorological Observatory,
Toronto.

INTRODUCTION.

This treatise, written in simple language, has for its main object the instruction of youth on the subject of Time and its measurement. Its design is to set forth the advantages to be derived from the use of a system of Notation, by which the passage of Time can be accurately and uniformly denoted throughout the civilized world by the same expressions.

The attempt is made in the following pages to make plain a modification in Time-reckoning, formulated on clearly defined principles. However briefly the explanations are given, it is with the hope that they will be found sufficiently intelligible. The change advocated is based on the resolutions of the delegates from various parts of the world, who represented their respective Governments in Conference in the autumn of 1884, at Washington, on the invitation of the President of the United States.

The unimpeachable character of the system proposed has been recognized by the highest authorities in the scientific world. Theoretically, no argument can be advanced against its acceptance. The one difficulty to be contended against, is its novelty; and it is only owing to its divergence from ancient usage that its practical application may be delayed.

As a rule, those advanced in life cling to the customs and theories they have long known. If, as a possibility, we could conceive a community composed entirely of aged persons, we might dream of an Utopia where change would be unknown.

This conservative element has its value, as it has its strength. When wisely exercised it will beneficially restrain recklessly conceived projects and vain experiments. It is, however, only to be commended when it has reason on its side; when the resistance it may offer to novel introductions is based on the teachings of experience and on sound judgment.

In the case in point not a single valid reason can be advanced in support of the ancient custom, by which each of the numberless localities on the surface of the earth, establishes its own reckoning of Time, arbitrarily, regardless of the outer world, and without consideration of the difficulties and confusion which the practice creates.

On the other hand, the new system is founded on scientific investigation, and is based on principles established from the observation of twenty centuries; principles which have now been stamped with the authority of the representatives of all nations.

It is to familiarize the mind of youth with correct ideas on this subject that these remarks have been put forth in their present form. By this means it is confidently anticipated that the difficulties which appear to stand in the way of the much needed reform may eventually be overcome, and that public opinion will ultimately be influenced to accept the new system of Time Notation.

TIME AND ITS NOTATION.

SECTION I.

THE IMPORTANCE OF THE QUESTION.

1. There are few considerations which, to the same extent, affect humanity as the passage of Time. It concerns every nation, every community, and race, indeed every individual on the surface of the globe.

2. Time is connected with all our duties, and with all the events of our lives in every stage of our existence.

3. Nevertheless there are few subjects so little understood; few persons can even properly define in what Time consists.

4. We have inherited from our forefathers certain usages in connection with its Notation, which modern experience has proved to be misleading and confusing.

5. We are constantly hearing of solar, sidereal, civil, astronomical, and local Time. Wherever we may travel in every country, we have distinct variations in each one of them. We do not find any two local Times in agreement except in the same longitude.

6. These results are the outcome of ancient usages and they imply a great variety of separate and distinct Time systems.

7. Moreover, the traditional practices which we follow associate the numbers of the hours with the position of the sun in each local firmament. For example, it is called 12 o'clock when the sun appears at the highest altitude to the spectator, whatever his position on the circumference of our sphere.*

8. Such usages are based on untenable principles. They ignore facts with respect to the true nature of Time which are indisputable; and they have caused embarrassment by making that which is a unity in itself appear to be divided into many classifications.

SECTION II.

THE PRESENT SYSTEM OF RECKONING.

1. Time is measured on the earth ordinarily by the sun's apparent motion in the heavens.

NOTE.—In this and the following sections the Sun alluded to is what is known by astronomers as the "Mean Sun."

2. The earth's rotation on its axis brings any given spot within the sun's rays, the first appearance of which we call sunrise.

3. As the earth continues to revolve, any given spot is moved onward until it comes directly opposite or under the sun. At that moment the sun is said to be in the Meridian of the place; or in other words the place is said to have a solar passage.

4. The earth continues to revolve until the sun is hidden from our sight. We call this phenomenon sunset.

5. The sun is again seen apparently rising from the eastern horizon; later it again reaches its highest position opposite the spectator when we have another solar passage.

6. The period of Time which we ordinarily call a day, begins 12 hours before and ends 12 hours after a solar passage at any place. As the globe revolves on its axis, every moment brings a fresh solar passage at succeeding Meridians, so that one day is always beginning and another ending somewhere.

7. With each place on the globe's surface determining the day according to its own Meridian, it is plain that we have, taking into view the whole earth, a countless number of days, all differing in the Time of their commencement and close.

SECTION III.

DEFECTS OF THE PRESENT SYSTEM.

1. The difficulties inseparable from the present method of Time reckoning have been set forth as follows:—

2. As the solar passage at any place denotes 12 o'clock noon, and as during each diurnal revolution there is a continual succession of solar passages, it follows that in taking a comprehensive view of the earth, it never ceases to be 12 o'clock, noon: a theory applicable to every hour of the twenty-four, and to every minute of every hour. Hence, it may be said that our usages imply the continual co-existence of every one of the 86,400 seconds into which the day is subdivided.

3. Except at places on the same Meridian, there are no simultaneous days on the earth's surface, and as the different days are always in various stages of advancement, discrepancies and errors result in assigning the precise period when an event takes place. The telegraph may give the exact local Time of an occurrence, but the Time so given must be in disagreement with local Time on every other meridian around the globe.

4. An event occurring on any one day may on the instant be announced in a locality where the Time is that of the previous day and in another locality where the Time is that of the following day.

5. About the period when the month or year passes into another month or year an occurrence may actually take place, according to our present system of reckoning, in two different months or in two different years.

6. There is therefore no certainty with regard to Time unless the precise geographical position be specified as an essential fact in connection with the event described.

7. Under these circumstances, it is obvious that our system of Notation is defective and possesses every element of confusion.

8. These incongruities are now being brought into prominence owing to the agencies of steam and electricity being employed to promote intercourse between nation and nation, and man and man.

9. Until the introduction of these modern agencies to the advancement of the general convenience, each locality was, to a great extent, contained within itself. Its foreign relationships were few and unfrequent. The inhabitants of a city had comparatively little intercourse with other communities which called for accuracy in the computation of Time.

10. Then isolated from the other groups of mankind the inconsistencies alluded to were unfelt; each place adopted its own reckoning of Time and its necessities suggested and required no change.

11. In modern times by rapid and instantaneous communications, the populations of all the civilized portions of the globe are being brought, so to speak, within one circle of observation

12. The age is remarkable for its discoveries in science and their practical application to daily life. We are accordingly made both to understand and to experience the confusion and the want of definiteness which arise from usages based on unsound or inadequate principles.

13. As railways and telegraphs are extended and multiplied, the difficulties will be intensified and will lead to complications in social and commercial affairs, to errors in chronology, to litigation in connection with, succession to property, insurance policies, and what are known as time-contracts in commerce; and in view of individual and general relationships they will act as a clog to the business of life to prove an increasing hindrance to human intercourse.

SECTION IV.

THE PROBLEM FOR SOLUTION.

1. The great aim is to establish a complete system by which Time may be computed everywhere on true principles and on a uniform basis.

2. The solution has been undertaken by scientific societies, aided by individual effort. In Europe and America, Conventions have been called to consider the course necessary to be taken.

3. It has become evident that the irregularities which have led to the existing dissatisfaction, arose from the failure to understand the true nature of Time and the means which should be taken to record its passage.

4. It has been found necessary first to determine how far the system at present followed is correct, or incorrect, and to what extent old usages can be retained in the attempt to introduce a Notation to meet fully all the new conditions which are being developed in this age.

5. While it is recognized that daylight and darkness must always govern the social affairs and ordinary duties of life in each locality, it is seen that there must be some common measure of Time and some method of computation which will be universal in its application.

SECTION V.

THE WASHINGTON CONFERENCE.

1. It was to determine the best mode of attaining the result desired, that among the various Conventions summoned, the President of the United States, on the authority of Congress, invited the Governments of all civilized nations to take part in the solution of the problem.

2. The Washington Conference was held at the political Capital of the United States; the Governments of twenty-five nations sending Representatives to it.* The Conference met throughout the month of October, 1884, and its members, with unanimity, agreed upon the establishment of the principles upon which the inhabitants of the globe may hereafter compute Time on one uniform system.

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* The following nations were represented by delegates at the Conference, viz.: Austria-Hungary, Brazil, Colombia, Costa Rica, France, Germany, Great Britain, Guatemala, Hawaii, Italy, Japan, Mexico, Paraguay, Russia, San Domingo, Salvador, Spain, Sweden, Switzerland, United States, Venezuela, Chili, Denmark, Liberia, Netherlands, Turkey.

SECTION VI.

THE UNITY OF TIME.

1. Time, unlike material bodies, cannot be divided into separate parts so as to constitute two or more distinct classes of duration, in the sense that solids and fluids can be divided.

2. Time may be compared to a stream unbounded in breadth, and illimitable in length, flowing onwards uniformly and unceasingly. There is no break in its continuity. There is only one constant unbroken and interminable passage of Time which pervades all space and all material things in nature. Carlyle speaks of it in these words: "The illimitable, never resting thing called Time, rolling, rushing on, swift, silent, like an all embracing ocean tide."

3. More than one unvarying stream of Time is inconceivable. Time may be likened to a continuously flowing quantity, the same throughout the entire universe. It is in no way influenced by matter, locality, distance or space. Time is essentially non-local, an indivisible unity, with the remarkable attribute, that it can be measured with the nicest precision.

SECTION VII.

THE UNIVERSAL DAY.

1. The decisions of the Washington Conference were in accord with the theory that Time is a unity, and that there should be one uniform computation of its passage.

2. The Conference accepted the fundamental principles of Universal Time, and established the Universal Day as a standard of measurement to be common to the whole globe.

3. This Universal Day is determined by the diurnal revolution of the earth. There is nothing in nature more certain or more uniform than the motion of the globe on its axis. The Universal Day is measured by this motion, and it is the interval between two successive solar passages on a particular Meridian which by the choice of the International Conference became the Zero for computing Time.

4. Unlike an ordinary day which is a purely local phenomenon the Universal Day is a measure of duration unrestricted by locality. As such it has been termed by societies and individuals, the Cosmic Day, by others the World Day. By whatever name it may be known it is equally related to all localities, and being essentially non-local, Universal or Cosmic Time will be understood to be the Time of the world.

5. The Meridian which establishes the Zero of Time Notation is in agreement with the Meridian from which terrestial longitudes are numbered. The latter, termed the Prime Meridian passes through the observatory at Greenwich. The former is on the direct opposite side of the earth and is termed the Antiprime Meridian.

6. The hours of the Universal Day are numbered in a single series – one to twenty-four—the same hour everywhere retaining the same number, uninfluenced by difference of longitude.

7. Accordingly the hours, with their sub-divisions of minutes and seconds, are always in complete agreement throughout the earth's surface.

SECTION VIII.

THE STANDARD HOUR MERIDIANS.

1. The position of the Standard Hour Meridians is derived from the Zero Meridian, determined by the Washington Conference.

2. Beginning at Zero, the Hour Meridians regularly established, at intervals of fifteen degrees of longitude, represent differences of one hour in Time. Such Meridians, equidistant on the circumference of the globe, may be employed for the regulation of Time in all localities, in all countries.

3. It must be clear that the Time so regulated will everywhere be directly related to the Universal or common World Time.

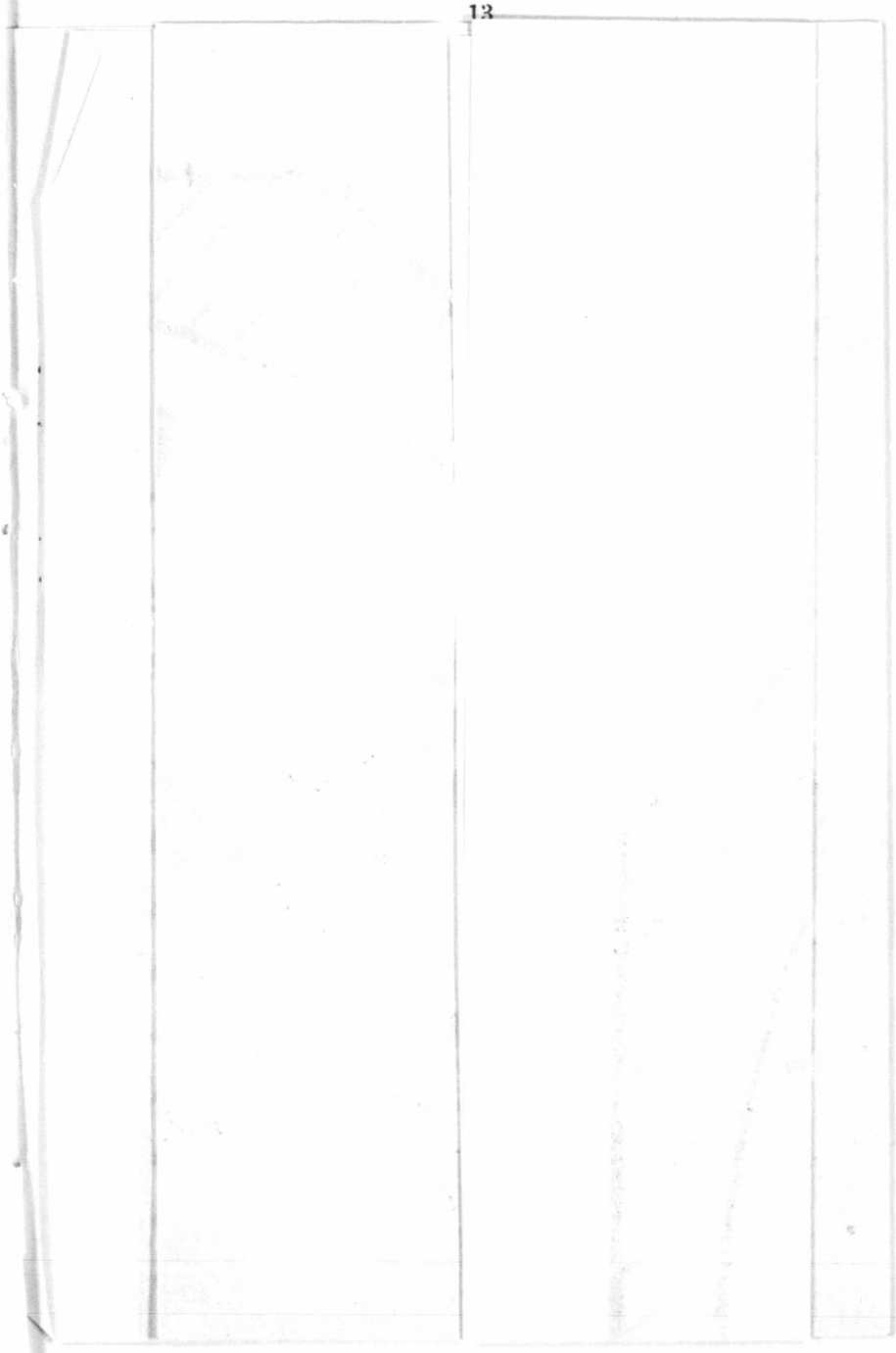
4. By numbering the Hour Meridians 1 to 24 from Zero, in consecutive order (See plate), the earth in its rotation becomes the great natural chronometer to regulate the reckoning of Time everywhere.

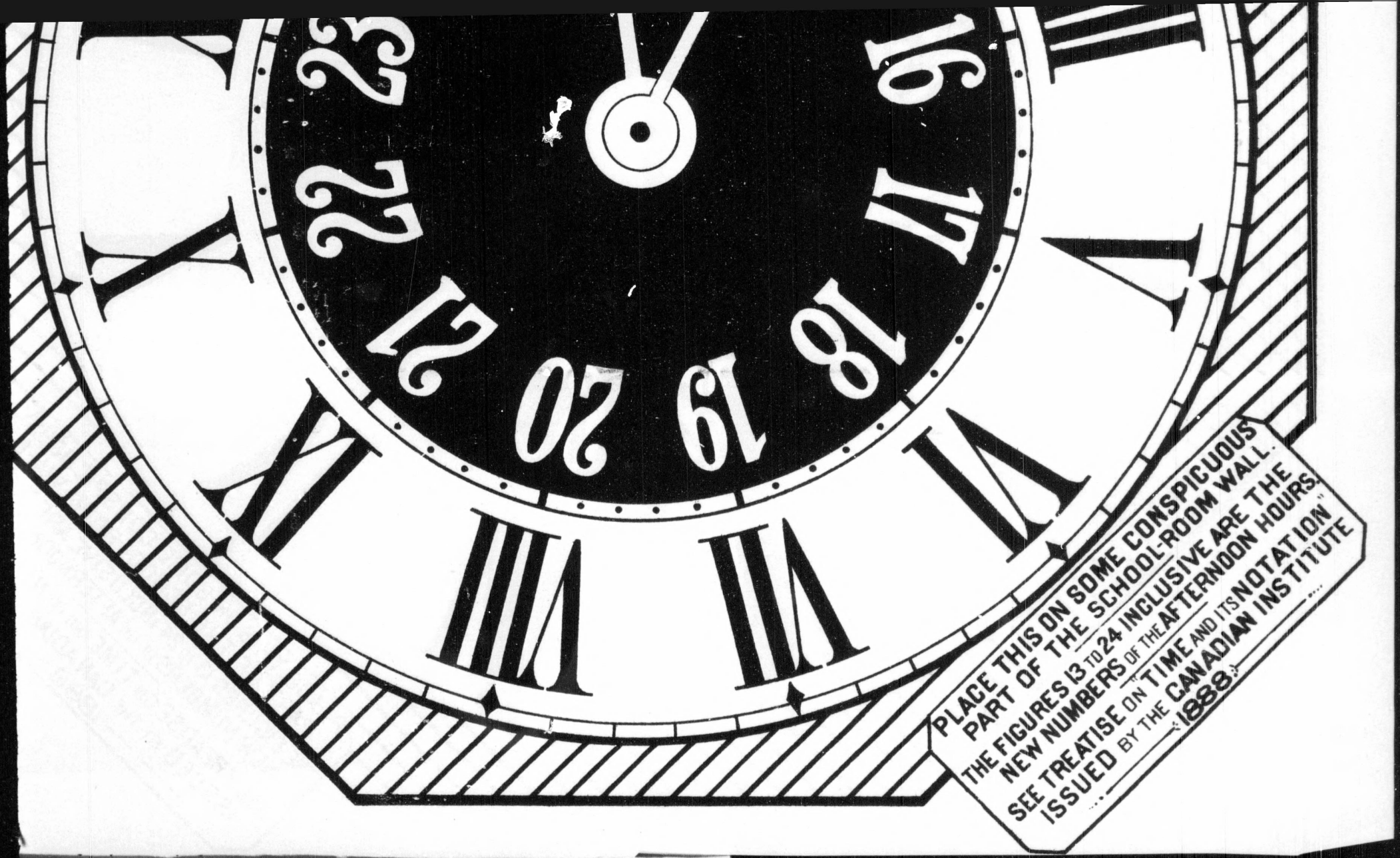
5. The Universal Day dates its commencement at the moment that the sun becomes vertical on the Meridian which, by the determination of the Washington Conference, establishes the Zero of Time Notation.

6. The solar passage at each of the Hour Meridians, according to their distinguishing number, will, at the moment of the solar passage at each such Meridian, indicate the true hour of the Universal Day. *

7. Thus the solar passage everywhere becomes the index of Time common to the whole world.

NOTE.—For the geographical position of the Hour Meridians see Appendix B.

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XI XII I II III IV V VI VII VIII IX X
PLACE THIS ON SOME CONSPICUOUS PART OF THE SCHOOL-ROOM WALL.
THE FIGURES 13 TO 24 INCLUSIVE ARE THE NEW NUMBERS OF THE AFTERNOON HOURS.
SEE TREATISE ON TIME AND ITS NOTATION ISSUED BY THE CANADIAN INSTITUTE 1888.

XI
22
23
24
13
14
15
16
III

Sun
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SECTION IX.

THE TWENTY FOUR HOUR NOTATION.

1. The practice of dividing the day into halves, numbered 1 to 12 in each case, distinguished as A.M. and P.M., has long been in use, but there is nothing to recommend it but custom and antiquity.

2. If this system of division be attended by any special benefit, it may be asked would it not equally be an advantage to have the hour, the week, the month, similarly divided into half hours, weeks and months, the one half in contra-distinction to the other?

3. If the practice be good and wise why not extend it to the currency and reckon by half dollars of fifty cents, in place of whole dollars of one hundred cents?

4. The division of the day into halves at noon, is productive of so much inconvenience, that the feeling must be one of surprise that it was ever made.

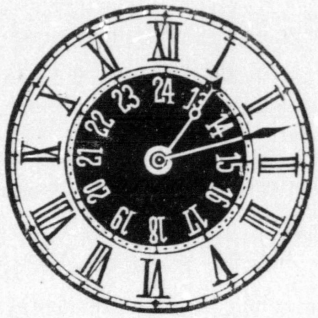
5. Since the introduction of railways, countless mistakes and delays involving loss have occurred, owing to the misprinting of the letters A. M. or P.M. Even when these letters are correctly given, the detail of the Time table is very often understood with difficulty. There is scarcely a traveller who has not to regret some misunderstanding, and disappointment, arising from this imperfect distinction.

6. The old usage offers no single advantage. The new system of reckoning the hours from one to twenty-four is without a single objection. It is in use on thousands of miles of railway with singular success.

7. The adoption of the new Notation completely removes all doubt as to the hours of the day. In special cases during its introduction, it may be well to add some explanatory words; thus, it could be stated with reference to an important engagement, "It will take place at 19:45 (7.45 o'clock. P. M. Old style)." Generally such addenda will not be necessary, and in a short period the new nomenclature may be used without explanation in any case.

8. It is suggested that a "colon," two vertical dots between the hours and minutes (thus 19:45 or 17:08), will be a sufficient distinctive mark for all ordinary purposes. A "colon," so placed, will at once denote Time and separate the hours from the minutes in the same manner as a single dot denotes *decimals* and separates whole numbers from parts of numbers. Generally there will be no necessity for adding the words "o'clock," or "hours" or "minutes." A "colon" so placed will be taken to denote *time* as unmistakeably as % denotes *per cent.*, as the sign $ stands for *dollars*, and as £ s. d. are the symbols for *pounds, shillings and pence.*

9. The Twenty-four Hour Notation has received the authority of the Washington Conference. The representatives of the first of the world's nations resolved that the old usage of numbering the day by two sets of twelve hours should be discarded, and that the hours of the Universal Day should be continued in a single series, from one to twenty-four (1 to 24). A slight acquaintance with modern scientific publications will establish that the new Notation is favoured by all men of intelligence who have examined the question.



10. The 24 hour Notation will not involve any change in the character of ordinary clocks and watches now in use. All that is necessary is to place on their dials the new numbers of the afternoon hours in an inner circle, as shown in the diagram or in such other manner as experience may dictate.*

SECTION X.

ADOPTION OF THE STANDARD HOUR SYSTEM.

1. On the Continent of North America, Time is regulated according to the Standard Hour Meridians, the principle of which is explained in Section VIII. In Great Britain and Sweden the same principle is observed. Throughout the Japanese Empire, the system has been established by law and it came into force on the 1st January, 1888.

2. Thus we have a fundamental principle of Universal Time, introduced into common use, in important divisions of the three Continents of America, Europe and Asia.

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* Clock and watch manufacturers are bringing into use various devices to meet the case The temporary means employed by Railway managers in introducing the new Notation is referred to in the appendix.

3. Wherever the principle of the Hour Meridians is acted upon, the hours, although they may be known by different numbers, will be in universal accord. A well regulated clock in one country will strike at the same moment as the clocks in all other countries. The minutes and seconds will be in complete agreement in every respect.

SECTION XI.

ADOPTION OF THE 24 HOUR NOTATION.

1. The adoption of the 24 hour Notation is favored by prominent men of science in Russia, Germany, Italy, Spain, France, Great Britain; and indeed throughout Europe generally. It is warmly supported in the United States and Canada. It has no stronger advocates than the Imperial Astronomer of Russia and the Astronomer Royal of England.

2. It has been brought into daily use on the great lines of Telegraph communicating from England to Egypt, India, China, Australia and South Africa.

3. The Canadian Pacific Railway adopted the Notation on the opening of the line from Lake Superior to the Pacific Coast, in 1886. It has continued in use, only to obtain more assured favor.

4. It has likewise been accepted by the Canadian Government on the Intercolonial line from Quebec to Halifax. At the beginning of 1888 it was employed for Railway purposes in the Provinces of Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Assiniboia, Alberta and British Columbia.

5. Wherever it has been adopted on Railways, it has been found advantageous in facilitating the movement of trains, and promoting the public safety. Experience has shown that, in the more intelligent and progressive communities, the public have readily accepted the change. The press, generally, has expressed a favourable opinion with regard to the new Notation.

6. It has been received with favour in nearly every quarter where it has been considered, and it is believed the day is not far distant when it will be brought into common use on the Railways throughout the whole of North America.

SECTION XII.

ADOPTION OF UNIVERSAL TIME.

1. The scheme of Standard Time by Hour Meridians, although valuable in itself may be considered only as a means of introducing a uniform reckoning of Time throughout each continent. In North America, Standard Time is acknowledged to have proved of incalculable public advantage, but it has left inconveniences which are still to be overcome.

2. As we travel westward from the Atlantic to the Pacific we pass through four regions differing in their reckoning by changes of even hours. In consequence of these differences, there are breaks in the Notation along the boundary lines of the several regions. The transference from region to region is attended with inconvenience; and although tolerated sa being less annoying than the much larger number of transitions formerly experienced, the difficulties will not be lessened as population and lines of communication increase. At no distant day it will become necessary to seek for the means of removing every obstacle to perfect freedom of intercourse.

3. The one available means to this end is to secure a uniform system of Time-reckoning throughout the continent. Naturally the attainment of this result suggests the adoption of Universal Time and the introduction, in its complete or in a modified form, of that which eventually must become the Notation of the world.

4. A fair and attentive consideration of the subject, set forth in the foregoing pages, must establish that there exists no necessary connection between the numbers by which the hours may be known and the position of the sun in relation to any portion of the earth's surface.

5. Take, for example, the hour of twelve: We have hitherto been accustomed to speak of 12 o'clock, as the hour when the sun is on the meridian of the locality where we live. No reason exists why the noon hour should not be called ten or fourteen, or, indeed, by any number of the series from one to twenty-four.

6. Reckoning by the Notation of Universal Time, the noon hour will invariably bear the same distinctive number as the Hour meridian of the locality. Each noon hour will have a different number according to longitude; for example, when the sun is in the Meridian at St. Petersburg it will be called the 10th hour, when in the Meridian of New York the 17th hour. The hour of noon will pass round the globe, its number advancing from one to twenty-four, each Hour Meridian distinguishing its noon by a separate and distinct number. Excepting within the region where the local reckoning is regulated by the 12th Hour Meridian, at no place will noon be known numerically as 12 o'clock.

7. When this principle of numbering the hours shall have been generally accepted it will be an easy step to admit its application in any case.

8. In those countries where Time is regulated by the Standard Hour Meridians as in North America, in some parts of Europe and in the Japanese Empire, and it shall be considered expedient to bring the Notation into more complete harmony with the Time of the World, it is obvious that the transition will not be difficult. It will be effected simply by moving forward or backward the dial hands of the clock a given number of even hours, as each case may require.

9. The adoption of Universal Time for all purposes of life, in all parts of the world, involves important considerations with respect to the Calendar dates, which claim attention.

SECTION XIII.

DAYS AND DATES.

1. In common language, the day, is that portion of the period occupied by a revolution of the earth, which is opposed to darkness or night; it is also understood to be the whole period from midnight to midnight, embracing in succession morning, noon and evening. In both cases it is associated in our minds with the alternations of light and darkness.

2. The term Universal or Cosmic Day has a much wider meaning. It is a measure of Time common to the whole world, and should be viewed as entirely disassociated from the phenomena of light and darkness.

3. Sunrise and sunset are important epochs to mark the ordinary or natural day, and as each locality differing in longitude has a separate sunrise and sunset, it is obvious that during each revolution of the earth on its axis there is a continual succession of natural days; each locality around the globe having its own day. Every natural day is local, and during each diurnal revolution we have as many such days as there are points on the surface of the earth varying in longitude; that is to say, in theory, the number is infinite.

4. Steam and electricity are conferring on the human race marvelous facilities for communication. Railways, steamships, telephones and telegraphs by land and sea, are bringing together the remotest parts of the earth. Every year localities separated by great distances are being brought, it may be said, into near neighbourhood. In recording events and in transacting business between distant places, it will not be possible under the old system of local Time to reckon the Calendar days, so as to avoid error and the difficulties which spring from inaccuracies in dates.

5. As an illustration of the anomalies which may result we have only to consider the consequences of instantaneous telegraphic connection between points having intimate commercial or political relations. A local day always begins in Ottawa and Washington three hours before the previous local day comes to an end in Vancouver and San Francisco. Again, an event may occur in California and British Columbia on the 31st December, sixteen to twenty hours after the 1st January had commenced in the Australian Colonies. Under such circumstances it is not difficult to conceive that serious errors may arise in matters of ordinary business and of public concern.

6. The Universal or World Day is the mean of all possible local days, and its general adoption as the unit for reckoning dates will render it practicable to overcome all the difficulties pointed out.

7. According to the determinations of the Washington Conference, the solar passage on the Antiprime Meridian is the initial Time-point of the Universal Day. This Time-point taken as the change of date in all parts of the world, brings the change of date to different periods of the local days, according to the geographical position of the various localities.

8. Only on the Prime Meridian will the change of date, according to the World Day, occur at midnight; to the eastward of that Meridian it will come after midnight, and to the westward it will occur before midnight. For every 15° of longitude eastward or westward, the change of date will be one hour after or before midnight in each case respectively.

9. Under the old system we hold the change of date everywhere to be at the midnight of each separate locality, but it has not always been so held, and it is not now a universal practice. The Jews, Turks and some other nations commence the day at sun-set. The Arabians, like modern astronomers, begin the day at noon, the Chinese an hour before midnight and the Japanese, until recently, have followed the custom of the ancient Babylonians in beginning the day at sun-rise.

10. The period for commencing the local day is established by usage, and there is no reason beyond general convenience why it should not begin at any stage of the earth's diurnal revolution.

11. The adoption of the Universal Day for all purposes of life, will admit of the Calendar dates being concurrent throughout all parts of the world; but as one side of the earth is always exposed to the sun's rays while the other is in shadow, it follows as a consequence that the simultaneous change of date must occur in different localities at all stages of light and darkness; that is to say, the moment of change from one date to another will fall at different periods of the local days in progress, in the various longitudes.

SECTION XIV.

CONTINENTAL NORMAL TIME.

1. It would not be possible for the world's dates to be concurrent on any other principle than that laid down, and in busy communities it would be open to objection to have the period of change at inconvenient hours. Fortunately, owing to the geographical distribution of the continents, the change of the World Day will occur in many important countries out of ordinary business hours.

2. In all communities it would be inconvenient to have the change of date during the working hours of the day; for many reasons it is desirable that the change should occur at some one of the middle hours of darkness, either before or after midnight.

3. For all practical purposes this object can be attained by the simple expedient of adopting for each continent requiring such provision, a Normal reckoning, which would be a definite number of hours behind or in advance of Universal Time.

4. Take for example North America. As the Universal Day begins on the central Meridian of the continent six hours before midnight, a reckoning six hours behind Universal Time would bring the apparent change of date to midnight on that Meridian. Supposing that such a reckoning be used everywhere between the Atlantic and the Pacific, the continental change of date would occur within the limits of the well known Standard Hour regions, as follows, viz.:—

The "Intercolonial" (60° W. long.), two hours after midnight.
The "Eastern" (75° W. long.), one hour after midnight.
The "Central" (90° W. long.) at midnight.
The "Mountain" (105° W. long.), one hour before midnight.
The "Pacific" (120° W. long.), two hours before midnight.

5. The adoption of a reckoning six hours behind World Time, to be known as American Normal Time, would result in uniformity from ocean to ocean, and it would overcome all the difficulties now experienced along the boundaries of the several Standard Time regions. The continental change of date would everywhere be concurrent, and although occurring at local midnight only in the central division of the continent, it would in every case fall within the middle hours of the night, so as in no way to interfere with business.

6. Turning to the opposite side of the earth, the Universal Day begins six hours after the local midnight on the central Meridian of Asia. In this case a reckoning six hours in advance of World Time would bring the apparent change of date to midnight on that Meridian. The adoption of such a Normal Time as a basis for uniform reckoning throughout

the Eastern Hemisphere would serve the same beneficial purposes as those referred to in connection with the American Normal Time.

7. If on this principle the reckoning of Time on the eastern and western continents be settled on a uniform basis, a simple correction in each case will bring the reckoning to World Time. In the case of America the correction will be *plus* six hours, in that of Asia *minus* six hours.

8. In both Europe and Africa the Universal Day itself might be taken as the common Standard. In both continents the change of date will occur in all important localities within one or two hours of the local midnights.

9. Australia with some reason might claim an independent Normal reckoning, possibly the same as that recently adopted by Japan. Many advantages would, however, result from the establishment of but one Normal Notation common to all countries lying eastward from Europe and Africa.

10. The same remarks apply to South America, the central districts of which lie somewhat to the east of the central Meridian of North America. There are many reasons, however, for the adoption of a common Time reckoning by the people of the two continents.

11. The simplest arrangement is to have *one eastern* Normal Time for Asia, Australia and the islands of the Indian and Pacific Oceans, and *one western* Normal Time for the twin continents of America. By such an arrangement a uniform reckoning on all the continents will be practicable and the translation of these subordinate reckonings to World Time can, whenever required, be effected with perfect accuracy and ease.

SECTION XV.

THE LEGAL HOURS IN EACH LOCALITY.

1. In all civilized communities the law recognizes certain hours of the twenty-four for opening and closing public offices, and for other purposes. A question will therefore arise as to what may be termed the "legal hours" under the new Notation.

2. It may be assumed that no change will in any degree affect our habits of life. We shall be governed as now by daylight and darkness. There will be no necessity to alter the periods of sleep or labour or to modify in the least the daily duties which follow the succession of morning, noon and night.

3. The only marked change will be in the numbers by which the hours will be known in the various longitudes. To establish the legal hours in

any locality, it will only be necessary to select a convenient hour as a Time-point and define it by statute as the local Zero for regulating the hours for opening and closing public offices, the poll, schools, churches or places of amusement, the hours for meals, social intercourse and all purposes of life.

4. The noon hours being governed by the longitude of the place, will generally be found the most convenient Time-points for regulating the legal hours in all localities. As an example, where it has been the custom to open any public office at 9 o'clock A.M., the office will continue to be opened three hours before noon, whatever the number of the noon hour.

SECTION XVI.

CONCLUSION.

1. It has been pointed out that we have inherited from our forefathers certain ideas and usages in relation to Time and its measurement, which the progress of events has rendered effete and inadequate. These long continued customs answered their purpose in the condition of mankind when they originated; we have, however, now entered upon a period in the world's history entirely different in its conditions, and it is not surprising that the usages of by-gone centuries are found incompatible with the new order of things.

2. In these days of rapid transit by railway and steamship, and the still more rapid communication by telegraph, telephone and electric cable, it is of great and general importance to recognize the unity of Time and take means to compute its passage by one common Notation. The necessity of so doing is now felt and the necessity increases with advancing science and passing years.

3. The Washington Conference, in which the representatives of twenty-five nations took part, assisted in the solution of the problem; a solution entirely practicable, and possibly the only practicable means of completely overcoming all the difficulties and securing all the advantages which are obtainable.

4. North America has taken the first step in giving practical effect to the solution of the problem by the adoption of what is known as Standard Time. The next important movement will be the acceptance by the general public of the 24-hour Notation. These steps effected, the crowning effort in the United States and Canada will be to secure complete uniformity throughout the continent by the adoption of Universal Time, or its equivalent, American Normal Time.

5. The nomenclature of the new system of reckoning will be universal, so that there need be no ambiguity, or confusion. The possibility of

discrepancies in the Calendar dates will be removed. The hours, the minutes, the seconds, will be everywhere concurrent. All divisions of Time in which the general public is concerned, will be established on a uniform basis, so that the greatest possible degree of accuracy will be reached, in commercial affairs, in recording events, in observing natural phenomena and in every other matter in which Time is an element of importance.

6. The reformation of the Calendar three centuries back, involved much more serious changes than those now contemplated. It was effected in Southern Europe in 1582; it was adopted in Scotland eighteen years afterwards, but it was so successfully opposed by popular prejudice that a hundred and seventy years elapsed before the reform passed to England. At length it was adopted in England by Act of Parliament and took effect in 1752, when the day after the 2nd September was made the 14th September. Thus Time was shortened, so to speak, eleven days, much to the indignation of the illiterate people of that period, who considered that a great injury had been inflicted upon them, seriously believing that their lives had been shortened eleven days. The populace clamoured and great mobs in some places found vent to their feelings in riotous excesses. The same statute moved back the commencement of the year two months and twenty-five days. The civil and legal year had previously begun on the 25th March (Annunciation); it was transferred to the 1st January. While the changes now contemplated are much less marked and will not perceptibly disturb the routine of life, they are not less important or less necessary; and as the people of different countries are much more advanced in general intelligence, it may be assumed that the new reform will be accomplished with comparative ease.

7. The simplification and unification of the modes of reckoning Time throughout the world will, draw the different branches of the human family into nearer relationship, and thus, with other influences in operation, assist in promoting a common interest and good feeling among the nations.

8. The new system of reckoning Time will exercise a beneficial influence on human affairs. In chronology, absolute precision of date will be assured. In commercial life it will give indisputable exactness. In telegraphy errors as to the hours of transmission in any part of the globe will be next to impossible. In operating railways greater safety will be promoted and the annoyances now experienced will be unknown.

9. Finally it may justly be said of the new system that founded on immutable principles, its general acceptance and permanent application will be the definite determination of the Notation of Time for all human purposes for ever.

APPENDIX A.

THE TWENTY-FOUR HOUR NOTATION.

In introducing the twenty-four hour Notation on the Canadian railways, the managers provided the means of adapting existing clocks and watches to the change. Extra dials were prepared and furnished free of cost not only to employees but to all who desired them. The following directions for applying the new dials were issued.

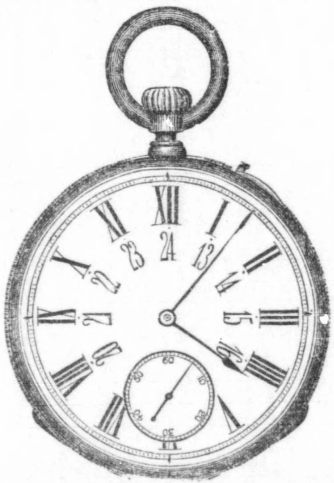
Directions for applying the new Dials.

" The extra dials furnished are of thin paper of sufficient size to contain the new afternoon hours, 13 to 24, within the existing Roman numerals I to XII. They are cut to the proper size, pierced for the axis of the hands, coated with gum like an ordinary postage stamp and made ready for application.

" If the watch or clock has a second hand, a segment should be removed from the extra dial to make room for it.

" In applying a new dial, moisten every part of its gummed surface, carefully place it in position and press it evenly and firmly so that every portion will adhere to the old dial. Unless this be done the new dial may scale off or blister, and interfere with the hands.

" The best time to apply the new dials is at half past four, half past five, half past six or half past seven, when hour and minute hands are together and little in the way."



The temporary and inexpensive expedient adopted admirably answers the desired purpose. Clock and watch manufacturers are now beginning to furnish other and more permanent means to meet the requirements of the new Notation.

APPENDIX B.

STANDARD HOUR MERIDIANS.

The following table is intended to show the geographical position of the twenty-four Standard Hour Meridians. They are numbered in consecutive order westward from the Antiprime Meridian, which is taken as the Zero of Time Notation.

Hour Meridians.	Universal Time at Solar Passage.	Longitude.	
		West from the Antiprime Meridian.	East and West from the Prime Meridian.
		°	°
Zero.	Zero.	Zero.	180 Antiprime Meridian.
No. 1	1 o'clock.	15	165 East.
" 2	2 "	30	150 East.
" 3	3 "	45	135 East.
" 4	4 "	60	120 East.
" 5	5 "	75	105 East.
" 6	6 "	90	90 East.
" 7	7 "	105	75 East.
" 8	8 "	120	60 East.
" 9	9 "	135	45 East.
" 10	10 "	150	30 East.
" 11	11 "	165	15 East.
" 12	12 "	180	0 The Prime Meridian.
" 13	13 "	195	15 West
" 14	14 "	210	30 West.
" 15	15 "	225	45 West.
" 16	16 "	240	60 West.
" 17	17 "	255	75 West.
" 18	18 "	270	90 West.
" 19	19 "	285	105 West.
" 20	20 "	300	120 West.
" 21	21 "	315	135 West.
" 22	22 "	330	150 West.
" 23	23 "	345	165 West.
" 24	24 and 0:00	360 and 0°	180 Antiprime Meridian.

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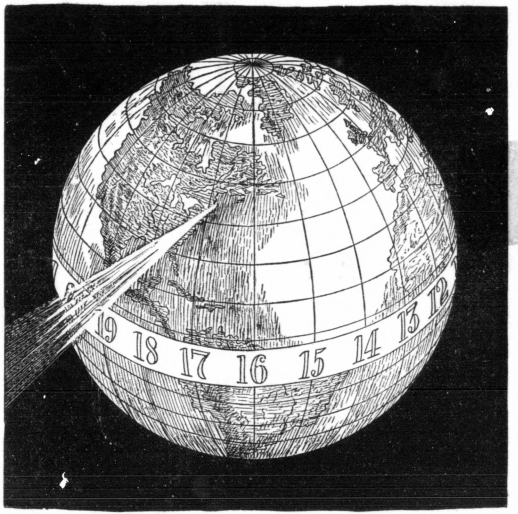
TIME AND ITS NOTATION.



"The Earth itself becomes the Great Natural Chronometer, and the Solar Passage everywhere the Index of Time." Sect. VIII.