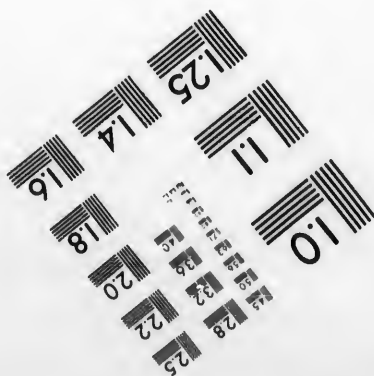
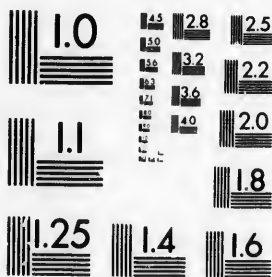


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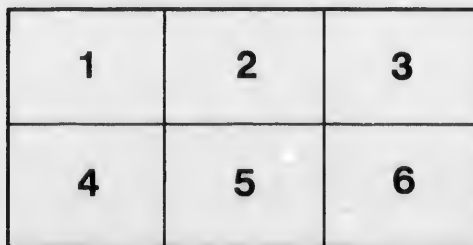
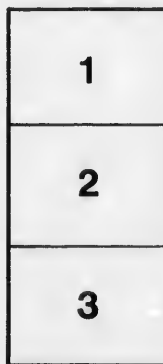
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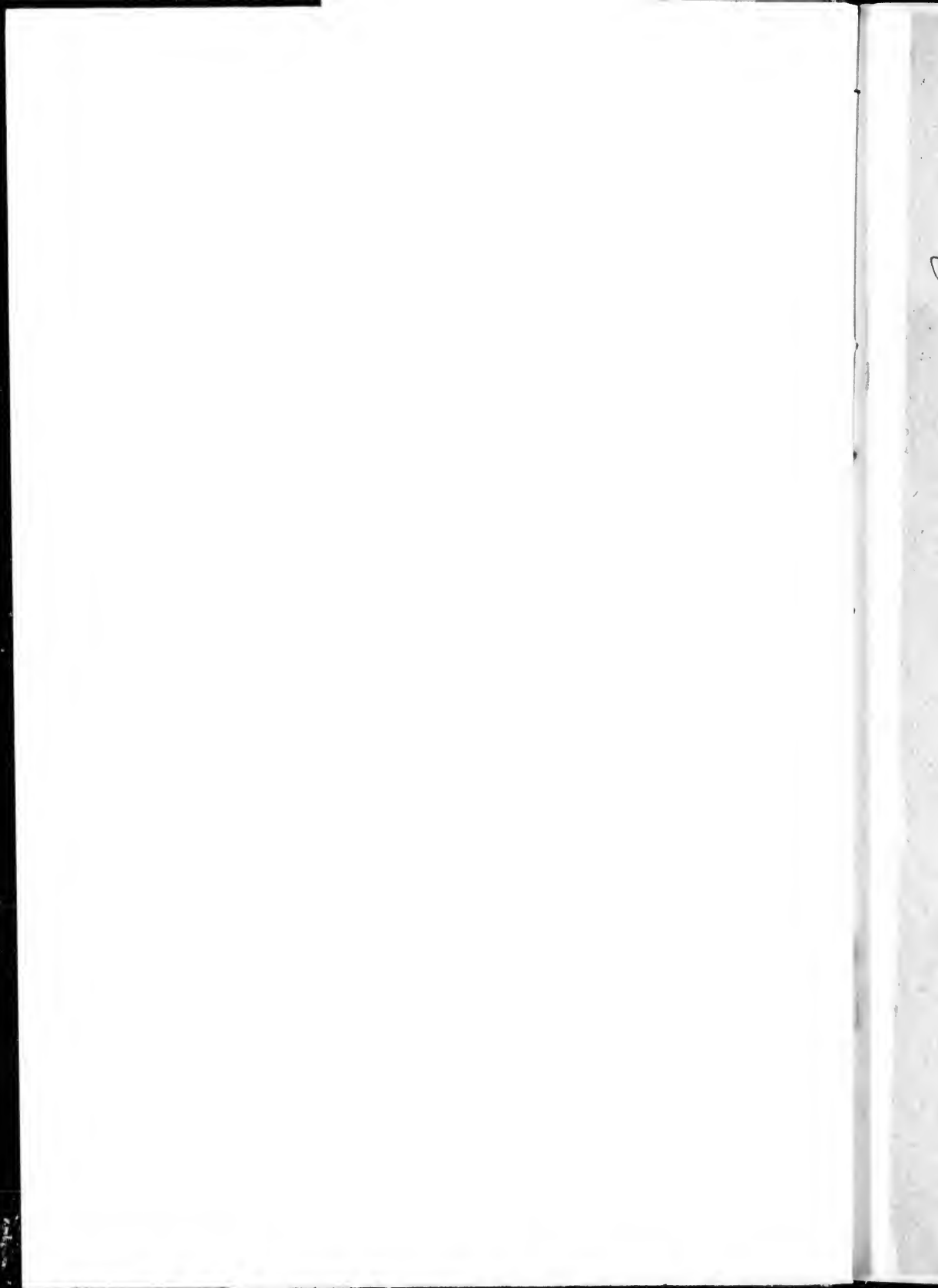
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DOCUMENTS

RELATING TO THE

FIXING OF A STANDARD OF TIME

AND THE

LEGALIZATION THEREOF.

PRINTED BY ORDER OF PARLIAMENT.

SESSION 1891.



OTTAWA:

PRINTED BY BROWN CHAMBERLIN, PRINTER TO THE QUEEN'S MOST
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To an ORDER of the HOUSE OF COMMONS, dated the 15th May, 1891 :—For copies of all letters, communications and reports in the possession of the Government, relating to the fixing of a Standard of Time, and the legalization thereof.

By order.

J. A. CHAPLEAU,
Secretary of State.

OTTAWA, 4th June, 1891.

CONTENTS.

- No. 1—Despatch dated 21st November, 1890, from the Colonial Secretary, Lord Knutsford, transmitting certain papers, viz. :—
- (a) Letter dated 26th July, 1890, from the Science and Art Department, expressing concurrence in the views of Mr. Sandford Fleming with reference to time reckoning, and recommending that they be communicated to the Governments of all the Colonies, with a view to the adoption of the Hour Zone system, and the 24-hour notation.
 - (b) Resolutions dated 25th April, 1890, of Committee on the Prime Meridian Conference, supporting the movement for the general reform in time reckoning in all the British possessions.
 - (c) Memorandum of Mr. Sandford Fleming, 20th November, 1889 (with map), on the movement for reckoning time on a scientific basis, by which the greatest possible degree of simplicity, accuracy and uniformity will be obtainable in all countries throughout the world.
- No. 2—Report, dated 27th December, 1890, of Mr. Charles Carpmael, Director of the Meteorological Department, on the documents referred to in Lord Knutsford's despatch, 21st November, 1890, recommending that with a view of legalizing the new system of reckoning time throughout the Dominion, a Bill be introduced in Parliament as a Government measure.
- No. 3—Bill referred to in Mr. Carpmael's report, introduced last Session of Parliament by a private member, on the petition of the Canadian Institute and others.
- No. 4—Petition referred to in Mr. Carpmael's report, from the Canadian Institute, Toronto, the Mayor and Corporation of Toronto, the Board of Trade, and citizens of Toronto.
- No. 5—Circulars of the Secretary of State, Washington, calling an International Conference, and Resolutions passed by the Washington International Conference of 1884, determining a zero of longitude and standard for time reckoning throughout the globe.
- No. 6—Bill introduced in the Congress of the United States respecting the reckoning of time throughout the United States.
- No. 7—Report of the Special Committee on Uniform Standard Time, American Society of Civil Engineers, dated 21st January, 1891.
- No. 8—Speech of Count Von Moltke, in the Imperial Parliament of Germany, on the time reform movement in Europe, delivered 16th March, 1891.
- No. 9—Communication dated 1st June, 1891, from the Royal Society of Canada, transmitting report adopted at the Montreal meeting of the Society, and other papers respecting time reckoning.

No. 1.

CIRCULAR DISPATCH FROM THE COLONIAL OFFICE, LONDON,
TO THE GOVERNOR-GENERAL OF CANADA AND THE
GOVERNMENTS OF ALL BRITISH COLONIES.

DOWNING STREET, 21st November, 1890.

SIR,—I have the honour to transmit to you a copy of a letter from the Science and Art Department (26th July, 1890) forwarding a copy of Mr. Sandford Fleming's memorandum on Time Reckoning together with the map which accompanies it.

I have the honour to be, Sir,
Your most obedient, humble servant,

The Officer Administering the Government of Canada. KNUTSFORD.

No. 1 (a.)

Department of Science and Art to Colonial Office.

MEMBERS OF COMMITTEE :

The Astronomer Royal.
Professor J. C. Adams, M.A., F.R.S.
Lt. Gen. R. Stratchey, R.E., C.S.I., F.R.S.
Dr. Hind, F.R.S.
The Hydrographer of the Navy.
Maj. General Donnelly, C.B.

DEPARTMENT OF SCIENCE AND ART,
LONDON, S.W., 26th day of July, 1890.

SIR,—Referring to the letter from the Colonial Office of the 15th February last, transmitting a copy of a despatch from the Governor General of Canada enclosing certain papers relating to the reform in time-reckoning which the Canadian Institute was desirous should be communicated to this Department, I am directed by the Lords of the Committee of Council on Education to inform you that these papers were submitted to the Committee appointed to advise My Lords with reference to this question.

The Committee consider "that it is desirable that Mr. Sandford Fleming's memorandum be forwarded to the Governments of all the Colonies for their consideration with a view to the adoption of the Hour Zone system in reckoning time generally and of the 24 hour notation for railway time tables."

"The Committee desire to express their concurrence in Mr. Sandford Fleming's views as to the advantages which would result from this reform and the ease with which it could be carried out."

I am also to request you to inform the Secretary of State for the Colonies that the Astronomer Royal calls attention to a paper by Dr. Schram published in the April number of the "Observatory" showing that "Standard time" is likely to be adopted shortly on the railways of Germany and Hungary, whilst other European countries are favourably disposed towards it.

I am directed to request that you will be good enough to move Lord Knutsford, should his Lordship consider the action expedient, to cause copies

of the memorandum and of the map which have been printed for the purpose to be sent to the Governors of Her Majesty's Colonies.

The Under Secretary of State
for the Colonies, Colonial Office, S.W.

I am, &c.,
W. D. DONNELLY,

No 1 (b.)

Committee on the Prime Meridian Conference.

Meeting of 25th April, 1890.

Present :—The Astronomer Royal (in the Chair).
The Hydrographer of the Navy.
General Donnelly, C.B.

Resolved—

1. That it is desirable that Mr. Sandford Fleming's Memorandum be forwarded to the Governments of all the Colonies for their consideration, with a view to the adoption of the Hour Zone System in reckoning time generally, and of the 24 hour notation for railway time tables. The Committee desire to express their concurrence in Mr. Sandford Fleming's views as to the advantages which would result from this reform, and the ease with which it could be carried out.

2. That it would be advisable that a similar recommendation should be forwarded to the Indian Government, and that the adoption of the 24 hour notation for railway time tables (which they understand has been adopted on several lines in India) should be recommended to the Railway Companies of the United Kingdom.

No. 1 (c).

MEMORANDUM on the movement for reckoning time on a scientific basis, by which the greatest possible degree of simplicity, accuracy, and uniformity will be obtainable in all countries throughout the world.

1. Notwithstanding the great advance which has been made during the present century, in all the Arts and Sciences and their application to the affairs of human life, the reckoning of time is still in a primitive condition in many countries and in an imperfect condition in every country. Difficulties have been developed since the introduction of rapid means of communication, through the twin agencies steam and electricity, which, when examined, prove that time is computed generally on principles which are untenable. The world's time reckoning is, in fact, an exceedingly complicated combination; it is productive of confusion and the confusion is apt to be increased and intensified as population increases and lines of rapid communication are multiplied.

2. During the last ten years efforts have been made to overcome the evils referred to by establishing a remedial system on a sound scientific basis which would be acceptable to all nations and by which perfect accuracy, uniformity and simplicity would everywhere be obtainable.

3. The subject has been carefully considered by many individuals and by scientific societies in Europe and America. It has been discussed at Geographical and Geodetic Congresses at Venice and Rome; and at conventions of scientists and practical business men in America. On all these occasions the solution of the problem has been promoted. As an outcome of these various meetings and efforts, the President of the United States, under the authority of an Act of Congress, invited the governments of all civilized nations to appoint delegates to meet in conference at Washington to consider the whole question and take decisive action in respect thereto.

4. The Washington Conference embraced delegates from twenty-five nations, they had eight sessions, the first was held on 1st October, 1884, the last on 1st November following. After patient deliberation and discussion the object of this International Conference was accomplished by the passage, with substantial unanimity, of a series of resolutions determining the principles upon which all the nations of the world may unite in the adoption of a universal system of reckoning time.

5. The important results of the Conference are the establishment of (1) a prime meridian for reckoning longitude, (2) a zero for time reckoning, and (3) a unit-measure of time to be common to the whole world.

6. The prime-meridian corresponds with the Greenwich meridian.

7. The zero of time may be defined as the moment of mean solar passage on the anti-prime meridian.

8. The unit-measure of time, designated the universal day, may be defined as the interval between two successive mean solar passages on the anti-prime meridian.

9. The Conference further determined that the hours of the Universal day shall be counted in a single series from zero to 24.

10. The Universal day as defined by the Washington Conference begins and ends at the same moment as the civil day at Greenwich, but it differs from the Greenwich civil day in respect to the numbering of the hours. While the Universal day has a single set of hours numbered from 0 to 24, the Greenwich civil day is divided at noon into halves, the half days before and after noon being sub-divided into separate sets of hours each numbered from 0 to 12 and distinguished as Ante-meridian and Post-meridian. Greenwich time is the local time so-called of the meridian of Greenwich. Universal time, on the other hand, is understood to be common to all localities and the Universal day is held to be the date of the world.

11. Considerable progress has been made in the adoption of the principles of universal time and the practical success which has attended the application of these principles goes to show that the unification of reckoning by the several nations can best be effected step by step.

RECKONING BY HOUR MERIDIANS.

12. The first important step is the adoption of the "Hour Zone System," commonly designated in America "Standard Time." It may be stated, that in the theory of universal time the fundamental principle is unity, it is held that there is not more than one time in the whole universe and that the idea of separate and distinct times in each separate locality is incorrect. While the essential principle of universal time is indisputable it cannot be denied that a perfectly uniform notation of time throughout the entire globe comes

into direct conflict with our preconceived notions and habits of thought. The Hour Zone system is introduced as an easy means of transition from old to new ideas and it is found that by adopting Hour Meridians as local standards for reckoning, grave difficulties are in a large measure overcome without any violent departure from our inherited usages and prevailing customs. The hour zone system also furnishes the means of applying the correct principles of universal time in ordinary affairs.

13. In the hour zone system the circumference of the globe is divided into twenty-four sections or zones. The central line of each zone is an hour meridian, and the hour meridians are fifteen degrees of longitude apart. The accompanying chart of the world on Mercator's projection shows the geographical position of the twenty-four hour meridians. They are numbered in consecutive order towards the west from zero, the ante-prime meridian.

14. The hour zones theoretically extend seven and a half degrees of longitude on each side of the hour meridians, but in practice that is by no means an essential rule. The boundary line of contiguous zones may be governed by national, geographical, or commercial circumstances.

15. As the earth rotates on its axis in twenty-four hours, an hour elapses between the solar passage on each successive hour meridian; it is obvious therefore that if the reckoning in each zone be governed by its respective meridian, the reckonings everywhere will be directly related. There will be differences but the differences will in every case be known and they will invariably be multiples of an hour. Throughout the globe there will be complete identity in the minutes and seconds. For example, when the reckoning in the tenth zone is six hours twenty-five minutes, in the eleventh zone it will be five hours twenty-five minutes, in the twelfth zone four hours twenty-five minutes, and so on, each successive zone differing by an exact hour. Thus the only departure from complete uniformity of reckoning around the globe will be in the numbers of the hours, but the numbers of the hours being governed by the numbers of the hour meridians, the passage to universal time is simple and direct.

16. As the reckoning in the zone of the twelfth hour meridian corresponds with Universal time the reckonings in all zones to the East of that meridian will be one or more full hours in advance of Universal time, and in all zones to the West of the twelfth hour meridian the reckonings will be behind universal time. Universal time will be the mean of all possible reckonings under the hour zone system, and the Universal day the mean of all possible local days.

17. The hour zone system has been adopted for ordinary use in portions of the three Continents of Asia, Europe, and America. In 1887 an Imperial Ordinance was promulgated directing that on and after the first day of January in the year following, time throughout the Japanese Empire would be reckoned by the third hour meridian. The reckoning in England and Scotland is by the twelfth hour meridian, in Sweden the eleventh hour meridian is the standard and quite recently it has been resolved in Austria-Hungary to be governed by the same meridian. Efforts are now being made to follow the same course in Germany and in other European countries. In North America the hour zone system has been in general use for six years. The reckoning of time being governed as follows, namely:—

By the 16th hour meridian in Nova Scotia and Prince Edward Island.

By the 17th hour meridian in New Brunswick, Quebec, Ontario, Maine, Vermont, Massachusetts, New Hampshire, Connecticut, New York, Pennsylvania, Rhode Island, New Jersey, Maryland, Virginia, North and South Carolina, Georgia, Florida.

By the 18th hour meridian in Manitoba, Kewatin, Minnesota, Wisconsin, Michigan, Iowa, Ohio, Illinois, Indiana, Kentucky, Missouri, Arkansas, Tennessee, Alabama, Mississippi, Louisiana.

By the 19th hour meridian in Assiniboia, Saskatchewan, Alberta, Athabaska, Montana, Dakota, Wyoming, Nebraska, Colorado, Kansas, New Mexico, Texas, Utah, Arizona.

By the 20th hour meridian in British Columbia, Washington, Idaho, Oregon, Nevada, California.

18. The adoption of the hour zone system has been the means of removing the chaos of local times which in many quarters previously caused much friction. Wherever the reckoning is governed by the same standard meridian there is complete uniformity in every division of time. In Japan, Central Europe, Great Britain, United States, Canada and Mexico, identity of reckoning prevails. In all these countries the hours are struck at the same moment, the only difference is in the numbers by which they are locally known; with that single exception every division of the day is simultaneous.

THE 24 HOUR NOTATION.

19. The second important step in regulating the reckoning of time throughout the world, is to abandon the division of the day into ante-meridian and post-meridian hours, separately numbered, and to substitute a single series of hours numbered from 0 to 24. This change was resolved upon by the Washington Conference with respect to the Universal day.

20. The old practice of dividing the day into separate sets of twelve hours, however it arose, has not only no advantage to recommend it, but the usage has been found to have positive disadvantages, which have been brought into prominence within the past generation. The division of the day into halves, doubles the chance of error and tends to confusion in connection with the running of railway trains. The mis-print or mistake of a single letter, A.M. for P.M. or *vice versa* will easily arise to cause inconvenience, loss of time, possibly loss of property, or loss of life.

21. The 24-hour notation, so called, removes all doubt and uncertainty and promotes safety. Where it has been adopted in Canada there is no ambiguity, moreover the change has been effected without difficulty and without danger. The hours having a lower number than twelve are known to belong absolutely to the first part of the day, and those having a higher number to the afternoon and evening.

22. The "24 hour notation" is strongly recommended by prominent men in Russia, Germany, Italy, Austria, Belgium, France, Spain, Great Britain, indeed it may be said in every country in Europe. It is brought into daily use on the great lines of telegraph leading from England to Egypt, India, China, Australia, and South Africa. It is received with very great favour in America. It has been in use for nearly four years on 2354 miles of the Canadian Pacific Railway and for nearly three years on the Canadian Government Railway, the Intercolonial, 986 miles in length. The Managers of these railways and all the employees speak of the "24 hour notation" in the highest

terms. It is the only system in use at this date, north of the 49th parallel and west of 89th meridian. There is not a province in Canada where it is not already in use. It has been adopted on the railways in Nova Scotia, New Brunswick, Prince Edward Island, Manitoba, Assiniboia, Alberta, British Columbia, and partly in Quebec and Ontario; so satisfactory are the results of the new notation that it has been determined to extend its application and it is expected that before long it will be in general use for railway purposes throughout the Dominion.

23. In the United States a strong expression of opinion in favour of the 24 hour notation has been obtained. The American Society of Civil Engineers, deeply concerned in the perfection of the railway system of the Republic, has since the year 1880 taken an active interest in time reform. This Society led the way in preparing the minds of men for the general acceptance of the Hour Zone system six years ago, and since then it has vigorously directed attention to the "24 hour notation." It has a special Committee whose duty under the authority of the Society is to correspond with Railway Managers on the subject, and in every proper way to promote the adoption of the new notation. The communications which have been sent out by the American Society of Civil Engineers to the leading railway men throughout the country have elicited a very large number of replies. They embrace the opinion of, it is believed, a considerable majority of the managers of all the Railway Companies in North America, and of all who have been heard from about 97 per cent. are in favour of the adoption of the 24 hour notation in the railway service of the country at an early date. It is quite obvious that there is a widespread feeling in favour of the change and it only remains for the General Time Convention, an organized body, representing all the railways in the United States, to take decisive action in the matter, so that the new notation may be brought into use simultaneously in every section of the country.

24. Canada in adopting the hour zone system and in introducing the "24 hour notation" has undoubtedly taken the lead in carrying into effect, in the most practical manner possible, the essential principles of Universal time. The "24 hour notation" has likewise been introduced in the Railway service of China, and it is not a little remarkable that one of the oldest Eastern civilizations conjointly with the youngest Western civilization should set an example in breaking through the trammels of custom to inaugurate a reform which every intelligent person believes to be desirable. Universal time will be substantially adopted in North America so soon as the "24 hour notation" is brought into use throughout the United States. There is but one step necessary to secure to Great Britain all the advantages of Universal time, that is the adoption of the "24 hour notation"; this one reform concerns the railway system and railway travellers especially, and in a country where all travel more or less, I cannot but think that if English railway managers were informed as to the ease with which the change has been introduced in Canada, and the satisfactory results which have followed, they would very speedily take means to obtain similar advantages. I am confirmed in this view by an examination of the letters which have been received by the Science and Art Department, South Kensington, copies of which I have been favoured with. These letters go to show that the resolutions of the Washington Conference on this subject are cordially favoured by the following important bodies and departments, viz. :—

1. Royal Astronomical Society.
2. The Royal Society.
3. The Board of Trade.
4. The General Post Office.
5. The Eastern Telegraph Company.
6. The Eastern Extension Telegraph Company.
7. The Eastern and South African Telegraph Company.
8. The Society of Telegraph Engineers.
9. The Trinity House.
10. The India Office.
11. The Colonial Office.
12. The Admiralty.

To these may be added the Committee of Council on Education, and the Board of Visitors of the Royal Observatory, Greenwich. Indeed, I cannot learn that a single objection has been received from any quarter.

25. As the fundamental objects of the Washington Conference were to remove all doubt and ambiguity in time-reckoning, to prevent discrepancies, to secure simplicity and introduce uniformity, it is manifestly important that the changes proposed, supported as they were at the Conference by the representatives of twenty-five nations, and subsequently looked upon in so many quarters as in themselves intrinsically desirable, should without unnecessary delay be accepted and as far as practicable put in force generally. The first important step is the selection of hour meridians and the adoption of the hour zone system. With these objects in view the accompanying map has been prepared; it shows the position of the twenty-four hour meridians and indicates in a general way the country or section of country to which any particular hour meridian has greatest proximity. It would greatly advance the unification of time throughout the world and greatly promote the common good of mankind if every nation with all convenient speed would take means to select the hour meridians on which its reckoning of time may be based. Appended hereto will be found a table indicating the hour meridians which in each case may be found eligible for selection, but in a matter of this kind each nation must judge for itself.

26. I have mentioned what has been done in America, more especially in Canada, in furtherance of this movement. If means be taken to extend the use of the hour zone system to all the British possessions around the Globe they will individually and collectively participate in the advantages of a common reckoning of time. I venture to submit, suggestively, the appended list of the principal British Colonies and Dependencies with the hour meridians which appear the most suitable for standards in each case.

SANDFORD FLEMING.

OTTAWA, 20th November, 1889.

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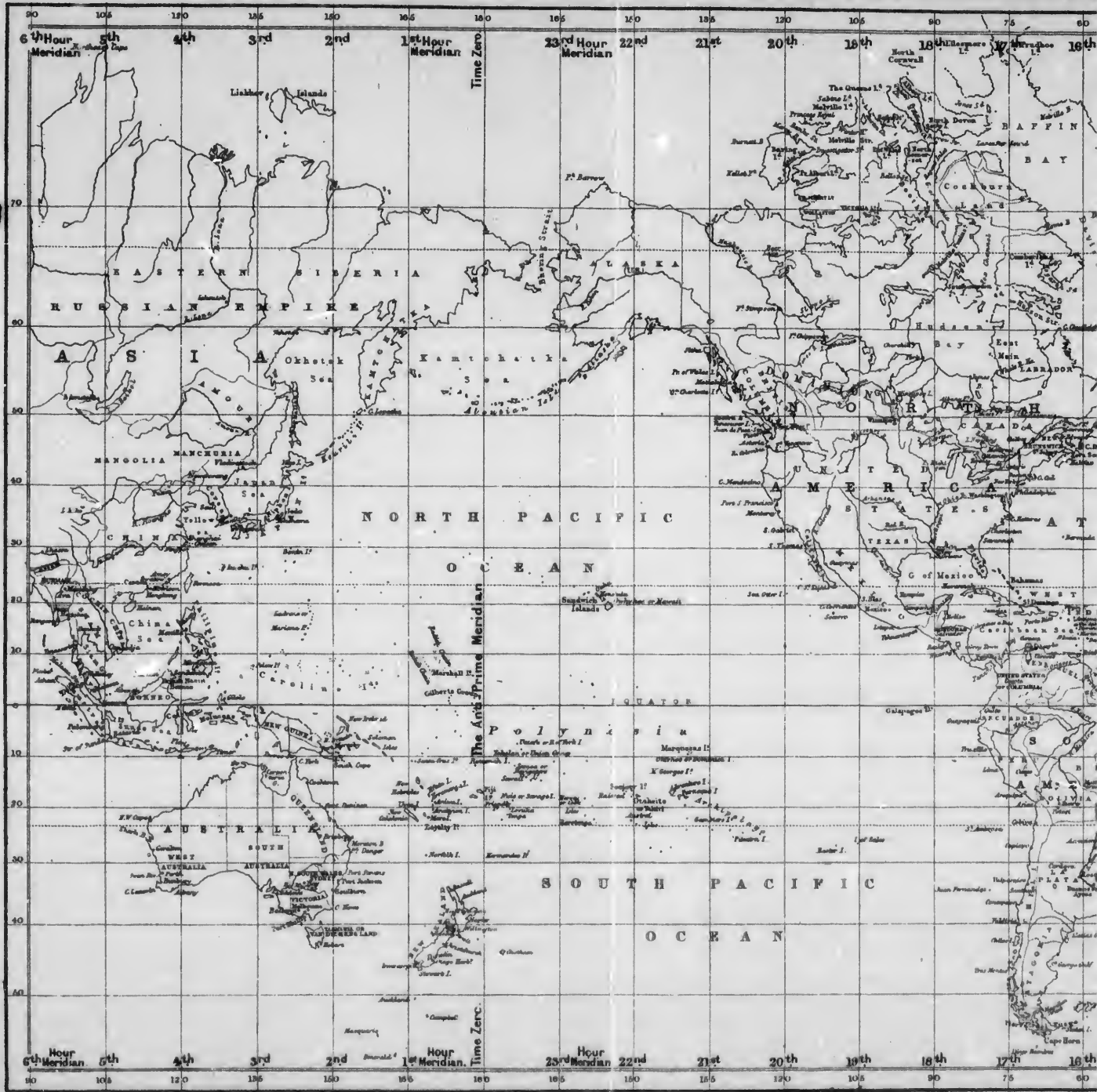
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BRITISH POSSESSIONS.

TABLE indicating the Hour Meridians, numbered as on the accompanying Map, which may be selected as Local Standards for reckoning time in each of the several British Possessions.

The last column gives the differences between local reckonings and the time of the world—Universal Time. The sign PLUS indicates that local reckonings are in advance of, and MINUS that they are behind, World Time in each case.

Countries.	Hour Meridians.		Hour Zone Reckonings faster or slower than World Time.
	East or West of Greenwich.	Numbered on Map.	
The British Islands (comprising)—			
England and Wales	0 —	12	0 hours.
Scotland	0 —	12	0 do
Ireland	0 —	12	0 do
Canada (comprising)—			
Nova Scotia	60 west	16	+ 4 do
New Brunswick	75 do	17	- 5 do
Prince Edward Island	60 do	16	- 4 do
Quebec	75 do	17	- 5 do
Ontario	75 do	17	- 5 do
Manitoba	90 do	18	- 6 do
Assiniboia	105 do	19	- 7 do
Saskatchewan	105 do	19	- 7 do
Alberta	120 do	20	- 8 do
Athabasca	120 do	20	- 8 do
British Columbia	120 do	20	- 8 do
Australasia (comprising)—			
New South Wales	150 do	2	+ 10 do
Victoria	150 do	2	+ 10 do
Queensland	150 do	2	+ 10 do
Tasmania	150 do	2	+ 10 do
South Australia	135 east	3	+ 9 do
Western Australia	120 do	4	+ 8 do
New Zealand	165 do	1	+ 11 do
Fiji	165 do	1	+ 11 do
New Guinea	150 do	2	+ 10 do
Possessions in Asia (comprising)—			
India	75 do	7	+ 5 do
Burma	90 do	6	+ 6 do
Ceylon	75 do	7	+ 5 do
Hong Kong	120 do	4	+ 8 do
Straits Settlements	105 do	5	+ 7 do
Labuan	120 do	4	+ 8 do
West India (comprising)—			
Jamaica	75 west	17	- 5 do
Turks Island	75 do	17	- 5 do
British Guiana	60 do	16	- 4 do
Bahamas	75 do	17	- 5 do
Trinidad	60 do	16	- 4 do
Barbadoes	60 do	16	- 4 do
Grenada	60 do	16	- 4 do
British Honduras	90 do	18	- 6 do
St. Vincent	60 do	16	- 4 do
St. Lucia	60 do	16	- 4 do
Tobago	60 do	16	- 4 do
Antigua	60 do	16	- 4 do
Montserrat	60 do	16	- 4 do
St. Christopher	60 do	16	- 4 do
Virgin Islands	60 do	16	- 4 do
Dominica	60 do	16	- 4 do
Possessions in Africa (comprising)—			
Cape of Good Hope	30 east	10	+ 2 do
Bechuanaland	30 do	10	+ 2 do
Basutoland	30 do	10	+ 2 do
Natal	30 do	10	+ 2 do

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BRITISH POSSESSIONS—*Concluded.*TABLE indicating the Hour Meridians, &c.—*Concluded.*

Countries.	Hour of Meridians.		Hour Zone reckonings faster or slower than World Time.
	East or West of Greenwich.	Numbered on Map.	
Possessions in Africa (comprising)—			
Sierra Leone.....	15 west	13	- 1 hour.
Gambia.....	15 do	13	- 1 do
Gold Coast.....	0 —	12	0 do
Lagos.....	0 —	12	0 do
Miscellaneous (comprising)—			
St. Helena.....	0 —	12	0 do
Gibraltar.....	0 —	12	0 do
Malta.....	15 east	11	+ 1 do
Cyprus.....	30 do	10	+ 2 do
Bermuda.....	60 west	16	- 4 do
Falkland Islands.....	60 do	16	- 4 do
Heligoland.....	15 east	11	+ 1 do
Aden.....	45 do	9	+ 3 do
Ascension.....	15 west	13	- 1 do
Fanning Island.....	150 do	22	- 10 do
Mauritius.....	60 east	8	+ 4 do
Newfoundland.....	60 west	16	- 4 do

FOREIGN COUNTRIES.

TABLE showing the Hour Meridians numbered as on the accompanying Map and conveniently situated for reckoning time under the Hour Zone system.

The last column gives the difference between local reckonings and the Time of the World—Universal Time. The sign PLUS indicates that local reckonings are in advance of, and MINUS that they are behind, World Time in each case.

Argentine Republic.....	60 west	16	- 4 hours.
Austria Hungary.....	15 east	11	+ 1 do
Belgium.....	0 —	12	0 do
Bolivia.....	60 west	16	- 4 do
Brazil.....	45 do	15	- 3 do
do.....	60 do	16	- 4 do
Bulgaria.....	30 east	10	+ 2 do
Costa Rica.....	90 west	18	- 6 do
Chili.....	75 do	17	- 5 do
China.....	120 east	4	+ 8 do
do.....	105 do	5	+ 7 do
Columbia.....	75 west	17	- 5 do
Congo.....	15 east	11	+ 1 do
Denmark.....	15 do	11	+ 1 do
St. Domingo.....	75 west	17	- 5 do
Egypt.....	30 east	10	+ 2 do
France.....	0 —	12	0 do
Germany.....	15 east	11	+ 1 do
Greece.....	30 do	10	+ 2 do
Hawaii.....	150 west	22	- 10 do
Honduras.....	90 do	18	- 6 do
Haiti.....	75 do	17	- 5 do
Italy.....	15 east	11	+ 1 do
Japan.....	135 do	3	+ 9 do
Mexico.....	105 west	19	- 7 do
Netherlands.....	0 —	12	0 do
Nicaragua.....	90 west	18	- 6 do
Norway.....	15 east	11	+ 1 do
Paraguay.....	60 west	16	- 4 do
Persia.....	60 east	8	+ 4 do

FOREIGN COUNTRIES—*Concluded.*TABLE indicating the Hour Meridians, &c.—*Concluded.*

Countries.	Hour Meridians.		Hour Zone reckonings faster or slower than World Time.
	East or West of Greenwich.	Numbered on New Map.	
Pern	75 west	17	- 5 hours.
Roumania	30 east	10	+ 2 do
Siam	105 do	5	+ 7 do
Servia	30 do	10	+ 2 do
Spain	0 --	12	0 do
Sweden	15 east	11	+ 1 do
Switzerland	15 do	11	+ 1 do
Turkey	30 do	10	+ 2 do
Russia in Europe	45 do	9	+ 3 do
do	30 do	10	+ 2 do
Russia in Asia	165 do	1	+11 do
do	150 do	2	+10 do
do	135 do	3	+ 9 do
do	120 do	4	+ 8 do
do	105 do	5	+ 7 do
do	90 do	6	+ 6 do
do	75 do	7	+ 5 do
do	60 do	8	+ 4 do
Uruguay	60 west	16	- 4 do
United States	75 do	17	- 5 do
do	90 do	18	- 6 do
do	105 do	19	- 7 do
do	120 do	20	- 8 do
Alaska	135 do	21	- 9 do
do	150 do	22	-10 do
Venezuela	50 do	16	- 4 do

No. 2.

REPORT OF THE DIRECTOR OF THE METEOROLOGICAL
DEPARTMENT, ON THE DOCUMENTS ON TIME RECKONING
FORWARDED BY THE HOME GOVERNMENT.

METEOROLOGICAL OFFICE,

TORONTO, December 27th, 1890.

SIR,—I have to acknowledge the receipt of your letter of the 9th inst., enclosing a letter from Lord Knutsford to His Excellency the Governor General, together with a copy of a letter from the Science and Art Department, forwarding a copy of Mr. Sandford Fleming's memorandum on time reckoning, and map accompanying it, and requesting me to report thereon.

I have the honour to report that on the 4th December, 1889, the Canadian Institute addressed a letter to the Governor General, enclosing a memorandum, prepared by Mr. Sandford Fleming, dated 20th November, 1889. The papers which you sent me show that this memorandum was submitted to a committee consisting of the Astronomer Royal, Professor J. C. Adams, Lt.-Gen. R. Strachey, Dr. Hind, Superintendent Nautical Almanac Office; the Hydrographer of the Navy, and Major-Gen. Donnelly, recommended that copies of the memorandum and of the maps be sent to the Governors of Her Majesty's colonies.

At the last session of Parliament a Bill was introduced by a private member, on petition of the Canadian Institute and others, with the object in view of permitting and legalising the new system of reckoning time, but the matter being but little understood, the Bill was withdrawn. Now that the principles of the system are set forth in a memorandum, which is endorsed by the highest authorities in the service of the Home Government, and the Home Government has seen fit to bring the matter to the attention of the Dominion Government, I would respectfully recommend that a Bill similar to that introduced last session be again presented, this time as a Government measure. This measure would not compel the use of the new system, but merely permit it and define it.

I remain, sir, your obedient servant,

CHARLES CARPMAEL, *Director.*

WM. SMITH, Esq., Deputy Minister Marine, Ottawa.

No. 3.

BILL INTRODUCED IN THE SENATE OF CANADA,
1890.

An Act respecting the Reckoning of Time.

(*Reprinted as proposed to be amended in Committee.*)

Preamble.

WHEREAS on the invitation of the President and Congress of the United States of America, an International Conference was held at Washington in 1884, consisting of duly appointed delegates from twenty-five nations, at which Canada was duly represented, to determine certain leading principles by which the inhabitants of the world could have a common system of reckoning Time; and whereas the said Conference, after prolonged deliberation, unanimously passed resolutions embodying the principles which should govern all nations in the measurement and notation of Time and recommended the meridian passing through the Royal Observatory at Greenwich, England, as a prime or initial meridian for the purpose of a Time-Zero; and whereas the "Hour meridian system," commonly called Standard Time, now in general use in Canada, and the twenty-four hour notation employed in operating the Government railways of Canada and the Canadian Pacific Railway from Lake Superior to Vancouver, are in harmony with the said resolutions and recommendations of the said International Conference; and whereas petitions have been presented to Parliament, urging that it would be in the general public interest to have these reforms in the measurement and notation of time legalized and sanctioned by Parliament; and whereas, since the general adoption throughout Canada of the mode of reckoning known as Standard Time, doubts have arisen as to the reckoning which has force in law and it is expedient to remove all such doubts: Therefore Her Majesty, by and with the advice and consent of the Senate and House of Commons of Canada, enacts as follows:—

1. In so far as Parliament has power to define and control the same, time throughout Canada shall be reckoned in accordance with the hour meridian system, commonly called Standard Time; and the system of hour meridians throughout Canada shall be based on the initial or prime meridian which passes through the Royal Observatory at Greenwich; and the reckoning of time throughout Canada shall be in agreement with the reckoning of civil time at Greenwich, excepting only with respect to the commencement of the day and the notation of the hours, which shall be as hereinafter provided, in all other respects the division and sub-division of the day into hours, minutes and seconds in Canada shall be synchronous with the division and sub-division of the day at Greenwich.

How time is to be reckoned.

System of hour meridians.

Time in Canada to be synchronous with Greenwich time.

2. The commencement of the day and the notation of the hours in the following Provinces and Territories of Canada shall differ from the commencement of the civil day at Greenwich and from the notation of the hours of Greenwich civil time as follows:—

Notation of hours.

(a.) In Prince Edward Island and Nova Scotia they shall be four hours behind the civil time at Greenwich,—that is to say, when it is four by the clock in the morning at Greenwich the day shall commence throughout Prince Edward Island and Nova Scotia, and when it is twelve by the clock at Greenwich it shall be eight by the clock throughout Prince Edward Island and Nova Scotia.

P. E. Island and Nova Scotia.

(b.) In New Brunswick, Quebec and Ontario they shall be five hours behind the civil time at Greenwich.

New Brunswick, Quebec and Ontario.

(c.) In Manitoba they shall be six hours behind civil time at Greenwich.

Manitoba.

(d.) In Assiniboia and Saskatchewan they shall be seven hours behind the civil time at Greenwich.

Assiniboia and Saskatchewan.

(e.) In Alberta, Athabasca and British Columbia they shall be eight hours behind the civil time at Greenwich.

Alberta, Athabasca and British Columbia.

3. The hours of the day may in any of the Provinces or Territories aforesaid be numbered from midnight to midnight in a single series of numbers from one to twenty-four, and this method of designating the hours of the day, commonly known as "The Twenty-four Hour Notation," shall be equally valid with that of numbering the hours in two series of twelve hours each, from midnight to noon and from noon to midnight, distinguished as *ante meridiem* and *post meridiem* hours.

Governor-in-Council may make regulations for other Territories.

4. The Governor in Council may from time to time, make such regulations as he sees fit, not contrary to this Act, as to all matters relating to the reckoning and notation of time in any part of Canada not mentioned in the second section of this Act.

Hours may be numbered from 1 to 24.

Governor in Council may change notation to suit convenience of particular places.

5. If it is shown to the satisfaction of the Governor in Council that it would be to the advantage or convenience of the inhabitants of any Province, Territory or part of a Province or Territory to have the commencement of the day and the notation of the hours in such Province, Territory, or part thereof, defined otherwise than as in the second section of this Act, the Governor in Council may make such change as he deems expedient, and may appoint the date at which such change shall have effect, and upon proclamation thereof in the *Canada Gazette* such change shall come into force at the date appointed therefor.

6. Whenever the doing or the not doing of anything at a certain time of day, or during a certain part of the day, has an effect in law, such time or part shall be reckoned and ascertained according to the provisions of this Act.

Short title.

7. This Act may be cited as "*The Reckoning of Time Act, 1890.*"

8. This Act shall come into force on the first day of July, A.D. 1891.

No. 4.

PETITION OF THE CANADIAN INSTITUTE, THE MAYOR, CORPORATION AND CITIZENS OF TORONTO ASKING FOR LEGISLATION.

To the Honourable the Senate of the Dominion of Canada, in Parliament Assembled:—

The petition of the undersigned, the President and Members of the Canadian Institute, Toronto; the Mayor and Corporation of the City of Toronto; the Toronto Board of Trade; the Harbour Commissioners; and other citizens of Toronto:

RESPECTFULLY SHEWETH:—

That the establishment of railways and telegraphs has developed imperfections in the ordinary modes of reckoning time, and that during the past ten years efforts have been made to obviate the difficulties which have arisen.

That to discover the means of overcoming the attendant confusion, which results in friction and tends to danger, the subject has received the earnest attention of scientific societies and individuals in Europe and America.

That an International Conference was held at Washington, in 1884, to discuss the question. That the conference consisted of duly appointed representatives from the Governments of twenty-five nations, and that after prolonged discussion in meetings extending over a month, they with unanimity passed resolutions embodying the principles upon which the difficulties may be overcome in all parts of the globe.

That the hour zone system (commonly called Standard Time) and the 24-hour notation are based on the resolutions of the Washington Conference.

And that wherever these systems have been brought into use, great advantages to the public have resulted.

That improvements in time reckoning and their application in every day life have so far not been legalized by Statute, and it would be in the general public interest to have them so legalized.

Wherefore your petitioners humbly pray that the 24-hour notation of time and the hour zone system of reckoning (commonly called Standard Time) be sanctioned and permitted by law throughout the Dominion of Canada.

And as in duty bound your petitioners will ever pray :

CHAS. CARPMAEL,
President Canadian Institute.

F. B. BROWNING,
Vice-President do

ALAN MACDOUGALL,
Secretary do

E. F. CLARK,
Mayor of Toronto.

JNO. BLEVINS,
City Clerk, Toronto.

JOHN J. DAVIDSON,
Pres. Board of Trade, Toronto.

EDGAR A. HILL,
Secretary do

CHARLES B. LEE,
Chairman, Harbour Commis.

MRYANT BALDWIN,
Harbour Master.

L. J. CLARK,

A. MORRISON,

ALEX. MARLING,

GEO. D. SIMPSON,

J. B. WILLIAMS,

H. R. FAIRCLOUGH,

J. DAVIS BARNETT,

JAMES BAIN, jun.,

O. MOWAT,

A. F. CHAMBERLAIN,

GEO. MURRAY,

ROBT. F. SCOTT,

THOMAS LANGTON,

G. B. ABOUT,

ROBERT YOUNG and others.

No. 5.

THE WASHINGTON CONFERENCE, 1884.

CIRCULARS from the Department of State, Washington, in reference to the calling of an International Conference to determine a common zero of Longitude and Standard for Time-Reckoning throughout the Globe.

DEPARTMENT OF STATE, WASHINGTON, 23rd October, 1882.

SIR,—On the 3rd of August last the President approved an Act of Congress in the following words :—

“ Be it enacted by the Senate and House of Representatives of the United States of America, in Congress assembled, that the President of the United States be authorized and requested to extend to the governments of all nations in diplomatic relations with our own an invitation to appoint delegates to meet delegates from the United States in the City of Washington at such time as he may see fit to designate, for the purpose of fixing upon a meridian proper to be employed as a common zero of longitude and standard of time reckoning throughout the globe, and that the President be authorized to appoint delegates, not exceeding three in number, to represent the United States in such international conference.

It may be well to state that, in the absence of a common and accepted standard for the computation of time for other than astronomical purposes, embarrassments are experienced in the ordinary affairs of modern commerce; that this embarrassment is especially felt since the extension of telegraphic and railway communications has joined states and continents possessing independent and widely separated meridional standards of time; that the subject of a common meridian has been, for several years past, discussed in this country and in Europe by commercial and scientific bodies, and the need of a general agreement upon a single standard recognized; and that, in recent European conferences especially, favour was shown to the suggestion that, as the United States possesses the greatest longitudinal extension of any country traversed by railway and telegraph lines, initiatory measures for holding an international convention to consider so important a subject should be taken by this Government."

The President, while convinced of the good to flow eventually from the adoption of a common time unit, applicable throughout the globe, thinks, however, that the effort now to be made should be to reach by consultation, a conclusion as to the advisability of assembling an international congress with the object of finally adopting a common meridian. He, therefore, abstains from extending an invitation for a meeting at an assigned day until he has ascertained the views of the leading governments of the world as to whether such international conference is deemed desirable.

I am accordingly directed by the President to request you to bring the matter to the attention of the Government of _____, through the Minister of Foreign Affairs, with a view to learning whether its appreciation of the benefits to accrue to the intimate intercourse of civilized peoples from the consideration and adoption of the suggested common standard of time so far coincides with that of this Government as to lead it to accept an invitation to participate in an international conference at a date to be designated in the near future.

You may leave a copy of this instruction with the Minister for Foreign Affairs, and request the views of his Government thereon, at as early a day as may be conveniently practicable.

I am, Sir, your obedient servant.

FRED'K T. FRELINGHUYSEN.

DEPARTMENT OF STATE, WASHINGTON, December 1st, 1883.

SIR,—By a circular instruction of October 23rd, 1882, you were made acquainted with, (the language of,) an Act of Congress approved August 3rd, 1882, authorizing and requesting the President to extend to other Governments an invitation to appoint Delegates to meet in the city of Washington for the purpose of fixing upon a Meridian proper to be employed as a common zero of longitude and standard of time-reckoning throughout the world; and you were instructed to bring the matter before the attention of the Government to which you are accredited and to inform it that the President deemed it advisable to abstain from the issuance of the formal invitation contemplated, until through preliminary consultation the views of the leading Governments of the world, as to the desirability of holding such an International Conference would be ascertained.

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In the year that has since elapsed this Government has received from most of those in diplomatic relations with the United States the approval of the project, while many have in terms signified their acceptance and even named their delegates.

Besides this generally favorable reception of the suggestion so put forth, interest in the proposed reform has been shown by the Geographical Conference held at Rome in October last, which very decisively expressed its opinion in favor of the adoption of the Meridian of Greenwich as the common zero of time longitude, and adjourned, leaving the discussion and final adoption of this or other equivalent unit, and the framing of practical rules for such adoption, to the International Conference to be held at Washington.

The President therefore thinks the time has come to call the Convention referred to in my instruction of October 23rd, 1882. I am accordingly directed by the President to instruct you to tender to the Government of _____, through its Minister for Foreign Affairs, an invitation to be represented by one or more delegates, (not exceeding three) to meet delegates from the United States and other nations in an International Conference to be held in the city of Washington on the 1st day of October next, 1884, for the purpose of discussing, and if possible, fixing upon a meridian proper to be employed as a common zero of longitude and standard of time reckoning throughout the globe.

You will seek the earliest convenient occasion to bring this invitation to the attention of the Minister of Foreign Affairs of _____ by handing him a copy hereof and requesting that the answer of his Government may be made known to you.

I am, Sir, your obedient servant,

FRED'K T. FRELINGHUYSEN.

RESOLUTIONS passed by the International Conference, in its several sessions, extending from October 1st to October 22nd, 1884, and confirmed by Final Act October 22nd.

I. "That it is the opinion of this Congress that it is desirable to adopt a single prime meridian for all nations, in place of the multiplicity of initial meridians which now exist."

This resolution was unanimously adopted.

II. "That the Conference proposes to the Governments here represented the adoption of the meridian passing through the centre of the transit instrument at the Observatory of Greenwich as the initial meridian for longitude."

The above resolution was adopted by the following vote:—

In the affirmative:

Austria-Hungary,
Chili,
Colombia,
Costa Rica,
Germany,
Great Britain,
Guatemala,
Hawaii,

Italy,
Japan,
Liberia,
Mexico,
Netherlands,
Paraguay,
Russia,

Salvador,
Spain,
Sweden,
Switzerland,
Turkey,
United States,
Venezuela.

In the negative :

San Domingo.

Abstaining from voting :

Brazil, France.

Ayes, 22 ; noes, 1 ; abstaining, 2.

III. "That from this meridian longitude shall be counted in two directions up to 180 degrees, east longitude being plus and west longitude minus."

This resolution was adopted by the following vote :—

In the affirmative :

Chili,	Hawaii,	Russia,
Colombia,	Japan,	Salvador,
Costa Rica,	Liberia,	United States,
Great Britain,	Mexico,	Venezuela,
Guatemala,	Paraguay,	

In the negative :

Italy,	Spain,	Switzerland.
Netherlands,	Sweden,	

Abstaining from voting :

Austria-Hungary,	France,	San Domingo,
Brazil,	Germany,	Turkey.

Ayes, 14 ; noes, 5 ; abstaining, 6.

IV. "That the Conference proposes the adoption of a universal day for all purposes for which it may be found convenient, and which shall not interfere with the use of local or other standard time where desirable."

This resolution was adopted by the following vote :—

In the affirmative.

Austria-Hungary,	Hawaii,	Salvador,
Brazil,	Italy,	Spain,
Chili,	Japan,	Sweden,
Colombia,	Liberia,	Switzerland,
Costa Rica,	Mexico,	Turkey,
France,	Netherlands,	United States,
Great Britain,	Paraguay.	Venezuela.
Guatemala,	Russia,	

Abstaining from voting

Germany, San Domingo.

Ayes, 23 ; abstaining, 2.

V. "That this universal day is to be a mean solar day ; is to begin for all the world at the moment of mean midnight of the initial meridian, coinciding with the beginning of the civil day and date of that meridian ; and is to be counted from zero up to twenty-four hours."

This resolution was adopted by the following vote :—

In the Affirmative.

Brazil,	Guatemala,	Paraguay,
Chili,	Hawaii,	Russia,
Colombia,	Japan,	Turkey,
Costa Rica,	Liberia,	United States,
Great Britain,	Mexico,	Venezuela.

In the Negative.

Austria-Hungary, Spain.

Abstaining from Voting.

France,	Netherlands,	Sweden,
Germany,	San Domingo,	Switzerland.
Italy,		

Ayes, 15 ; noes, 2 ; abstaining, 7.

VI. "That the Conference expresses the hope that as soon as may be practicable the astronomical and nautical days will be arranged everywhere to begin at mean midnight."

This resolution was passed without division.

VII. "That the Conference expresses the hope that the technical studies designed to regulate and extend the application of the decimal system to the division of angular space and of time, shall be resumed, so as to permit the extension of this application to all cases in which it presents real advantages."

The motion was adopted by the following vote :—

In the Affirmative.

Austra-Hungary,	Hawaii,	Russia,
Brazil,	Italy,	San Domingo,
Chili,	Japan,	Spain,
Colombia,	Liberia,	Switzerland,
Costa Rica,	Mexico,	Turkey,
France,	Netherlands,	United States,
Great Britain,	Paraguay,	Venezuela.

Abstaining from Voting.

Germany, Guatemala, Sweden.

Ayes, 21 ; abstaining, 3.

Done at Washington, the 22nd October, 1884.

C. R. P. RODGERS, *President.*
 R. STRACHEY,
 J. JANSSEN,
 L. CRULS, *Secretaries.*

No. 6.

BILL INTRODUCED IN THE CONGRESS OF THE UNITED STATES.

In the Senate January 16, 1891.

Mr. EVARTS introduced the following bill ; which was read twice and referred to the Committee on the Judiciary.

A BILL

Respecting the reckoning of time throughout the United States.

Whereas an act was passed in eighteen hundred and eighty-two to authorize the President of the United States to call an international conference to fix on and recommend for universal adoption a common prime meridian, to be used in the reckoning of longitude and in the regulation of time throughout the world ; and

Whereas in pursuance of the said act a conference was held at Washington in eighteen hundred and eighty-four, at which twenty-five nations were represented by delegates duly appointed ; and

Whereas the said conference, after prolonged deliberation, with substantial unanimity passed resolutions embodying the principles which should govern in the measurement and notation of time, and recommended the meridian passing through the observatory at Greenwich, England, as a prime meridian for all nations ; and

Whereas the "hour meridian system," commonly called standard time, now in general use in the United States, is in accordance with the said resolutions and is based on the said prime meridian as an initial standard and has been found to be much to the advantage of interstate commerce ; and

Whereas, since the general adoption throughout the United States of the mode of reckoning known as the standard time doubts have arisen as to the reckoning which has force in law, and it is expedient to remove all such doubts : Therefore,

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled. That time throughout the United States shall be reckoned in accordance with the hour meridian system, commonly called standard time, and the prime meridian recommended by the Washington International Conference of eighteen hundred and eighty-four shall be the initial standard for reckoning time ; and the meridians which are a multiple of fifteen degrees from the prime meridian shall be the hour meridians or substandards by which the local reckoning of time shall be regulated ; and the reckoning of time throughout the United States shall be in agreement with the reckoning of civil time on the prime meridian, excepting only with respect to the commencement of the day and the notation of the hours, which shall be as hereinafter provided ; in all other respects the division and subdivision of the day into hours, minutes, and seconds in the United States shall be synchronous with the divisions and subdivisions of the day on the prime meridian.

SEC. 2. That the commencement of the day and the notation of the hours in different time sections of the United States shall differ from the commencement of the civil day and the notation of the hours on the prime meridian as follows :

(a) In the time sections where the reckoning of time is regulated by hour meridian number seventeen, or the sub standard meridian which is seventy-five degrees west longitude, the reckoning shall be five hours behind the reckoning on the prime meridian.

(b) In the time section where the reckoning of time is regulated by hour meridian number eighteen, or the sub standard meridian which is ninety degrees west longitude, the reckoning shall be six hours behind the reckoning on the prime meridian.

(c) In the time sections where the reckoning of time is regulated by hour meridian number nineteen, or the sub standard meridian which is one hundred and five degrees west longitude, the reckoning shall be seven hours behind the reckoning on the prime meridian.

(d) In the time section where the reckoning of time is regulated by hour meridian number twenty, or the sub standard meridian which is one hundred and twenty degrees west longitude, the reckoning shall be eight hours behind the reckoning on the prime meridian.

SEC. 3. That the time sections referred to in section two of this act embrace the country on each side of and contiguous to the substandard meridians therein mentioned; but it shall be competent for the constituted authorities of any State, city, incorporated towns and villages, or by the commissioner or courts of any county to adopt the substandard by which to reckon time, as shall seem to them most convenient, and such standard shall be legal and shall be recognized by the courts and officials of the United States; and the time for juridical, municipal, registration, or other purposes in any locality shall, unless otherwise specified, be held to be according to the reckoning so adopted and commonly used by the inhabitants of such locality.

SEC. 4. That the hours of the day may, in any locality, be numbered in a single series of numbers, from zero to twenty-four, and this method of designating the hours, commonly known as "twenty-four hour notation," shall be equally valid with that of numbering the hours in two series of twelve hours each, distinguished as ante-meridian and post-meridian hours.

SEC. 5. That this act shall come into force on _____, anno Domini, eighteen hundred and ninety-one.

No. 7.

ANNUAL REPORT OF THE SPECIAL COMMITTEE ON UNIFORM STANDARD TIME.

AMERICAN SOCIETY OF CIVIL ENGINEERS.

Presented January 21st, 1891.

The Special Committee on Uniform Standard Time begs leave to report :

In the last annual report of the Committee it was brought to the notice of the Society that the Government of the United States had not taken any action on the resolutions and recommendations of the International Conference, held in Washington in 1884, and that as Standard Time, so universally adopted in civil life throughout North America, is in complete accord with the resolutions of the Conference, it would be in the public interests to have the recommendations authoritatively recognized by Act of Congress. The suggestions of the Committee having been accepted at the annual meeting, it was

considered advisable to ascertain the views of the members generally. The Board of Directors accordingly submitted to letter-ballot the draft of a memorial, representing to the Government of the United States:

First.—That, in the opinion of this Society it would be in the general interests of the United States to accept formally the resolutions of the International Conference, held at Washington in 1884.

Second.—That, in the opinion of this Society, it would be in the general interests to legalize, by Act of Congress, the now common system of regulating time-reckoning by hour meridians.

Third.—That, in the opinion of this Society, it would be in the general interests to embrace in an Act of Congress a permissive clause, authorizing and legalizing the use of the 24-hour notation.

It was decided by letter-ballot on March 5th that the memorial should be adopted—226 voting “yea,” 7 voting “nay”; the majority in favour being 219. The memorial has since been duly forwarded to Washington and presented to the President of the United States, and to both Houses. A bill has likewise been prepared in accordance with the terms of the memorial, having in view the desired legislation. This bill has been presented and referred to committees in both Houses. A printed copy of the Senate Bill is appended hereto.

At the last annual meeting the Committee submitted a detailed statement establishing that a majority of the railway managers in the United States and Canada were in favour of the 24-hour notation. Evidence has since been received from officers of railways not before heard from and the Committee is now enabled to report that the total number of railway authorities who have communicated directly with the Society, expressing themselves in favor of the proposed change to the 24-hour notation of time, is as follows, viz.:

1. Presidents, Vice-Presidents and General Managers..	135
2. General Superintendents.....	77
3. Superintendents	114
4. General Traffic Managers.....	12
5. Engineers	65
Total	403

The aggregate length of railway with which these officers are connected is estimated at about 140,000 miles. A list, revised up to the present date, of railway managers in favor of the new notation of time is appended.

From these facts it is plain that the proposal to adopt the 24-hour notation in the working of railways on this continent, meets with general concurrence, and obviously what is required on the part of those who are responsible for the administration of the railway service of the country, to effect the desired change, is to act in accord, and by joint arrangement to fix upon some date when the new notation may be brought into general use for railway purposes. The Committee therefore respectfully recommends that the question of change, together with the evidence of the harmony of opinion which prevails, be brought by this Society in a formal manner to the attention of the General Time Convention and the Board of Railway Presidents at their next periodical meetings.

The advantages of the 24-hour notation are beginning to be recognized in various branches of civil life. In hospitals, for example, to prevent mistakes

by nurses in the administration of medicine, in recording temperatures, and in other matters, the new system is being gradually introduced; also in weather tables and in the recording of meteorological readings; indeed in departments where simplicity of system and accuracy is essential the new notation is being spontaneously brought into use in many quarters. For two or three years back the Canadian Almanac has abandoned the old notation and substituted the new. It is in connection with the railway service, however, that the general introduction of the 24-hour notation may mainly be looked for, and the Committee cannot doubt that, thus brought into use, the intelligence of the community will welcome the change; the ready acceptance of "Standard Time" by the general public throughout the United States and Canada directly on its adoption by the railway authorities, seven years ago, may be instanced. Although it cannot be expected that the 24-hour notation will so speedily come into common use, there are grounds for the belief that eventually it will prevail and become universal.

The Committee has the satisfaction to report that a communication has been received from the Director-General of railways in India, which gives official announcement of the fact that the 24-hour notation has recently come into use on all the railways throughout the Indian Empire, and that this result is partly in consequence of the satisfactory trial of the new system on some of the lines during the past few years.

The Committee has received the strongest assurances from all quarters that wherever the new notation has been adopted in the working of railways, it continues to give increased satisfaction. Experience has shown that the change can be effected with great ease, absolute safety and without creating any disturbing influence in any direction. When your Committee reported a year ago, the 24-hour notation was then in use on less than 4,000 miles of railway. It has now been permanently adopted on an aggregate length exceeding 20,000 miles.

The time-reform movement has for some years attracted much attention in Austria-Hungary, Germany, Italy, France and Belgium, and there is every prospect of the principle of Standard Time being adopted throughout Central Europe at an early day.

An official correspondence has been placed in the possession of the Committee which establishes that the British Government has taken steps which will tend to promote the general adoption of Standard Time and the 24-hour notation in all the British possessions. This correspondence can scarcely fail to be of interest to every member of this Society, inasmuch as we learn by it that the reform in time-reckoning which the American Society of Civil Engineers has taken a leading part in bringing to its present satisfactory condition, meets with the approval and hearty recommendation of the highest scientific authorities in the service of the British Government. The committee in England which has so favorably reported on the universal adoption of Standard Time and the 24-hour notation, consists of the Astronomer Royal, the Superintendent of the Nautical Almanac, the Hydrographer to the Admiralty, and the Secretary of the Science and Art Department, South Kensington, together with Professor Adams and General Strachey, both of whom were delegates at the Washington Conference of 1884.

A memorandum, prepared by a member of the Special Committee on Uniform Standard Time, setting forth the principles of time-reckoning long

advocated by this Society, has been endorsed by these distinguished men, and recently has been sent by the British Government to the governments of all the British possessions around the globe, with a view to the adoption of Standard Time generally and of the 24-hour notation for railway time-tables. The railway companies of England, Ireland and Scotland have likewise been recommended to adopt the 24-hour notation. A copy of this document with its accompanying map is appended hereto.

In concluding this report, the Committee feels that it is not out of place to remark that, as the Members of this Society have in an important manner been associated with the construction of the great artificial highways of commerce on this continent, it was eminently fit and proper that the American Society of Civil Engineers should take a prominent part in promoting a reform in time-reckoning, and in advancing a movement calculated to render the railway system more perfect, its administration more simple, and the railway service more safe to the general public. The Committee feels warranted in pointing out that the important results already secured are in a great measure attributable to the support and countenance given to the movement from the first days of its inception by this Society. It must likewise be obvious that the advantages yet to result will not be confined to the United States, to Canada or to this continent; that the beneficial influence of the American Society of Civil Engineers, in connection with a much-needed reform, which concerns all persons every moment of their lives, will be felt eventually in every civilized country.

This Committee was first appointed at the Convention of the Society held in Montreal in June, 1881. During these (nearly) ten years it has been the earnest endeavour of the members of the Committee to carry out the instructions with which they have from time to time been charged, and they trust they may be permitted to express the satisfaction felt by them with regard to the results so far accomplished. There only remains to complete the labours of the Committee the general introduction of the 24-hour notation throughout this country. There is a reasonable expectation that the reform is now on the eve of adoption in connection with the railways of the United States and Canada, and as that event would practically complete the object for which the Committee was originally appointed, they respectfully submit that the Committee may then with propriety be discharged.

The Committee avail themselves of this opportunity to express their deeply-felt thanks for the confidence which has invariably been reposed in them year by year.

Respectfully submitted,

SANDFORD FLEMING, *Chairman.*
CHARLES PAINE,
THOMAS EGGLESTON,
JOHN M. TOUCEY,
Members of Committee.

Approved, William P. Shim, President of the Society, *ex-officio* member of the Committee.

No. 8.

GENERAL VON MOLTKE ON TIME REFORM.

To the Editor of THE EMPIRE.

SIR,—One of the last if not the last speech delivered by Count von Moltke in the German imperial parliament was on a subject of special interest to Canadians. On the 16th of last month the venerable statesman-soldier spoke at considerable length on the question of universal time reform, and gave countenance in forcible and clear language in favor of the system which we have introduced into Canada. As the arguments advanced by the aged and distinguished general must affect public opinion not only in Europe, but wherever his name is known, they may be of interest to your readers. I have the satisfaction to transmit a translation of the deceased general's speech, somewhat condensed.

Yours, etc.,
SANDFORD FLEMING.

OTTAWA, April 24.

IMPERIAL GERMAN PARLIAMENT SITTING 16TH MARCH, 1891.

On the question of the imperial railway department, Count von Moltke said:

Gentlemen, allow me a few words on the subject which has been dealt with at an earlier session. I will not long detain you, as I am very hoarse, on which account I have to ask your indulgence.

That unity of time is indispensable for the satisfactory operating of railways is universally recognized, and is not disputed. But, gentlemen, we have in Germany five different units of time. In north Germany, including Saxony, we reckon by Berlin time; in Bavaria, by that of Munich; in Wurtemberg, by that of Stuttgart; in Baden, by that of Carlsruhe, and on the Rhine palatinate by that of Ludwigs-hafen. We have thus in Germany five zones, with all the drawbacks and disadvantages which result. These we have in our own fatherland, besides those we dread to meet at the French and Russian boundaries. This is, I may say, a ruin which has remained standing out of the once piecemeal condition of Germany, but which, since we have become an empire, it is proper should be done away with. (Very true.)

Gentlemen, it may seem to be of slight significance that the railway traveller finds at each new railway station a new notation of time which does not accord with his watch, but all these different times become an actual difficulty of vital importance in carrying on the business of railways, especially for the services which in a military point of view must be demanded.

Gentlemen, in case of mobilization, all the time tables which apply to troops must be detailed in the time used in each locality. Naturally the troops and the inhabitants called out, can only judge by the reckoning at the place of their assembly and at their homes. Equally so the railway authorities sending out the time tables are similarly circumstanced.

As the north German authorities only reckon by Berlin time all the arrangements and tables must be in Berlin time. This repeated elsewhere, easily becomes the source of errors; errors which in their consequences may be very serious. There are circumstances of transport which may very much increase

the difficulty, such as suddenly to change an arrangement, which a stoppage or an accident on the railway would, in a moment, render necessary. Gentlemen, it would be of great advantage if we could attain a common German unity of time; for this, above all others, is the reckoning by 15th meridian east of Greenwich adapted. This meridian cuts through Norway, Sweden, Germany, Austria and Italy. By establishing the 15th meridian as a standard of reckoning there will arise at the extreme eastern boundary a difference of 31 minutes, at the western of 36 minutes. Gentlemen, in south Germany less differences have been easily accepted into customary use, and in America they have much greater differences.

Gentlemen, unity of time merely for the railway does not set aside all the disadvantages which I have briefly mentioned; that will only be possible when we reach a unity of time reckoning for the whole of Germany, that is to say, when all local time is swept away.

Against this project all sorts of prejudices now are felt by the public, I think wrongfully. Certainly, after due consideration, the scientific men of your observatories had given their authority against this spirit of opposition.

Gentlemen, science desires much more than we do. She is not content with a German unity of time, or with that of middle Europe, but she is desirous of obtaining a world time, based upon the meridian of Greenwich, and certainly with full right from her standpoint, and with the end she has in view.

Now, the opinion has been expressed that the introduction of this common time into citizen life would cause confusion. The inconvenience it would cause to manufactories and to industry is especially brought forward. In this relation I must turn to the earlier amplifications of our colleague, Von Strumm. If the difference of time from the 15th degree to some other place is known, for example to Neunkirchen (perhaps 29 minutes), it cannot be difficult to modify the regulations of the factory in accordance with it. If the manufacturer in March desires his men to begin at sunrise, so the regulations can establish 29 minutes past six. If he requires them in February at 10 minutes past six, so the regulations can name 39 minutes past 6, and so on.

How, then, will it affect the agricultural population? Indeed, gentlemen, the agricultural labourer does not pay much attention to the hour. For the most part he has none. He looks around to see if it is already light; then he knows that he will soon be called to work by the court bell. When the court clock goes wrong, which is generally the case—(merriment)—when it is a quarter of an hour too fast, then certainly he comes a quarter of an hour before the time to work, but by the same clock he leaves a quarter of an hour earlier, the duration of work remains the same. Gentlemen, seldom in practical life is punctuality asked in respect to minutes. In many places it is customary for the school hour to be put back 10 minutes, that the children may be present when the teacher arrives. Even the hour of the courts of justice is often put back so that the parties can assemble before the proceedings commence. It is inverted in the villages which lie near the railways. The rule is to put the clock forward some minutes so that the folk do not lose the train. Indeed, gentlemen, this difference often becomes an academic quarter of an hour, and sometimes becomes somewhat longer. (Merriment.)

We have not yet adduced the difference between the time of the sun and mean time. Herr Von Strumm is perfectly right that this difference of time

would be added to the already existing difference. But, gentlemen, we have to reckon both positively and negatively; in certain times the difference has to be added, in other times to be deducted. The climax of 16 minutes is reached only four days in the year.

Gentlemen, has anybody amongst us who lives punctually by a well regulated clock ever remarked that he, in a fourth part of the year, has sat down to table 16 minutes too early, or that he has retired too early to rest, and in the following fourth of the year too late? I think not.

Gentlemen, just the circumstances that this not important difference between solar time and mean time is not known to the great part of the public, nor felt by it, appears to me to prove that the apprehensions which are put forth on account of the discontinuance of local time are without ground.

Gentlemen, we are not able by a vote or by resolution to establish all that the movement aims to accomplish. Possibly this may be effected later through international negotiations. But I believe it will assist the movement if the Parliament declares itself in sympathy with a principle which, in America, in England, in Sweden, in Denmark, and Switzerland and in South Germany has already obtained acceptance.

The report of the Imperial Railway Department was approved.

STANDARD TIME—FROM THE "EMPIRE."

24th April, 1891.

The sudden death of General Von Moltke has caused a well known correspondent, Mr. Sandford Fleming, to direct attention to the remarkable speech delivered by the deceased general only last month in the Imperial German Reichstag. The subject is unity of time, and the occasion was during a discussion respecting the adoption throughout the German empire of the same system of time reform which is already introduced in Canada. The speech of Von Moltke, a translation of which appears in another column, appears to have had great influence in Europe; and the action taken by Germany will, no doubt, lead eventually to a further extension of the principle of reckoning the hours, the adoption of which has removed much friction on this side of the Atlantic. There is still one thing needed in connection with this reform: it requires to be legalized. From Nova Scotia to British Columbia the system is in use, but there is no statute enacting its legality, and doubts have arisen as to the reckoning and notation of time which has force in law. This uncertainty should not exist, as it may involve legal questions in respect to banking, the administration of justice, registration or elections, which will readily suggest themselves to gentlemen engaged in legal pursuits. After the establishment of the railway system in Great Britain, the same uncertainty prevailed and it became necessary to pass an Act prescribing and defining the use of Greenwich time throughout England and Scotland. The same necessity for legislation has become apparent in the United States. A bill was introduced by Mr. Evarts in the Senate and by Mr. Flowers in the House of Representatives, and next session they will undoubtedly become law. Similarly, a bill was introduced into the Canadian Parliament last year by Senator MacInnes, of Burlington, but owing to the late period of its presentation the measure did not get beyond its second reading. We understand that the bill will again be introduced this session.

No. 9.

ROYAL SOCIETY, CANADA, TO THE MINISTER OF MARINE.
ON THE STANDARD UNIT OF TIME AND THE HOUR MERIDIAN.

ROYAL SOCIETY OF CANADA, OTTAWA, 1st June, 1891.

SIR,—I have the honour on behalf of the Royal Society of Canada to transmit several papers for the information of the Government, including a report adopted by the Society at its recent general meeting in Montreal, on "the unit measure" and the "hour meridians" in connection with the subject of universal time reckoning, and bearing on the question of the legislation which is required in the Dominion.

I have the honour to be,
G. C. W. HOFFMANN,
Hon. Secretary.

The Hon. C. H. TUPPER, Minister of Marine.

ROYAL SOCIETY OF CANADA.

Address at the Opening of Section III, by the President, Sandford Fleming, C.M.G., LL.D., M. Inst. C.E., F.G.S., &c., 27th May, 1890.

THE UNIT MEASURE OF TIME.

I desire, at the opening meeting of this Section of the Royal Society, to bring to your attention a subject of some general importance.

For a number of years past attempts have been made on both sides of the Atlantic to effect a reform in the method of reckoning time. The degree of success which has attended the movement is a matter of surprise, when we consider that the changes involve a departure from the usages of society and are in opposition to the customs of many centuries.

The modern introduction of rapid means of communication has created conditions of life different from those of preceding generations. It may be said that until a few years back localities separated by a few miles of longitude were assumed to have distinct and separate notations of time. When many localities were first brought into close relations by the establishment of a line of railway, the different local times (so called) with which the railway authorities had to deal, produced much confusion; in order to attain security for life and property in operating the line, and likewise to promote the convenience of the public using it, it became necessary to observe a uniform notation, which received the name of Railway Time; that is to say, the many local reckonings which prevailed at the numerous points between the two termini were reduced to a single reckoning, common to the many localities.

As lines of railway multiplied, the unification of the reckoning of time became more indispensable, and it early came to be seen that the benefits to result from unification would be in proportion to the extent of territory embraced within its operations. At length it became obvious that uniformity of reckoning might with advantage be extended to a whole continent or the whole globe. Investigation also established that such an extension would contravene no law of nature or principle of science.

The proposal to supersede the numberless local times by a single notation, synchronous in every longitude, had a somewhat utopian aspect. Many indeed regarded it as a revolutionary innovation, for it came into direct conflict with the customs and the habits of thought which had descended from a remote antiquity. Nevertheless, the potent agencies, Steam and Electricity, which have co-operated in making astonishing transmutations in human affairs, have forced on our attention the investigation of time and its notation, and demanded some change to meet the altered circumstances of daily life.

If we consider the nature and attributes of that which we know as time, we will find that it is wholly independent of material bodies and uninfluenced by space or distance; that it is essentially non-local and an absolute unity; that it is not possible for two times to co-exist, or for time to be divided into two parts having a separate entity, in the sense that material things can be divided. This view of time incontrovertibly established, there is no ground for the theory that there are many local times. We may, therefore, sweep away the ordinary usages based on that theory as being unsound and untenable, and the way is made clear for a comprehensive system of time reckoning to embrace the whole globe.

About fourteen years ago the effort was first made to introduce a reform which would satisfy the requirements of the age. Whatever system might be adopted, it was felt that it should be based on the fundamental principle that *there is only one time*. It was, moreover, held to be expedient that there should be only one reckoning of time common to all nations; and to secure a common reckoning, one established zero and one common unit of measurement became necessary.

With the attainment of these objects in view, preliminary discussions took place at the meetings of several scientific associations in Europe and America, and it was held that in a matter of such widespread importance the unit of time should be a measure which could be readily referred to as a perpetual standard for the use of the entire human family. It was likewise felt desirable, if not indispensable, that all nations should acquiesce in its recognition.

It was accordingly proposed at an International Geographical Congress at Venice, in 1881, and confirmed at a Geodetic Congress at Rome held two years later, that the Government of the United States should be invited formally to call a conference of representatives to be specially appointed by the Governments of all civilized nations, to consider the subject and determine the zero and standard of reckoning to be used in common throughout the globe.

Six years ago this conference assembled under the auspices of the United States, in the City of Washington, the Governments of twenty-five nations sending fully accredited delegates. Their deliberations extended over the month of October, 1884; with substantial unanimity they passed a series of resolutions, in which the unit of measurement was constituted, and they recommended that time be computed according to the solar passage on a recognized zero meridian of the earth's surface.

The resolutions of the Washington conference thus authoritatively established the fundamental principles which underlie the scheme for a general unity of time reckoning; each nation being left in its discretion to accept the details of the reform whenever deemed expedient in each individual case. To facilitate the acceptance of the new system, the circumference of the globe has

been divided into twenty-four sections, the reckoning in each section being based on a standard, subsidiary to, but directly related to the unit measure. In the twenty-four subsidiary standards the hours are simultaneous, although differently numbered in accordance with the longitude of the several sections. With the single exception respecting the numbers by which the hours are locally to be known, there is complete identity in every sub-division of time throughout the twenty-four sections. The many local days which follow in succession during each diurnal period are by this arrangement of subsidiary standards reduced to twenty-four normal days, each differing an hour in the moment of its commencement from the day which succeeds. Twelve of these normal days precede and twelve follow the primary standard or unit measure of time, which is the mean of the whole series of normal days. By this expedient, which has received the name of "the standard time system," the means have been provided by which all nations, without any apparent great departure from old usages, may observe substantially the one common reckoning.

The adoption of the system of standard time has already made considerable progress. In North America standard time was first introduced in railway economy; it has since been generally accepted by the mass of the community. In Asia the same system has been legally established throughout the Japanese empire. In Europe a general interest has been awakened on the subject, and at the present moment it attracts special attention in Austria-Hungary, Germany and Belgium; late advices give expression to the belief that standard time will be adopted by the railway service of these countries before many months. It is already observed in Sweden and Great Britain.

Thus, at the present day, standard time has been fully accepted in Asia by not less than forty millions of people, in Europe by almost an equal number, in America by more than sixty millions; and there is scarcely a doubt that in no long period it will be in use throughout the greater part of Central Europe, making a total number of probably two hundred and thirty millions of the most progressive peoples in the three continents who will have accepted the principles of reckoning based on a common unit. Without taking into account Central Europe, where the reform is on the eve of adoption, the unification of time reckoning has so far advanced that in Japan, Norway, Sweden, England, Scotland, Canada and the United States, all well-regulated clocks strike the hours at the same moment (although locally the hours are distinguished by different numbers), and the minutes and seconds in all these countries are absolutely synchronous.

The unit of measurement authoritatively established by the resolutions of the International Conference of 1884 is the basis of the system by which these results have been obtained; and we must regard this new system as the one which shall hereafter be observed by the great mass of the civilized inhabitants of the world in their daily reckonings and in their chronology. It is of first importance, therefore, that no doubt or ambiguity should exist in connection with it. By the resolutions of the conference of 1884 the unit measure may be defined as the interval of duration extending from one mean solar passage on the anti-meridian of Greenwich to the next succeeding passage. This standard unit has been variously designated as follows, viz. :—

- | | |
|-----------------------|------------------------|
| 1. A Universal Day. | 4. A Cosmopolitan Day. |
| 2. A Terrestrial Day. | 5. A World's Day. |
| 3. A Non-Local Day. | 6. A Cosmic Day. |

It requires no argument to show that no one of these six terms is appropriate. The unit of time is not a day in the ordinary sense ; it is indeed much more than an ordinary day. According to our habit of thought, a day is invariably associated with alternations of light and darkness ; and each day, moreover, has a definite relationship to some locality on the surface of the earth. The day as we commonly understand it is essentially local ; and during each rotation of the globe on its axis, occupying a period of twenty-four hours, there are as many days as there are spots on sea and on land differing in longitude. These numberless days are separate and distinct, each having its noon and midnight, its sunrise and sunset. The time-unit is an entirely different conception ; it is equal in length to a day, and must from its nature be synchronous with some one of the infinite number of local days ; by the resolutions of the Washington Conference it is identified with the civil day of Greenwich ; but while the latter is simply a local division of time limited to the Greenwich Meridian, the unit measure is, on the other hand, not so limited ; it is equally related to all points on the earth's surface in every latitude and longitude. Under this aspect, the wider functions and general character of the unit measure remove it from the category of ordinary days, as we understand the familiar expression, and to obviate all doubt and uncertainty regarding it, it is in the highest degree desirable that the universal time-unit should be distinguished by some appellation by which, apart from its local relationship, it may always be indisputably known.

It was Lord Chief Justice Coke who said that "error is the parent of confusion ;" as the primary object of time reform is to obviate confusion, we should take every precaution to preclude error. Is it not therefore expedient that we should adopt means to secure a proper and appropriate designation for the unit measure and abandon as misnomers each one of the terms which have hitherto been applied to it? In a paper on the subject of time reckoning, published in the transactions of this Society in 1886, the unit measure is defined, its uses described, and it is likewise pointed out that its distinctive appellation remains undetermined. I consider it to be my duty to draw attention to the want, and while it would be an act of presumption on my part to propose a name, I will venture the remark that in the general interests of science an effort should be made to supply it. It has been found expedient to derive technical terms from a classical etymology, and I beg leave to suggest that the same rule might be followed in this case with obvious advantage. Whatever name be chosen, if derived from a Greek or Latin root, the word would in all countries have the same definite meaning, and could readily be incorporated into all languages. If such a word be adopted as will clearly express "a unit measure of time" it will gradually come into general use, as in the parallel cases of "telegram," "telegraph," "photograph," "lithograph," etc., and by this means all nationalities will be enabled to give expression to one and the same meaning when they refer to time reckoning in its broad significance.

I humbly submit that the Royal Society of Canada will confer a general benefit and act becomingly by taking the initiative in obtaining an appropriate designation for the unit measure of time.

If that view be concurred in by this Section of the Society, I respectfully suggest that a special committee be appointed to consider the subject, with instructions to report during the present session.

THE UNIT MEASURE OF TIME.

REPORT OF SPECIAL COMMITTEE OF SECTION III.

(*Presented to the Section by Monsignor Hamel.*)

The Committee to whom the expediency of suggesting an appropriate name for the unit measure of time has been referred, begs leave respectfully to report :—

The Committee recognizes the advisability of obtaining a suitable nomenclature, and concurs in the views expressed in the address of the President of the Section as to the expediency of some steps being taken by the Society; the Committee is likewise of opinion that we must seek in the classical languages for the material to construct an appropriate word, which will command the acceptance of every nationality.

The Committee conceives that whatever may be the individual opinions of members of this Society, it is not at present expedient to do more than draw attention to the requirement. Your Committee therefore recommends that in the name of the Royal Society of Canada correspondence be opened with sister societies in other parts of the world, with the view of bringing the subject to their notice, asking the favour of an expression of opinion regarding it.

The Committee recommends that the Council be requested to take such steps as may be deemed expedient to bring the subject to the attention of sister societies.

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The above Report was submitted by Section III to the Society, at the general meeting held 29th May, 1890, and approved.

JNO. GEO. BOURINOT,
Hon. Secretary, R. S. C.

ROYAL SOCIETY OF CANADA.

REPORT of the Time Nomenclature Committee, presented in general meeting by Monsignor Hamel, on behalf of section III and approved by the Society.

MONTREAL, 28th May, 1891.

The Time Nomenclature Committee has considered the question referred to it respecting the "unit of time" and the "hour meridians" and beg leave to report.

THE TIME-UNIT.

The unit of measurement as stated in the address of the President last year (copy appended) is the basis of the new system of universal time reckoning. It is determined by the resolution of the International Conference held at Washington in 1886 when twenty-five nations were represented. So far, the unit is without an appropriate name and the Royal Society has taken the initiative in an effort to supply the requirement. As a result of the action taken by the Society last year the following compound words have been submitted :

1. Chronocanon.....(the time-standard.)
2. Chronomonad.....(the time unit.)
3. Cosmochron.(the world time.)
4. Cosmognome.....(the world dial or style.)
5. Heliomonad(the sun-unit.)

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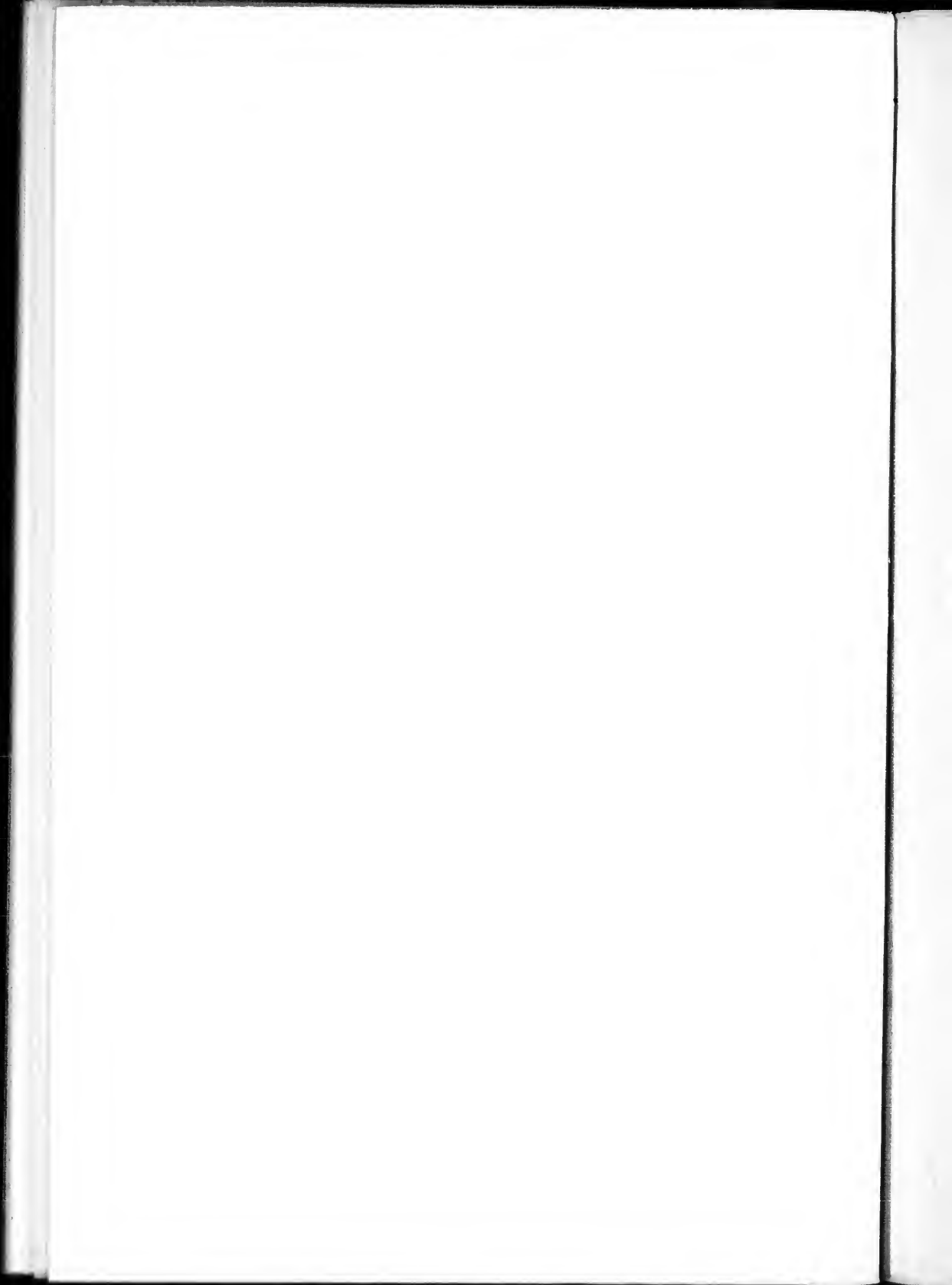
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6. Metremer.....(the measuring day.)
7. Metrochron.....(the measuring time.)
8. Monochron(the unit of time.)
9. Nomochron(the law or standard of time.)
10. Pantochron(universal time.)

Two short words have likewise been proposed, to which the Committee desire to direct special attention. The first, "Heliad," derived from Helios (the sun), is thought by some to be "sufficiently self-interpreting," and no further removed from classical usage than many other scientific terms derived from Greek; it has besides a methical and metaphorical propriety, as Heliads (Heliades) in ancient mythology were the children of the sun, and the time measure may also metaphorically be considered a child of the sun.

The second word, "Chroné" or "Chron," as a monosyllable, presents but one verbal element of the idea to be expressed, but it has the advantage of being a chief component part of nearly all words already in common use relating to time. The following may be instanced:—

1. Anachronism—An error in point of time.
2. Chronicle—A narrative in the order of time.
3. Chronic—Continuing a long time.
4. Chronogram—A writing, including the date of an event.
5. Chronograph—An instrument for denoting small intervals of time—a stop watch.
6. Chronometer—An instrument for measuring time.
7. Chronology—The science which treats of dates in the order of time.
8. Chronometry—The art of measuring time.
9. Isochronous—Occurring in equal times.
10. Metachronism—An error in chronology.
11. Parachronism—Dating an event later than the time it happened.
12. Prochronism—Dating an event in advance of the time it happened.
13. Synchronal—Happening at the same time.

THE HOUR MERIDIANS.

The designation of the Hour Meridians is becoming a question of practical interest in nearly all countries, in connection with legislation required respecting the reckoning of time. It is important for this and other reasons that a nomenclature be adopted which will obviate all confusion and give the greatest satisfaction in future years in all quarters of the globe. In North America the meridian 75° west longitude has tentatively received the name "Eastern" from the fact that it passes near the Eastern Coast of the United States. South of the equator however this term is inadmissible inasmuch as the same Hour-meridian follows approximately the Western coast of South America. Again the 105th meridian west has been termed the "Mountain" meridian, for the reason that it traverses the Rocky Mountains where they occur in the United States; but the same meridian followed north passes through the heart of the great Prairie region of Canada, unmarked by the presence of mountains, and followed south beyond the American coast, it meets no land whatever, it passes over only the Pacific Ocean to the Antarctic Circle.

In Europe the name "Adria" has been attached to the meridian 15° East longitude, presumably owing to the fact that it intersects the Adriatic sea. This designation may be held to be acceptable in Europe, but it must be considered as less appropriate in the Southern hemisphere.

Owing to the restricted meaning of nearly all local and geographical terms it is obvious to the Committee that it will be difficult, if not impossible, to secure names based on such terms, which will be generally acceptable, and the difficulty is increased by reason of the diversity of language among the nations.

The Committee, after much consideration, is of opinion that, as a nomenclature based on numbers would have the one meaning in all languages and would be equally appropriate in both hemispheres, the twenty-four hour meridians should be distinguished by numbers. Everything considered it would in the opinion of the Committee be most advantageous to commence the series of numbers at the anti-prime meridian as zero and follow the apparent motion of the sun towards the west. (See explanatory note appended.)

This principle generally assented to, the Hour meridians which constitute the substandards for universal time-reckoning would be numbered as follows:—

Anti-Prime Meridian	180° east and west from Prime Meridian,	"Zero."
Hour Meridian	165° east longitude,	numbered 1, "Unus."
do	150° do	2, "Duo."
do	135° do	3, "Tres."
do	120° do	4, "Quatuor."
do	105° do	5, "Quinque."
do	90° do	6, "Sex."
do	75° do	7, "Septem."
do	60° do	8, "Octo."
do	45° do	9, "Novem."
do	30° do	10, "Decem."
do	15° do	11, "Undecim."
do	0° Prime Meridian,	numb'd 12, "Duodecim."
do	15° west longitude,	number'd 13, "Tredecim."
do	30° do	14, "Quatuordecim."
do	45° do	15, "Quindecim."
do	60° do	16, "Sedecim."
do	75° do	17, "Septemdecim."
do	90° do	18, "Octodecim."
do	105° do	19, "Novemdecim."
do	120° do	20, "Viginti."
do	135° do	21, "Viginti unus."
do	150° do	22, "Viginti duo."
do	165° do	23, "Viginti tres."

Anti Prime Meridian 180° east and west longitude "Zero."

With the view of obtaining approval to the proposed nomenclature, or an expression of opinion regarding it, the Committee recommend that the Council be requested to bring the matter to the attention of scientific men and sister societies in other countries.

CHARLES CARPMAEL,
Chairman of Committee.

Approved at the General Meeting of the Society held at Montreal 29th May, 1891.

GEO. M. GRANT,
President.

GEO. STEWART,
Acting Honorary Secretary.

EXPLANATORY NOTE RESPECTING THE HOUR MERIDIANS AND HOUR ZONES.

For other reasons than those referred to in the report, the Hour Meridians should be distinguished by numbers in the order indicated.

1. The twenty-four hour meridians take their origin from the recognized zero of time, which is diurnally determined by the solar passage on the anti-prime meridian; it is therefore natural that if they are to be known by numbers, the series of numbers should begin at the anti-prime meridian as zero.

2. If we commence to observe the passage of time at the instant of zero, in the lapse of an hour the earth will have revolved on its axis fifteen degrees and brought the first hour meridian west of the anti-prime meridian under the sun. What more appropriate designation for this hour meridian than number one? (*unus*), at the end of the second hour the earth will have revolved another fifteen degrees and brought under the sun the second hour meridian west of the anti-prime meridian. With equal propriety this may be termed hour meridian number two (*duo*), similarly the third, fourth and every one of the twenty-four hour meridians may be numbered in consecutive order.



If this mode of distinguishing the hour meridians is characterised by simplicity, it will likewise be found to be convenient. Referring to the accompanying projection of the northern hemisphere, the figures around the circumference indicate the hour meridians numbered on this principle: These figures likewise indicate the twenty-four hours into which the world's standard unit measure of time is divided. The motion of the earth on its axis brings each hour meridians in succession to its solar passage, and by numbering them as described a complete coincidence is obtained between the hour meridians and the hours of the world's standard. For example when the solar passage is on hour meridian number twelve it will be 12 o'clock —when on hour meridian number seventeen it will be 17 o'clock and so on for every meridian. Thus we realize the conception

that the earth itself is the great standard chronometer while the sun is the index to point out the hours.

The hour zone system has been designed to facilitate a common reckoning in all longitudes without any apparent wide departure from old usages and prevailing customs. The proposed manner of numbering the hour meridians establishes a direct relationship between the reckoning in each zone or section and the world's standard. This relationship may conveniently be reduced to the following formula :—

Let H be the number of the hour meridian, then—

(1.) In the zone of hour meridian number 12 (*duodecim*) (corresponding with the meridian of Greenwich) the notation of the hours will agree with the world's standard.

(2.) In all EAST longitudes, the notation will be in advance of the world's standard; the number of hours FASTER than W.S. will in each case equal twelve *minus* H .

(3.) In all WEST longitudes the notations will be behind the world's standard; the number of hours SLOWER than W.S. will in each case equal H *minus* twelve.

The distinguishing number of each hour meridian will be the key to the notation in the zone of that meridian, and it will denote the precise relation which the local reckoning bears to the world's standard.

By this system, uniformity of reckoning throughout the globe will be unbroken, except in the numbers by which the hours will be distinguished in the several zones. The notation will differ an even hour from zone to zone. In all other respects there will be complete identity of reckoning and everywhere synchronism will practically prevail.

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