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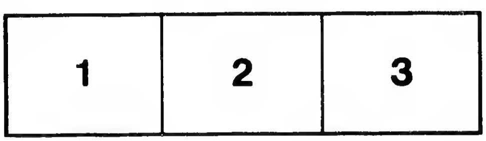

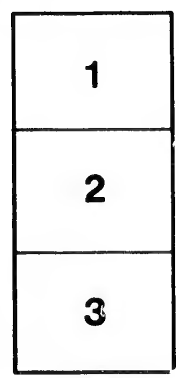

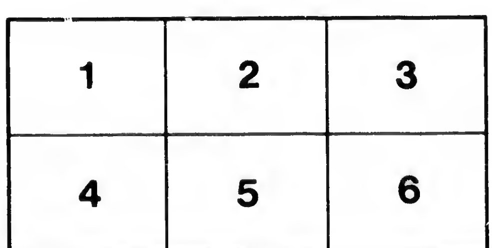

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TERRESTRIAL TIME.

A Memoir, by SANDFORD FLEMING, C.M.G., M. INST. C.E., F.G.S., F.R.G.S.
Engineer-in-Chief Canadian Pacific Railway, &c.

THE QUESTION to which I propose to direct attention is not purely English in its interests, or, indeed limited to any particular country or continent. It is a question which concerns all nations in common; and is probably of less importance to the inhabitants of the British Isles than to colonists and to those who live in continental countries.

Within a comparatively recent period, the human race has acquired control over a power, which already has, in a remarkable degree, changed the condition of human affairs. The application of steam to locomotion by land and water has given an enormous stimulus to progress throughout the world, and with the electric telegraph as an auxiliary, has somewhat rudely shaken customs and habits which have been handed down to us from bygone centuries. We still cling, however, to the system of Chronometry inherited from a remote antiquity, notwithstanding difficulties and inconveniences which are constantly met in every part of the world, but which are so familiar to us that they are not regarded, or are silently endured.

I do not refer to the mechanism of our clocks and watches. The art of watch making has by no means remained behind in the general advancement. The horological instruments now

1876
(69)

made are, indeed, of surprising accuracy and beauty; and simply as machines, for measuring time and dividing it into minute portions, they undoubtedly are unrivalled amongst the productions that come from the hand of man. The difficulties to which I allude, are due primarily to the principle of construction by which our clocks and watches are made to indicate time only according to the longitude of places on the earth's surface; and, in a less degree, to the fact, that we adhere to the custom of dividing the day into halves of twelve hours each, one set of hours being described as *ante meridian*, the other as *post meridian*.

To illustrate the points of difficulty, let us first take the case of a traveller in North America. He lands, let us say, at Halifax, in Nova Scotia, and starts on a railway journey through the eastern portions of Canada. His route is over the Intercolonial and Grand Trunk Lines. He stops at St. John, Quebec, Montreal, Ottawa and Toronto. At the begining of the journey he sets his watch by Halifax time. As he reaches each place in succession, he finds a considerable variation in the clocks by which the trains are run, and he discovers that at no two places is the same time used. Between Halifax and Toronto he finds the railways employing no less than five different standards of time. If the traveller remained at any one of the cities referred to he would be obliged to alter his watch in order to avoid much inconvenience, and, perhaps, not a few disappointments and annoyances to himself and others. If, however, he should not alter his watch, he would discover, on reaching Toronto, that it was an hour and five minutes faster than the clocks and watches in that city.

In the United States the inconvenience is greater. Along the great railway lines leading from Boston, New York, Philadelphia, and other cities on the Atlantic seaboard, to the west as far as San Francisco, the variation of time is of no trifling importance. The difference between the time of New York and that of San Francisco is nearly three hours and a-half. Between these extreme points there are many standards of time, each city of any importance having its own. The railway companies have to conform to this state of things, and, as in Canada, are obliged to adopt local standards Hence the discrepancies in time which perplex the traveller in moving from place to place.

On the Continent of Europe, and, indeed, wherever lines of communication extend between points differing to any considerable extent in longitude, the same difficulty is experienced. On a journey from Paris to Vienna, or to St. Petersburg, the standard time employed by the railways changes frequently, and the extreme difference in time between the first and last city is nearly two hours.

Suppose we take the case of a person travelling from London to India. He starts with Greenwich time, but he scarcely leaves the shores of England, when he finds his watch wrong. Paris time is used for the journey until that of Rome becomes the standard. At Brindisi there is another change. Up the Mediterranean ship's time is used. At Alexandria Egyptian time is the standard. At Suez ship's time is resumed, and continues with daily changes until India is reached. Arriving at Bombay the traveller will find two standards employed, local time and railway time, the latter being that of Madras. If he has not altered his watch since he left England he will find it some five hours slow; should he continue his journey to China it will fall eight hours behind.

In the United Kingdom the difficulties due to longitude are felt in a very modified form. The greater island, embracing England and Scotland, is comparatively limited in extent, particularly in width. One standard of time is therefore used. It is only in respect to the smaller island, Ireland, that the difference in longitude calls for a difference in time; in the whole United Kingdom, consequently, there are practically only two standards, viz., Greenwich time and Irish time, the difference being twenty-five minutes. No one, therefore, whose experience has been confined to the United Kingdom, can form an adequate idea of the extent of the inconvenience arising from the causes alluded to in regions of the world where geographical circumstances render the use of a multiplicity of standards necessary.

The railway system is the principal agent in the development of the difficulties referred to, and the still further extension of steam communications in great continental lines, now begins to force the subject on our attention. Canada supplies a good illustration of what is occurring. The railways built and projected there will extend from the eastern coast of Newfoundland on the Atlantic to the western coast of British Columbia on the Pacific, embracing about seventy-five degrees of longitude. Every existing Canadian city has its own time. Innumerable settlements are now being formed throughout the country ultimately to be traversed by railways; and in a few years, scores of populous towns and cities will spring up in the now uninhabited territories between the two oceans. Each of these places will have its own local time; and the difference between the clocks at the two extremes of Canada will be fully five hours. The difficulties which will ultimately arise from this state of things are apparent; they are already in some degree felt; they are year by year increasing, and will, at no distant day, become seriously inconvenient. This is the case not in Canada alone, but all the world over.

The other class of difficulties arises from the division of the day into halves of twelve hours, each numbered from one to twelve, from midnight to noon, and from noon to midnight consecutively. Inconveniences resulting from this cause, may be familiar to many who have had occasion to consult "Bradshaw," or other railway and steamboat time tables. Simply as an illustration, the experience of a stranger during the first few days of his sojourn in the United Kingdom, may be taken.

A few weeks ago he (the writer) landed at Londonderry by the Allan line of steamers from North America. Circumstances calling him to a place near Sligo, and having two days to spare, he determined, if it could be done within that period, to visit the locality referred to. "The Official Irish Travelling Guide" was consulted, and the several routes were carefully studied. Persons resident in Ireland, and accustomed to travel, were also consulted, and a route was determined on, by which the traveller could, with apparent comfort and certainty, leave Londonderry any morning, and return the night of the day following. The journey was by railway to Enniskillen sixty miles; thence by public car to Manor Hamilton, thirty miles; thence by private carriage to Killennumery, eight which miles completed the first day's journey. Next day, it was arranged to leave in time to drive to Bandoran, forty-two miles, in order to catch a train, which "The Official Travelling Guide" indicated, would leave at 5.35 p.m., and enable the traveller to reach Londonderry at ten o'clock the same evening. There appeared to be no doubt, about accomplishing the journey within the time and in the precise manner described.

The traveller set out, reached the house of his friend near Sligo on the first day, without difficulty, and, on the second day, started in a conveyance specially engaged to take him to Bandoran in time for the 5.35 p.m. train. The conveyance actually reached Bandoran at 5.10 p.m., apparently affording twenty minutes to spare. But the discovery was soon made that no train would leave that evening. The station master was appealed to for an explanation, and, comparing the "Official Irish Travelling Guide," as it was termed, with the time table hung up in the railway office, it was found that the "Official Guide" should have read 5.35 a.m., instead of 5.35 p.m. Thus, owing to the system of dividing the day into two sets of hours, a most trifling typographical error made a morning train appear to be an afternoon train, twelve hours later than intended.

There was no help for it but to remain at Bandoran until next day, and, as the morning train on the Bandoran branch did not, like the supposed afternoon train, run to meet an express train on the main line, there was no regular means by which the traveller could reach his destination before 1.30 o'clock in the afternoon of the third day, in place of 10 o'clock, p.m., on the second day. An actual loss was thus entailed on him of sixteen and a-half hours, while several other persons were subjected to needless inconvenience and disappointment.

This was the first few days' experience of a visitor from a distant country to the United Kingdom, where untold wealth and talent have, during many years, been expended in establishing, developing, and perfecting the railway system !

The question need not be asked, how many or how few similar experiences could be related ? A single case like the one described, is quite sufficient to establish that perfection of system has not by any means been reached, and that the present mode of measuring time and arranging railway time tables, leads to errors which might any day prove serious in their consequences. Such a case as the foregoing should be rendered an impossibility in this age, more especially in the British Islands, where the railway system was cradled, and where it has been nurtured and maintained for half a century.

A remedy for the evils to which attention is directed, is clearly of importance not only to this generation, but to those who are to succeed us. No complete solution to the problems presented may be possible ; but a general enquiry into the subject of Chronometry may suggest some means by which the difficulties may in some degree be met.

Time is measured in nature by the motions of the heavenly bodies. The great natural measures are three in number; the year; the (lunar) month ;* and the day. All other divisions of time, as the civil month, the week, the hour, the minute and

* The Chinese reckon by the lunar month. With them, the age of the moon and the day of the month are identical.

the second, although long in general use, are arbitrary and conventional.

Of the three great natural divisions of time, the period measured by the diurnal movement of the earth on its own axis, constituted the first space of time reckoned by the human race; and is undoubtedly the most important to man in all stages of civilization. It involves the most familiar phenomena of light and darkness, and embraces the constantly recurring periods of wakefulness and sleep, of activity and rest.

A day is the shortest measure of time afforded by nature. It is denoted by the revolution of the earth, and, although the motion of the earth is perfectly uniform, indeed the only strictly uniform motion that nature presents, we have three kinds of natural days all varying in length; the solar, lunar and siderial.

A solar day is the period occupied by a single revolution of the earth on its axis in relation to the sun.

A lunar day is the interval of time occupied by a revolution of the earth on its axis in relation to the moon.

A siderial day is the period required for a complete revolution of the earth on its axis in relation to the fixed stars.

Of these three natural days, the siderial day is the only one perfectly uniform in length. The lunar day, on account of the irregular and complicated motion of the moon in the heavens, is never employed as a measure of time. The solar day is variable in length on account of the form of the earth's orbit around the sun, and the obliquity of the ecliptic. Solar time is that shown by a sun-dial.

Although the siderial day is uniform in length, being perfectly independent of the sun, and having no relation to the daily return of light and darkness, it is not employed for civil purposes. The commencement of the siderial day is constantly changing throughout the year; at one period it comes at midnight, at another period at high noon.

It has been found convenient, therefore, to establish an artificial day, uniform in length, designated the mean solar day.

The mean solar day, as its name implies, is the average length of all the natural solar days in a year, and is the time intended to be indicated by ordinary clocks and watches.

In a year there are 366 siderial days and only 365 solar days. A solar day, therefore, exceeds the length of a siderial by about $\frac{1}{365}$ part of a day, or nearly four minutes (three minutes 55·9094 seconds).

The mean solar day, according as it is employed for civil or astronomical purposes, is designated the civil day, or the astronomical day. The former begins and ends at midnight; the latter commences and ends at noon. The astronomical day is understood to commence twelve hours before the civil day, but its date does not appear until its completion, twelve hours after the corresponding civil date.

It has been stated that all shorter periods of time than a day, are entirely conventional and arbitrary, there being actually no smaller measure than a day denoted by nature.

The sub-division of the day into parts has prevailed from the remotest ages; though different nations have not agreed, either with respect to the epoch of its commencement, the number of the sub-divisions, or the distribution of the several parts.

The division of the day with which we are most familiar is that which separates the whole space of time occupied by a diurnal revolution of the earth into two equal parts; one part extending from midnight to noon, the other part from noon to midnight. These half-days are sub-divided into twelve portions or hours, and these again into minutes and seconds.

In China and some other parts of the world, no half-days are used. The Chinese divide the day into twelve parts, each being equal to two hours of our time; these they again divide into eight parts, thus subdividing the whole day into ninety-six equal parts. The Italians, the Bohemians and the Poles have a division of the day into twenty-four parts, numbered from the first to the twenty-fourth—from one o'clock to twenty-four o'clock.

In Japan there are four principal points of division,—at noon, midnight, sunset and sunrise—dividing the natural day into four variable parts. These four parts are divided each into three equal portions, together making twelve hours. Each hour is again divided into twelve parts, thus making in all, one hundred and forty-four sub-divisions of the day. The six hours between sunrise and sunset differ in length, day by day from the six hours between sunset and sunrise. During the summer the hours of the day are much longer than those of the night, and shorter on the contrary in winter.

The division of that portion of the day during which the sun is above the horizon into twelve parts, belongs to the remotest ages of antiquity. The division of the other portion, which embraces the period of darkness, into the same number of parts, was introduced at Rome in the time of the Punic Wars.

The system of dividing the day by the rising and setting of the sun, makes the hours indefinite periods, as they continuously change with the seasons. Except at the equinoxes, the hours of the night and day can never be of equal length. Near the equator the variations are least; they increase with every degree of latitude until the Arctic and Antarctic circles are reached, within which a maximum is attained. Even in the latitude of Rome, the length of the hours of daylight and darkness nnder this system have an extreme difference of 75 minutes.

The day is reckoned to begin in China before midnight, the first hour extending from 11·00 p.m. to 1·00 a.m. of our mode ot reckoning. The Jews, Turks, Austrians and others, with some of the Italians, have begun their day at sunset. The Arabians begin their day at noon, and in this respect they resemble the astronomers and navigators of modern nations. It has been customary in Japan to adhere to the practice of the ancient Babylonians in beginning their day at sunrise.

The Babylonians, Persians, Syrians, Greeks and other ancient nations, began their day at sunrise, and had divisions corresponding to morning, forenoon, mid-day, afternoon, evening and night.

The ancient, like the modern, Arabians began their day at noon.

The Chaldean astronomers divided the day into sixty parts; like the modern Chinese they also had a division of the day into twelve hours.

The ancient Egyptians (probably B.C. 1000) divided the day equally into day and night, and again sub-divided each half into twelve hours, numbered from 1 to 12; the night with them commenced six hours before and terminated six hours after midnight; the day began six hours before noon and lasted twelve hours, or until six hours after noon.

These are some of the customs, as gleaned from history, which have prevailed at various times in different countries with respect to the day and its sub-division. To these may be added the customs practised at sea by navigators. The shipping of different nations have had different customs, but the most common practice on shipboard, is to divide the 24 hours into six equal portions called "watches;" and these, again, into eight equal parts known as "bells," and numbered from one to eight. Thus the whole day is sub-divided into 48 equal parts. The period of time called a "watch" is four hours in length, the reckoning being as follows:—

From noon to 4 p.m., the afternoon watch.

,, 4 p.m. to 8 p.m., the dog watches (from 4 to 6 being the first dog watch, from 6 to 8 being the last dog watch).

,, 8 p.m. to midnight, the first (night) watch.

,, midnight to 4 a.m., the middle (or second night) watch.

,, 4 a.m. to 8 p.m., the morning watch.

,, 8 a.m. to noon, the forenoon watch.

From what has been set forth it would appear that man has reckoned the day to begin at sunrise, at sunset, at noon, at midnight, at one hour before midnight, at six hours before midnight, and at six hours before noon, and that he has divided it in a great variety of ways; *firstly*, into two, four, twelve, twenty-four and one hundred and forty-four unequal parts; *secondly*, into two, four, six, eight, twelve, twenty-four, forty-eight, sixty, and into ninety-six equal parts, without including the small subdivisions of minutes and seconds. The common practice at present with most civilized nations is to divide the day into two series of twelve hours each, a custom which corresponds very closely with that followed by the ancient Egyptians long before the Christian era. Thus, while we have made extraordinary advances in all the arts and sciences, and in their application to every day life, we find ourselves clinging to a conventional and inconvenient mode of computing time; one not materially different from that practised by the Egyptians, perhaps thirty centuries ago.

The Chinese system would, without a doubt, suit the requirements of this age much better than that which we now follow. The halving of the day is one source of difficulty which ought not to exist, and it would be an important step to imitate the custom of computing time, which is followed by that old oriental civilization. The adoption of the Chinese system, by which half days would be thrown out of use, would not, however, obviate the very serious inconveniences which have been referred to, resulting from differences in longitude.

To overcome, at once, both difficulties, is the problem which presents itself for solution.

It has been stated that a day is the shortest measure of time which we find in nature. As a consequence, man is left to sub-divide the day in any way best calculated to promote his own convenience. There can be no doubt, whatever, that all divisions, except that produced by the rising and setting of the sun, are entirely artificial and arbitrary.

When the decimal system was adopted by the French, it was proposed to divide the day into ten and a hundred parts: a scheme which would probably be the best at this age of the world had the whole system of horology to be established *de novo*. In view of generally prevailing customs, however, it will, doubtless, be felt that any attempt to introduce the decimal division of the day would be unwise; that it would be futile to propose a change which could only succeed by seriously interfering with the existing system.

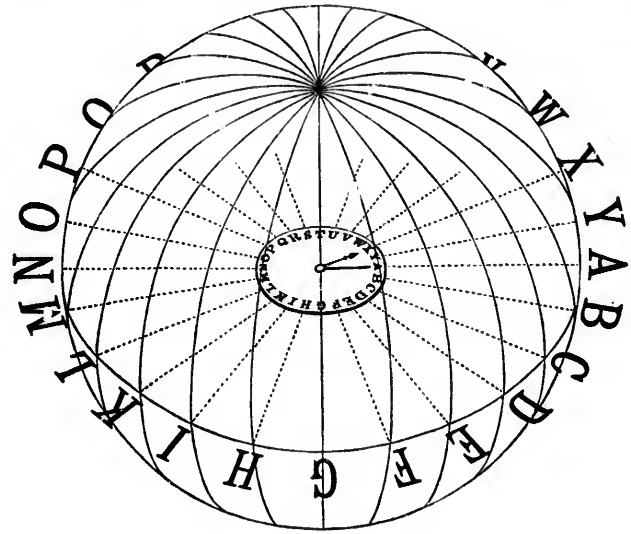
The progress of the world may, indeed, before long, demand a radical change in our Chronometry; but the present method of computing time in the more civilized parts of the earth, is so interwoven with human affairs, that it cannot in the meantime be disregarded. It will be evident that the consideration of any change should be entered on in the full recognition of established customs. Instead of attempting to uproot and supersede the present system, it is considered that a new scheme to meet the requirements of the age, should rather be engrafted on, and be in complete harmony with the old one.

In this view the following suggestions are offered:—

It is proposed to take as the unit-measure of time, the artificial day known as the mean solar day.* This unit

* The siderial day—the only natural day uniform in length—from its uniformity would be well suited for the standard unit of measure required. But it is not sufficiently marked for the ordinary purposes of life. The diurnal return of the sun in the heavens is a phenomenon much easier observed by the generality of man than the culmination of

to be divided into twenty-four equal parts, and these, again, into minutes and seconds by a standard timekeeper or chronometer, hypothetically stationed at the centre of the earth.



It is proposed that, in relation to the whole globe, the dial plate of the central Chronometer shall be a fixture, as in Fig. 1; that each of the twenty-four divisions into which the day is divided shall be assumed to correspond with certain known meridians of longitude, and that the machinery of the instrument shall be arranged and regulated so that the index or hour hand shall point in succession to each of the twenty-four divisions as it became noon at the corresponding meridian. In fact the hour hand shall revolve from east to west, with precisely the same speed as the earth on its axis, and shall therefore point directly and constantly towards the (mean) sun, while the earth moves round from west to east.

It is proposed in order properly to distinguish these, as well as the new time indicated by the Standard Chronometer, that the twenty-four divisions shall be known by the letters of

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a star. Hence the solar day reduced to a mean is better suited for civil purposes.

the alphabet, and that the corresponding meridians shall also be so known.

Each of the twenty-four parts into which the day is proposed, as above, to be divided, would be exactly equal in length to an hour; but they ought not to be considered hours in the ordinary sense, but simply twenty-fourth parts of the mean time occupied in the diurnal revolution of the earth. Hours as we usually refer to them, have a distinct relation to noon or to midnight at some particular place on the earth's surface; while the time indicated by the Standard Chronometer would have no special relation to any particular locality or longitude: it would be common and equally related to, all places; and the twenty-four sub-divisions of the day would be simply portions of abstract time.

The standard time-keeper is referred to the centre of the earth in order clearly to bring out the idea, that it is equally related to every point on the surface of the globe. The standard might be stationed anywhere, at Yokohama, at Cairo, at St. Petersburg, at Greenwich or at Washington. Indeed, the proposed system if carried into force, would result in establishing many keepers of standard time, perhaps in every country, the electric telegraph affording the means of securing perfect synchronism all over the earth.

The time indicated by these instruments, it has been stated, would be designated by letters. In order still further to distinguish it from siderial, astronomical, civil or local time, it is proposed, that, as it is common to the whole earth it should be known as "common" or "terrestrial time;" probably "universal time" would be a designation still more appropriate, but for the present the term "terrestrial time" will be used.

Besides the keepers of standard time established at many places, possibly in every civilized country, it is suggested that every clock and watch, should, as far as practicable, move synchronically, all indicating "terrestrial time." As a theory, it is proposed that when the hands of any one time-piece point to A or to G, the hands of each and every other horological instrument in use throughout the globe, should point to A or to G at the same moment.

It is obvious that if clocks and watches constructed on these principles and the scheme of "terrestrial time" were in general use, the difficulties and inconveniences which have been alluded to and which seem inseparable from the present system, would be fully met. Every connecting steam line, indeed every communication on the face of the earth, would be worked by the same standard, viz., "terrestrial time." Every traveller having a good watch, would carry with him the precise time that he would find employed everywhere. *Post meridian* could never be mistaken for *ante meridian*. Railway and steamboat time-tables would be simplified, and rendered more intelligible, to the generality of mankind than many of them are now.

Examples of time-tables placed side by side may be presented. Table A. is an ordinary "through" time-table from Cork to London, extracted from the published sheets of one of the Railway Companies. Table B. shows the application of terr 'strial time to the same route.

Table A.		Table B.	
Cork	6·0 a.m. Irish time.	Cork	Y. 40.
Mallow	6·55 ,, ,,	Mallow	A. 35.
Limerick ...	11·20 ,, ,,	Limerick ...	E. 0.
Tipperary ...	12·40 p.m. ,,	Tipperary ...	G. 20.
Waterford ...	4·30 ,, ,,	Waterford ...	L. 10.
New Milford.	2·55 a.m. Greenwich time.	New Milford.	V. 55.
Swansea... ...	5·20 ,, ,,	Swansea... ...	Y. 20.
Cardiff	6·33 ,, ,,	Cardiff	A. 33.
Exeter	2·10 p.m. ,,	Exeter	I. 10.
Plymouth ...	4·25 ,, ,,	Plymouth ...	L. 25.
Gloucester ...	8·40 a.m. ,,	Gloucester ...	P. 40.
Swindon... ...	10·10 ,, ,,	Swindon... ...	R. 10.
Oxford	1·25 p.m. ,,	Oxford	U. 25.
Reading	11·13 a.m. ,,	Reading	F. 13.
London (Pad.).	12·10 p.m. ,,	London (Pad.).	G. 10.

Condensed time-tables of the great mail and passenger route now being established through Canada to the Pacific, prepared in accordance with both systems, may also be presented.

TABLE C.—*The Present System.*

Principal Stations.	Local Time.		Slower than Greenwich.
LONDON...	8·00 p.m. ...	Greenwich time	0·00
DUBLIN	8·00 a.m. ...	Irish time	0·25
(*en route*) ...	... 1st noon	Irish time	„
W. COAST IRELAND	1·00 p.m. ...	Irish time	„
(*at sea*) ...	... 2nd noon	Ship's time	1·00
(*at sea*) ...	... 3rd noon	Ship's time	1·40
(*at sea*) ...	... 4th noon	Ship's time	2·20
(*at sea*) ...	... 5th noon	Ship's time	3·00
ST. JOHN, N'f'land	9.00 a.m. ...	Newfoundland time ..	3·30.
(*en route*) ...	... 6th noon	Newfoundland time ...	„
ST. GEORGE N'f.ld.	6·00 p.m. ...	Newfoundland time ...	„
SHIPPIGAN	10·00 a.m. ...	New Brunswick	4·30.
(*en route*) ...	... 7th noon	New Brunswick	„
RIV. DU LOUP ...	10·00 p.m. ...	Montreal time	5·00.
QUEBEC	2·00 a.m. ...	Montreal time	„
MONTREAL	8 a.m. ...	Montreal time	„
(*en route*) ...	... 8th noon	Montreal time	„
OTTAWA...	1·00 p.m. ...	Montreal time	„
NIPPISING	8·30 p.m. ...	Huron time	5·30.
L. SUPERIOR... ...	10·00 a.m. ...	Superior time	6·00.
(*en route*) ...	... 9th noon	Superior time	„
FORT WILLIAM ...	3·30 p.m. ...	Superior time	„
KEEWATIN	1·30 a.m. ...	Winnepeg time	6·30.
SELKIRK	6·00 a.m. ...	Winnepeg time	„
(*en route*) ...	... 10th noon	Winnepeg time	„
LIVINGSTON	3·00 p.m. ...	Saskatchewan time ...	7.00.
SASKATCHEWAN ...	9·30 p.m. ...	Saskatchewan time ...	„
BATTLEFORD ...	1·00 a.m. ...	Athabasca time	7·30.
EDMONTON	9·30 a.m. ...	Athabasca time	„
(*en route*) ...	... 11th noon	Athabasca time	„
MONTBRUN	2·15 p.m. ...	Athabasca time	„
YELLOW HEAD PASS	7·00 p.m. ...	Yellow Head time... ...	8·00.
TETE JAUNE CACHE	8·15 p.m. ...	Yellow Head time ...	„
(*en route*) ...	... 12th noon	Yellow Head time ...	„
PACIFIC TERMINUS.	11·30 p.m. ...	Pacific time	8·30.

TABLE D.

System of Terrestrial Time.

London	P. 00.
Dublin	C. 25.
1st *Noon (en route)* ...	G. 25.
W. Coast Ireland	H. 25.
2nd *Noon (at sea)*	H. 00.
3rd *Noon (at sea)*	H. 40.
4th *Noon (at sea)*	I. 20.
5th *Noon (at sea)*	K. 00.
St. John, Newfoundland	G. 30.
6th *Noon (en route)* ..	K. 30.
St. George N'f'land ...	R. 00.
Shippigan	I. 30.
7th *Noon (en route)* ...	L. 30.
Riv. du Loup	W. 00.
Quebec	B. 00.
Montreal	H. 00.
8th *Noon (en route)* ...	M. 00.
Ottawa	N. 00.

Continued.	
Nippising	V. 00.
L. Superior	L. 00.
9th. *Noon (en route)* ...	N. 00.
Fort William	Q. 30.
Keewatin	C. 00.
Selkirk	G. 30.
10th. *Noon (en route)* ...	O. 00.
Livingston	R. 00.
Saskatchewan	X. 30.
Battleford	C. 30.
Edmonton	M. 00.
11th. *Noon (en route)* ...	P. 00.
Montbrun	Q. 45.
Yellow Head Pass ...	W. 00.
Tete Jaune Cache	X. 15.
12th. *Noon (en route)* ...	P. 30.
Pacific Terminus.	W. 30.

A comparison of these tables will illustrate the extreme simplicity of Table D, the one prepared on the principle of terrestrial time. The watch of every traveller would agree with the times given opposite each station in this table, an impossibility under the old system.

It is not proposed to do away with local time. It is contemplated by this scheme that each time-piece, clock, or watch should indicate terrestrial time, together with local time. The various methods by which the object may be accomplished, remain now to be considered.

If the practice of dividing the day into two series of hours, each numbering from 1 to 12, could be wholly ignored, the nomenclature proposed for terrestrial time, might very readily be employed for local purposes. The time of day is now known by numerals, but numerals have no special advantage over letters. Habit has undoubtedly rendered the former familiar to the mind in connection with the hour of the day, but if the naming of the 24 divisions had to be done afresh, and letters instead of numerals were adopted, there can be no doubt whatever, that the time of day could be as well expressed, and be as easily understood by the former as by the latter.

It has been stated as part of the scheme, that each letter has a corresponding meridian of longitude and that time-keepers are to be so adjusted as to point to the meridional letter precisely when it is noon in the particular longitude.

Suppose G to be the meridional letter of the British Islands. How easy it would be for an inhabitant to comprehend that it was noon, when the hands of the clock pointed to G, that it was midnight when they pointed to the letter on the dial plate opposite G, viz., T. Or, in speaking of any particular time of day, say four hours before mid-day, it would be just as easy to understand what time was referred to by the use of the letter C as by the use of the roman numeral VIII. It is perfectly obvious that every person living in England, Ireland and Scotland, would soon become familiar with the several letters, and the precise relation which they had to the time of day. If we pass to another part of the world, say where

Fig. 2.

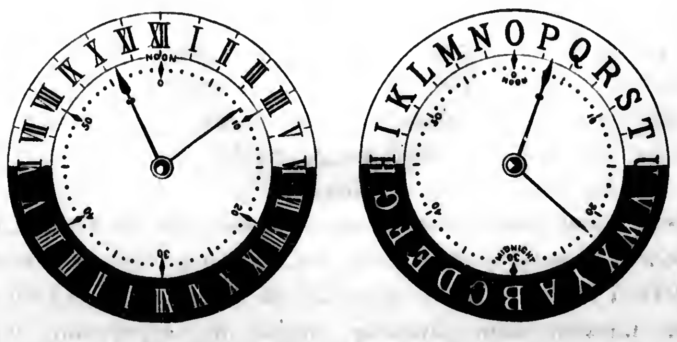
O becomes the meridional or noon letter, as in Fig. 2, there could be no misunderstanding the meaning of the expression, "Time P. 22." It could have but one meaning viz., 1 hour and 22 minutes after mid-day, while the expression, "1.22 o'clock," has a double meaning undetermined without the addition of "*ante-meridian*" or "*post meridian.*"

To render the dial plates of time-pieces perfectly intelligible, in each place when used for local time, the expedient shown in *Fig.* 2 might be adopted. Here the noon and midnight letters are clearly distinguished, and that portion of the day which includes the hours of darkness cannot be mistaken. These or similar expedients, could be employed with the same effect in the clocks and watches used in every place on the surface of the earth.

It would, however, be vain to assume that the present system could be wholly abolished or seriously disregarded. It becomes expedient, therefore, to consider how the advantages of the scheme of terrestrial time could be secured in every day life. It is perfectly obvious that the present system cannot be overlooked; and that, although perhaps not perpetuated, it must for some time be continued. We must therefore look for some means by which the new scheme may be employed in conjunction with the old, until perhaps at some period in the future, the latter may fall into disuse.

The first arrangement which suggests itself, is to have two dial plates to each time-piece, the same wheel-work moving the hands of both, one indicating terrestrial time, the other indicating the local time of the place. Stationary clocks might have the dial plates side by side as in Fig. 3.

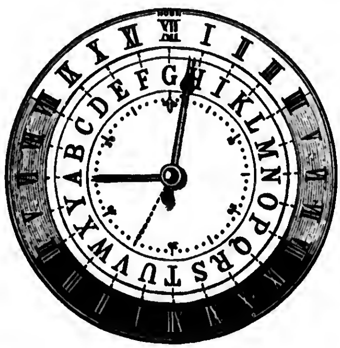
FIG. 3.



Watches, or other portable instruments, on the other hand, might more conveniently have the dial plates back to back. In the latter case, means would be provided for adjusting the local time dial plate to correspond with any new longitude to which the instrument might be moved. Terrestrial time on the other dial plate would remain unaltered.

Another plan of construction may be suggested, by which terrestrial and local time could be indicated on the same face of the clock or watch as in Fig. 4. In this arrangement it is proposed to have the Roman numerals for local time inscribed on a movable disc, which would admit of adjustment for any longitude without in the least disturbing the machinery of the instrument or interfering with the index hands.

FIG. 4.



Church and other stationary clocks, as well as watches, the use of which would be confined to particular districts, would have the local time disc permanently secured in the proper position. Only in the case of persons travelling beyond any particular local time district, would the local time disc require to be changed. Its adjustment, under such circumstance, would be simple; it would only be necessary to move the disc round until twelve o'clock noon coincided with the meridional letter of the new locality. Suppose, for example, the letter G represented the longitude of the new position of the watch, twelve noon placed in conjunction with G would complete the adjustment of the instrument. For every other new position, the same operation would be repeated. Notwithstanding every change that may be made for local time, the machinery of the watch need not be touched, and the hands would continue to indicate correct terrestrial time, The distinction between terrestrial time and local time would always be perfect; the former would invariably be known by letters, the latter as at present by the Roman numerals.

If the change in longitude were but slight—making a difference in local time, of only a few minutes—and in any case it became indispensible that precise theoretical local time should be indicated by the watch, in that case, a third hand for the odd minutes, as shown by the dotted lined (Fig. 4) would be required. It is, however, hereafter suggested that for ordinary purposes this would be quite unnecessary.

As in the diagrams, it is proposed to denote that portion of the day which includes the hours of darkness by a black or dark ground, in order that the night hours could never be mistaken for the hours in the middle of the day, which have the same numerals. It is likewise proposed to distinguish the several "watches" into which the day is divided on shipboard. The local time disc, exhibits a light portion between 8 a.m. and 4 p.m.; this includes and represents the forenoon and afternoon watches, noon being the dividing point. The dark portion, extending four hours before, and four hours after midnight, embraces the two night watches; while the shaded portions, from 4 p.m. to 8 p.m., and from 4 a.m. to 8 a.m. represent the dog-watches and the morning watch. This arrangement, would, perhaps prove useful, in view of the vast and yearly increasing number of ships that adopt, and constantly use, the division of the day into "watches," finding it, as they appear to do, the most convenient scheme of division for daily routine at sea.

Navigators are required to employ a standard time to enable them from day to day, when on long voyages, to compute their longitude. For this purpose it is a practice with ships to carry the local time of the national observatory of the country to which they respectively belong. For example: French ships reckon their longitude by Paris time; British ships by Greenwich time. Terrestrial time would serve precisely the same purpose as a standard for geographical reckoning, and it would be some advantage to the marine of the world to have a uniform standard established —the common property of all nations and in common use by land and water everywhere. It has already been said that the telegraph provides the means of securing perfect accuracy at all stations, however remote; indeed, through this agency, timekeepers may be made to beat time synchronously all over the globe. Already the length of telegraph lines in operation approaches 400,000 miles, and we are warranted in believing that ultimately the means of instantaneous communication will ramify through every habitable country and find its way to every port of commercial importance.

It may be said, that with clocks moving synchronically and indicating terrestrial time all over the globe, it would be of little advantage to attempt to maintain precise local time at every place on the earth's surface. Our clocks but rarely indicate true local time; even our most perfect timepieces are for the greater portion of the year either faster or slower than the sun. In fact correct ordinary timekeepers must necessarily at certain seasons be 15 or 16 minutes faster or slower than true solar time, yet no inconvenience whatever is found to result. It will be admitted, that the adoption of Irish time in England or English time in Ireland, would scarcely be felt in civil affairs. The difference between English and Irish time as arbitrarily established, is twenty-five minutes; but in the west of Ireland the local mean time is forty minutes behind English time (Greenwich.) Greenwich time is used throughout England and Scotland, although it is half an hour faster than correct local mean time on the west coast of the latter country.*

In every country, local time is more or less arbitrarily established; it could not be otherwise, without causing great

* True Solar time is sometimes about 45 minutes in the Western coast of Scotland, and 55 minutes in the west of Ireland, behind Greenwich time.

confusion, as no two places, unless in the same meridian, have the same true local time. In considering the whole subject, it is felt, that if some simple rule could be agreed upon for defining local time everywhere, it would materially add to general convenience.

It is suggested that each of the twenty-four lettered meridians, (Fig. 1) should be taken as standard longitudes for establishing approximate local time, and that as a general rule all places should adopt the local time of the nearest of these meridians. This would greatly reduce the number of local time standards, and would divide the surface of the globe into twenty-four "lunes," forming distinct local time sections extending from pole to pole, within one or other, of which every place would find its position. Only in extreme cases would the difference between the true and approximate local time be as much as half an hour. In many cases there would be no difference ; and in no case could the differenec be of the slightest moment in the ordinary business of civil life. Whenever exact time was required for any purpose, terrestrial time, assuming it to be in general use, would be available.

In this view, if we assume one of the lettered meridians, G, to pass through Greenwich,* and terrestrial time for the moment to be G 45, then approximate local time at other places around the globe would simultaneously be as in the plates which follow. In each of the separate figures it will be noticed that the hands and the dial for terrestrial time remain constantly in the same relative position, while the moveable disc on which is inscribed the roman numerals for local time varies in each case. If each figure be examined it will be found that 12 o'clock noon is successively brought in conjunction with the letters which represent the 24 meridians, as in Fig. 1. With each separate figure is given simultaneous time at a number of well known places around the globe—approximate local time of course changing with the meridian ; terrestrial time remaining constant.

* See Fig. G., Page 25.

A embracing Yenisaisk, Tomsk (Siberia), Tibet, Calcutta, Bay of Bengal, Andaman Islands.

App. Local 6.45 *p.m.* ... *Ter. G.* 45.

B Gulph of Obi, Omsk (Siberia), Kashmir, Lahore, Bombay, Coralline Islands, Chagos Islands.

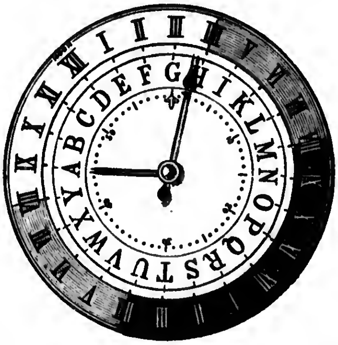
App. Local 5.45 *p.m.* ... *Ter. G.* 45.

C Nova Zembla, The Ural Mountains, Orsk, Sea of Aral, Khiva, Khcrassan, Mauritius.

App. Local 4.45 *p.m.* ... *Ter. G.* 45.

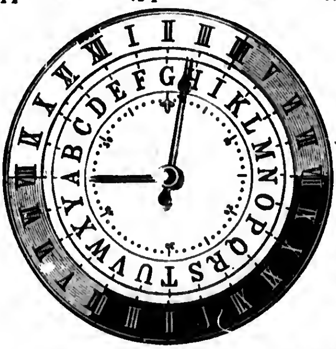
D Archangel, Nizney Novgorod, Astrakhan, Bagdad, Arabia, Aden, Somali, Madagascar.

App. Local 3.45 *p.m.* ... *Ter. G.* 45.



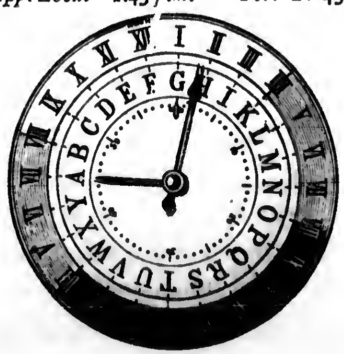
E Lapland, St. Petersburg, Constantinople, Alexandria, Nubia, Ujiji, Transvaal, Natal.

App. Local 2.45 *p.m.* ... *Ter. G.* 45.



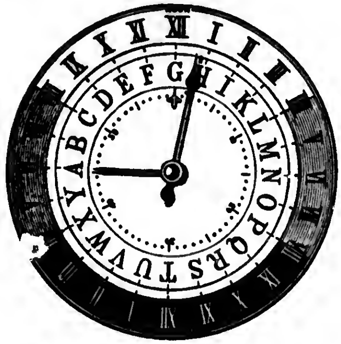
F Spitzbergen, Sweden, Berlin, Naples, Malta, Tripoli, Congo, Cape of Good Hope.

App. Local 1.45 *p.m.* ... *Ter. G.* 45.



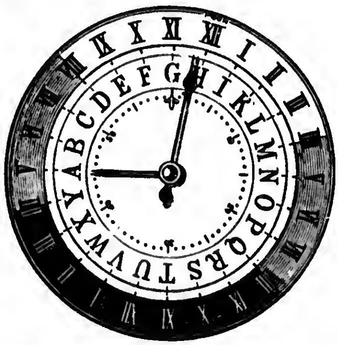
G England, France, Spain, Algeria, Timbucto, Ashantee, St. Helena Island.

App. Local 12.45 *p.m.* ... *Ter. G.* 45.



H Iceland, Madeira, Canary Islands, Senegambia, Sierra Leone, Asension Islands.

App. Local 11.45 *a.m.* ... *Ter. G.* 45.

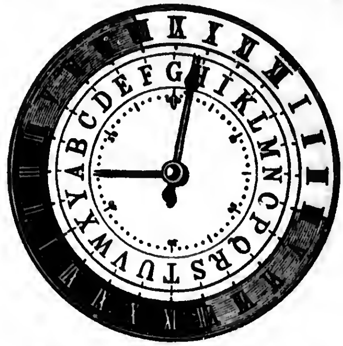


I East Greenland, The Azores, Cape Verde Islands, Fernando Island, South Georgia Islands.

App. Local 10.45 *a.m.* ... *Ter. G.* 45.

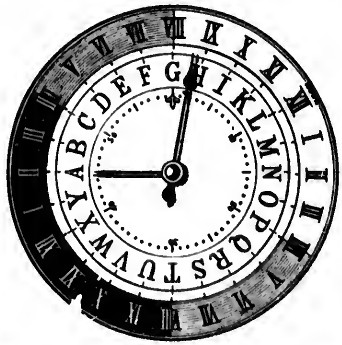
K West Greenland, The Banks of Newfoundland, Maranhao, Eastern Brazil, Rio de Janeiro.

App. Local 9.45 *a.m.* ... *Ter. G.* 45.



L Baffin's Bay, Labradore, Barbadoes, Trinidad, British Guiana, Buenos Ayres, The Falkland Islands.

App. Local 8.45 *a.m.* ... *Ter. G.* 45.

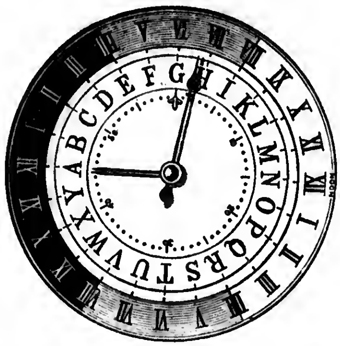


M Hudson Strait, Ottawa. Washington, Cuba, Jamaica, Equador, Peru, Chili, Patagonia.

App. Local 7.45 *a.m.* ... *Ter. G.* 45.

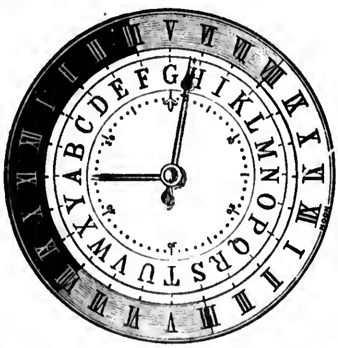
N Hudson Bay, Lake Superior, St. Louis, New Orleans, Yucatan, Guatemala, Galapagos Islands.

App. Local 6.45 *a.m.* ... *Ter. G.* 45.



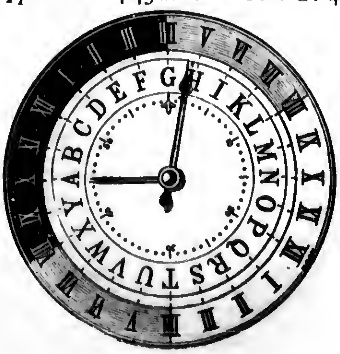
O Melville Sound, Lake Athabasca, Saskatchewan District, Colerado, Mexico, Cape Corrienta.

App. Local 5.45 *a.m.* ... *Ter. G.* 45.



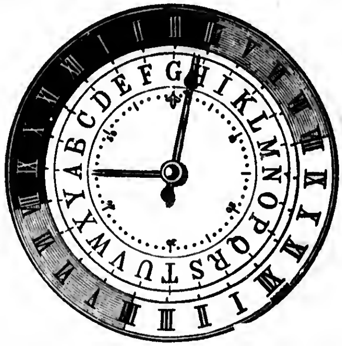
P Banks Land, Great Bear Lake, British Columbia, Oregon, California, Sea Otter Islands.

App. Local 4.45 *a.m.* ... *Ter. G.* 45.



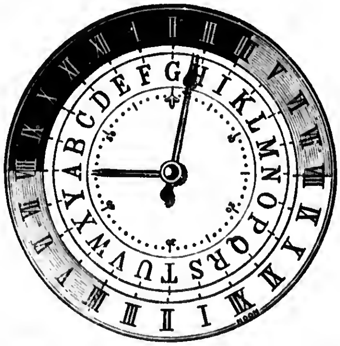
Q Fort Good Hope, Sitka, Queen Charlotte Islands, Paxavos Islands, Gambia Islands, Pitcairn Island.

App. Local 3.45 *a.m.* ... *Ter. G.* 45.



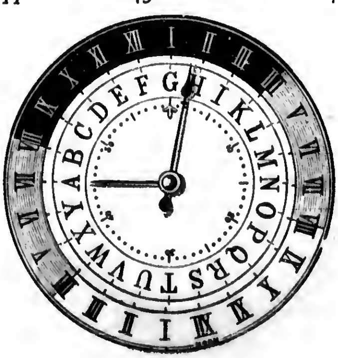
R Alaska, Owhyhee Sandwich Islands, Malden Islands, Starbuck Islands, Society Islands, Tubuai Islands.

App. Loeal 2.45 *a.m.* ... *Ter. G.* 45.



S Behring Strait, Fox Islands, Necker Island, Palmyra Island, Fanning Island, Palmerston Island.

App. Local 1.45 *a.m.* ... *Ter. G.* 45.

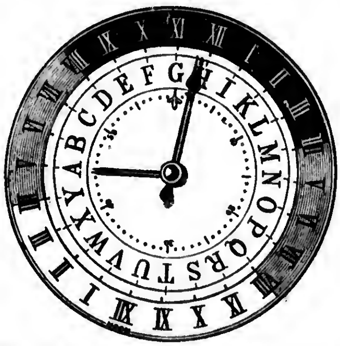


T Wrangel Land, Aleutian Islands, Gilbert Islands, Fiji Islands, North Island New Zealand.

App. Local 12.45 *a.m.* ... *Ter. G.* 45.

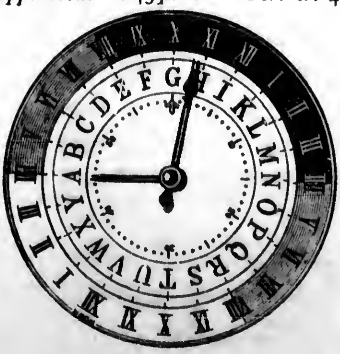
U Kamchatka, Marshall Islands, New Hebrides, Norfolk Island, Middle Island, New Zealand.

App. Local 11.45 *p.m.* ... *Ter. G.* 45.



V New Siberia, Sea of Okotsh, Queensland, New South Wales, Victoria, Tasmania.

App. Local 10.45 *p.m.* ... *Ter. G.* 45.

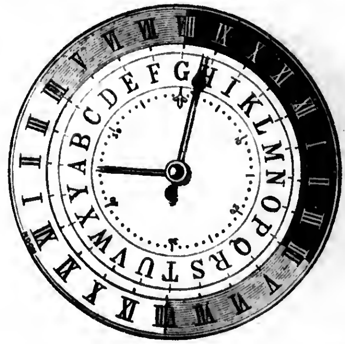


W Verkoansk, Nikolaevsk, Japan, New Guinea, North Australia, South Australia.

App. Local 9.45 *p.m.* ... *Ter. G.* 45.

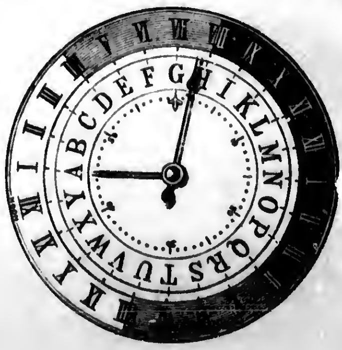
X Central Siberia, Eastern China, Formosa, Philipine Islands, Sandalwood Island, Western Australia.

App. Local 8.45 *p.m.* ... *Ter. G.* 45.



Y Cape Sievero, Irkoutsh, Central China, Cochin China, Singapore, Sumatra, Java.

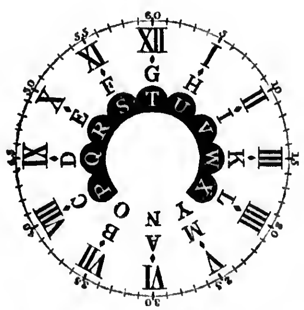
App. Local 7.45 *p.m.* ... *Ter. G.* 45.



It will perhaps be allowed that the scheme of terrestrial time, if put into practice, would, without seriously interfering with the existing customs, completely obviate all the objections to the present system w'ich have been set forth. It has been shown that the use 'ocal time may be retained very much as now, and that may be indicated along with terrestrial time, by the same clocks and watches. Objections may, however, be raised to the scheme, on account of the apparent neccessity of abolishing all existing clocks and watches, and substituting new ones. This indeed would be an insuperable objection, if it held good, but the necessity of this course is only apparent, as it is proposed to utilize existing timepieces simply by furnishing them with new dial-plates.

If we take a watch or clock to be used in any particular country, it would be a simple matter to inscribe on its dial the letters which designate terrestrial time. A still better plan would be to provide a new dial plate, such as Fig. 5.

FIG. 5.



In this design it will be noticed that G is assumed to be the meridional or noon letter of the place and the letters on a dark ground between 8 p.m. and 4 a.m. represent the hours in the two "night watches." With such simple expedients as these it would be perfectly practicable, without superseding existing time-keepers, to secure in a large degree the advantages of the new scheme in any country comparatively limited in geographically extent.

Clocks and watches now in use might thus in a very inexpensive way be so adapted as to show terrestrial in addition to local time. It would only be necessary to have railway and steamboat time-tables prepared in accordance with the new system in order to bring its advantages into common use. But this would apply only to localities or individual countries limited in extent. Mankind, generally, throughout the world, would not participate in the full advantages promised by the scheme until time-keepers for common use were constructed on new principles. A general change could only be a gradual process; but as there are some hundreds of thousands of time-keepers made every year, it would be well, in the event of the subject of this paper being deemed worthy of attention, for the manufacturers of horological instruments to consider the expediency of introducing such changes in their construction as may seem to be advisable. This suggestion applies more especially to the manufacture of portable time-keepers, watches, chronometers, &c.

Figs. 6 and 7, represent one of a variety of arrangements by which terrestrial and local time may conveniently be indicated. Fig. 6, shows the watch open with the terrestrial time dial

FIG. 6.

FIG. 7.

plate exposed. Fig. 7, shows the same watch closed, with the local time numerals engraved on the face of the case; the latter being pierced in order that the hands may be seen. The local time disc is designed to be adjustable for any meridian.

In this communication attention has been directed to the various customs that have prevailed, and which now prevail with respect to the measurement of time; and attention has been drawn to the fact, that of late years the telegraph, and more especially the application of steam to locomotion, have rendered the ordinary practice of reckoning time but ill suited to the circumstances which now exist. It cannot be supposed that these active agents in human progress have completed their mission; nay, we may rather assume, that these extraordinary powers, but recently placed under the control of man, have but commenced their career, and that they will still achieve greater triumphs in the work of colonization and civilization.

On the new continent, America, these wonderful agents have been employed to the greatest relative extent, as the subjoined estimate from late returns will show:—

	Population.	Miles of Railway.
ASIA	824,548,500	7,643
EUROPE	309,178,300	88,748
AFRICA	199,921,600	1,451
N. & S. AMERICA	85,519,800	83,655
AUSTRALASIA ...	4,748,600	1,752
* Totals ...	1,423,917,800	183,248

It has been pointed out that difficulties already met in portions of America threaten to become seriously inconvenient as the Railway system continues to be extended. On that continent, therefore, it may be assumed that a practicable scheme to meet the difficulties alluded to would be favourably received. The importance of the subject is not confined to America. It requires no great foresight to see that all quarters of the globe are now or will eventually be interested. Australia and Africa will before long be pierced, perhaps girdled by railways. Asia, with more than half the population of the world, must in due time yield to the civilizing pressure of steam and participate in the general progress. In North and South America there is indeed room for many times the total length of existing

* Estimate of Behm and Wagner.

railways, but even taking the present mileage and population as a basis, the proportion would give to Europe and Asia together more than one million miles. These two great continents have as yet only 96,000 miles of railway and it would probably be taking too sanguine a view to suppose that so great an increase as that due to the American ratio would speedily be realised. No one, however, can doubt that the network of railways in Western and Central Europe will before long be greatly enlarged; that its branches will extend to Asia, and that offshoots will ultimately be prolonged to the farthest shores of the Chinese and Russian Empires. A comparatively few years may, indeed, witness extraordinary progress made in the direction indicated, when difficulties will undoubtedly be experienced such as those which I have described, on a scale greater than in America.

The subject to which attention is directed clearly concerns all countries. It is especially important to Canada, the United States, Brazil, indeed, to the whole of America. It is important to France, Germany, Austria, and to every nation in Europe. It is of peculiar interest to the gigantic Empire of Russia, extending over nearly 180 degrees of longitude and with a total variation in local time of about twelve hours. It is of still greater importance to the Colonial Empire of Great Britain with its settlements and stations in nearly every meridian around the entire globe, and with vast territories to be occupied by civilized inhabitants, in both hemispheres.

The system of Chronometry we have inherited, was doubtless, well suited to the purpose for which it was designed two or three thousand years ago; or to the requirements of man two generations back, before the great modern civilizers, steam and electricity began their work. Now we begin to realize the fact, that the system is awkward and inconvenient, and in comparatively a few years, say, by the time the twentieth century dawns, may we not find a radical change imperatively demanded by the new conditions of the human race?

It is probably not too soon, therefore, to discuss the subject. It would indeed be a vain task to attempt to abolish a custom less hoary with age, less generally practised, and even more faulty than our system of computing time. But the scheme submitted involves no great fundamental change. The ancient custom needs not be discontinued. It is merely suggested that it be improved, and that such modifications be introduced as are rendered necessary by the conditions of an age in which all portions of the habitable globe are being occupied by civilized communities, and brought into constant communication by steamboat, railway and electric telegraph.

Before the introduction of Railways in England, every town and village kept its own time. A person travelling in those days would find his watch varying more and more from the local clocks as he proceeded from place to place. On the establishment of the railway system, this state of things could not be tolerated; any attempt to work them by local time could only lead to needless complication and confusion. The railways demanded a uniform time, and Greenwich time was used. This was looked upon in many places as an innovation, and was for a considerable period opposed; but at last the advantages of a uniform time became so manifest that Greenwich time came into general use.

But for the employment of Greenwich time in England it would be an extremely difficult task to regulate safely the great number of trains which daily travel. The safe working of the railways is indeed a problem sufficiently difficult even with Greenwich time, and we can scarcely conceive how much the problem would be complicated if we were to revert to the system of local time as it prevailed in England in the days of stage coaches when every town and hamlet kept its own time.

Among the several objects which the scheme of terrestrial time has in view, not the least important is to extend to the world similar advantages to those which have been conferred on England by the general adoption of Greenwich time since the commencement of the railway era.

The foregoing has reference to the subdivisions of the day. I shall now briefly direct attention to the day itself, and consider a difficulty with regard to the determination of the precise date of any occurence, and point out the elements of confusion which exist under our present system of reckoning.

First, let us select points in four quarters of the globe, each about ninety degrees apart—say, in Japan, Arabia, Newfoundland, and Alaska. If we assume it to be Sunday midnight at the first mentioned place, it must be noon at the opposite point, Newfoundland, but on what day is it noon? Arabia being to the west of Japan the local time there will be 6 p.m. on Sunday, and Alaska, lying to the east of Japan, the time there will be 6 a.m. on Monday. Again, when the clock indicates 6 p.m. on Sunday in Arabia it must be Sunday noon at a point ninety degrees further west, or at Newfoundland; when it is 6 a.m. on Monday at Alaska it must be noon on Monday ninety degrees further east, also at Newfoundland. Thus, by tracing local time east and west from a given point to its antipodes, the clock on the one hand becomes twelve hours slower, on the other hand twelve hours faster. In the case in point, while it is midnight on Sunday in Japan, at precisely the same moment it is noon at Newfoundland on two distinct days, viz., on Sunday and on Monday.

Secondly, let us trace local time, only in one direction around the earth. The day does not begin everywhere at the same moment. Its beginning travels from east to west with the sun, as the earth revolves in the opposite direction, and it takes an entire revolution of the globe on its axis to begin the day everywhere. Immediately on the completion of one revolution the beginning of the day ends and the end of the day begins, but the globe must make another complete revolution before the end of the day entirely finishes. The globe must in fact make two entire revolutions before any one week-day runs out, consequently each and every day of the week runs over 48 hours, and taking the whole globe into account two civil days always co-exist. The first 24 hours of one day co-exist with the last 24 hours of its predecessor, while the remaining 24 hours co-exist with the first 24 hours of the day which follows.

The accompanying diagram is intended to show the manner in which one day overlaps another; eight equi-distant stations round the globe are taken and the day begins three hours later at each successive station.

* ...24 *hours* ...*... 24 *hours* ...*... 24 *hours* ...*... 24 *hours* ... *

1	India	Friday	Saturday	Sunday	Monday
2	Arabia	Friday	Saturday	Sunday	Monday
3	France	Friday	Saturday	Sunday	Monday
4	N'F'Land	Friday	Saturday	Sunday	Monda.
5	Minn-ta	Friday	Saturday	Sunday	Mond
6	Alaska	Friday	Saturday	Sunday	Mo
7	Fiji	Friday	Saturday	Sunday	
8	Japan	Friday	Saturday	Sunday	
	India	Friday	Saturday	Sunday	

* ...... *Friday* 48 *hours* ...... *

* ...... *Saturday* 48 *hours* ...... *

* ...... *Sunday* 48 *hours* .... *

It will thus be seen that if we take a general view of the whole globe, on any given day, Saturday begins in the middle of Friday, and does not end until the middle of Sunday. Friday on the other hand runs into the middle of Saturday and Sunday commences at the moment Friday ends. To state the case differently, the same moment of absolute time which is part of Saturday in one place, is equally part of Friday in some place west, and of Sunday in some other place east.

From the fact that not only are the hours of the day different in every meridian, but that two different days are constantly running on the surface of the globe, it is a difficult matter under our present system of reckoning to assign properly the hour and day of occurrence on which any event takes place. We may learn the local time of an occurrence, but that time will be correct only in the meridian of the locality, everywhere else it will be inaccurate, indeed, if the fact of the occurrence be transmitted over the world by telegraph, it may, in some places, be recorded on different days. If the incident occurs at the close of a month or a year, it may be announced in two different months or in two distinct years. Under our present system it is quite possible for two events to take place several hours apart, the first and older occurring in the new year, the second, although last in absolute time, falling within the old year. The same may be said of events that occur during the twenty-four hours which elapse when one century merges into another.

Hence it may be supposed discrepancies in historical and other important dates very readily arise.*

We have the telegraph to convey intelligence from one part of the earth's surface to another. This instantaneous means of communication is under the control of the highest scientific direction, and there ought not to be the slightest difficulty in determining and putting on record the precise day and hour of the occurrence of any event. It is nevertheless evident from the foregoing explanations that we have not in common use the means of doing so, and that there is still wanting in civil life a proper system of reckoning time and verifying dates.

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* (NOTE.)—Discrepancies in historical dates are by no means uncommon. In one of the last books from the press, "Labillieré's History of Victoria," these discrepancies are frequently mentioned. One may be instanced: Referring to the discovery of Port Phillip Bay, where Melbourne now stands (p. 108, Vol. I.), although with the original log book before him, the historian is unable to decide whether the event took place on the 26th or 27th of April, 1802. The discoverer himself (Captain Flinders) appears to be equally doubtful.

The co-existence of two distinct days of the week, and the uncertainty, as to dates arising therefrom may possibly involve important legal questions of various kinds, which will readily suggest themselves to gentlemen engaged in legal pursuits.

The system of Terrestrial time would, it is thought, supply the want. As part of the system it would be necessary to establish an initial meridian to denote the dividing line between each day. It is suggested that the initial meridian be established through or near Behring's Straits, passing from pole to pole through the Pacific Ocean, so as to avoid all Continents and Islands. Every civilized country, indeed, all habitable lands would thus be brought within the limits of the same day, which for convenience might be designated—" The Terrestrial Day." The Terrestrial day would not it is true commence at all places at the same local hour, but it would begin and end everywhere at the same moment in absolute time. The general adoption of the system of Terrestrial Time would enable every human being to reckon by a common day and by a common subdivision of the day. Every steamboat and every locomotive would be worked by the same standard, every telegram would be despatched, practically by the same timekeeper, and all uncertainty and confusion would be obviated.

In this paper it has been my desire to point out the character and causes of the inconveniences and difficulties inseparable from our present mode of reckoning time, which are being developed by the rapid extension of lines of communication over the earth. I trust I have succeeded in showing that it is desirable to have some modifications in our system of chronometry in order to meet the condition of an advanced stage of civilization, and that we should not any longer be compelled to perpetuate old customs and practices which general progress will probably render excessively inconvenient if not intolerable. We have undoubtedly entered upon a remarkable period in the history of the human race. Discoveries and inventions crowd upon each other in an astonishing manner. Lines of telegraph and steam communications are girdling the earth, and all countries are being drawn into one neighbourhood—but when men of all races, in all lands are thus brought face to face, what will they find? They will find a great many nations measuring the day by two sets of subdivisions, as if they had recently emerged from barbarism and had not yet learned to count higher than twelve. They will find the hands of the various clocks in use pointing in all conceivable directions. They will find at the same moment some men reckoning that they live in different hours, others in different days. Is it not important, then, that an attempt should be made to provide a change for this state of affairs and devise for common use some simple uniform system which all nations may with advantage adopt whenever they may feel inclined to do so.

Should the desirability of some change be admitted, it is important to ascertain what the change should be. A new scheme should be well considered and rendered generally acceptable in the first place, so that whenever the necessity of a change be felt in any country or community, it may be spontaneously adopted; the inhabitants of the place feeling assured that they have selected the system which eventually will become universal. My duty has been simply to attempt to draw attention to the subject, and submit some suggestions for consideration. The subject is one which I feel concerns all countries, although in different degrees, and I shall be gratified if I have in any way assisted in initiating a discussion, which may result ultimately in the production of a matured comprehensive scheme suitable for all lands and advantageous to all mankind.

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