Fraser's Calendar

AND

Telegraph Note Book.

CONTAINING SEVERAL USEFUL TABLES, AND MISCELLANEOUS INFORMATION ADAPTED FOR TELEGRAPH INSPECTORS AND OTHERS EMPLOYED ON THE STAFF OF THE INDIAN TELEGRAPH DEPARTMENT.

COMPILED BY

LIONEL V. FRASER,

ASSISTANT SUPERINTENDENT, INDIAN TELEGRAPH DEPARTMENT.

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SHAKESPEARE.

MADRAS:

CALEB FOSTER,

FOSTER PRESS, 23, RUNDALL'S ROAD, VEPERY,

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PREFACE.

THE Contents of this work, were first collected for private use, and their publication is an after thought.

The intention is to offer information in a convenient form for use of members of the Indian Telegraph service, and others interested in Telegraphy.

In collecting together material of a Miscellaneous discription for the first time, it is not found easy to arrange it in a systematic manner, but this difficulty it is hoped may be obviated by the Index of Contents.

It is also thought that should encouragement be given, the publication may be hereafter repeated, when additions and improvements can more readily be effected.

No pretensions are claimed for the work, more than may be allowed for a simple compilation.

The Author acknowledges to having made free use of various sources of available information and to having quoted from different works the names of which it would be tedious to enumerate.

THE COMPILER.

CONTENTS.

The Calendar.

PRINCIPAL ARTICLES OF THE CALENDAR FOR THE YEAR 1872.

Golden Number	11	Dominical Letter	C. F.
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Solar Cycle	5	Julian Period	6585

ERAS.

The year 1289 of the Mahomedan Era commences on March 11th 1872.

The year 5633 of the Jewish Era commences on October 3rd 1872.

The year 1224 of the Burmese Era commences on April 13th 1872.

The Ramadan (month of abstinence observed by the Turks) commences on November 2nd 1872.

FIXED AND MOVEABLE FESTIVALS, ANNIVERSARIES, &c., &c.

Epiphany	Jan. 6	Pentecost—Whit Sunday	May 19
Septuagesima, Sunday	Jan. 28	Birth of Queen Victoria	May 24
Quinquagesima—Shrove Sunday	Feb. 11	Trinity Sunday	May 26
Ash Wednesday	Feb. 14	Corpus Christi	May 30
Quadragesima—1st Sunday in Lent	Feb. 18	Accession of Queen Victoria	June 20
St. David	Mar. 1	Proclamation of do.	June 21
St. Patrick	Mar. 17	Mid-Summer Day—St. John the Baptist	June 24
Palm Sunday	Mar. 24	Birth of Prince of Wales	Nov. 9
Annunciation—Lady Day	Mar. 25	St. Andrew	Nov. 30
Good Friday	Mar. 29	1st Sunday in Advent	Dec. 1
Easter Sunday	Mar. 31	Christmas Day	Dec. 25
Low Sunday	Apr. 7	St. John the Evangelist	Dec. 27
Rogation Sunday	May 5		
Ascension Day—Holy Thursday	May 9		

ECLIPSES.

In the year 1872 there will be two Eclipses of the Sun and two of the Moon.

I. A Partial Eclipse of the Moon, May 22nd 1872.

II. An Annular Eclipse of the Sun, June 6th 1872.

	H. M.		H. M.
Commencing at	6 51 A. M.	Ending	0 49 P. M.
Greatest Observation	9 58 A. M.	Duration	5 58 P. M.

III. A Partial Eclipse of the Moon, November 15th 1872.

IV. A Total Eclipse of the Sun, November 30th 1872.

EXPLANATIONS OF CHRONOLOGICAL NOTES.

GREGORIAN CALENDAR, OR NEW STYLE.

Previous to 1582 the length of the year had been reckoned at 365 days and 6 hours, as computed by Julius Cæsar (B. C. 45); but as the true length of a solar year is only 365 days, 5 hours, and about 49 minutes, an error had arisen from this computation, amounting in 1582 to 10 days in advance. To rectify the Calendar, and to prevent future irregularities, it was decreed as follows by Pope Gregory XIII.—

The year 1582 to consist of	... 355 days.
The ordinary year to consist of	... 365 ,,
The year 1584 and every fourth year afterwards (termed leap year) to consist of	... 366 ,,
The years 1700, 1800, 1900, 2100, and so on—three out of every four centuries afterwards, to be reckoned not as leap years, but as ordinary years of...	... 365 ,,

This mode of computation, termed the Gregorian Calendar, or New Style, has been gradually adopted in all the countries of Europe except Russia and Greece, where the Old Style still prevails.

The New Style was adopted in Great Britain in 1752, when it was enacted that September 3 of that year should be reckoned as September 14 (the difference of time then amounting to 11 days). During the present century, the difference between the Old and New Styles is 12 days; this time must therefore be allowed for in Russian and Greek bills. Thus a Russian bill dated March 2, must be reckoned as dated March 14.

Leap year may be readily ascertained by dividing any given year—for instance, 1850—by 4; if there is no remainder, it is leap year. If there be a remainder, as in dividing 1855, the number over shows how many years it is after leap year.

GOLDEN NUMBER.

Golden Number, in Chronology, is that number which indicates the year of the lunar cycle, for any given time. It was called the Golden Number because in the ancient calendar it was written in letters of gold, on account of its great usefulness in *ecclesiastical computations, especially in fixing the time of* Easter. *It was likewise* called the Prime, because it pointed out the first day of the new moon, *primum lunæ*. To find the Golden Number add 1 to the year of our Lord, divide the sum by 19, and the remainder is the Golden Number, the quotient at the same time expressing the number of cycles which have revolved from the beginning of the year preceding the birth of Christ.

SOLAR CYCLE, OR CYCLE OF THE SUN.

A PERIOD OF 28 YEARS.

DOMINICAL LETTER.

Dominical Letter in Chronology, is that letter of the Alphabet which points out in the Calendar the Sundays throughout the year, thence also called the Sunday Letter or *Deis Domine*.

The Dominical letter may be found universally, for any year of any century, thus:—Divide the centuries by 4, and take twice what remains from 6, then add the remainder to the odd years, above the even centuries, and their 4th—Divide their sum by 7, and the remainder, taken from 7, will leave the number answering to the letter

ROMAN INDICTION.

Indiction (Cycle of,) in Chronology, a mode of computing time by the space of 15 years, instituted by Constantine the Great; originally the period for the payment of certain taxes.

The Popes, since the time of Charlemagne have dated their acts by the year of the indiction, which was fixed on the 1st January. At the time of the reformation of the Calendar, the year 1582 was reckoned the 10th year of the indiction. Now this date, when divided by 15, leaves a remainder 7, that is three less than the indiction, and the same must necessarily be the case in all subsequent years; so that, in order to find the indiction for any year, divide the date by 15 and add 3 to the remainder. It has no connection with the motions of the heavenly bodies.

JULIAN PERIOD.

Julian Period, in Chronology, signifies a revolution of 7980 years, which arises from multiplying the Solar cycle, the cycle of the moon, and the cycle of indiction into one another.

This period is of great use, as the standard and general receptacle of all other epochs is periods and cycles; into this as into a larger ocean, all streams of time discharge themselves, yet so as not to lose their peculiar characters; and had historians remarked the number of each cycle in each year, respectively, there could have been no dispute about the time of any action or event in past ages.

When the Christian Era commenced, 4713 years of the Julian period were elapsed, 4713 therefore being added to the year of our Lord, will give the year of the Julian period.

REVOLUTIONS, DISTANCES, &C., OF THE PLANETS.

NAMES.	Periodical Revolution.	Mean Distance from the Sun in English Miles.	Diam. in English Miles.	Time of Rotation upon their Axis.
	Yrs. d. h. m. s.			d. h. m. s.
Sun	.....	.....	887,076	25 7 48 0
Mercury	0 87 23 15 44	36,890,000	2,950	1 0 5 28
Venus	0 224 16 49 8	68,770,000	7,900	0 23 21 3
Earth	1 0 5 48 48	95,298,260	7,312	0 23 56 4
Moon	0 27 7 43 5	95,268,260	2,160	27 7 43 5
Mars	1 321 22 18 27	145,205,000	4,500	1 0 37 2
Flora	3 98 ...	209,826,000	.....	.....
Melpomene	3 180 ...	218,900,000	.....	.....
Victoria	3 207 ...	222,373,000	.....	.....
Euterpe	3 214 ...	222,585,000	.....	 0
Vesta	3 229 ...	225,000,000	296	.....
Urinia	3 236 ...	.....	.....	.....
Phocea	3 242 ...	227,335,000	.....	.....
Iris	3 248 ...	227,334,000	.....	.....
Metis	3 253 ...	227,387,000	.....	.....
Hebe	3 284 ...	230,000,000	.....	.....
Parthenope	3 285 ...	231,200,000	.....	.....
Fortuna	3 302 ...	233,100,000	.....	.....
Massilia	3 305 ...	233,400,000	.....	.....
Thetis	3 341 ...	237,400,000	.....	.....
Amphitrite	4 23 ...	.....	.....	.....
Bellona	4 239 ...	.....	.....	.....
Astræa	4 52 ...	245,600,000	.....	.....
Egeria	4 53 ...	245,800,000	.....	.....
Irene	4 55 ...	246,070,000	.....	.....
Lutetia	4 75 ...	248,250,000	.....	.....
Pomona	4 78 ...	.....	.....	.....
Proserpine	4 82 ...	252,035,000	.....	.....
Eunomia	4 114 ...	252,300,000	.....	.....
Juno	4 131 ...	254,312,000	79	.....
Thalia	4 166 ...	258,000,000	.....	.....
Ceres	4 220 ...	263,713,000	163	.....
Pallas	4 227 ...	264,256,000	670	.....
Polyhymnia	4 316 ...	.....	.....	.....
Psyche	5 09 ...	279,500,000	.....	.....
Calliope	5 16 ...	280,300,000	.....	.....
Hygeia	5 189 ...	297,530,000	.....	.....
Themis	5 195 ...	299,440,000	.....	.....
Euphrosyne	5 190 ...	.....	.....	.....
Jupiter	11 315 14 39 2	495,917,000	88,780	0 9 55 21
Saturn	29 164 7 21 50	909,026,000	77,230	0 10 16 1
Uranus	83 294 8 39 0	1,828,071,000	35,000	.....

WEIGHTS AND MEASURES.

TROY WEIGHT.

Grains.
- 4... 1 Carat.
- 24... 1 Pennyweight.
- 480... 20... 1 Ounce.
- 5,760...240...12...1 Pound.

AVOIRDUPOIS WEIGHT.

Drams.
- 16... 1 Ounce.
- 256... 16... 1 Pound.
- 7,168... 448... 28...1 Quarter.
- 28,672...1,792...112...4...1 Hundred
- 573,440—35,840—2,240—80—20...1 Ton.

By a late Act the stone weight is to be 14 lb., and 8 stone to be the cwt.; and no contract is to be valid if otherwise made.

APOTHECARIES' WEIGHT.

Grains.
- 20... 1 Scruple.
- 60... 3... 1 Dram.
- 480... 24... 8... 1 Ounce.
- 5,760...288...96...12...1 Pound.

Medical men use this weight in mixing medicines, but buy and sell simple drugs *by Avoirdupois weight.*

LIQUID MEASURE.

Pints.
- 2... 1 Quart.
- 8... 4... 1 Gallon.
- 504... 252... 63...1 Hogshead.
- 672... 336... 84...1-3...1 Puncheon.
- 1,008... 504...126...2...1½-1 Pipe.
- 2,016...1,008...252...4...3-2...1 Tun.

Also,

Quarts.
- 4... 1 Gallon.
- 36... 9... 1 Firkin.
- 72... 18... 2...1 *Kilderkin.*
- 144... 36... 4...2...1 Barrel.
- 216... 54... 6...3...1½...1 Hogshead.
- 288... 72... 8...4...2 ...1 Puncheon.
- 432...108...12...6...3 ...2...1 Butt.

DRY MEASURE.

2 pints	1 quart	4 bush.	1 sack.
2 qs.	1 pottle	8 bush	1 quar.
2 pots.	1 gallon	4 qurs.	1 chdn.
2 galls.	1 peck	5 qurs.	1 wey.
4 pecks	1 bush.	10 qurs.	1 last.
2 bush.	1 strike		

CLOTH MEASURE.

Inches.
- 2¼... 1 Nail.
- 9 ... 4...1 Quarter of a Yard.
- 36 ...16...4...1 Yard.
- 27 ...12...3...1 Flèmish Ell.
- 45 ...10...5...1 English Ell.

SOLID OR CUBE MEASURE.

1728 inches.....	1 solid foot
27 feet.....	1 yard
40 feet unhewn.....	1 ton
50 feet hewn timber.....	
108 feet.....	1 stk wood
125 feet.....	1 crd wood

LONG MEASURE.

3 b. corns	1 inch	5½ yards	1 pole
4 inches	1 hand	4 poles	1 chn.
10 inches	1 spn	40 poles	1 furg.
12 inches	1 foot	8 furlgs	1 mile
3 feet	1 yard	3 miles	1 leag.
5 feet	1 pace	69½ miles	1 deg.
6 feet	1 fath		

SQUARE OR LAND MEASURE.

144 inches.....	1 square foot
9 feet.....	1 square yard
272¼ feet.....	1 rod brickw.
100 feet.....	1 sq. flooring
16 poles.....	1 chain
40 poles.....	1 rood
4 roods, or 4840 sq. yards.....	1 acre
640 acres.....	1 square mile
30 acres.....	1 yard of land
100 acres.....	1 hide of land
40 hides.....	1 barony

WINE MEASURE.

	Gals.		Gals.		Gals.
Lisbon, per pipe.....	117	Teneriffe, per pipe.....	100	Tent, per hhd.....	52
Bucellas.....	117	Vidonia.....	100	Claret.....	46
Port.....	115	Sicilian.....	93	Hermitage.....	46
Sherry.....	108	Madeira.....	92	Hock.....	30

COUNTING HOUSE CALENDAR FOR 1872.

January.

	M.	T.	W.	T.	F.	S.
	1	2	3	4	5	6
	8	9	10	11	12	13
	15	16	17	18	19	20
	22	23	24	25	26	27
	29	30	31	...	...	...

February.

	M.	T.	W.	T.	F.	S.
	...	...	...	1	2	3
	5	6	7	8	9	10
	12	13	14	15	16	17
	19	20	21	22	23	24
	26	27	28	29	...	...

March.

	M.	T.	W.	T.	F.	S.
	...	...	...	...	1	2
	4	5	6	7	8	9
	11	12	13	14	15	16
	18	19	20	21	22	23
	25	26	27	28	29	30
	...	...	...	...	...	...

April.

S.	M.	T.	W.	T.	F.	S.
...	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	...	...	...	...

May.

S.	M.	T.	W.	T.	F.	S.
...	...	...	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	...

June.

S.	M.	T.	W.	T.	F.	S.
...	...	...	...	...	...	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	...	...	...	...	...	...

July.

S.	M.	T.	W.	T.	F.	S.
...	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	...	...	...

August.

S.	M.	T.	W.	T.	F.	S.
...	...	...	...	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

September.

S.	M.	T.	W.	T.	F.	S.
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	...	...	...	...	...

October.

S.	M.	T.	W.	T.	F.	S.
...	...	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	...	...

November.

S.	M.	T.	W.	T.	F.	S.
...	...	...	...	...	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

December.

S.	M.	T.	W.	T.	F.	S.
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	...	...	...	...

JANUARY 1872, 31 DAYS.

PHASES OF THE MOON.

	D.	H.	M.		D.	H.	M.	
Last Quarter....	4	3	20	*Morning.*				
New Moon..	10	8	19	Afternoon.				
					17	5	23	*Afternoon.*
					25	10	35	Afternoon.

Day of Month.	Day of Week.	MEMORANDA OF PASSING EVENTS.
1	Mon	
2	Tues	
3	Wed	
4	Thur	
5	*Fri*	
6	Sat	
7	SUN	
8	Mon	
9	*Tues*	
10	Wed	
11	Thur	
12	Fri	
13	Sat	
14	SUN	
15	Mon	
16	Tues	
17	Wed	
18	Thur	
19	Fri	
20	Sat	
21	SUN	
22	Mon	
23	Tues	
24	Wed	
25	Thur	
26	Fri	
27	Sat	
28	SUN	
29	Mon	
30	Tues	
31	Wed	

FEBRUARY 1872, 29 DAYS.

PHASES OF THE MOON.

	D.	H.	M.		D.	H.	M.	
Last Quarter.....	2	3	31	Afternoon.	First Quarter.....	16	11	45 Morning.
New Moon..,.....	9	7	13	Morning.	Full Moon.....	24	4	17 Afternoon.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Thur	
2	Fri	
3	Sat	
4	Sun	
5	Mon	
6	Tues	
7	Wed	
8	Thur	
9	Fri	
10	Sat	
11	Sun	
12	Mon	
13	Tues	
14	Wed	
15	Thur	
16	Fri	
17	Sat	
18	Sun	
19	Mon	
20	Tues	
21	Wed	
22	Thur	
23	Fri	
24	Sat	
25	Sun	
26	Mon	
27	Tues	
28	Wed	
29	Thur	

Perigee..... 7*d* 8*h*. Afternoon. | Apogee..... 19*d*. 7*h*. Afternoon

MARCH 1872, 31 DAYS.

PHASES OF THE MOON.

	D.	H.	M.		D.	H.	M.	
Last Quarter.....	3	0	49	Morning.	First Quarter.....	17	7	46 Morning.
New Moon	9	6	14	Afternoon.	Full Moon.....	25	7	4 Morning.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Fri	
2	Sat	
3	Sun	
4	Mon	
5	Tues	
6	Wed	
7	Thur	
8	Fri	
9	Sat	
10	Sun	
11	Mon	
12	Tues	
13	Wed	
14	Thur	
15	Fri	
16	Sat	
17	Sun	
18	Mon	
19	Tues	
20	Wed	
21	Thur	
22	Fri	
23	Sat	
24	Sun	
25	Mon	
26	Tues	
27	Wed	
28	Thur	
29	Fri	
30	Sat	
31	Sun	

APRIL 1872, 30 DAYS.

PHASES OF THE MOON.

	D.	H.	M.		D.	H.	M.	
Last Quarter,.....	1	7	53	Morning.	Full Moon..... ...	24	6	58 Afternoon.
New Moon..... ...	8	5	53	Morning.	Last Quarter.....	30	1	42 Afternoon.
First Quarter.....	16	3	32	Morning.				

Day of Month.	Day of Week.	Memoranda of passing events.
1	Mon	
2	Tues	
3	Wed	
4	Thur	
5	Fri	
6	Sat	
7	Sun	
8	Mon	
9	Tues	
10	Wed	
11	Thur	
12	Fri	
13	Sat	
14	Sun	
15	Mon	
16	Tues	
17	Wed	
18	Thur	
19	Fri	
20	Sat	
21	Sun	
22	Mon	
23	Tues	
24	Wed	
25	Thur	
26	Fri	
27	Sat	
28	Sun	
29	Mon	
30	Tues	

Perigee... 2*d*. 2*h*. Morn. | Apogee... 15*d*. 11*h*. Morn. | Perigee... 27*d*. 0*h*. After.

MAY 1872, 31 DAYS.

PHASES OF THE MOON.

	D.	H.	M.		D.	H.	M.	
New Moon	7	6	40	*Afternoon.*	*Full Moon*	23	4	29 **Morning.**
First Quarter	15	9	27	Afternoon.	Last Quarter.....	29	7	33 **Afternoon.**

Day of Month.	Day of Week.	Memoranda of passing events.
1	Wed	
2	Thur	
3	Fri	
4	Sat	
5	Sun	
6	Mon	
7	Tues	
8	Wed	
9	Thur	
10	Fri	
11	Sat	
12	Sun	
13	Mon	
14	Tues	
15	Wed	
16	Thur	
17	Fri	
18	Sat	
19	Sun	
20	Mon	
21	Tues	
22	Wed	
23	Thur	
24	Fri	
25	Sat	
26	Sun	
27	Mon	
28	Tues	
29	Wed	
30	Thur	
31	Fri	

JUNE 1872, 30 DAYS.

PHASES OF THE MOON.

	D.	H.	M.		D.	H.	M.
New Moon.....	6	8	44 Morning.	Full Moon.....	21	0	19 Afternoon.
First Quarter.....	14	0	40 Afternoon.	Last Quarter	28	2	48 Morning.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Sat	
2	Sun	
3	Mon	
4	Tues	
5	Wed	
6	Thur	
7	Fri	
8	Sat	
9	Sun	
10	Mon	
11	Tues	
12	Wed	
13	Thur	
14	Fri	
15	Sat	
16	Sun	
17	Mon	
18	Tues	
19	Wed	
20	Thur	
21	Fri	
22	Sat	
23	Sun	
24	Mon	
25	Tues	
26	Wed	
27	Thur	
28	Fri	
29	Sat	
30	Sun	

Apogee..... 9d. 8h. Afternoon. | Perigee..... 22d. 9h. Morning.

JULY 1872, 31 DAYS.

PHASES OF THE MOON.

	D.	H.	M.			D.	H.	M.	
New Moon.....	5	11	46	Afternoon.	Full Moon...	20	7	14	Afternoon.
First Quarter.....	14	1	9	Morning.	Last Quarter	27	0	40	Afternoon.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Mon	
2	Tues	
3	Wed	
4	Thur	
5	Fri	
6	Sat	
7	Sun	
8	Mon	
9	Tues	
10	Wed	
11	Thur	
12	Fri	
13	Sat	
14	Sun	
15	Mon	
16	Tues	
17	Wed	
18	Thur	
19	Fri	
20	Sat	
21	Sun	
22	Mon	
23	Tues	
24	Wed	
25	Thur	
26	Fri	
27	Sat	
28	Sun	
29	Mon	
30	Tues	
31	Wed	

AUGUST 1872, 31 DAYS.

PHASES OF THE MOON.

	D. H. M.				D. H. M.		
New Moon.....	4	3	7 Afternoon.	Full Moon.....	19	2	14 Morning.
First Quarter.....	12	11	13 Morning.	Last Quarter.....	26	1	56 Morning.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Thur	
2	Fri	
3	Sat	
4	Sun	
5	Mon	
6	Tues	
7	Wed	
8	Thur	
9	Fri	
10	Sat	
11	Sun	
12	Mon	
13	Tues	
14	Wod	
15	Thur	
16	Fri	
17	Sat	
18	Sun	
19	Mon	
20	Tues	
21	Wed	
22	Thur	
23	Fri	
24	Sat	
25	Sun	
26	Mon	
27	Tues	
28	Wed	
29	Thur	
30	Fri	
31	Sat	

SEPTEMBER 1872, 30 DAYS.

PHASES OF THE MOON.

	D.	H.	M.		D.	H.	M.	
New Moon	3	6	15	Morning.	Full Moon	17	10	26 Morning.
First Quarter	10	7	24	Afternoon.	Last Quarter	24	6	43 Afternoon.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Sun	
2	Mon	
3	Tues	
4	Wed	
5	Thur	
6	Fri	
7	Sat	
8	Sun	
9	Mon	
10	Tues	
11	Wed	
12	Thur	
13	Fri	
14	Sat	
15	Sun	
16	Mon	
17	Tues	
18	Wed	
19	Thur	
20	Fri	
21	Sat	
22	Sun	
23	Mon	
24	Tues	
25	Wed	
26	Thur	
27	Fri	
28	Sat	
29	Sun	
30	Mon	

Perigee..... 15*d.* 9*h.* Morning. | Apogee..... 27*d.* 7*h.* Morning.

OCTOBER 1872, 31 DAYS.

PHASES OF THE MOON.

	D.	H.	M		D.	H.	M.
New Moon..... ..	2	8	52 Afternoon.	Full Moon	16	8	56 Afternoon.
First Quarter.....	10	2	25 Morning.	Last Quarter.....	24	2	15 Afternoon.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Tues	
2	Wed	
3	Thur	
4	Fri	
5	Sat	
6	Sun	
7	Mon	
8	Tues	
9	Wed	
10	Thur	
11	Fri	
12	Sat	
13	Sun	
14	Mon	
15	Tues	
16	Wed	
17	Thur	
18	Fri	
19	Sat	
20	Sun	
21	Mon	
22	Tues	
23	Wed	
24	Thur	
25	Fri	
26	Sat	
27	Sun	
28	Mon	
29	Tues	
30	Wed	
31	Thur	

Perigee..... ..... 13*d*. 0*h*. Morning. | Apogee..... 25*d*. 2*h*. Morning.

NOVEMBER 1872, 30 DAYS.

PHASES OF THE MOON.

	D.	H.	M.			D.	H.	M.	
New Moon	1	10	49	Morning.	Last Quarter	23	11	6	Morning.
First Quarter	8	9	12	Morning.	New Moon	30	11	56	Afternoon.
Full Moon	15	10	29	Morning.					

Day of Month.	Day of Week.	Memoranda of passing events.
1	Fri	
2	Sat	
3	Sun	
4	Mon	
5	Tues	
6	Wed	
7	Thur	
8	Fri	
9	Sat	
10	Sun	
11	Mon	
12	Tues	
13	Wed	
14	Thur	
15	Fri	
16	Sat	
17	Sun	
18	Mon	
19	Tues	
20	Wed	
21	Thur	
22	Fri	
23	Sat	
24	Sun	
25	Mon	
26	Tues	
27	Wed	
28	Thur	
29	Fri	
30	Sat	

Perigee	7*d*. 2*h*. Morning.	Apogee	21*d*. 11*h*. Afternoon.

DECEMBER 1872, 31 DAYS.

PHASES OF THE MOON.

	D.	H.	M.			D.	H.	M.	
First Quarter.....	7	4	57	Afternoon.	Last Quarter	23	7	33	Morning.
Full Moon	15	3	5	Morning.	New Moon.....	30	11	57	Morning.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Sun	
2	Mon	
3	Tues	
4	Wed	
5	Thur	
6	Fri	
7	Sat	
8	Sun	
9	Mon	
10	Tues	
11	Wed	
12	Thur	
13	Fri	
14	Sat	
15	Sun	
16	Mon	
17	Tues	
18	Wed	
19	Thur	
20	Fri	
21	Sat	
22	Sun	
23	Mon	
24	Tues	
25	Wed	
26	Thur	
27	Fri	
28	Sat	
29	Sun	
30	Mon	
31	Tues	

Perigee.....	3	5	Afternoon.	Perigee.....	31	7	Afternoon.

Calendar for the Year 1873.

MONTHS.	DAYS OF THE WEEK.						
	Sun	Mon	Tue	Wed	Thu	Fri	Sat
January	...	...	...	1	2	3	4
First Quarter.... 5	5	6	7	8	9	10	11
Full Moon.....13	12	13	14	15	16	17	18
Last Quarter.....21	19	20	21	22	23	24	25
New Moon.....28	26	27	28	29	30	31	
February	...	...	...	...	...	...	1
First Quarter.... 4	2	3	4	5	6	7	8
Full Moon.....12	9	10	11	12	13	14	15
Last Quarter.....20	16	17	18	19	20	21	22
New Moon.....27	23	24	25	26	27	28	
March	...	...	...	...	...	...	1
First Quarter.... 6	2	3	4	5	6	7	8
Full Moon.....14	9	10	11	12	13	14	15
Last Quarter.....21	16	17	18	19	20	21	22
New Moon.....28	23	24	25	26	27	28	29
	30	31					
April	...	...	1	2	3	4	5
First Quarter.... 4	6	7	8	9	10	11	12
Full Moon.....12	13	14	15	16	17	18	19
Last Quarter.....20	20	21	22	23	24	25	26
New Moon.....26	27	28	29	30			
May	...	...	...	...	1	2	3
First Quarter.... 4	4	5	6	7	8	9	10
Full Moon.....12	11	12	13	14	15	16	17
Last Quarter.....19	18	19	20	21	22	23	24
New Moon.....26	25	26	27	28	29	30	31
June	1	2	3	4	5	6	7
First Quarter.... 3	8	9	10	11	12	13	14
Full Moon.....10	15	16	17	18	19	20	21
Last Quarter.....17	22	23	24	25	26	27	28
New Moon.....24	29	30					

MONTHS.	DAYS OF THE WEEK.						
	Sun	Mon	Tue	Wed	Thu	Fri	Sat
July	...	...	1	2	3	4	5
First Quarter.... 2	6	7	8	9	10	11	12
Full Moon.....10	13	14	15	16	17	18	19
Last Quarter.....16	20	21	22	23	24	25	26
New Moon.....24	27	28	29	30	31		
August	...	...	...	...	...	1	2
First Quarter.... 1	3	4	5	6	7	8	9
Full Moon..... 8	10	11	12	13	14	15	16
Last Quarter.....15	17	18	19	20	21	22	23
New Moon.....23	24	25	26	27	28	29	30
First Quarter.....31	31						
September	...	1	2	3	4	5	6
Full Moon..... 6	7	8	9	10	11	12	13
Last Quarter.....13	14	15	16	17	18	19	20
New Moon.....21	21	22	23	24	25	26	27
First Quarter.....29	28	29	30				
October	...	...	...	1	2	3	4
Full Moon..... 6	5	6	7	8	9	10	11
Last Quarter.....13	12	13	14	15	16	17	18
New Moon.....21	19	20	21	22	23	24	25
First Quarter.....29	26	27	28	29	30	31	
November	...	...	...	...	...	...	1
Full Moon..... 4	2	3	4	5	6	7	8
Last Quarter.....12	9	10	11	12	13	14	15
New Moon.....20	16	17	18	19	20	21	22
First Quarter.....27	23	24	25	26	27	28	29
	30						
December	...	1	2	3	4	5	6
Full Moon..... 4	7	8	9	10	11	12	13
Last Quarter.....11	14	15	16	17	18	19	20
New Moon.....19	21	22	23	24	25	26	27
First Quarter.....26	28	29	30	31			

March 2.—1st Sunday in Lent.

April 11.—Good Friday.

June 1.—Whit Sunday.

Novr. 30.—Advent Sunday.

JANUARY 1873, 31 DAYS.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Wed	
2	Thur	
3	Fri	
4	Sat	
5	Sun	
6	Mon	
7	Tues	
8	Wed	
9	Thur	
10	Fri	
11	Sat	
12	Sun	
13	Mon	
14	Tues	
15	Wed	
16	Thur	
17	Fri	
18	Sat	
19	Sun	
20	Mon	
21	Tues	
22	Wed	
23	Thur	
24	Fri	
25	Sat	
26	Sun	
27	Mon	
28	Tues	
29	Wed	
30	Thru	
31		

FEBRUARY 1873, 28 DAYS.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Sat	
2	Sun	
3	Mon	
4	Tues	
5	Wed	
6	Thur	
7	Fri	
8	Sat	
9	Sun	
10	Mon	
11	Tues	
12	Wed	
13	Thur	
14	Fri	
15	Sat	
16	Sun	
17	Mon	
18	Tues	
19	Wed	
20	Thur	
21	Fri	
22	Sat	
23	Sun	
24	Mon	
25	Tues	
26	Wed	
27	Thur	
28	Fri	

MARCH 1873, 31 DAYS.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Sat	
2	Sun	
3	Mon	
4	Tues	
5	Wed	
6	Thur	
7	Fri	
8	Sat	
9	Sun	
10	Mon	
11	Tues	
12	Wed	
13	Thur	
14	Fri	
15	Sat	
16	Sun	
17	Mon	
18	Tues	
19	Wed	
20	Thur	
21	Fri	
22	Sat	
23	Sun	
24	Mon	
25	Tues	
26	Wed	
27	Thur	
28	Fri	
29	Sat	
30	Sun	

APRIL 1873, 30 DAYS.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Tues	
2	Wed	
3	Thur	
4	Fri	
5	Sat	
6	Sun	
7	Mon	
8	Tues	
9	Wed	
10	Thur	
11	Fri	
12	Sat	
13	Sun	
14	Mon	
15	Tues	
16	Wed	
17	Thur	
18	Fri	
19	Sat	
20	Sun	
21	Mon	
22	Tues	
23	Wed	
24	Thur	
25	Fri	
26	Sat	
27	Sun	
28	Mon	
29	Tues	
30	Wed	

MAY 1873, 31 DAYS.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Thur	
2	Fri	
3	Sat	
4	Sun	
5	Mon	
6	Tues	
7	Wed	
8	Thur	
9	Fri	
10	Sat	
11	Sun	
12	Mon	
13	Tues	
14	Wed	
15	Thur	
16	Fri	
17	Sat	
18	Sun	
19	Mon	
20	Tues	
21	Wed	
22	Thur	
23	Fri	
24	Sat	
25	Sun	
26	Mon	
27	Tues	
28	Wed	
29	Thur	
30	Fri	

JUNE 1873, 30 DAYS.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Sun	
2	Mon	
3	Tues	
4	Wed	
5	Thur	
6	Fri	
7	Sat	
8	Sun	
9	Mon	
10	Tues	
11	Wed	
12	Thur	
13	Fri	
14	Sat	
15	Sun	
16	Mon	
17	Tues	
18	Wed	
19	Thur	
20	Fri	
21	Sat	
22	Sun	
23	Mon	
24	Tues	
25	Wed	
26	Thur	
27	Fri	
28	Sat	
29	Sun	
30	Mon	

JULY 1873. 31 DAYS.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Tues	
2	Wed	
3	Thur	
4	Fri	
5	Sat	
6	Sun	
7	Mon	
8	Tues	
9	Wed	
10	Thur	
11	Fri	
12	Sat	
13	Sun	
14	Mon	
15	Tues	
16	Wed	
17	Thur	
18	Fri	
19	Sat	
20	Sun	
21	Mon	
22	Tues	
23	Wed	
24	Thur	
25	Fri	
26	Sat	
27	Sun	
28	Mon	
29	Tues	
30	Wed	

AUGUST 1873, 31 DAYS.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Fri	
2	Sat	
3	Sun	
4	Mon	
5	Tues	
6	Wed	
7	Thur	
8	Fri	
9	Sat	
10	Sun	
11	Mon	
12	Tues	
13	Wed	
14	Thur	
15	Fri	
16	Sat	
17	Sun	
18	Mon	
19	Tues	
20	Wed	
21	Thur	
22	Fri	
23	Sat	
24	Sun	
25	Mon	
26	Tues	
27	Wed	
28	Thur	
29	Fri	
30	Sat	

SEPTEMBER 1873, 30 DAYS.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Mon	
2	Tues	
3	Wed	
4	Thur	
5	Fri	
6	Sat	
7	Sun	
8	Mon	
9	Tues	
10	Wed	
11	Thur	
12	Fri	
13	Sat	
14	Sun	
15	Mon	
16	Tues	
17	Wed	
18	Thur	
19	Fri	
20	Sat	
21	Sun	
22	Mon	
23	Tues	
24	Wed	
25	Thur	
26	Fri	
27	Sat	
28	Sun	
29	Mon	
30	Tues	

OCTOBER 1873, 31 DAYS.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Wed	
2	Thur	
3	Fri	
4	Sat	
5	Sun	
6	Mon	
7	Tues	
8	Wed	
9	Thur	
10	Fri	
11	Sat	
12	Sun	
13	Mon	
14	Tues	
15	Wed	
16	Thur	
17	Fri	
18	Sat	
19	Sun	
20	Mon	
21	Tues	
22	Wed	
23	Thur	
24	Fri	
25	Sat	
26	Sun	
27	Mon	
28	Tues	
29	Wed	
30	Thur	

NOVEMBER 1873, 30 DAYS.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Sat	
2	Sun	
3	Mon	
4	Tues	
5	Wed	
6	Thur	
7	Fri	
8	Sat	
9	Sun	
10	Mon	
11	Tues	
12	Wed	
13	Thur	
14	Fri	
15	Sat	
16	Sun	
17	Mon	
18	Tues	
19	Wed	
20	Thur	
21	Fri	
22	Sat	
23	Sun	
24	Mon	
25	Tues	
26	Wed	
27	Thur	
28	Fri	
29	Sat	
30	Sun	

DECEMBER 1873, 31 DAYS.

Day of Month.	Day of Week.	Memoranda of passing events.
1	Mon	
2	Tues	
3	Wed	
4	Thur	
5	Fri	
6	Sat	
7	Sun	
8	Mon	
9	Tues	
10	Wed	
11	Thur	
12	Fri	
13	Sat	
14	Sun	
15	Mon	
*16	Tues	
17	Wed	
18	Thur	
19	Fri	
20	Sat	
21	Sun	
22	Mon	
23	Tues	
24	Wed	
25	Thur	
26	Fri	
27	Sat	
28	Sun	
29	Mon	
30	Tues	

CALENDAR

Showing the Day of the Week and Month in any Year from 1800 to 1900.

EXAMPLE.—To ascertain the day of the week corresponding to March 5, 1869, look in the Table of year for 1869, opposite which will be found the letter C, (termed the Dominical Letter); then look in the Table of Months, opposite March, for the same letter (C), and underneath the column containing it will be found the Calendar for March, 1869, which shows March 5, to be Friday. When the Calendar for the Month is found, any other day of the week or month can easily be ascertained.

It will be observed that there are two letters opposite the Leap Years. The first letter is used for January and February, the second for the other months.

Table of YEARS.		A	B	C	D	E	F	G	Table of YEARS.
	January ...	A	B	C	D	E	F	G	
	February ...	D	E	F	G	A	B	C	
	March ...	D	E	F	G	A	B	C	
	April	G	A	B	C	D	E	F	
	May... ..	B	C	D	E	F	G	A	
1800	E	E	F	G	A	B	C	D	1851 E
1801	D	G	A	B	C	D	E	F	1852 D C
1802	C	C	D	E	F	G	A	B	1853 B
1803	B	F	G	A	B	C	D	E	1854 A
1804	A G	A	B	C	D	E	F	G	1855 G
1805	F	D	E	F	G	A	B	C	1856 F E
1806	E	G	A	B	C	D	E	F	1857 D
1807	D	B	C	D	E	F	G	A	1858 C
1808	C B	E	F	G	A	B	C	D	1859 B
1809	A	C	D	E	F	G	A	B	1860 A G
1810	G	F	G	A	B	C	D	E	1861 F
1811	F	A	B	C	D	E	F	G	1862 E
1812	E D	D	E	F	G	A	B	C	1863 D
1813	C	G	A	B	C	D	E	F	1864 C B
1814	B	B	C	D	E	F	G	A	1865 A
1815	A	E	F	G	A	B	C	D	1866 G
1816	G F	C	D	E	F	G	A	B	1867 F
1817	E	A	B	C	D	E	F	G	1868 E D
1818	D	F	G	A	B	C	D	E	1869 C
1819	C	D	E	F	G	A	B	C	1870 B
1820	B A	B	C	D	E	F	G	A	1871 A
1821	G	G	A	B	C	D	E	F	1872 G F
1822	F	E	F	G	A	B	C	D	1873 E
1823	E	C	D	E	F	G	A	B	1874 D
1824	D C	A	B	C	D	E	F	G	1875 C
1825	B	F	G	A	B	C	D	E	1876 B A
1826	A	D	E	F	G	A	B	C	1877 G
1827	G	B	C	D	E	F	G	A	1878 F
1828	F E	G	A	B	C	D	E	F	1879 E
1829	D	E	F	G	A	B	C	D	1880 D C
1830	C	C	D	E	F	G	A	B	1881 B
1831	B	A	B	C	D	E	F	G	1882 A
1832	A G	F	G	A	B	C	D	E	1883 G
1833	F	D	E	F	G	A	B	C	1884 F E
1834	E	B	C	D	E	F	G	A	1885 D
1835	D	G	A	B	C	D	E	F	1886 C
1836	C B	E	F	G	A	B	C	D	1887 B
1837	A	C	D	E	F	G	A	B	1888 A G
1838	G	A	B	C	D	E	F	G	1889 F
1839	F	F	G	A	B	C	D	E	1890 E
1840	E D	D	E	F	G	A	B	C	1891 D
1841	C	B	C	D	E	F	G	A	1892 C B
1842	B	G	A	B	C	D	E	F	1893 A
1843	A	E	F	G	A	B	C	D	1894 G
1844	G F	C	D	E	F	G	A	B	1895 F
1845	E	A	B	C	D	E	F	G	1896 E D
1846	D	F	G	A	B	C	D	E	1897 C
1847	C	D	E	F	G	A	B	C	1898 B
1848	B A	B	C	D	E	F	G	A	1899 A
1849	G	G	A	B	C	D	E	F	1900 G F
1850	F	E	F	G	A	B	C	D	

		1	S	1	S	1	F	1	T	1	W	1	T	1	M				
		2	M	2	S	2	S	2	F	2	T	2	W	2	T				
		3	T	3	M	3	S	3	S	3	F	3	T	3	W				
		4	W	4	T	4	M	4	S	4	S	4	F	4	T				
		5	T	5	W	5	T	5	M	5	S	5	S	5	F				
		6	F	6	T	6	W	6	T	6	M	6	S	6	S				
		7	S	7	F	7	T	7	W	7	T	7	M	7	S				
		8	S	8	S	8	F	8	T	8	W	8	T	8	M				
		9	M	9	S	9	S	9	F	9	T	9	W	9	T				
		10	T	10	M	10	S	10	S	10	F	10	T	10	W				
		11	W	11	T	11	M	11	S	11	S	11	F	11	T				
		12	T	12	W	12	T	12	M	12	S	12	S	12	F				
		13	F	13	T	13	W	13	T	13	M	13	S	13	S				
		14	S	14	F	14	T	14	W	14	T	14	M	14	S				
		15	S	15	S	15	F	15	T	15	W	15	T	15	M				
		16	M	16	S	16	S	16	F	16	T	16	W	16	T				
		17	T	17	M	17	S	17	S	17	F	17	T	17	W				
		18	W	18	T	18	M	18	S	18	S	18	F	18	T				
		19	T	19	W	19	T	19	M	19	S	19	S	19	F				
		20	F	20	T	20	W	20	T	20	M	20	S	20	S				
		21	S	21	F	21	T	21	W	21	T	21	M	21	S				
		22	S	22	S	22	F	22	T	22	W	22	T	22	M				
		23	M	23	S	23	S	23	F	23	T	23	W	23	T				
		24	T	24	M	24	S	24	S	24	F	24	T	24	W				
		25	W	25	T	25	M	25	S	25	S	25	F	25	T				
		26	T	26	W	26	T	26	M	26	S	26	S	26	F				
		27	F	27	T	27	W	27	T	27	M	27	S	27	S				
		28	S	28	F	28	T	28	W	28	T	28	M	28	S				
		29	S	29	S	29	F	29	T	29	W	29	T	29	M				
		30	M	30	S	30	S	30	F	30	T	30	W	30	T				
		31	T	31	M	31	S	31	S	31	F	31	T	31	W				

GOVERNMENT TELEGRAPH DEPARTMENT.

TELEGRAPH ACT.

LEGISLATIVE COUNCIL OF INDIA.

THE 24TH MARCH 1860.

The following Act, passed by the Legislative Council of India, received the assent of the Right Honorable the Governor-General, on the 12th March 1860, (communicated to the Legislative Council, on the 24th idem), and is hereby promulgated for general information :—

ACT NO. VIII. OF 1860.

An Act for regulating the establishment and management of Electric Telegraphs in India.

WHEREAS it is expedient that better provision should be made for regulating the establishment and management of lines of Electric Telegraphs in India; It is enacted as follows :—

Preamble.

I. Act XXXIV. of 1854 *(for regulating the establishment and management of Electric Telegraphs in India)* is hereby repealed, except as to any act or offence which shall have been done or committed, or to any fine or penalty which shall have been incurred, or to any proceedings which shall have been commenced, before this Act shall come into operation, and except also as to any license for the establishment of a line of Electric Telegraph granted under the said Act. All things done under the authority or in pursuance of the said Act, shall be as valid and effectual as if this Act had not been passed.

Act repealed.

II. *Within the British territories in India, the* Governor-General of India in Council shall have the exclusive privilege of establishing *lines of Electric Telegraph. Provided that the* Governor-General of India in Council may grant a license to any person or Company or establish a line of Electric Telegraph within any part of such territories, which license shall be revocable on the breach of any of the conditions therein contained.

Governor-General in Council to have the exclusive privilege of establishing Electric Telegraphs.

Proviso.

III. Whoever shall otherwise than under license duly granted as aforesaid *establish, or after revocation of such license maintain a* line of Electric Telegraph within the said territories, *shall be liable to a fine not exceeding one thousand Rupees,* and for every week during which such line shall be maintained *shall be liable to a further fine not exceeding five* hundred Rupees.

Penalties for establishing or *maintaining* unauthorized Electric Telegraphs.

IV. Whoever shall use a line of Electric Telegraph, knowing or having reason to believe that it is an *unlicensed line, for the purpose of* sending or receiving messages, or shall perform any service *incidental thereto, shall, for every such offence, be liable to* a fine not exceeding fifty Rupees.

Penalty for using or working such Telegraphs.

V. The Governor-General of India in Council may, on the occurrence of any public emergency, take temporary possession of any line of Electric Telegraph established under license within the said territories.

Government may take possession of Telegraphs established by License.

VI. Any Railway Company, on being required so to do by the Governor-General of India in Council, shall permit the Government to establish upon the land of such Company adjoining the line of Railway, a line of Electric Telegraph, and shall give every reasonable facility for establishing and using the same.

Government may establish Telegraphs on land of Railway Company.

VII. The Governor-General of India in Council may, from time to time frame rules for the conduct of Electric Telegraphs established by Government not inconsistent with this Act, and therein prescribe the regulations, conditions, and restrictions according to which all messages and signals shall be transmitted.

Governor-General in Council to frame rules for the conduct of Government Telegraphs.

VIII. The Government shall not be responsible for any loss or damage which may occur in consequence of any person employed by the Government Electric Telegraph Department failing to transmit with accuracy any message entrusted to him for transmission; and no such person shall be responsible for any such loss or damage, unless he shall cause the same negligently, maliciously, or fraudulently.

Government not responsible for loss or damage.

IX. Whoever shall, without permission, enter into the signal room of a Government Telegraph Office, or shall refuse to quit the same on being requested to do so by any Officer or servant employed therein, or shall wilfully obstruct or impede any such Officer or servant in the performance of his duty, shall be liable to a fine not exceeding one hundred Rupees.

Penalty for intruding into signal room, &c.

X. Whoever shall wilfully cause or attempt to cause any interruption to the transmission of signals along a line of Electric Telegraph established by the Government, by cutting or injuring the wire, or by injuring any portion of the line or posts, or any instrument or apparatus, or by any other means, shall be liable to imprisonment, with or without hard labor, for a term not exceeding two years or to fine or to both.

Penalties for cutting the line.

XI. Whoever, being in the employ of the Government in the Electric Telegraph Department, shall wilfully secrete, make away with, alter, or omit to transmit, any message which he may have received for transmission or delivery, or shall wilfully or otherwise than by the official order of a Secretary to the Government of India, or Government of Madras or Bombay or Lieutenant Governor of Bengal, or of the North Western Provinces, or of the Punjab, or Chief Commissioner of Oude, or such other Officers as the Governor-General of India in Council shall authorize to give such order, divulge any message or the purport of any message or signal to any person not entitled to receive or to become acquainted with the same, shall be liable to be imprisoned with or without labour, for a term not exceeding two years, or to fine, or to both.

Penalties for omitting to transmit or deliver messages or for divulging messages, &c.

XII. Whoever offers a bribe to any persons in the employ of Government in the Electric Telegraph Department in order to induce such person to act in a manner inconsistent with his duty, shall be liable to be imprisoned for a term not exceeding six months, or to fine, or to both.

Penalty for offering a bribe.

XIII. Whoever, being in such employ, shall be guilty of any act of drunkenness, carelessness, or other misconduct, whereby the transmission or delivery of any message shall be endangered, or who shall loiter or make delay in the transmission or delivery of any message, shall be liable to imprisonment with or without hard labor, for a term not exceeding three months, or to a fine not exceeding one hundred Rupees, or to both.

Penalty for misconduct.

XIV. Whoever, being in such employ, shall transmit by the Electric Telegraph any messsage upon which the prescribed charge has not been paid, intending thereby to defraud the Government, shall be liable to be imprisoned, with or without hard labor, for a term not exceeding two years, or to fine, or to both.

Penalties for sending messages without payment to Government.

XV. Whoever shall transmit or cause to be transmitted by an Electric Telegraph established by Government a message which he knows to be false or fabricated, shall be liable to be imprisoned, with or without hard labor, for a term not exceeding two years, or to fine, or to both.

Penalties for sending fabricated messages.

XVI. Any person not being a European British subject, who shall, beyond the local limits of the jurisdiction of a Court of Judicature established by Royal Charter, commit any of the offences mentioned in Sections X., XI., XII., XIII., XIV., and XV. of this Act, shall be punishable upon conviction by any Magistrate within whose jurisdiction the offence shall be committed. If any such offence be committed beyond the said local limits by a European British subject, the offender shall be punishable upon conviction before a Court of Judicature established by Royal Charter.

Jurisdiction beyond local limits of Supreme Court.

XVII. Any person, whether a European British subject or not, who shall, within the local limits of the jurisdiction of a Court of Judicature established by Royal Charter, commit any of the offences referred to in the last preceding Section, shall be punishable upon conviction before such Court.

Jurisdiction within local limits of Supreme Court.

XVIII. Any person, whether a European British subject or not, who shall be guilty of any offence, for which, according to the provisions of this act, he shall be liable to a fine only, shall be punishable for such offence by any Magistrate of Police for any of the Presidency Towns of Calcutta, Madras, and Bombay, or for the Settlement of Prince of Wales' Island, Singapore, and Malacca, Magistrate, Joint-Magistrate, or person lawfully exercising the powers of a Magistrate, within whose jurisdiction the offence shall be committed; and any person hereby made punishable by a Magistrate of Police shall be punishable upon summary conviction.

Fine how to be adjudged.

XIX. All fines imposed under the authority of this Act, for offences punishable by fine only, by any Police Magistrate, Magistrate, Joint-Magistrate, or person lawfully exercising the powers of a Magistrate, may, in case of non-payment thereof, be levied by distress and sale of the goods and chattels of the offender, by warrant under the hand of any of the above-named Officers, and in case any such fine shall not be forthwith paid, any such Officer may order the offender to be apprehended and detained in safe custody until the return can be conveniently made to such warrant of distress, unless such party shall give security to the satisfaction of such Officer for his appearance at such place and time as shall be appointed for the return of the warrant of distress, any such Officer may take such security by way of recognizance or otherwise, and if, upon the return of such warrant, it shall appear that no sufficient distress can be had whereon to levy such fine, and the same shall not be forthwith paid, or in case it shall appear to the satisfaction of such Officer, by the confession of the party or otherwise, that he has not sufficient goods and chattels whereupon such fine or sum of money could be levied if a warrant of distress were issued, and such Officer, by warrant under his hand, may commit the offender to prison, there to be imprisoned only or to be imprisoned and kept to hard labor, according to the discretion of such Officer, for any term not exceeding two calendar months where the amount of the fine shall not exceed fifty Rupees, and for any term not exceeding four calendar months where the amount shall not exceed one hundred Rupees, and for any term not exceeding six months in any other case; the commitment to be determinable in each of the cases aforesaid on payment of the amount.

Fine how levied.

Imprisonment if no sufficient distress, &c.

XX. If any Servant of the Government employed in the Electric Telegraph Department within the dominions of any Foreign Prince or State in alliance with the Government of India in which an Electric Telegraph is established by the Government, shall within the dominions of such Prince or State commit any act hereby prohibited, or omit to do any act hereby required to be done by any person similarly employed within the

Authority to punish Government Servants who commit offences against this Act in Foreign Territory

ment shall be guilty of an offence, and on conviction thereof shall be punished in the same manner as if such act had been done or omitted within the said last mentioned territories; and every such person may be tried, convicted, and punished either by fine or otherwise, according to the nature of the offence, by any Court or officer duly empowered by the Governor-General of India in Council to take cognizance of offences committed in such dominions by Servants of the Government, or by any Court or Magistrate or other competent Officer in any part of the British territories in India in the same manner as if the offence had been committed in such part of the territories.

Explanation of terms.

XXI. The word "Magistrate" in this Act shall include Joint-Magistrates and persons, lawfully exercising the power of Magistrates, and the word "Fine" shall include a penalty of forfeiture.

Government to frame rules for Telegraph establishment by license.

And to declare Act applicable to Telegraph established within British Territories by Foreign Powers.

XXII. It shall be lawful for the Governor-General in Council to frame rules for the conduct of any Electric Telegraph established by license under this Act and to declare from time to time what portions of this Act shall be applicable to such Telegraph and to persons using the same, or employed in connexion therewith. It shall also be lawful for the Governor-General in Council to declare from time to time that this Act, or such portions thereof as may be specified, shall be applicable to an Electric Telegraph established or to be established within the British Territories in India, by any Foreign Prince or State with the consent of the British Government, and to persons using such Telegraph or employed in connexion therewith.

M. WYLIE,
Clerk of the Council.

TELEGRAPH RULES AND RATES.

The following revised rules and tariff relating to the despatch of Telegraph messages in INDIA, BRITISH BURMAH, AND CEYLON sanctioned by the Governor-General in Council with effect from the 1st January 1872, are published for general information.

GENERAL.

Rule I.—The accuracy of messages is not guaranteed, and the sender and receiver must accept all risks arising from non-delivery, errors, or delays.

Classification of Offices.

Rule II.—Telegraph Stations are divided into three classes—1*st*, those performing permanent day and night duty; 2*nd*, those performing full day duty; 3*rd*, those of limited day duty.

Office hours.

Except on the days stated in Rule III, stations of the 1st class are open day and night for the reception and transmission of messages.

Stations of the 2nd class are open from 7 A.M. till 9 P.M.

Stations of the 3rd class are open from 10 A.M. till 5 P.M., and on Sundays and the holidays enumerated in Rule III, from 7 to 8 A.M and from 4 to 6 P.M.

Hours of business on Sundays and Holidays.

Rule III.—All Offices will be closed to the public between the hours of 8 A. M. and 4 P. M. (local time) on Sunday, Christmas Day, New Year's Day, Good Friday, and the Queen's Birthday.

Exceptions in favor of emergent telegrams signed by competent autho-

Rule IV.—In cases of life and death, or of extraordinary emergency, a message countersigned by the chief Civil or Military authority at a station, or by any of the authorities empowered to "clear the line" (see Rule XLVII.

Rule V.—No message or messages of more than 200 words can be sent at any one time by any private individual or firm, and no second message by the same individual or firm till after the lapse of three hours, unless the lines be free and not required by any one else.

Limit to length of messages.

Messages should be legibly written and clearly expressed.

Rule VI.—Senders of messages are advised to write their messages in an unmistakeable and distinct hand, and to use the shortest and most familiar words they can select. The more intelligible the message, the greater is the probability of its being correctly transmitted.

ACCEPTANCE OF MESSAGES FOR TRANSMISSION.

Messages must be legibly written in the Roman character.

Messages in the vernacular.

Rule VII.—Messages must be in the Roman character, and legibly written. Messages can be sent in vernacular, if written in the Roman character; the charge will be the same as for a message in a foreign language.

Messages translated for natives.

At stations other than the Presidency Towns, every assistance possible is afforded to natives in the translation of messages into English or *vice versa*.

Form to be followed.

Rule VIII.—The body of the message must be preceded by the address, and followed by the signature. The true signature and address of the sender must always be written at the foot of the message.

Verification of private messages may be insisted upon.

The sender of a private message can always be called upon to prove that the signature attached to it is genuine.

Rule IX.—The address must contain all the information necessary to ensure the delivery of the message at its destination, and the sender must in all cases support the consequences of insufficiency of address. After the message is once despatched, it can neither be completed nor rectified except by the despatch of a fresh message.

Full address necessary.

Ordinary, *cipher*, *Code*, and *foreign* messages.

Rule X.—Messages may be written in *ordinary English language*, in *cipher*, in *Code*, or in any *foreign language* written in the Roman character.

Ordinary messages can contain only standard English dictionary words.

Cipher messages are those which consist wholly or in part of groups of figures or letters not forming words. The whole of the cipher portion must be composed *exclusively* of letters of the alphabet or exclusively of figures. The body of the message may consist either wholly of cipher or partly of cipher and partly of ordinary language. The parts in cipher must be placed between parentheses, separating them from the rest of the message.

EXAMPLES OF CIPHER MESSAGES WHICH ARE ADMISSIBLE.

"(4597) (63289) (459) (181764)."

"Send sharp (839) (2146). Further shipments (154)."

"(A V K) (B) (C P G) (G K R S N)."

"Exchange falling (B K S) (F B J K) No demand (B K J)."

EXAMPLES OF CIPHER MESSAGES WHICH ARE NOT ADMISSIBLE.

"(45 A B C) (234 X Y Z)."

"Code" messages are those in which a number of recognised words follow each other without forming sense.

Messages consisting of nouns, adjectives, &c., unconnected by verbs and other parts of speech necessary for the formation of sentences are considered "code" messages. Cipher and code messages are always repeated back by every station *en-route* to ensure the greatest possible accuracy.

Rule XI.—Messages in ordinary language can contain no unusual combinations, abbreviations, or constructions, nor words of more than six syllables. Any word in common use, which, although requiring two words to express, is generally recognised as one word, is charged as one word when so written; when the two parts are not joined by a hyphen or apostrophe, and when less than seven syllables. "Halfpenny," "Twopence," "Threepence," up to "Elevenpence," when written as a single word, count as one word only. "F. O. B." and "C. F. I.," when writen as separate letters, are each counted as three words, but when written "Fob," "Cfi," as one word.

No unsual abbreviations or combinations permitted.

Rule XII.—Every interlineation, reference, erasure, or alteration of words should be authenticated by the sender of the message, or by his representative.

Authentication of corrections necessary.

Rule XIII. Messages from places where there is no Telegraph Station should be addressed to the nearest Government Telegraph Office by Post registered, together with Telegraph Stamps sufficient for their payment; or if Telegraph Stamps be not procurable, Postage Stamps at the rate of seventeen annas per Rupee. Such messages are charged at the day rate at whatever time they may reach the Telegraph Station.

Messages sent by Post to Telegraph Stations for transmission.

In the case of a private message sent by Post to a Telegraph Station with an insufficient number of stamps, the message and stamps will be returned "Bearing" to the sender, who should in all cases give his full address.

Treatment of messages received by Post for transmission insufficiently stamped.

Rule XIV.—Messages can be addressed to places where there are no Telegraph Stations. In such cases, the sender must state from what Telegraph Station the message should be posted.

Messages addressed to non-Telegraph Stations.

Example.—To Kalka, "Post Umballa," or Kalka, "Post Kussowlie." To Gudduck, "Post Dharwar," or Gudduck, "Post Bellary." No charge will be made for *inland* postage, which is defrayed by the Telegraph Administration.

If the sender of a message that has to be delivered by *inland* post wishes it to be sent to destination by registered Post, he must prepay the postal registration fee of four annas, and intimate that this has been done by placing the words "Post registered," instead of "Post," before the name of the Telegraph Station at which the message is to be posted.

Postal registration is compulsory in the case of messages addressed to places beyond Indian limits, and in such cases the postage and registration fees must be prepaid.

Rule XV.—Service messages have no right of precedence, and take their turn for despatch with private messages, except in cases of pressing public emergency, when priority may be claimed on special grounds.

Service messages take their turn for despatch with private messages.

Rule XVI.—With the following exception, all charges for messages must be prepaid in cash or in stamps:—

"Bearing" messages. Messages are sent "bearing" from sea-ports when received by mail steamers or other vessels for despatch, but no such message "prepaid" or "bearing" will be received for transmission until the name of the vessel has been made known. *Bearing messages will not be delivered*

Use of Stamps.

Rule XVII.—All charges on telegrams are prepaid in Telegraph Stamps, which are procurable at every Treasury and every Government Telegraph Station.

Form of Stamp provides a guarantee to the sender and to Government.

Telegraph Stamps are double-headed, the object being that the *upper half* shall be returned on the receipt (whereby the sender receives a guarantee that his message has not been suppressed for the sake of the stamps), and the *lower half* shall be affixed to the message as voucher to Government that it has been prepaid.

Stamps to be properly affixed to the forms.

The senders of messages should be careful to affix their stamps on the spaces left blank for the purpose on the message forms, *the upper half on the receipt, the lower half on the message*, and to see that the Stamps are defaced with the Office Stamp which bears the name of the station and date.

Cut or defaced Stamps cannot be received.

Telegraph Stamps cut in two, before being sent into a Telegraph Office, or which are in any way defaced, cannot be accepted.

Forms obtainable *gratis* at all stations.

Proper Forms on which to write messages are available *gratis* at all Telegraph Stations, and *senders are requested to use these forms only*.

Rule XVIII.—No unpaid messages, except those specified in the Departmental Regulations, shall on any account be transmitted. A violation of this rule will suject the Signaller or Telegraph Master in charge of the station from which a message is improperly despatched to dismissal from the public service.

No unpaid messages to be despatched under penalty.

Rule XIX.—Telegraph Masters are required to refuse to transmit a message which may be of a decidedly objectionable or alarming character. Should the character of a message be disputed, the matter may be referred to a Secretary to Government, if the dispute occur at the seat of Government, or to the chief Civil or Military Officer if at a provincial station.

Objectionable messages to be refused acceptance.

CHARGES.

Rule XX.—*No charge is made for the transmission of the address.*

Free address.

The address includes names of stations from and to which the message is to be despatched, the *bonâ fide* names of the sender and addressee, *and the latter's address*. No other words can be transmitted unless paid for as part of the body of the message, and the Officers of the Telegraph Department are authorized to omit from the address any words which are not essential to the correct delivery of the message.

Charge for a message in ordinary English language.

Rule XXI.—The following are the rates of charges for a message in ordinary English language—

(*a.*) Between any two stations in India, or between any two stations in the Provinces under the Administration of the Chief Commissioner of British Burmah, *one Rupee for every six words or less, exclusive of the address.*

(*b.*) Between any station in India and any station in British Burmah, or between any station in India and any station in Ceylon, *one Rupee eight annas for every six words or less, exclusive of the address.*

(*c.*) Between any station in Ceylon and any station in British Burmah, *two Rupees for every six words or less, exclusive of the address.*

Charge for a message in cipher, in words of concealed meaning, or in

Rule XXII.—The charge for a message in cipher, in code or in a foreign language, is double the charge for a message in ordinary English language.

Messages despatched to and from Railway Stations without extra charge

Rule XXIII.—A message can be sent from any station of the Government Telegraph Department to any Railway Telegraph Station, or *vice versa*, without additional charge.

Ceylon local rates.

Rule XXIV.—The local rates in Ceylon are *one Rupee for* 20 *words inclusive of address*, for any description of message between any two stations *not exceeding* 200 *miles apart*, with eight annas for every additional ten or fraction of ten words. For distances greater than 200 miles, those charges are doubled. Double charges are levied on messages sent after hours or on holidays, the same as in India.

Occasions on which double charges are leviable.

Rule XXV.—A double charge will be levied on all *messages tendered for transmission* between the hours of 6 P. M. and 6 A. M. (local time), also on Sundays and the following holidays :—Christmas Day, New Year's Day, Good Friday, and the Queen's Birthday.

TARIFF.

No charge is made for the transmission of the address. See Rule XX.

For every six words or less, exclusive of the address.	In ordinary English language.		In cipher, code, or in a foreign language.		
	Rs.	A.	Rs.	A.	
Between any two stations in *India*	1	0	2	0	See Rules XXI(*a*) & XXII.
Between any two stations in the provinces under the administration of the Chief Commissioner of *British Burmah*	1	0	2	0	Do. do.
Between any station in *India* and any station in *British Burmah*	1	8	3	0	See Rules XXI(*b*) & XXII.
Between any station in *India* and any station in *Ceylon*	1	8	3	0	Do. do.
Between any station in *Ceylon* and any station in *British Burmah*.	2	0	4	0	See Rules XXI (*c*) & XXII.

CEYLON LOCAL TARIFF.

For a message of 20 *words, including address.*

		For every additional ten or fraction of ten words.
Between any two stations in Ceylon not exceeding 200 miles apart	One rupee.	Eight annas.
Between any two stations in Ceylon exceeding 200 miles apart...	Two rupees.	One rupee.

Words joined by a hyphen.

Rule XXVI.—Words joined by a hyphen are counted as so many separate words.

Words separated by an apostrophe.

Rule XXVII.—Words separated by an apostrophe are counted as so many separate words. *(This rule does not apply to nouns in the possessive case, as "General's."*

Proper names, titles, &c.

Rule XXVIII.—Proper names of towns and persons, names of places, streets, ships, titles, Christian names, prefixes, and qualifications, are counted for the number of words employed to express them.

Every *separate* character, including an underline, charged as a word.

Rule XXIX.—Every *separate* character, whether letter or figure, is counted as a word. The same applies to an underline.

Signs of punctuation.

Rule XXX.—Signs which the instruments express by a single signal (signs of punctuations, hyphens, apostrophes, inverted commas, parentheses, fresh paragraphs) are not counted. But decimal points, commas, fresh bars of division, used with figures, are each counted as a figure. Signs used to separate groups in cipher messages are counted each as a figure or letter, unless the sender expressly desires that they be not transmitted.

Charges for figures.

Rule XXXI.—When numbers are expressed in figures in ordinary messages, each group of five or fewer figures is counted as a word; letters added to figures to form ordinal numbers are each counted as a figure.

Method of counting cipher messages.

Rule XXXII.—In cipher messages, the parts in cipher must consist exclusively of Arabic figures or exclusively of letters of the alphabet, and be placed between parentheses, separating them from the rest of the message. All the characters, figures, letters, or signs employed in the cipher text are added together, the total divided by five, and the quotient, plus one for the remainder, if there be any, gives the number of words the ciphers represent.

All words to be transmitted charged for.

Rule XXXIII.—All that the sender writes in his message to be transmitted is included in the cost, but the address of a message, as defined in Rule XX, *will be transmitted without charge.*

Date and time of receipt added by the department and transmitted *free.*

The day, hour, and minute of receipt of a message into a Telegraph Office for despatch are in every instance added by the department *and telegraphed free of charge.* Senders may, however, date their messages if they think fit, but the sender's date, if given, will be charged for, and, to avoid confusion with that given by the department, will, if written at the beginning, be transferred to the end of the message.

Multiple messages charged as separate messages.

Rule XXXIV.—A message addressed to several persons, or to the same person in localities where delivery is to be effected by different offices, is charged for as so many separate messages.

Multiple messages charged as one message.

Rule XXXV.—A message addressed to several persons in one locality, or to the same person at several places of residence in one locality, with or without transmission by post, is charged for as a single message, but a copying fee of four annas, independently of postage, if any, is charged for each destination after the first.

Charges on service messages.

Rule XXXVI.—Service messages from all public functionaries must be paid for in cash or in stamps prior to despatch: the rates are the same for service messages as those charged to private individuals. *(This rule will be relaxed in the case of Secretaries to Government and the chief Civil and Military officers of a Station, but to them only in cases of emergency, the sender of the message being bound to take the necessary steps to ascertain the amount of the charges on it and to pay them into the Telegraph Office without fail within 24 hours.)*

REGISTERED MESSAGES.

Registration of messages.

Rule XXXVII.—The sender of any message has the power

Rule XXXVIII.—The charge for registering is equal to the charge for the message. A registered message is indicated by the word "*recommandé*," which, to ensure the greatest accuracy, is telegraphed (free) both in the official instructions and as the first word of the text of the message.

Charge for registration.

Rule XXXIX.—When a message is registered, the different stations employed in its transmission collate it as it passes by, repeating it to each other integrally, and the terminal station, immediately after the delivery of the message, despatches a telegram to the sender announcing the exact time at which it reached its destination. If the message cannot be delivered, the return telegram indicates the circumstances which prevented delivery, and, if possible, gives the information necessary to enable the sender to cause his message to reach its destination.

Treatment of registered messages.

Rule XL.—The return message has priority in transmission over other messages of the same class.

Priority of return message.

Rule XLI.—The sender of a registered message can have the return message addressed to him at any station by giving the necessary instructions. The words necessary to convey these instructions will be considered as part of the message, and charged for accordingly.

The return message can be sent to any station.

PREPAID REPLIES.

Rule XLII.—The sender of a message can prepay a reply. He must add the words "reply paid" or "answer paid." These must form the concluding words of the message, but will not be charged for. On depositing the corresponding sum the sender can add (free) to the words "reply paid" or "answer paid" the amount to which he wishes the reply to be limited. When the words "reply paid" alone are given, without any specified amount, it will be understood that the minimum charge only has been prepaid. The terminal station pays to the receiver, in Telegraph Stamps, the amount prepaid, leaving it to him to send his answer how, and when, and to what address, he pleases; or not to send one at all. The reply is considered in every respect as a fresh message. Should it be impossible to effect delivery of a reply-paid message, the terminal station sends a telegram to that effect to the sender, and this telegram takes the place of the return message for which a reply has been prepaid. *The words "reply paid" or "answer paid" entitle the addressee to receive the equivalent of the minimum charge only, and if he wishes to answer at a time when the double charge is levied, he must pay the additional cost himself. It should be distinctly understood that it is not compulsory on the addressee to send a reply. The duty of the Telegraph Department consists simply in paying to him in Telegraph Stamps the amount deposited, leaving him at liberty to do what he pleases with it.*

DELIVERY.

Free delivery within five miles of a Telegraph Station.

Rule XLIII.—Messages will be delivered free of charge at any place within five miles of a Telegraph Station. Beyond this distance, messages will be sent by Post or by such other means as the sender may arrange and pay for.

Words necessary to explain delivery are charged for.

Rule XLIV.—Any additional words that may be necessary to explain the delivery of a message, when its destination is more than five miles beyond the nearest Telegraph Station, will be considered as part of the message, and charged for accordingly.

Charge for re-addressing a message.

Rule XLV.—Should the addressee of a message leave the station to which it is addressed, and it be sent on by Telegraph to some other station, an additional charge of one Rupee for every six words of message in ordinary English language, and of two Rupees for every six words of message not in ordinary English language, must be paid by the addressee for every extra address, *before the*

CLEAR LINE MESSAGES.

Rule XLVI.—On emergent occasions of great importance, the public functionaries named below have the power to "clear the line," that is, to suspend the receipt and despatch of all messages until the one for which the line is "cleared" is passed on:—

(1).—The Governor General of India.
(2).—The Governors of Madras, Bombay, and Ceylon.
(3).—Commanders-in-Chief, India, Madras, and Bombay.
(4).—Lieutenant-Governors of Bengal, North-Western Provinces, and the Punjab.
(5).—Secretaries to the Government of India.
(6).—Secretaries to the Governments of Madras, Bombay, Bengal, North-Western Provinces, and Punjab.
(7).—Chief Commissioners of Oudh, the Central Provinces, British Burmah, and Mysore and Coorg.
(8).—Agents to the Governor-General, Rajpootana and Central India.
(9).—Commissioners of Sindh and Peshawur.
(10).—Director General of Telegraphs in India.
(11).—The Resident at Hyderabad (Deccan).

The messages so sent are, however, to be paid for in cash or in stamps, as other service messages.

REFUNDS.

Rule XLVII.—No refund will be made for a message delivered wholly or partially in an unintelligible state (or for late delivery, mis-delivery, or non-delivery) unles it be registered (*recommandée*). Applications for refunds, as also all complaints respecting messages, should be addressed to the *Telegraph Check Office, Calcutta*.

Under no circumstance is a refund given for a non-registered message.

Every claim should be made, under penalty of rejection, within three months from the date of the message. *When an overcharge has been made on an Inland message through the neglect of the Telegraph employés, and when there exists no doubt whatever as to the justice of the claim, the amount overcharged will be repaid at once by the Telegraph Master.*

Rule XLVIII.—If a registered message be not delivered through the fault of the Telegraph Department or be delayed or mutilated to such an extent as to be manifestly unable to fulfil its object, the whole charge made for it will be returned to the sender.

Conditions of refund in the case of a registered message.

Rule XLIX.—If the sender of an Inland message wishes to cancel it before transmission has commenced, he can do so; but the charges upon it will not be returned when once the stamps are obliterated. If the message is in course of transmission, or has already been despatched, it can only be cancelled by a paid message from the sender to the Telegraph Master of the terminal station. If in addition the sender wishes to be informed by Telegraph in what manner his request has been acted upon, he must deposit the cost of the return telegram.

Not admissible when a message is cancelled at the sender's request.

OBLIGATION OF SECRECY.

Rule L.—To secure secrecy as much as possible, all persons, including Officers of the Department not actually on duty, are strictly prohibited from entering the signal-room. Breach of this regulation renders an offender liable to a fine of Rupees 100 under Act VIII of 1860.

Rule LI.—Violation of secrecy on the part of any person in the Department will be punished by dismissal from office, forfeiture of arrears of pay, and a declaration in the official Gazette of the incapacity of the delinquent to serve the Government in any capacity. Breach of this rule renders the offender liable to the further punishment of fine, or to imprisonment with or without labor not exceeding two years, or to both. It is a violation of secrecy to mention the fact that a message has been received or despatched by any particular person or firm.

Penalties for divulging the contents of a message.

Rule LII.—The sender and receiver have a right to be furnished with certified true copies of any message sent or received by them; a fixed charge of four annas is made for every copy furnished. As no Telegraph Office keeps copies of messages longer than three days, applications for copies required after that time has elapsed should be made to the Telegraph Check Office, Calcutta.

Certified copies of messages obtainable by sender and receiver.

Applications for copies must be made within six months of the date of the message. At the expiration of that period all message drafts are destroyed.

One anna must be enclosed for postage of the reply, failing which it will be sent "bearing."

PRESS MESSAGES.

Rule LIII.—Under certain conditions, to be ascertained on application to the Director General of Telegraphs, (Traffic Branch), *bonâ fide* Press messages, *i. e.*, messages in the ordinary English language addressed to, and intended for publication in a newspaper, can be despatched at reduced rates:

GOVERNMENT TELEGRAPH DEPARTMENT.

CIRCULAR.

It has been decided to issue certificates to correspondents of news-papers to enable them when travelling to avail themselves of the reduced rates for Press N P Messages which they may despatch from any Government Telegraph Office. Such certificates will be in the form given below and will require renewal every year.

Traffic.

If the requisite certificate, signed by the Director General, is presented to a Telegraph Master, he will register it, and will accept at the reduced rates, mentioned in para. 6 of Traffic Circular 19 of 1871, all messages coming under the Press Rules which may be tendered by the person named in the document. A copy of the rules for Press Messages is printed on the back of the form of certificate, and is also given below.

NEWS-PAPER CORRESPONDENT'S CERTIFICATE.

1872.

Certified that _____ has been registered as the correspondent of the _____ news-paper, and that he is entitled under the Rules for Press Messages sanctioned by the Governor General in Council with effect from the 1st January 1872 to send telegrams of manifestly public interest, and containing no commercial news of any kind, to the address of that news-paper at one-fourth the ordinary rate, and without extra charge when sent at night or on Sundays and Holidays.

This certificate will hold good until the 31st December 1872, unless it shall have been previously revoked owing to an infringement of the Rules printed on the reverse.

Director General of Telegraphs in India.

RULES FOR PRESS MESSAGES.

1. A "Press" message is defined to be a message, written in ordinary English language, originating in India, British Burmah or Ceylon, addressed only to a news-paper or news-papers within those limits, and intended for publication in its entirety in such news-paper or news-papers. The message must be one of manifestly public interest, and must contain no commercial news of any kind.

2. All rules and regulations that apply to ordinary messages apply also to Press messages, except as regards the charges.

3. The charge for a "Press" message will be one-fourth the ordinary rate, and not be subject to the increase levied on ordinary messages despatched at night, and on Sundays or Holidays.

4. Before the concession can be applied in any particular instance, the name of the Press Association, Firm or Individual furnishing the news, and that of the news-paper in which it is to be published, must be submitted to the Director General of Telegraph in India, in whom is vested the power of refusing the concession in any particular case on sufficient grounds, or of withdrawing it after it has been granted, should he have reason to believe that the conditions are in any way infringed.

5. In no case will the names of a news-paper and its correspondents be registered until after a declaration has been made by both parties, that the contents of the messages shall be published as transmitted, and shall be used for no other purpose.

GOVERNMENT TELEGRAPH DEPARTMENT.

List of places in India and Ceylon at which there are Stations for the Despatch and receipt of Telegrams by the Public.

For Detailed Rules and rates, See Tariff Sheet.

1st Class Stations are open day and night.	2nd Class Stations are open from 7 A. M. till 9 P. M.	3rd Class Stations are open from 10 A. M. till 5 P. M.

	Class.		Class.		Class.
A.					
Abbottabad* ...	3rd				
Aboo* ...	3rd	Akyab* ...	1st	Arrah, E. I. ...	
Adoni, M. ...		Allahabad* ...	1st	Arrunghatta, E. B. ...	
Aeng* ...	1st	Allahabad, E. I. ...		Assensole, E. I. ...	
Agra* ..		Aleppi* ...	2nd	Atcheepore* ...	2nd
Agra, E. I. ...	2nd	Allumdangah, E. B. ...		Atgaum, G. I. P. ...	
Ahmedabad* ...	2nd	Allyghur* ...	3rd	Attaree, P. ...	
Ahmedabad, B. B. ...		Allyghur, E. I. ...		Attock* ...	3rd
Ahmednuggur* * ...	3rd	Amboor, M. ...		Auspree, M. ...	
Ahmoodpore, E. I. ...		Amnapettah, G. S. I. ...		Avady, M. ...	
Ahrowra Road, E. I. ...		Amrolee, B. B. ...		Avenashy Road, M. ...	
Ajgaen, O & R. ...		Anarkullie, P. ..		Azimgunge, I. B. ...	
Ajmere* ...	2nd	Andaree, B. B. ...		B.	
Akola* ...	3rd	Annand, B. B. ...			
Akola, G. I. P. ...		Arconum Junction, M..		Babai, G. I. P. ...	
Akote, open during the		Arconum, C. ...		Babasoal, E. I. ...	

GOVERNMENT TELEGRAPH.—*(Continued.)*

	Class.
Bagra, G. I. P.	
Bahawa, E. I.	
Baijnath, E. I.	
Baligurriah, E. B.	
Balasore*	3rd
Bally, E. I.	
Bailygunge, E. B.	
Bandora, B. B.	
Bangalore*	1st
Bangalore, M.	
Bangalore, G. S. I.	
Bankipore*	2nd
Bankipore, E. I.	
Barajree, B. B.	
Bareilly*	2nd
Baroda*	3rd
Baroda, B. B.	
Barrackpore*	2nd
Barrackpore, E. B.	
Barrh, E. I.	
Barsee Road, G. I. P.	
Basrah, C. & S. E.	
Bassein Road, B. B.	
Beas, P. & D.*	
Beawur.*	3rd
Bechooan, E. I.	
Beddiah, E. I.	
Beehea, E. I	
Beejapore, E. I.	
Beeleemora,*	
Beerh, G. I. P.	
Begumabad, P. & D.	
Belgaum*	1st
Belgachee, E. B.	
Bellary*	1st
Benares*	2nd
Benares, E. I.	
Beora*	3rd
Berewlee (Dysur,) B. B.	
Berhampore (Ganjam*)	2nd
Berhampore, E. I.	
Beypore, M.	
Bezwarrah*	1st
Bhandoop, G. I. P.	
Bhorwarree, E. I.	
Bhaugulpore, E. I.	
Bheelar, B. B.	
Bhosawul*	1st
Bhosawul, G. I. P.	
Bhowpore, E. I.	
Bhurtpore,*	3rd
Bhynder, B. B.	
Biddabatty, E.I. (Temporary)	
Bihta, E. I.	
Bimlipatam*	1st
Biswa bridge, G. I. P.	
Boinchee, E. I.	
Boisur, B. B.	
Bolepore, E. I.	
Bombay*	1st
Bombay, G. I. P.	
Boodalore, G. S. I.	
Boolundshuhur, E. I.	
Boree, G. I. P.	
Boree Bunder, G.I.P.	
Boregaum, G. I. P.	
Borhampore, G. I. P.	
Broach*	2nd & 3d
Broach, B. B.	
Buckassur, E. I.	
Bucktearpore, E. I.	
Budlapore, G. I. P.	
Budnaira, G. I. P.	
Buggoolah, E. B.	
Bulsar, B. B.	
Bunkerry, G. I. P.	
Burdwan*	2nd
Burdwan, E. I.	
Burgurh, E. I.	
Burhan, E. I.	
Burhea, E. I.	
Burhee*	
Burnuggur*	
Burrakpore, E. I.	
Burrara, D.	
Burriarpur, E. I.	
Burtna, E. I.	
Buxar, E. I.	
Byculla*	2nd
Byoulla, G. I. P.	

C.

	Class.
Cachar*	3rd
Cadgoody, M.	
Calcutta*	1st
Calicut*	2nd
Callian, G. I. P.	
Camalpore,*	
Cannanore*	2nd
Canning, C. & S. E.	
Caroor, G. S. I.	
Carwar*	2nd
Cawnpore*	2nd
Cawnpore, E. I.	
Cawnpore, O. & R.	
Chalisgaum, G. I. P.	
Chandernagore, E. I.	
Chandnee, G. I. P.	
Chandore, G. I. P.	
Chappahatte, C. & S. E.	
Cheechawutnee, P. & D.	
Chicacole*	3rd
Chinchpoogly, G.I.P.	
Chinchwud, G. I. P.	
Chindwara, G. I. P.	
Chinnamapett, M.	
Chittagong*	1st
Chogdah, E. B	
Chola (Boolundshuhur Road,) E. I.	
Chooadangah, E. B.	
Chumargaum, B. B.	
Chunar, E. I.	
Chundna, E. B.	
Chunga Munga, P. & D.	
Chunnoo, P. & D.	
Churney Road, B. B.	
Cochin*	1st
Cocanada*	1st
Codoor, M.	
Coimbatore, M.	
Colar Road, M.	
Colgong, E. I.	
Colombo* (Ceylon)	
Comillah*	2nd
Comercally, E. B.	
Conjecode, M.	
Conjeveram, C.	
Connaghur, E. I. (Temporary)	
Cooch Behar*	3rd
Coompta*	1st
Coopum, M.	
Coorla, G. I. P.	
Cootipooram, M.	
Cossie Bridge, E. I. (Temporary)	
Cuddalore*	3rd
Cuddapah, M.	
Cudumbathoor, M.	
Cudumudy, G. S. I.	
Cuttack*	1st
Cuttalay, G. S. I.	
Cynthia, E. I.	

D.

	Class.
Dabonra, E. I.	
Dacca*	1st
Dadree, E. I.	
Dadur, G. I. P.	
Damagodium*	3rd
Damaun Road, B.B.	

GOVERNMENT TELEGRAPH.—(*Continued.*)

	Class.
Damergaum, G. I. P. ...	
Dandreedih, E. I. ...	
Darbajee, S. ..	
Darjeeling* ...	3rd
Decksal, G. I. P. ...	
Deebhorah, E I. ...	
Deesa* ...	1st
Deewa, G. I. P. ...	
Dehra* ...	3rd
Delhi* ...	2nd
Delhi, E. I. ...	
Deobund, D. ...	
Deoree, E. I. ...	
Deolalee* ...	1st
Deolalee, G. I. P. ...	
Dera Ghazee Khan* ...	1st
Dera Ismail Khan* ...	3rd
Dhanoo Road, B. B. ...	
Dharwar* ...	3rd
Dhollera, G. I. P. ...	
Dhond, G. I. P. ...	
Dhoobree* ...	2nd
Dhooliah* ...	3rd
Dhurrarah, E. I. ...	
Dhurum Khundee, G. I. P.	
Diamond Harbour* ...	2nd
Dildernagore, E. I. ...	
Dinapore* ...	
Dinapore, E. I ...	
Dongergaum, G. I. P. ...	
Doodneh, G. I. P. ...	
Doomraon, E. I. ...	
Dongree, B. B. ...	
Doorgapore, E I. ...	
Dorbazee, S. ...	
Dowlaishwaram* ...	3rd
Dum-Dum, E. B. ...	
Dygaum, G. I. P. ...	

E.

Echapore, E. B. ...	
Egutpoora, G. I. P. ...	
Elamanore, G. S. I. ...	
Enchampilly* ...	3rd
Erinpoorah* ...	3rd
Erode, G. S. I. ...	
Erode Junction, M. ...	
Etaree, G. I. P. ...	
Etawah, E. I. ...	
Etola, B. B. ...	

F.

Ferozabad, E. I. ...	
Frere Street, S. ...	
Futtehpore, E. I. ...	
Futtyghur* ...	3rd
Futwah, E. I. ...	
Fyzabad* ...	3rd

G.

Gaiepoora, E. I. ...	
Galle (Ceylon)* ...	
Garrawarra, G. I. P. ...	
Gazeeabad, E. I. ...	
Gazeeabad Junction, P. & D. ...	
Ghidhour, E. I. ...	
Ghogah, E. I. ...	
Geridi, E. I. ...	
Ghotee, G. I. P. ...	
Goa* ...	2nd
Goalparah* ...	3rd
Goalundo* ...	1st
Goalundo, E. B. ...	
Golwood, B. B. ...	
Goodoor, G. I. P. ...	
Goolburga, G. I. P. ...	
Goona* ...	3rd
Goondacal Junction, M	
Gooty, M. ...	
Goraie (Kooshtea,) E.B.	
Gooriatum, M. ...	
Gooskarah, E. I. ...	
Goraie Bridge, E. B. ...	
Gowhatty* ...	2nd
Grant Road, B B. ...	
Guhmer, E. I. ...	
Guntoor* ...	3rd
Gwalior* ...	3rd

H.

Harownee, O. & R. ...	
Hattrass, E. I. ...	
Henzada* ...	1st
Hingunghat* ...	3rd
Hooghly, E. I. ...	
Hooghly, Point* ...	2nd
Hotimurdan* ...	3rd
Howrah, E. I. ...	
Hurdah, G. I. P. ...	
Hurdwar* ...	3rd
Hurruppa, P. & D. ...	
Hursood, G. I. P. ...	
Hyderabad (Deccan)* ..	2nd

I.

Indore* ...	1st

J.

Jacobabad* ...	3rd
Juddubpore, C. & E. R..	
Jagotee, E. R. ...	
Jaffna (Ceylon)* ...	
Jagadispore, E. I. ...	
Jalesur Road, E. I. ...	
Jamtarrah, E. I. ...	
Jeempeer, S. ...	
Jetwar, E. I. ...	
Jehwoor, G. I. P. ...	
Jeypore* ...	2nd
Jheelum* ...	3rd
Jheenjuck, E. I. ...	
Jokye, E. I. ...	
Jollarpett Junction, M.	
Joongshaie, S. ...	
Jowra* ...	3rd
Jowra, G. I. P. ...	
Jubbulpore* ...	1st
Jubbulpore, E. I. ...	
Jubbulpore, G. I. P. ...	
Juggadaree, P. & D. ..	
Julgaum, G. I. P. ...	
Jullum, G. I. P. ...	
Jullundhur* ...	2nd
Jullundhur City, P. & D.	
Jullundur Cantonment, P & D. ...	
Julpigorie* ...	2nd
Jumalpore, E. I. ...	
Junmooee, E. I. ...	
Jundiala, P. & D. ...	
Jusrah, E. I. ...	
Juswanthnagore, E. I. ..	

K.

Kamptee* ...	3rd
Kanchraparah, E. B. ...	
Kandy (Ceylon)* ...	
Kangaum* ...	

* 1st.—Cotton season. 2nd or 3rd otherwise.

* GOVERNMENT TELEGRAPH.—(*Continued.*)

	Class.
Karalee, G. I. P.	...
Keamaree, S.	...
Keem, B. B.	...
Keem, G. I. P.	...
Kevalore, G. S. I.	...
Khaga, E. I.	...
Khamgaum, G. I. P.	...
Khanah, P. & D.	...
Khanawalla, P. & D.	...
Khandallah, G. I. P.	...
Khankeer, G. I. P.	...
Khanoo Junction, E. I.	
Kheirgaum, G. I. P.	...
Kheirwadee, G. I. P.	...
Khoorjah, E. I.	...
Khundwa*	... 3rd
Khundwa, G. I. P.	...
Khunna, P. & D.	...
Khurdee, G. I. P.	...
Khurmatar, E. I.	...
Khutowlie, P. & D.	...
Kirkee, G. I. P.	...
Kirkieaum, G. I. P.	...
Kitarpore, P. & D.	...
Kissengunge, E. B.	...
Kohat*	... 3rd
Kolapore*	... 3rd
Koksa, E. B.	...
Kondipuram, M.	...
Koomarcolly, E. B.	...
Korun, G. I. P.	...
Kordachary, G. S. I.	...
Kooshtea (Locomotive Shed,) E. B.	...
Kosgee, M.	...
Kotree, S.	...
Kristna (River,) G. I. P.	
Kujgaum, G. I. P.	...
Kujrah, E. I.	...
Kulikery, G. S. I.	...
Kulitalay, G. S. I.	...
Kurchuna, E. I.	...
Kurjut, G. I. P.	...
Kurkulla, G. I. P.	...
Kurnool*	... 3rd
Kurrachee*	... 1st
Kurrachee, S.	...
Kurrubgaum, G. I. P.	...
Kurruck Baile, G. I. P.	...
Kussarah, G. I. P.	...
Kussowlee*	... 3rd
Kutcha Roo, P. & D.	...
Kutnee, E. I.	...

L.

	Class.
Lahore*	... 1st
Lahore, P. & D.	...
Lalapetta, G. S. I.	...
Lanowlee, G. I. P.	...
Lassulgaum, G. I. P.	...
Loodiana, P. & D.	...
Loonee, G. I. P.	...
Luckady, M.	...
Luckie Serai, E. I.	...
Lucknow*	... 2nd
Lucknow, O. & R.	...

M.

	Class.
Madras*	... 1st
Madras, M.	...
Madras, G. S. I.	...
Mahableshwar	1st & 3rd
Maharajpore, E. I.	...
Mahim; B. B.	...
Mahreh, G. I. P.	...
Mailputty, M.	...
Malabar Point*	1st & 3rd
Maligaum*	... 3rd
Malloor, M.	...
Malwah, E. I.	...
Manaar (Ceylon)	..
Mancoor, E. I.	...
Mandla, G. I. P.	...
Mandwa, G. I. P.	...
Mangalore*	... 2nd
Manickpore, E. I.	...
Manowrie, E. I.	..
Markoondie, E. I.	...
Masulipatam*	... 2nd
Matheran	.. 3rd
Mayting, S.	...
McDonald's Choultry, M	
McLeod, S.	...
Meagaum, B. B.	...
Mean Meer, East P. & D	
Mean Meer, West, P. & D	
Meer Gunge, G. I. P.	...
Meerut*	... 2nd
Meerut City, P. & D.	...
Meerut Cant. P. & D.	...
Mehmoodabad, B.B.	...
Meijam, E. I.	
Mercara*	... 1st
Mhow*	... 2nd
Midnapore*	... 2nd
Mirzapore*	... 2nd
Mirzapore, E. I.	...
Mogulserai, E. I.	...
Mohar, E. I.	...
Mohesnunda, E. I.	...
Mohol, G. I. P.	...
Mohona, G. I. P.	...
Mokameh, E. I.	...
Monghyr Fort, E. I.	...
Montgomery*	...
Moodanoor, M.	...
Mooltan*	... 2nd
Mooltan, P. & D.	...
Mooraroee, E. I.	...
Moortazapore, G. I. P.	...
Moradabad*	... 2nd
Morapore, M.	...
Morar*	... 3rd
Moulmein*	... 2nd
Mozuffernuggur, P. & D.	
Muddapur, E. I.	...
Muddikurry, M.	...
Mud Point*	... 2nd
Mugowan, E. I.	..
Mugrah, E. I.	...
Mujgaon, E. I.	...
Mulkapore, G. I. P.	...
Mullapooram, M.	...
Mullarpore, E. I.	...
Mulleer, S.	...
Mundisore*	... 2nd
Munglepore, E. I.	...
Mungdoo*	... 1st
Munmar, G. I. P.	...
Mununpore, E. I.	...
Murree*†	... 2nd
Mussawud, G. I. P.	...
Mussoorie*†	... 3rd
Muttra*	... 3rd
Myanoung*	... 3rd
Myhere, E. I.	..
Myjee, G. I. P.	...
Mymaree, E. I.	...
Mysore*	... 2nd

N.

	Class.
Nagercoil*	... 2nd
Naggery, M.	...
Nagpore*	... 1st
Nagpore, G. I. P.	...
Nandgaum, G. I. P.	...
Nandore, G. I. P.	...
Narel, G. I. P.	...
Nargaum, G. I. P.	...
Narkuldangah, (Loco. Shed,) E. B.	...

† Offices occasionally opened

GOVERNMENT TELEGRAPH.—(*Continued.*)

	Class.
Nassick* ...	2nd
Nassick Road, G. I. P..	
Nawadeah, E. I. ...	
Nedamungalum, G. S. I.	
Neemgaum, G. I. P. ...	
Neemuch* ..	2nd
Neemcha, E. I. ..	
Negapatam* ...	1st
Negapatam, G. S. I. ...	
Nellore* ...	3rd
Neriad, B. B. ...	
Newaee, E. I. ...	
Newera Elia (Ceylon)*	
Najdongree, G. I. P. ...	
Nimbera, G. I. P. ...	
Niphar, G. I. P. ...	
Nowsaree, B. B. ...	3rd
Nowshera* ...	
Nulhattee, E. I. ..	
Nulhattee, I. B. ...	
Nulwar, G. I. P. ...	
Nuncherla, M. ...	
Nundaloor, M. ...	
Nursingpore, G. I. P....	
Nusseerabad (Rajpootana)* ...	3rd
Nusseerabad (Khandesh,) G. I. P. ...	
Nyehattee, E. B. ...	
Nynee, E. I. ...	
Nynee Tal* ...	3rd

O.

Omerkote* ...	3rd
Ookarah, P. & D. ...	
Oomrawuttee* ..	1st& 3rd
Oonao, O. & R. ...	
Ooroolee, G. I. P. ...	
Ootacamund* ...	2nd

P.

Pabroo* ...	1st
Pachora, G. I. P. ...	
Padoung* ...	1st
Pagdar, G. I. P. ...	
Pahadee (Baroda,) B. B.	
Paharee, E I. ...	
Palamcotta* ...	3rd
Palghaut, M. ...	
Pallee, E. I. ..	2nd
Pallej, B. B. ..	
Pandooah, E. I. ...	
Paneeghur, E I. ...	
Pangsa, E. B. ...	
Panolee, B. B. ...	
Paphoond, E. I. ...	
Pardee, B. B. ...	1st& 2nd
Parell,*† ...	
Parell, G. I. P. ...	
Parell, B. B. ...	
Parns, G. I. P. ...	
Passoor, G. S. I. ...	
Patna, E. I. ...	1st
Patus, G. I. P. ...	
Paumben* ...	
Pawkoor, E. I. ...	2nd
Peerpointee, E. I. ...	
Peperia, G. I. P. ..	
Perambore, M. ...	
Peranduray, M. ...	2nd
Perpengaddy, M. ...	
Peshawar* ...	
Phillour, P. & D. ...	
Phugwarah, P. & D. ...	1st
Pondicherry* ..	
Poody, M. ...	
Poogalore, G. S. I. ...	
Poolgaum, G. I. P. ...	
Poomulwaree, G I. P...	1st
Poona* ...	
Poona, G. I. P. ...	2nd
Pownar, G. I. P. ...	
Prome* ...	
Pulloor, C. ...	2nd
Purley, M. ...	
Purneah* ..	
Purodah, E. B. ..	
Putoor, M. ...	
Puttamby, M. ...	

Q.

Quilon* ...	3rd

R.

Raiwind. P. & D. ...	
Rajampett, M. ...	
Rajbaree, E. B. ..	
Rajgown, E. I. ...	
Rajkote* ...	2nd
Rajmehal, E. I. ..	
Rajpore, P. & D. ...	
Rajunpore* ...	3rd
Ramunggur, E. B. ...	
Ramoo* ...	2nd
Rampore, G. I. P. ...	
Rampore, Haut, E. I ...	
Ranaghat, E. B ...	
Raneegunge* ...	2nd
Raneegunge, E. I. ...	
Rangoon* ...	1st
Rawal Pindee*	2nd
Reddipully, M. ...	
Ravere, G. I. P. ...	
Rogoonathpore, E. I'...	
Roorah, E. I. ..	
Roorkee* ..	2nd
Royalcherroo, M. ...	
Rutlam* ..	2nd

S.

Saburmuttee, B. B. ...	
Saharunpore, P. & D....	
Sahibgunge* ...	1st
Sahibgunge, E. I. ...	
Saipore, G. I. P. ...	
Saktighur, E. I. ..	
Salamungalum, G. S. I.	
Salem, M. ..	
Samuggur, E. B. ...	
Samulputty, M. ..	
Sattara* ...	3rd
Saugor Island* ...	2nd
Sealdah (Terminus) EB	
Searsole, E. I. ...	
Secunderabad, (Deccan)* ..	3rd
Secunderabad, E. I. ...	
Seepree* ...	3rd
Sehora, G. I. P. ...	
Sehora Road, E. I. ...	
Seemultollah, E. I.. ...	
Seonee (Nagpore)* ..	3rd
Seorajpore, E. I. ...	
Serampore, E. I. ...	
Serathoo, E. I. ...	
Setarampore, E. I. ...	
Sewnee, G. I. P. ...	
Shahabad, G. I. P. ...	
Shajehanpore* ...	2nd
Shajapore* ..	3rd
Shapore, G. I. P. ...	
Sheagaum, G. I. P. ...	
Shekoabad, E. I. ..	

GOVERNMENT TELEGRAPH.—(*Continued.*)

	Class.
Sher Shah, P. & D.	...
Shervaroy Hills, M.	...
Shikarpore*	... 3rd
Shillong*	... 2nd
Shoaygheen*	... 2nd
Sholapore, G. I. P.	...
Sholinghur, M.	...
Shoranoor, M.	...
Sickle, G. S. I.	...
Simla*	... 1st & 3rd
Simree, G. I P.	...
Sindee, G. I. P.	...
Sion, B. B.	...
Sironcha*	... 3rd
Sirsa Road, E. I.	...
Sirswah, P. & D.	...
Sirsoul, E. I.	...
Sisowlee, G. I. P.	...
Sleemanabad, E. I.	...
Sodepore, E. B.	...
Sohagpore, G. I. P.	...
Somanoor, M.	...
Somna, E. I,	...
Sonapore, C. & S. E.	...
Sowda, G. I. P.	...
Sucheen, B. B.	...
Sukkur*	... 1st
Sukuldeah, E. I.	...
Sultanpunge, E. I.	...
Sunjan, B. B.	...
Sunkery Droog, M.	...
Sunnehwal, P. & D.	...
Surat*	... 2nd
Surat, B. B.	...
Sutna, E. I.	...
Sydapore, G. I. P.	...
Sylhet*	... 3rd

T.	Class.
Tadputri, M.	...
Tanjore, M.	...
Tanoor, M.	...
Tanna, G. I. P.	...
Tattepore, P. & D.	...
Teenpahar, E. I.	...
Tellicherry*	... 2nd
Teroovembore, G. S. I.	...
Theruvellum, M.	...
Thyetmyoo*	... 2nd
Timbornee, G. I. P.	...
Tinnanore, M.	...
Tiroor, M.	...
Tirupetty, M.	...
Tirutany, M.	...
Titwalla, G. I. P.	...
Toondla, E. I.	...
Topossie, E. I.	...
Tounghoo (Burmah)*	2nd
Tounghoop (Arracan)*	1st
Trichinopoly, G. S. I.	...
Trincomallee (Ceylon)*	
Tripatoor, M.	...
Trivalore, G. S. I.	...
Trivandrum*	... 2nd
Trivellore, M.	...
Tulligum, G. I. P.	...
Tuticorin*	... 1st

U.

Umballa*	... 2nd
Umballa City, P. & D.	...
Umballa Cantonment P. & D.	...
Umritsur*	... 3rd
Umritsur, P. & D.	...
Umulsar, B. B.	...
Unclesur, B. B.	...
Undal, E. I.	...
Undarah, E. I.	...
Urcharah, E. I.	...
Utchuldah, E. I.	...

V.

Vaniembaddy, M.	...
Veerungaum*	... 3rd
Vellore*	... 2nd
Vellore, M.	
Veraur, B. B.	...
Vingorla*	... 2nd
Vizagapatam*	... 2nd
Vizianagrum*	... 3rd

W.

Walliar, M.	...
Wanradharam, P. & D.	
Wassind, G. I. P.	...
Wassud, B. B.	...
Wontimettah, M.	...
Wootapollium, M.	...
Wudwan*	... 3rd
Wurdha, G. I. P.	...
Wurrengaum, G. I. P.	...
Wutkallee, M.	...

Y.

Yedaghurry, G. I. P.	..
Yerragoontla, M.	..

Z.

Zumnneah, E I.	...

N. B.—No charge is made for delivery within five miles of a Telegraph Station.

The Stations marked with asterisk are Government Telegraph Stations.

The Stations without the asterisk are Railway Telegraph Stations, the names of the Railways being indicated by the letters affixed to the Stations, viz :—

B. B.	stands for	Bombay, Baroda & C. India.
C. & S. E	„	Calcutta & South Eastern.
E. B.	„	Eastern Bengal.
E. I.	„	East India.
G. I. P.	„	Great Indian Peninsula.
G. S. I.	„	Great Southern of India.
I. B.	stands for	Indian Branch.
M.	„	Madras.
O. & R.	„	Oudh and Rohilcund.
P. & D.	„	Punjab and Delhi.
S.	„	Scinde.
C.	„	Carnatic.

TARIFF FOR FOREIGN MESSAGES.

The Tariff is for Messages containing from 1 to 20 words, including names and addresses. A message containing from 21 to 30 words, is charged for at the rate of one rate and a half. A message from 31 to 40 words at two rates, and so on. All charges must be prepaid by the sender, except in the few cases in which the Rules specially state the Receiver has to pay. Stations within the London Delivery Radius—Balham, Battersea, Bayswater, Bermondsey, Blackfriars, Blackheath, Blackwall, Bow, Brompton, Brixton, Camberwell, Campdentown, Chalk Farm, Chelsea, Clapham, Dalston, Deptford, Dulwich, Euston, Forest Hill, Gipsey Hill, Greenwich, Hackney, Hampstead, Herne Hill, Highbury, Highgate, Holloway, Hornsey, Islington, Kensington, Kennington Kentish town, Kilburn, King's cross, Kingsland, Knight's Bridge, Lower Norwood, New Wandsworth, Notting Hill, Paddington, Peckham, Pimlico, Poplar, Ratcliffe, Shoreditch, Shepherd's Bush, Southwark, Stockwell, Statford (Essex) Streatham, St. John's Wood, Sydenham, Vauxhall, Victoria Docks, Walworth, Wandsworth, Waterloo, Westminster and Woolwich.

To all Stations in	From Stations West of Chittagong.		From Stations East of Chittagong and in Ceylon.	
	20 words.		20 words.	
	Rs.	A.	Rs.	A.
Aden, via Red Sea	25	0	27	0
Algeria, via Turkey	28	0	30	0
„ „ Teheran I. E. Company's Line ...	45	4	47	4
„ „ Red Sea & Marseilles Cable	42	4	44	4
„ „ Red Sea and Italy	44	10	46	10
Austria and Hungary, via Turkey	26	0	28	0
„ via Teheran, I. E. Company's Line... ...	43	8	45	8
„ „ Red Sea	43	8	45	8
Baden, via Turkey	26	0	28	0
„ „ Teheran	43	8	45	8
„ „ Red Sea	43	8	45	8
Barbary, „ Turkey	30	10	32	10
Tripoli, „ Red Sea	46	8	48	8
Benghazi, „ Turkey	34	0	36	0
„ „ Red Sea	50	4	52	4
Bavaria, „ Turkey	26	0	28	0
„ „ Teheran	43	8	45	8
„ „ Red Sea	43	8	45	8
Belgium, „ Turkey	26	8	28	8
„ „ Teheran	43	12	45	12
„ „ Red Sea	43	12	45	12
Corfu, „ Turkey	26	8	28	8
„ „ Teheran	45	12	47	12
„ „ Red Sea	43	12	45	12
Denmark, „ Turkey	26	8	28	8
„ „ Teheran	43	8	45	8
„ „ Red Sea	43	8	45	8
Egypt, via Turkey and El. Arish	29	12	31	12
„ „ Red Sea	34	4	36	4
France and Corsica, via Turkey	27	4	29	4
„ „ Teheran	43	12	45	12
„ „ Red Sea...	43	12	45	12
Germany North, via Turkey	26	0	28	0

TARIFF FOR FOREIGN MESSAGES.—(*Continued.*)

To all Stations in	From Stations West of Chittagong.		From Stations East of Chittagong and in Ceylon.	
	20 words.		20 words.	
	Rs.	A.	Rs.	A.
Germany, North via Red Sea	43	4	45	4
Gibraltar, via Red Sea	45	4	47	4
Great Britain and Ireland, via Turkey ...	45	8	47	8
,, ,, Teheran	45	8	47	8
,, ,, Red Sea ...	45	8	47	8
London and Channel Island, via Turkey	45	8	47	8
,, ,, Teheran ...	45	8	47	8
,, ,, Red Sea	45	0	47	0
Greece, via Turkey	25	4	27	4
,, ,, Teheran	44	4	46	4
,, ,, Red Sea	44	4	46	4
Holland, via Turkey..	26	0	28	0
,, ,, Teheran	43	8	45	8
,, ,, Red Sea	43	8	45	8
Italy, via Turkey	26	0	28	0
,, ,, Teheran	42	10	44	10
,, ,, Red Sea	42	10	44	10
Java, via B. I. Extension and British Australia	37	4	...	...
Batavia and Welteroreden Cables	..	...	39	4
West of Samarang	37	12	39	12
East of Samarang	38	12	40	12
Luxemburg, via Turkey	26	4	28	4
,, ,, Teheran	43	8	45	8
,, ,, Red Sea	40	4	42	4
Malta, via Turkey	27	4	29	4
,, ,, Teheran	45	12	47	12
,, ,, Red Sea	40	4	42	4
Norway, via Turkey	26	12	28	12
,, ,, Teheran	43	10	45	10
,, ,, Red Sea	43	10	45	10
Persian Gulf—				
Gwadur ...	10	12	12	12
Jack ...	16	12	18	12
Henjam ... } via Kurrachee ...	18	12	20	12
Bushire ...	18	12	20	12
Fao ...	21	6	23	6
Scilly Isles, via Turkey	30	6	32	6
,, ,, Teheran	46	14	48	14
,, ,, Red Sea	46	14	48	14
Orkney Isles, via Turkey	29	8	31	8
,, ,, Teheran	46	0	48	0
,, ,, Red Sea	46	0	48	0
Shetland Isles, via Turkey	29	8	31	8
,, ,, Teheran...	46	0	48	0
,, ,, Red Sea	46	0	48	0
Persia, via Kurrachee	21	12	23	12
Portugal, via Turkey	28	10	30	10
,, ,, Teheran	45	4	47	4

TARIFF FOR FOREIGN MESSAGES.—(*Continued.*)

To all Stations in	From Stations West of Chittagong. 20 words.		From Stations East of Chittagong and in Ceylon. 20 words.	
	Rs.	A.	Rs.	A.
Russia, via Turkey	26	12	28	12
In Europe, via Persia	40	10	42	10
„ „ Red Sea	40	10	42	10
6 On Caucasus, via Turkey	28	0	30	0
6 „ „ Persia...	37	8	39	8
6 „ „ Red Sea	47	0	49	0
6 In Asia West of Tomsk, via Turkey	30	0	32	0
6 „ „ Persia	41	0	43	0
6 „ „ Red Sea	49	0	51	0
6 In Asia between Tomsk and Werkne Oudinsk... } via Turkey ...	33	10	35	0
6 „ „ Persia	44	4	46	4
6 „ „ Red Sea ...	52	4	54	4
Servia, via Turkey	24	12	26	12
„ „ Teheran	43	0	45	0
„ „ Red Sea...	43	0	45	0
Singapore, via B. I. Extension Cable	27	12	29	12
Saigon, via „ China Sub-Marine Cable...	30	12	41	12
Spain, via Turkey	28	4	30	4
„ „ Teheran	44	12	46	12
„ „ Red Sea	44	14	46	12
Sweden, via Turkey	27	0	29	0
„ „ Teheran	43	4	45	4
„ „ Rea Sea	43	4	45	4
Switzerland, via Turkey	26	8	28	8
„ „ Teheran	43	0	45	0
„ „ Red Sea	43	0	45	0
Tunis, via Turkey	28	0	30	0
„ „ Teheran	45	4	47	4
„ „ Red Sea	42	4	44	4
Turkey in Asia	21	8	23	8
1st Division ... } via Fao	23	4	25	4
2nd „ ... }				
„ Seaports, via Persia	45	4	47	4
„ „ „ Red Sea	45	12	47	12
„ Inland „ Persia	47	0	49	0
„ „ „ Red Sea	47	6	49	6
Turkey in Europe, via Fao	24	12	26	12
„ „ Teheran	43	12	45	12
„ „ Red Sea	43	12	45	12
United Principalities, via Turkey	24	12	26	12
(Moltoo Wallachia,) „ Teheran	42	10	44	10
„ „ Red Sea	42	10	44	10
Wurtemburg and Hohenzollern } via Turkey	26	0	28	0
„ Teheran	43	8	45	8
„ Red Sea	43	8	45	8
Hong Kong,* via B. I. Extension and China Sub-Marine Cable	51	4	53	4
Shanghai, via ditto.	63	12	65	12

NOTICE.—The following changes in Foreign Tariff took effect from the 10th December 1871—Ten word messages abolished on all routes. Rate Via Turkey to London and Great Britain same as Via Teheran and Suez.

SPECIAL TARIFFS.

From	To	20 words. Rs.	A.	
Madras...	Penang	15	0	No reduction for 10 word messages.
„	Singapore	23	0	
„	Batavia & Weltirvreden	34	0	
„	West of Samarang ...	34	8	
„	East of Samarang ...	35	8	
„	Saigon	35	0	
Bombay	Aden	20	4	

TELEGRAPH RATES CONTINENTAL AND AMERICAN FROM LONDON.

	£	s.	d.
Austria and Hungary	0	7	0
Alexandria (via Malta)	1	11	0
Bavaria and Baden...	0	7	0
Belgium	0	3	6
British Columbia	3	1	0
Cairo and Suez (via Malta)	1	15	0
Canada	2	1	0
California	2	13	6
Cincinatti	2	8	6
Cuba	3	2	6
Denmark	0	5	0
France	0	4	4
Greece (via Corfu)	1	2	0
Holland	0	4	9
Italy	0	8	6
Jamaica	3	17	6
Malta	0	11	0
North Germany	0	7	0
Norway	0	6	0
New York City	2	1	0
Portugal	0	11	6
Philadelphia	2	3	6
Russia (in Europe)	0	11	0
Russia (west of Tomsk, Siberia)	0	17	0
Russia (east of Tomsk, Siberia)	1	3	6
Sweden	0	8	0
Spain	0	13	6
Switzerland	0	7	8
Turkey (in Europe)	0	10	0
Turkey (in Asia)	0	16	6

NOTE.—The Continental rates quoted are for messages of 20 words, including names and addresses, with half rates for every additional 10 words.

The American rates are for messages of 10 words only, addresses being charged at the same rate extra.

TRAFFIC MEMO.

Telegrams to America.

The Anglo-American Company (*via* Valentiá) charge for the name of the "Station from"

TABLE *shewing the Strain corresponding to the Sog or Dip of a Wire, suspended at both ends—(Culley.)*

Sog in inches.	No. 8 wire ordinary 88 yards span.	No. 8 wire 110 yards span.	No. 11 wire homogeneous 110 yards span.	Sog in inches.	No. 8 wire ordinary 88 yards span.	No. 8 wire 110 yards span.	No. 11 wire homogeneous 110 yards span.
	lb.	lbs.	lbs.		lbs.	lbs.	lbs.
24	313	429	266	15	510	...	392
23	326	448	280	14	543	...	420
22	340	467	291	13	583	...	448
21	359	486	302	12	624	...	476
20	377	504	313	11	690	...	504
19	397	532	324	10	756	...	...
18	418	560	336	9	841	...	...
17	448	588	355	8	926	...	...
16	477	616	374	7	1018	...	...

THE ELECTRIC TELEGRAPH IN AUSTRALIA.

The estimated cost of the lines will be read with interest, as affording a fair Index of the cost of Material and rate of labour in the colonies. In Victoria the cost of the 300 miles of telegraph is estimated at 75*l.* per mile, the whole cost being 22,500*l.* In South Australia the estimate is 60*l.* per mile for the 320 miles required; the total cost, 19,200. The average cost of all the lines of telegraphs in the United States is stated to be $200, or about 40*l.*, and in this country it is rather more than 60*l.* per mile, so that the estimate for the Australian lines cannot be considered as excessive. We would urge upon the local Governments the duty of avoiding anything like false economy in the construction of the lines. In the United States durability has been sacrificed to the desire for cheapness of construction, and, as a consequence, gaps are constantly occurring in the communications in America owing to the decaying and rotting of the poles, the rupture of wires not sufficiently strong, and other causes which a slight additional expenditure at the commencement of the works might have obviated. The proposed telegraphic stations on the Victoria line are Melbourne, Geelong, Ballarat, Raglan, Warrnambool, Belfast, and Portland; on the line in South Australia—Adelaide, Mouut Barker, Strathalbyn, Goolwa, Port Elliot, Guichen Bay, and Mount Gambier. The cost of the maintenance and working of the lines, including interest on capital, will be 11,200*l.* per annum.—*Australian and New Zealand Gazette.*

ELECTRIC TELEGRAPH RATES IN AUSTRALIA.

Head Office, corner of William-street and Flinders lane.

CHARGES.

To or from any of the following places, within the Colony of Victoria:

TEN words ... ... One Shilling.
Each additional word ... ... One Penny.

Press Messages at half-rates.

Ararat	Carisbrook	Inglewood	Otway	Stawell
Avoca	Chiltern	Jamieson	Penshurst	Streatham
Bairnsdale	Clunes	Kerang	Port Albert	Stuart Mill
Ballarat	Colac	Kilmore	Portland	Swan Hill
Beaufort	Coleraine	Kyneton	Queenscliff	Talbot
Beechworth	Collingwood	Linton	Gen. P. Office.	Taradale
Belfast	Creswick	Longwood	Rosedale	Tarnagulla
Belvoir	Daylesford	Maldon	Rutherglet	Wahgunyah
Benalla	Dunolly	Majorca	Sale	Walhalla
Buninyong	Echuca	Malmsbury	Sandhurst	Wangaratta
Bright	Flinders	Mansfield	Sandridge	Warrnambool
Campendown	Geelong	Maryborough	Sepastopol	Williamstown
Cape Schanck	Hamilton	Mornington	Seymour	Wood's Point
Castorton	Heathcote	Mortlake	Smythesdale	Yackandandah

Railway Circ.

Geelong	Sunbury	Castlemne	Meredith	Runnymd
Little Riv.	Gisborne	Wmstn. Juc.	Ballart. W.	Echuca
Werribee	Woodend	Spencer-st.	Sandhurst	Wmstn. Pr.

TASMANIA.

From Melbourne to Launceston, Hobart Town, or any telegraph station in Tasmania.

Land lines.—For ten words 2s., and for each additional word 2d. *Submarine Cable*, for ten words 4s., and for each additional five words, or fraction of that number, 2s.

Hobart Town, Melton-Mowbray, Oatlands, Ross, Campbell Town, Longford, Launceston, Low Heads, Mount Nelson.

NEW SOUTH WALES.

SYDNEY—ten 3s.; add. 3d.—Adelong, Albury,* Araluen, Armidale, Balranald, Bathurst, Bendemeer, Berrima, Bombala, Braidwood, Burrowa, Campbelltown, Cassilis, Cooma, Deniliquin,* Denman, Dubbo, Eden, Euston, Forbes, Glen Inees, Goulburn, Grafton, Grenfell, Gundagai, Gabo Island Lighthouse, Gunnedah, Hartley, Hay, Inverell, Jervis Bay, Kiama, Kiandra, Kyamba, Liverpool, Maitland East, Maitland, Merimbula, Merriwa, Morpeth, Moruya, Moulamein, Mt. Victoria, Mudgee, Murrurundi, Muswellbrook, Narrabri, Nattai, Newcastle, Orange, Parramatta, Penrith, Picton, Port Stepens, Port Macquarie, Queanbeyan, Raymond Terrace, Richmond, Redfern, Scone, Singleton, Sofala, South Head, Tambaroora, Tamworth, Teraia, Tenterfield, Tumut, Uralla, Urana, Wagga Wagga, Wellington, Wentworth, West Kempsey, Windsor, Wollombi, Wollongong, Yass, Young.

SOUTH AUSTRALIA.

ADELAIDE—ten 2s.; add. 2d.—Alberton, Angaston, Auburn, Blanchetown, Bowden, Burra Burra (Kooringa), Clare, Dry Creek, Freeling, Gawler Town, Glenelg, Goolwa, Greenock, Gumeracha, Hahndorf, Holdfast B, Kadina, Kapunda, Kincraig, Kingston, Langhorns Bridge, Lobethal, Lyndoch, McDonnell Bay, McGrath's Flat, Macclesfield, Melrose, Milang, Moonta, Mt. Barker, Mt. Gambier, Mt. Pleasant. Mt. Torrens, Nairne, Narracorte, Noorlunga, Nuriootpa, Normawille, Overland Corner, Peninsula, Penola, Port Adelaide, Port Augusta, Port Elliot, Port Wakefield, Riverton, Robetown (Guichen Bay), Roseworthy, Salisbury, Smithfield, Strathalbyn, Tanunda, Truro, Victor Harbor, Wallaroo, Watervale, Wellington, Willunga, Woodside, Woodville, Yankalilla, at same rate.

QUEENSLAND.

BRISBANE—ten 6s.; add. 4d.—Bloomsbury, Bowen, Banana, Cape Moreton, Caboolture, Clermont, Cleveland, Condamine, Dalby, Dunwich, Durah, Drayton, Gratton, Goodna, Grandchester, Gayndah, Gladstone, Golden Fleece, Gympie, Hawkwood, Helidon, Inkermans, Ipswich, Kepple Bay. Lytton, Mackay, Marlborough, Maryborough, Nebo, Pilot Station, Rockhampton, Roma, St. Lawrence, Tarrom, Townsville, Toowoomba, Warwick, Waverly, Woogaroo, Woody Island, same rate.

THE RED SEA TELEGRAPH.

(*Times* 1870.)

The length of the Bombay and Suez cable, chances to be precisely the same as that of the French Atlantic between Brest and Duxbury, and, excepting for the liberal use of ground flint or silica, as a protection against the ravages of the teredo, its coverings are also similar. The teredo attacks hemp with great readiness, and in a cable recently raised that had been lying for some years between Toulon and Algiers was found to have reached, and slightly to have channelled the gutta percha of the core. Like the French Atlantic, the cable will receive extra coverings for a great distance from the shore. Experience has shown that motion on the bottom of the sea extends to a much greater depth than was at one time believed, and, therefore, in addition to the ordinary massive shore end, it is now the practice to have many miles of an intermediate character before the comparatively weak deep sea section commences.

The central and essential portion of the cable, the conductor, consists of a strand of seven copper wires, six of which are wound in long spiral coils around a central one. Into the section between Bombay and Aden these wires are one-fourth heavier than between Aden and Suez; but in both sections they are quite fine and slender, weighing at most only 180lb. per nautical mile. The strand of wires is then covered with alternate layers of Chatterton's compound, a mixture of gutta percha, India rubber, and other gums, and of gutta percha itself. The Chatterton's compound is first applied, and it flows into and fills the interstices between the wires. In the Bombay and Aden section four layers of each kind are employed, in the Aden and Suez section three layers; and in both cases the conductor and these layers constitute together what is called the core of the cable. This core is a little more than a quarter of an inch in diameter, and it is sent in three mile lengths from the gutta percha works to the factory at Greenwich for completion. Each three mile length is wound upon a huge bobbin, and on arrival at Greenwich is put into a tank under water and tested electrically after some hours of submersion. If its condition be satisfactory it is next covered with a serving of jute yarn steeped in a solution of cutch or other preservative mixture, and being, in fact, a protective padding between the core and its outer coverings. This jute yarn is applied by a machine consisting of several bobbins, revolving around a tubular axis through which the core passes, so that it is clothed as it goes on its way. It is important as regards electric condition that the cable should be always wet. The core on its bobbin retains enough moisture by cohesion to fulfil this requirement, the jute yarn itself is wet, and the clothed core passes immediately into a tank containing water. Up to this point, except for the slight difference of thickness already mentioned, the whole of the cable is alike; but afterwards its treatment varies with its destination. The greatest length, or the 1,874 miles of deep sea cable between Bombay and Aden, requires the least protection. It is covered by nine strands of wire and hemp, each strand composed of a galvanized homogeneous iron wire, rather less than one-tenth of an inch in diameter, and surrounded by five yarns of Russian or Manilla hemp. Each strand is first passed through a mixture of pitch, tar, and ground flint, and the whole cable again through a similar mixture. Lastly, a strand or strands of yarn are wound spirally round it; it is again passed through the mixture, and so into a tank to be ready for shipment. The effect of winding the yarn around the covering wires is that these are not in contact, but separated from each other by about their own diameter. The section next in length consists of 1,205 miles for the deeper portion of the Red Sea, and this is more strongly protected. Its covering consists of 12 galvanized iron wires, without hemp, each about the sixth of an inch in diameter, and wound on spirally so as to be in absolute contact. Above this there are strands of jute yarn, laid on in two servings in opposite directions, and covered with one covering of Latimer Clark's compound—that is, of ground flint and mineral pitch.

The shore end at Bombay receives for ten miles the additional protection of 12 strands of galvanized iron wire, each strand consisting of three wires of one-fifth of an inch in diameter. For 86 miles further it is covered by ten single wires, each a quarter of an inch in diameter; and for 50 miles more by 12 wires, each one-fifth of an inch in diameter. Approaching Aden, the shore end has 20 miles like the last described portion, and then ten miles covered with the strands of triple wire. In the Red Sea, both at Aden and Suez, there will be ten miles with triple strands, and at the Aden extremity 325 miles, covered with ten wires of one-fifth of an inch, before the deep sea portion is reached. In all the portions the strands, or single wires, are wound on spirally; and in all, excepting each ten miles of shore end, the wires are covered externally by yarn, and this by a coating of Latimer Clark's compound.

The Great Eastern left England carrying 5,512 tons of cable, 3,824 tons of fuel, 6,499 tons of coal, and apparatus and appliances, making up a freight of 21,000 tons in weight, and of about three millions sterling in value. Her design is to call at St. Vincent to fill up with coal, not only replacing what has been consumed, but loading deep. Her next stoppage will be at the Cape, and from thence she will proceed through the Mozambique Channel to Bombay, where she will be due after 60 steaming days, or early in January, and where she will be joined by the Chiltern. The Hibernia will proceed direct to Aden and the Hawk to Suez.

When the Great Eastern and Chiltern have completed their coaling at Bombay

they will proceed in company to Aden, the former laying the cable. When the Hibernia, Great Eastern, and Chiltern are ready to leave Aden they will proceed in company for 335 miles, by which time the Great Eastern will have exhausted her Red Sea portion. The Hibernia will then splice and carry on the work, the Great Eastern leaving her consorts and returning by way of Aden to England. When the Hibernia has paid out all her cable the Chiltern will splice in her turn, and continue laying as far as the Gulf of Suez. By the time this is done the Hawk will have laid her shore end at Suez, and have come 60 miles to meet the Chiltern. A splice between these portions will complete the undertaking. The speed at which the cable is laid must not exceed five knots an hour.

The Great Eastern and the expedition as a whole are under the command of Captain Halpin, who is assisted by the same staff, and carries the same machinery, that laid the Atlantic cable of 1866 and the French Atlantic cable of the present year, Captain Halpin commanded on the latter occasion, and was chief officer of the Great Eastern on the former, so that he brings to his work all the advantages of experience and full knowledge of those who are under his orders. Reckoning crew, engineers, and the staff specially carried for laying and testing the cable, the Great Eastern has 360 souls on board.

CHRONOLOGICAL NOTES.

MAGNETISM.

A. D. 1200.—The compass known in Europe during 1200 A. D.

A. D. 1576.—Robert Norman, an instrument maker in London, first discovered the dip of the needle.

A. D. 1600.—Dr. Gilbert of Colchester, physician to Queen Elizabeth published his "*Fractatus de Magnete.*" He first used the words Poles with reference to magnets, and gave the first theory of terrestrial magnetism.

A. D. 1683.—Halley, the Astronomer, Royal, published his theory of the four poles.

A. D. 1688 and 1689, at the expense of Government he made two magnetic voyages. the results of which he embodied in his chart of the lines of equal declinative published 1701.

A. D. 1722.—The diurnal variation was discovered by Graham, the celebrated instrument maker of London.

A. D. 1800.—During this century armatures began to be used, single and double touch discovered.

1778.—Brugman, discovered that Cobalt was attracted, and Bismuth was repelled by the magnet.

1789.—Coulomb, discovered the law of the distribution of magnetism on a magnetic bar, and the law of magnetic attractions and repulsions.

1768.—The first inclination chart was published by Wilke, at Stockholm.

1799-1803.—Humbolt, inaugurated the present system of careful observations of terrestrial magnetism by taking comparative measurements of the magnetic elements at Peru and Paris.

1817.—Haustun's work on the magnetism of the earth was published at Christiania.

1826.—He published the first isodynamn chart.

1831.—Barlow, suggested the electric origin of terrestrial magnetism.

1833.—And introduced correcting plates of soft iron for ships.

1831.—Captain Ross came upon the north magnetic pole.

1835.—Stations were established throughout Europe.

1836.—And the observations were published by Ganos and Weber.

1833-1340.—Ganos, perfected his theory.

1837.—Colonel Sabine published an isodynamical chart of the whole globe.

1845.—Diamagnetism was discovered by Faraday.

1840-1854.—Observations were made at Stations throughout the British Empire British officers under the direction of Colonel Sabine.

1855—Tyndall, shewed that a diamagnetic body assumed the opposite polarity to [illegible]tic body when under the action of magnetic force.

FRICTIONAL ELECTRICITY.

600 B. C.—Thales refers in his writings about this time to the fact that amber when rubbed, attracts light and dry bodies—the only electric fact known to the ancients.

1600 A. D.—The Science of Electricity dates properly from this period, when Gilbert of Colchester published his celebrated treatise in which he gives a list of substances which he found to possess the same property as Amber, and speculates on magnetic and electric forces. He is the inventor of the word electricity, which he derived from the Greek word electron, amber.

1672.—Ottobon Garricke-burgomaster of Magdeburg, in his work 'Experimenta Nova Magdeburdien' describes among his other inventions, the first electric Machine ever made, which consisted of a Globe of Sulphur turned by a bundle, and rubbed by a cloth pressed against it by the hand.

1709.—Hawkshee, constructed a Machine in which a glass Cylinder, rubbed by the dry hand, replaced Gurricke's Sulphur globe.

1729.—Grey and Wehler, were the first to transmit electricity from one point to another, and to distinguish bodies into conductors and non-conductors.

1733—1745 A. D.—Dufay, shewed the identity of electrics and non-conductors, and of non-electrics and conductors, and was the first to discover the two kinds of electricity, and the fundamental principle which regulates their action.

1733—1744.—Much attention was during this period given in Germany to the construction of electric Machines, up to this time, notwithstanding the inventions of Gurricke and Hawkshee, the Glass tube rubbed by a piece of cloth which Gilbert first introduced was used in all experiments, Boze, a professor at Wittenberg. taking the hint from Hawkshee's Machine, employed a glass for his Machine and furnished it with a prime conductor. Winkler, a professor at Leipsic, was the first to use a fixed cushion in Machine.

1746.—*The Leyden Jar was discovered accidentally at Leyden by Muschenbrook*; but the honor of the discovery has been contested also in favor of Currens, a rich burgess of that town, and Khist, canon of the Cathedral of Camin, in Pomerania.

1747.—Franklin, shewed the electric conditions of the Electric Jar.

1752.—And proved the identity of Lightning and Electricity by his famous Kite experiment. This last was performed with the same object about the same time, and quite independently by Romas of the town of Nerae, in France.

1760.—Franklin made the first Lightning Conductor.

1753-1759.—Canton, Wilke, and Epinus, examined the nature of induction.

1768.—Ramsden was the first to construct a plate-machine.

1780—and Nairn, a two fluid Cylinder Machine.

1775.—The Electrophorus was invented by Volta.

1782—and the Condense by the same Electricism.

1787.—Coulomb, by means of his torsion balance ,investigated the laws of electric attraction and repulsion.

1837.—Faraday, published the first of his researches on induction.

1840.—Armstrong, designed his hydro-electric machine.

GALVANISM.

The Science of Galvanism dates from the close of the 18th Century.

1780, A. D.—Galvani, in making investigations on the nervous irritability of cold-blooded animals, discovered by accident that the limbs of a recently killed frog when hung up by the crural nerve on a metal support near an electric machine, contracted convulsively at the recurrence of each spark. This he properly accounted for by the back stroke. Six years afterwards (1786) in experimenting on atmospheric electricity with frog limbs as delicate electro-scopes, he obtained, also accidentally the same convulsions by bringing the copper hook on which the nerve hung and the limb itself, simultaneously in contact with an iron railing. The similarity of the result led him to attribute it to the same cause, viz.: electricity either existing in the limb itself or produced in the conducting ore of metal. On consideration, he adopted the former hypothesis, and looked upon the limb as a self charged Leyden Jar, with the nerve as the brass knot and wire ; the interior of the muscle as the minor coating, and the

1792 —Volta, discarded the account given by Galvani of his experiment; and from the fact that the convulsions in question took place with more energy when there were two metals in the conducting ore instead of one, attributed the source of electricity to the heterogeneity of the metals employed. He maintained that at the surface of contact of two different metals an electric force arising from their hiterogeneity is generated which throws them into different tensions. This doctrine forms the fundamental principle of the contact theory of galvanism. In reply to Volta, Galvani proved incontestably that the contraction in the limbs of the frog took place when only one metal was employed, and even when the conductor was not of metal at all. Subsequent discovery has proved Galvani to be partly right in attributing the cause of these convulsions to animal electricity, and Volta also to be partly right in attributing them to electricity generated in the metal ore, for both causes may be at work in producing the result.

Fabroni, a professor at Florence was the first (1792) to suggest chemical action as one of the causes at work in Galvani's experiment.

Volta did not accept of Galvani's vindication, but supported his theory by several apparently conclusive experiments. In 1799, he constructed, as the crowning evidence of the truth of his reasoning, his pile, and with it properly begins the history of galvanism. To Galvani is due the merit of discovering a new manifestation of electricity, to Volta is due the merit of displaying in it a source of power of incalculable importance, and which but for his genius, might have remained among the barren curiosities of science. Hence it becomes a question of some difficulty to decide to which of the two the science owes its origin whether it is to be called Galvanism or Voltaism. Priority of discovery has led men generally to decide in favor of Galvani. although Volta has almost equal claim to have his name attached to the science.

The first account of Volta's pile reached England in a letter to Sir Joseph Banks from the inventor (1800) a few weeks afterwards, Carlisle and Nicholson decomposed water with it, and afterwards several Salts. They were the first to use platinum electrodes. Davy, in the same year, traced the electricity of the Pile to chemical action, Wollasten (1801) reiterated the same theory, and went the length of attributing even frictional electricity to chemical action. He proved likewise the identity of the two electricity, and showed that, by diminishing the electrodes to mere points, the electricity of the machine could produce the same chemical effects as that of the Pile. In 1802, Cruikshank improved the construction of the Pile, by disposing the plates horizontally in a trough instead of vertically in column. The main features of electrochemical decomposition were discussed by Davy in his famous Bakerian Lecture of 1806.

In 1807, the same Philosopher obtained for the first time by galvanic agency, the metals Potassium, Sodium, Barium, Strontium, Calcium, and Magnesium.

Delac (1809) first made dry piles of gold and silver paper, and these were altered and improved by Zamboni (1812).

In 1813, Davy, discovered the electric light and Voltaic ore by means of the Colossal battery then placed at his disposal at the Royal Institution.

Œrsted (1820) first observed the action of the current on the magnetic needle: and a few months afterwards, Ampere, discovered the law of this action, and originated an electric theory of magnets, which has proved wonderfully fertile in practical results.

In the same year, Schweigger invented the Galvanometer.

In 1825, Boequerel, with the aid of his differential Golvanometer, investigated the conductibility of metals. Kemp, in 1826, first used amalgamated zinc for the galvanic battery. In 1827, Ohm gave a mathematical theory of the pile, rigidly deduced from Volta's fundamental principle, and in perfect keeping with experiment.

Faraday discovered (1833-34) the definite nature of electro chemical decomposition, and proved that electro-chemical and chemical equivalents were identical. In 1836, Daniel constructed his constant Battery, Spencer in England, and Jocobi in Russia, made simultaneously (1837) the discovery of electro-metallurgy. Grove (1839) constructed his nitric acid battery. Faraday (1840) proved, apparently beyond dispute the truth of the chemical theory.

Joule (1840) discovered the law regarding the production of heat by the current. In 1840, Cooper suggested the use of Carbon, and Hawkins that of iron, for platinum in Grove's battery. Smee's battery dates also from this year. In 1843, Wheatstone,

by means of his rheostat and resistance coils, investigated the resistances offered by various conducting substances to the current. In the same year Bunsen introduced his carbon battery.

The rivalry which has all along existed between the advocates of the Chemical and Contact theories has been highly conducive to the advancement of the science, each party calling in the aid of invention and discovery to support the truth of their statements. Among the more distinguished Contact theorists may be mentioned, Volta, Ritter, Pfuff, Biot, Deluc, Ohm, and Fechner; and among the Chemical theorists, Fabroni, Davy, Wollaston, Parrot, de La Rive, and Farnday. Davy, latterly maintained a theory of distribution and equilibrium of electricity midway between the two, which numbered among its supporters Jaeger, Berzelius, Ermann and Prechtl.

FERGUSON'S INTRODUCTION TO ELECTRICITY.

All electric phenomena are studied under three heads—Statical Electricity, Current Electricity, and Magnetism.

Statical Electricity investigates the properties of Electricity which is insulated, or which is only tending to discharge. It is usually got by friction, and hence statical electricity and frictional electricity are frequently used as synonymous. Frictional electricity as it is usually studied, however, not only treats of electricity in its statical condition, but of electricity passing in a single discharge or momentary current.

In fact, a body is never charged except by means of discharge in some part of the line of action.

Statical electricity always occurs in a dual form, namely, as positive and negative electricity, the characteristic property of which is attraction and repulsion.

When positive and negative electricity neutralise each other through a conductor, the conductor shews no trace of either, but becomes possessed of entirely new properties, which are characteristic of electricity in discharge or in motion. A continued discharge constitutes a current. Current electricity also called Dynamical electricity, is chiefly obtained from chemical action (Galvanism,) from mechanical action (Magneto Electricity), and from heat (Thermo-electricity).

The properties of the current are manifested partly in its path, partly external to it. The current in its path possesses chemical, thermal, and physiological powers. External to its path, its action is closely allied with magnetism.

When the path of a current has the form of a spiral, it possesses properties almost identical with those of the magnet. The distinguishing property of the current external to its path, or of magnetism, is attraction and repulsion, but with conditions differing from those of positive and negative electricity.

Magnetism thus appears to form a branch of current electricity. The action of magnets on each other, however, which properly constitutes the science of magnetism, may be studied quite apart from their apparent electric constitution.

As the action of the earth on the magnetic needle must be understood before current strength, can be measured, magnetism usually forms the first step in the science of electricity.

THE ELECTRIC TELEGRAPH.

A Telegraph (from *tele*, afar, and grapho, I write) is an Instrument used for the purpose of carrying intelligence to a distance. To telegraph, also implies an idea of speed. Three agents have been employed for telegraphing. Sound, light, and electricity. Light and Electricity far exceed sound as an easy, rapid and certain means of Telegraphing through long distances. Light, though extremely rapid, is by no means a docile agent, it proceeds in straight lines, and will not bend around the globe of our earth, or over the inequalities on its surface.

In 1794 the 'Semaphore' an ocular Telegraph by M. Chappe was introduced into

cross bar, in the shape of the letter T. The cross bar turning on a pivot, could be placed at various inclinations, and had two smaller arms attached to its extremities, also capable of turning upon these, so as to form various angles with them. By independent movements of the different parts it was susceptible of being placed in one hundred distinct attitudes, giving that number of different signals. Lights were used at night to supply the place of the day apparatus, which was then invisible. Towers had to be erected in prominent positions within sight of each other. In foggy weather the 'Semaphore' was useless.

One of the earliest attempts at signalling was introduced into our navy, by order of the Duke of York (afterwards James II, by signal flags, to direct the manœuvres of the fleet, each flag conveying some peculiar information.

The Telescope was usually employed to assist the eye when the distances were far apart; but, even with that aid, all such Telegraphs consisting of objects to be seen at a distance, depended for their success, on the state of the weather.

Other mechanical processes consisted of ringing of bells, or making other signals, by means of wires, or by air or water enclosed in tubes; but for great distances these were all found to be practically useless. As soon as it was known that electricity could be conducted along wires, it began to be regarded as a possible means of conveying information, especially when it was ascertained by various experiments, that the distance to which it might be led was apparently unlimited, provided that perfect insulation of the wire could be obtained.

In 1747, Dr. Watson exhibited electrical effects from discharged Jars, at a distance of two miles from the source of excitement. From that time down to 1823 many ingenious and partially successful attempts were made both in England and on the continent to render frictional electricity available for telegraphic purposes; and in many instances, these contained the embryos of modern processes.

The wires were insulated sometimes by being suspended in the air with silk threads, or by being supported on posts of baked wood, or were enclosed in glass tubes placed in wooden troughs filled with pitch and buried in the ground. With electricity of high intensity, good insulation was very difficult of attainment, but when electricity of low intensity was discovered, the difficulty was in a great measure removed. By means of the electric Agency, the decomposition of water, or of metallic salts, was tried for telegraphing signals, but with unsatisfactory results.

In 1820 Professor Oersted discovered that the compass needle is deflected from its usual direction by an electric current flowing in a course parallel to it. That important fact formed the basis of many schemes for an electric telegraph, and among others, for that of Messrs. Cooke and Wheatstone who united their inventions, and subsequently committed them to the management of a Company known by the name of "The Electric Telegraph Company."

In April and May 1839, the first long line of Telegraph ever constructed in any country was erected by Dr. O'Shaughnessy, M.D., F.R.S., afterwards Sir W. B. O'Shaughnessy, Superintendent of Telegraphs in India, in the vicinity of Calcutta. The line was 21 miles in length, embracing 7,000 feet of river circuit. The experiments performed on this line removed all reasonable doubts regarding the practicability of working Electric Telegraphs through enormous distances, a question then, and for three years later, disputed by high authorities, and regarded generally with contemptuous scepticism.

The various forms of Electric Telegraphs now in general use, are electro-magnetic. The signals are given by the deflection of a needle to the right or left, or by mechanism connected with the armature of an electro-magnet, which sways to and fro under the action of the magnet and a counter spring, or between two opposite electro-magnets.

Electro-chemical telegraphs have also been designed, but they have never come into permanent use. Electric Telegraphs of all classes are of two kinds, those which merely give passing signals to the observer or listener, and those which permanently record their signals; the former may be called signalling, the latter recording telegraphs.

The number of inventions connected with the Electric Telegraph is almost endless, and would engross a long series of volumes for their description.

We shall here content ourselves by merely mentioning those at present existing on most lines.

The forms most in use every where at present are Morse's Telegraph, and Cooke and Wheatstone's needle Telegraph. For private and metropolitan use, some form of the Magneto-electric dial telegraph is employed. In point of simplicity and certainty, Morse's system can hardly be exceeded, and even as regards speed it stands equal or nearly so, to the most rapid recorders.

In concluding this brief notice it should be recorded that to Stunheil (in 1838) is due the discovery of the Earth's Circuit and the need of only one wire. He was also the first to stretch wires on insulated supports.

OCEAN TELEGRAPHY.

It is one of the astonishing achievements of our day that insulation has been obtained for wires extending many miles, under water; considering that the admission of salt water into the bundle of wires, so as to form a connexion between them at any one point, however minute, would destroy their action for the whole distance.

The extent of Submarine communication has become very great, and is almost daily increasing.

Four attempts have been made to establish telegraphic communication with America; the first in 1857, the second in 1858, the third in 1865, and the fourth in 1866. In the first and third, the cable snapped, and was partially lost; and in the second, it was laid, but became useless in a few weeks. On the 27th of July 1866, Europe was telegraphically joined to America by a cable successfully laid between Valentia, on the coast of Ireland, and Newfoundland. Since which a French Atlantic Cable has been successfully laid.

A list of recent Submarine Telegraph Cables.

	Cables.	Date.	Length laid.
			Knots.
1.	Persian Gulf	1864	1148
2.	Atlantic	1865	1896
3.	Persian Gulf	1866	160
4.	Atlantic	1866	1852
5.	England and Hanover	1866	224
6.	Placentia bay and Sydney	1867	112·1 / 188·7
7.	Cuba and Florida	1867	125·4
	Havannah to Keywest	...	119·9
	Keywest to Punta Rassa	...	9·27
8.	Anglo-Mediterranean	1868	...
9.	French Atlantic	1869	2584
	Brest—St. Pierre	...	749
	St. Pierre—Duxbury	...	...
10.	British Indian	1870	1460·66
	Suez—Aden	...	1817·43
	Aden—Bombay	...	...
11.	Falmouth and Gibralter	1870	823·68
	Falmouth—Lisbon	...	346·00
	Lisbon—Gibraltar	...	...

A list of recent Submarine Telegraph Cables.—*(Continued.)*

	Cables.	Date.	Length laid.
12.	Gibraltar and Malta	1870	1105·07
13.	Marseilles, Algiers and Malta	1870	...
	Marseilles to Bona	...	502
	Bona to Malta	...	360
14.	Anglo-Mediterranean Duplicate	1870	...
15.	British Indian extension	1870	...
	Penang—Singapore	...	1447·17
	Penang—Madras	...	387
16.	China Telegraph	1870	1632
17.	British Australia	1870	...
	Batavia and Singapore	...	579
	Batavia and Port Darwin	...	...
18.	Persian Gulf	1868	525
19.	Anglo-Danish	1868	365
20.	Anglo-Norwegian	1869	240
21.	Moen-Banholm	1869	82
22.	A land cable	1869	87
			69
		1869	9
23.	Shetland cables	...	...
24.	North China	...	1098
	Hong-Kong—Shanghai	...	1198
	Shanghai—Posietta	...	200
25.	Melbourne to Launceston	1869	

NOTES ON PRACTICAL TELEGRAPHY.

Insulators, are fixed to Telegraph posts, to prevent loss of current from the wire to the earth.

In the case of 2 or more wires on the same support, a metallic support is preferred, to prevent "*Contact,*" between wires by leakage from Insulators.

"Earth Plate," a plate of Copper 4 or 5 feet square placed vertically in the Earth with copper wires soldered thereto and carried insulated to the Instrument via the Battery.

When the extremities of a Circuit are connected to "Earth" which is an infinitely large conductor, their respective tensions are diffused in all directions without producing any appreciable tension in the Earth itself, so that the circuit will continue to flow.

A faulty joint will hinder the passage of the current and thereby cause greater "Resistance," and a consequent waste of Electro motive force to overcome.

To establish Telegraph communication between two places, there must be 1st a conductor (wire) Insulated from the Earth. The circuit must be completed, either by another wire or by the earth, and Instruments placed within the circuit to receive and transmit Signals thus—

It is better to use wire suspended on supports, than insulated wire buried in the ground, as there is better insulation insured; any accident can be more readily detected

Gutta Percha, does not deteriorate, when submerged in the Sea, in fresh water somewhat, more especially in dry earth—*India Rubber* from its cleanness, purity, high non-conducting power, and low inductive capacity is admirably adapted to Telegraphic purposes. It bears a temperature of 212 ° with impunity.

Timber posts are preserved against decay and insects by being prepared with some antiseptic such as creosote or sulphate of copper. The butt ends should be well roasted over a slow fire, a foot below and a foot above the intended ground line should be slightly charred and tarred, when hot with a mixture of 4 parts gas tar (boiled with powdered quick lime, to expel the water and Ammonia) and one of Stockholm tar.

The smaller the number of posts to the mile, the better will be the Insulation, and the less the cost; but the greater the liability to accident, and the greater the difficulty of making repairs.

For a Telegraph Line of 8 wires, not less than 20 supports should be used per mile. For a Line of not more than 4 wires, 16 supports per mile or even fewer, are sufficient.

Telegraph Lines crossing public roads, or Railway crossings should be at a sufficient height from the ground to admit passing traffic. The wires should be carefully bound to Insulators at 3 or 4 supports on each side of the road.

The lee side of a public road or Railway is to be preferred on account of the wind's pressure on the supports.

The supports should always be made to lean back slightly against the strain of curves and should be stayed so as to oppose the strain—on straight lines where exposed to the wind, double stays, to prevent their moving either way, are required; on sharp curves, the strain of the wire acts as a stay in one direction.

Timber posts should be provided with an earth wire or contact conductor. It is important that this wire should make good earth.

The smaller the wire, the more care is needed in insulation, for an increased resistance in the wire virtually adds to the length of the circuit. The thicker the wire used as a conductor, the greater is the conducting surface.

Wire for general use, should be soft, and capable of stretching 18 to 20 per cent. before breaking. For very long spans, harder wire, which does not stretch so readily is preferred. The soft wire should be capable of being bent at right angles several times backward and forward without breaking so that joints may be made securely.

Iron expands $\frac{1}{14\,8\,1\,6}$ of its length, or about $4\frac{1}{10}$ inches per mile for every 10 degrees of heat, so that between winter and summer, or 32 ° and 62 °, there will be on a line of 20 supports to the mile, a difference of length in each space of wire of nearly $\frac{7}{16}$th of an inch.

New wire should be strained till it stretches, and loses its spring, before being put up on line for use, this then is technically said to be 'killed.'

The number of wilds or joints in the wire for a Telegraph line should be as few as possible, as they are often defective, weak places are also caused by dirt or cinder in the iron and by splits in the rod.

Galvanizing wire, simply means coating it with zinc. The term is apt to mislead, it would be better to say zincing.

To prevent contact when the supports carry more than one wire. The wires are kept at as great a distance apart as possible. They should be strained to an equal level. The Bracket arms for the upper set of wires are sometimes made longer, than those below.

Where the wires are exposed to smoke or the sea-air, it is recommended that they should be painted or tarred. Boiled Stokholm tar is said to answer well.

Telegraph line wires should always be kept free from branches or leaves of trees, when this is not possible they are sometimes covered with tarred tape, as a partial insulator to prevent loss of current.

Stranded wire rusts more rapidly than solid wire, owing to its larger surface, and gives way rapidly when exposed to smoke. Steel or the so-called homogeneous iron, is to be preferred when the span is too long for ordinary wire.

Spiders webs are apt to cause inconvenience on a line of wires, by escapement of current from one wire to another especially in wet weather.

Dirt or smoke on Insulators tends to render the insulation less perfect. They should therefore be periodically cleaned.

After a smart shower of rain the Insulation of a line is often improved, by the cleansing effect of the rain on the insulators.

Wires on Lines near the Sea, are more liable to get rusted by the salt air.

Earth currents or deflections sometimes steady, at other times changing from positive to negative very rapidly, occasionally appear in the wires. They seem to be caused by currents flowing from one part of the earth to another, which enter the wires by one of their earth connections, and leave them by another.

The direction of such currents is not determined by the actual course of the wires, but by that of a straight line drawn from one extremity, or earth plate to the other, modified by leakage to earth from bad insulation or faults. These currents are almost always passing; but it is only occasionally, during what are called *Magnetic Storms*, that they are sufficiently powerful, to affect the Telegraph.

When communication is stopped by these currents, it is possible when the currents do not vary rapidly from + to —to restore it by the use of a magnet, but this method is seldom satisfactory. Where there are two wires both may be disconnected from earth entirely, and used as a metallic circuit or loop without earth. This succeeds perfectly when both are well insulated, but any cause which brings them into connection with the earth, permits the Earth's current to flow through them.

These *Earth Currents* must not be confounded with the *Earth Battery* current set up between two dissimilar earth plates, or with the current which sometimes is set up when the conductor of a Cable or buried wire is in contact with earth at a fault.

Telegraphic apparatus to transmit signals may be divided into Needle Instruments, Printing Instruments, and Acoustic Instruments.

In Bright's Bell Instruments the signals of the needle instrument are represented by the sound of two Bells varying in tone, placed on either side the clerk's desk, two finger keys are used, one for + the other for — currents, and the line current acts upon relays which close the local circuits in which the Bells are placed.

The needle Instrument is simply a vertical galvanometer, with a key or apparatus for placing a Battery in Circuit, and for reversing the current.

The connections of a Morse instrument. (Receiving). The current enters from the Line, through the coil B. to Y. and S. of the switch, to stud 1, through the key, to stud 2; to 1 of commutator (the switch being to the right side) to 3; to 2 of relay, through its coils to 1 to 2 of commutator, to 4 to "Earth" and back. The Relay tongue *being in contact with the platinum screw, closes the circuit of the Local Current*, commencing from C. to A. through the Armature coils to B., to A. of Relay, through its tongue to Z. of *Local Current*. The Local Current traverses the coils of the Armature Magnet, and generates Magnetism in the cores, the printing armature (or sounder) is then attracted down.

Wheatstone's Alphabetical Dial Telegraph is extensively used in the metropolis and elsewhere both for public and private establishments. It consists of two distinct parts, viz., the "Commutator" for sending the message, and the "Indicator" for receiving the same, &c.

Wheatstone's automatic system is worked thus. Long strips of paper are perforated by a Machine, with apertures grouped to represent letters of the alphabet. A strip thus prepared is placed in an Instrument associated with a source of Electric power, which on being set in motion moves it along, and causes it to act on two pins, in such a manner that when one is elevated, the current is transmitted to the Telegraphic cir-

direction. The elevation and depression of these pins are governed by the apertures and intervening intervals. These currents following each other indifferently in these two opposite directions act upon a writing instrument at a distant station, and produce corresponding marks on a slip of paper moved by Mechanism. The advantages of the automatic over the voluntary system are very great.

The Telegraph is worked by current or Dynamical Electricity.

Voltaic or Galvanic Electricity is produced by Chemical action on metals immersed in a liquid which acts more upon one, than upon the other.

A current would not be produced by using two plates of the same metal attacked equally by the acid, because an equal tension being acquired by each, and there being no difference in tension, there would be no tendency towards a transfer of Electricity.

The 'Britannia' joint is made by slightly bending up the ends of the two wires, laying them side by side, binding them tightly together with No. 16 wire, and well soldering the whole.

No joint however clean and firm, can be depended on if made by mere contact or twisting, for the metals will rust or oxidise sooner or later and the passage of the current will increase this tendency, a twisted joint is apt to break from the harding of the wire in twisting. The Britannia joint is considered the strongest and best.

Soldering.—There is nothing more important than the perfect continuity of a Circuit, and this can only be attained, when every connection or joint is well soldered.

In "terminating" a wire, it should never be twisted, or it will break. It must be lapped once round the Insulator, the end then brought round, bound to the wire and soldered as a Britannia joint.

GENERAL LAWS OF THE BATTERY.

1st. The Electro motive force of a Voltaic current varies with the number of the Elements and with the nature of the Metals and liquids which constitute each Element, but it is in no degree dependent on the dimensions of any of their parts.

2nd. The Resistance of each Element is directly proportional to the distance of the plates from each other in the liquid, and to the specific resistance of the liquid, and is also inversely proportional to the surface of the plates in contact with the liquid.

3rd. The Resistance of the connecting wire of the Circuit is directly proportional to its length and to its specific resistance, and inversely proportional to its Section "Ohm's Law."

SIEMEN'S BROTHER'S TELEGRAPH WORKS AT WOOLWICH.

*The Messrs. Siemen's have some large works at Charlton near Woolwich, where the covering and testing of Telegraph Cables, the construction of Telegraphic implements, and other operations, are carried on. The works are on the South bank of the Thames, and they cover about four acres of ground. The number of men employed varies considerably, according to the amount of Cable work going on; the permanent staff numbers about 300 men, but when there is a great press of business, sometimes as many as 1000 men are employed.

* * * *

Each Cable is tested for insulation by means of 100 cells of Daniell's battery, charged with Sulphate of Copper and weak Sulphate of Zinc; but no free acid.

The Zinc end of the battery is applied to the Cable, and the copper end to the earth; the other end of the Cable is free, and not in contact with the earth. Under these circumstances, the worse the insulation the greater is the deflection of the needle of the reflecting galvanometer placed in circuit, because the greater the leakage the more freely does the current flow.

The induction test is performed by applying the zinc end of a Daniell's battery of 10 cells to one end of the conducting wire for one minute, and then permitting the

The deflection thus produced is then compared with the deflection from a condenser of known capacity, which has also been charged by means of the same battery and for the same time. The greater the induction the greater the discharge, and the less the induction the better the cable. The results of all tests except the induction test, vary with the temperature, so allowances are made for differences of temperature by calculation, 75 deg. Fahrinheit being the standard. Another test is made to determine the electrical resistance of the copper wire, and this is done by means of Wheatstone's Diagram.

A FEW HINTS ON ELECTRIC SCIENCE.

(By S. T. Preston.)

It is my intention in this paper to touch on a few points of practical and general interest connected with the above subject. In no English elementary work on electricity have I observed that the useful law of Ohm has been treated with that attention which its importance merits. This law throws a clear light on all important points affecting the practical use of Voltaic batteries, and much confusion exists on this subject in those works where its application has been ignored. I shall therefore endeavour to explain and illustrate this law in such a manner as to be intelligible to all who follow the exposition given. In the first place it is necessary that the following statement of the law should be clearly understood. The strength of a Voltaic current, as measured by the amount of deflection of the magnetic needle, or by its power to effect chemical action, is proportional to the electro-motive force or tension of the electricity forming that current, or, which is the same thing, to the tension or accumulation of electricity at the poles of the battery when insulated—*i. e.*, not closed by a conductor. The strength of the current must also obviously be effected by the resistance it has to encounter in its passage, and it is inversely proportional to that resistance.

Such is Professor Ohm's law simply stated, which was evolved by him merely from theoretic considerations, and without recourse to experiment. The truth of it has since been thoroughly established by experimental investigation. The resistance of a Voltaic element or cell is made up, first, of the internal resistance of the liquid depending on its conducting power and the sectional area of it traversed by the current; secondly, of the resistance of the external circuit—*i. e.*, conducting wires, &c. We shall now proceed to examine some facts of importance deduced from this law. It can be expressed algebraically in a very simple manner.

Taking first the case of a single cell, and putting e for electromotive force, R for internal resistance, and r for external resistance, we have for strength of current,

$$S = \frac{e}{R + r}.$$

We will now examine what effect on the current is produced by the addition of cells arranged in one row. Supposing the total number of the cells to be expressed by the symbol n. The circuit having remained unchanged, the external resistance will continue constant, the internal resistance, however, will evidently be n times as great; also, the electro-motive force of one cell being e, that of n cells will be $n\,e$.

For the strength of current in this case we have, $S = \frac{n\,e}{n\,R + r}$.

The influence which the increase in number of cells arranged in one row has on the current will, as the formula shows, depend very much on the external resistance of the circuit r.

To show the matter in a clear light, we will investigate the two extreme cases.

Supposing the circuit to consist of a short and thick copper wire, whose resistance may, therefore, be neglected, compared with the internal resistance of the cell.

We have then for the strength of the current in this case, neglecting the symbol r,

$$S = \frac{n\,e}{n\,r} = \frac{e}{R}.$$

is the same value as that given above for the strength of current given by a single

shows that the internal resistance having, by the addition of cells, been augmented exactly in the same proportion, there is therefore no increase in the strength of current. Several important results follow from this. The current obtainable from any number of cells arranged in one row can never exceed that obtained from a single cell, when the resistance of the circuit is small. If, therefore, it is our intention to obtain a strong current in such a circuit, nothing can be gained by adding cells arranged in one row.

We will now consider the second extreme case. Supposing the resistance of the circuit to be so great in comparison with the internal resistance of the battery, that the latter may be neglected, striking out n R, the formula becomes, $S = \frac{n\,e}{r}$. Or, with a circuit of great resistance, the strength of the current increases very nearly proportionally to the number of elements added. In such cases, therefore, this is the proper arrangement of the cells. It will now be of interest to observe the effect produced by increasing the size of each cell; or, which is the same thing, placing the cells side by side, *i.e.*, with positive poles coupled together, as well as negative. The strength of current afforded by one cell was shown above to be, $S = \frac{e}{R + r}$.

The increase of surface of the battery is the augmentation of the sectional area of the fluid traversed by the current; and the internal resistance is therefore diminished in the same ratio.

If n cells be thus coupled, the resistance will be $\frac{R}{n}$, that of each cell being expressed by R.

In this case, the strength of the current will therefore be,

$$S = \frac{e}{\frac{R}{n} + r} = \frac{n\,e}{R + n\,r}.$$

Taking again the extreme case, where the external resistance made up of a short thick wire may be neglected, and striking out n r, the formula becomes $S = \frac{n\,e}{R}$. That is, when the resistance of the circuit is small, the current is augmented proportionally to the size of the cell, or to the number of cells combined in the manner described.

In the above description the terms "quantity arrangement" and "intensity arrangement" have been purposely avoided. The terms were invented previous to the introduction of Ohm's law, an acquaintance with which clearly shows the causes of the variation in the strength of the current in the different arrangements of the cells. These terms are therefore better avoided, as tending to mislead.

We have so far observed that, in dealing with a circuit of considerable resistance, the cells should be arranged in one row, and *vice versa*; and we shall now proceed to show for those who are interested in the subject, what particular arrangement should be selected in order that the maximum effect may be obtained in any case. Having a given number of cells to dispose of, and a circuit of given resistance, the rule is to arrange the cells in such a manner as to make the internal resistance of the battery equal to that of the circuit.

I shall attempt to make the algebraic proof as clear as possible.

As an illustration of the manner in which the various arrangements of the cells affect the internal resistance, we will take a particular case.

Supposing there are twelve disposable cells, and putting the resistance of each cell at unity; then for the arrangement in one row, the resistance will be 12. It will now be observed that if the cells be arranged in two rows of 6, the sectional area of each cell being doubled, and the length of the battery being reduced to one-half, the resistance will consequently amount to ¼ of that in the first case, or, $\frac{1}{2^2}$; that is, if the

noted that if the battery be made half the length, there are two rows available, and similarly for any other possible combination. The electro-motive force also varying as the number of cells arranged in line, would be halved in the case of two rows of six.

After this preliminary illustration we will proceed to the proof.

Suppose a battery arranged in such a manner that the internal resistance is equal to the resistance of the given circuit r, and calling the electro-motive force of the arrangement e. The strength of the current will be, according to Ohm's law,

$$S = \frac{e}{r + r} = \frac{e}{2r}$$

If now the battery be made x times shorter, the electro-motive force will be $\frac{e}{x}$, and the resistance, as before explained, $\frac{r}{x^2}$; and without changing the resistance of the circuit the expression for the strength of current will now be,

$$S = \frac{\frac{e}{x}}{\frac{r}{x2} + r} = \frac{e}{r\left(x + \frac{1}{x}\right)}$$

It is now our business to show that the value of the strength of current represented by this last expression, in which case the arrangement of the cells has been altered, is less than that obtained from the first formula, where the resistance of the battery was made equal to that of the circuit.

It will be observed that the value of the expression $\left(x + \frac{1}{x}\right)$, whatever values be assigned to x, must be greater than 2. Unity is of course excepted, which would represent no change in the arrangement of the cells. The value of S. in the second case is therefore diminished by any alteration in the arrangement of the cells. In order therefore to obtain the maximum of effect, the first arrangement is the correct one. From the above consideration it can be deduced that the strength of an electric current in any circuit varies as the square root of the number of cells employed.

To take an illustration; if four cells are used, and the number of cells be doubled, the electro-motive force will be augmented in the same ratio, but the internal resistance will also be increased. In order then that the electro-motive force due to eight cells may exercise its full effect in doubling the force of the current, it is necessary that the resistance should not be increased; it will therefore be necessary to double the area of the liquid traversed by the current by adding another row of eight cells, or sixteen in all. This proves the rule stated above. For the present I bring this subject to a conclusion.

ELECTRICITY: ITS THEORY, SOURCES, AND APPLICATIONS.

By J. T. Sprague.

We may conveniently sum up the principles of measurement in Fleming Jenkin's words:—"A battery or other rheomotor of unit electro-motive force will generate a current of unit strength in a circuit of unit resistance, and in the unit of time will convey a unit quantity of electricity through this circuit, doing in the same time a unit of work or its equivalent. These relations leave the absolute magnitude of the series of standards undetermined. Weber has proposed to fix the series in various ways, but the most convenient, where measurements have to be made by observations conducted by the aid of magnets, is probably that in which the series is fixed by the definition of the unit current, as that current the unit length of which at a unit distance exerts a unit force on the unit magnetic pole. The definition of the unit magnetic pole by Gauss and Weber, in its turn, depends solely on the units of mass, time, and

This is the base adopted, and we have now to study the units developed from it. The names given to the units are derived on the suggestion of Mr. Latimer Clark from those of the most distinguished electricians.

Electro-motive Force and Tension	the Volt.
Static Quantity	the Farad.
Resistance	the Ohm.
Quantity or Current	the Veber.

ELECTRO-MOTIVE FORCE.—Force or energy is the generic term of all the actions we are acquainted with, and modern science regards it as *motion* in some form when active, as the tendency to motion when in the latent or *potential* condition. We call it

WORK, as related to masses of matter.

AFFINITY, in the chemical relations of atoms of matter.

COHESION, in the relations of molecules of the same body.

ADHESION or friction, as related to the superficial molecules of different bodies.

HEAT, as related to the atoms and molecules of matter each moving independently among its neighbours.

ELECTRICTY, when connected with a complete circle of polarized molecules, this being the essential condition of electrical action.

Electro-motive force, then, is any action or power which tends to produce this polarized connected circle of molecules, and its degree is measured by the amount of tension or strain it can produce on such a circle.

Friction develops electro-motive force through the adhesion between superficial molecules in contact.

Chemical affinity by its efforts to break up the molecules acting on each other.

Mechanical motion produces it by exertion against the action of molecules; but all produce it only if the required conditions are present, otherwise they produce heat, &c.

THE VOLT.—This unit is simply a measure, but there exists no standard of it, and it is therefore purely a matter of calculation, being the hypothetical force needed to fulfil the conditions laid down in par. 187. It is 10^5 or 100,000 absolute units. Its nearest practical representation is the *Daniell's cell in perfect order; the force of this* cell is, according to the best authorities, 1·079, that is, the unit electro-motive force is ·9268 of a Daniell's cell. As the force exerted in a thermo-electric battery is constant for given ranges of temperatures, the standard volt might be obtained by ascertaining the number of alternations of two metals, copper and iron for instance, the junctions of which alternately at the freezing and the boiling points of water furnished the exact force; but as the Daniell's cell is a convenient and practical electro-moter, always at hand and easy to experiment with, it is probably the most convenient standard, subject only to correction by *the above figures. A table, to be hereafter given, of* the forces of the various other batteries in common use will enable calculations to be made of the forces of any combination.

TENSION, OR POTENTIAL.—This is very commonly regarded as the same thing as electro-motive force, but really it is its first action; although the two are always equal they are differently localized, the force lies only at the point of original action, the tension is distributed over the whole circuit. We may compare it to a strained spring in which is stored up in a state of tension the force which strained it, and which thus remains quiescent but *potential*, capable of producing effects equivalent to its generating force. It is thus a purely static condition, and can never rise beyond the degree equal to the resistance of the circuit, and *even when producing current the difference* of tension which generates the current will be proportioned to the resistance between any two points. It resembles the force stored up in an elevated reservior of water; as soon as the pressure rises beyond the weakest point of its containing boundary, rupture occurs, and the force or water passes away in a gentle current or a violent rush according to the degree to which the resistance has yielded. Hence tension never manifests itself, nor as all the effects of what is called static electricity are effects of leakage, or

fore also alters the tension. The reason of the enormous tension of frictional or static electricity is that it is developed against high resistance, the circuit being almost entirely composed of dielectrics or non-conductors, substances of high specific resistance.

The volt is the unit of tension also.

QUANTITY.—THE FARAD.—There is a considerable amount of difference among authorities as to this unit, only, however, as to a difference of a million times; it will probably be ultimately settled on the basis of the doctrine in section 187. Clark defines it as "that quantity of electricity which with an electro-motive force of one volt would flow through a resistance of one megohm in one second." This is not in accordance with the principle, but really describes one-millionth of the true unit, or what Varley calls the microfarad.

Although the farad is thus described as flowing, it really is a static unit; it means the amount of charge a condenser is capable of, and its most common use is as a measurement of the static charge which each wave of electricity imparts to a cable before it makes itself manifest at the distant end.

CURRENT.—THE VEBER.—This obviously should be the same thing as the unit of static quantity; it is furnished by the fundamental principles (par. 187) in accordance with Ohm's laws. Thus $C = \frac{E}{R}$ the current is proportionate to the electro-motive force divided by the resistance; substituting units, therefore, this gives $\frac{1}{1} = 1$, or by the actual values in absolute units, $\frac{\text{Volt.}}{\text{Ohm}} = \frac{100{,}000}{10{,}000{,}000} = \text{Veber } \cdot 001$, or one-thousandth of an absolute unit; but Clark calls the unit of current the $\frac{1}{100{,}000{,}000}$ of the absolute unit.

An idea of what the real value of this unit is may be derived from the statement that it decomposes per second ·0092 grammes of water, producing 17·2 cubic centimetres of mixed gases at standard temperature and pressure, or dissolves ·0332 grammes of zinc. The gramme being 15·434 grains, these figures, which do not however quite agree, make the unit equal to ·015 of the chemical equivalent unit used in these papers —or, in other words, this chemical unit is equivalent to 66·6 of the B. A. units of current, and by multiplying any of my figures by 66·6 the subject will be expressed in the standard units; but in the present confused condition of the subject I do not give this statement with any great confidence.

RESISTANCE.—THE OHM.—Here, at all events, we have something really definite, for of this alone is there a fixed value ascertained and standard measures issued. It is equal to ten million absolute units. Resistance is so important an item of electrical science that it deserves full explanation. It is whatever opposes that act of polarization and discharge along a chain of molecules which constitutes the electric current, and every substance has its specific resistance; this means that each such substance requires a definite exertion of force to set up the state of polarization and effect discharge. When this resistance is very great, the substance is a non-conductor or dielectric, such as gutta-percha. In chemical compounds, or "electrolytes," it is exactly proportioned to the heat the components give off in uniting, and so the same quantities of various substances require more and more force to overcome them—or, in other words, their resistance rises in proportion to what is commonly called the chemical affinity which holds them together. In metallic wires each also has its specific resistance for given lengths. These various actions will require full elucidation under the different heads. At present it is only necessary to say that, let the actual cause or source of resistance be what it may, all may be expressed by any one, and the most convenient is the measure of length of a wire of known resistance. Hence arose a great variety of units based upon any standard which was at hand, such as a length of copper or silver wire of a given size. Of these arbitrary units Siemen's is really the best, because based on mercury, a metal easily obtained pure; it is one metre in length

ley's unit is also commonly used; it is a mile in length of No. 16 copper wire, but this is a very uncertain measure. Wheatstone used a copper wire, 1ft. of which weighed 100 grains. The standard B.A. units or ohms are made of an alloy of platinum and silver, which changes its resistance very little with change of temperature, and, for the same reason, resistance coils should be made of German-silver wire. A standard unit once obtained, copies of it can be made by comparison, without reference to actual length and size of wire, and any required resistance is obtained by multiplication; but practically we must have an actual standard unit to start from, and it cannot be too strongly impressed upon any one wishing to really understand electricity, that he should obtain his measurements in this actual definite standard and prepare such instruments as will be hereafter described.

The ohm is equal to 1·0456 of Siemen's units.

Siemen's unit is equal to ·9564 of the ohm.

Varley's unit is equal to about 25 ohms—that is to say, the ohm is about 211ft. of ordinary good No. 16 copper wire.

I append here, as furnishing a comprehensive view of the various units, a table recently published by Mr. Varley in the *Electric Telegraph Review*.

Subject.	Unit's name.	Value in E. M. units.	1,000,000 units and value in E. M. units.	$\frac{1}{1{,}000{,}000}$ units and value in E. M. units.
Resistance	Ohm	107 ...	Megohm $= 10^{13}$..	
Capacity	Farad	10^{-7} ...	.....	Microfarad 10^{-13}
Potential	Volt	10^{5} ...		
Quantity	Veber	10^{-2} ...	.....	Microveber 10^{-8}

$$\text{Veber} = \frac{\text{Volt}}{\text{Ohm}} = \frac{105}{107} = 10^{-2}$$

$$\text{Microfarad} = \frac{\text{Volt}}{\text{Megohm}} = \frac{10^5}{10^{13}} = 10^{8}$$

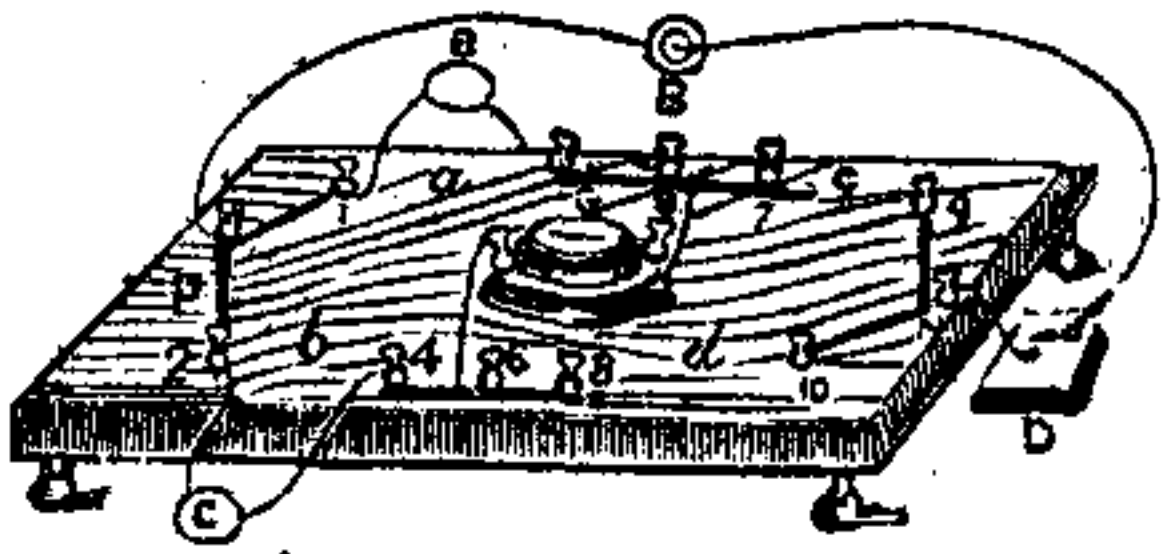
$$\text{Farad} = \frac{\text{Veber}}{\text{Volt}} = \frac{10^{-2}}{10^5} = 10^{-7}$$

$$\text{Microfarad} = \frac{\text{Microveber}}{\text{Volt}} = \frac{10^{-8}}{10^5} = 10^{-13}$$

The microfarad here represents what is usually called the farad.

For the sake of those who may not understand these formulæ it may be well to say that the small figures mean the several "powers," or repeated multiplication by the main figure, this being here 10, it may be shortly said that the expressions mean 1 followed by as many 0s as the small figure shows. Thus 10^7 means 10,000,000 (ten million); the negative sign places the 0s before the 1, thus 10^{-3} is ·001 (one thousandth).

Wheatstone's Bridge.—Before describing the various forms of resistance instruments and the properties of wires, I will give the description of this, the most perfect and convenient instrument for measuring resistances, and so comparing conductors, batteries, &c. It is based on the fundamental law of electric conduction, that the current will distribute itself through every path open to it in proportion to the resistances. This principle is utilized in the instrument by presenting two distinct paths for one current, each path being under control. In one is included the resistance to be measured—in the other, known resistances, which are varied until they are equal to and therefore balance the one to be measured. Fig. 54 is an oblong board, fitted with binding



screws P N, and 1 to 10, the wires belonging to which furnish the two paths between P and N, which are connected to the battery, which, if a resistance is to be measured, must be a constant one, Daniell's being the best. G is a galvanometer, which should be very delicate, but not of great resistance, and should therefore be made of not very fine wire and fitted with an astatic needle, with very little directive power, as it is not *intended to measure, but only to indicate the passage of a current*; such an instrument as described at page 2 will be suitable. Its terminals are connected to 5 and 6, and therefore it unites the two circuits. If there is the slightest difference in the resistance of these two, part of the current passes through the galvanometer to the one whose resistance is least. Between 1 and 3, 2 and 4, 7 and 9, 8 and 10, are openings, *a*, *b*, *c*, *d*, the other connections being made with stout wire, soldered to the screws as shown, but underneath. If these openings are closed by wires exactly alike, G will not be disturbed when battery contact is made, which, as many trials may be needed, is best done by a commutator, as shown at D. In using the instrument the resistance to be measured is connected to 1 and 2, as R; while the resistance coils C are connected to 2 and 4, and altered till G shows no action. The other openings are subordinate, and might be dispensed with, as they are generally closed by simple wires, but they add greatly to convenience, various resistances may be interposed in them, and the sum or differences will give the required resistance. Of course care must be taken that any extraneous resistances, such as connecting wires, are exactly alike on both sides.

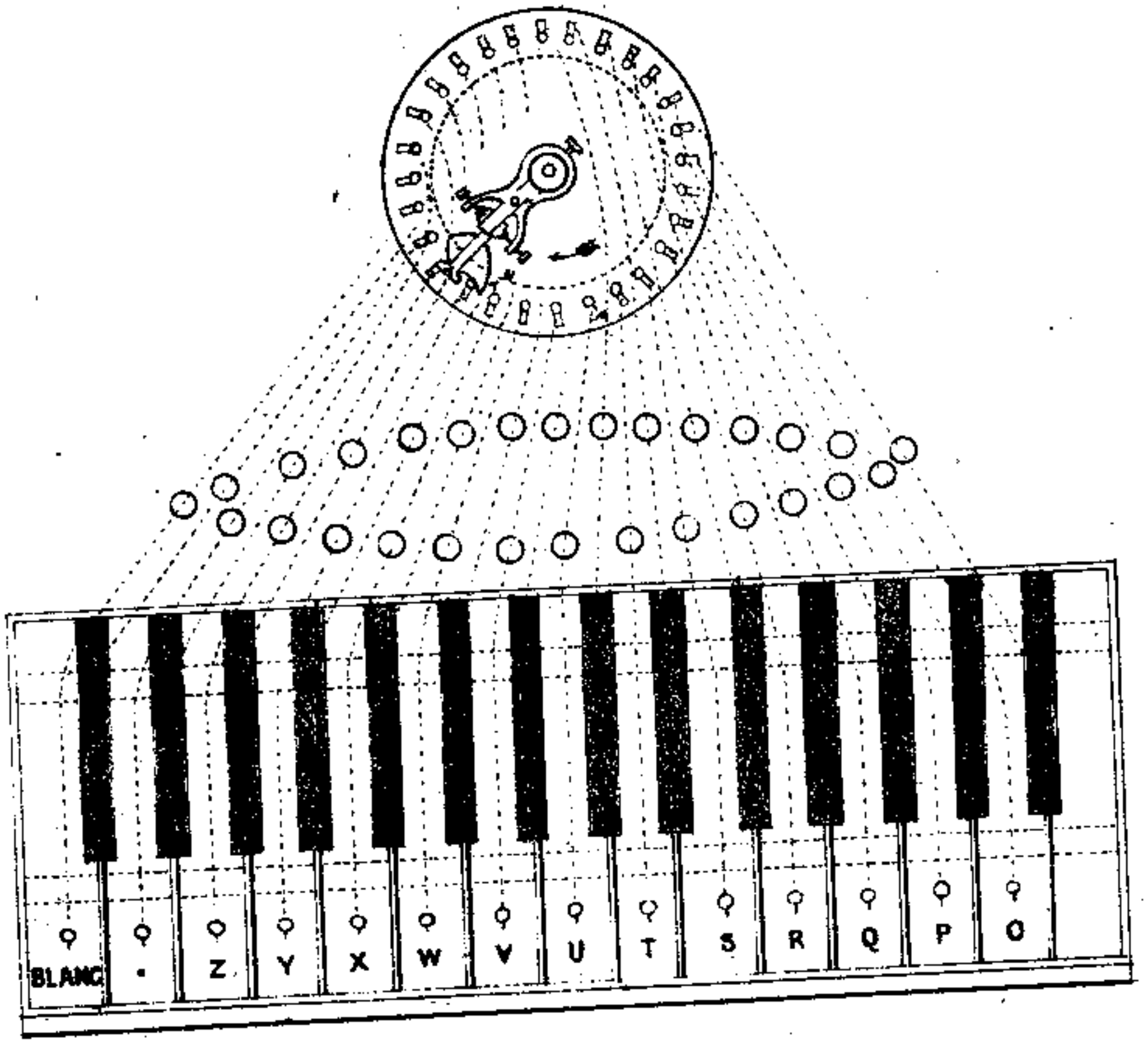
It is important to observe that not only must the total resistance of each path be alike, but it must also be evenly arranged, those in the openings *a*, *b* equal, and those in *c*, *d* equal to each other, for if those in *a*, *d* were alike, and also those in *b*, *c*, unless all were equal the greater part of the current would choose the path of least resistance and cross the galvanometer although the two sides of the balance would be equal. It should also be observed that the smaller the resistance of the galvanometer in proportion to that of the circuits the better, and therefore the openings *c*, *d* should be closed, not by stout wires, but by resistances much greater that that of the galvanometer.

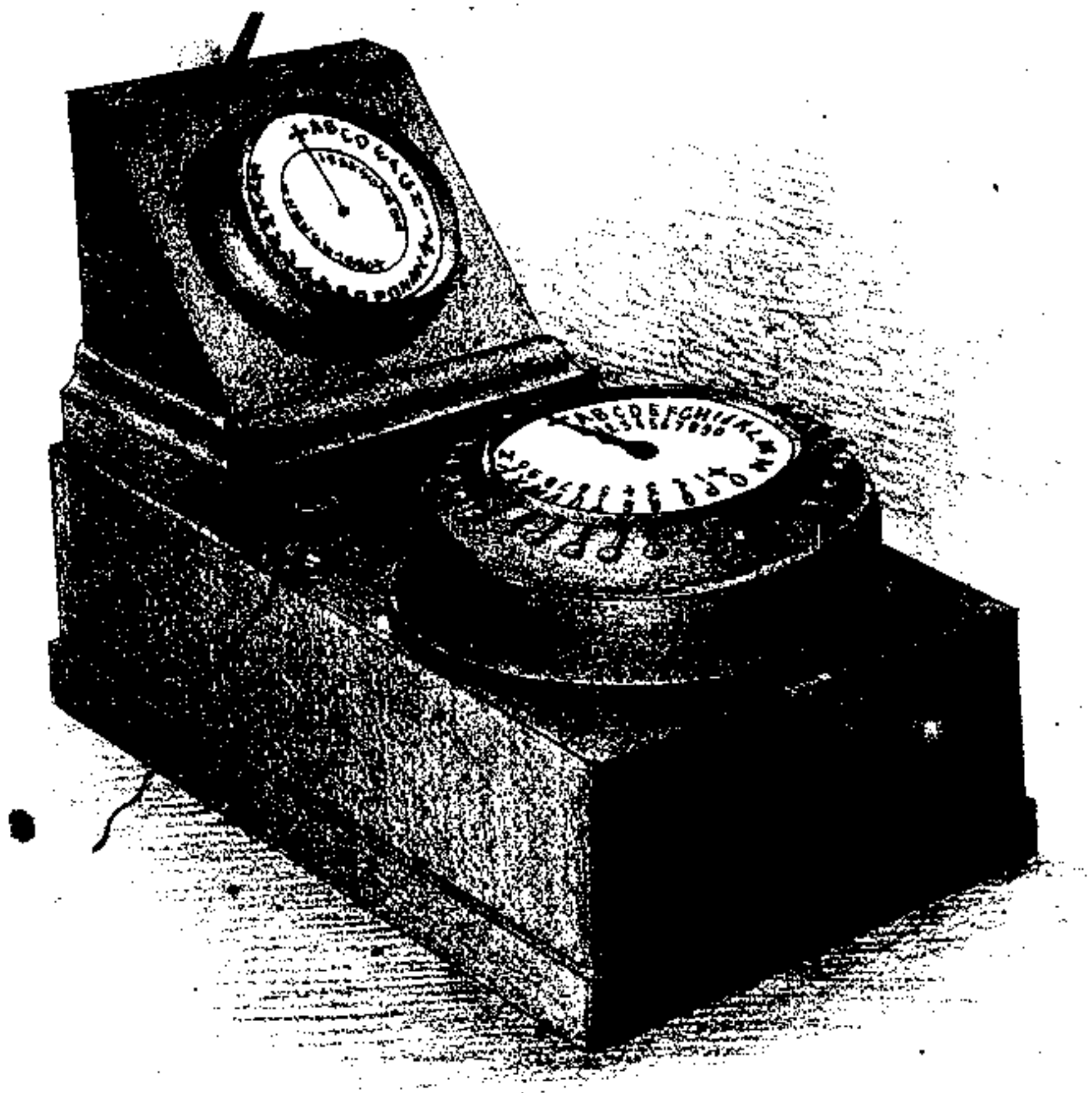
THE POST OFFICE AND THE TELEGRAPHS.

Now that the Post-office has fairly settled down into working order with the telegraph system, and is rapidly extending the wires throughout the length and breadth of the land, it may not be amiss if we endeavour to give an explanation, for the benefit of some of our readers, of the mechanism of the various instruments employed by the Post-office in this increasingly-important branch of the public service.

The telegraph instruments employed by the Post-office are of six kinds, viz., the single needle, the bell, Hughes's type-printing, the Morse printing, Wheatstone's A B C, and Wheatstone's automatic. The A B C instrument is used principally in connection with private wires; the type-printing and automatic instruments are employed only in first-class offices; whilst the single needle, the Morse, and the bell are those in general use. There are, at present, two kinds of single needle instruments, one with a handle and the other with two keys, somewhat resembling

Fig. 53.





former, and remain the only single-needle instrument in use. The two keys are termed the right and left, and the alphabet is read by causing the upper point of the needle to incline in one direction or the other as *either of the keys is depressed.* Thus for the letter A an inclination is given to the needle towards the left, and then one towards the right, represented on paper thus V. For the letter E one inclination to the left is made, and for T one to the right; whilst I is represented by two inclinations to the left, and M by two to the right. The other letters are obtained by a variation of the number and position of the inclinations to the right and left. The punctuation marks are designated by a multiplication or a combination of the signs used for some of the letters, as are also the signals between the communicating offices. Thus the "period" is represented by three Is, the comma by three As; and the intimation that the message is understood, which should be given after each word, is conveyed by the sign for the letter T, whilst the contrary is implied by the sign for E. Until recently the only instrument in general use was the double-needle, in which the letters of the alphabet were divided between two discs, and the number of inclinations imparted to the needle on one or other of the dials spelt out the message; but although this was undoubtedly the most rapid of the needle instruments, and was employed in transmitting speeches from the Throne and parliamentary debates, it is not used in the Post-office system, and, on principles of economy and accuracy, the single-needle will doubtless soon supersede it everywhere.

The bell instrument is probably the most rapid of non-automatic telegraphs, but is of course not well suited for offices where a number of instruments are in use at the same time and in the same room. It consists of two bells of different pitch, known as the right and left bell, as the message is spelt out by the number and variation of the strokes on either or both bells. Thus A is designated by one stroke on the left and one on the right bell; E by one on the left; T one on the right; whilst I is represented by *two strokes on the left, and M by two on the right* bell.

In the Morse printing instrument the message is conveyed by a series of dots and dashes, which, by a variation of arrangement, are made to designate the whole of the letters of the alphabet. These dots and dashes are impressed in a continuous line on a narrow slip of paper, and are read of and transcribed by the receiving clerk. By this means a record of a telegram is kept in the exact state in which it was sent. The signals are produced by the action of an electro-magnet, which attracts an armature carrying a lever. At one end of this lever is a point or "style" which impresses on a strip of paper, moved by the agency of clockwork, the "dots and dashes" that spell out the message. The signals are forwarded by depressing the end of a brass lever, either momentarily to produce a "dot," or for a space of time sufficient to produce a "dash." By this means a succession of currents are sent along the line, and the dots and dashes are impressed on the paper at the receiving station, in exact coincidence with the length of time the lever-key at the sending station was depressed. Thus the letter A is represented by · — ; E by · ; T by — ; whilst I is designated by · ·, and M by — —. It will be observed by the attentive reader that, although *the message is conveyed in these three methods* by the employment of different signs, the alphabet is the same for each instrument. Thus, with the needle instrument, A is represented by one inclination to the left and one to the right; with the bells, it is represented by one blow on the left and one on the right; and with the Morse, by a dot and dash; whilst I is signalled by two inclinations to the left, two strokes on the left bell, or two dots on the strip of paper. This arrangement runs throughout the whole alphabet, the dots and dashes of the Morse corresponding to the strokes on the left or right bell, and to the inclinations of the needle to the left or right.

But perhaps the most ingenious, as it undoubtedly is the most valuable, of all inventions for sending messages by the telegraph is Hughes's type-printing instrument, an illustration of part of which is here given. It consists of a train of wheels driven by a weight, the speed being governed by a vibrating rod, the free end of which is attached to a crank on a fly-wheel, so that its arc of vibration can increase or diminish according to the amount of force employed. By this means the instrument can only run at the speed permitted by the vibrations of the rod; and by moving a sliding

synchronous, or so near that the difference will not exceed 1-30,000th of a second in a minute. The type-wheel contains 54 different characters, which by a simple contrivance are acted upon by 28 keys; this result being obtained by arranging the letters and figures in two series, and by means of a lever causing the type-wheel to present one or the other at will. The type-wheel, which revolves continuously, carries by means of bevel wheels a contact-making arm, which travels aronnd the disc of pins acted upon by the finger-keys. When a key is pressed down the corresponding pin in the disc comes into contact with the revolving arm, and the current is thus transmitted, passing in its course through the magnet, and detaching the armature, which thus comes into contact with a detent. This detent locks a shaft to the train in motion, and when it is released a cam raises the paper against the type-wheel, where it is impressed with the required letter. The current acts in a similar way at the receiving station, by detaching the armature, thus permitting the printing shaft to make one revolution and to take the impression of the letter from the type-wheel, which is brought into a similar position to that at the sending station by means of a detent, which only permits the wheel to start when in unison with that of the sending machine. A feature of great importance is the arrangement by which a maximum effect is obtained from the electro-magnet. In this instrument the armature is held constantly against the cores of the magnet, whilst an adjustable spring tends constantly to draw it away. When a key is touched, the magnetism by which the armature is held is neutralized, and the spring exerts its full power. The armature then rises and strikes against the detent, thus unlocking the printing shaft, which shaft, by means of a cam, replaces the armature in its original position, at the same time taking the impression of the letter. The speed of this instrument is about 200 letters a minute, and its great value, particularly for long submarine lines, is apparent, from the fact of one wave only being required for each letter, and from the simplicity and sensitiveness of the electrical arrangements. The patent rights have been purchased *by the Governments of France and Italy for their respective territories*; the American Telegraph Company have the right to use it in America, and the sole right for the United Kingdom is now vested in the Postmaster-General.

We have left ourselves but little space to speak of the other instruments in use at the Post-office; it must be sufficient, therefore, to say that Wheatstone's automatic *system consists* of a *perforator*, which punches *holes in a strip of paper; a transmitting* apparatus, into which the perforated slip is inserted, and the current sent by means of needles which penetrate the orifices in the paper; the recording or printing apparatus, which, by means of pens supplied with ink, mark the strip of paper at the receiving station with "dots and dashes;" and the translator, by the operation of which the telegraphic symbols are reduced to the ordinary characters of the alphabet. The *A B C instrument of Wheatstone* is perhaps the most readily understood of any and is extensively used by private firms. It consists of a communicator for sending messages and an indicator or receiving instrument. The dial of both communicator and indicator contains the letters of the alphabet, the ordinary figures, and a few other signs. Around the dial of the communicator are arranged keys corresponding to the letters and signs on the dial. The interior of the instrument contains a permanent horse-shoe magnet, with coils for the production of the necessary currents. By means of the handle shown in the engraving, a soft iron armature is made to revolve, and if a key is then pressed down the hand will revolve till it reaches the corresponding letter, and a current is sent along the wire, which moves the hand of the receiving indicator to the letter or character which it represents.

The method of representing time by the telegraph is by using the letters A to M to designate the figures on a clock-dial. Thus A will represent 1 o'clock and M will stand for 12; whilst M A would be 5 minutes past 12, and A B 10 minutes past 1. The notation of the exact time to a minute is accomplished by using the letters R S W X to represent the minute marks on the clock-face; thus B A X would mean 9 minutes after 2, and G S 2 minutes after 7.

Here we must bring our slight description of the instruments in use by the Post-office to a close, premising that, truly wonderful as the invention is in its present state

THE GOVERNMENT TELEGRAPH IN ENGLAND.

(Times, February 5, 1870.)

This morning witnesses a change similar, both in character and in its probable effects, to the adoption of the Penny Post. The Telegraphic System of the country is now in the hands of the Post Office. An immense business has passed quietly into the hands of the Government; the network of wires spread over the country is, as it were, gathered up into one hand, and the provision of the most rapid means of mutual communication is now the responsible duty of a Department of State. Science has never achieved a greater triumph than in the patient discoveries by which the most subtle of known agencies has thus been developed into one of the most general and most important conditions of social, commercial, and public life. The purchase money has been paid over to the Telegraph Companies, and a natural force, scarcely recognized within the lifetime of many of us, has already proved worth six millions of money. It is but too evident, in fact, that the Companies have made an excessively good bargain with the public. There is no mistaking the significance of a premium of one, two, or even three hundred per cent., on shares. But, apart from the fact that the State always buys dear, we do not grudge the purchase money. The Companies have done good service as pioneers, and we are stepping into the fruits of their work. We have not the slightest doubt that, even at the price paid, the country will find it has made a good bargain. No apprehensions need be entertained for the revenue, but pecuniary profit to the Government is the least of the advantages to be expected.

It is some time since the subject was discussed and it may not be amiss to remind the reader of the practical consequences of this transfer. The first, and, perhaps, greatest, change is that the Telegraph will now become nearly as ubiquitous as the Post. Hitherto, Telegraphic Offices have been scarcely more numerous or accessible than Railway Stations. They were confined to towns and the great lines of communication. This was a necessary consequence of the business being in the hands of Commercial Companies. It was the interest of such bodies to carry the wires only to those places from which they could expect considerable and constant business. It was no part of a Company's duty to consider the convenience of the public, except so far as it was likely to contribute directly to the shareholders' profits. The consequence was that we possessed an excellent Telegraphic Service between the chief centres of commercial and political life, but a very limited and imperfect service between these centres and outlying points. Little more could be expected than was furnished by the service between London and Manchester, but it might be a matter of considerable trouble, time, and expense to telegraph to a large village or small town lying a little off the direct line between the two places. In fact, a messenger could often in such cases have arrived before a Telegraphic Message, and without much additional expense. It will be the duty of the Government, on the contrary, to provide every facility for the public, compatible with a reasonable return on the capital invested. If the correspondence between two great towns proves highly remunerative, the superfluous profits may be applied towards the extension of branch lines, very useful to the public, but not likely to pay their own expenses. Thus, the first result of the change will be to nearly double the number of Telegraph Offices. Instead of 1882 places hitherto served by the Companies, we have been promised that the Government will serve 3,376; and instead of only 247 branch offices, there are now to be 842. These numbers, moreover, will increase as the system gets into working order. Whereas there has been hitherto one Telegraph Office to every 13,000 of the population, the Government propose to furnish one office to every 6,000 persons. The intention is, we believe, to render every Money Order Office a Telegraph Office. But the means of Telegraphy are to extend beyond even the Telegraph Offices. It is proposed to sell stamped forms, which persons may keep in hand like postage envelopes; and by dropping one of these into the nearest pillar box or post-office, the message will be forwarded by Telegraph when the box is next cleared. In short, we shall be able to send a Telegram with as much facility as we now send a letter. The wires will cover the country like a vast spider's web, from any point of which we shall be able to make ourselves felt, by an electric tremor, at any other point.

The Telegraph, therefore, ought now to be as convenient a means of communication as the Post. In addition to this, we shall know that we can send a Telegram at a fixed and moderate cost. This is an advantage precisely similar to that of the Penny Postage, and its greatest advantage lies, not merely in the reduction of expense, but in the removal of all uncertainty and trouble. The gain in cheapness will be very considerable, for though most of the companies adopted a shilling charge for twenty words, the additions for delivery of the message were often comparatively large. The Government, it was understood last year, will make no charge for delivery, the increase in the number of stations greatly diminishing the expense of this part of the work. In time—and we are assured in no long time—the charge may be reduced to sixpence; but it is prudent to commence with the price actually tested by experience. The fixity of charge, however, will be almost as great an incitement as its diminution to the use of the wires. Uncertainty how much he might have to pay made a man hesitate before sending many a Telegram, and, as a rule, to hesitate about such things is to decide against them. We shall now know that, for a shilling, we can send any ordinary message anywhere, and possessing the certainty of this facility, we shall learn to use it. The Telegraph, in fact, with all its known capabilities, has never yet been a familiar agency to people in general. It has never quite shaken off the mystery from which it has so lately begun to emerge. To send or receive a Telegram, at least in private life, has been, to the mass of people, something strange and exceptional, and even, from association, rather disagreeable. For the future we shall carry Telegrams in our pockets as easily as shillings and postage-stamps, and we shall soon learn to use and receive them with similar readiness.

It is very possible it will take some little time before this immense advance in our means of communication is fully appreciated; but the day will surely come when we shall wonder how life was managed without Government Telegraphs, just as we now wonder how people could get on without the Penny Post. We shall be surprised how we could exist without being able, at all times and places, to get directions in an unexpected difficulty, to convey a sudden order or to countermand it, to make or cancel an appointment, for a simple shilling, or sixpence, or some day, perhaps, for less. We shall not understand what it is to be out of speaking distance of each other. The rapidity and completeness with which these advances will be realized must depend, in great measure, on the success with which the Government opens the new system. The plan we report this morning, of bringing the errand-boys under a regular discipline, is an instance of forethought which promises well for the rest of the arrangements. The essential points will be rapidity and certainty, and of these, perhaps, certainty is of the greater importance. The rapidity is pretty sure to improve, but a lack of certainty would be fatal to confidence.

MADRAS TIME.

Madras "Time" for Messages received and sent, is used in the Indian Government Telegraph Offices; and the day begins after 12 o'clock at night, from which the hours are counted up to 24.

TELEGRAPHIC NUMERALS.

1.	2.	3.	4.	5.	6.	7.	8.	9.	0.
B	C	G	J	K	L	N	Q	V	Z

TABLE OF SIZES, WEIGHTS, AND RESISTANCES OF IRON WIRE.

Gauge.	Diameter.	Weight of 100 yds.	Weight of 1 Mile.	Length of 1 Cwt.	Area of Section.	Breaking Weight.	Resistance per Mile.	Remarks.
		lbs.	lbs.	Yards.	Sq. In.	lbs.	British Association Units.	
1	·3	68·75	1210	162	·071	4520	4·109	The sizes Nos. 5½, 9½, 12½, 15* are special Wires made for the Indian Telegraph Department, and the Breaking Strain shewn opposite them is that at which they are tested on purchase and it is calculated at the rate of 17500 feet of their own length. The other Breaking Strains are calculated at 64000 lbs. per square inch; at which the very best wire will break if slightly annealed. But, as the Breaking Strain varies with the quality of the wire, and the degree to which it is annealed, it is not safe to calculate *on more than ⅔ of this* weight. To calculate the weight of copper wire it may assumed roughly as ⅛ heavier than Iron.
2	·28	59·9	1054	187	·062	4344	4·717	
3	·26	51·65	909	215	·053	3400	5·470	
4	·24	44	775	255	·045	3896	6·409	
5	·22	37	651	303	·038	2432	7·637	
5½	·21	34·09	600	328·5	·0346	1988	8·286	
6	·2	30·56	538	361	·031	2008	9·245	
7	·185	26·15	461	428	·0265	1776	10·78	
8	·17	22·1	389	509	·023	1472	12·79	
9	·155	18·36	323	609	·0195	1248	15·39	
9½	·149	17·04	300	657	·0173	994	16·57	
10	·14	14·97	264	747	·016	1064	18·83	
11	·125	11·95	211	939	·0125	800	23·56	
12	·11	9·24	163	1244	·01	640	30·50	
12½	·105	8·52	150	1314	·0086	497	33·14	
13	·095	7·05	124	1589	·0071	455	40·09	
14	·085	5·51	97	2031	·0057	365	51·26	
15	·075	4·29	76	2608	·0044	282	65·42	
15*	·075	4·26	75	2628	·0043	248	66·29	
16	·065	3·22	57	3473	·0033	191	87·22	
17	·057	2·48	44	4515	·0026	167	113·00	
18	·05	1·91	34	5600	·002	128	146·23	
19	·045	1·55	27	7246	·0016	103	184·14	
20	·04	1.22	21	9168	·0013	83	236·76	
21	·035	·94	17	11980	·001	64	292·46	
22	·03	·69	12	16300	·0007	45	414·32	

TABLE OF NO. OF YARDS PER POUND OF SMALL COPPER WIRE—(CULLEY.)

Biringham Wire Gauge.	Diameter. Inches.	Diameter. Millimettes.	No. of Yards in 1 pound.	
24	·025	·635	177·7	
25	·023	·584	210·0	
26	·019	·483	307·8	
27	·018	·457	342·94	
28	·016	·406	434·03	
29	·015	·381	493·8	
30	·014	·355	569·51	
31	·012	·305	771·6	
32	·010	·254	1111·11	
34	·0096	·244	1205·6	
35	·0087	·281	1466·6	
36	·0079	·200	1780·3	
37	·0067	·170	2475·2	
38	·0058	·147	3302·9	
39	·0042	·106	6298·7	
40	·0039	·099	7305·0	
41	·0033	·084	10202·0	

A strand of No. 16 Copper Wires Weight 2·017 oz. per yard, 221·87 lbs. per mile.

LABOUR FOR CONSTRUCTION.

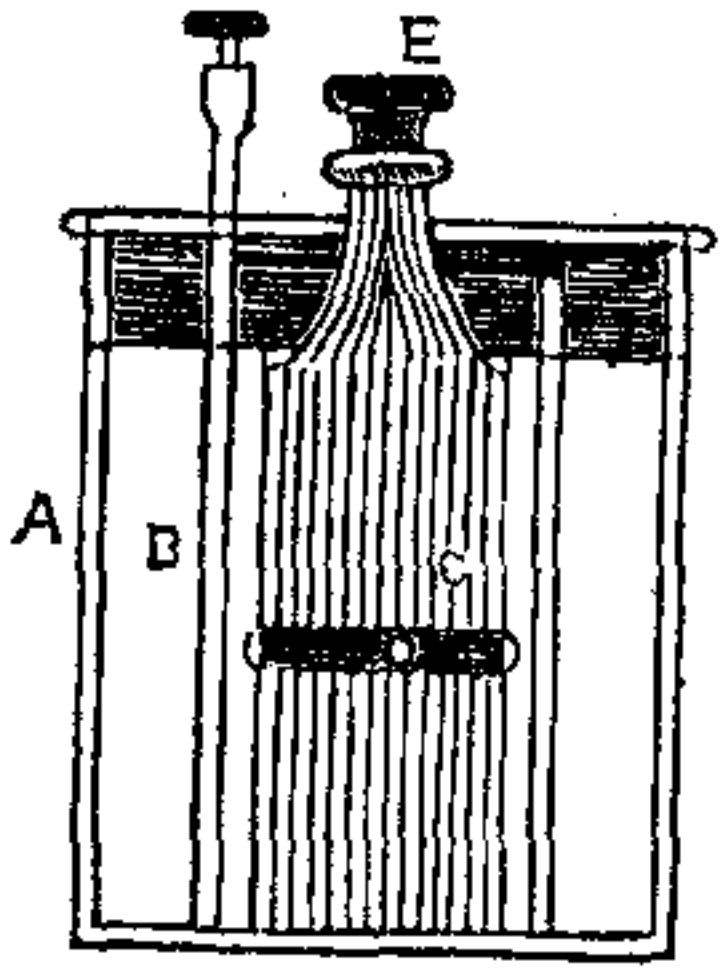
Nature of work.	Description of Labourers.	Percentage. Per	Men.
Fitting Standards	Carpenters ...	Standard ...	0·1
	Coolies ...	,, ...	0·5
Digging holes ... in clay	Coolies ...	,, ...	1·0
rubble	,, ...	,, ...	2·0
rock	,, ...	,, ...	0·5
Erecting posts	,, ...	,, ...	1·0
Fitting couplings	,, ...	,, ...	0·2
Insulating	,, ...	Insulator ...	
Erecting Wire including uncoiling, binding to insulators, &c.	Coolies ...	Mile ...	6·0
Marking out line, and Cutting small trees or jungle	Coolies ...	,, ...	4·0
Repairing Tools	Carpenters ...	,, ...	0·5
	Smiths ...	,, ...	0·5
	Coolies ...	Each ...	0·5
Twisting Wire Stays	,, ...	,, ...	0·5
Fixing Stays	,, ...	,, ...	1·0
Digging up old posts	,, ...	,, ...	4
Taking down and coiling old Wire ...	,, ...	,, ...	1
Jointing	,, ...	,, ...	

TABLE OF WAGES.

ANNAS PER DAY.

No. of *men* or days.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	No. of men or days.
	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	RS. A.	
1	0 1	0 2	0 3	0 4	0 5	0 6	0 7	0 8	0 9	0 10	0 11	0 12	0 13	0 14	0 15	1
2	0 2	0 4	0 6	0 8	0 10	0 12	0 14	1 0	1 2	1 4	1 6	1 8	1 10	1 12	1 14	2
3	0 3	0 6	0 9	0 12	0 15	1 2	1 5	1 8	1 11	1 14	2 1	2 4	2 7	2 10	2 13	3
4	0 4	0 8	0 12	1 0	1 4	1 8	1 12	2 0	2 4	2 8	2 12	3 0	3 4	3 8	3 12	4
5	0 5	0 10	0 15	1 4	1 9	1 14	2 3	2 8	2 13	3 2	3 7	3 12	4 1	4 6	4 11	5
6	0 6	0 12	1 2	1 8	1 14	2 4	2 10	3 0	3 6	3 12	4 2	4 8	4 14	5 4	5 10	6
7	0 7	0 14	1 5	1 12	2 3	2 10	3 1	3 8	3 15	4 6	4 13	5 4	5 11	6 2	6 9	7
8	0 8	1 0	1 8	2 0	2 8	3 0	3 8	4 0	4 8	5 0	5 8	6 0	6 8	7 0	7 8	8
9	0 9	1 2	1 11	2 4	2 13	3 6	3 15	4 8	5 1	5 10	6 3	6 12	7 5	7 14	8 7	9
10	0 10	1 4	1 14	2 8	3 2	3 12	4 6	5 0	5 10	6 4	6 14	7 8	8 2	8 12	9 6	10
11	0 11	1 6	2 1	2 12	3 7	4 2	4 13	5 8	6 3	6 14	7 9	8 4	8 15	9 10	10 5	11
12	0 12	1 8	2 4	3 0	3 12	4 8	5 4	6 0	6 12	7 8	8 4	9 0	9 12	10 8	11 4	12
13	0 13	1 10	2 7	3 4	4 1	4 14	5 11	6 8	7 5	8 2	8 15	9 12	10 9	11 6	12 3	13
14	0 14	1 12	2 10	3 8	4 6	5 4	6 2	7 0	7 14	8 12	9 10	10 8	11 6	12 4	13 2	14
15	0 15	1 14	2 13	3 12	4 11	5 10	6 9	7 8	8 7	9 6	10 5	11 4	12 3	13 2	14 1	15
16	1 0	2 0	3 0	4 0	5 0	6 0	7 0	8 0	9 0	10 0	11 0	12 0	13 0	14 0	15 0	16
17	1 1	2 2	3 3	4 4	5 5	6 6	7 7	8 8	9 9	10 10	11 11	12 12	13 13	14 14	15 15	17
18	1 2	2 4	3 6	4 8	5 10	6 12	7 14	9 0	10 2	11 4	12 6	13 8	14 10	15 12	16 14	18
19	1 3	2 6	3 9	4 12	5 15	7 2	8 5	9 8	10 11	11 14	13 1	14 4	15 7	16 10	17 13	19
20	1 4	2 8	3 12	5 0	6 4	7 8	8 12	10 0	11 4	12 8	13 12	15 0	16 4	17 8	18 12	20
21	1 5	2 10	3 15	5 4	6 9	7 14	9 3	10 8	11 13	13 2	14 7	15 12	17 1	18 6	19 11	21
22	1 6	2 12	4 2	5 8	6 14	8 4	9 10	11 0	12 6	13 12	15 2	16 8	17 14	19 4	20 10	22
23	1 7	2 14	4 5	5 12	7 3	8 10	10 1	11 8	12 15	14 6	15 13	17 4	18 11	20 2	21 9	23
24	1 8	3 0	4 8	6 0	7 8	9 0	10 8	12 0	13 8	15 0	16 8	18 0	19 8	21 0	22 8	24
25	1 9	3 2	4 11	6 4	7 13	9 6	10 15	12 8	14 1	15 10	17 3	18 12	20 5	21 14	23 7	25
26	1 10	3 4	4 14	6 8	8 2	9 12	11 6	13 0	14 10	16 4	17 14	19 8	21 2	22 12	24 6	26
27	1 11	3 6	5 1	6 12	8 7	10 2	11 13	13 8	15 3	16 14	18 9	20 4	21 15	23 10	25 5	27
28	1 12	3 8	5 4	7 0	8 12	10 8	12 4	14 0	15 12	17 8	19 4	21 0	22 12	24 8	26 4	28
29	1 13	3 10	5 7	7 4	9 1	10 14	12 11	14 8	16 5	18 2	19 15	21 12	23 9	25 6	27 3	29
30	1 14	3 12	5 10	7 8	9 6	11 4	13 2	15 0	16 14	18 12	20 10	22 8	24 6	26 4	28 2	30

FAVRE'S GALVANIC BATTERY.



A. Outer Jar containing Solution of Common Salt.

B. Zinc Cylinder or positive Element.

C. Porous Jar or Bottle, contains Nitric Acid, is made of Graphite and forms the Negative Element.

D. India rubber ring, separating the Jar C. from the Zinc Cylinder.

E. Gutta Percha Stopper.

MINOTTI'S ELEMENT.

Which is the simplest and least expensive form of Daniell's element, consists of an Earthernware jar, at the bottom of which is placed a disc of sheet copper connected to an insulated wire. The jar is half filled with sulphate of copper crystals, over which a dise of felt is placed, and above this a thick layer of sawdust to act as a Diaphragm. The zinc plate is circular; and lies upon the Saw dust. When in use, the cell is filled up with acidulated water. A thin layer of oil above this is found useful to prevent evaporation.

VULCANITE.

Vulcanite, when pure, should consist only of India Rubber and Sulphur. Its specific gravity is about 1.31. It should present a clean Conchoidal surface when broken; a granular fracture is due to admixture of other materials. Its surface when polished, should be free from specks or indentations. By frictions with a black silk rubber it becomes strongly excited with negative electricity which in a dry atmosphere it should retain for some hours. In thin strips it is very elastic, and when heated it may be bent and will retain its new shape or form permanently when cooled.

The surface of Vulcanite becomes conducting, partly by the condensation of moisture, and a slight film of Sulphurous Acid, which is produced by the exidates of Sulphur. On this account, all Vulcanite supports and connections should be repeatedly washed with boiling water, and rinsed well in distilled water, and dried. This is the most effectual way of dealing with Vulcanite apparatus when found leaky, as friction will not remove entirely the film of acid. It is however better to keep its surface

CHATTERTON'S COMPOUND.

The compound, by means of which the alternate coatings, of Gutta Percha upon a cable conductor are cemented together, is composed of the following ingredients :—

Stockholm tar	1 part.	by weight.
Resin	1 part.	
Gutta Percha	3 parts.	

This compound is used also for filling up the interstices of Strand Conductors. Its specific gravity is about the same as that of ordinary Gutta-Percha, its insulating capacity, however is much less.

TABLE OF THE WEIGHT OF IRON PER NAUTICAL MILE IN CABLES OF DIFFERENT SIZES INCLUDING 3 PER CENT FOR LAY.

Size of wire B. W. G.	Diameter in miles.	Number of wires in Cable.									
		9	10	11	12	13	14	15	16	17	18
		CWT.	CWT.	CWT.	CWT.	CWT.	CWT.	CWT.	CWT.	CWT.	CWT.
00	380	191	212	233	254	276	297	318	339	360	382
0	340	153	170	187	204	251	238	255	271	289	305
1	300	119	132	145	158	172	185	198	211	224	238
2	284	107	118	130	142	153	166	177	189	201	213
3	259	89	98	108	118	127	138	147	157	167	177
4	238	75	83	91	100	108	116	125	133	141	149
5	220	64	71	78·1	85	92·3	100	107	114	121	128
6	203	54	60	66·0	72	78·0	85	90·0	97	102	109
7	180	43	47	51·7	57	61·1	66	70·5	76	79·9	85
8	165	35·8	39·8	43·8	47·7	51·7	55·7	59·7	63·6	67·7	71·6
9	148	28·9	32·1	35·3	38·6	41·7	45·0	48·2	51·4	54·6	57·8
10	134	23·6	26·3	28·9	31·5	34·2	36·8	39·5	42·0	44·7	47·3
11	120	19·0	21·1	23·2	25·3	27·4	29·6	31·7	33·8	35·9	38·0
12	109	15·6	17·3	19·0	20·8	22·5	24·2	26·0	27·7	29·4	31·2
13	95	11·9	13·2	14·5	15·8	17·2	18·5	19·8	21·1	22·4	23·7
14	83	9·6	10·1	11·1	12·1	13·1	14·1	15·2	16·2	17·2	18·2
15	72	6·8	7·5	8·3	9·0	9·8	10·5	11·3	12·0	12·8	13·5
16	65	5·5	6·1	6·7	7·3	7·9	8·5	9·2	9·7	10·4	10·9

APPROXIMATE CUBICAL CONTENTS OF ROUND TELEGRAPH POLES.

Length Feet.	Mean Diameter in Inches.																
	5	5¼	5½	5¾	6	6¼	6½	6¾	7	7¼	7½	7¾	8	8¼	8½	8¾	9
18	2·45	2·70	2·96	3·24	3·53	3·83	4·14	4·47	4·81	5·16	5·52	5·89	6·28	6·68	7·09	7·51	7·95
20	2·72	3·00	3·29	3·60	3·92	4·25	4·60	4·97	5·34	5·73	6·13	6·55	6·98	7·42	7·88	8·35	8·83
22	2·99	3·30	3·62	3·96	4·31	4·68	5·07	5·46	5·87	6·30	6·74	7·20	7·67	8·16	8·66	9·18	9·71
24	3·27	3·60	3·95	4·32	4·71	5·11	5·53	5·96	6·41	6·88	7·36	7·86	8·37	8·90	9·45	10·02	10·60
26	3·54	3·90	4·28	4·68	5·11	5·53	5·99	6·46	6·94	7·45	7·97	8·51	9·07	9·65	10·24	10·85	11·48
28	3·81	4·20	4·62	5·04	5·49	5·96	6·45	6·95	7·48	8·02	8·58	9·17	9·77	10·39	11·03	11·69	12·17
30	4·09	4·50	4·94	5·40	5·88	6·38	6·91	7·45	8·01	8·60	9·20	9·82	10·47	11·13	11·82	12·52	13·25
32	4·36	4·81	5·27	5·77	6·28	6·81	7·37	7·95	8·55	9·77	9·81	10·48	11·17	11·87	12·61	13·36	14·13
34	4·63	5·11	5·60	6·13	6·67	7·24	7·83	8·44	9·08	9·74	10·43	11·13	11·86	12·62	13·39	14·19	15·02
36	4·90	5·41	5·93	6·49	7·06	7·66	8·29	8·94	9·62	10·32	11·04	11·79	12·56	13·36	14·18	15·03	15·90
38	5·18	5·71	6·26	6·85	7·46	8·09	8·75	9·44	10·15	10·89	11·65	12·44	13·26	14·10	14·97	15·86	16·78
40	5·45	6·01	6·59	7·21	7·85	8·52	9·21	9·94	10·69	11·46	12·27	13·10	13·96	14·84	15·76	16·70	17·67

TELEGRAPH MORSE ALPHABET.

A.	· —	1.	· — — — —
B.	— · · ·	2.	· · — — —
C.	— · — ·	3.	· · · — —
D.	— · ·	4.	· · · · —
E.	·	5.	· · · · ·
F.	· · — ·	6.	— · · · ·
G.	— — ·	7.	— — · · ·
H.	· · · ·	8.	— — — · ·
I.	· ·	9.	— — — — ·
J.	· — — —	0.	— — — — —
K.	— · —	Full Stop (.)	· — · — · —
L.	· — · ·	Colon (:)	— — — · · ·
M.	— —	Semicolon (;)	— · — · — ·
N.	— ·	Comma (,)	· — · — · —
O.	— — —	Note of Interrogation (?)	· · — — · ·
P.	· — — ·	Note of Adiration (!)	— — · · — —
Q.	— — · —	Hyphen (-)	— · · · · —
R.	· — ·	Apostrophe (')	· — — — — ·
S.	· · ·	Parenthesis ( )	— · — — · —
T.	—	Inverted Comma (" ")	· — · · — ·
U.	· · —	*Begin another Line*	- — · — · ·
V.	· · · —	Bar of Division ($\frac{1}{2}\frac{1}{3}$)	— — — — — —
W.	· — —		
X.	— · · —	Call Signal	— · — · — · —
Y.	— · — —	Understand Message	· · · — ·
Z.	— — · ·	Correction, or repeat	· · · · · · · ·
		End of Message	· — · — · — ·
Æ.	· — · —	Wait	· — · · ·
Œ.	— — — ·	Cleared out and all right	· — · · — ·
Ue.	· · — —		· — ·
Ch.	— — — —		

RULES FOR SPACING.

The length of a dot being taken as unit.

1st. A Dash is equal in length to 3 dots.

2nd. *The space between the elements of a letter is equal to 1 dot.*

3rd. The space between two letters of a word is equal to 3 dots.

4th. The space between two following words is equal to 6 dots.

TO FIND THE DIFFERENCE OF TIME BETWEEN TWO PLACES.

Each 15° difference of longitude represents one hour difference of time.

Therefore divide the difference of the longitudes of two places by 15, and the quotient gives the difference in time.

Example.—The longitude of Greenwich is 0° 0', that of New York 74° 7' W. The difference in time between them is therefore $\frac{74\ \ 7'}{15} = 4\text{h. } 56\frac{1}{2}\text{m.}$

PROPERTIES OF GUTTA PERCHA.

Gutta-Percha is the milky juice of a large tree, the "Isonandra Gutta," extracted by incisions in the tree, and dried before the sun; or by evaporation at natural temperature. Little care being observed in the process, the Gutta-Percha is much mixed with particles of bark, sheds of leaves, and other impurities, and is delivered in commerce in blocks of an irregularly square shape, and various sizes, of a yellowish brown colour, and containing from 10 to 25 per 100 of moisture. Heated to 280°, it melts, or rather softens, to the consistence of treacle. At 140° it is still soft but very

At as low a temperature as the freezing point it continues flexible, and free from brittleness, or tendency to cracking. When purified, it is totally insoluble in water or spirits of wine. It is not acted upon by acids, alkalies, or saline solutions, and is insoluble in fixed oil. It does not unite with melted wax, suet, resin or pitch. It is very ductile when soft, but not elastic.

In chemical composition, Gutta-Percha is nearly the same as caoutchouc or Indian-rubber.

Like Caoutchouc, it is dissolved by sulphuric ether, by the liquid hydro-carbons, chloroform, and rectified oil of turpentine, from all of which solutions it is recoverable in its original state; but Gutta-Percha thus dissolved and recovered becomes whitish and brittle after a short time, and ceases to be applicable for the numerous purposes which, when prepared as subsequently described, it is so perfectly adapted.

When freed from impurities, Gutta-Percha has been proved to remain totally unaltered in fresh water for four years; in salt water, for more than two years; in wet earth, for five years. These facts denote the great probability of its continuing unchanged in the same media for an indefinite period.

Of all substances yet subjected to experiment (except Hooper's India-rubber) Gutta-Percha proves to be the best insulator or non-conductor of electricity. Caoutchouc and shell-lax approach it nearest in this most valuable property.

Asphaltum, pitch, and the resins, are far inferior to Gutta-Percha in insulating power.

As far as experiment has yet been carried, it is not attacked by white auts or other rodent insects, but, like all tasteless substances of its consistence, it is liable to be gnawed by rats and mice.

Gutta-Percha is collected in various localities in the Malayan Archipelago, in Borneo, and all the adjacent islands. Singapore is the mart from which it is exported to Europe, its price delivered in London ranges from £ 3-19-4 to £ 4-4-0 per hundred weight. It is free from duty.

GALVANIZATION OF IRON.

The iron is first prepared to receive the layer of zinc to be united to it. This is done in the following manner:—

The iron is placed for 5 or 6 minutes in a mixture of one part Muriatic acid to six of water. It is then taken out and dried in a furnace, heated to a dull red. When the iron has attained this heat it is again taken out and allowed to dry in the air. The scales of Oxyde are removed by percussion, any black spots which remain on the surface are separated by allowing the iron to remain ten to twelve hours in water, slightly acidulated with some fermented bran which has been steeped in the fluid for eight or ten days. The rods are next agitated in water containing a few hundredth parts of Sulphuric Acid. This done they are finally placed in water, and rubbed with sand and tow, after which they may be kept in water for use Before immersing the iron in the Zinc bath it is necessary to dry it. Messrs. Morewood and Rogers effect this in an atmosphere of vapour, from which the air is excluded as completely as possible. This they accomplish by heating the articles in an iron case, the bottom of which is covered about three inches deep with Sal Ammoniac. The vapour of the salt drives out the air. The temperature must be gradually raised, since the object is merely to fill the case with the vapour of Sal Ammoniac. To coat the iron with Zinc it is simply immersed in a Zinc bath, after having been prepared as above.

Varieties.

TO PURIFY WATER.

Put into a hogshead of water a large table spoonful of powdered alum, stir it and in a few hours the impurities will be sent to the bottom, a pailful of 4 gallons, may be purified by a single tea spoonful of Alum.

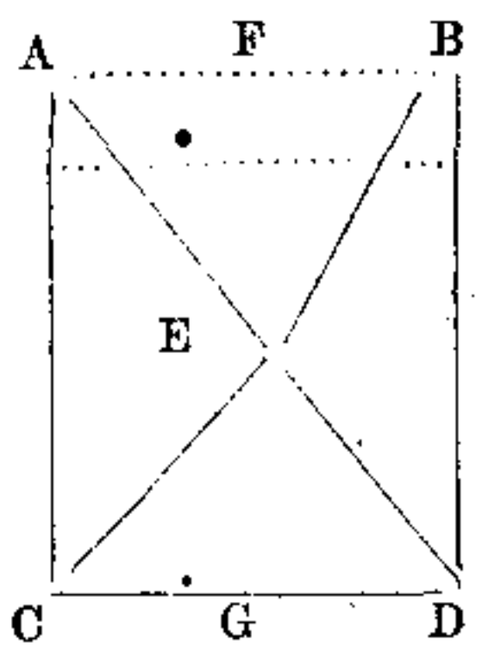
Freshly burnt charcoal is also an excellent sweetener of water.

TO FIND THE HEIGHT OF ANYTHING BY ITS SHADOW.

Walk to the end of the shadow and fix in the ground a stick, which measure and then the length of the shadow thrown by it; then measure the shadow of the tree (or whatever it is) and deduct from it in the same proportion, as the difference between the length of the stick and the length of its shadow and you have the result.

MODE OF TELLING THE WIDTH OF A RIVER IN A "NATURAL" WAY.

An Indian being asked the question, what was the width of a river? thus solved it *naturally*. He went down to the side of the river, and fixed upon a spot as a centre; then he selected two trees, on the right and left, on the other side, as near as his eye could measure equi-distant from where he stood. Having done so, he fell back until he came to where his eye told him that he had obtained the point of an equilateral triangle. Thus in the diagram, he selected the two trees A and B, walked back to E and there fixed a mark. He then fell back in the direction ED, until he had, as nearly as he could tell, made the distance from A·E equal to that from ED, and fixed another mark. The same was repeated to EC, when the last mark was fixed. He then had a parallelogram; and as the distance from F to E was exactly equal to the distance from E to G, he had but to measure the space between the bank of the river and E, and deduct it from E G, and he obtained the width of the river required. This calculation occupied the man three minutes only and was found to be perfectly correct.—*Marryatt's Violet.*



TO SPORTSMEN.

Hints on Loading Revolvers.—Never load a Revolver in damp weather without first snapping off a cap on each nipple, Joyce's common caps are quite good enough for this, or for practising with, but Ely's tin lined ones, made for and sold with Colt's Pistols, are the only ones to be trusted, both to stand continued damp, and to make sure that when exploded, they will not interfere with the revolution of the cylinder; they are much thinner in the metal than any of the other caps. The least quantity of oil on the top of the nipple will render useless one of the tin-lined caps, much sooner than any amount of damp; I have soaked one of Ely's for two hours in water, and then having blown the water out, fired it off all right. The nipple of a Colt's pistol is the reverse of that of a common gun, as it is large at the top and decreases to a very fine hole at the bottom, and by this means the whole of the flash of the cap is collected together, and rushes into the powder, which can never be seen at the top of the nipple, as is, or ought to be, the case in that of a gun. With the medium size Colt, the "navy or belt holster" (which is the best I think) never use the round, but always the conical bullet, as the former will hardly penetrate through a thick cummerbund, while the

latter will (as has been proved) penetrate as deep as a musket bullet. Never use more than half the charge that is sent, as the right one, out from England with a Colt, as it makes the pistol recoil too much and destroys the aim. When putting oil on the spindle on which the cylinder revolves, let it if possible be some animal oil, such as whale oil, or Neat's foot oil, or purified Bear's grease; as these never clog and get thick; directly after firing, it is more necessary than ever, to snap off caps on the nipples, as there is always a dampness left by the powder.—*Correspondence Lahore Chronicle.*

HINTS TO EQUESTRIANS IN DIFFICULTIES.—When called on to cross a river by swimming a horse, the rider must be prepared to sink about breast deep as a horse swims nearly upright; he should sit very quiet, and give the horse his head, not guiding by the reins, if the horse is distressed he must throw himself off and hold it by the mane or tail: a horse cannot kick in the water. He must be especially cautious never to get in front.—*Notes on Brigade Movements.*

HINTS TO HORSE BUYERS.—Never buy a horse that hits his legs, or to speak plainly, cuts or brushes. Never buy one with a long, weak, deer neck. Always suspect vice when you see the white of the eye, or observe the animal look back at you when mounted. Be careful that the fore feet are of the same size; avoid flat feet and consequent low heels. If you wish to be firmly carried, choose a well formed head, big nostril, short neck, deep in the ribs, short in the cannon, or below the knee, big, well-formed ankles (always rejecting upright ones), width of loin, big thighs, and well formed hocks. As to go fast you must have length, choose a long waist, rather than high limbs. Never purchase a horse without standing behind him when trotted up and down the yard; you will then be able to see if he does not cross his legs and goes straight and true. Avoid a horse if you see him shift his feet in the stable, be they equal or not in size; feverish symptoms may be expected in the most essential of all parts, the foundation. Remember there is no stronger part of a horse than the weakest; and if a dealer calls your attention to the beautiful flat fore legs, be most minute in examining the hind ones. When the horse is led out, if you suspect his wind, turn short, and give him a blow with your hand or stick; if he grunts, reject him. Such a horse is a bull, or a roarer. A good chest and pedigree are essential to good wind. Small bone and good sinews; and, if pace be required, reject the D'Orsay action. Doubtless, there are exceptions to all rules; but nine times out of ten, conformation will bear you out in supporting them. To go well through mud, the rider should in the gallop, see the knee and fore foot before the saddle.

HINTS ON THE CARE OF HORSES.

SKILFUL veterinary surgeons are seldon met with; you had better kill your horse by your own experience than call in a man of no ability who would finish the business in the same way and make out a long bill into the bargain.

A FEW HINTS.—The feet of the horse should be examined and picked out when he comes home; and if it be necessary to use stopping for feet, there is nothing equal to the application of water; water not only softens the foot, but keeps it cool. Water may be applied to the foot by means of flannel or tow soaked in it applied to the foot, and fastened by means of small flat spelks, fixed in the interior edge of the shoe. Where horses can take their exercise in the dewy grass, their feet will not want stopping; but this is not always attainable particularly in the arid plains of India.

When a horse comes in dirty on no account allow him to be ridden into the river or any water for the purpose of washing off the dirt, nor yet allow the water brush to be applied much above the fetlock. Indolent grooms, will, if not prevented, wash off the dirt from the thighs and under the belly, the sides, &c., by which disease is produced that often ends in glanders.

Incidental occurrences, such as pricks, bruises, kicks, &c., should be attended to immediately. The injuries the bottom of the feet sustain are generally from nails, sharp flints, broken bottles, &c., and in these cases it will sometimes be requisite to remove the shoe, in order to be able to examine the wound in a proper manner. The wound should be cleaned, and if it be not serious, the application of a little of any of the spirituous balsams will be sufficient. Treads and bruises between hair and hoof,

balsam or some balsamic tincture applied to them. Bruises from blows and kicks, and the like, should be bathed with any kind of repellents, such as cold vinegar, goulard, or brandy; any of which will very much assist in dissipating the blood which rushes into the smaller arteries where the bruise takes place. All kinds of green wounds may be cured by the balsams already enumerated; these will be found preferable to unctuous applications, particularly where a bandage cannot be used.

EXERCISE.—No horse can continue in good health without exercise. Want of exercise will cause the legs to swell; in which case the circulation of the blood becomes sluggish in the extremities, and the parts far removed from the heart; the gross particles of this fluid, therefore, lodge or remain inactive in the finer arteries of the horse's limbs, and cause the legs to swell. In this case unless measures be taken in time, physic, bleeding, &c. must be had recourse to in addition to exercise.

FOOD.—Every animal is affected by the food which he eats, and hence when a horse has subsisted for years in swamps, and such like places, and has consequently been feeding upon nothing but faint and foggy food, however well he may appear, he is no sooner taken into the stable, and put to a little work, than he exhibits unquestionable symptoms of weakness and debility; his legs swell, and he will fly to pieces (as the term is) if this be not prevented by proper attention and management. Walking, good food and bandaging the legs at night is preferable to the administration of physic. It is true a dose of physic will reduce the swellings of the legs but the operation reduces the horse also, already weak and debilitated, and therefore this makes bad worse, as in a few days the legs will swell again worse than they did prior to the administration of the physic.

SEVERE LABOR.—It sometimes happens that the horse's legs swell from severe labor or fatigue; in such case fomentations of warm water should be applied, which with rest and gentle exercise will have the desired effect.

SHOEING.—As a general rule, in applying the shoe, pare the hoof as little as possible, from which, however, deviation must occur:—as for instance, where the foot is deep and the sole hollow, the crust is generally thick and strong, and will, of course allow of more paring than a broad thin foot. But no absolute rule can be laid down; as to how far this paring is to be carried, each foot should be treated according to its degree of strength, weakness, brittleness, &c.

As in the action of the horse, the *frog* was intended by nature to touch the ground, if it be disabled by too much paring from doing this—if it thus be deprived of its natural action, the tendon becomes elongated, lameness perhaps produced, and not unfrequently wind galls. The *bars* should not be scooped out, because in conjunction with the frog they are intended to keep open and defend the hinder part of the foot.

Generally speaking, the shoe should stand wider at the points of the heel than the foot itself, or as the foot grows, the heel of the shoe becomes imbedded in the foot of the horse, which will be likely to break the crust, produce lameness or a corn. The foot should be kept short at the toe; as if left too long, it becomes thin and weak, and the heels low, whereby the flex or tendons of the leg are strained whilst a short toe has a tendency to strengthen the foot, and also to keep the heels open and expansive.

In shoeing a thin-footed horse, when the toe is cut short, it is advisable to leave it nearly square, merely rounding off the angles with the rasp. No nails should be driven into the hoof more forward than these angles, even in the strongest feet, nor yet so far in general; and by this method, the nourishment that would proceed to the support of the toe descends to the heels, and tends to keep them open. This however, applies more to the hinder than the fore feet, because the horn is always thicker at the toe before than behind; while the quarters are even thicker of horn behind than before, by reason of the wearing of the toe being greater behind than before. The heel of the shoe, on strong and narrow heeled horses, should be made straight at the extreme points; the form of the shoe thus assisting in the distension of the heels of the horse.

A FEW PRESCRIPTIONS FOR HORSES.

ing out, itching, swelling of the legs, &c., it will be highly advisable to apply the fleam or the lancet, in order to check the progress of the approaching disease. If the horse has been well kept, little worked or exercised, and is full of flesh, it may reasonably be concluded the blood vessels are over-charged; and of course they must be relieved by evacuation, in the application of which a sound judgment should be exercised. If the horse has been kept at regular work or exercise, and by severe exertion is overworked the loss of two or three quarts of blood and a day's rest will operate a cure.

COLDS.—When a horse contracts a cold, if it be but slight, warm clothing and moderate exercise will effect a cure. If the cold be violent, bleeding, purging, sweating, and perhaps a diuretic ball may be necessary, by which inflammation is prevented, and the disease expelled. Should, however, fever attend the cold, the horse should lose two, three or even four quarts of blood which would greatly relieve him. Give a gentle dose of physic, and also gruel, and if he will not take the gruel, let his water be chilled; gentle exercise, warm clothing. This method is much superior to cordials, balls, mashes, &c.

If a horse, after being ridden till he is very hot, be suffered to cool too fast, he will contract a violent cold, attended by fever; he should be copiously bled, and have plenty of chilled water with a little oatmeal stirred in it, given to him. Mashes may be given in this case, followed by a mild dose of physic. If the horse does not dung as usual immediate relief should be applied by the process of back raking, followed by a glyster, made of thin gruel or any warm liquid and a little lard or grease in it. Should the fever not abate, bleeding and physic will be advisible, keeping the horse well clothed to promote perspiration, as well as to prevent cold, leading the animal abroad if the air be not severe. If no amendment be perceptible, call in the assistance of a veterinary surgeon, if such a person be within your reach.

FEVER POWDER.—Powdered Nitre (potash), 1 oz.; Camphor and Tartarized Antimony of each, 2 dr.

ALTERATIVE BALL.—Succotrine aloes, 2 dr.; Castile Soap, 2 dr.; Tartarized antimony, 2 dr.; syrup enough to form the ball for one dose.

TREATMENT FOR CANKER.—Take away the diseased part and strong liniment applied every day. Bar shoe put on with dressing under the shoe. Cut away the hard horn where the foul flesh appears. Dress with sulphuric or white arsenic. When healthy flesh is formed dress with equal parts of tar, aloes, myrrh, cutta, white vitriol.

SWELLING ON THE KNEE.—Treatment, Alterative Balls. Sixty leeches on the knee. Fomentations. Poultices. Strong mercurial ointment rubbed on the knee with a mild blister.

WORMS.—Alterative Balls. Alterative Powders. Strong Purgatives.

CONTRACTED FEET.—Blister the coronet of both fore feet, drawing or cutting away the sole, rasping the feet to blood down from the coronet to sole in front of foot.

CORDIAL DRINK FOR COUGH.—Vinegar 1 pint; Honey 1 pint; Tincture of opium, ½ oz.; Liquorice Powder, 2 oz.; Sugarcandy, 2 oz.; Oil of Anniseed ½ oz.; Oil of Cloves, 40 drops; Oil of Carraway Seeds 40 drops; Cardamom Seeds and Saffron each 2 dr. Boil the honey, vinegar and sugar candy all together with the liquorice powder and cardamom seeds; then strain it. Lastly put the other ingredients and mix all together. This gargle should be given twice a day.

ALTERATIVE COUGH BALL.—Gum Ammoniacum 3 dr.: Powdered Squill and Opium each 1 dr.: Camphor 1 dr.; Barbadoes Tar 1 dr.; Sulphur Vivum 1 dr.; Syrup enough to form the ball for one dose.

TREATMENT FOR STRANGLES.—Shave off hair first—poultice, rubbing in stimulating ointment: tumour opened and freed from matter; poultices again applied; small piece of lint dipped in blister liniment—alterative powders in bran mashes every day and alterative balls.

to be given every day or every other day according the the severity of the case, and the mixture to be well rubbed into the sore with a tooth-brush every third day: after a fortnight or three weeks, it will be desirable to give an aloetic purge. Ardower is the best food, 3 or 4 seers per diem, with gentle exercise. This receipt has been tried with great success in an Irregular Cavalry Regiment.

ANTIDOTES OF POISON.

EMETICS.—The best emetic is about thirty grains of sulphate of zinc in a little warm water; if this cannot be had, mustard and warm water, or a few pinches of snuff and warm water, may be substituted; it should be taken copiously, a cupful at a time. The usual emetic of ipecacuanha and tartarised antimony lowers the strength and therefore should never be given in cases of poisoning. Tickling the throat with a feather will frequently have the desired effect.

SOUR-TASTING ACIDS.—(In ordinary phrase all acids are sour; but in chemistry this is not the case; prussic acid and arsenious acid, or arsenic, for instance, are not sour.) Nothing better than chalk can be given as an antidote to sour-tasting acids, such as aqua-fortis, oxalic acid, oil of vitriol, spirit of salt, or very strong vinegar. First give an emetic; then let copious draughts of powdered chalk be given in water, or (as is better) in milk. If no chalk is immediately at hand, knock down a handful of a ceiling or wall.

ALCOHOL.—Emetic as soon as possible; apply cold water to the head, and give spirits of hartshorn.

AMMONIA, and other caustic Alkalies.—Give immediately an emetic and plenty of vinegar and water.

ARSENIC.—Hydrated peroxide of iron, given in large quantities. Obtain it from a druggist's shop; or if the druggist should not be able to make it (as may happen,) take his stock bottle of *tincture of muriate of iron* (perhaps about a quart;) take about double the quantity of hartshorn, and mix both in a dish. The mixture will immediately become thick and a red muddy paste will fall. This paste is the antidote. It should be rapidly collected upon a pocket handkerchief, or other piece of cloth which may be at hand, worked to free it from excess of hartshorn, and administered to the patient freely without delay. The antidote is quite harmless.

CHARCOAL, (VAPOUR OF.)—Get the patient at once into the open air, dash cold water on the head and body, apply friction to the chest and pungent salts to the nostrils.

COPPER (from the action of vinegar on copper vessels, or in any other form.)—Draughts of white of egg beaten up with water.

CORROSIVE SUBLIMATE.—Copious draughts of white of egg beaten up with water, or, still better, with milk.

CREOSOTE.—Emetics and white of eggs.

FALSE MUSHROOMS, NUX VOMICA, MONKSHOOD (taken in mistake for horseradish,) and other acrid Narcotics.—Emetic of mustard and warm water, or, if mustard cannot be obtained, a few pinches of snuff and warm water. The patient should be supported and compelled to pace the room; and should not be suffered to sleep.

LEAD (white lead or sugar of lead).—Epsom salts.

LUNAR CAUSTIC.—Large quantities of salt water: and an emetic.

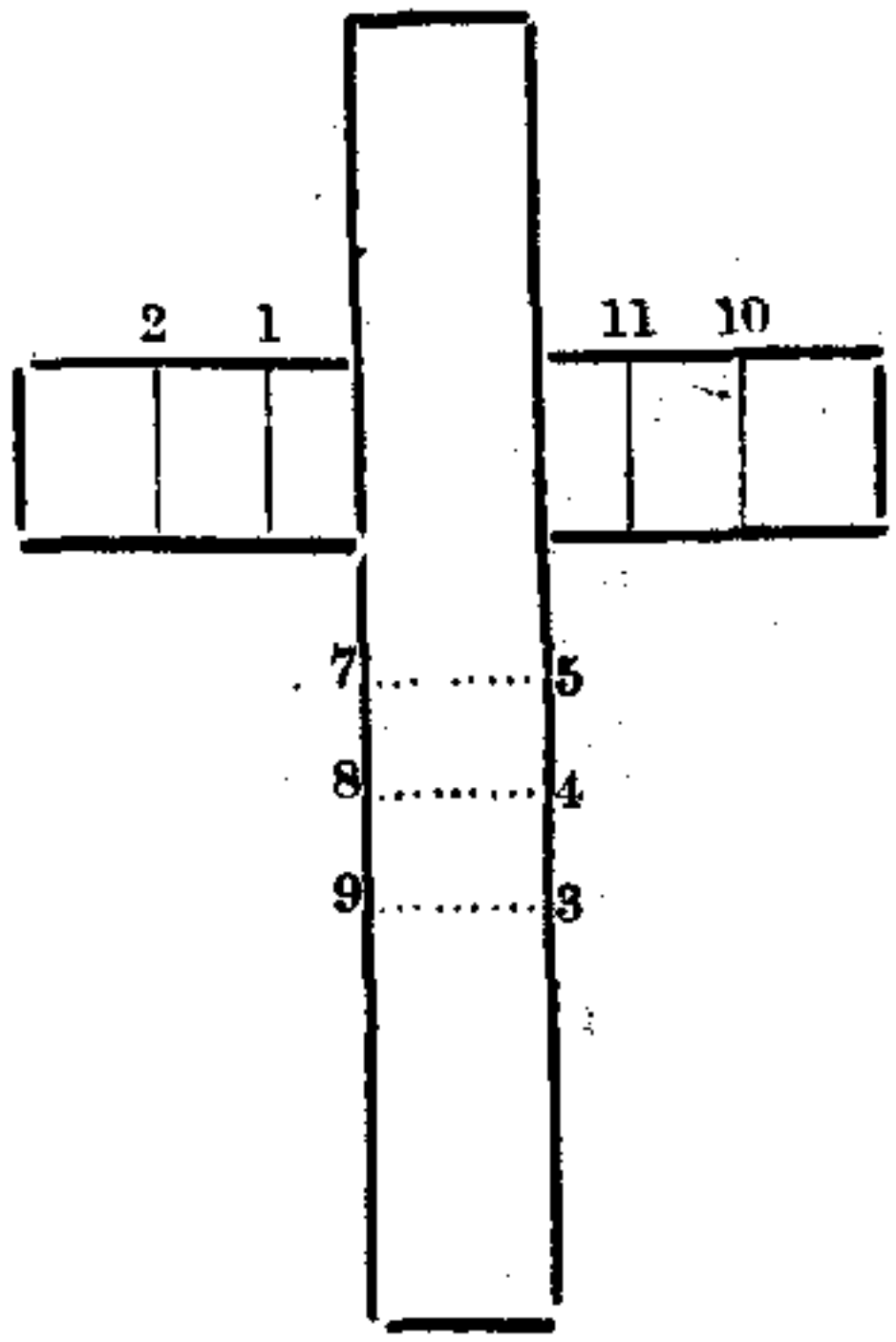
OPIUM.—Emetic as above. Use the stomach pump as soon as possible. Strong coffee, without milk or sugar, may be given in the interval. The patient must not be suffered to sleep, and must be pinched or pricked if necessary to prevent it.

STRYCHNINE.—A strong decoction of coffee has been recommended as an antidote or this poison.

TARTARISED ANTIMONY (or Tartar Emetic.)—Plenty of warm water; tea made of nutgalls or of oak bark. If these cannot be obtained, gentian or catechu may be sub-

SUN DIAL.

Made of wood in the shape of a flat cross; the upper and side arms being three inches in length. The divisions on the upper surface of the side arm being ¼ of an inch and below being ⅛—1 inch and 1¼.



RECEIPT TO KEEP GUM ALWAYS LIQUID.

Mix with the gum a few drops of nitric acid, aqua fortis.

RECEIPT TO PREVENT THE DISAGREEABLE TASTE OF MEDICINE.

Before taking medicine put a piece of alum into your mouth and get the taste of it.

HARDENING OF ENGLISH CAST-STEEL FOR CUTLERY.

August Kiesu of Issugni in Switzerland, prepares sharp instruments from English cast steel by immersing the blades of a cherry red heat, into a bath composed of four parts of finely powdered yellow resin, two parts of fish oil, to which is added in a very hot state, one part of melted tallow, and allowing them to cool perfectly; after which they are heated without wiping them, and hardened in water in the ordinary way. The blades hardened by this process are said to be more uniformly done than by any other method, at the same time they are not too much so, or the metal too brittle.—"*Builder.*"

TO REMOVE SPOTS OF INK FROM PAPER.

A solution of oxalic acid, laid lightly on with a paint brush.

RECEIPT FOR MAKING SENSATIVÉ PAPER.

Take good letter paper—use Bichromate of Potash 10 grains, Sulphate of copper 20 grains. Distilled water 1 oz. It must then be washed over in the dark with a solution of Nitrate of Silver of moderate strength.

SOLDER* FOR TELEGRAPH IRON WIRES.

Tin 1, Lead 1½; or Tin 1, Lead 1.

* Soldering (Culley) connections in apparatus and test-boxes must never be soldered with Acids or Chloride of zinc. These liquids cannot be entirely removed,