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MADRAS RECORD OFFICE.**Government of Madras.***Public Works* **DEPARTMENT.**

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Not to be folded or roughly handled

11-8
Report.
of the
Government Astronomer
on the
Wiring of the Fort Gun
by
Electricity.

Madras Observatory
1871

Madras Observatory, April 22nd 1871.

From

N. R. Pogson, Esq.,

Government Astronomer and Meteorological Superintendent.

To

Col^l G. A. Barr. Esq.

Secretary to Government

Public Works Department.

Sir,

In compliance with the
Proceedings of the Madras Government,
Telegraph Department, 3rd December 1870 No 75,
I have the honor to furnish the following
Report on the result of firing the Test
Gun by means of an electric current
transmitted from the Observatory.

New Telegraph Line. The new line of Telegraph laid for the
purpose under the direction of Mr. Williams,
Assistant Superintendent, having been spe-
cially reported upon by the Superintendent
of Telegraphs, Madras Division, it is only
necessary for me to state, that, thanks
to Mr. Williams's punctuality, skill and
assiduity, it was ready as soon as required,
and was most efficiently and securely set
up. I am quite satisfied that no failures
in the firing of the gun are attributable
to any defect in the line or in the
arrangements made by the Telegraph
Department.

Mr Winter's
discharging
apparatus.

2. The apparatus by which the gun is fired was invented and constructed by Mr H. R. Winter, Telegraph Engineer to the Madras Peguway Company; his services having been duly applied for, and kindly conceded by the Railway Agent and Manager Mr. Elwin. By means of a very ingenious yet simple contrivance the current releases a leaden cylinder weighing about thirty pounds, the fall of which draws a vertical steel guiding rod, through about two feet, gives the pull upon the lanyard instead of the artillery-man's arm. No change is required in the ordinary process except that when all is ready and the friction tube inserted into the vent of the gun the artillery-man has to stand aside and wait for the telegraphic current from the Observatory, instead of as formerly, pulling the lanyard by hand. The machine now in use is very satisfactory and rarely a source of failure, but like all electrical appliances requires occasional adjustment and looking after; the more so when it is remembered that it has to bear the jarring effects of the discharge of an eighteen pounder gun twice a day, only a few feet distant, the concussion of which is sufficient to produce change in almost any screw adjustments subjected to so severe and unusual a trial.

The discharging apparatus is enclosed in a strong wooden house, expressly made for the purpose at the Gun Carriage Manufactory, by the kind permission of Col. J. Hay Campbell,

the Superintendent of that Establishment.

Results of 161 days
trial of the new
method. — 3. From October 11th 1870 to March 20th 1871, we have a period of 161 days or 3222 discharges.

The gun being fired twice daily; viz. at noon and eight p.m. by means of currents from the Observatory. On 292 occasions or nearly ninety-one per cent of the whole the signals have been perfectly successful. The electric current failed to fire the gun thirty times in all, but twelve times out of the thirty it was discharged by means of a second current precisely five minutes after the even hour, and was therefore just as serviceable for a time as if fired by the first current. This leaves only eighteen occasions on which a Captain of a vessel in the Madras Roads could not employ the gun at the moment for determining the error and rate of his chronometer, and on eight of these the time of firing was noted as formerly at the Observatory and published in the *Gayette* and daily papers. There remain therefore only ten occasions out of 322 or less upon three per cent of really lost signals; three owing to simple mistakes, and eight times when the gun was not fired at all.

General sources of failure to which the method is liable.

There are five distinct sources of failure to which time-gun signals are liable. — They are as follows:

1st Defects in the line of telegraph, chiefly owing to bad insulation of the wires. In the old line formerly employed for dropping a time ball some years back, this was doubtless a very frequent cause of failure, the current being carried off, especially on rainy days, by contact with overhanging trees; but as stated in paragraph 1, the new line appears to be faultless, and no failures are now attributable to such causes.

2nd The Daniell's battery employed for sending the current requires considerable care and attention, and as the proper management of such an apparatus was an entirely new duty at the Observatory, it is probable that several of the thirty failures recorded during the period under consideration, may have been due to this simple cause. The experience now gained on this point will doubtless render failures arising from the battery extremely rare.

3rd The machinery, although very recently boxed up and of first rate

quality is necessarily liable to suffer derangement from the inevitable concussion every screw and joint must undergo at each successive discharge of the gun. Sea air and dust also rapidly produce their bad effects, but by frequent cleaning and inspection these sources of error may be rendered insignificant.

4th The most insurmountable cause of failure is undoubtedly faulty friction tubes. The machine first supplied had a much lighter weight, which always fell on the disc due to the signal but was powerless against an usually tough tube. The original machine was replaced by the one now in use on November 28th, 1870, and the new one being much heavier and stronger than the first, never yet failed in a similar manner. The friction tubes recently supplied are evidently of a very superior quality to those at first employed; but still imperfect ones must from time to time be expected, and when met with will necessarily occasion a miss-fire.

At Gohiburgh where a gun has for many years been fired in a similar manner the proportion of bad tubes was stated by Prof G. P. Smyth, the Astronomer Royal for Scotland, in one of his reports to be one

in seventy As a probable safe-guard against such mishaps Prof. Smyth suggested a double vent to the gun, and the use of two tubes upon each occasion, and thus, applied to the Liverpool June Gun, appears most entirely to have obviated failures arising from faulty friction tubes. Prof. Smyth does not however appear to have adopted his own proposal at Edinburgh, as such occasional failures are really of little consequence, scarcely in fact worth the double expenditure of friction tubes and the alteration of the piece of ordnance employed.

5th. With regard to the signal to be given by reference to a sidereal clock instead of one showing mean time, mistakes may occur in the computation or misentry of the sidereal time corresponding to noon or eight p.m. But by one such error has yet happened at Madras and upon the arrival of the new Automatic Astronomical Clock expected from England, nothing of the kind can occur, as the clock will indicate mean time and will deliver its own signals hourly with unerring precision, so that of course the gun might be fired twenty seven times per day instead of three, without any additional trouble or hindrance to the Astronomer.

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The mean time clock has in such cases to be adjusted daily to true mean time by comparison with the standard sidereal regulator, and thus done, it is left to complete its own contacts, and can only do so at the precise moment when both minute and second hand point to unity.

Degree of requisite accuracy far more than attained at Madras

It would of course be more agreeable and gratifying if failures could be entirely obviated, but from the details given in the last paragraph it is clearly evident that such perfection is unattainable. It is moreover of very little importance, for if only we signal for day or night the method might still be regarded as efficient and of incalculable advantage for the rating of chronometers in the Roads and the consequent greater safety of every vessel whose Captain avails himself of the valuable aid rendered. It is a question whether when a failure does occur, from whatever cause, it would not be more satisfactory to the public to have no signal, than one five minutes late, as ordinary unsentimental individuals provoked with inferior watches may be misled thereby, although no Captain comparing his chronometer or even any tolerably accurate observer of the most ordinary good watch could ever be uncertain as to whether the gun was fired at the precise hour or five minutes

later. I am myself strongly in favor of no gun except at the precise hour, but fearing its total omission might be less agreeable to the military authorities than a mere delay of a few minutes, I suggested the delivery of a second signal precisely five minutes later, whenever the first one failed to discharge the gun. A miscomprehension of this compromise led to some very absurd remarks in various newspapers by writers who only publicly exposed their utter ignorance of the subject and furnished amusement for the better informed, to whom the existing arrangements must have been perfectly satisfactory and very acceptable.

General precision of the
transit signals

While palpable errors of entire minutes, occasioned by unavoidable failures are for all practical purposes of no consequence, it is on the other hand of vital importance that the seconds and fractions of a second should be rendered with unerring accuracy. Assuming, as must in any case be done, that the time found by means of the Observatory Transit Circle and sidereal regulator is exact, there yet remains the uncertainty arising from the attempt to subdivide the interval between the beats, as the even hours of mean time come daily $3^m 56.56$ later by a sidereal clock and rarely upon the even second.

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How far this has been accomplished will be best shown by stating the facts, that $92\frac{1}{2}$ per cent of the signals given in the time under consideration have been within one tenth of a second of perfect truth; $13\frac{3}{4}$ per cent between one tenth and two tenths, and only 8 per cent above two tenths in error. The greatest uncertainty in any case due to a "successful signal" was four tenths of a second of time. Upon the arrival of the expected normal motor clock every signal will be mechanically exact and though occasional failures can never be obviated, their occurrence will only be proclaimed by silence. The actual errors will then be hundredths of a second instead of, as at present tenths only.

Summary of Report

I may therefore briefly sum up this Report by stating, 1st, that whereas one correct signal per day would be sufficient for the wants of the Marine Service, 292 perfectly correct signals were given in the 181 days between October 11th 1870 and March 20th 1871: 2nd That the small number of failures which occurred from all causes combined at the commencement of the scheme, was quite insignificant and is pretty certain to diminish considerably in future, and 3rd, that the precision already attained is far in excess of what is actually

required, and will be practically perfect when the new electrical clock has been once got properly into working order.

Time intervals
for the Observatory
and Time Map
of Madras

It may not be out of place to state in conclusion that, from two hundred well observed discharges of the gun, it has been determined that the flash of the gun follows the delivery of the signal at the Observatory by forty-four hundredths of a second of time, due allowance for which is made, by transmitting the current so much in advance of noon and eight p.m. Also, that by 100 careful comparisons between flash and report as noted at the Observatory, the time interval for that is 18.32 seconds. With this interval and the measured distance, a Time Scale, and five second circles, were laid down upon a map of Madras which accompanied the Mayum Press Almanac for 1877, so as to enable any one to read off for his position, within a second or less, the interval to be subtracted from the time of report in order to obtain the true moment of the flash, viz either noon or eight p.m.

I have the honor to be

Sir

Your most obedient Servant
A. R. Pogson
Government Astronomer

1871 Sept
From : No 1869.
The Government Astronomer
of

The Secretary to Government
Public Works Department.

Recd 3rd Dec/70 No 1-2 Feb
" 12 April/71 - 56 Mils

Madras Observatory. April 22-1871
Received 26 April 1871.

Report of the Government
Astronomer on the firing
of the Fort gun by Electricity.
No 1336-15 May/71

With an add

Recd 5 May 1871
(27 April 1871 - 2nd time)

No 1336
Communicated to the Dept of
Telegraphs Madras Division with reference to
his letter dated 4 April 71. to 18.
N. A. N. D.
L. J. 107. Astronomer
Chief of Telegraphic Drivings in
Madras Division

15

1871 Sept
10/4/12
BT

Pro 3rd Dec 1871

11-3-10

Govt of 1871 Under
PUBLIC WORKS.

To

Dated

Recd

[Handwritten signature]

G. O. 15th May 71. No 1336.

271 + 272.

Nos. 269 + 270

[Faint handwritten text, possibly a list or description of items]