producing, at any given rate of rotation, the separate tones of a common chord in succession: or by interposing a cylindrical lens to distribute the rays in a linear beam to the four series at once, the united tones of the chord could be produced simultaneously.

Further it was found that the thickness and the breadth of the receiving-disk makes no difference within certain limits in the loudness or quality of the resulting tone. And in the case of transparent substances such as mica and glass these limits may be wide: in the case of glass the loudness was the same with a disk of half a millimetre as with one of three centimetres thickness. In consequence rare substances may be used in disks as small as one square centimetre in area. Cracked or split disks of glass, copper, and aluminium produce sensibly the same effects as if they were whole.

II. *The molecular structure and state of aggregation of the receiving disk appear to exercise no important influence upon the nature of the tones emitted.*—Disks of similar thickness and surface emit sounds of the same pitch no matter of what material they be. Although there may be slight specific differences between the actual modes of production of the phenomenon from *very* thin disks of different materials, these differences are reduced to a vanishing quantity by rendering the receptive surface alike, as for example by covering them all alike with a film of lampblack. Moreover the effect produced by ordinary radiations is, *cæteris paribus*, the same practically for transparent substances as widely differing from one another as glass, mica, selenite, Iceland-spar, and quartz, whether cut parallel or perpendicular to the optic axis, and is the same in polarised light as in ordinary light.

III. *The radiophonic sounds result from a direct action of radiations upon the receiving substances.*—This proposition appears to be established by the following facts:—1. That the loudness of the sounds is directly proportional to the quantity of rays that fall upon the disk. 2. That by using a polarised beam and taking as a receiving-disk a thin slice of some substance which can itself polarise or analyse light, such as a slice of tourmaline, the resulting sounds exhibit variations of loudness corresponding to those of the rays themselves, when either polariser or analyser is turned; and the sound is loudest when the light transmitted by the analysing disk is a minimum.

IV. *The phenomenon appears to be chiefly due to an action on the surface of the receiver.*—The loudness of the emitted sound depends very greatly upon the nature of the surface. Everything that tends to diminish the reflecting power, and increase the absorbing power of the surface, assists the production of the phenomenon. Surfaces that are rough-ground or tarnished with a film of oxidation are therefore preferable. It is also advantageous to cover the receiving surface with black pulverulent deposits, bitumen black, platinum black, or best of all with lampblack; but the increase of sensitiveness under this treatment is only considerable in the case of very thin disks, as for instance from ·1 to ·2 of a millimetre. Very sensitive radiophonic receivers may be thus made with extremely thin disks of zinc, glass, or mica smoked at the surface. It may here be noted amongst M. Mercadier's results that for *opaque* disks, the thinner they are the louder is the sound, and that excellent results are given by metallic foil—copper, aluminium, platinum, and especially zinc—of but ·05 millim thickness. The employment of such sensitive receivers has enabled M. Mercadier to arrive at several other important conclusions

V. *Radiophonic effects are relatively very intense.*—They can be produced not merely with sunlight or electric light, but with the lime-light, and also with gas-light, and even with petroleum flames, and with a spiral of platinum wire heated in the Bunsen-flame.

VI. *Radiophonic effects appear to be produced principally by radiations of great wave-length, or those commonly regarded as calorific.*—In order to satisfy himself on this point M. Mercadier had recourse to the spectrum direct, without attempting to employ cells of absorbant material such as alum solution or iodine in dissolved bisulphide of carbon as ray-filters. A brilliant beam of light was produced by means of a battery of fifty Bunsen cells, and with this, by means of ordinary lenses and a prism of glass a spectrum was produced, the various regions of which could be explored with one of the sensitive receiving-disks mentioned above. The maximum effect was found to be produced by the red rays and by the invisible ultra-red rays. From yellow up to violet, and beyond, no perceptible results were obtained. The experiment was tried several times with receivers of smoked glass, platinised platinum, and plain bare zinc. The greatest effect appeared to be yielded at the limit of the visible red rays. The rays which affect the electric conductivity of selenium in the photophone are, as Prof. W. G. Adams has shown, not the red rays, but rays from the yellow and green-yellow regions of the spectrum. This fact alone would justify the distinction drawn between the phenomena of radiophony and those of the selenium photophone, though probably these are only two of several ways of arriving at a solution of the problem of the transmission of sonorous vibrations by radiation. Theoretically a telephone with a blackened disk inclosed in a high vacuum and connected with an external telephone should serve as a receiver; and the writer of these lines has already attempted to devise a thermo-electric receiver for reproducing sounds from invisible calorific rays.

S. P. T.

THE JOHN DUNCAN FUND

THE following subscriptions to this fund have been received during the past week:—

	£	s.	d.		£	s.	d.
Amount previously announced	48	6	0	Major Deedes ...	0	10	0
Charles F. Tomes, F.R.S.	1	0	0	Anon.	0	1	3
J. S.	2	0	0	Sir J. Fayrer	1	1	0
Dr. Vacher	1	1	0	T. C. Kent	1	0	0
R. R. Glover ...	1	1	0	Lawson Tait	1	1	0
Thomas Walker ...	5	0	0	Heinrich Simon ...	2	0	0
M. M. Pattison Muir	1	1	0		65	2	3

THE TIME OF DAY IN PARIS

THE importance of precise and uniform time throughout Paris becoming ever and continually more appreciated, the Municipality have taken the matter in hand, and have established a system of what they call "horary centres." These horary centres really consist of standard clocks, erected in different places, and controlled by electricity from the Paris Observatory. Moreover each standard clock is furnished with additional electrical work of its own, which enables it to send out an hourly current and control other clocks in its neighbourhood, placed in circuit with it. The advantage of this arrangement over any system of electrical dials is apparent, for with the latter any mischance or practical joke with the wires would cause the whole city to be misled or completely deprived of time. The problem, as put by Leverrier, and as it has been practically solved by M. Breguet, was this:—To keep correct the hour given by various regulators distributed in the city by means of an electric current sent from the Observatory. If the current, in consequence of any accident, fails, the regulators continue to work, with a very slight advance, without the electric correction. The wires have their centre at the Observatory, where there is an astronomical regulator on the first floor. This instrument is maintained at the exact time indicated by the astronomical observations,

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