86. *Explosion Spectra of Mercury.*

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Two methods of obtaining explosion spectra were tried. A condenser battery consisting of 450 glass plates immersed in oil, having capacity of 1.7 microfarads and capable of sustaining about 40 KV, had a spark gap of a few cm., and a sample of pure mercury oxide was placed in the circuit between pointed carbon rods; by charging the condenser with a rectified transformer current, the heavy discharge current passed through the sample, which was instantaneously evaporated. The light thus emitted was focussed to a Hilger quartz spectrograph. In the other method, an arrangement similar to Anderson's was utilised. Fine stream of mercury, 6 cm. long and 0.3 mm. thick, was maintained through an iron capillary tube; this passed through an iron ring of 2.5 cm. diam.; the discharge passed between the ring and the jet about 6 cm. long, when the spark passed between the gap of 4 or 5 cm. The jet was thus exploded by the strong current passing through it; the self-inductance of the connection being 3.10^{-4} henry, the current was over 1000 A, and the temperature above 10000° by estimation. The jet was exploded in the interior of a hollow cylinder (7 cm. diam., 10 cm. length); it had a slit 3 cm. long and 6 mm. wide. A quartz rod, 7 cm. long, of elliptic section was brought close to the slit and the light excited during the explosion brought by it to the slit of a quartz spectroscope. The exploding arrangement was enclosed in a thick iron cylinder of 19 cm. diam. 52 cm. height; the lid was provided with a porcelain insulator for letting in an iron tube for the jet; another insulator was fixed in the lateral face of the cylinder to lead in an iron rod to the ring above mentioned. The cylinder being closed air-tight, the violent noise of explosions was heard as clicks from outside, and the noxious mercury vapour filled the interior of the cylinder only. The quartz rod was fixed with Khotinsky cement to an iron tube, pierced through the walls of the cylinder and welded to it. The intense light

Triplet Series.

	P. L.	Expl. 1	Expl. 2
Principal (1 <i>s</i> —1 <i>p</i>)			
5460.7	60d, r	50d, r	50d, r
4358.3	150d, r	150d, r	100D
4046.6	100d, r	100s	90d
Diffuse (1 <i>p</i> — <i>md</i>)			
(2) { 3662.9	80d, r	70d	{ nebul. 3670 to 3635
3654.8	50	40d	
3650.2	100	100d, v	
{ 3131.6	60d, r	50d	{ nebul. 3135 to 3123
3125.7	60	40d	
2967.4	60d, r	60	
(3) { 3025.6	15	0	{ nebul. 2660 to 2650
3023.5	50	15D	
2653.7	25	neb.	
2652.0	40	"	trace
2534.8	rev.	5D	
(4) { 2805.4	60	0	0
2482.4	50d	0	0
2378.3	30	0	0
(5) { 2699.5	50D	0	0
2399.6	40D	0	0
2302.1	8d	0	0
(6) 2352.5	8D	0	0
(7) 2603.1	5D	?	?
Sharp (1 <i>p</i> — <i>ms</i>)			
(2) { 3341.5	55d, r	35d	30D
2893.6	55d, r	35	30D
2752.8	50d, r	15	trace
(3) { 2925.4	50	6d	3D
2576.3	30	0	0
2464.1	30	3d	0
(4) { 2759.7	30	0	0
2446.9	25	1	0
2345.4	7	6	3
(5) 2380.2	0	?	?
(6) 2625.2	3d	0	?
Combination			
(<i>p</i> ₁ , 3) 3011.1	4	0	?
(<i>p</i> ₃ , 3) 2524.7	3	0	?
(<i>p</i> ₁ , 4) 2799.8	20d	10	10D
(<i>p</i> ₂ , 4) 2478.1	10d	0	0
(<i>p</i> ₃ , 4) 2374.0	5	0	0
1 <i>p</i> ₁ —2 <i>p</i> ₁ 3680.0	25D, r	15D, r	nebul. 3685 to 3677
1 <i>p</i> ₁ —3 <i>p</i> ₁ 3050.5	5d	1d	0
1 <i>p</i> ₂ —2 <i>p</i> ₁ 3144.5	4d	1d	?
1 <i>p</i> ₂ —2 <i>p</i> ₂ 3305.1	2	0	0
1 <i>p</i> ₂ —3 <i>p</i> ₁ 2672.7	20	0	0

Singlet Series.

	P. L.	Expl. 1	Expl. 2
Diffuse (1 $P-mD$)			
(2) 5790.7	30	20	20
(3) 4347.5	30	0	0
(4) 3906.4	35d	0	0
(5) 3704.2	25D	1d	0
Sharp (1 $P-ms$).			
(3) 4916.0	35	0	10
(4) 4108.1	20	0	0
Combination (1 $p-mD$)			
(p_2 , 2) 3131.8	60d, r	50d	nebul. 3135 to 3123
(p_3 , 2) 2967.5	60d, r	60	60D
(p_2 , 3) 2355.1	30	nebul.	nebul. 2660 to 2650
(p_1 , 4) 2806.8	5d	8s	10
(p_2 , 4) 2483.8	9	0	0
(1 p_2-ms)			
(1) 2536.5	rev.	20d	rev. trace
(2) 4077.8	40d, r	20s	20d, r
(3) 2856.9	20s	0	0
(1 $P-md'$)			
(2) 5769.6	30	20	20
(3) 4339.2	30	0	0
(4) 3901.9	7	0	0
Ionised Mercury (Hg^+)			
5769.1	2	30	30
5425.3	0	20	20
4960.4	10	10	15
3984.0	15	40	90
3736.0	8	7d	10d
3264.1	0	8d	10d
3227.8	0	5	9
3208.2	0	15	15
2947.1	0	20d	20d
2935.9	0	7d	5d
2847.8	0	65d	70d
2820.0	15d	20D, v	20D
2702.5	0	10	10
2492.1	0	15d	10D
2407.4	0	25d	15d
2315.0	0	5d	15d
2296.4	0	4d	10d
2263.9	0	10	15d
2262.3	0	5	10d
2253.1	0	15	20D

caused by explosion can be received on a screen through the rod. The use of quartz rod is much recommendable for such purposes.

The first method evidently gives spectra intermediate between arc and spark; they are distinguished as Expl. 1 from those of real explosion (Expl. 2) in the tables. These spectra were compared with the spectrum emitted by mercury vapour at 85 cm. pressure, lighted at 100 V and 2.5 A. This pressure lamp is of special construction in silica glass and burns with mercury electrodes. The spectrum is somewhat different from that of vacuum arc; it is distinguished from other spectra by P.L.

The principal result is to be gathered from the tables. d , D , r , v , have the usual meaning; the series notation is that of Fowler. Only some lines of ionised mercury are given as examples. Lines are affected with pressure shifts, so that normal values are given in the tables.

There were besides lines of gold and thallium in the explosion spectrum of mercury; the discussion is reserved for separate communication.

In the spectrogram were found lines of iron due to the discharge at the ends of the mercury jet; consequently some lines overlapped and were rendered quite ambiguous. The tables at once show that *most of the series lines, except the principal, become faint and nebulous*; this is especially marked *in the diffuse series of the triplets*. *The loss in intensity is more marked with increase in the term number*: the first triplet of the diffuse series becomes nebulous and extends over 35 angstroms; for $m=4$ and upwards, the lines are all evanescent. It is remarkable that the characteristic line 2537 is reduced to a trace in the explosion spectrum. On the contrary, *lines due to ionised mercury are nearly all strengthened*; those not appearing in the vapour lamp attain sometimes an intensity comparable with strong series lines in the vacuum arc. This is naturally to be expected, as the vapour of the exploded mercury is full of ionised mercury. There are some new lines in the ultra-violet region not here given, and are probably due to electron stripped mercury atoms. A more minute discussion will be given in the Scientific Papers of the Institute.

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