verified with a lead tube of 1·06in. and 1·57in. A cartridge of 463gr. of dynamite, which stemmed in the metallic tube in the ordinary way does not ignite firedamp, ignites it every time when it is placed in an internal glass tube stemmed into a lead tube, as has been observed. For a similar reason, dynamite simply poured into a lead tube of 1·26in. and 1·65in. and then stemmed ignites firedamp, although under the same conditions dynamite rammed down does not ignite it.

From this the very important conclusion is deduced that it is always necessary to ram down and carefully stem, though not excessively, the explosives in the shot-hold; they work better, and are less dangerous. By varying the shape of the vessel which contains the explosive the density of charging is not effected, but the work imposed per unit of volume of the gases produced by the detonation is varied. For example, by flattening the tube the work is increased. Thus the observed fact that dynamite enclosed in a lead tube of circular section of 1·18in. and 1·57in. ignites the gas, although ignition is not produced when the same tube is flattened. It has been shown that the gases of the detonation issuing from the tin tube of 0·98in. and 1·57in., which contains the internal glass tube filled with dynamite, should possess a temperature of 4,568° Fahr. They no longer ignite the gas, but this effect must be on the point of production, for with a lead tube of 1·06in. and 1·57in. ignition took place. It appears, consequently, that the apparent temperature of ignition is a little above 4,568° Fahr. By another method it was found to vary between 3,902° and 4,136° Fahr. The discordance between these two estimates will not appear considerable if the numerous sources of error which might affect them are considered. The latter value is a special function of very numerous variables, such as the dimensions of the internal glass tube, the space left between the sides of the tube and those of the metallic tube, and possibly even the shape of this space. For these various reasons, the first estimate, which fixes the apparent temperature of ignition of firedamp mixtures at about 3,992° Fahr., appears to deserve most confidence.

Method of Detonation of Various Explosives in a Closed Vessel—Experimental Researches.—The results given by the detonation of explosives in tubes have been made use of, in order to gain some notion of the method of decomposition of these explosives in a closed vessel. Indeed, if an explosive properly stemmed in a tin tube of 0·98in. and 1·57in. is detonated in the boiler, and if the compression produced is measured, this compression will correspond to about 0·63 of the heat developed by the explosion, which can thus be, at least, approximately measured. The results in the following table have been so obtained.

Explosive.	Weights of		Tubes.		$P'-P$, Pressure in Inches of Water.	(*a.*) Q.	(*b.*) Q.
	Cartridges.	Detonators.	Metal.	Diameters.			
	Gr.	Gr.		In.			
Dynamite, 75 per cent. ...	771·6	23·5	Tin	0·98, 1·57	20·67	...	385·9
	771·6	23·5	Lead	1·26, 1·65	18·11	...	
	771·6	23·5	„	1·18, 1·38	22·24	...	
Blasting-gelatine, Paulilles ...	771·6	23·5	Tin	0·98, 1·57	24·41	456·5	609·3
Bellite	771·6	23·5	Lead	1·18, 1·38	18·50	393·0	397·8
	771·6	23·5	Tin	0·98, 1·57	20·08	377·1	
Pyroxyline-powder, Moulin-Blanc	771·6	23·5	„	0·98, 1·57	18·50	345·4	325·5 to 397·0
20 per cent. dynamite, 80 per cent. ammonia-nitrate	771·6	23·5	„	0·98, 1·58	11·02	205·6	198·5
67 per cent. dynamite, 33 per cent. ammonia-alum	771·6	23·5	„	0·98, 1·57	14·96	281·9	131·0
60 per cent. dynamite, 40 per cent. sal ammoniac	771·6	23·5	„	0·98, 1·57	14·57	271·9	138·9
67 per cent. dynamite, 33 per cent. sal ammoniac	771·6	23·5	„	0·98, 1·57	16·54	309·7	194·5
60 per cent. cotton (0·68), 40 per cent. ammonia-nitrate	463·0	23·5	„	0·98, 1·57	11·81	369·2	381·1
80 per cent. cotton (0·68), 20 per cent. ammonia-nitrate	463·0	23·5	„	0·98, 1·57	11·02	345·4	325·5
90 per cent. cotton (0·68), 10 per cent. ammonia-nitrate	463·0	23·5	„	0·98, 1·57	9·05	281·9	301·7

(*a.*) Q deduced, reckoned the fraction lost in mechanical work per 1,543·2gr.
(*b.*) Q theoretical, per 1,543gr.

This table shows that blasting-gelatine is not perfectly detonated even when steamed in a tin tube of 0·98in. and 1·57in. The complete detonation of this substance—that is to say, the complete combustion of the gases of the cotton by the oxygen of the dynamite—require stronger vessels, capable of keeping the gases a little longer time in mutual contact. It is probable that gelatine in soft rocks of little resistance only develops a part of its energy. Bellite and pyroxyline-powder detonate completely in a tin tube of 0·98in. and 1·57in.; bellite detonates perfectly even in a lead tube of 1·18in. and 1·38in. Mixtures of dynamite and sal ammoniac detonate in the tin tube of 0·98in. and 1·57in. nearly the same as they detonate when unconfined. The decomposition of the sal ammoniac is not effected, or very partially so, even under comparatively favourable conditions. The speed of the decomposition of the sal ammoniac is too little. Mixtures of dynamite