A more detailed report is to appear in the *Helv. Phys. Acta*.

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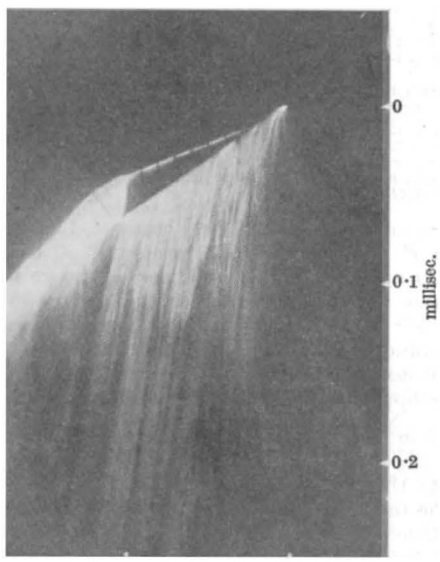
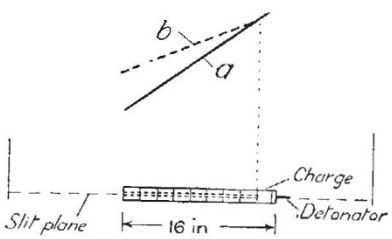
[1] A good survey is given by Curtis, W. E., and Evans, S. F., *Proc. Roy. Soc.*, A, **141**, 603 (1933). See also Venkateswarlu, P., *Proc. Ind. Acad. Sci.*, A, **24**, 480 (1946).
[2] Elliott, A., *Proc. Roy. Soc.*, A, **174**, 273 (1940).
[3] Loomis, F. W., *Phys. Rev.*, **29**, 112 (1927). Mecke, R., *Ann. Phys.*, **71**, 104 (1923).
[4] Mulliken, R. S., *Phys. Rev.*, **46**, 549 (1934).
[5] Wieland, K., *Helv. Phys. Acta*, **14**, 420 (1941). See also Victor Henri Memorial Volume (Liège, in the press).

Velocity of Detonation of a Tubular Charge of Explosive

DETERMINATIONS of the velocity of detonation of unconfined columns of pressed tetryl pellets, made by me in these laboratories in 1941 by means of the Buxton rotating-mirror camera[1], showed that the velocity was higher by several hundreds of metres per second when there was a continuous cylindrical cavity in the column. For example, whereas the velocity of detonation in a cylinder of tetryl, 7/8 in. in diameter and of density 1·44, was 6,875 m./sec., the velocity in a cylinder of the same diameter but containing an axial cavity ¼ in. in diameter was 7,780 m./sec. Later experiments confirming and extending this result were made here by Dr. W. B. Cybulski with the same camera, after he had introduced modifications which considerably improved its accuracy.





The photographic record reproduced herewith was obtained by Cybulski with a tubular charge formed with pellets of an explosive, translucent when cast (40 : 60-tetryl/trinitrotoluene, density 1·62); the column was 16 in. long, 1¼ in. in diameter and contained an open cavity 14 in. long and 0·35 in. in diameter. Initiation was at the closed end. The trace depicted by line *a* of the explanatory diagram is formed by the detonation wave in the wall of the tube, and its slope corresponds with a speed of 7,380 m./sec. (the mean of six determinations having a range of 80 m./sec.). This is 255 m./sec. faster than the velocity of detonation, 7,125 m./sec., in a similar solid cylinder. With a narrower cavity, 0·25 in. in diameter, the speed in the wall rises to 7,410 m./sec., an increase over the normal rate of nearly 300 m./sec. The increase becomes smaller with wider cavities; for example, when the diameter is 0·64 in. the speed in the wall is 7,220 m./sec., an increase of only 95 m./sec. above the normal speed. The trace corresponding with line *b* of the diagram is of a luminous effect within the cavity and visible through the translucent explosive; it moves in advance of the detonation wave in the wall and is no doubt a manifestation of the well-known Munroe effect[2]. Within the cavity the speed is no less than 12,500 m./sec., and beyond the end of the column the effect is recorded as a flame of intense luminosity and long duration; for a short distance its speed is appreciably higher even than within the cavity.

Determinations of the velocity of detonation in cylinders of different diameters show that the value 7,125 m./sec. in this explosive is its limiting velocity, or the 'maximum possible velocity' of Berthelot. It is found that, when the cavity is filled with inert material such as 'Plasticine', the rate in the wall is the same as that in a solid charge; thus a higher value obtained experimentally with a hollow charge is abnormal in that it is a result of events within the cavity. That the passage of the luminous effect therein does not cause a forward motion of the tube, producing only an apparent increase in the velocity of detonation, has been proved by first superposing on the film a shadow photograph of the undetonated charge. At least two other explanations remain: that the passage of the internal effect is responsible either for immediate physico-chemical changes of the explosive in the wall, or for a modification in the form of the detonation wave therein.

The experimental work was carried out for the Ministry of Supply, and thanks are due to the Chief Scientist for permission to publish this note.

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[1] Payman, Shepherd and Woodhead, Safety in Mines Research Board Paper, No. 99 (1937).
[2] Munroe, *Amer. J. Sci.*, **36**, 48 (1888).

Co-ordination Complexes Containing Olefines

THE concept of the 'co-ordinate link' type of bond formed by donation of lone pair electrons has recently been generalized by Walsh[1] to include also donation by bonding electrons. A similar idea has been independently put forward by Dewar[2] to explain certain intramolecular rearrangements. This new idea that donation by bonding electrons may occur,