At a watergate AC (Fig. 14a,-b), the water above stands at the height h_1, and below at h_2. The sluice gate is pulled up so far that water from the opening BC (Fig. 14b) flows out. If no friction were present, then the water in the region BCDE would flow farther underneath the stationary water GBDF. In fact, however, friction exists between the flowing water and the stationary water. As a consequence stationary water above BD is dragged along by the flowing water below BD, and the result is that the water-level is lowered some distance from G, so that a piling-up is seen at M. The smaller is the pressure-head difference h_1-h_2, the smaller is the exit velocity of the water from the opening BC, the farther back toward BC is this congestion M, and conversely. Also, the steepest slope lies toward the exit opening.

A compression line analogous in our case is the line CC_1 (Fig. 11), the wave crest of a relative pressure maximum that originates by the impact of the powder gas coming from the gun against the opposing relatively stationary outside air. This plate-shaped wave crest therefore is produced by the rapid increase of the compressed outside air together with the powder gases; depending on whether this plate is or is not sharply projected in the photographic exposures, it is seen as a flat ellipse or straight line.

Since the gases within the angle MCC_1 (Fig. 11) flow essentially with only longitudinal velocity, the line CC_1 is approximately vertical to the bore-axis.

We now consider those gas particles whose flow lines lie outside the angle MCC_1. In the case of these, an appreciably larger transverse velocity component is present than in the case of the particles moving in the close vicinity of the bore-axis. This component is independent in magnitude of the inclination of the flow lines, as well as of the absolute value of the flow velocity. The inclination of the flow lines, which lie in the regions MAB and MA_1B_1 (Fig. 11), however, is greater, and consequently the transverse velocity component is also relatively large, although the orbital velocity of the gas particles themselves is smaller at first. Behind the middle of the flow pattern there exists so rapid an increase of the flow velocity[1]

1) A measure for the size of the transverse velocity comes from the fact that the blast of a strong air-flow from a bomb with about 10 to 15 atm. across the flow form is able to exert no appreciable influence on the position or the