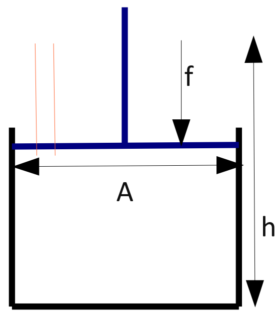
Velocity of efflux in a pressurized fluid -

Assuming this is a piston cylinder arrangement -



A force f applies on the piston, since the area of the piston (and of the base of the cylinder also) is A, the pressure imposed by the piston on the fluid will be f/A.

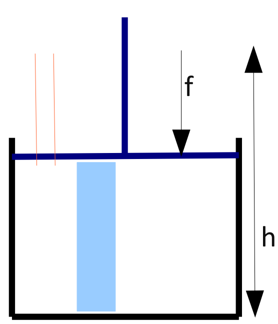
From the piston an orange pipe emerges which allows the fluid from the cylinder to move out; the objective is to compute the velocity of the fluid flowing out.

The elevation of this pipe from the base of the cylinder is h.

Considering a no field situation, the pressure f/A applies indirectly from the base to the fluid...it does not apply directly from the piston; since if the cylinder would not have existed, the fluid would have just moved in the direction of the force applied by the piston; it's cause of the cylinder which gives a normal reaction through which the fluid gets pressurized.

So the cylinder is applying a force P on the fluid, each block of the fluids will experience a forces opposite to the direction of f because of which the fluid will come out of the orange pipe.

Considering a rectangular block of fluid in the cylinder with mass m and height h -



and assuming the area of it's side facing the base as k, then the force application on this block will be p*k...then the acceleration on this block will be $\frac{p \times k}{m}$.

So if the acceleration will commence till the height h (after which the fluid will flow out), the velocity of the fluid flowing out will be -

$v^2 = 2\frac{p \times k}{m}h$ ....from $v^2 = u^2 + 2as$

So -

$$v = \sqrt{2\frac{p \times k}{m}h}$$

As you can see from this formula, the velocity is not a function of the height at which the piston is currently raised.

The acceleration $\frac{p \times k}{m}$ will be independent of k, since m will be linearly proportional to k, thus any increment in it's value will cancel out.

If a field is there (for example gravity) which works against the direction of acceleration ($\frac{p \times k}{m}$), then the effective acceleration of this block will be $\frac{p \times k}{m} - g$; where g is the acceleration posed by the intruding field; thus the formula becomes -

$$v = \sqrt{2\left(\frac{p \times k}{m} - g\right)h}$$