Manufacture of Hollow Steel Forgings, e.g. Ammunition Shells (230, 155, 140, 120 mm and other sizes) and Gas Bottles.

Forging Lubricants recommended

1st stage: Piercing of the hot billet (1250° C)
Place the hot billet in the forging die. Put a small amount (tee spoon) of
"Graphitex FP 3 dry granulate" on top of billet *(this can be done automatically).*
Fill the water- based product Graphitex CR 21 or Graphitex CR 9, diluted approximately 1: 5 with water, into the small container that is placed on the back of the die.

Whilst the piercing punsh is moving downward pressing a cavity into the billet, the 2nd punsh is automatically submerged into the small container with the aqueous lubricant. *There is no reason why an oil- based product should be used at this stage.*

2nd stage: Forging
The "forging pot" is lubricated with Rexal SL, an oil-based product, containing graphite and special additives.
Water-based products had been tried, but because of the great heat emanating from the billet, these attempts have not been successful. (Leidenfrost phenomena). May be this could be managed with a high velocity spray system. In that case Graphitex CR 21 at a dilution rate of 1:5 or 6 with water is recommended.

Whilst the 2nd punch *(lubricated during the 1st stage*) is slowly moving down, penetrating the pierced billed deeper and deeper, the sides of the shell are moving upwards.

3rd stage: Reverser drawing
The 3rd stage is a reverse drawing process. Both, the long punch and the rings, are spray lubricated with the diluted Graphitex 118 K, or Graphitex CR 9, or Graphitex CR 21.
Dilution ratio: 1:5 up to 1:10 with water.

4th stage: Bottling operation
After the hollow forging has been drawn, a so-called bottling has to be performed.
Usually this is done on a smaller press. For this operation a special lubricant has been formulated with the name "Graphitex Hi-Ex".
This is a heavily loaded graphite grease with powerful expulsion agents that prevents sticking of the forging during this operation.