WASC 1943 WAI 472

Drtick & John Wilson on cordite extrusion John Wilson, 173 The Hornbeams, Harlow, Essex CM20 1PL. Tel. 01279 426690 23/06/2004

Model Engineer, Dear Mike,

Further to the article on "Hydraulics at the Royal Gunpowder Mills" that you published in Vol. 191, No.4204 last October, I wonder if you would be interested in the following?

## Cordite Extrusion at the Royal Gunpowder Mills.

The regular reader may recall an item in last Octobers edition No.4204 on Hydraulics at the Royal Gunpowder Mills, Waltham Abbey, Essex. Well since then I have been asked by a fellow volunteer, to make a demonstration press for Cordite Extrusion. All though cordite was extruded by hydraulic press, I didn't have the necessary materials to hand, to make a hydraulic press, so went for the simpler screw press instead.

But first a little science. Cordite is a mixture of Guncotton & Nitro-glycerine mixed together with a dollop of Petroleum Jelly (for lubrication & corrosion protection). Both Guncotton and Nitro-glycerine are extremely dangerous and unstable explosives, but mixed together they become stable and safe to handle, and become an effective propellant.

A simple distinction between explosives & propellants. The propellant shoots the missile at the target. The explosive blows the target up.

My Scientific friends at the Gunpowder Mills get quite huffy if we non scientific types start confusing explosives with propellants.

To use cordite as a propellant, it first needs to be extruded through a die to give a particular shape for the device it is to be used in, so propellant for a missile would have a different extrusion die to propellant for a shell.

Photo 1 shows a recently renovated cordite press on display at the Mill. Photo 2 shows the two halves of a typical die. Note the 7 stainless steel tubes in the centre of the die, which are each 0.050" OD and have a bore of 0.020". The multitude of small holes are the feed holes for the cordite into the die and are 1.5mm dia.

As the cordite is forced through the die and around the tubes, this creates seven holes running down the length of the cordite, the holes giving a greater surface area to the propellant so that it burns more effectively.

To stop the holes closing as the cordite exit's the die, air is forced down the tubes to prevent collapse of the extrusion. The brass tube at the front of the die is 0.125" OD and is the airline connection. Photo3 shows the die assembled, with the extrusion bore of 0.480" face up.

Having never worked at the Mills myself, I have never seen cordite, but I am told, it is the consistency of bread dough, but for my demo, I have used well kneaded plasticine.

My press was built from scrap, laying around in the workshop, plus an old foot pump donated by Dave Hewkin, who asked me to build the press in the first place. John Wilson, 173 The Hornbeams, Harlow, Essex CM20 1PL. Tel. 01279 426690 23/06/2004

The first task was to dismantle the pump and decide how to mount the die. The pump outlet end (where the hose normally fits), was bored to take the die. The inside of the end casting was polished to give a good face for the die to seat on. Its worth pointing out that in the full size press, no seals are used, so all mating faces are metal to metal. The Press piston is a loose fit in the cylinder bore, so that cordite can seep up the sides of the piston. I assume this is so that there is no heat generated by seals rubbing on the cylinder bore as the cordite is compressed, as the cordite is temperature sensitive. Equally no air must be trapped in the cordite when it is loaded into the press as air under compression rises in temperature and could cause an explosion.

The pump outlet casting was mounted on two columns (photo4) and the die inserted (photo6). Next the Cylinder of the pump, which has a bore of 2.110" was reduced from 5" to 4" in length to make the assembly more manageable.

The piston (photo8) is a piece of aluminium 2.100" dia, giving 0.010" clearance on the cylinder bore and is held onto the screw jack by a U clamp so that it is free to turn as pressure is applied to the jack, as per the prototype.

*Photo7 shows the complete assembly and photo9 shows two pieces of extruded plasticine with the seven holes clearly seen.* 

Extruding the plasticine was extremely hard and experiments with other mixtures (one suggestion being flour & cooking oil) is called for. Or perhaps a bigger die may work better, but never the less, the result is promising.

Incidentally, unlike my two puny pieces of plasticine, cordite was extruded in long lengths, anything from two feet upward, depending on the application it was to be used in and I have seen photos of lengths of 12 ' or more being extruded using a horizontal press. The extrusion was then fed onto a long table in front of the press, where it would be placed into packing cases for storage and transportation.

Yours Sincerely,

John Wilson Volunteer for the Royal Gunpowder Mills. Registered Charity No. 1062968/0.





Photo2 Photo1



Photo3



Photo4



Photo5



Photo6



Photo7



Photo8

Photo9