

The birth of the INCH

Everything started around May 2004, following various discussions, directly with Laurie **Ingram** and a few technicians, also on various Forums on the often discussed topic '**Rear Locking Actions**'.

Highly motivated on this concept, influenced also by Laurie's enthusiasm, I decided to put on paper a principle of rear locking mechanism, sufficiently rigid to shoot down in flames the received idea concerning the so-said myth 'Bolt metal compression' because of the distance Bolt Head Recess-Locking Lugs, causing cartridge case-stretching on firing.

The existing rear-locking mechanisms were studied. All references to the **SMLE** system were immediately discarded because of the inherent flexibility of the system and horizontal closed lugs location (contrary to all other 2 lugs systems with vertical lugs closure. The evaluation concerned principally **Four** mechanisms:

- The French **MAS 1936**.
- The Austrian **Steyr-Mannlicher SSG**.
- The Danish **Schultz and Larsen M62**.
- The **Remington 788**.

Numerous users of those models were contacted, and exhaustive technical exchanges allowed to conclude that the reproaches commonly made to the system were absolutely unjustified, more to the contrary...

-The French system **MAS Modele 1936** was certainly the strongest, the simplest and the fastest cycling of all the military Bolt action designs. The fast cycling being mostly because of the rear locking system and lugs arrangement, allowing to reduce considerably the Bolt travel. His two generous locking lugs, situated at 45° (4.30 and 10.30 o'clock) allowed exceptional mechanical performances. It was also considered that this mechanism was the basis of an extremely accurate sniper rifle, the **MAS Modele FR-F2**, still in service to day in many armies.

-The Austrian **Steyr-Mannlicher SSG**, bolting by means of 3 sets of lugs, of the interrupted threads principle, originally a sniper rifle (SSG = ScharfSchuetzenGewehr), but was also produced in limited quantities as a single shot Target version, and this model was highly considered for its Long Range accuracy.

-The Danish **Schultz and Larsen M62** derived from a former repeater hunting rifle model. The M62 was extremely rigid. This model is still highly considered by UK Match riflemen for its long range performance. This 4-Lugs mechanism represented the forefather of the **SWINGs M71**, **PARAMOUNTs**, **C.G-RPAs**, **CG-MILLENIUMs**, those models showing exactly the same lugs geometry as the **M62**, but with the lugs moved at front.

-The **Remington 788** has a solid reputation for accuracy when used for the calibres it was designed for. Its multiple lugs arrangement was the real negative point for this excellent design.

I then had an evaluation made of the mechanism functions of the 3 possible variants, 2 , 3 , and 4 Lugs. arrangements.

At this stage, we had to give a name to the project, and **Bill Mac Farlane** ,actual Fullbore List Moderator proposed the contraction '**C.G-INCH**' who received my enthusiastic approbation.

The initial study allowed to determine several fundamental advantages inherent to a rear locking system:

-Moving the bolting lugs to the rear of the loading port allowed a considerable reduction of the Bolt travel. In a front-locking system, because of the added length of the Lugs and Counter Lugs that compels to have the cartridge to override them before being chambered adds to the necessary function travel of the Bolt. The Rear Locking system seemed making possible to allow up to 33% of Bolt travel reduction.

-The pressure transmission to the Bolt Lugs was almost parallel to the axis of the mechanism. The rear Lugs acting much more as a buttress.

-The absence of complex shapes at the Bolt Head level allowed a perfect centering Receiver/Bolt at this important level. The close tolerances of the two diameters, Receiver bore and Bolt Head diameter were moved forward significantly as compared to the Front locking system, directly at the level of the case head recess of the Bolthead.

-For this important question of concentricity it immediately appeared that, contrary to the front locking Receivers, a rear locking one allowed the Receiver to be bored/reamed/threaded/squared in **ONE** single CNC machining operation from the front, thus allowing the perfect concentricity of all the functional bores and squareness of the shoulders, only obtainable for front locking in custom costly actions or by subsequent 'trueing', a process even more costly at the end. Effectively, a front locker need to have the succession of bores and shoulders machined in two operations, one from the front (barrel threads and lugs recess, and one from the rear (bolt raceway).

-The system allowed a considerable increase of two important values: The Lugs bearing and Lugs shear areas.

-The cocking Ramp being behind the Lugs, the cross-sections along the Bolt cylinder were maintained perfect concentric cylinders and of ample cross-section, without any weakening point whatsoever.

-The same cause played for the Receiver, in what concerned the Trigger pocket.

-The principle was making easy the adoption of a coned breech, ensuring the feeding absolutely faultless for all kinds of ammunition, from the .223 and shorter rounds (BR or PPC), to the .338 Magnums, in a system maintained very short (187mm-7.362').

-The gain represented by the shorter Bolt and travel allowed a substantial lengthening of the Barrel shank. I was then able to envisage a mixed fitting, composed of two close toleranced diameters, one at front and

one at rear of the central threaded part. The two diameters ensuring the centering of the barrel, and the central threaded section ensuring the only function a thread set is intended for: **tighrening**. (Threads are never fully self-centering). This principle being of extreme importance for frequent barrel changes, as it maintain an absolute dead zero shift.

-The system allowed also a long loading port, particularly well situated for easy feeding reach while the rifle was on shoulder.

A specification list was established with the following constraints :

-Choice of materials and treatments in accordance with the most recent metallurgy advances.

-Bolting system still quite unseen, in regular geometrical form. Two models were intended:

--The **TETRA** with 4 Lugs of square section, opening angle 45°.

--The **DELTA** with 3 Lugs of triangular section and round apexes, opening angle 60°.

-Length identical to the **Millenium**, 187mm (7.362").

-Same Bedding system, 3 countersunk Bedding screws and compatible with the systems Flexibed and fleXibloc beddings.

-Other bedding options, recoil spigot, vee block and conventional bedding.

-Mechanism as rigid as possible. For this reason, the Receiver diameter was fixed to 38mm (1.496') for the basic model.

-The Bolt travel was fixed to 85mm (3.346') this allowing direct feeding of short and standard lenght calibres ammunition, but also those of Magnum cartridges, up to the .338 Lapua length, but for those bigger ones, the ejection of the case only. A gain of 27% of Bolt throw travel over a normal forward locking short action, was then achieved.

-120° cone shaped Bolt head, matching in a corresponding female cone in the barrel, ensuring a perfect smooth feeding, with no risk of bullet tips damaging.

-Symetric disposition of the Lugs arrangement, closed in triangle for the **DELTA**, ensuring a large section of the receiver ahead and behind of each of the Lugs, an important factor for rigidity and strength.

The first test model designed was the **TETRA**, built in unique prototype, that **Laurie Ingram** stocked using the Flexibed system in a **Dunlap**-style stock, chambered in 6mmBR Impr., which he took to Canberra end of 2005 to get an 11th place in the F-Class Championships Aggregate and winning also the 2006 Daily Telegraph in the Bisley Imperial with a 88/90 score.

The designer then realised that the **TETRA**, with its 45° opening brought not very much improvements to his precedents 4 Lugs models and decided to realise the **DELTA** only, with 3 lugs in 'cloverleaf' triangular shape. With its 60° Bolt opening, this model represented the perfect compromise between 4 and 2 lugs designs, with lugs bearing surfaces, lugs shear area and total added bearing angle unequalled otherwise.

Initially, **Jackson Rifles** were to produce the model, and some **DELTA** prototypes were realised under this label. Some were immediately put in use

and **David Richards** used one in the 2008 Imperial Meeting, that he ended in the Queens Prize just one point behind the winner (shooting a **C.G MILLENIUM**), and with the best score at long range. **David** will also finish 7th in the 2009 Bisley Grand Aggregate with the same rifle on a Flexibed stock.

Jackson Rifles having finally decided to not go further in their initial projects and, after those prototypes, I decided to redesign the model, incorporating in it some improvements, for instance:

-**Reversible Firing Pin Tip**, giving the possibility to always have a spare tip inside the mechanism for a quick eventual change.

-**Primary extraction** ensured by the combination Bolt Stop Key / Guide ramp, extremely positive system, giving a good 2 mm of primary extraction. This was an addition to the quick Bolt removal system.

-**C.G- X-Treme Trigger**, indifferently on 3 or 4 Levers principle to adapt to various Long Range disciplines and pull weights. <http://www.x-tremeshooting.com/index.php?page=cgxtrememod22>

In May 2008, **Chris Quartermaine and Rod Shehan**, managers of **Woody Engineering**, in Woodanilling, West Australia, <http://www.actionclear.com.au/products/cginch.php> took contact in view to obtain the fabrication and marketing rights of the **INCH-Delta**. We met here in Normandy, and they tested successfully two models. The serial production is well on the way now, and the rifles built on the mechanism **INCH-Delta** and '**Made in Australia**' start to be talked about...and to WIN... One of the first production models, Titanium Nitride-coated (very hard, low-friction Hi-Tec coating, in gold colour), met considerable success at the **NRA of America Convention in Phoenix (AZ)**, in May 2009. It now shows in USA, where it is imported by **Tom Myers (X-Treme Shooting Products)**. **Gary Eliseo** is making his Tube Stock for the **INCH** (model **CG1**) <http://www.competitionshootingstuff.com/id31.htm>, perfectly suited for this adaptation.

One of the first **CG-Inch** actions fitted in an **Eliseo CG1** stock with a **Broughton** and **Pac Nor** interchangeable barrels is on extensive successful testing by **Warren Dean** of **Thatcher (AZ)**, prominent member of the US F-Class Team. From Warren's quote, the **CG INCH** is the most accurate rifle action he ever shot.

Cooperation between designer and **Woody Engineering**, now under **Chris** and **Donna Quartermaine** management is a great human experience, and we have together several projects.

R.Chombart,
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