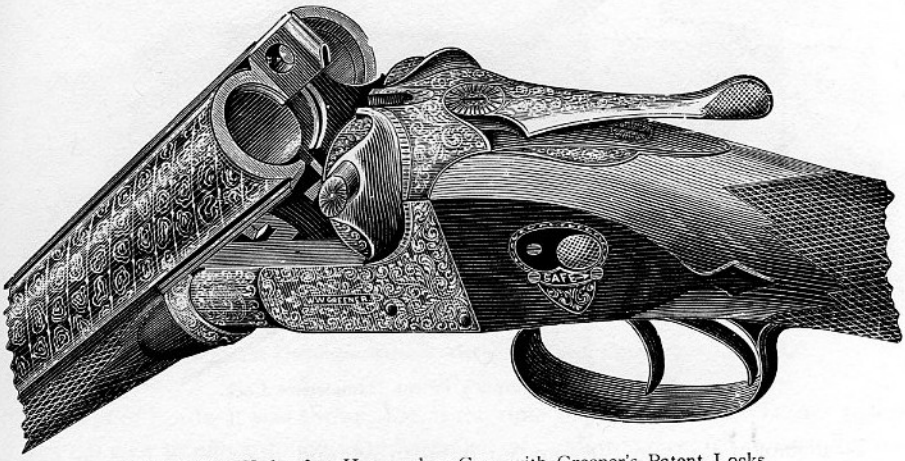
Another form of top bolting revived by the late Editor of the *Field* and by Mr. Rigby in their hammerless guns is shown in the Abbey breech-loader, an American invention of some twenty years ago. It is a sliding bolt, binding vertically to the breech action a flat extension of the top-rib. It is probably more secure than the ordinary doll's head, for the expansion of the barrels being upward and the strain on the breech-action backward, the bearing of the bolt remains unaltered at time of the explosion.

GREENER'S TREBLE WEDGE-FAST HAMMERLESS GUN, THE "FACILE PRINCEPS."

From the annexed illustration it will be seen that the shape of this breech action is neater than the Anson and Deeley hammerless gun. This is due to an

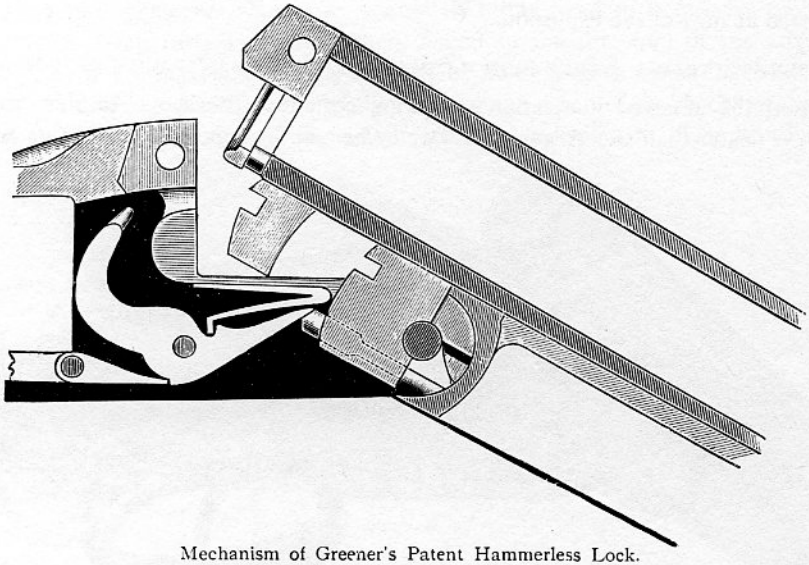


The Treble Wedge-fast Hammerless Gun, with Greener's Patent Locks.

entire change in the lock-mechanism and method of cocking the gun; by this change of principle a strong screw joint-pin is substituted for the solid hinge-pin; the holes through the breech-action joint and fore-end are not required, and the lifting-cams, or "dogs," are dispensed with. This allows of a round-shouldered body being substituted for the objectionable square Anson and Deeley pattern body, and greatly increases the handiness and solidity besides adding to the appearance of the gun.

The cocking is effected by a sliding rod working in the under lump; the tumblers are arranged similarly to those of the Anson and Deeley, but have their fore extremities turned in so as to engage with the cocking rod. Upon the barrels

being dropped for loading, the cocking rod is raised with the lump and lifts the tumblers at the same time, and so effects the cocking. The shape and arrangement of the tumblers and cocking rod are shown in the following illustrations, the first of which is a sectional view of the mechanism, and the second shows the gun as exposed underneath when the cover-plate has been removed.



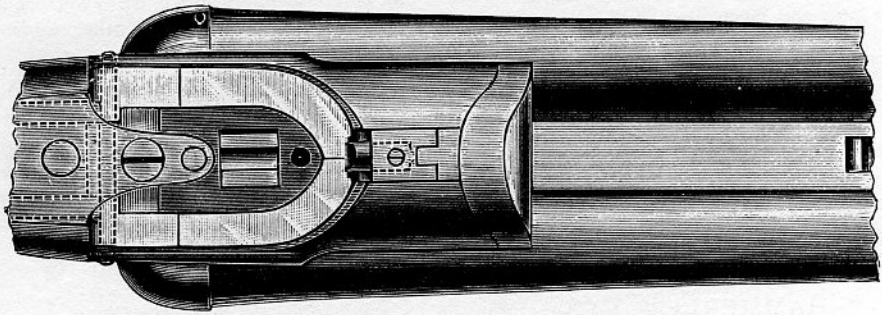
Mechanism of Greener's Patent Hammerless Lock.

To dismount the gun the fore-end is taken off, and the sliding cocking-rod is then free to slip forward past the tumblers, instead of carrying them upward, as the barrels swing; on putting the gun together the placing of the fore-end upon the gun presses the cocking rod into position and holds it to its work there.

This mechanism was at first made with a cocking swivel hooked in the lump and kept in position by a sliding rod; it has now been further simplified by substituting the cocking slide for the swivel and rod. During the past twenty years thousands of guns have been made upon this principle, which has been found to possess decided advantages and proved as effectual as it is simple. It is the plan used by the author for hammerless guns and rifles of all bores, and the general arrangement of the lock-work having been found the best suited to all requirements, is followed in the later patterns of self-ejecting guns, which will be described later.

BARREL-COCKING MECHANISMS COMPARED.

The leverage obtained by the falling of the barrels to open the gun was first used for the purpose of effecting the cocking of the locks by J. Needham in his ejector gun, which is elsewhere described. Later the Anson and Deeley mechanism was produced, and in this the same leverage was utilised, but by different means. This was followed by the author's hammerless mechanism, in which use was also made of the leverage of the barrels, but in a different manner. The common use of the principle led to considerable litigation with reference to the rights of the various patentees. In the suit of Couchman *v.* Greener, which was carried to



Greener's Patent Hammerless Lock Mechanism, with Cover Plate removed.

the House of Lords, it was shown that at the time of the Anson and Deeley patent it was not new to effect the cocking by means of the leverage which is brought into play on tilting the barrels to open the breech, and Mr. Needham's gun was put in to show this; and that, this being so, all that the plaintiffs had protected by their patent was that part of the cocking mechanism which was combined with the leverage afforded by the barrels. This, according to their own specification, is a lever formed by the prolongation backwards of the fore-end beyond the hinge-pin of the barrels, such lever working in a groove in the lump, the long arm being the fore-end, the short arm being the prolonged part of it, and the fulcrum being the same as that on which the barrels turn. It was pointed out that the mechanism which Mr. Greener had combined with the leverage afforded by the barrels was not a lever at all, but a to-and-fro movement in a horizontal plane; and that, although the sliding stem might possibly be considered as a prolongation backwards of the

fore-end, it was not a lever, but merely an abutment to give rigidity to the hook attached to the lump. That there was an essential difference between the Anson and Deeley mechanism and that of the Greener "Facile Princeps" was the view taken by all the three courts in which the case was successively heard. The Master of the Rolls in the Court of Appeal said—

"The essential part of the combination of the lock mechanism—the Anson and Deeley—claimed by the plaintiff, was not only that the fore-arm should be used for the purpose of cocking, but that the forward part of it should be the long-arm of the lever. But, although that part of the defendant's gun was used for the purpose of cocking, yet it was not used as the long-arm of the lever, and was therefore not part of the combination claimed by the plaintiff."

Lord Justice Lindley remarked—

"The scheme is different, the idea is different: that is to my mind so plain, when you look at the guns and mechanism, that it presents to me no difficulty in the matter; in other words, I say the two guns are worked upon different ideas altogether."

Lord Justice Bowen also remarked—

"Juries sometimes are apt to be led away more hastily by similarities which are not similarities in principle. Treating the question as one of fact: do the defendants, with the gun as made, use the fore-end as a lever? That is a question of fact. Lord Justice Lindley has expressed my views most fully, and I agree entirely in the views expressed by him upon that point."

HAMMERLESS GUNS COCKED BY THE MAINSPRING.

To ease the strain of cocking hammerless guns when opening or closing the gun, several plans have been devised. Possibly the ordinary rebound principle—to half-bent only—was employed in hammerless guns with this intent. If so the notion was false, as a stronger mainspring had ultimately to be overcome. More successful from this standpoint are systems in which the alteration of the position of the mainspring or its fulcrum is a basis to ease the hand-strain of cocking. To date of writing, four systems employing one or other of these principles are known.

The first is Tolley's Patent (Specification No. 461, 1877). The principle here employed is the use of a sliding mainspring, and a narrowing or > tumbler; the tumbler-pivot is situate between the mouth and inner extremity of the >; each arm of the mainspring is provided with a roller, and the mainspring itself is in connection with the barrels, from which, by means of cam, connecting-rod, or other gear, it receives a longitudinal motion; on opening the gun the mainspring is drawn away from the tumbler, and immediately its arm is past the tumbler-pivot it presses