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PERCUSSION CAPS

By E. Wyndham Hulme, B.A.

Prime agent of Percussion's reign,
Its glory shall Forsyth obtain;
The first the flint who did discard,
May fairly claim a just reward.

Sporting Magazine, 1820-21.

FULMINATES of gold and silver were known before the year 1799, but not put to practical use. Samuel Pepys mentions in his diary under date

"Nov. 11, 1663. At noon to the Coffee-house, where with Dr. Allen some good discourse about physick and chymistry. And among other things I telling him what Dribble the German Doctor do offer of an instrument to sink ships; he tell me that which is more strange, that something made of gold, which they call in Chymistry Aurum Fulminans, a grain I think he said, of it put into a silver spoon and fired, will give a blow like a musquett and strike a hole through the silver spoon downward, without the least force upward and this he can make a cheaper experiment of, he says, with iron prepared."

A number of fulminating compounds either with mercuric oxide and sulphur, or mercuric nitrate and phosphorus, or mercuric oxide and potassium chlorate, and others were proposed, but none of them could be used. It was at a meeting of the Royal Society on the 13th March, 1800, that Edward Howard, F.R.S., announced the discovery of what is now known as fulminate of mercury. He analysed his fulminate of mercury according to every method then known to chemists and, in one of his experiments, treated "the mercurial powder by means of dilute sulphuric acid." He was severely injured by an ensuing explosion, which led him to confess, that "he would feel more disposed to prosecute other chemical subjects."

FIG. 26. EDWARD CHARLES HOWARD, F.R.S.

FIG. 27. WILLIAM ELEY.

Howard's experiments show that fulminate of mercury was useless as a military powder, but suggest the possible use for breaking up ordnance. As a primer, he points out that gunpowder laid over the fulminate was not inflamed by the explosion of the latter.

The application of detonating powder to the discharge of firearms came later; at first chlorate powder was used, the mercuric fulminate cap is of a later date. It made the cartridge possible, the success of which is largely due to the labours of William Eley. Since the question of priority in this invention is in dispute, the following notes, which are the result of a careful investigation of the subject, will be of interest.

ALEXANDER JOHN FORSYTH.

Forsyth's experiments with detonator locks were first made in the year 1805, when he constructed a lock for a sporting gun with which he shot "with safety during the whole season." In the spring of 1806 he submitted the invention to the Master-General of the Ordnance, by whom he was requested to adapt his principle to the requirements of the military service. After some £600 had been spent in experiments, Forsyth claimed to have succeeded in applying his system both to the musket and a three-pounder, and negotiations were opened at the inventor's suggestion, for basing his remuneration on the saving of gunpowder effected by the new mechanism. This gave the Government a loophole for escape. A change of ministry took place, and Lord Chatham, the successor of the Marquis of Hastings in the Mastership of the Ordnance at once discharged Forsyth from further experimenting on the Government's behalf. The inventor's bare expenses were paid, but no other remuneration was given until 1843, after the percussion system was adopted officially, when a sum of £1,000 was divided amongst Forsyth's relatives—the inventor having died in that year. To return: however, in 1807, Forsyth, acting on the suggestion of the Government, took out a patent drafted as stated by himself, "in the most general items," *i.e.*, he claimed all forms of per-

cussion locks with all suitable detonating mixtures. These claims after arduous fighting, were finally sustained in Forsyth *v.* Riviere in 1819, after which trial the trade appears to have accepted some form of licence. Great as the merits of Forsyth's invention unquestionably were, the effect of the patent was prejudicial to the development of the industry. Forsyth was obstinately wedded to his detonating mixture, viz., potassium chlorate, charcoal and sulphur, and he persisted in retaining the original design of his lock. It is stated that his guns were manufactured at Liège, which would have made the efficient supervision of improvements difficult. According to Mr. Blanch, we find in the "London Directory" of 1812, Forsyth and Co., Patent Gunmakers, 10, Piccadilly, and in 1818 at 8, Leicester Square, where they remained until 1852. The original gun as invented by Forsyth was exhibited at the 1851 Exhibition in Hyde Park, London.

Probably the enforcement of his patent rights occupied most of the leisure hours of the Scotch Minister, who to the last (viz. in 1843) failed to recognize the superiority of the cap and nipple mechanism. Be that as it may, Forsyth's resistance to improvements in the percussion lock during the term of his patent accounts for the obscurity which has shrouded the history of the invention of the fulminate of mercury percussion cap. The period and country of origin of the invention are fairly well defined, the number of claimants to the honour are considerable. In the present essay it is not pretended that all difficulties have been solved, or that all avenues of research have been finally explored, but something, it is hoped, has been done towards stating with precision the relative claims of those who were instrumental in the introduction of the new system between 1818 and 1823.[1]

The Forsyth lock was both original and ingenious. In place of the priming pan outside the flush hole, a round plug, having a small cavity on the top which led to the flash hole, was fitted into the barrel,

[1] The following description of the Forsyth and Manton locks has been kindly supplied by Mr. Herbert J. Blanch.

FIG. 28. FORSYTH MAGAZINE (ASSEMBLED).

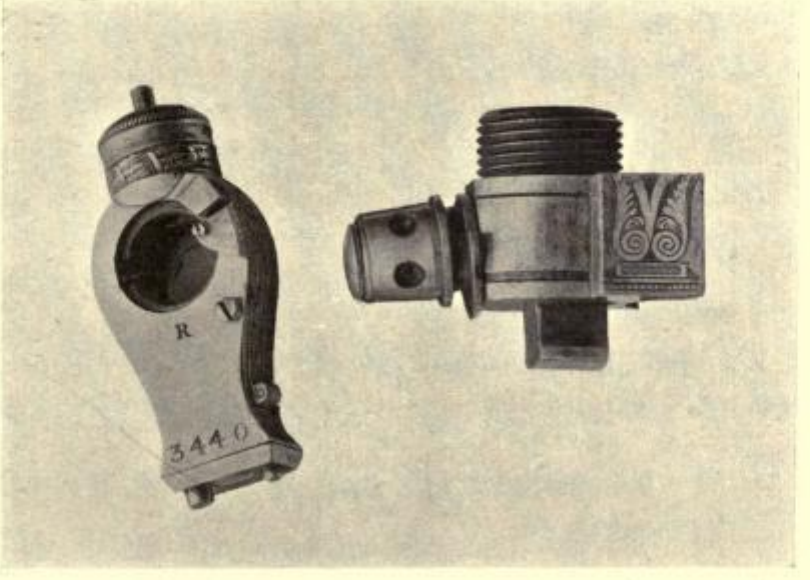

FIG. 29. FORSYTH MAGAZINE (DETACHED).

and upon this plug was pivoted a magazine in the shape of a small scent bottle with two necks opposite each other. In one neck was mounted a striker rod held up by a light spring, and in the other neck was a hole drilled down to the central plug, to contain enough detonating powder for about twenty discharges, covered by a sliding lid. In this lid, opposite the hole containing the powder, was a similar hole fitted up with a plug of horn or leather, to act as a safety vent in case the entire contents were discharged by friction or jar. This perhaps only rarely happened, but the great objection to the system was the necessity of handling the loose detonating powder, and, although pellets or pillules of various compositions were tried, as soon as the copper tube and copper cap had been invented, which obviated the necessity of actually handling the detonating powder, and cut it up into very small quantities, which were quite safe for ordinary handling, and yet sufficiently sensitive when placed in position on the lock and fired by a blow from the hammer, all attempts to work with the loose powder were abandoned.

The operation of priming with the Forsyth gun was to rotate the magazine primed until the hole containing the detonating powder was over the small cavity in the top of the plug leading to the touch-hole, when a small quantity fell by gravity into the cavity of the plug, assisted by the jar of the primer being arrested in its rotation against a stop pin on the lock plate.

The primer was then rotated into the opposite position, which brought the small striker rod over the cavity now containing the detonating priming, and ready to be fired on the fall of the hammer on the striker.

In 1816 "Joe Manton" patented a gun having a copper tube containing detonating powder held "fore and aft" in a hole in the head of the hammer, which, in falling, struck the open end into a cavity in a plug, containing the flash hole, projecting from the barrel.

In 1816 he improved on this in another patent, by placing the

copper tube in the flash hole itself, where it was held by a spring cover, and was struck in the middle, through a hole in the cover, by the hammer which had an axe-shaped striking piece.

This gave a very powerful flash and certain ignition, and could not blow the hammer back again, as might happen with the other system, the only drawback being that the fired tube might blow out to the right or left with considerable force, to the danger of any one near.

E. Goode Wright, of Hereford.

In 1823 Wright published his classical paper on the preparation of fulminate of mercury caps.[1] In this paper he strongly asserts the superiority of the fulminate over the chlorate of potash mixture of Forsyth. Wright was led to make his experiments after hearing a series of lectures in chemistry delivered by Murray at Hereford in November, 1822, at which date the copper cap was well known. Indeed, Wright's statement contains an admission of the fact. "After he (*i.e.* the lecturer) left us I was induced to make the powder and try it *with the copper cap.*" In the same paper, however, Wright refers to experiments made by him "several years ago" with fulminate of mercury as a primer for guns, and this statement is carried back by the compilers of the "Temple Anecdotes" to the year 1805, the year of Forsyth's original experiments. In confirmation they quote an undated letter from the Duke of Wellington to Wright to show that Wright was at that time advocating the use of fulminate of mercury in copper caps in the military services. A search through the Board of Ordnance papers from 1806-26 shows that the paper correspondence has not been preserved. It may have perished in the fire at the Tower of London *circa* 1840, in which the original correspondence, *re* Forsyth's invention, was lost; or the Duke may have treated the letter as personal correspondence. The letter, however, can be dated

[1] "Phil. Mag." vol. lxii, p. 203.

approximately as not earlier than 1820, for the Duke's answer refers to an official report condemning the percussion system, which has been preserved, and which is dated 12th May, 1820. This correspondence therefore cannot affect the main issue, for the copper cap was already the subject of a French patent prior to this date. Nor can the early experiments of Wright have been of such a nature as to invalidate Forsyth's patent, for in 1819, in Forsyth *v.* Riviere, the question of novelty was exhaustively treated, and the only apparent anticipation alleged by the defendant was that of a clergyman named Butler, of Okeford, near Blandford in Dorsetshire, who had invented a lock of similar description, and communicated the idea to a gunmaker named Symonds, but the judge directed that the disclosure was insufficient to affect the validity of Forsyth's patent.

F. Joyce, Chemist.

Wright's paper was followed in 1824 by the experimental manufacture of copper caps by the chemist, F. Joyce. In an excellent monograph, entitled "The Sporting Cartridge" (London, 1906), Messrs. Joyce and Co. claim an earlier date, but the correct date is, I venture to assert, settled by the following quotation from the third edition of Colonel Hawker's "Instruction to young Sportsmen" (1824): "Since the first part of this work was printed off, a letter has been received from Mr. Joyce, chemist, 11, Old Compton Street, Soho, inclosing a specification of a new 'anti-corrosive percussion powder.' All he can say is that he has fired twenty-four copper caps with this new powder after dipping each cap for some time in water, and not one of them missed fire." In the fifth edition of Hawker (1826) the writer further states: "It may be hardly fair to say publicly what the composition is (because Mr. Joyce candidly told me, though I believe it is pretty well known), and although it was long ago adopted by Mr. Goode Wright, of Hereford, according to a statement which, as an utter stranger, I was favoured with by the gentleman;" and he goes on to give Joyce credit for having overcome many obstacles before bringing

the percussion caps to perfection. Obviously the quality of the copper, the tempering and water-proofing of the fulminate were all matters which would require careful working out before the manufacture could be established on a large scale. The evidence of the London Postal Directories supports Hawker's statement. Joyce's name appears from 1823-27, as "Operative Chemist, 11, Old Compton Street." In 1828 F. and E. Joyce are styled "Percussion powder manufacturers," and in 1831 they re-appear under the same description at 55, Bartholomew Close. In 1843 F. Joyce describes himself as "practical chemist, inventor and sole manufacturer of the anti-corrosive gun cap," etc. The facts suggest a close connection between Wright's paper in 1823 and the manufacture of the copper cap by Joyce in 1824.

Joseph Egg.

Our examination of Wright's claims has tended to prove that the invention of the copper cap and nipple mechanism preceded by some years the practical information required for the manufacture of the fulminate of mercury. Wright appears to have been the first to give this information to the public. Apart from the question of the fulminate two individuals have directly claimed the invention of the copper percussion cap and nipple mechanism, viz., Joshua Shaw, the naturalized American, and Joseph Egg, the Piccadilly gunmaker. The latter engraved his claims on his own gun-locks, and it is probable that he was one of the first London gunmakers to put this class of lock upon the market. As late, however, as 1821 he was pushing a percussion gun-lock, which is thus described in the "Sporting Magazine," 1821:

> Of magazine some did complain,
> And vowed it threatened senseless brain,
> A safer mode by tube and peg,
> Is offered to the world by Egg.

His adoption of the cap and nipple mechanism was probably subsequent to this date. In 1841, when public interest was again aroused by the adoption of the percussion cap by the military authorities,

Mr. H. Wilkinson, of Pall Mall, took great trouble to ascertain the truth as to the invention of the copper cap, and published the result of his researches in his "Engines of War," page 187, from which the following abstract is taken:

"Mr. Egg, I believe, purchased the invention from Mr. Roantree, a gunmaker at Barnard Castle, Durham, who had it from a workman employed by Mr. Joshua Shaw, now residing at Philadelphia. I can trace it no further. Mr. Shaw assured me that in 1814 he invented a steel cap, which, when fired, was retained to be primed again; that in 1815 he made a pewter cap, which was thrown away after using; and, lastly, that in 1816 he used a copper cap precisely similar to those at present employed. He made application for a patent in England; but the solicitor, to whom it was referred, decided that it could not be obtained without infringing Forsyth's patent then in force."

JOSHUA SHAW.

Before discussing Shaw's claims, we must now turn to the French specifications, which contain the earliest description of the invention. On the 29th July, 1818, Prélat, a Paris gunmaker, patented a hollow cock and a conical nipple, which was charged by dropping a few grains of fulminate of mercury into the cavity of the cock. On the 28th July, 1820, he filed a certificate of addition, in which a flanged copper cap charged with a secret composition is substituted. A month later, Deboubert, also a Paris gunmaker, patented a cylindrical copper cap charged with fulminate of silver. Both these patents are believed to be merely copies or modifications of models made by the London gunmakers. It is also stated that the manufacture of fulminate of mercury started in France in 1819. Now let us turn to Shaw's statements. The dates of his first visit to the United States, of his return to England, and his final settlement in the States are uncertain. The dates of his alleged applications for English and American patents are also unknown, and the specification of his first American patent, dated 1822, was destroyed by fire. In July, 1824, however, a committee of

the Franklin Institute reported favourably on his copper and pasteboard primers ("Mech. Mag.," vol. iii, p. 142). These were charged with Forsyth's compound, "which had been the only vehicle in use till within some few months, when a new discovery was made of a metallic preparation, perfectly neutral, and indeed less corrosive than gunpowder itself, and of this Mr. Shaw has availed himself." The committee goes on to show that Shaw was using his detonating compounds in waxed pasteboard primers, which were pressed into a recess in the breech of the gun. At this date, therefore, Shaw was using Forsyth's compound and fulminate of mercury in the form of flat caps. His earlier experiments with the cylindrical metal caps had been laid aside until Wright's paper had shown a practical method of manufacturing and applying the fulminate of mercury. This view is supported by Shaw's letter in the "Franklin Journal" for 1829 (pp. 271-73), in which he defends Wright against a foreign critic who had written in favour of the chlorate of potash primer. After the expiration of Forsyth's patent, he writes: "Wright introduced the fulminating mercury, since which there have been no complaints whatever of the corrosion of the locks," and he goes on to state that percussion guns were more generally used in America than in England, "although the guns themselves are the manufacture of that country," owing to the superiority of the American copper caps. As regards the latter, Shaw states: "I have been in the habit of using copper caps for at least the last thirteen years (*i.e.*, from 1816), and for the last seven years (*i.e.*, from 1822) have manufactured and sold them at the rate of two millions annually." Shaw's claim to the invention of the percussion cap are restated somewhat differently in "The Scientific American" for 7th August, 1869, which contains his memoir, but in our present state of imperfect information it is safer to regard his claims as not proven. As in the case of Joyce, it is probable that Shaw's manufacture of percussion caps on a large scale was subsequent to and inspired by Wright's paper in 1823, and in spite of a statement to the contrary, it is doubtful whether the copper percussion cap was included in his patent of 1822. It is greatly to be wished that some American

investigator would ascertain the whereabouts of the MS. autobiography which Shaw is said to have compiled. It is impossible to doubt, however, that he was closely connected with the first trials of the copper cap—that he was present at the birth of the invention, if not actually the inventor, and that these experiments took place in this country about 1816, the year when Manton unsuccessfully contested the validity of Forsyth's patent. If it could be shown that these experiments were conducted in London, Manton's workshop would be the likeliest place; and mention is made by Colonel Hawker, in the seventh edition of his work, of one of Manton's workmen, "J. Greenfield one of Joe's very best workmen and his cabinet counsellor in all matters of difficulty (than whom) no man in London has invented more little articles for other people to get the credit of." This individual had recently been taken into the service of F. Joyce, the percussion cap maker. If some connection could be established between Greenfield and Shaw, the mystery of the copper cap would perhaps be over; but too many links in the chain of evidence are wanting to warrant any definite conclusion.

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Include experiments on gold and silver fulminates.

1800. Howard, E. On a new fulminating mercury. (Phil. Trans., 1800, pt. 1, pp. 204-38.)

1833. On fulminates and the manufacture of the percussion cap. (Lardner's Cabinet Cyclopedia: Manufactures in Metal, vol. ii, pp. 119-23.)

1868. Bishop, J. L. History of American manufactures, 3rd ed. vol. iii, p. 444.

Describes the process of making percussion caps at Waterbury.

(2) Alexander John Forsyth (1769-1843)

1799, 2nd June. Forsyth, A. J. On certain useful properties of the oxygenated muriatic acid (as a mordant). (Nicholson's Journal, vol. iii, 1800, pp. 158-60.)

1805-6 and 1840-3. Forsyth's original correspondence (1805-6) with the Ordnance Office was destroyed by fire, but the substance is preserved in

(*a*) The Mechanic's Magazine, vol. xxxii, 1839-40, which contains a reprint of an article in the Aberdeen Herald; (*b*) his *Brief Statement* (*Ordnance Office Papers "Inventions"*) preserved at the Record Office, in which his claim to remuneration by the Government is stated. Forsyth's claims were supported by Lord Brougham "his counsel in all his law suits" whose certificate is in the same file.

1811-19. Forsyth's Law Suits:

1811. Forsyth *v.* Vicars.
1816. Forsyth *v.* Manton. ("The Times," 13th and 16th July.)
1818. Forsyth *v.* Manton. (*Ibid.*, 14th December. Full report.)
1819. Forsyth *v.* Levier. (*Ibid.*, 3rd May. Injunction.)
1819. Forsyth *v.* Riviere. (*Ibid.*, 5th June.)
1819. Forsyth *v.* Hall. (*Ibid.*, 14th August.)

Forsyth *v.* Riviere being the most important case as regards evidence of prior user, some pains have been taken to trace a fuller report than that in "The Times." The King's Bench records are of no value for the purpose and the Affidavit series yielded little of value. Messrs. Crowders, Vizard, Oldham and Co., 51, Lincoln's Inn Fields, successors of Vizard and Blower,

solicitors for the plaintiff in this action state that their predecessors destroyed a quantity of papers about forty years ago including probably the briefs, etc. in this case. Application was also made to the successors of the defendants' solicitor, Jenkyns, but hitherto without result.

(3) E. Goode Wright, of Hereford

1823. 18 Sept. Wright, E. G., on the firing of gunpowder by fulminating mercury (Phil. Mag., vol. lxii, p. 203). Reprinted in Gill's Techn. Repos., vol. iv, pp. 313, 316, with an editorial, which elicited a further statement from Wright (*Ibid.*, pp. 370-72). Wright's experiments were repeated in Germany by Lieut. Schmidt, who came to an opposite conclusion. (Schweigger's Journal, 1824, p. 66, translated in Franklin's Journal, 1829, p. 100.) For further controversy, see Shaw, 1829.

1869. Temple, R. and C. The Temple Anecdotes, Invention and Discovery, pp. 93-95. (The Duke and the Inventor.) There is no trace of Wright's letter to the Duke of Wellington, referred to here, in the Ordnance Papers "Inventions" or in letters preserved at the Record Office.

(4) Joshua Shaw (1776-1860)

Life. Scientific American. 1869, 7th Aug., and Dunlap (W.), History of the arts of Design in the U. S., vol. ii, p. 320. A MS. Autobiography is said to exist.

1822. Franklin Committee. Report (on Shaw's percussion primers) (Mechanic's Mag., vol. iii, 1825, p. 142-43).

1827. Shaw, J. Remarks on the properties essential in good gunpowder, and upon the methods of testing its strength. Franklin Journal, vol. iv, pp. 127-29. (Recommends a slow powder for percussion guns.)

1827. Shaw, J. Description of a method of testing the quickness of

gunpowder (Franklin Journal, vol. iv, pp. 282-4). Shaw here refers to apparatus constructed by him in 1814, to test the advantage "of using the copper caps or primers which I had then invented" with the percussion gun, his conclusion being that the slowest powder was the best for that class of gun. The copper cap referred to was probably a flat cap covered with copper foil. There is no suggestion of the cap and nipple mechanism.

1829. Shaw, J. Remarks on an article . . . on fulminating powders (a reply to Lieut. Schmidt). (Franklin Journal, N.S., vol. iii, pp. 271-3.)

1830. Shaw, J. Observations on the fabrication of detonating powder. (Franklin Journal, N.S., vol. vi, pp. 108-10.) States that he prefers the chlorate mixture for firing ordnance.

(5) Shaw's Patents

There is no trace of Shaw's alleged applications for an English and American patent prior to 1820; probably an application here would have brought him into conflict with Forsyth, while in the U.S. a term of two years' residence was required of an alien. The Specification of his first U.S. patent, 1822, was destroyed by fire at Washington.