



# The Development of Percussion Primers

by S. JAMES GOODING

*S. James Gooding, still another contributor in little need of introduction to gun collectordom, is Editor-in-Chief of The Canadian Journal of Arms Collecting and Director of the arms books publishing house Museum Restoration Service, Ottawa (Ont.). He has spent "nearly all" of his 43 years as a student of firearms history, with special interest in the evolutionary phases of new systems and the transitions from one system to another. He was responsible for the management and organization of the Arms & Armour section at the Royal Ontario Museum from 1949 to 1957. He has published articles in all major arms periodicals; his magna opera are the books Canadian Gunsmiths and An Introduction to British Artillery. A resident of Ottawa, he is married and has two children. The present article is serving Mr. Gooding as the basis for a much enlarged future edition, to appear in book or monograph form.*

## I.



When in 1807 the Rev. Alexander Forsyth of Belhelvie Parish in Scotland patented his invention for the ignition of gun charges by shock- or blow-sensitive explosive compounds, he triggered, as it were, a long succession of developments which culminated in the rim- and centerfire cartridge primers in use today.

The explosive, blow-sensitive properties of many substances, in particular of the fulminates of gold, mercury and silver, had been known in the early seventeenth century and most likely in the sixteenth and even before, but there are no records of any successful harnessing of their forces—their explosions were too powerful to allow them to serve as propellants, and no one prior to Forsyth seems to have thought of any other use. (The word "fulminate" is often but erroneously used to describe any substance that will explode or detonate when struck sharply, but, properly speaking, fulminates are salts of fulminic acid,  $C:N.OH$ , and nothing else; a detonating compound that is not a fulminate should not be called one.) Forsyth's experiments seem to have begun around 1800, resulted in a prototypal but workable detonator lock in 1805, and were continued in 1806 and after in the Tower of London under the patronage and encouragement of Lord Moira, Master General of Ordnance. On April 11th, 1807, Forsyth was granted Patent No. 3032, which covered all forms of percussion locks using detonating substances. Forsyth's principles proved successful not only owing to his particular detonating compound itself—the basic ingredient



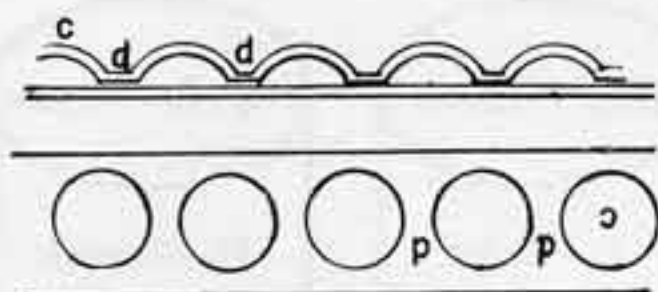


Figure 8.

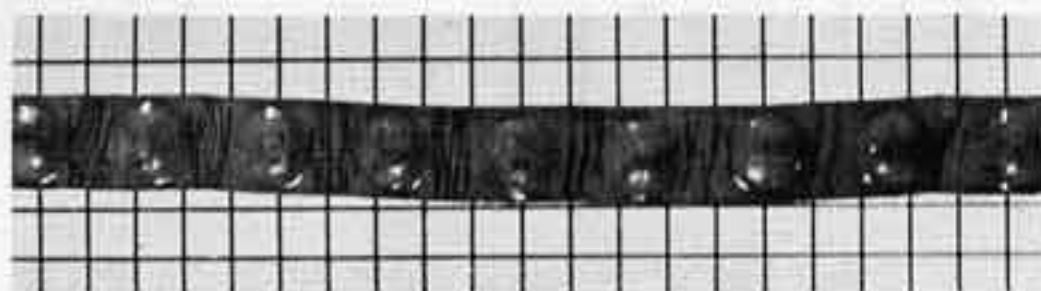


Figure 9.

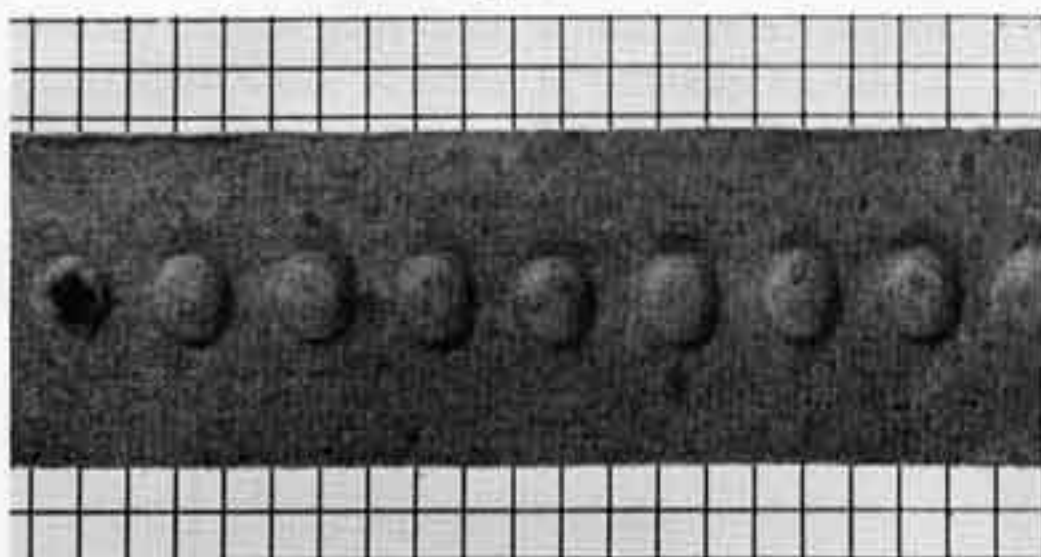


Figure 10.

version of Maynard's tape, but green and red versions have also been observed—their significance is not known. Fig. 10 shows a section of tape obtained by Col. B.R. Lewis, author of *Small Arms and Ammunition in the United States Service*, from the reference collection assembled by Dr. Maynard. It is 11/16ths in. wide and is said to have been part of the tape submitted with Maynard's original patent application in 1845.

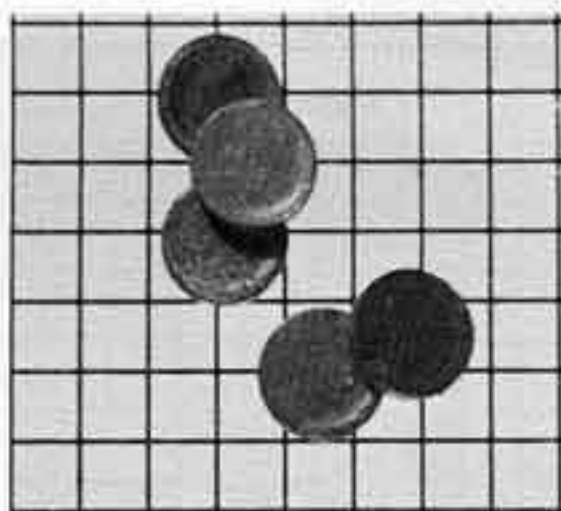


Figure 11.

In Fig. 11 we see Christian Sharps' pellet primers, patented in the U.S. on June 28th, 1853. They were designed to be used in a magazine fitted to the Sharps rifle. They were made of two small copper cups with the detonating compound sandwiched between them. Col. B.R. Lewis reports (op.cit.,cf.Fig.10) that an earlier type had foil on one side.

No illustration is available for Heurteloup's Continuous Tube, but from the description of British Patent No. 9084, issued to Charles Baron Heurteloup on September 9th, 1841, the invention appears to have been a continuous tube filled with a specially

compounded detonating powder. The inventor stated: "I shake [the detonating powder] into small soft metal drawn tubes of pewter or other soft metal, of about one tenth of an inch in diameter, [which are] closed at their lower ends by being pinched which keeps the powder from running out... After filling... the tubes are... pressed through a pair of rollers, which will flatten them, and cause them to assume the form of tapes." The tubes described were used in an under-hammer gun with a knife in the nose of the hammer which cut off the required amount of the tube without detonating the remainder. The Baron, whose "commoner" name was Charles Louis Stanislas, received earlier patents in England, France and the United States for the same basic idea.

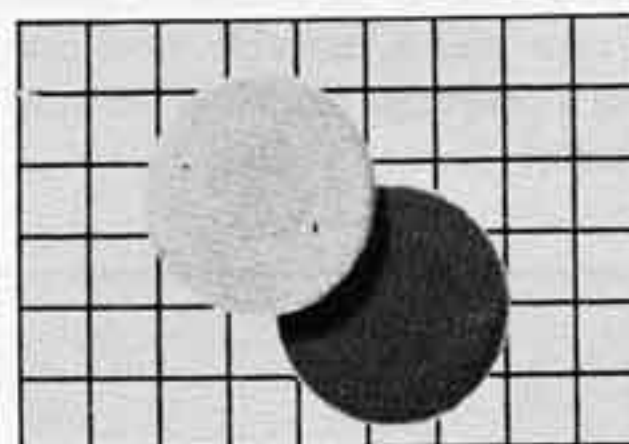


Figure 12.

Fig. 12 shows two cardboard primers, red on one side and white on the other. They are 11/32nds in. in diameter and allegedly came from a package marked "Butterfield Primers" handwritten in old ink on the wrapper. This may be true, but their diameter is too large to fit any of the Butterfield magazines that have been observed by the present author. It is more likely that the Butterfield that was patented in 1885 used a primer similar to the Sharps' primers.

**Tube primers** fell into three main groups:

*Manton and Manton-type primers* were little metal tubelets inserted sideways and perpendicularly into a touchhole, the projecting part resting on a small flashpan-like anvil onto which it was clamped by a hinged, spring-loaded holder and then struck by the dull-blade nose of the hammer. The earliest of these devices were open at both ends, the detonating compound inside being kept in place by its expansion upon drying after having been filled into the tube; but since the tube was struck by the hammer nose in the middle, as much fire spewed outward from the lock as inward into the charge—a discomfiting circumstance for bystanders, and of course dangerous in the proximity of open powder flasks and of guns being loaded. As we shall see, many attempts were made to solve this problem.

*Side primers* were not fundamentally different from the Manton-types but rate being classified by themselves because of the various built-in holding, clamping and end-closing gadgets with which they were fitted.

*Nipple primers* were inserted vertically into vents, "cones" and nipples of various shapes.



# TUBES

## Manton Tubes

J. Manton  
'French'  
G. Console  
&c.

## Side Primers

P. Hawker  
D. Long  
A. Clayton  
C. Lancaster  
&c.

## Nipple Primers

W. Richards  
C. Lancaster  
Mushroom  
&c.

Although Joseph Manton obtained his first patent on a percussion tube in 1818, his patent No. 3985, obtained February 29, 1816, was for a lock which used a form of tube as the means of ignition. Actually, the 1816 tube was a movable steel one which was loaded with a pellet and placed in the nose of the hammer. He wrote:

... that part of the cock which holds the flint in common locks is made with the proper aperture to receive and hold a small tube which contains a minute quantity of some of those substances which will produce fire and explosion ... and the flame produced by the explosion issuing with violence from the perforated end of the tube

Figure 13.

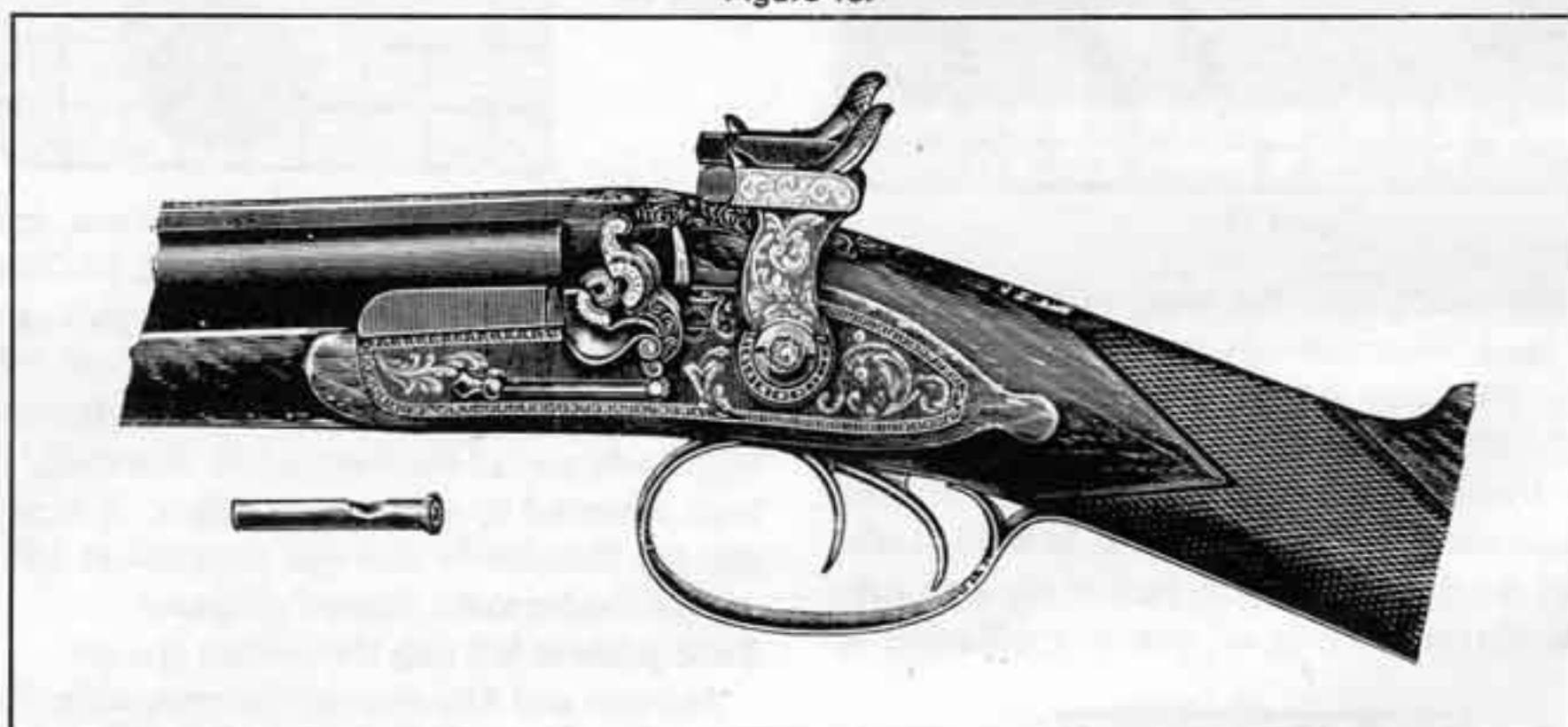


Figure 14.

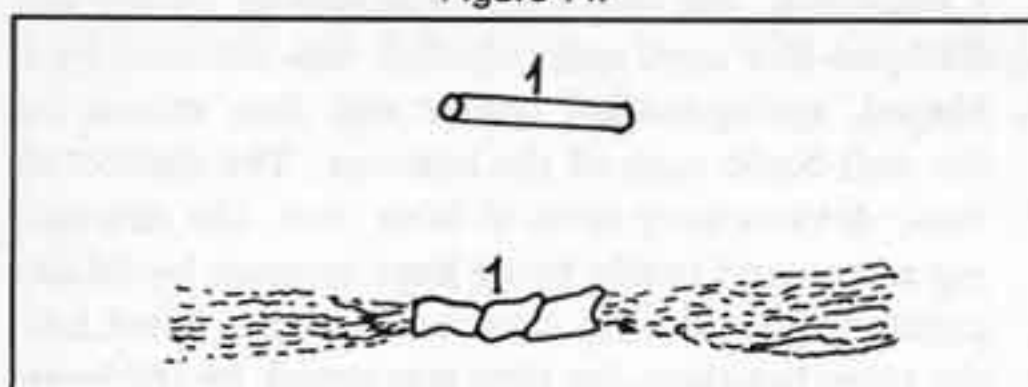


Figure 15.

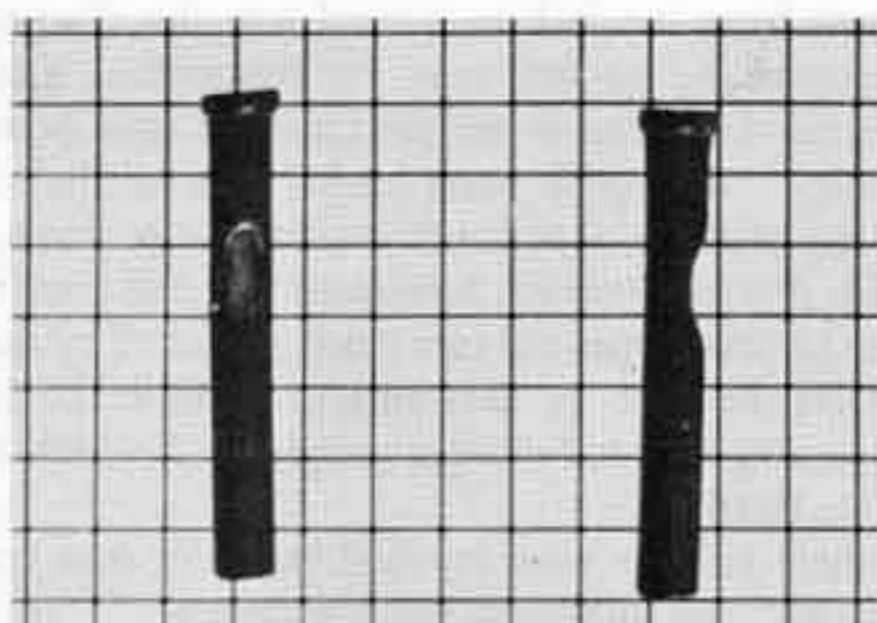
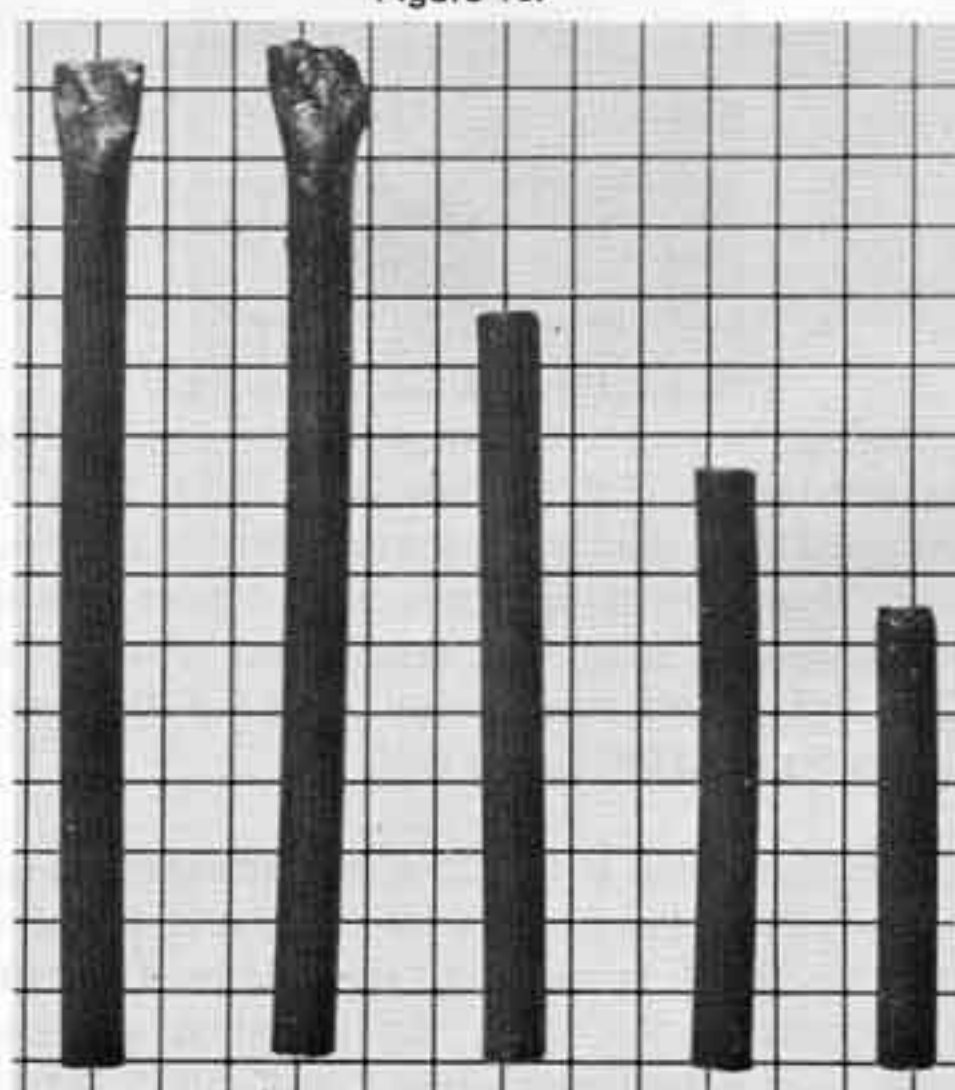


Figure 16.



passes through the touch-hole or passage into the barrel of the piece . . . When the piece is re-loaded the said tube which contained the detonating substance can be readily detached from the cock and replaced by another . . . and the perforated end of the tube and touch-hole may be covered with as much bees wax or any such substance as will completely exclude damp air.

Manton's second patent, No. 4285, enrolled on February 2, 1818, covers the tubes illustrated in Figs. 15 & 16. The drawings which he included with the specifications are a little confusing but they are included here (Fig. 14) for the information that might be derived from them. He stated in the specifications:

My primers for firearms are small hollow tubes made of very thin metal or other suitable substance. The dimensions of the tube must be according to the size of the piece to which they are to be applied as primers, but for a musket or fowling piece they should be from half an inch to three-quarters of an inch in length, and from one-tenth to one-eighth of an inch in diameter, and open at both ends . . . the open ends of the primer are stopped with bees wax to retain the fulminating substance in the tube, and preserve the same from damp . . . I confine my claim to the invention of primers or detached tubes as I have described.

Many variations of Manton's tube primer will be encountered and it is now difficult to determine how the first ones were made. It is likely though that they were simple tubes like those illustrated in Fig. 16, for Hawker mentions that they were drilled from solid metal rods. Those shown are approximately .10 inch diameter and from .62 to 1.45 inches long.

The earliest illustration that has been found which identifies a tube as "Manton's," is that used by W.W. Greener in *The Gun and Its Development*, first published in 1881. He illustrated the same primer as that shown in Fig. 13.



Figure 17.

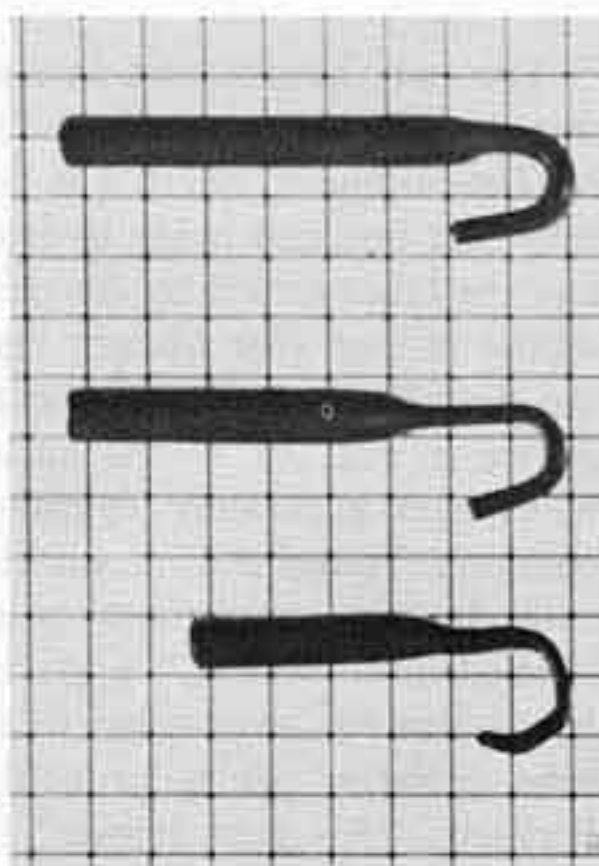


Figure 18.

In the 9th (1844) edition of *Instructions to Young Sportsmen*, Hawker illustrated the primer shown in Fig. 17, which is very similar to those in Fig. 18. He stated "a gentleman in a two-handed punt can have which he pleases—either a light (80-90 lb.) stanchion flint, or a heavy (120 lb.) one with the copper primer of Joe Manton: the only detonating ignition that I could ever depend on, and that will safely hold the primer, with very large guns."

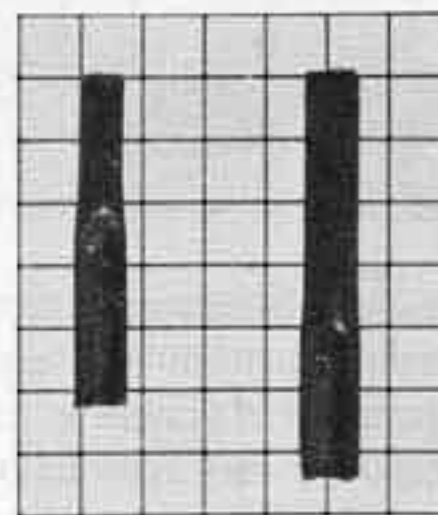


Figure 19.

The crimped tube primers shown in Fig. 19 probably stem from the 1820s. They have been called "French" because the first of this species was found in a cased pair of pistols by D. Ancion & Fils of Paris—though of course this does not insure French primacy of the invention.

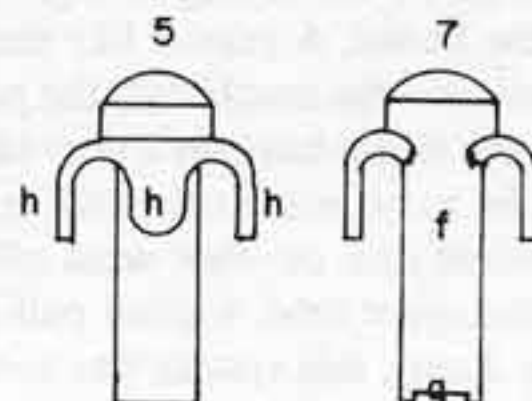


Figure 20.



Figure 21.

The primer patented by Westley Richards on February 11, 1831, is now often called a "mushroom primer," but it was known by many names during the period that it was popular. In the patent specifications it was called simply "Primers for Firearms." The first known writer to give it a name was Hawker in *Instructions to Young Sportsmen*; he called it the "new steel primer" in 1833, and the "hermetically sealed primer" or "solid brass primer" in 1844. A bag of the primers manufactured for the "agent in London," William Bishop, 170 Newbond Street, well known at the time as "The Bishop of Bond Street," identified them as safety primers." The detonating substance was held in .15 inch diameter brass tubes which were inserted into the hole of the nipples or touch holes (as they were called in the patent specifications). Judging from



the name, the primer was probably of all-steel construction as originally made, but all those examined by the author have brass tubes, tinned iron flanges and a red-colored waterproofing over the end. In the patent papers it was noted that the primer could be "recharged with percussion powder as often as required."

Figure 22.



Giuseppe Console, a Milanese gunmaker in the service of the Imperial Austrian Military Government, came up with a percussion system in the early 1830's specifically designed for easy conversion of flintlocks. He cut the frizzen off the flashpan cover, leaving only the hump-backed cover, brazed up the flashpan flush to the top but with a little groove running from the touchholes outward to the end of the pan, and sometimes also brazed a convex protruberance to the bottom of the pancover. Into the flint cock's jaws was fitted a downcurved nose long enough to strike the pancover on the hump. A primer like the one in Fig. 22 was inserted into the touchhole, the pancover was closed down onto it, the hammer's nose struck the top of the hump, the blow was transmitted to the primer, the primer flashed and the shot went off. For easier extraction of the spent tube, a small pull-wire was attached to each. Later, this system was much perfected and refined, especially as the famous Model 1854, but the principle of the cover-transmitted blow remained always. A considerable quantity of 1854 and later Console muskets were imported by the Union during the American Civil War.



Figure 23.

Charles Lancaster, the famous and excellent London gunsmith, designed a variant of the tube primer which was popular for a time. Hawker described it in 1844, together with Long's primer (see below), as "best for single guns because they (being side primers) do not obscure the line of sight." Lancaster's tube was inserted laterally into the primer hole, after

which the umbrella, made of thin tinned iron, was pressed over a steel bolster designed for it. The exact date of introduction of this "umbrella primer," as it is sometimes called, has not been established, but about 1840 would seem right.

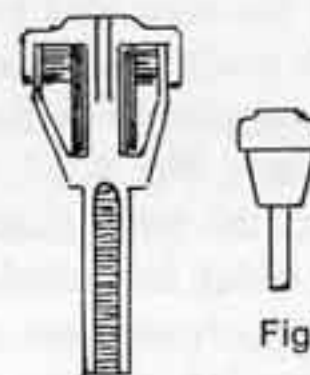


Figure 24.

In the same 1844 edition of *Instructions*, Hawker describes Long's primer as:

this new invention [which] has all the advantages of the preceeding one [Lancaster's 'umbrella']; and here the tube is placed so close to the charge that the smallest quantity of detonating powder is sufficient to insure instantaneous ignition, with the least possible report from the primer. All below is lined with platina, so that the largest grained, and consequently the strongest powder may be used without the risk of missing fire.

Daniel Long & Son were London gunsmiths working at 8 Old Cavendish Street, and there was a John Long at 8 Allsop Place, Regent's Park. Hawker does not state which Long was the inventor, but since he had high praise for Daniel, it would appear that it was his design.



Figure 25.



Figure 26.

The only information available on the tube illustrated in Fig. 25 comes from Greener's *The Gun and Its Development*, where it is described as a "priming tube, the one end being inserted into the touch-hole and the other struck by the cock." It appears to be a nipple primer (for upright insertion), judging from the description and from the appearance. As to the device in Fig. 26, to the author's knowledge it has never been accurately identified, although it is quite common. Herschel C. Logan in his work *Cartridges* calls it "the mushroom primer—another of the hooded tube primers," while Lewis Winant in *Early Percussion Firearms* refers to it simply as "one of the tube primers." It is probably related to Westley Richards' "All-Steel Primer" (Figs. 20 & 21).





Figure 27.



Figure 28.

Two other unidentified tube primers are the flag-shaped one in Fig. 27 and the hooked one in Fig. 28. The first is possibly a side-primer tube; all specimens found have turned up in England and may be dated 1830-40. The tube section of the hook-shaped device is identical to that in Fig. 15, and may be an adaptation of Hawker's side primer (see Fig. 30, below). Enough have been found in England to indicate that they were commercially produced, not privately made by a gadgeteering sportsman.

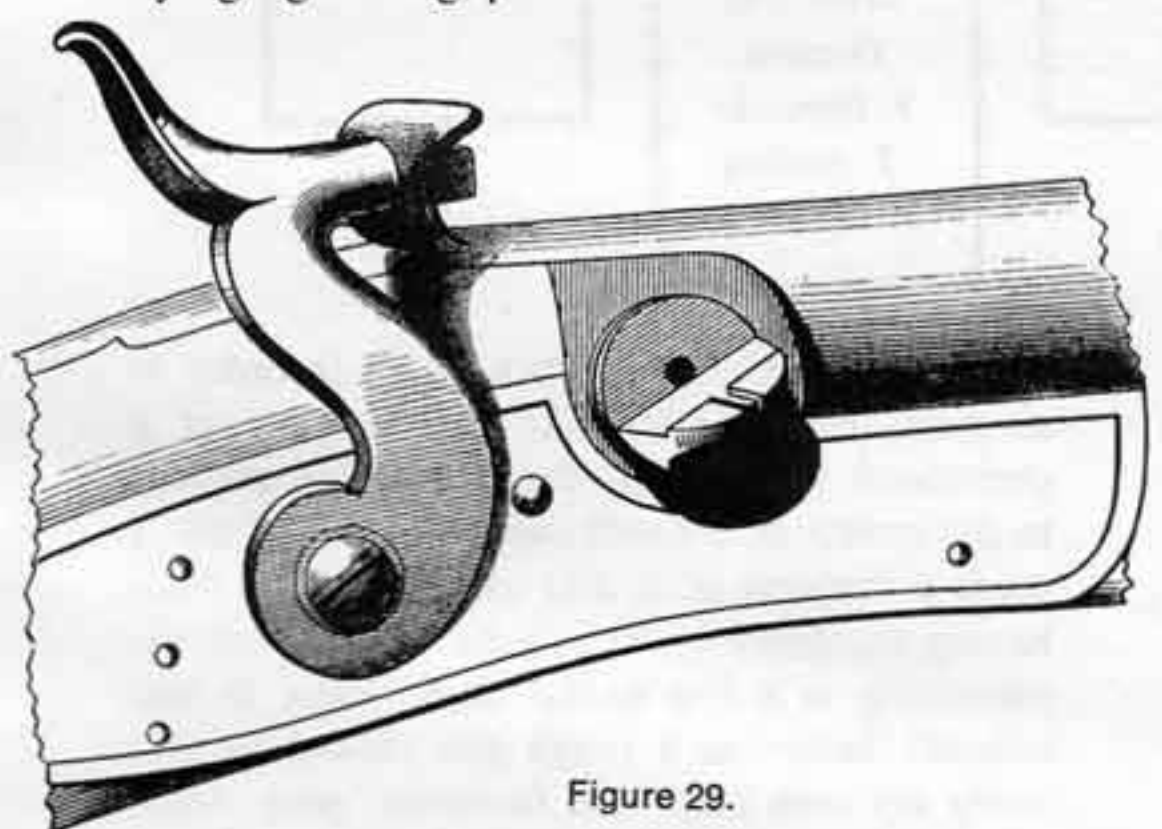


Figure 29.



Figure 31.



Figure 30.

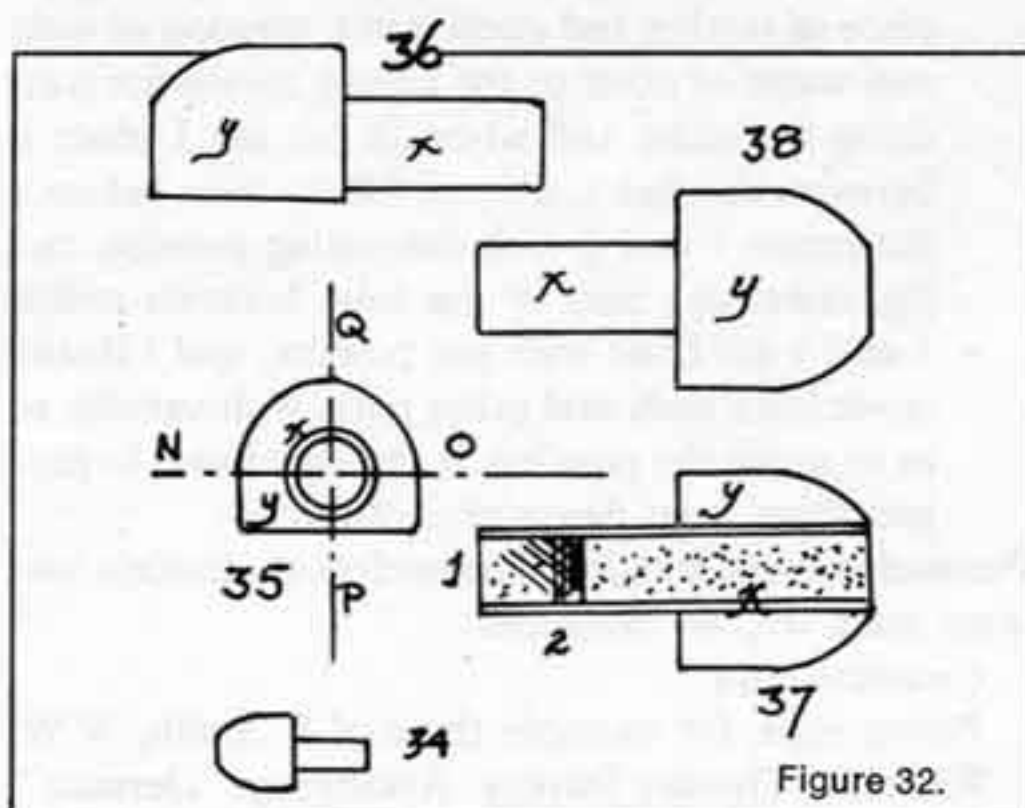


Figure 32.

In 1848-49, Peter Hawker developed what he called his "saucer-plug and side-primer ignition." It consisted of a shelf-like plug threaded into an enlarged vent (Fig. 29). The tube primer had a hook to be clamped over the edge of the shelf, and a three-fourths-circular brass end platelet (soldered on) embossed with the inscription "P. Hawker" around the head of a hawk (Fig. 30). He conducted field trails at Keyhaven on June 4, 1849. A variation of Hawker's primer was registered by Alfred Clayton, a gunmaker of Lymington, in December of 1850, Reg. No. 2486. It was described in *The Practical Mechanic's Magazine*, January 1, 1851. The Clayton primer shown in Fig. 31 is marked *Alfred Clayton—Patent—Southampton*, but this was probably an illegal use of the word "Patent," since no such patent has been found; the primer should have been stamped "Registered." The similarity between Hawker's and Clayton's systems—indeed, the near-identity—raise some unanswered, and probably unanswerable, questions. Was there close cooperation between the two men? Hawker's son, Major P.W.L., chose to publish Clayton's rather than his father's version when he edited the 11th and posthumous 1859 edition of *Instructions* (Fig. 29); did he do so on his father's advice, or on a basis of extant correspondence and notes? Had Peter honorably yielded place because he had known Clayton's system to be better? The hawk's head embossed on the Clayton primer as reproduced in the 11th edition is particularly intriguing!

The last of the major tube primers to be considered is Charles Lancaster's of 1850. His patent, No. 13161, July 3rd of that year, covers many aspects of weaponry, especially artillery; we are concerned here solely with Part Three, *Improvements in The Manufacture of Percussion Tubes*, for the dimensions of the primers under this heading indicate that they were intended for small arms. The specifications say that his invention consisted in:

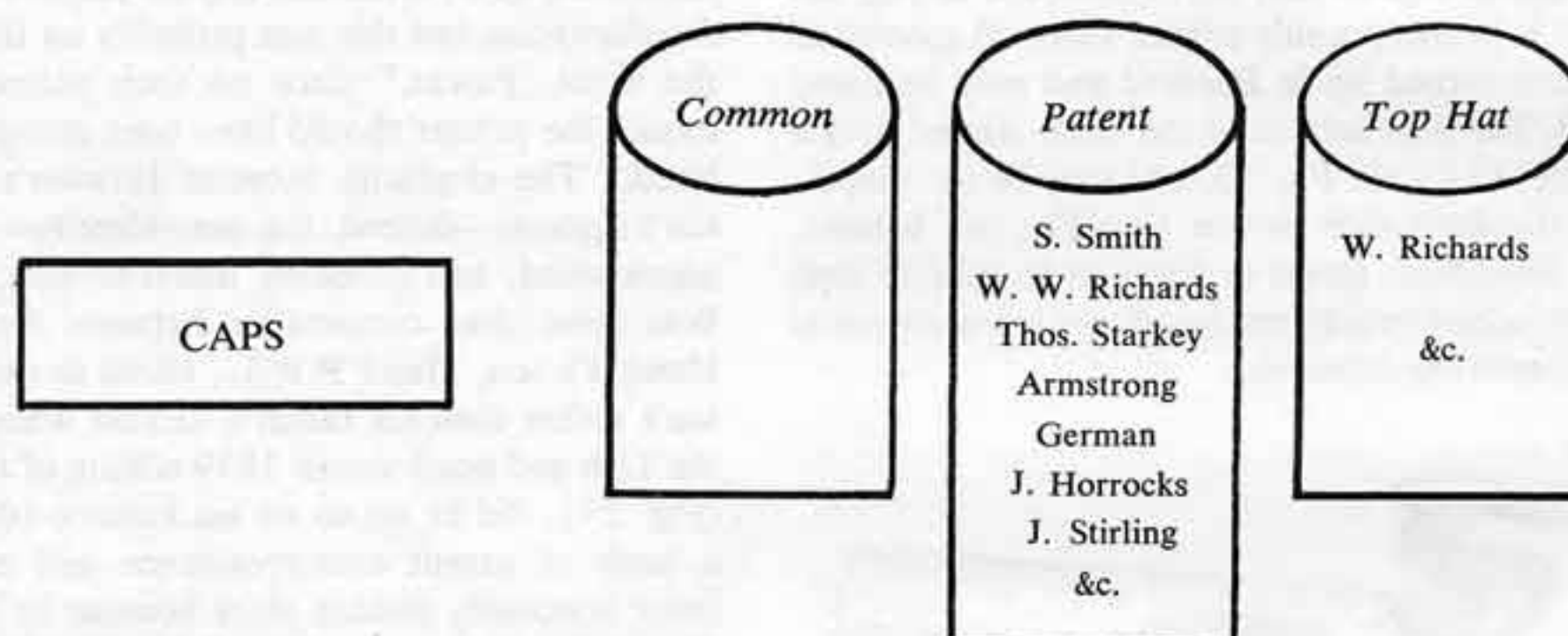
... wholly or partially covering such tubes with leather or some other material possessing the



same or similar amount of compressibility, and also in filling such tubes partly with gun powder and partly with detonating powder. I have . . . exhibited several views of the said percussion tube and tools for forming the same. Figure 34 exhibits the percussion tube, drawn to the natural size, and as it would appear when formed; Figure 35 is an end view thereof, drawn to a scale 6 times the natural size; Figure 36 a side elevation of the said percussion tube; Figure 37 a longitudinal and vertical section thereof taken through the line n, o, at Figure 35 . . . X marks a piece of copper tubing, around one part of

edition must have taken place in 1816 or shortly after, judging from the reference to Manton's detonators and Davies Street, from where Manton moved to Hanover Square in 1819:

The copper cap is now in general use all over the world, and therefore many gun-makers attempt to claim its invention as their own. I do not mean to say that I was the inventor of it—probably not; but this I must beg leave to state:—When Joe first brought out his detonator in Davies Street, he made the most perfect gun I ever saw; and doubting whether such another



which a piece of leather y or other suitable elastic substance . . . in the following manner . . . take a piece of leather and steep it in a solution of soda and water or other of the known means for softening the same and when fit for use I place it between the dies z, z' . . . I fill the tube between the points 1 and 2 with detonating powder, and the remaining part of the tube between points 2 and 3 are filled with gun powder, and I finally cover both ends and other parts with varnish so as to retain the powders in the tube [and] to protect them from damp or moisture.

**Percussion caps**, too, lend themselves to division into three main overall categories:

*Common caps*

*Patent caps*, for example those of S. Smith, W.W. Richards, Thomas Starkey, Armstrong, "German", J. Horrocks, J. Stirling *et al.*

*Top hat caps*, e.g. those of W. Richards, &c.

The invention of the percussion cap is surrounded by controversy and confusion. A number of men have claimed the honor, but even as early as 1840 it was already impossible to single out one individual who could say with certainty to have been the inventor.

The most famous claimant was Joseph Manton. Hawker promoted himself for the laurels, suggesting that in fact the idea was his, Manton's only the execution—the incident he described in the 7th (1833)

could be got, I set my wits to work in order to simplify the invention. At last the plan of a perforated nipple, and the detonating powder in the crown of a small cap, occurred to me. I made a drawing of it, and took it to Joe. After having explained it, he said he would show me something in a few weeks' time, when, lo and behold! there was a rough gun altered to precisely my own plan—his factotum, poor Asell, informing me that the whole job was done from my drawing. Thus Joe, who led the fashion for all the world, sent out a few copper-cap guns, and I know with some degree of reluctance. The trade, finding he had then deviated from his own patent, adopted this plan, and it proved to answer so well that we now see it in general circulation.

Since Manton felt free to "send out a few copper-cap guns," presumably without fear of prosecution by Forsyth (who succeeded in getting Manton's 1818 tube primers declared an infringement until April 11, 1821, the date of the Forsyth Patent expiration), and since "the trade . . . [found Manton] had then deviated from his own patent," a statement implying presumed validity of that patent, the incident must have occurred sometime between 1816 and 1818.

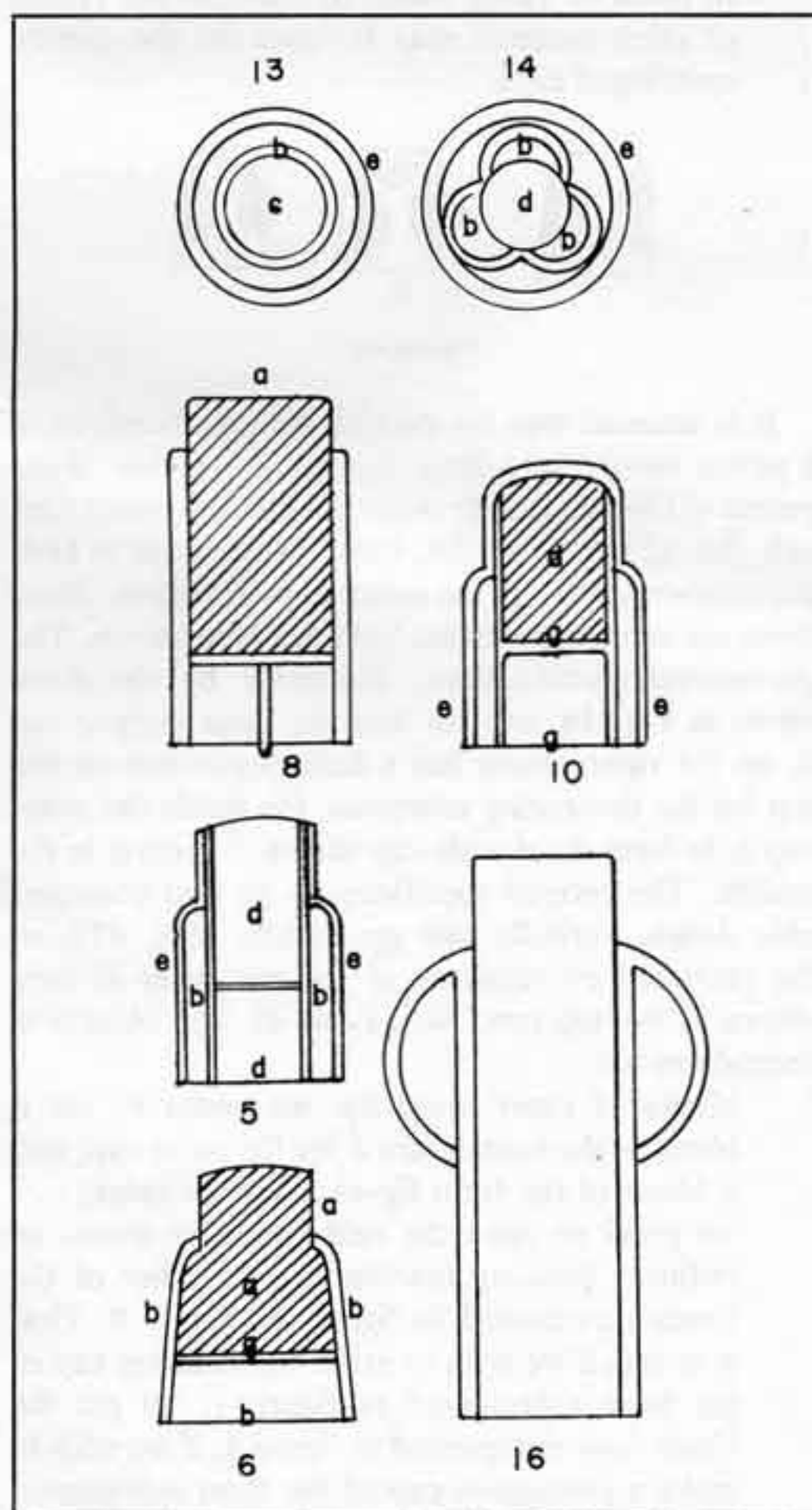
The great gunmaker Joseph Egg engraved on many of his superb products that he was the inventor of the percussion cap, but his claim is not nearly as sound



diameter of the cap being so much larger than that of the priming powder, the explosion is not near so much confined and thus removes all chance of the cap being blown to pieces." Three variations of Smith's cap have been observed: two with domed central sections and the crowns, the other with a flat central detonator receptacle, more like the patent drawing.

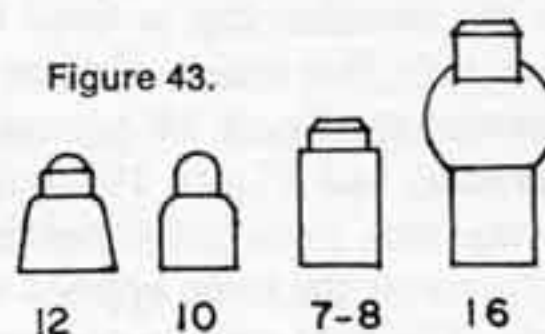
The drawings for Thomas Starkey's patent, No. 9188 of December 16, 1841, are missing, but from the wording used in the specifications it appears that caps were in production under the patent. The inventor states: "My improvements consist in depositing the fulminating powder between the caps, the one placed within the other, the end of the inner cap being perforated with a small hole, exactly coincident with the touch-hole in the nipple or cone of the gun, . . . waterproofing by a disc of tinfoil or instead of tinfoil a round piece of oiled silk or other water proof material may be used . . ."

Figure 42.



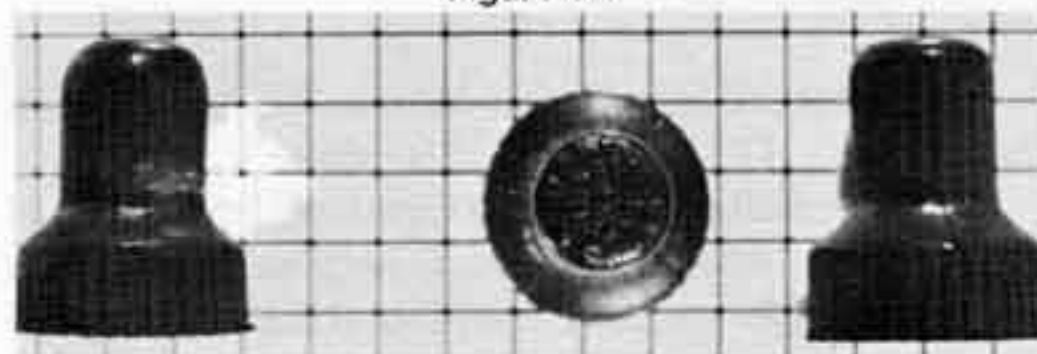
W.W. Richards' patent, No. 7041 of March 22, 1836 (Figs. 42 & 43), called for "making the primers much larger than the ordinary copper caps . . . And my improvements consist, first, in removing or transferring the percussion or detonating powder of the primer from immediate contact with the inside of the head, or top, of the cap or primer, and placing it nearer to the mouth thereof, so that the explosion or firing of the detonating primer shall not take place at the bottom of the interior or the cup of the primer but nearer to its mouth . . . I shall describe several different methods of constructing these improved primers." Figure 43 shows the simplified external view of each of the variants of this "improvement,"

Figure 43.



the numbers corresponding with those of the sectionalized views in Fig. 42. The specifications explain that the detonating powder had been "removed from the top of the cap into its novel position, nearer to the mouth thereof. Letter *a* is the top of the cap, *b* the sides, *c* the position of the priming or detonating powder, . . . the space between *a* and *c* being occupied by a piece of any kind of hard metal, *b*, soldered or otherwise fastened into the cap . . . by placing the priming material into a shallow cup or dish, fixed into the end of a piece of hard metal."

Figure 44.



W.W. Richards' "two-step" cap (Fig. 44) is known to have existed in three different lengths, from .375 to .425 in., the diameters remaining equal. The middle size is made of considerably heavier copper than the other two. The shortest is marked *Registered March 9, 1849* in raised letters on the top, indicating registry under the *Non-Ornamental or Useful Act* of 1843 (Reg. No. 1806).

The specifications from W.W. Richards' patent, No. 14027 of March 28, 1852, state that:

Figures 16 and 17 represent my improved percussion cap. It consists of a tube of Gutta Percha, in the upper part of which a percussion cap of the ordinary form and construction is inserted as shown in the section, Figure 16. In putting my