

Case 1063 PCT

**Method for ensuring a predetermined muzzle velocity of
an artillery projectile and projectiles designed
5 according to said method**

The present invention relates to a method in firing
artillery projectiles, such as various types of shells,
from rifled barrels, for preventing the degree of wear
10 of the barrel from which the projectiles are fired from
having a negative effect on the muzzle velocity of the
projectiles. The invention also encompasses a number of
artillery projectiles or shells designed according to
said method, and a method of manufacturing these.

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When firing with modern ammunition containing
propellant with a high energy content, the barrels from
which the ammunition is fired are subject to very heavy
wear, and long before the barrel wear has reached a
20 level where the barrel ought to be rejected (reject
stage) this wear has a detrimental effect on the muzzle
velocity (V_0) of the projectiles fired from the barrel.
The problem is well-known to engineers in the field and
there are several different methods available for
25 determining the barrel wear. According to one of these
methods Δd_{25} , the increase in diameter due to wear is
determined in millimetres over the lands of the barrel
rifling at a point 25 mm forward of the origin of the
rifling, that is to say where the rifling commences,
30 whilst another, older method relies on determining
something called the "kontrisse displacement", which
involves determining the forward creep of the origin of
the rifling in the barrel resulting from wear. The
barrel lands are introduced with successively rising
35 end faces inclined in relation to the axis of the
barrel, and it is against these end faces that bands of
the projectiles or shells must be rammed home in the
actual loading operation, so that the bands in this so-
called ram-home position afford an effective propellant

gas obturation forward in the barrel. When the propellant charge of the projectile is then ignited, the propellant gases thereby formed behind the projectile will force the projectile forwards in the barrel under simultaneous deformation of the band, the angular twist of the barrel rifling imparting a rotation to the projectile. In conventional loading, however, the actual ram-home position of the projectiles is primarily defined by factors other than simply the position of the origin of the barrel rifling, and this applies especially in so-called cartridge ammunition, in which the case position defines the position of the cartridge and hence of the projectile in the barrel. In such cartridge ammunition the projectile and the cartridge case containing the propellant charge are in fact normally united with one another up to the point of firing, when the propellant gases formed by ignition of the propellant charge force the projectile out of the case. It is therefore primarily the position of the case in the loading or chamber position of the barrel which normally defines the overall position of the round in the barrel and because this case position is protected from the hot propellant gases by the cartridge case it will be subject to substantially less wear than the actual barrel.

The aforementioned measuring methods for determining the barrel wear therefore imply a determination of the barrel wear which most rapidly affects the muzzle velocity of the projectiles fired from the barrel, namely that which occurs at the actual origin of the rifling, that is to say in direct proximity to the ram-home position of said projectiles in the barrel for firing. Since the projectiles, as previously indicated, are when firing normally always rammed home in the same position in the barrel designed to bring the band of the shell into proper contact against the barrel rifling, that is to say the origin of the rifling, in a

new barrel, the forward creep of the origin of the rifling in the barrel, that is to say away from the ram-home position of the projectiles, in fact means that in a worn barrel, in which the origin of the rifling has been shifted forwards in the barrel, i.e. away from the ram-home position, a gap will initially be formed between the band of the projectile and the inside of the barrel before the projectile has begun to move forwards in the barrel, which on firing of the propellant charge of the projectile results in a leaky ram-home position and a forward leakage of propellant gas past the band, which therefore in turn has a negative effect on the gas pressure behind the projectile, thereby resulting in a lower projectile muzzle velocity than intended. This gas leakage will obviously be sealed off as soon as the projectile begins to move forwards and its band reaches the new wear position for the origin of the rifling, but the gas leakage will still be so great that in a Bofors 40 mm automatic anti-aircraft gun using conventional projectiles or shells a reduction in the muzzle velocity V_0 of approximately 3% or about 30 m/sec can already be expected after 700 rounds, despite use of the best possible wear protection additives of the titanium dioxide type. For the same gun firing armour-piercing shells, a 5% reduction in the V_0 gives an 8% lower armour penetration.

The present invention now affords a solution to this problem in that it outlines a general principle for maintaining the design muzzle velocity (V_0) of a new barrel for a certain type of projectile or shell, even in a worn barrel. The invention can then in turn be divided up into a number of different methods for embodying this principle, some of which inherently means that limited modifications will have to be made to the projectiles or shells used in the application of the invention. These modifications, however, are not so comprehensive that they cannot be made both to existing

stocks of projectiles or shells and ones newly produced.

5 The invention is therefore characterized in that the obturation between the rifled inside of the barrel used in firing and the shell band on the projectile or shell thrust into the ram-home position in the barrel is rendered independent of the degree of wear of the barrel used for firing.

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The basic principle behind the invention is therefore that the position of the band of the projectiles or shells, used in firing, in relation to the origin of the rifling, that is to say where the barrel rifling
15 begins, must be rendered independent of the origin of the rifling in the barrel, the position of which varies according to the degree of barrel wear, and the obturation between the band of each projectile must thereby be completely sound even in heavily worn
20 barrels.

A first method for fulfilling this basic principle means that the ram-home position in the barrel of the projectiles or shells used for firing is not fixed once
25 and for all at the time the barrel is manufactured, as is normally the case, but is instead made to vary according to the actual position of the origin of the rifling in the barrel for each round fired. This means, therefore, that the ram-home position for the shells or
30 projectiles is successively shifted forwards in the barrel according to its degree of wear. In purely practical terms this development of the invention means that the shells or projectiles are rammed home to the point of contact between the band of the projectile or
35 shell and the origin of the rifling, which is independent of the origin of the rifling in the barrel, the position of which varies according to the degree of barrel wear.

If cartridge ammunition is then used for firing, that is to say ammunition in which the shell or the projectile is united during the loading sequence with a cartridge case containing the propellant charge, the elements will have to be rammed home with such force that the projectile or the shell is, if necessary, already detached from the cartridge case at the time of ramming home, that is to say before its propellant charge has been ignited, and the propellant charge is prevented from escaping in the barrel chamber position before it is ignited in that it comprises, for example, so-called multi-hole propellant manufactured in larger pieces or in that the constituent smaller particles of propellant are vacuum-packed. The requirement according to the invention is that the band of the shell or the projectile must already form effective obturation against the origin of the rifling before firing, whilst the case position of the charge casing in the barrel must be unchanged even in the case of a worn barrel. In the case of worn barrels, therefore, both the projectile and the cartridge case will already have separated from one another before the cartridge propellant was ignited. This is because, as stated previously, any degree of wear caused by the position of the cartridge in the barrel is of far less significance than the barrel wear and the axial creep of the origin of the rifling that varies according to this.

Effect can also be given to the basic idea behind the invention by firing shells or projectiles provided with slightly deformable bands, the position of which in a longitudinal direction has been adjusted in order to afford a perfect obturation against the origin of the rifling, even in heavily worn barrels and where the material of the band is so adjusted that when loading in slightly worn barrels the band is sufficiently deformed by the origin of the rifling to give the same ram-home position as in the case of the worn barrel.

According to this variant, therefore, the ram-home position of the individual projectile or shell in the barrel can be maintained unaltered regardless of the degree of barrel wear, whilst obtaining the desired
5 obturation between the band of the shell or the projectile and the origin of the rifling in any worn state of the barrel.

According to a development of the variant of the
10 invention above projectiles provided with a relatively lightly deformed forward band adapted to heavily worn barrels and a rear, more conventional band adapted to slightly worn barrels are used for firing in both worn and entirely new barrels. The idea behind this design
15 is that in slightly worn barrels the forward band, when said projectile is actually rammed home, will be sufficiently deformed to allow the rear, more conventional band to assume a correct position relative to the origin of the rifling. Similarly, the forward
20 band will assume the initial, direct obturation function in heavily worn barrels.

The next step in the development of the invention involves providing the projectiles or shells used for
25 firing with bands which are displaceable in the longitudinal direction of each shell and the position of which in the longitudinal direction when ramming home the projectile or the shell in the barrel from which it is to be fired is adapted to a position that varies according to the degree of barrel wear. In
30 shells with displaceable bands, the bands are therefore in the initial position in their longitudinally more forward position, following which the degree of barrel wear when ramming the shell home in the barrel adjusts
35 the position of the moveable band to the degree of wear through direct contact between the moveable band and the origin of the rifling. In the case of a new barrel, therefore, the resistance of the band against the origin of the rifling will shift the band towards its

rear position in the firing direction of the shell, whilst the band remains in its forward position in the case of heavily worn barrels. In the case of shells with moveable bands of the type characteristic of the invention, a perfect obturation is therefore always achieved against the origin of the rifling, regardless of the barrel wear.

A further development of the projectiles with displaceable band further means that their band is divided up into at least two different bands, at least one of which, arranged closest to the front end of the projectile or shell in its firing direction, is displaceable within a limited range in the longitudinal direction of the projectile. One of these two bands, therefore, the forward, displaceable band, will in its forward position serve for an adjustment to heavily worn barrels, whilst in its rear position together with the other band, the fixed band, it is adapted to less worn barrels.

This projectile variant having a displaceable forward band and a fixed rear band can then in turn be augmented by a ductile, that is to say plastically deformable, intermediate part, which whilst limiting the displacement of the movable band in slightly worn barrels also gives rise to an improved propellant gas obturation against the inside of the barrel. In a heavily worn barrel the ductile intermediate part at the same time ensures that the forward displaceable band maintains an obturation position as far forward as possible against the origin of the rifling. The ductile intermediate part might in turn be composed of a deformable copper or copper-nickel alloy or a heat-resistant plastic.

According to yet another variant of the invention, the band of the projectile or shell is given an entirely new design with a lip seal, which is angled rearwards

in the firing direction of the projectile or the shell and is at least to some extent plastically deformable. This band design therefore differs radically from the plane, annular circumferential surface of the conventional band, which lies radially somewhat outside the actual circumferential surface of the projectile or shell, and which is virtually adapted to the inside of the barrel solely by dint of the fact that the barrel rifling lands break through the parts of the band situated outside the circumferential surface of the projectile. The new type of band now proposed having a lip seal, which is angled rearwards in the firing direction, provides a band which directly adjusts to barrels with differing degrees of wear, whilst the outer flank of the lip seal will afford the same deformability as the annular circumferential surface of the more conventional bands, in order to allow the lands of the barrel rifling to impart the helical twist of the rifling to the projectile in the form of its rotation, in just the same way as with conventional bands. A ductile pure copper or a suitable copper alloy having the same characteristics is proposed as a suitable material for the aforementioned lip seal. According to a further development of the invention, the rear-facing flanges of said lip seal in the firing direction of the projectile may be supported, for example, by a tubular support member in the shape, for example, of a deformable copper tube, which gives the lip seal a greater deformability in that this tubular component comprises an inner cavity giving it a substantially greater deformation area.

All aspects of the invention have now been defined in the following patent claims and will merely be described somewhat further with reference to the drawings attached, in which

Fig. 1 shows a lateral projection of an artillery projectile (shell)

- Fig. 2 shows a partially sectional detail of the parts of a cartridge round that are of interest in the context of the invention, loaded in a barrel intended for this
- Fig. 2a on a large scale shows the ringed part of Fig. 2 where the barrel is new
- Fig. 2b on a large scale shows the ringed part of Fig. 2 where the barrel is heavily worn
- Fig. 3 on a large scale shows the same projection as in Fig. 2 after ramming home in a heavily worn barrel
- Fig. 4 shows a conventional shell for comparison
- Fig. 5 shows a shell with band shifted according to a variant of the invention
- Fig. 6 shows a shell with double bands according to a variant of the invention
- Fig. 7 shows a shell with displaceable band according to a variant of the invention
- Fig. 7a shows a detail of the shell according to Fig. 7 loaded in a new barrel
- Fig. 7b shows a detail of the shell according to Fig. 7 loaded in a worn barrel
- Fig. 8 shows a detail of a variant of the shell according to Fig. 7 loaded in a new barrel
- Fig. 9a shows a detail of a further variant of the shell according to Fig. 7 loaded in a new barrel
- Fig. 9b shows the same variant as 9a loaded in a worn barrel
- Fig. 10a in cross section shows the function of an entirely new type of shell band in a new barrel
- Fig. 10b in cross section shows the function of the band according to Fig. 10a in a worn barrel and
- Fig. 11 shows a partially sectional view of a shell provided with a moveable band.

In the drawings discussed below, some different parts

appear in many or all figures and for practical reasons these have been given the same reference numerals in all figures regardless of the scale to which they are drawn in the various figures or how much can be seen of the part in question from the respective figure.

These reference numerals common to all figures are:

shells 1 (these may accordingly be provided with various types of bands),

2 denoting the front, pointed parts of the shells,

3 their middle banded parts and

4 their rear parts, which in the case of cartridge ammunition are initially fixed in a respective cartridge case up to the moment of firing, whilst

5 denotes parts of the barrels from which the shells 1 are intended to be fired, new barrels being denoted by 5a and heavily worn barrels by 5b, and

forward parts of cartridge cases by 6, whilst

7a denotes the origin of the rifling in a new barrel and 7b the origin of the rifling in a worn barrel and

8 denotes a gap between the respective band and the inside of a worn barrel 5b. The firing direction of the projectiles from the barrels has been denoted by an arrow a.

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The shell 1 illustrated in Fig. 1, 2, 2a and 2b is provided with a conventional band 9. As can be seen from Fig. 2a, this affords an effective obturation against the origin of the rifling 7a in a new barrel 5a. It can further be seen from Fig. 2b that when the shell is rammed home in a worn barrel 5b, the band 9 of the same shell 1 leaves a gap between the inside of the barrel and the band 9, since the origin of the rifling 7b has shifted forward in the barrel due to wearing of the barrel 5b.

Fig. 3 shows the result of ramming home a shell 1 in a worn barrel 5b. The shell is provided with a conventional band 10. As can be seen from the figure,

the band affords good obturation against the more forward origin of the rifling 7b in the worn barrel 5b, but at the same time it can be seen from the figure that the shell 1 has been rammed home with a force so great that it has travelled out of the cartridge case 6 by the distance x in the figure. This distance x is therefore equal to the forward movement of the origin of the rifling 7b in the firing direction of the barrel caused by the barrel wear.

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The shell 1 shown in Fig. 4 is a wholly conventional shell having a conventional band 11. In the figure the part of the shell 1 which reoccurs with different band shapes in Fig. 7-9 is marked by a dashed line.

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Fig. 5 now illustrates the variant of the invention which involves providing shells with a more forward band 12, intended to function in both new and heavily worn barrels (compare the position of the band 12 on the shell 1 with the position of the band 11 on the shell 1 in Fig. 4). The band 12 is therefore made from an easily deformable material, such that when the shell is rammed home in a new barrel it will be sufficiently deformed to produce the same ram-home position in the new barrel as in the heavily worn barrel, where the band, due to its relatively forward position, there also affords perfect obturation against the origin of the rifling.

Fig. 6 then in turn illustrates the variant of the invention according to which the shells 1 are to be provided both with a more forward, preferably somewhat narrower and more easily deformable band 13 and an entirely conventional band like the band 11 in Fig. 4. According to this variant, therefore, the forward, narrower band must only be resistant enough, when the shell is rammed home in new, unworn barrels, for it to be deformed to a degree sufficient to allow the ram-home position of the shell to remain constant

regardless of the degree of barrel wear. With the shell in the same ram-home position in heavily worn barrels, therefore, the forward band assumes the obturation function against the inside of the barrel.

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Fig. 7 shows a further variant of the invention in which the band 14 of the shell 1 is made axially displaceable in the longitudinal direction of the shell, so that it can adjust both to new barrels and barrels with a greatly varying degree of wear. The range within which the band 14 has been made axially displaceable has been denoted by 15 in the drawing.

In Fig. 7a and 7b the function of the displaceable band 14 has been illustrated in more detail for a new barrel 5a and a heavily worn barrel 5b. As will be seen from Fig. 7a, the displaceable band 14 assumes its rearmost position in the firing direction of the shell 1 when the shell is rammed home in a new barrel 5a, since the band 14 already affords obturation in this position. It can further be seen from Fig. 7b that when the shell 1 is loaded in a heavily worn barrel 5b the band 14 is forced to assume its most forward position in order to afford the desired obturation against the inside of the barrel 5b. The reference numeral 16 denotes a spline-like guide, which ensures that the band does not begin to slip in its groove in the circumferential surface of the shell. Regardless of the design shape of the band, it is this which must ensure that the desired rotation is imparted to the shell in its trajectory outside the muzzle of the barrel.

Referring now to Fig. 8, this illustrates a further variant of the shell 1 provided with both a forward, moveable band 17 and a more conventional fixed rear band 18. This variant has only been illustrated in a heavily worn barrel. In a new, unworn barrel the function will be as in Fig. 7a.

Fig. 9a and 9b then in turn illustrate a further variant of the band having a fixed band part 20 and moveable band part 19. A third band part 21 is then arranged between moveable band part 19 and the fixed band part 20. This third band part 21 is made from a ductile, plastically deformable material and its dual function is to ensure that the forward band part 19 affords a satisfactory gas-tight obturation against the inside of the barrel and through its own compression to further improve this gas-tight obturation, at all times regardless of the degree of wear of the particular barrel (5a, 5b) used for firing.

Fig. 10a and 10b further illustrate yet another development of the invention, according to which the outside diameter of the band 22 of the shell 1 has been made adjustable to both new and worn barrels. According to the invention this flexibility is achieved in that the band is designed with a lip seal 23, which is angled rearwards in the firing direction of the shell, whilst the band is entirely made of a material which is to some degree plastically deformable and sufficiently ductile when fired through the barrel to allow the lands of the barrel rifling to form grooves therein and to give the shell the desired rotation in its trajectory. As is shown in Fig. 10a, a shell 1 having a band formed in this way will, when rammed home in a new barrel 5a, assume the same ram-home position as when the same shell is rammed home in a heavily worn barrel 5b (see Fig. 10b). This is because the lip seal 23 permits an adequate deformation of the band. As support, the lip seal 23 on its inside has been provided at its rear-facing edge in the firing direction of the shell with an annular, ductile compressible insert 24, which itself like the lip seal is of annular shape and is pressed into an annular groove 25 under the lip seal 23 of the actual band 22. The fact that the annular insert 24 is made from a deformable material and also has an internal cavity

means that the lip seal 23 has an extra large deformation range.

Fig. 11 is primarily included in order to illustrate a method of manufacturing shells having a moveable band. This also represents a variant of the present invention.

Fig. 11 therefore shows a partially sectional view of a shell 26, which is assembled from a forward shell half 27, which is internally threaded at 28 and is in turn screwed together with a rear shell half 29 via an external thread 30 formed in the shell half 29. An annular obturator 31 is furthermore arranged in the joint between the shell halves. Together, the shell halves 27 and 29 have a common explosive-filled interior space 32. The shell 26 is further provided with a moveable band 33. In the fitted state the band is displaceable from an initially forward position, in which it appears in the figure, to a rear position. The displacement of the band in the longitudinal direction of the shell is limited by a stop edge 35. The band 33 is furthermore guided, so that it cannot rotate, on splined grooves/lands 34 between its respective limit positions.

The idea behind this variant of the invention is therefore that, when the shell is rammed home in the barrel, the worn position of the origin of the rifling will force the band 33 back along the splined grooves/the lands 34 to the position that best corresponds to the worn position of the barrel.

The fact that the band must be displaceable, but that a certain limited resistance should be required for this displacement, therefore represents an element of the invention.

The shell 26 shown in Fig. 11 having a firing direction

a is very easily assembled in that it is made with a forward and rear half 27 and 29 respectively, which are screwed together. The two shell halves can suitably be produced on modern automatic machines. When assembling
5 said shell, the copper band 33 is pressed over the splined grooves/the lands 34 in the shell half 29, following which the obturator 31 is fitted and the shell halves 27 and 29 are screwed together. The shell is then ready for the explosive to be poured into the
10 space 32 and for fitting of a fuse.

The general method of producing banded, explosive shells by screwing two shell parts together, in which the band is first pressed onto one of the shell halves,
15 represents a distinct simplification of the otherwise complicated fitting of the actual band. The method is therefore suitable for all types of shells that can be manufactured in two halves.

Case 1063 PCT

Patent claims

5 1. Method in firing artillery projectiles (1) from
rifled barrels (5a, 5b) for preventing the degree of
wear of the barrel from which the projectile is fired
from having a negative effect on the muzzle velocity of
the projectile, **characterized in that** the position of
10 the band (9, 10, 12, 13, 14, 17, 19, 21) of the
projectiles or shells (1), used in firing, in relation
to the origin of the rifling (7a, 7b), that is to say
where the barrel riffling begins, is rendered
independent of the origin of the rifling (7a, 7b) in
15 the barrel, the position of which varies according to
the degree of barrel wear, in that said band position
is adjusted in the longitudinal direction of the shell
according to the actual position of the origin of the
rifling.

20 2. Method in firing artillery projectiles (1) from
rifled barrels (5a, 5b) according to the method in
Claim 1 for preventing the degree of wear of the barrel
from which the projectile is fired from having a
25 negative effect on the muzzle velocity of the
projectile, **characterized in that** the projectile or the
shell (1) used when loading the barrel (5a, 5b) is
rammed home to a point of contact between the band (10)
of the projectile or the shell (1) and the origin of
30 the rifling (7a, 7b), which is independent of the
origin of the rifling in the barrel, the position of
which varies according to the degree of barrel wear.

3. Method according to Claim 2, **characterized in that**
35 when cartridge ammunition is used for loading the
barrel the projectile is rammed home with such force
that the projectile or the shell (1) is, if necessary,
already detached from the cartridge case (6) at the
time of ramming home, that is to say before its

propellant charge has been ignited.

4. Method in firing artillery projectiles (1) from rifled barrels (5a, 5b) according to the method in Claim 1 for preventing the degree of wear of the barrel from which the projectile is fired from having a negative effect on the muzzle velocity of the projectile, **characterized in that** in firing, shells or projectiles (1) are used which are provided with bands (12), the position of which in the longitudinal direction of the projectile or the shell (1) has been adjusted to the degree of barrel wear, so that the ram-home position of the projectile or the shell in the barrel can be maintained unaltered regardless of the degree of wear of the barrel (5a, 5b).

5. Method according to Claim 4, **characterized in that** in firing, projectiles (1) are used which are provided with a forward band (13) adjusted to heavily worn barrels (5b) and a rear band (11) adjusted to slightly worn barrels (5a).

6. Method according to Claim 4, **characterized in that** in firing, shells or projectiles (1) are used which are provided with bands (14, 17, 19) which are displaceable in their longitudinal direction and the position of which in the longitudinal direction when each is respectively rammed home is adjusted to a position that varies according to the degree of wear of the barrel (5a, 5b).

7. Method according to Claim 6, **characterized in that** in firing, projectiles (1) are used which have a first band (14, 17, 19) displaceable in the longitudinal direction of the projectile or the shell and adjusted to more or less worn barrels (5b), and a second rear band (18, 20) fixed in the longitudinal direction of the projectile or the shell and adjusted to less worn barrels.

8. Method according to Claim 7, **characterized in that** in firing, shells or projectiles (1) are used in which a ductile obturator ring (21) is fitted between their
5 moveable bands (19) and fixed bands (20).

9. Projectile or shell (1) intended for performing the method according to any one of Claims 1 to 8, **characterized in that** it is provided with at least one
10 band (12), the position of which in the longitudinal direction of the projectile or the shell (1) has been adjusted to the degree of barrel wear, so that the ram-home position of the projectile or the shell in the barrel can be maintained unaltered regardless of the
15 degree of wear of the barrel (5a, 5b).

10. Projectile or shell (1) according to Claim 9, **characterized in that** it is provided with a forward band (13) adjusted to heavily worn barrels (5b) and a
20 rear band (11) adjusted to slightly worn barrels (5a).

11. Projectile or shell (1) according to either of Claims 9 or 10, **characterized in that** it is provided with at least one band (14, 17, 19) displaceable in its
25 own longitudinal direction and the position of which in the longitudinal direction when it is respectively rammed home is adjusted to a position that varies according to the degree of wear of the barrel (5a, 5b).

30 12. Projectile or shell (1) according to any one of Claims 9 to 11, **characterized in that** it is provided with a first band (14, 17, 19) displaceable in the longitudinal direction of the projectile or the shell and adjusted to more or less worn barrels (5b), and a
35 second rear band (18, 20) fixed in the longitudinal direction of the projectile or the shell and adjusted to less worn barrels.

13. Projectile or shell according to Claim 12,

characterized in that it comprises a ductile obturator ring or third band (21) fitted between its own moveable band (19) and the fixed band (20).

5 14. Projectile or shell (1) intended for performing the method according to Claim 1, **characterized in that** it is provided with at least one band provided with lip seals (23), which are angled rearwards in the firing direction of the projectile and are not too hard to be
10 deformable in slightly worn barrels but afford obturation during the initial phase of firing in heavily worn barrels (5b).

15 15. Method for manufacturing banded shells (26) designed according to any one of Claims 9 to 14, **characterized in that** the shells (26) are made in two halves (27 and 29), which are screwed together, the one shell half (27) having a threaded joint part (30), which in assembling is introduced into the other
20 internally threaded (28) shell half, once the separately manufactured band (33) has been pressed over either of the shell halves into its intended location formed directly adjoining the joint.

25 16. Method according to Claim 15 for manufacturing shells having at least one moveable band of the type defined in any one of Claims 11 to 13, **characterized in that** the band (33) that is intended to move is pressed down over splined grooves/lands (34) formed in either
30 of the shell halves (27 or 29) to its forward position in the intended firing direction (a) of the shell, following which the shell halves (27 and 29) are screwed together.