

(22) 1991/02/05

(43) 1991/08/23

(45) 2001/07/03

(72) Woo, Kenneth J., US

(72) Annan, Robert K., US

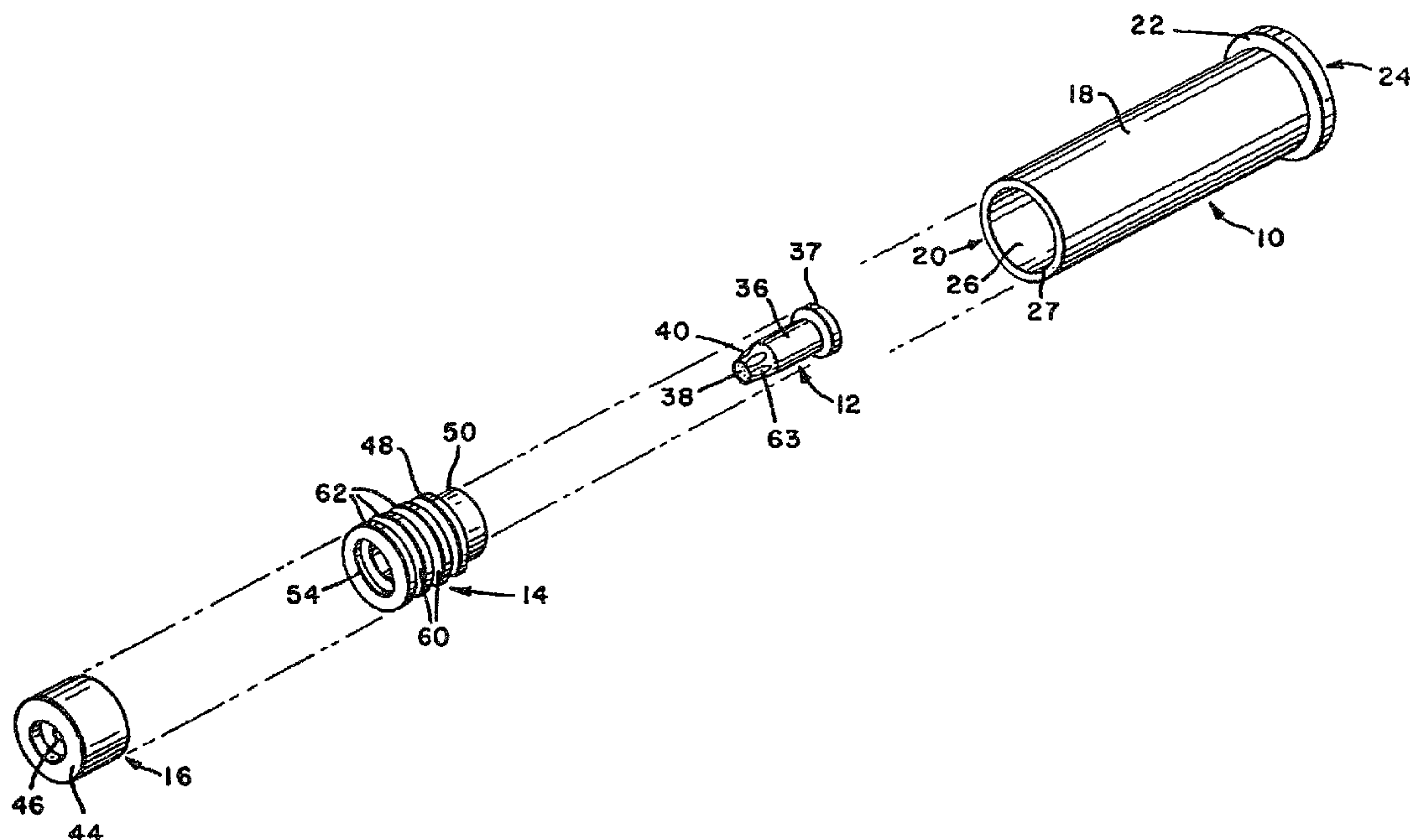
(73) Burndy Corporation, US

(51) Int.Cl.⁵ F42B 5/307

(30) 1990/02/22 (483,904) US

(54) DOUILLE MULTIPLICATEUR DE PUISSANCE

(54) **POWER BOOSTER BUSHING**



(57) A power booster bushing for obturating powder gases in a cartridge case employed by power actuated tools used for connecting power cables. The power booster bushing supports an explosive power cell and is slidably positioned in the cartridge case bore and has a series of ribs defined by grooves engaging the cartridge case bore. The interface between the cartridge case bore and the bushing is sealed during detonation of the power cell by means of the circumferential ribs. The bushing undergoes an "accordion effect" during detonation characterized by axial compression of the bushing and resulting in the prevention of powder gas escape through the open breech end of the cartridge case.

ABSTRACT

A power booster bushing for obturating powder gases in a cartridge case employed by power actuated tools used for connecting power cables. The power booster bushing supports an explosive power cell and is slidably positioned in the cartridge case bore and has a series of ribs defined by grooves engaging the cartridge case bore. The interface between the cartridge case bore and the bushing is sealed during detonation of the power cell by means of the circumferential ribs. The bushing undergoes an "accordion effect" during detonation characterized by axial compression of the bushing and resulting in the prevention of powder gas escape through the open breech end of the cartridge case.

BACKGROUND OF THE INVENTION

The present invention relates in particular but not exclusively to power booster cartridges employed by power activated tools for fitting connectors to power cables, and to a power booster bushing for receiving and positioning a power cell within the power booster cartridge.

United States Patent No. 4,722,189 assigned to Burndy Corporation is directed to an explosively operated tool for connecting a tap or branch cable to a permanently installed main power cable. The power tool uses an explosive charge or power cell which generates sufficient force to drive a wedge into a sleeve connection between the main cable and tap wire.

The power cell described in U.S. Patent No. 4,722,189 includes a tubular cartridge case, a rim fire power cell held by a supporting collar or power booster bushing slidably fitted in the cartridge case, and a power piston slidably fitted in the cartridge case ahead of the power cell for transmitting explosive force during operation of the power tool. The cartridge case has openings both at its muzzle and breech ends. According to the '189 patent, the power tool is armed when its power ram is inserted into the open muzzle end of the cartridge case as the power tool engages an unfinished connector and the power ram pushes the power piston and power booster bushing with power cell rearwardly so that the power cell is positioned at the open breech end of the cartridge case within range of the firing pin.

Because of the sliding interface between the power booster bushing and the cylindrical interior surface of the cartridge case there is an opportunity for migration of powder gases rearwardly past the interface and outwardly

through the breech opening when the power cell is
detonated. Such powder gas migration tends to diminish the
power available for actuating the power tool. Additionally,
the powder gases cause erosion of the power tool's breech
5 plug mechanism carrying the firing pin.

OBJECTS OF THE INVENTION

It is an object of the invention to provide a
10 power bushing for obturating powder gases in a power
booster cell.

It is a further object of the invention to
provide a power booster bushing for a cartridge case having
15 an open breech end in which the bushing slidably positions
a power cell at the open breech end and in which the
bushing collapses axially during detonation of the power
cell in order to prevent migration of powder gases
rearwardly of the bushing and out the open breech end.

20

SUMMARY OF THE INVENTION

The present invention is directed to a power
booster comprising a cartridge case having an open breech
25 end and a generally cylindrical inner surface divided by a
radially extending shoulder into a forward cartridge
chamber and a rear cartridge chamber; a power cell and
booster bushing subassembly located within the cartridge
case; and a booster piston in the cartridge case ahead of
30 the booster bushing; wherein: the power cell has a firing
rim; the booster bushing is generally cylindrical and has
an outer surface of greater and lesser diameters defined by
a radially extending shoulder and an axial bore for
receiving and retaining the power cell; the lesser diameter
35 portion of the booster bushing cooperating with the open
breech end of the cartridge case to position the power cell
with respect to the cartridge case; the booster bushing

being slidably fitted into the cartridge case with its lesser diameter portion received by the rear cartridge chamber positioning the power cell rim at the open breech end of the cartridge case, and with the greater diameter portion of the booster bushing fitted in the forward cartridge chamber with the radial shoulders of the cartridge case and booster bushing in abutting relation; and the greater diameter portion of the booster bushing having at least one circumferential groove defining ribs which obturate powder gases and accommodate a collapsing accordion effect of the booster bushing to prevent escape of powder gases through the breech end of the cartridge case when the power cell is detonated.

The exterior configuration has purposes of creating a gas-tight seal at the interface between cartridge case at its open breech end and the power booster bushing so as to obturate powder gases tending to migrate outwardly of the breech end of the cartridge case. As a result, there is an increase in power delivered to the power ram of the power tool. Additionally, there is a reduction in the extent of wear of the breech plug mechanism caused by powder gases.

The present invention also relates to a power booster for power activated tools comprising a cartridge case having a tubular wall with open muzzle and breech ends, a booster bushing and a power cell with a firing rim subassembly slidably fitted into the cartridge case, and a power piston in the cartridge case ahead of the subassembly, the cartridge case having a generally cylindrical inner surface divided by a radially extending shoulder into a forward cartridge chamber and a rear cartridge chamber, the booster bushing being generally cylindrical and having an outer surface of greater and lesser diameters defined by a radially extending shoulder, the bushing having an axial bore for receiving the power

cell, the bushing being slidably fitted into the cartridge case with its lesser diameter portion received by the rear cartridge chamber positioning the power cell rim at the open breech end of the cartridge case, and with the greater
5 diameter portion of the bushing fitted in the forward cartridge chamber with radial shoulders of cartridge case and bushing in abutting relation and with the fluted front end of the power cell in confronting relationship with the power piston, the greater diameter portion of the bushing
10 having a plurality of grooves on its outer surface defining a series of ribs thereon for accommodating axial collapse of the bushing and obturating power cell gases when the cartridge case is fired.

15 In operation, when the power cell is detonated, the powder gases drive a power piston and a power ram toward the muzzle end of the cartridge case inducing a reaction force on the front face of the booster bushing which collapses the bushing along its central axis with the
20 ribs tightly engaging the interface of the cartridge case to prevent migration of gases rearwardly past the bushing cartridge case interface and preventing the escape of gases through the breech end of the cartridge case.

25 The above and further objects advantages and features of the invention will occur to those skilled in the art upon an understanding of the specification or on employment of the invention in practice.

30

DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the invention has been chosen for purposes of illustration only and is shown in
5 the accompanying drawing in which :

FIGURE 1 is an exploded perspective view of a power booster cartridge including the power booster bushing of the present invention.

10

FIGURE 2 is a view of the breech end of the power booster bushing shown in FIG. 1.

FIGURE 3 is a side view of the power booster bushing partially cut away along line 3-3 of FIG. 2 to illustrate its construction.

15

FIGURE 4 is a sectional view of the power cell before firing.

20

FIGURE 5 is a perspective view of the power bushing before firing.

FIGURE 6 is a section view of the booster cell after firing.

25

FIGURE 7 is a perspective view of the booster bushing after firing.

Referring now to the drawing, the power booster according to the present invention includes a cartridge case 10, a power cell 12, a power booster bushing 14 and a power piston 16 shown in FIG. 1. The cartridge case as best shown in FIGS. 1 and 4, is of known construction and includes a hollow cylindrical casing 18 with an open muzzle end 20 and a flanged 22 open breech end 24 for positioning the power cell and booster bushing at the breech end of the cartridge case. The inner surface 26 of the cartridge case bore 27 is generally cylindrical defining a forward cartridge chamber 28 extending from the open muzzle end to an annular shoulder 30 adjacent the breech end for receiving the bushing 14 and power cell 12, the power piston 16 and the tool's power ram 31. The annular shoulder 30 defines a rear cartridge chamber 32 of lesser diameter extending to the breech opening for receiving the power booster bushing and positioning the power cell in the breech opening within striking range of the tool's firing pin (not shown). The annular shoulder 30 of the cartridge case cooperates with a corresponding shoulder 34 on the bushing for the purpose of locating the power cell precisely at the breech end of the cartridge case as the power tool is armed and also for retaining the bushing in the cartridge case when the power cell is detonated.

The power cell 12 is of known construction and includes a metallic, preferably brass, casing 36 filled with a powder charge 38 and having a conical tip 40 for directing the powder gases and their explosive force axially of the cartridge case during detonation. The power cell tip is fluted along its surface and crimped in a known manner to confine the powder charge. Detonation occurs when the firing pin (not shown) strikes the power cell rim 37.

10 The booster case also includes a power piston 16 of known construction which engages the power ram 31 of the power tool for driving the power ram and actuating the tool during operation. Powder gases act on the beveled rear face 42 of the powder piston while the front face 44 engages the power ram driving it forward during tool operation. A central port 46 allows for escape of spent powder gases through the power piston.

The power booster bushing 14 has a generally cylindrical shape of greater 48 and lesser 50 diameters defined by a radially extending shoulder 34. The rear portion of the bushing, as noted above, cooperates with the breech shoulder 30 of the cartridge case for positioning the power cell and for maintaining the bushing in position when the power cell is detonated.

25 The bushing further includes an axial bore 54 for accommodating the power cell and an annular recess 56 at its breech end to accommodate the rim 37 of the booster cell allowing for ease of assembly of power cell and

booster bushing while precisely locating the booster cell rim at the breech end for purposes of detonation and restraining the power cell against forward movement when struck by the firing pin.

5 The greater diameter 48 of the booster bushing includes a plurality, preferably three grooves 60 extending circumferentially of the greater diameter surface and spaced axially from each other. The grooves define a plurality of ribs 62, preferably four, in the
10 preferred embodiment along the interface of the cartridge case bore. The ribs thus formed act to obturate powder gases when the power cell is fired. Additionally, the grooves enable the bushing to collapse axially, as shown in FIGS. 5 and 6, as an aid in obturating the powder
15 gases. As the power cell detonates the powder gases first through the power cell flutes 63 and drive the power piston forward thereby inducing a reaction force against the front face of the bushing which causes the booster to collapse in an axial direction. The
20 collapsing of the booster bushing causes an accordion effect thereby creating a gas-tight seal between the greater diameter outer wall and the adjacent inner surface of the booster case. The relative condition of the power bushing is shown before firing in FIG. 5 and
25 after firing in Fig. 7.

The power booster bushing can be made of any suitable material and in a preferred embodiment is fabricated of high density polyethylene with natural

color and using virgin material. Other materials found suitable are nylon, GE LOMOD (TM), Dupont's Zytel (TM), and GE Xenoy (TM). Each rib is about 0.050 inches wide having a depth of 0.067 inches. The rear most rib is
5 somewhat wider and has a width of 0.082 inches.

In the preferred embodiment of the invention using a cartridge case of known dimensions there is a reduction in an axial length of the booster bushing, i.e., the accordion effect, of approximately 0.070 to
10 0.100 of an inch. For a booster bushing initially 0.655 inches in length there is a reduction in length of approximately 10-15%.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows.

1. A power booster comprising :

5 a cartridge case having an open breech end and a generally cylindrical inner surface divided by a radially extending shoulder into a forward cartridge chamber and a rear cartridge chamber;

a power cell and booster bushing subassembly located
10 within the cartridge case; and

a booster piston in the cartridge case ahead of the booster bushing;

wherein :

the power cell has a firing rim;

15 the booster bushing is generally cylindrical and has an outer surface of greater and lesser diameters defined by a radially extending shoulder and an axial bore for receiving and retaining the power cell;

20 the lesser diameter portion of the booster bushing cooperating with the open breech end of the cartridge case to position the power cell with respect to the cartridge case;

the booster bushing being slidably fitted
25 into the cartridge case with its lesser diameter portion received by the rear cartridge chamber positioning the power cell rim at the open breech end of the cartridge case, and with the greater diameter portion of the booster bushing fitted in the forward
30 cartridge chamber with the radial shoulders of the cartridge case and booster bushing in abutting relation; and

the greater diameter portion of the booster
bushing having at least one circumferential groove
35 defining ribs which obturate powder gases and accommodate a collapsing accordion effect of the booster bushing to prevent escape of powder gases

through the breech end of the cartridge case when the power cell is detonated.

2. A power booster according to claim 1 in which the
5 greater diameter portion of the booster bushing has n -grooves and $n+1$ ribs.
3. A power booster according to claim 1 in which the
10 greater diameter portion of the booster bushing has two grooves and three ridges.
4. A power booster according to claim 1 in which the
15 greater diameter portion of the power bushing has three grooves and four ribs.
5. A power booster as defined in claim 1 in which the
booster bushing collapses approximately 10% to 15% of the
initial axial length.
- 20 6. A power booster for power activated tools comprising a cartridge case having a tubular wall with open muzzle and breech ends, a booster bushing and a power cell with a firing rim subassembly slidably fitted into the cartridge case, and a power piston in the cartridge case ahead of the
25 subassembly, the cartridge case having a generally cylindrical inner surface divided by a radially extending shoulder into a forward cartridge chamber and a rear cartridge chamber, the booster bushing being generally cylindrical and having an outer surface of greater and
30 lesser diameters defined by a radially extending shoulder, the bushing having an axial bore for receiving the power cell, the bushing being slidably fitted into the cartridge case with its lesser diameter portion received by the rear cartridge chamber positioning the power cell rim at the
35 open breech end of the cartridge case, and with the greater diameter portion of the bushing fitted in the forward cartridge chamber with the radial shoulders of the

cartridge case and booster bushing in abutting relation and with a fluted front end of the power cell in confronting relationship with the power piston, the greater diameter portion of the bushing having a plurality of grooves on its
5 outer surface defining a series of ribs thereon for accommodating axial collapse of the bushing and obturating power cell gases when the cartridge case is fired.

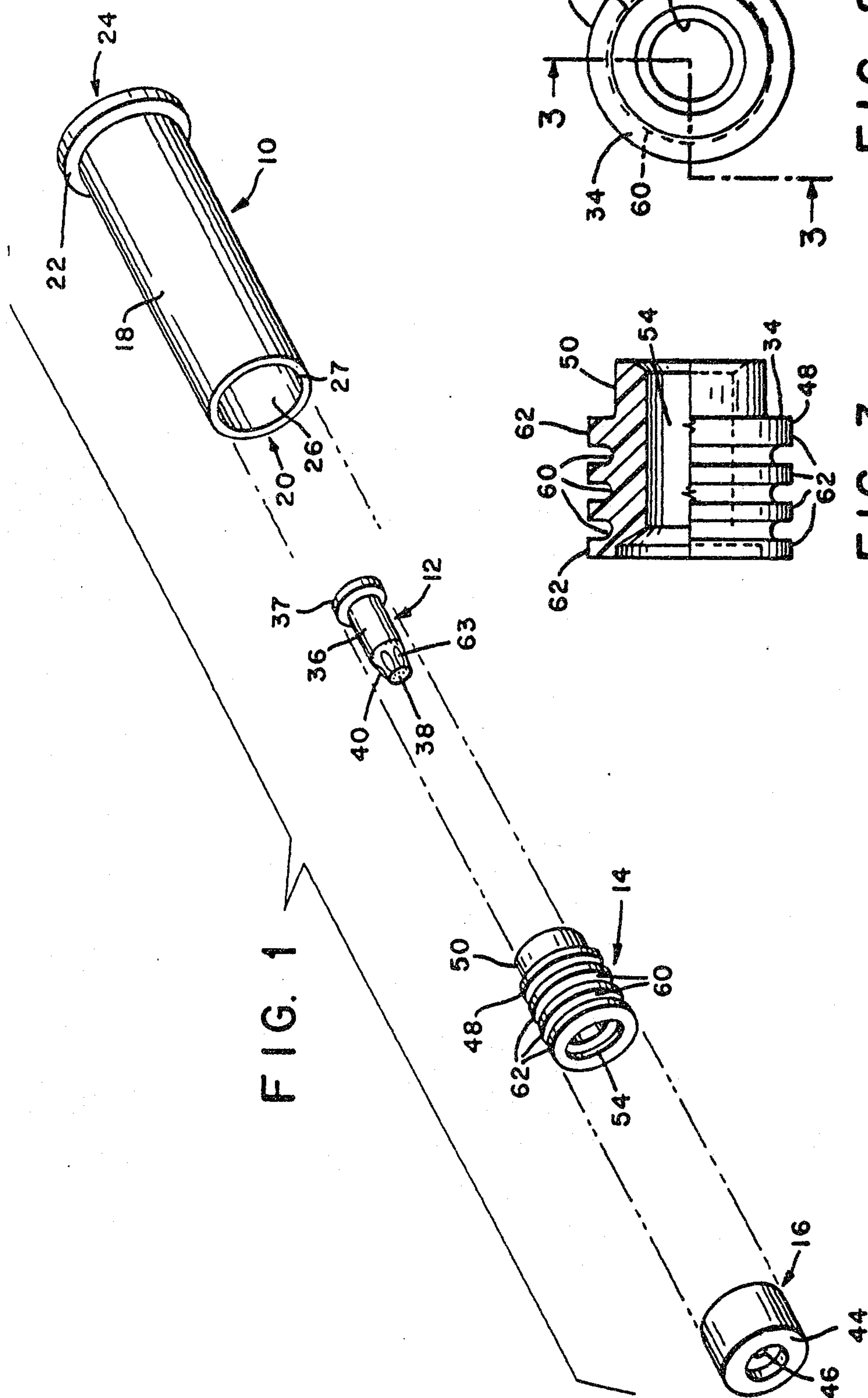


FIG. 1

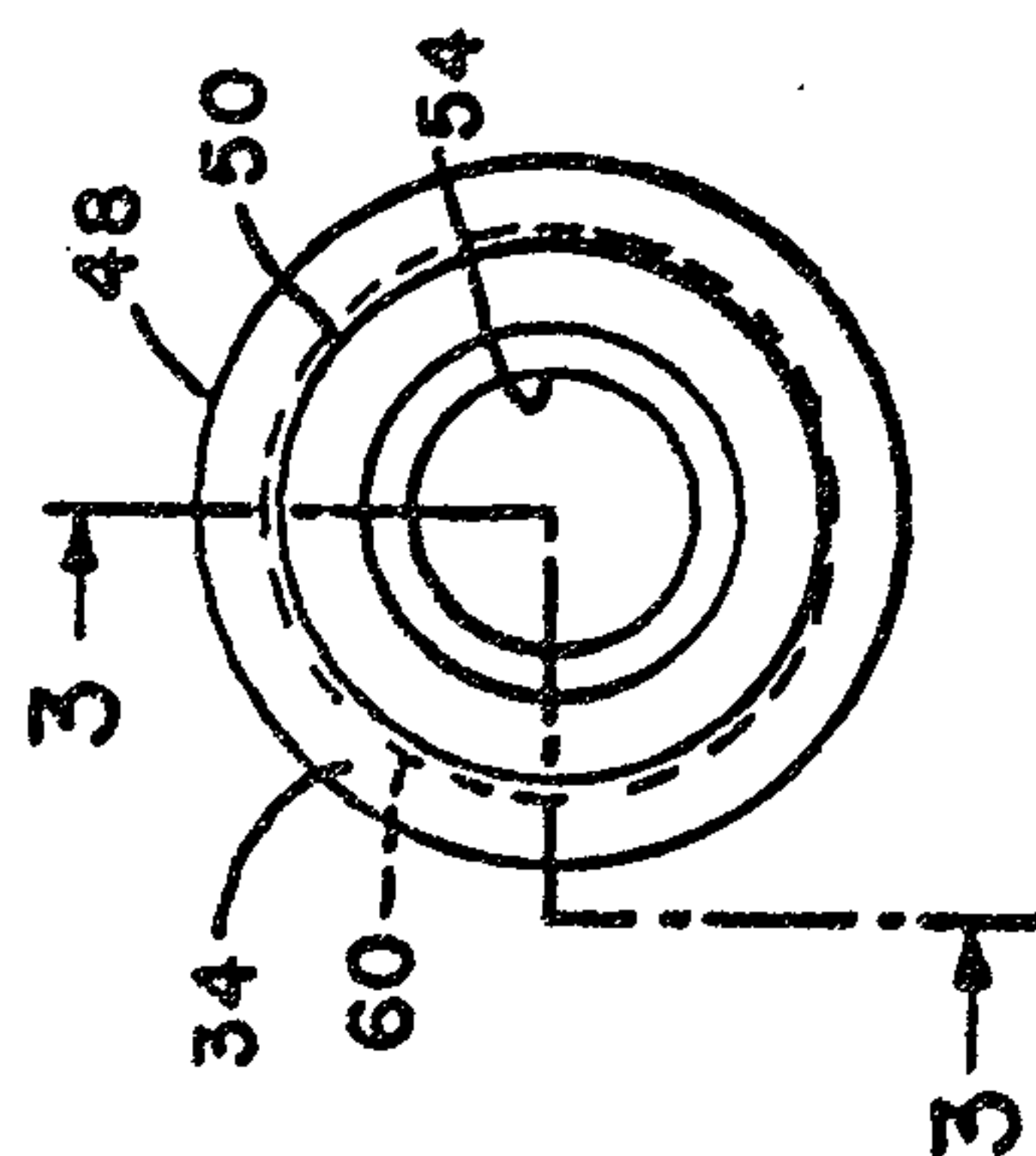


FIG. 2

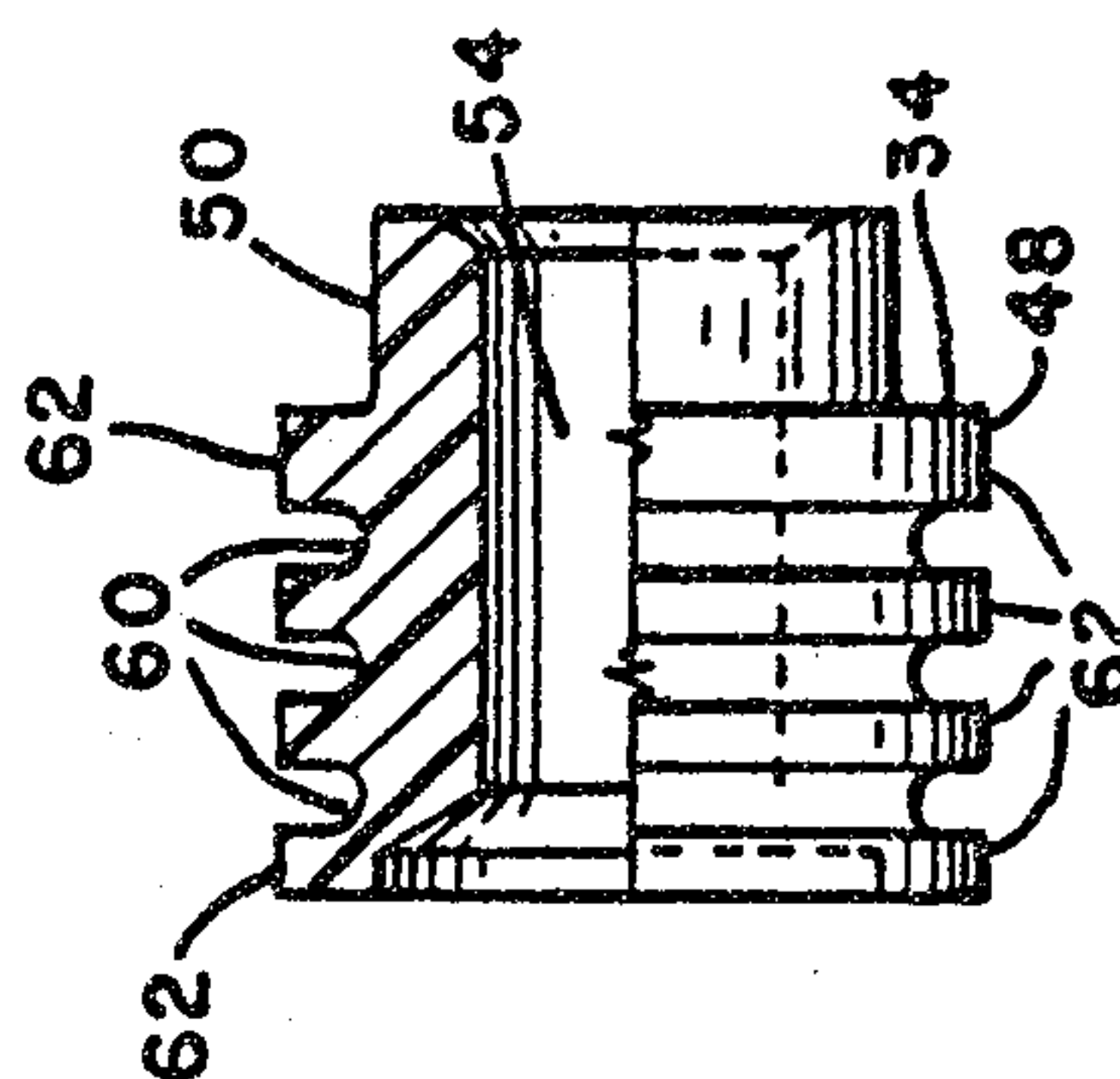


FIG. 3

INVENTORS
 Kenneth J. Woo and
 Robert K. Annan
FetherstonRough & Co
 Patent Agents

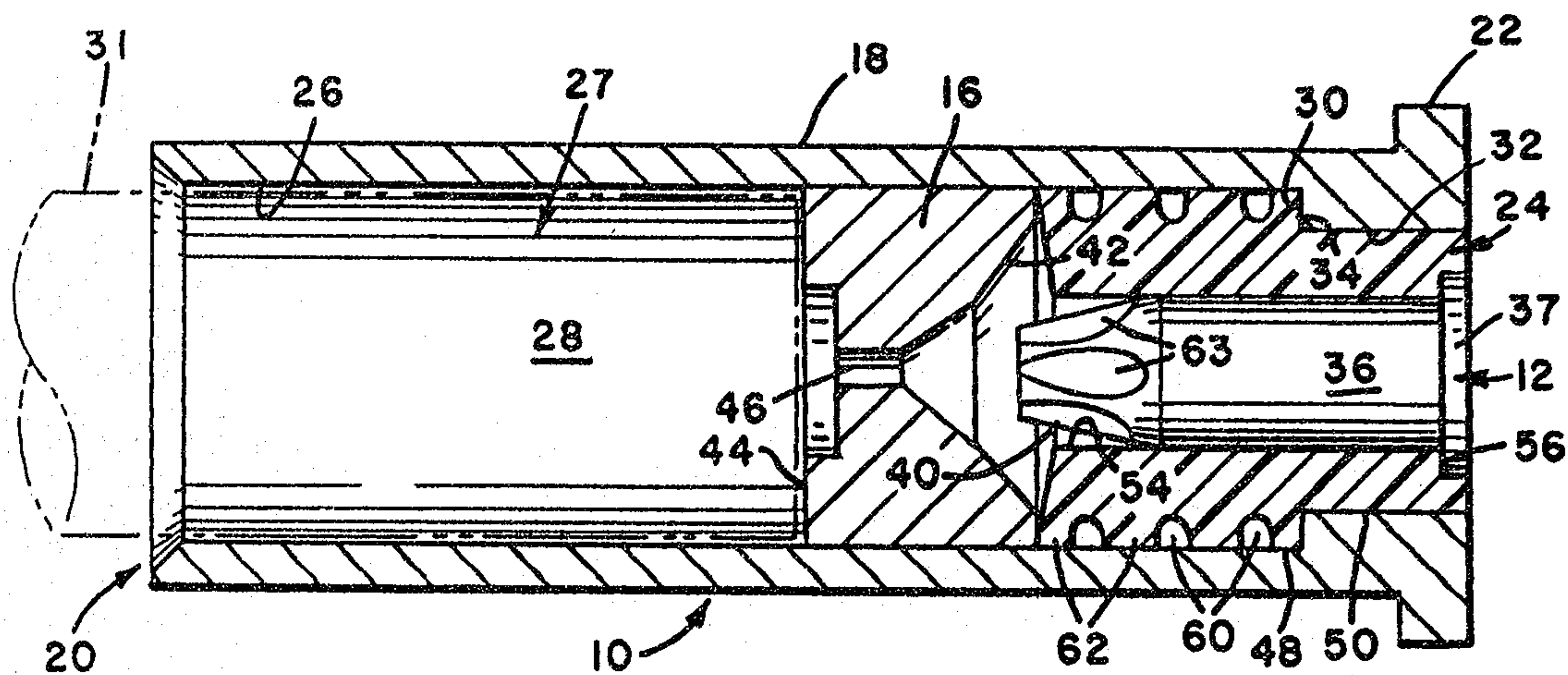


FIG. 4 (BEFORE FIRING)

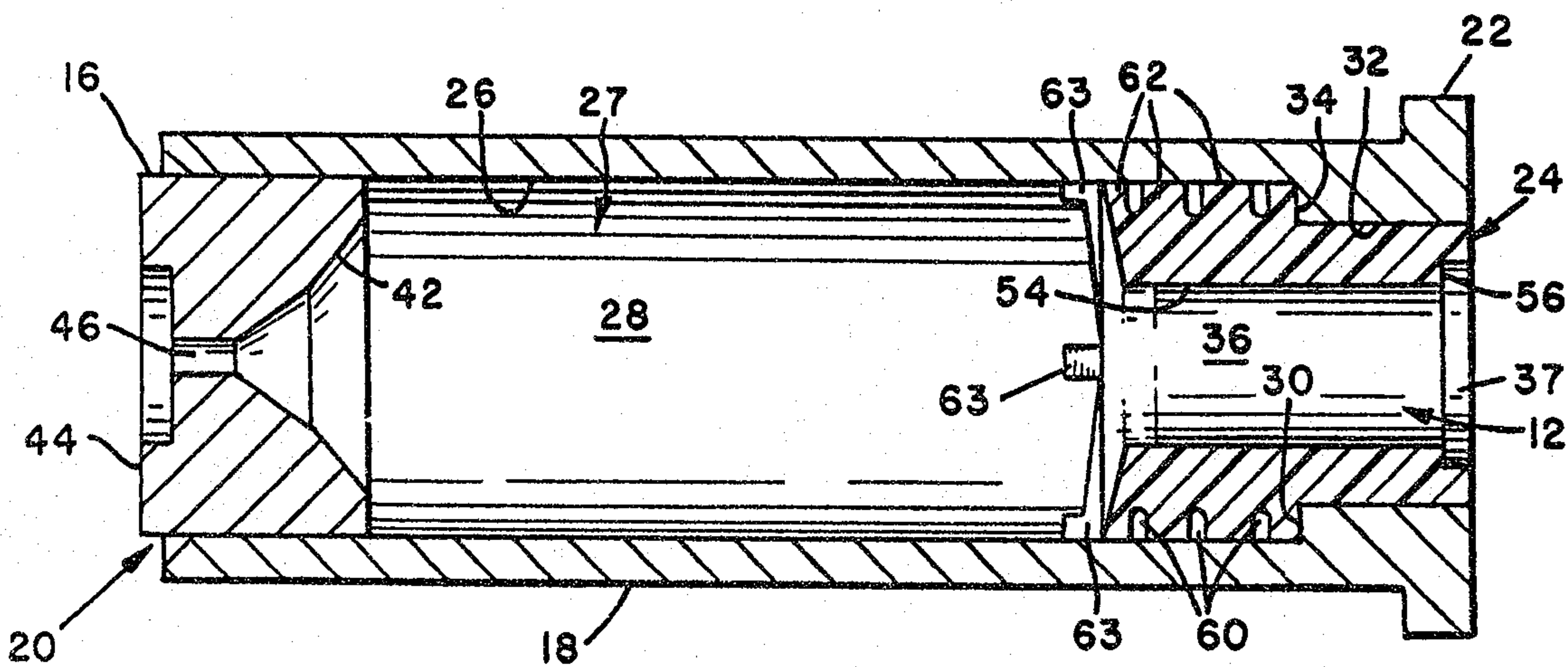


FIG. 6 (AFTER FIRING)

INVENTORS
Kenneth J. Woo and
Robert K. Annan
Fetherstonhaugh & Co
Patent Agents

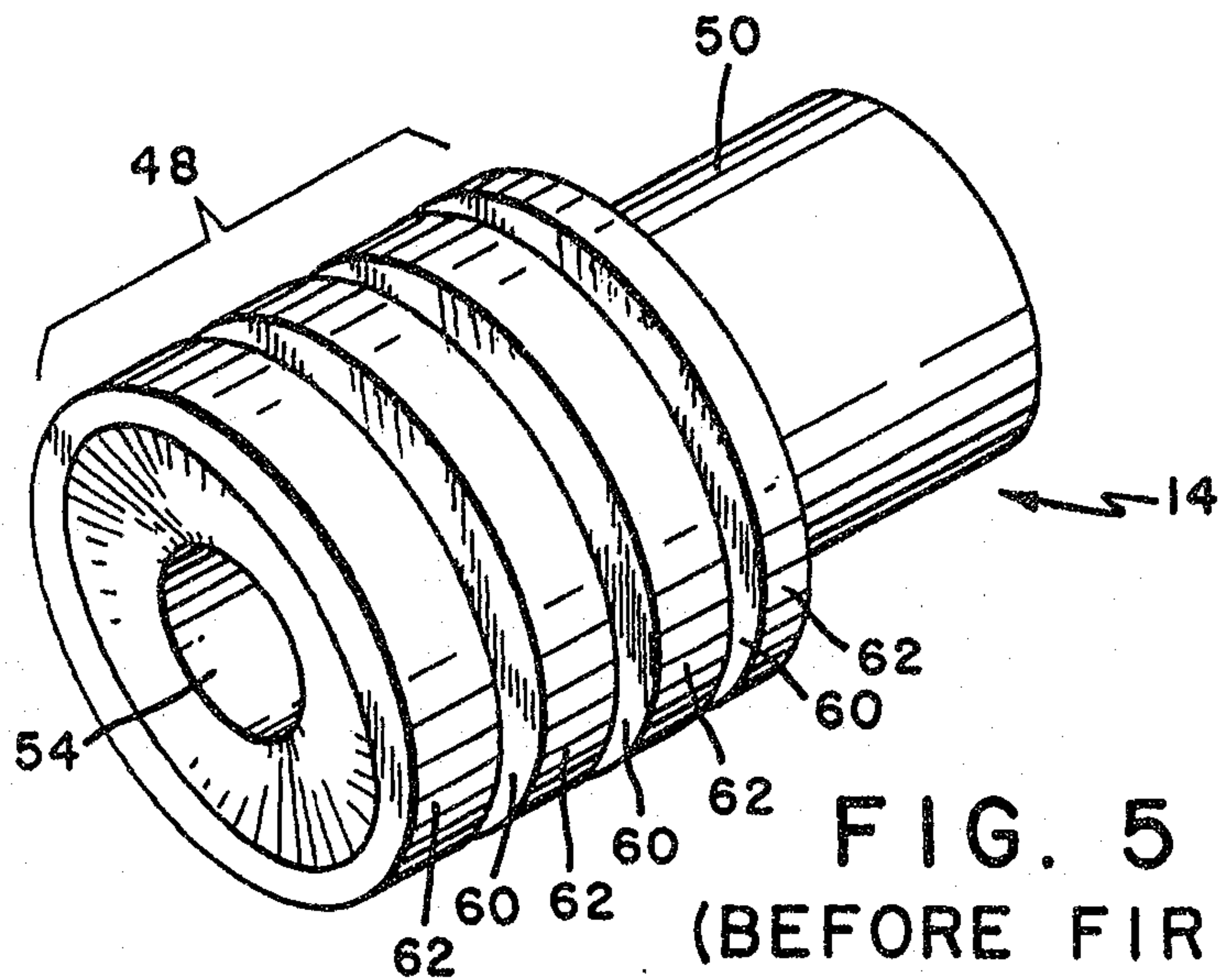


FIG. 5
(BEFORE FIRING)

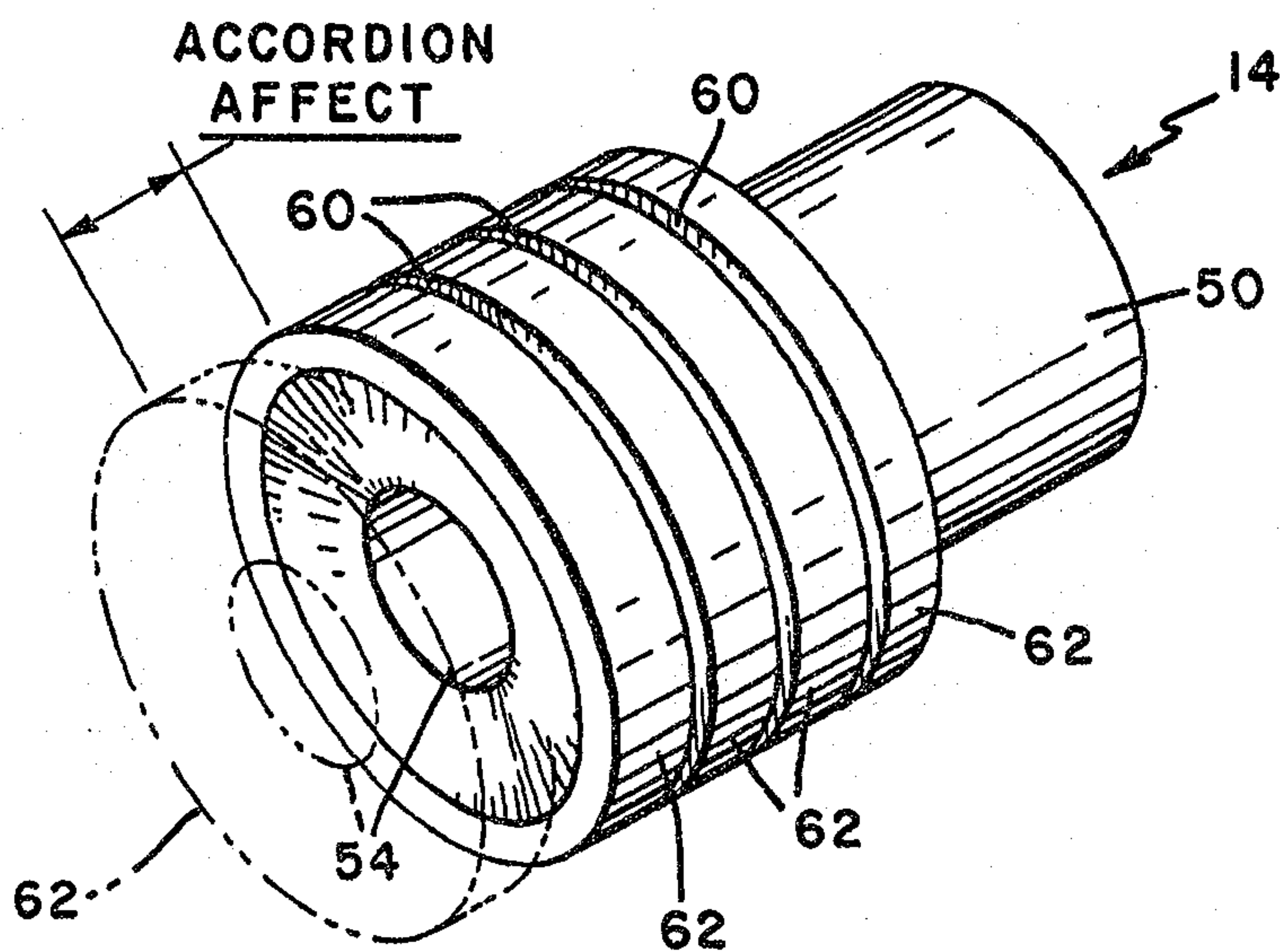


FIG. 7
(AFTER FIRING)

INVENTORS
Kenneth J. Woo and
Robert K. Annan
Fetherstonhaugh & Co
Patent Agents

