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54 **Cartridge firing arrangement.**

57 A propellant cartridge 12 mounted in a body 10, 14, 16 has two percussion caps 34 at one end which can be struck, to fire the cartridge, by respective firing pins 24, 24a, slidable mounted in the body for movement from retracted positions, spaced from the percussion caps, to their firing positions.

The firing pins, normally held in their retracted positions by shear pins 38, can be urged towards their firing positions, to fire the cartridge, after shearing of the shear pins, by a common firing member 40 in the form of a piston slidable in a bore 42 in the body and to which bore gas under pressure may be supplied to fire the cartridge.

The arrangement described affords increased reliability of cartridge firing.

Title: "Cartridge firing arrangement"

THIS INVENTION RELATES to a cartridge firing arrangement particularly, but not exclusively, for use in conjunction with cartridge actuated devices such as used in aircraft ejection seats, parachute deployment systems and the like.

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In the field of application noted, it is clearly of the greatest importance that the respective cartridge should fire successfully when required to do so, and it is an object of the present invention to provide a cartridge firing system which is of increased reliability in operation as compared with known systems.

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According to one aspect of the invention there is provided a cartridge firing arrangement including a plurality of firing pins mounted in a body for movement parallel with one another between respective retracted positions and respective firing positions, each firing pin having an operative end for engagement with a respective percussion cap and a head at the opposite end, the firing arrangement including a common firing member mounted for movement in said body parallel with said firing pins and in line therewith, whereby said common firing member may engage the heads of said firing pins to move the firing pins simultaneously towards their firing positions.

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According to another aspect of the invention there is provided the combination of a cartridge and a cartridge firing arrangement therefor, the cartridge firing arrangement including a plurality of firing pins mounted in a body for movement parallel with one another between respective retracted positions and respective firing positions, each firing pin having an operative end and a head at the opposite end, the combination including, for each said firing pin, a respective percussion cap mounted in said cartridge, the

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arrangement being such that each said firing pin, in its retracted position, has its operative end spaced from the respective percussion cap but that when a said firing pin is propelled rapidly from its retracted position to its firing position, its operative end will strike the respective percussion cap to fire the same, the arrangement further including a common firing member mounted for movement in said body parallel with said firing pins and in line therewith, whereby said common firing member may engage the heads of said firing pins to move the firing pins simultaneously towards their firing positions.

An embodiment of the invention is described below by way of example with reference to the accompanying drawings in which:-

FIGURE 1 is a view in section of a cartridge and firing unit embodying the invention,

FIGURE 2 is a view of the unit of Figure 1 in axial section perpendicular to the plane of section of Figure 1, and

FIGURE 3 is an exploded perspective view of the assembly of Figures 1 and 2.

The drawings show a cartridge and firing arrangement embodied, in this instance, in an igniter for the rocket motor of a rocket-powered ejection seat for an aircraft.

The unit shown comprises a tubular breech 10, a cartridge casing 12 having a tubular cylindrical body part received within the breech 10 and head part 13 received within a generally tubular housing 14. The cartridge casing 12 is, of course, occupied by a combustible propellant (not shown). The housing 14 is internally threaded at one end to receive the correspondingly externally threaded adjacent end of the breech tube 10. A firing pin block 16 received within the housing 14 has an external screw thread in engagement with an internal screw thread formed in the housing 14 and is screwed into the housing until an end face 18 thereof remote from the cartridge casing 12 engages an annular abutment 20 formed around the interior of housing 14 and facing towards the cartridge casing 12. The breech 10 is screwed into the housing 14 sufficiently to clamp the head portion 13 of the cartridge casing 12 between the firing pin block 16 and the

adjacent end of the breech 10, the head portion 13 having, at the junction with the body portion of the cartridge, an annular shoulder 22 which engages the adjacent end of the breech tube 10.

5 Two identical firing pins 24 are mounted in the firing pin block 16 for sliding movement parallel with the common axis of the breech tube 10 and housing 14, each firing pin 24 being substantially cylindrical and having a head portion 24a and a shank portion 24b, the head portion 24a being of substantially greater diameter than the shank portion 24b and the shank
10 portion 24b providing, at its end remote from the head portion, the operative end of the firing pin for engagement with a percussion cap as described below. The head portion 24a of each firing pin 24 is slideably accommodated within a respective cylindrical bore 25 extending into the block 16 from the end face 18 thereof, whilst the shank portion 24b is
15 extendable through a respective co-axial bore of reduced diameter extending from the end of the respective bore 25 remote from the end face 18 through a face 26 of the block 15 which adjoins the head 13 of the cartridge casing 12. The axes of the two sets of firing pins 24 and the bores 25 receiving the same are disposed symmetrically with respect to the central
20 axis of the breech 10 and housing 14, equally spaced from and in diametrically opposed positions relative to said central axis.

As shown in Figures 2 and 3, the head portion 13 of the cartridge casing 12 is cut away on diametrically opposite sides thereof to provide
25 parallel flat lateral faces 30 spaced equally from the central axis of the cartridge and housing 14 at a distance apart substantially less than the diameter of the cartridge casing and of the block 16, the planes of the lateral faces 30 being parallel with the common plane of the axes of the two firing pins 24. Formed in the end face of the central portion of the head
30 part 13 of the cartridge casing 12 which affords the lateral faces 30, and in alignment, in the axial direction, with respective ones of the firing pins 24, are two circular recesses 32 which receive, as shown in Figures 1 and 2, respective percussion caps 34.

35 The end of the housing 16 nearer the cartridge is formed with a diametral slot or channel having planar side walls 17, parallel with one another and with the central axis of the housing, said slot or channel having

a bottom defined by said end face 26. The dimensions of said slot or channel in the housing 16 are such that the central portion of the head 13 of the cartridge casing fits snugly within said slot with each lateral face 30 lying closely against a respective parallel opposing side wall 17 of said diametral slot. By this means the alignment of the percussion cap recesses 32 and the firing pins 24 is ensured.

A central projection 36 is provided in the bottom of each recess 34, opposing the respective shank 24_b of the respective firing pin, whereby, in operation, the respective percussion cap will be pinched between the projection 36 and the operative end of the respective firing pin. Passages 38 extend from the bottom of each recess 32 to the hollow interior of the cartridge casing to allow the hot gases produced by the firing of the respective percussion cap to pass to the propellant within the cartridge casing and ignite the same.

Each firing pin 24 is normally held in a retracted position in which its operative end is spaced from the respective percussion cap 36 by a respective shear pin 38 passing through a respective bore in the block 16 perpendicular to the axis of the respective bore 25 and passing through a diametral bore in the respective head portion 24_a. In this retracted position the head portion 24_a of each firing pin 24 projects from the block 16 beyond the end face 18 thereof.

The housing 14 carries, adjacent the heads 24_a of the firing pins, a piston 40 which is sealingly slidable, along the axis of the housing 14, in an end part 42 of the axial bore in the interior of the housing 14, the piston 40 being sealed with respect to the bore 42 by a sealing ring 44. In the arrangement shown, the piston 40 is, for lightness, of hollow cup-like form with the annular rim at its open end being engaged, when the piston 40 is at its most remote from the block 16, with an end wall 41 of the housing 14. A central passage through said end wall 41, continuous with a central passage 41 through a spigot 50 extending from said end wall, allows, in operation, the passage of gas under pressure to operate the cartridge as described below. A tubular proofing peg 52 co-axial with the housing 14 and with said passage 42 is fitted internally within said end wall and spigot 50 and projects into the space defined within the piston 40 as shown. The peg 52 serves to

prevent incorrect assembly of the piston.

5 In operation, the spigot 50 is connected with a source of pressurised gas, which may, for example, be produced by a further cartridge device (not shown) which causes the piston 40 to be urged against the ends of the heads 24a of the firing pins. The shear pins 38 hold the firing pins 24 in their retracted positions until the gas pressure forcing the piston 40 against the firing pins has obtained a value sufficient to fracture the shear pins 38, whereupon the firing pins 24 are propelled rapidly forwards to strike the
10 percussion caps 34 and thus fire the cartridge.

15 It will be appreciated that since the firing pins and percussion caps are duplicated, the likelihood that both of these sets of components may fail to operate correctly and thus fail to ignite the cartridge is substantially less than would be the case if only a single firing pin and percussion cap were used. Furthermore, the constructions illustrated in the drawings, permits fixing pins of a somewhat lighter construction and smaller diameter than conventionally employed to be used, which in turn makes the assembly less
20 prone than it might otherwise be to inadvertent operation through the assembly being subjected to very high acceleration, for example by a blow to the breech tube 10 or housing 14 or an impact on the aircraft incorporating the assembly. At the same time, the piston construction described allows the piston 40 to be very light, and the lightness of the piston may be enhanced by an appropriate choice of material therefor, such
25 as titanium, again minimising the risk of unintentional firing of the cartridge due to the assembly being subjected to substantial acceleration. Nevertheless, the piston arrangement described provides a large area to respond to gas pressures of limited range, which in turn makes the shear pins more effective.

30 The features disclosed in the foregoing description, in the following claims and/or in the accompanying drawings may, both separately and in any combination thereof, be material for realising the invention in diverse forms thereof.
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CLAIMS

1. A cartridge firing arrangement including a plurality of firing pins mounted in a body for movement parallel with one another between
5 respective retracted positions and respective firing positions, each firing pin having an operative end for engagement with a respective percussion cap and a head at the opposite end, the firing arrangement including a common firing member mounted for movement in said body parallel with said firing pins and in line therewith, whereby said common firing member may engage
10 the heads of said firing pins to move the firing pins simultaneously towards their firing positions.

2. The combination of a cartridge and a cartridge firing arrangement therefor, the cartridge firing arrangement including a plurality of firing pins
15 mounted in a body for movement parallel with one another between respective retracted positions and respective firing positions, each firing pin having an operative end and a head at the opposite end, the combination including, for each said firing pin, a respective percussion cap mounted in said cartridge, the arrangement being such that each said firing pin, in its
20 retracted position, has its operative end spaced from the respective percussion cap but that when a said firing pin is propelled rapidly from its retracted position to its firing position, its operative end will strike the respective percussion cap to fire the same, the arrangement further including a common firing member mounted for movement in said body
25 parallel with said firing pins and in line therewith, whereby said common firing member may engage the heads of said firing pins to move the firing pins simultaneously towards their firing positions.

3. A cartridge firing arrangement according to claim 1, or the combination according to claim 2, wherein said common firing member comprises a piston movable in a bore by gas pressure.
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4. A cartridge firing arrangement or combination according to claim 3 wherein each firing pin has a respective shear pin associated therewith, retaining the firing pin in its retracted position.
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5. A mechanism incorporating a cartridge firing arrangement according to claim 1 or the combination of claim 2.

5 6. A cartridge firing arrangement substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

7. The combination of a cartridge and cartridge firing arrangement, substantially as hereinbefore described with reference to, and as shown in, the accompanying drawings.

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8. Any novel feature or combination of features disclosed herein.

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Fig. 3.

