(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 793 194 A1**

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
06.06.2007 Bulletin 2007/23

(21) Application number: **05750241.1**

(22) Date of filing: **17.05.2005**

(51) Int Cl.:
F41A 9/46 *(2006.01)* ***F41A 9/14*** *(2006.01)*
F41A 9/54 *(2006.01)*

(86) International application number:
PCT/ES2005/000273

(87) International publication number:
WO 2005/111526 (24.11.2005 Gazette 2005/47)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR

(30) Priority: **17.05.2004 AR 0410169 U**

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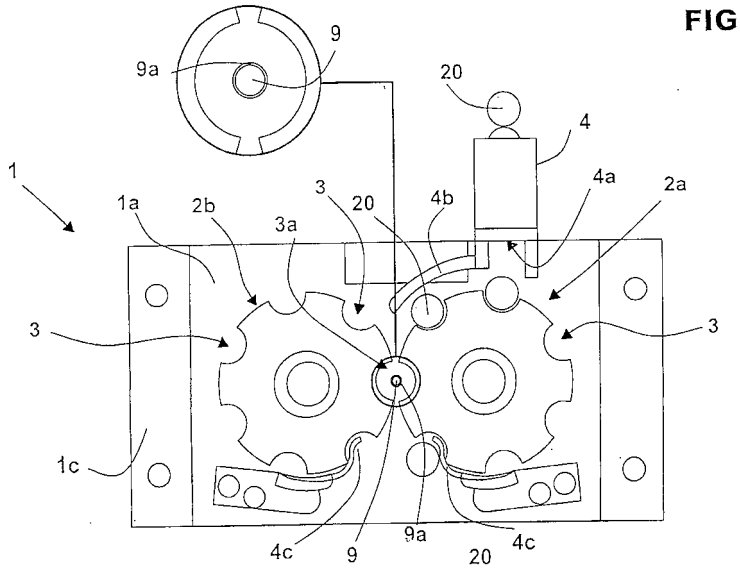
(54) CONTINUOUS-ACTION TRIGGER DEVICE

(57) Continuous action firing possessing a frame (1) with one or more sets of adjacent drums (2a)(2b) with cartridge (20) receptacles (3); these drums (2a)(2b) are synchronized and animated with a rotational movement in opposite directions, so that their receptacles (3) come together face-to-face complementing the formation of a transitory firing chamber (3a), that is interveningly between the firing hammer (9), or an electrically activated fulminate electric ignition system or a percussion and electric mixed system, and the bore (11a)of the barrel (11); the device also possesses means of synchronization such as gears (6) between the directional shafts (5) of the drums (2a)(2b) and the firing hammer control device (10) that controls the firing hammers movement (9). Impelled by conductors and linked by means of synchronization (6) (10), the directional shafts (5) move the drums (2a)(2b) rotationally in opposite directions. Cartridges (20) coming a magazine (4) are received in the receptacles of the main drum (2a) and, helped by the guide track (4b), they are transported to the transitory firing chamber (3a) formed by both receptacles (3) facing the main drum (2a) and the complementary drum (2b). Once the cartridge (20) is used, it remains adhered to the receptacle (3), it is extracted by means of the extractors (4c).

FIG. 1



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Description

Invention Field

[0001] The present invention refers to the field of armament and firearms, principally those devices based on mechanical function. More particularly, those devices that consist of continuous firing mechanisms that, based on the complementary action of sets of drums, permitting the formation of a transitory firing chamber for the firing of cartridges, all of which permits a continuous action with high velocity and precision.

Invention Objective

[0002] Continuous action firing device that permits high velocity and precision firing, with one or more sets of adjacent drums possessing cartridge receptacles, given that said drums are synchronized and animated with a rotary type movement in opposite directions, so that the receptacles face each other, complementing the formation of a transitory firing chamber between the firing hammer, or electric ignition system electrically actuated or a mixed percussion and electric system, and the bore of the barrel. The main drum receives the cartridges in its receptacles that come from the magazine and transports them to the transitory firing chamber formed by the two receptacles facing the main drum and the complementary drum; once the cartridge is used, it is extracted by means of expulsors.

BACKGROUND OF THE INVENTION

[0003] Up to present there are an innumerable amount of weapons and devices based on different mechanisms that allow the firing of projectile carrying cartridges.

[0004] The patent document en the United States of America US 1304 shows one of these basic devices that is based on a current rotating drum. The cartridges are housed in the drum receptacles until they are facing the drum zone and the bore of the barrel, where the projectile is resultantly fired and the used cartridge is retired from the firing zone or chamber by the rotational displacement of the drum.

[0005] The patent document US 4442753 shows an ammunition magazine system based on a solitary rotating drum that consists of an automatic carrousel to transfer the cartridges.

[0006] The patent document US 4442753 shows a mechanism with one rotating firing chamber, which has cartridge transferring.

[0007] The patent document US 6588311 shows the magazine device for a turret-mounted weapon. It is based on a rotating drum in which its receptacles deposit modular units with magazines and cartridges. So in this case, the rotating drum displaces and rotates carrying these modular units.

[0008] In general, there are a great number of devices possessing fixed chambers, which include mechanisms that are for the extraction of used projectiles.

Description of the Invention

[0009] In general terms, the invention consists of a continuous action firing device which includes a frame assembly(1) with one or more sets of adjacent drums (2a)(2b) which are equipped receptacles (3) for cartridges (20); these drums (2a)(2b) are synchronized and animated with a opposite direction rotating movement, so that the receptacles (3) face each other complementing the formation of a transitory firing chamber (3a) that is interferingly situated between the firing hammer (9), or an electrically actuated ignition system or a mixed percussion and electric system, and the bore (11a) of the barrel (11); the device also comprises means of synchronization, such as gears (6) between the directional axis (5) of the drum (2a)(2b) and firing hammer controller (10) that control the firing hammer (9) movement , or means of synchronization suitable to when the electrical ignition takes place by means of an electrical system. In this last case, the ignition system is similar to the one used, for example, in the 30mm caliber ammunition of the French series DEFA 550 machine gun; this variation of the invention makes the system safer and eliminates the need for a series of mechanical pieces. The invention also allows the ignition system to be mixed, the mix being percussion and electric.

[0010] It should be mentioned that, at the precise moment after firing, the pressure is not lost, the sheath of the ammunition should be a type that completely encases the tip of the projectile; this type of ammunition is not unheard of, for example, the 32 caliber ammunition used in competition.

[0011] In accordance with the objective specifications, the continuous action firing device, can be applied to any fixed or mobile structure or vehicle that is aptly prepared, will continuously fire projectiles from cartridges (20), while possessing:

1 A firing hammer (9), or an electric ignition system which uses an electrically actuated detonator, or both, that acts against the cartridges (20);
2 A barrel (11) with bore(11a), through which projectiles are projected from the said cartridges (20); the current device is characterized in that it possesses;
3 At least, one frame assembly (1).
4 At least, two adjacent drums (2a)(2b) provided with both sets of receptacles (3) for cartridges (20).
5 Said drums (2a)(2b) are synchronized and animated, rotating in opposite directions;
6 Said rotation determine that the receptacles (3) of both drums (2a)(2b) have a concurrent trajectory until the are adjacently face to face, so that the said receptacles (3) complement the formation of a transitory firing chamber (3a); and
7 Said transitory firing chamber (3a) is interferingly

between the firing hammer (9), or the electrical ignition system, and the bore (11a) of the barrel (11).

[0012] The firing device of the invention can be free moving or mounted on any structure that is apt for the purpose, whether fixed or mobile, including all types of installation, such as on land vehicles, amphibious vehicles, submarines or aircraft.

[0013] One of the purposes of this invention is to contribute an original device that, based on the complementary action of the set of drums that form a transitory firing chamber, allows for continuous firing of cartridges. Another purpose will be to provide said device for variable uses where applicable; such as in fixed installations for mobile structures, including all types of air, land, amphibious, and submarine vehicles.

[0014] One advantage of this invention is that it is not based on a fixed chambering process in which the projectile is detained, introduced to the weapon and later extracted. On the other hand, the formation of the transitory firing chamber fixed between two complementary drums, allows the cartridges to be fired without stopping and without arriving into a position in which it must later be extracted.

[0015] Another advantage of this device is that it can be applied to different types of weaponry, whether the weaponry is small or very large scale.

[0016] Another advantage is that, according to the supply of cartridges, the device can fire continuously without seizing and without imperfections or obstructions, thanks to its means of synchronization. These methods of synchronization also prevent operating errors.

[0017] Another advantage is given due to the fact that the devices directional axis can be connected to other means of direction. So, the device can voluntarily vary its firing velocity. In this aspect the device's synchronization methods can also guarantee a perfect performance at any firing velocity.

[0018] As is with all firing devices, primarily those that are characteristically repeating, the effective dissipation of its generated heat is important. Never the less, it should be noted that in the invented device the chamber is transitionally constituted with each firing by means of the alignment of the complementary receptacles of the two drums, and immediately after the firing the two halves of said chamber separate and displace, forming another distinct transitory firing chamber for the next firing. This allows for the dissipation of heat, at all points on the metallic surfaces, that was produced from firing, which is more effective than in other firing devices. The cooling systems which would be suitable for the here mentioned invention are conventional cooling systems that are well known by technical experts and can be applied through air or through fluid for forced heat extraction.

Brief Description of the Drawings

[0019] For better clarity and understanding of the invention, the following figures represent one of the preferred embodiments, all of which simply titled for illustrative example and without limits.

[0020] Figure 1 is a front elevational view, of the device without the anterior support, so that the formation of the transitory firing chamber can be appreciated in view of the guide orifice of the firing hammer. The mentioned transitory firing chamber and the orifice with the firing hammer can be appreciated in the details included.

[0021] Figure 2 is a perspective frontal view, in flight, of the firing device without the anterior support.

[0022] Figure 3 is a perspective anterior-superior view of the firing device with the anterior support separated so that its inside can be appreciated.

[0023] Figure 4 is a perspective posterior-inferior view without one of the synchronization gears so that the firing hammer's action can be observed.

[0024] Figure 5 is an exploded perspective anterior-inferior view that allows the components of the device to be appreciated.

[0025] Figure 6 is an exploded perspective posterior-inferior that allows the devices components to be appreciated, especially the posterior part.

[0026] Figure 7 is an exploded perspective posterior-superior view that allows the devices components to be appreciated.

[0027] In the distinct figures, the reference numbers indicate their equal corresponding parts, and the groups of various elements have been distinguished with letters.

[0028] List of principle references:

(1) Device frame assembly.

- (1a) Posterior support frame (1).
- (1b) Anterior support frame (1).
- (1c) Lateral support frame (1).

(2a)(2b) Drums.

- (2a) Principal drum.
- (2b) Complementary drum.

(3) Receptacles of the Drums (2a)(2b).

- (3a) Transitory firing chamber [formed by face-to-face cavities(3)].

(4) Cartridge magazine (20).

- (4a) Magazine mouth.
- (4b) Guide track.
- (4c) Means of expulsion.

(5) Rotational axis of the drums (2a)(2b).

(6) Synchronization gears [means of synchronization].

(7) Head support.

(8) Mobile head of firing hammer (9).

(8a) Elastic piece of the firing hammer (9).

(9) Firing hammer.

(9a) Orifice.

(10) Firing hammer control device for the mobile head (8) [by means of synchronization and action of the firing hammer (9)].

(11) Firing barrel.

(11a) Bore of the barrel (11).

(20) Cartridges.

PREFERRED EMBODIMENTS OF THE INVENTION

[0029] In a preferred realization, the device would possess an integrated frame assembly (1) with posterior supports (1a), supports or lateral walls (1c) and anterior support (1b).

[0030] The posterior support (1a) and the anterior support (1b) provide the rotating mount for the directional axis (5) able to connect to any type of conductor - axle, shaft, gear, etc.- that propels them. In the extreme posterior parts of the directional axis (5) there are gears (6) that synchronize the shafts and causes their respectively opposite rotating movements. Over one of these directional shafts (5) there is a fixed firing hammer control device (10) that will control the firing hammer's (9) movement. In other realizations, the ignition can take place due to an electric ignition system that uses an electrically actuated fulminate or through the use of a mixed system of percussion and electricity.

[0031] The mentioned firing hammer (9) is impelled by a mobile head (8) that is articulated in a support head (7) mounted in the posterior support (1a). The mobile head (8) that is moved as a result the firing hammer control device (10) and the presence of an elastic piece (8a) - similar to a spring - both help to keep the mentioned mobile head (8), similar to a hammer, normally tense against the firing hammer (9) so that it displaces inside of the guiding orifice (9a) of the posterior support (1a).

[0032] The drums (2a)(2b) are located between the provided space of the posterior support (1a) and the anterior support (1 b) of the frame assembly (1). These drums (2a)(2b) consist of a main drum (2a) and a complementary drum (2b) that are solidly on their respective directional shafts (5).

[0033] The mentioned drums (2a)(2b) made up of open receptacles (3) able to house cartridges (20) and that, in their current form of development, formed of cavities that affect the bodies of the drums (2a)(2b).

[0034] The rotating movement in opposite directions of the drums (2a)(2b), keeps the receptacles (3) of both drums (2a)(2b) in a concurrent trajectory until they come together adjacently face to face, the position that complements the formation of a transitory firing chamber (3a).

[0035] The main drum (2a) would transport the cartridges (20), from the mouth (4a) of a cartridge (20) magazine track (4) to the mentioned transitory firing chamber (3a). The cartridges (20) are dependent on a guide track (4b), which maintains them in their respective receptacles (3), during which rotation of the main drum (2a) is produced between the said magazine (4) and the transitory firing chamber (3a).

[0036] Moreover, the transitory firing chamber (3a) takes a position that is intervening to and between the firing hammer (9) and the bore (11a) of the barrel (11). This barrel (11) is mounted on the walls of the anterior support (1b) so that the bore (11a) crosses the said walls and stays aligned with the firing hammer (9) to allow to firing of the projectile from the cartridge (20).

[0037] With regards to the transitory firing chamber (3a), the receptacles (3) of the drums (2a)(2b) follow a divergent trajectory so as to cross the area of influence of the cartridge (20) expellers (4c). These expellers (4c)- one for each drum (2a) or (2b)- both have arms over which both drums rotate (2a)(2b), so that the receptacles (3) are swept by said arms to expel the used cartridges (20).

[0038] Distinct forms of framework can be developed so that the frame assembly (1) can be used to mount two or more sets of tumblers (2a)(2b). Each set of drums (2a)(2b) forms its own transitory firing chamber (3a) and this, at the same time, is made up of its respective firing hammer (9) and firing barrels (11). Also, the means of synchronization (6)(10) can be independent for each set or be linked. The same can be true with respect to the means by which the conductors can be individual for each set of drums (2a)(2b) or common to all of them.

Group Functions

[0039] Driven by means of conductors - not illustrated - and linked by means of synchronization (6)(10), the directional shafts (5) move the drums (2a)(2b) in rotationally opposite directions. The receptacles (3) of the main drum (2a) receive the cartridges (20) from the magazine (4) and helped by the guide track (4b), they are transported to the transitional firing chamber (3a) formed by both receptacles (3) facing the main drum (2a) and the complementary drum (2b). One of the directional shafts (5), moves the mobile head (8) against the firing hammer (9). The for mentioned (9) hits against the cartridge firing the projectile from the cartridge (20) which exits through the bore of the barrel (11).

[0040] Once the cartridge (20) is used, even though it stays in the receptacle (3), is resultantly extracted by means of expellers (4c) that are secured to the receptacles (3) before they again reach the area of the mouth (4a) of the cartridge (4).

[0041] Since the present invention has been especially described and it's nature determined, and possibilities of practical development, it is without question that once in practical use small details of the construction and form

of the present invention could be modified, referring to, and without straying from the fundamental principles that clearly are substantiated in the vindictive clauses that follow:

Claims

1. Continuous action firing device, applicable to any fixed or mobile structure or apt vehicles, which will continuously fire projectile filled cartridges, **characterized in that** they possess the following:

   - a firing hammer, or an electric ignition system which is actuated electrically, or a percussion and electric mixed system, that acts against the cartridges;
   - a barrel along which the bore projects the projectiles of the said cartridges; possessing:

     • At least, one frame assembly;
     • At least two adjacent drums provided with both sets of receptacles for cartridges, said drums in a state of synchronization and animated in rotationally opposite direction;

   wherein said rotational movement positionally determines that the receptacles of both drums have a concurrent trajectory until they are adjacently face-to-face, so that said receptacles complement the formation of a transitional firing chamber; and
   where said transitory firing chamber is interveningly positioned between the firing hammer, or an electric ignition system, or a percussion and electric mixed system, and the bore of the barrel.

2. Continuous action firing device according to claim 1, **characterized in that** said drums a firing hammer, or an fulminate electric ignition system which is actuated electrically, possessing a main drum and a complementary drum containing both sets of receptacles for cartridges; said main drum which is the means of transporting the cartridges from the mouth of a magazine to the transitory firing chamber that, between said firing hammer or ignition system and the barrel, is formed by the receptacles that, displaced by the rotational movement in opposite directions of both drums, come together successively face-to-face.

3. Continuous action firing device according to claim 1, **characterized in that** said cartridge receptacles consist of receptor cavities that affect the bodies of both drums.

4. Continuous action firing device according to claim 1, **characterized in that** the drums are synchronized by means of synchronization that possess:

   - a least one set of driven shafts that, with capacity to be connected by means of conductors, correspond to both drums;
   - gearing means that link to said shafts together, and
   - cam means that, impelled by one of the said directional shafts, control the swaying movement of the firing hammer with respect to the transitory firing chamber.

5. Continuous action firing device according to claim 1 and 4; **characterized in that** the firing hammer that acts upon the transitory firing chamber is actuated by a mobile head that, articulated on a frame and under an elastic influence that remains normally tense against the said firing hammer, is displaced by means of cam means joint with one of the directional shafts of the drums.

6. Continuous action firing device according to claim 1, **characterized in that** between the bore of the barrel and the transitory firing chamber there is a guide track that maintains the cartridges in their respective receptacles during the rotation of the main drum from said magazine until the said transitory firing chamber.

7. Continuous action firing device according to claim 1, **characterized in that** the mounting frame comprises a posterior and anterior support between which are arranged the drums that form the transitory firing chamber, said firing chamber being situated between the firing hammer, which acts through a guide orifice of the posterior support, and the barrel situated in the anterior support.

8. Continuous action firing device according to claim 1 and 4, **characterized in that**:

   - the frame mount contains, at least, one posterior and one anterior support between which is located a rotating mount of the driven shafts on where the drums are mounted;
   - said posterior support provides a mount for said synchronization means and is provided with at least one guide orifice through which the firing hammer is actuated;
   - the said anterior support is provided at least, with one aperture corresponding to the bore of the barrel;
   - said orifice of the firing hammer and said bore of the barrel are aligned; and
   - between said firing hammer and said bore of the barrel, the receptacles of both drums form the transitory firing chamber.

9. Continuous action firing device according to claim 1 and 4, **characterized in that** the swaying movement

of the firing hammer is impelled by said mobile head and said cam means which comprise a sprocket-like wheel propelled by one of the driven shafts.

10. Continuous action firing device according to claim 1, **characterized in that** the rotational movement in opposite directions of both drums makes certain that the receptacles of both drums have, a divergent trajectory so that the receptacles of both drums are influenced by cartridge expellers.

11. Continuous action firing device according to claim 10, **characterized in that** the cartridge expellers comprise two arms, on which both drums rotate allowing the receptacles to be swept by said arms.

12. Continuous action firing device according to claim 1, **characterized in that**:

- it comprises two or more sets of adjacent drums each of said drums being provided with a set of cartridge receptacles;
- the drums of each set are synchronized and animated so as to move rotationally in opposite directions;
- said rotational movement determines that the receptacles of said both drums of a same set, have a concurrent trajectory until the drums are congruent and face-to-face, so that the mentioned receptacles complete the formation of the transitory firing chamber; and
- the transitory firing chamber formed by each set of drums is made up of firing hammer receptacle and a barrel, between which is located the transitory firing chamber.

FIG. 1

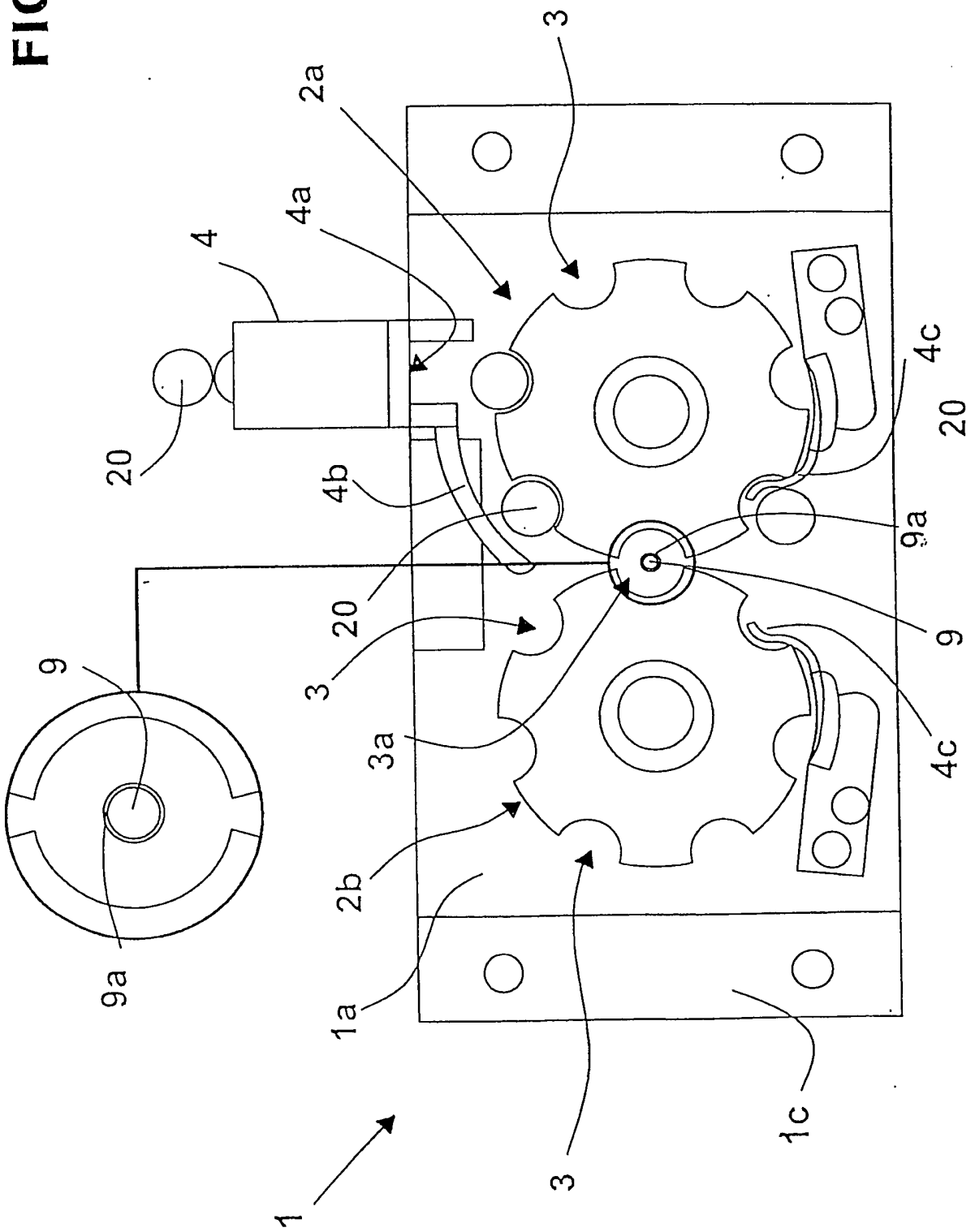


FIG. 2

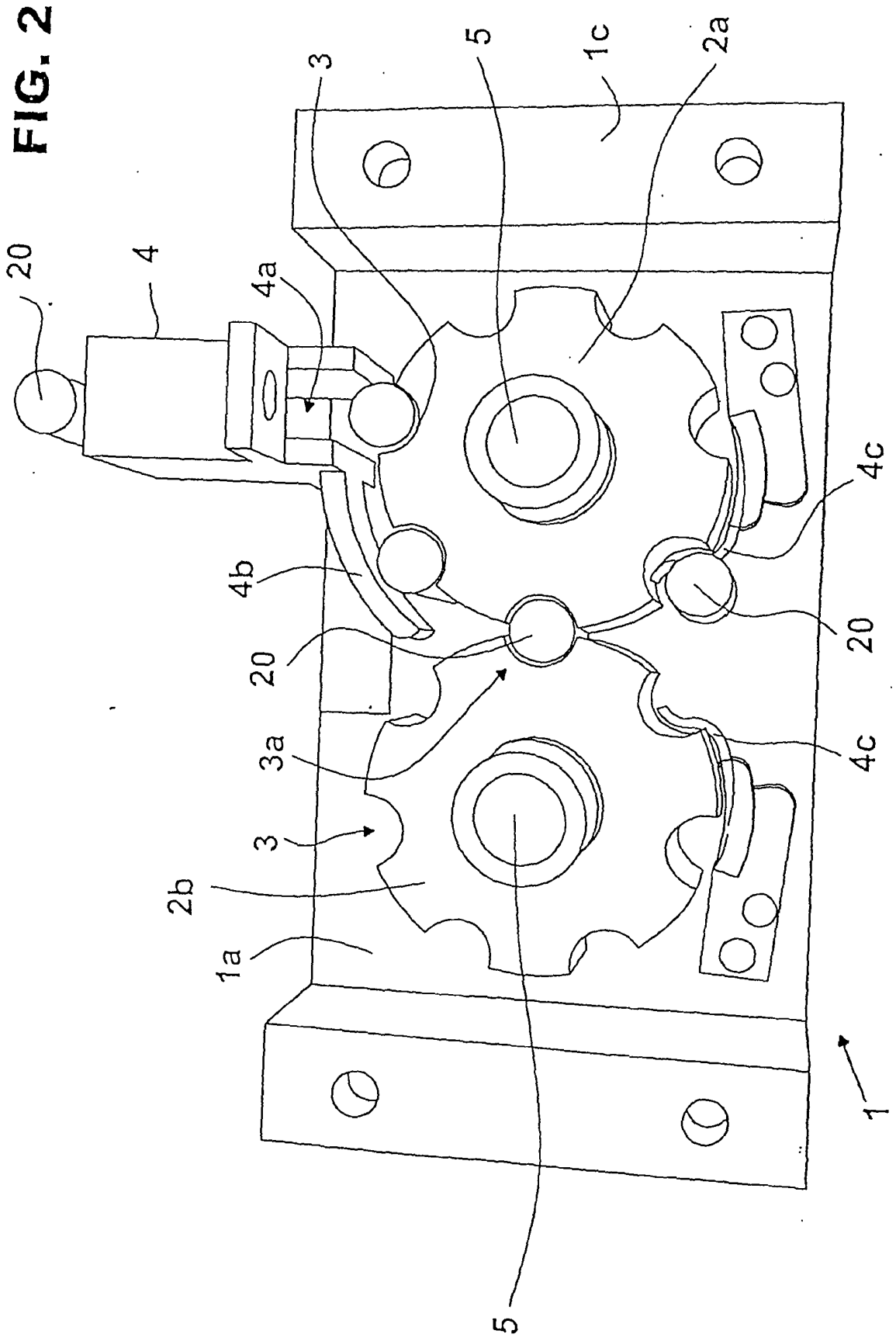


FIG. 3

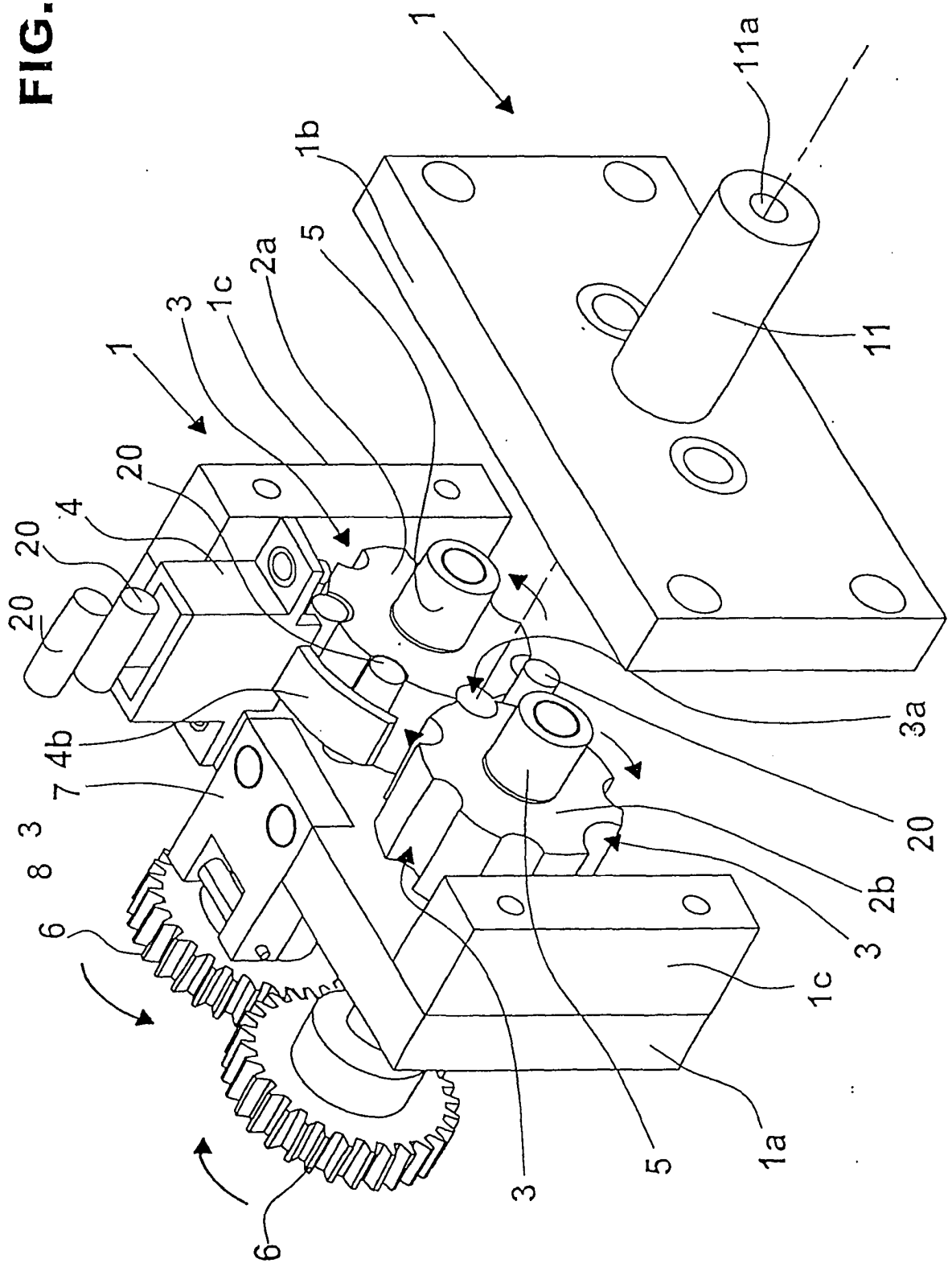


FIG. 4

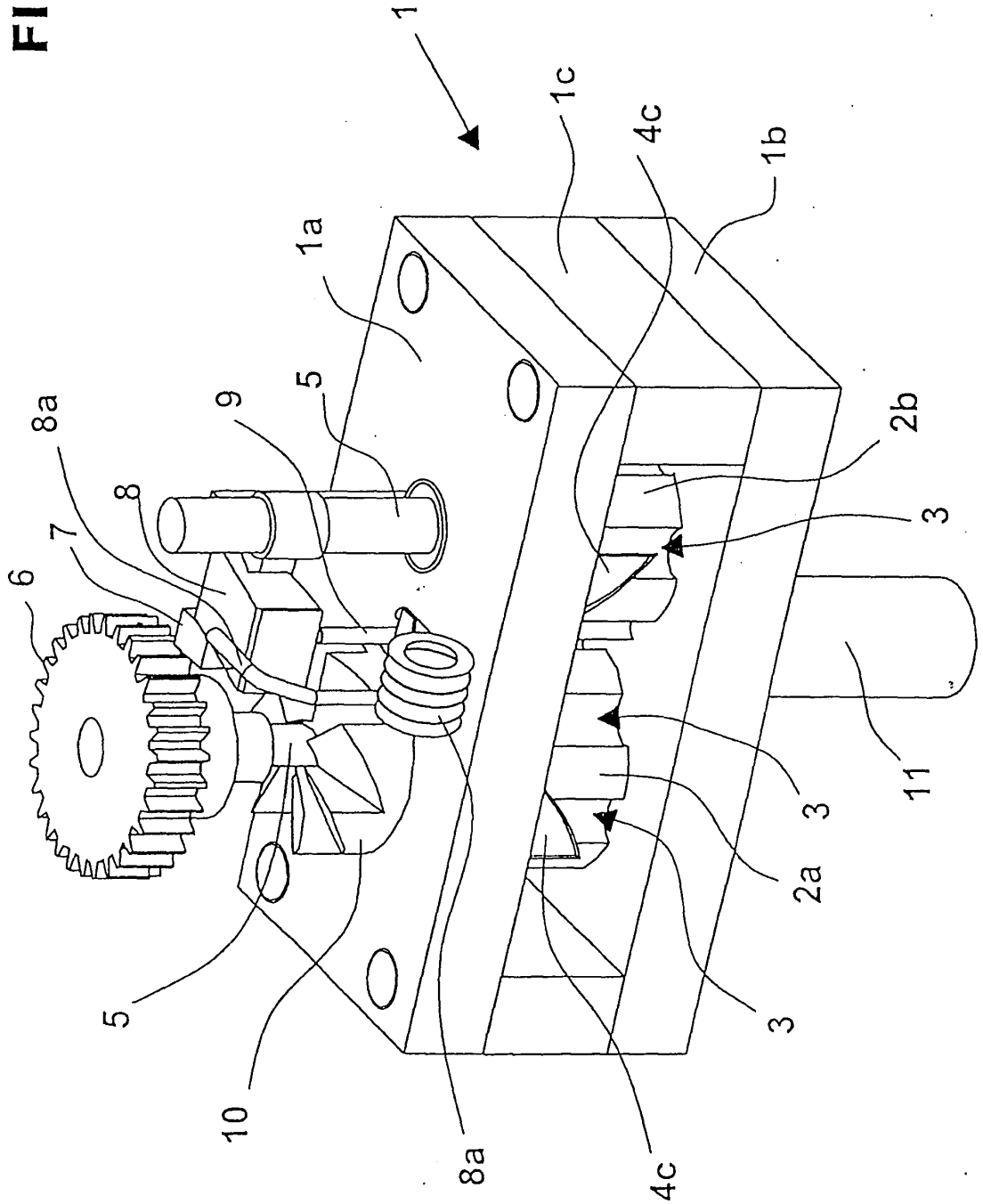


FIG. 5

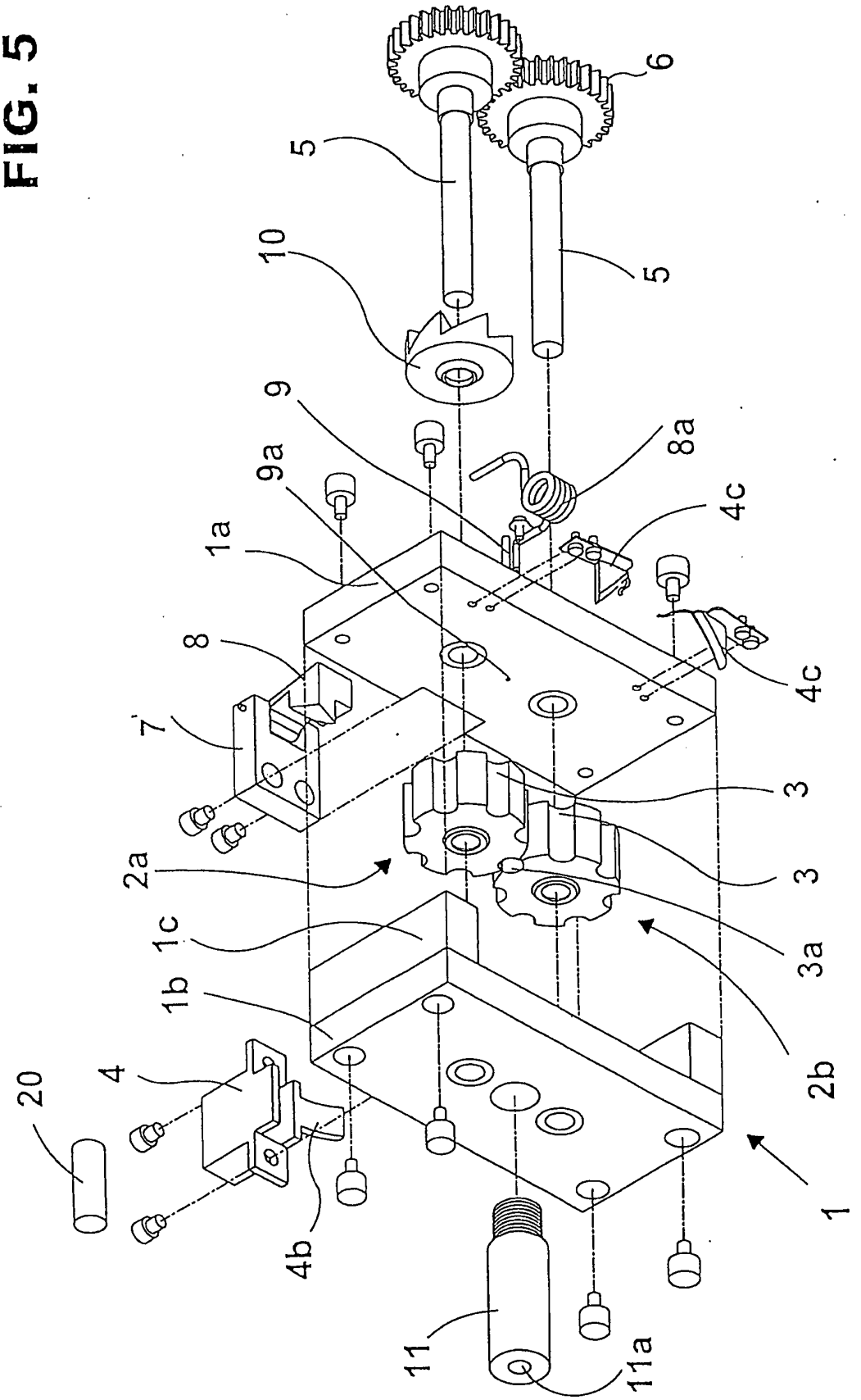


FIG. 6

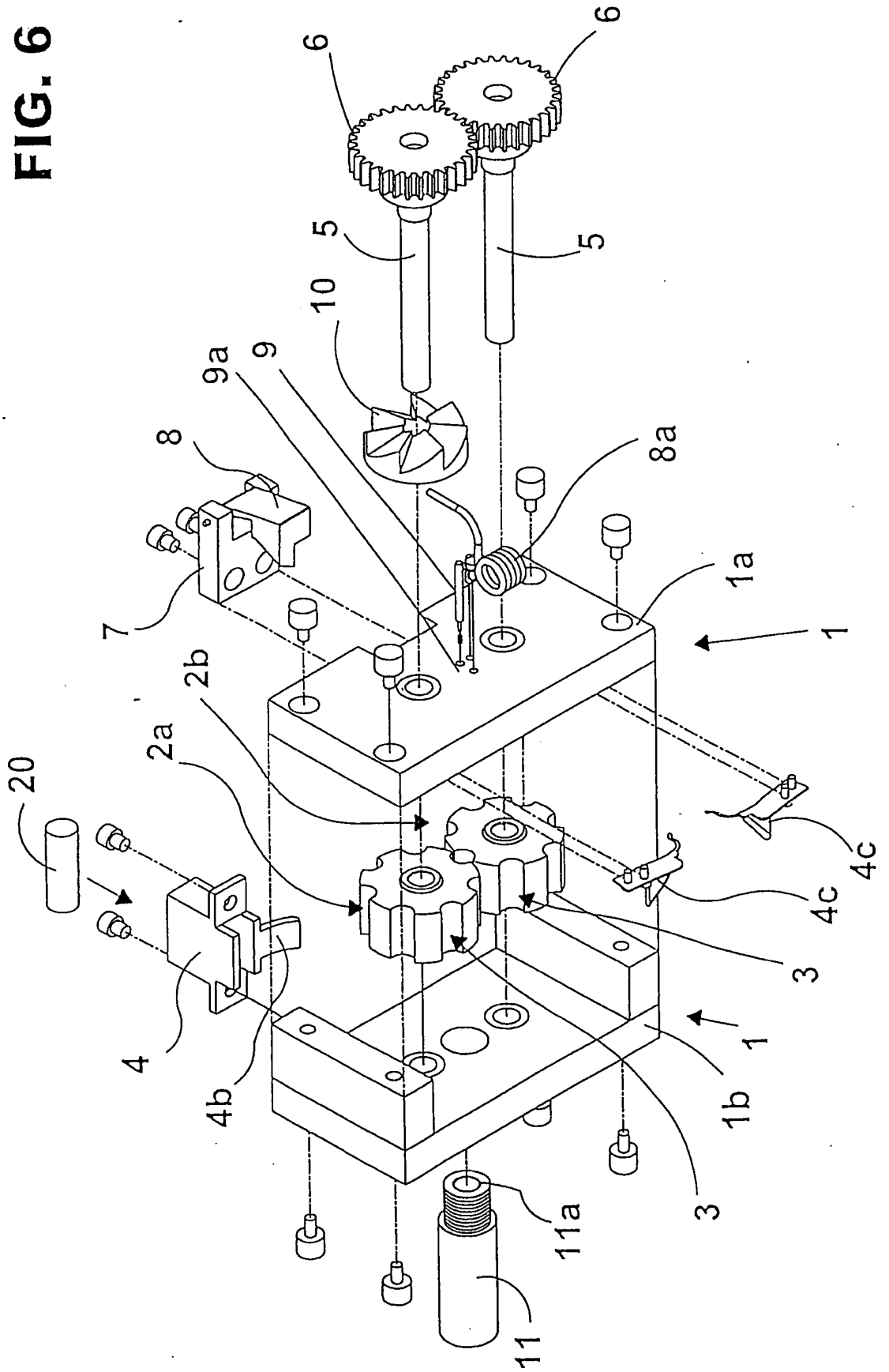
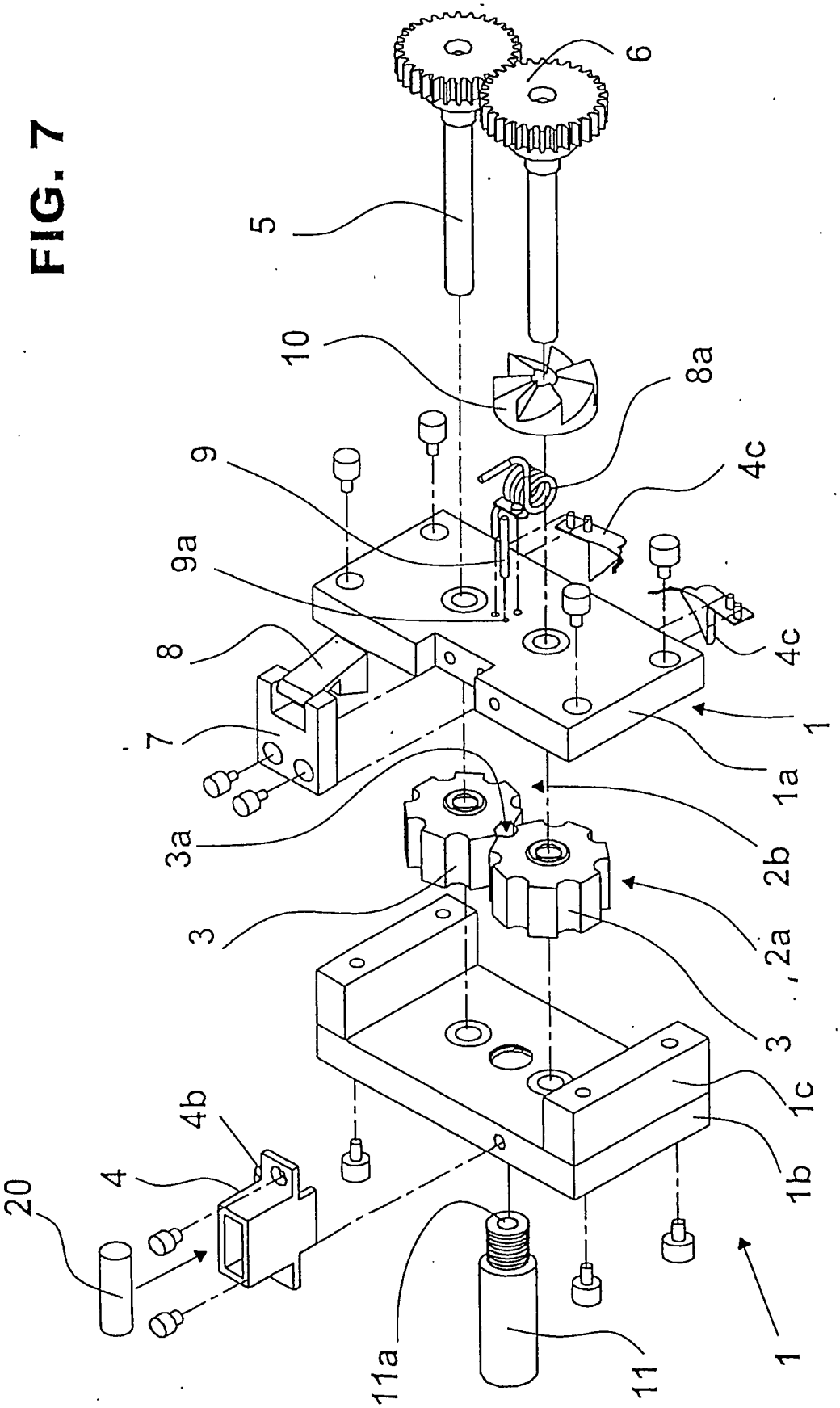


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.
PCT/ ES 2005/000273

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 F41A9/46, F41A9/14, F41A9/54

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 F41A

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CIBEPAT,EPODOC

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3262367 A (MARTWICK WILFORD E; YOUMANS DUANE C) 26.07.1966, column 3, líne 38 - column 44, líne 5; figures.	1-5,7-9,12
Y		6,10,11
Y	US 3747249 A (OUELLETTE H) 24.07.1973, column 1, líne 64 - column 2, líne 2; column 3, líneS 56 - 61; figures. 2,3	6,10,11
X	US 3704772 A (MEIER OTTO H) 05.12.1972, **description, figures**	1
A		4
A	US 2317579 A (STUART BACON HENRY) 27.04.1943, figura 2	1,6
A	US 2965004 A (SHOELSON MITCHELL J; WASSEL EUGENE S) 20.12.1960, **description, figures 4-5**	1,12

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
19 JULY 2005 (19.07.05)	**27 JULY 2005 (27.07.05)**
Name and mailing address of the ISA/ **S.P.T.O.** Facsimile No.	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International Application No
PCT/ ES 2005/000273

Patent document cited in search report	Publication date	Patent familiy member(s)	Publication date
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US 3262367 A	26.07.1966	FR 1435240 A GB 1096215 A DE 1453922 A1	15.04.1966 20.12.1967 26.03.1970
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US2317579 A	27.04.1943	**NONE**	----------

Form PCT/ISA/210 (patent family annex) (July 1992)

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 4442753 A **[0005] [0006]**
- US 6588311 B **[0007]**