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

(11) Publication number: **0 207 033 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **86850219.6**

(51) Int. Cl.⁴: **F41F 9/06**

(22) Date of filing: **17.06.86**

Die Bezeichnung der Erfindung wurde geändert (Richtlinien für die Prüfung im EPA, A-III, 7.3).

(30) Priority: **19.06.85 SE 8503045**

(43) Date of publication of application: **30.12.86 Bulletin 86/52**

(84) Designated Contracting States: **CH DE FR IT LI SE**

(71) Applicant: **Aktiebolaget Bofors**
Box 900
S-691 80 Bofors(SE)

(72) Inventor: **Lindberg, Sven**
Norrlandsgatan 13
S-693 00 Degerfors(SE)

(74) Representative: **Falk, Bengt et al**
Nobel Corporate Services Patents and Trademarks
S-691 84 Karlskoga(SE)

(54) Magazine for automatic artillery pieces.

(57) The disclosure relates to an extremely compact, preferably gun-mounted magazine (2) for fully-automatic artillery pieces. The magazine (2) according to the invention includes a plurality of round compartments (I-VI) which are disposed in parallel side-by-side relationship and each accomodate a plurality of parallel superposed rounds which may successively be fed down towards a discharge position specific to each round compartment. Together, these in turn form a transverse feeding channel (6) along which a special, stepwise operating transverse feed mechanism (6) works. According to the invention, each compartment (I-VI) is provided with a specific round hoist (8) which lifts all rounds in the compartment apart from that round which lies in the discharge position. The round hoist in that filled compartment which lies most distal from the piece, seen in the direction of feed of the transverse feeding channel, must, however, always be in the unsecured state so that this compartment continually supplies fresh rounds to the transverse feeding channel. Special sensing devices (9) are provided for release of the round hoist (8) in the compartment which is next in turn when the preceding compartment has been emptied. The recoil of the gun is employed for release of the round hoists.

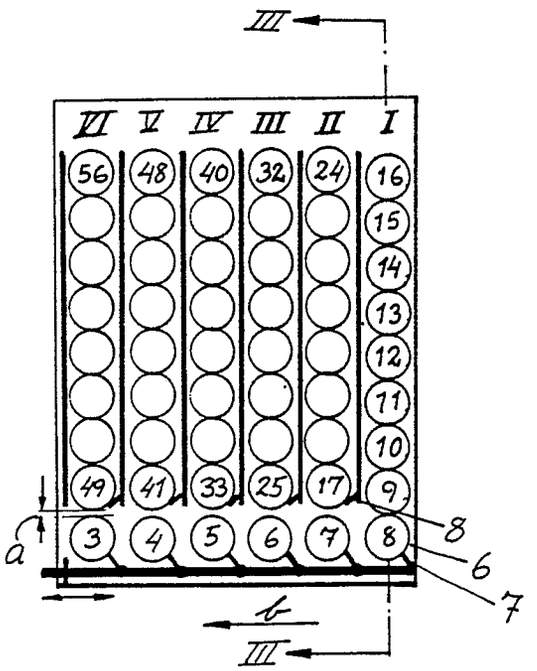

Fig. 2

EP 0 207 033 A2

IMPROVEMENTS TO MAGAZINES

TECHNICAL FIELD

The present invention relates to an extremely compact, preferably gun-mounted, magazine for fully automatic artillery pieces, primarily anti-aircraft guns.

The magazine according to the present invention comprises a plurality of preferably vertical compartments for rounds of ammunition, the compartments being disposed in side-by-side parallel relationship and each accomodating a number of parallel superposed rounds, which may progressively be fed down to a discharge position specific to each compartment, whence the rounds are fed further towards the ramming position of the gun by means of a transverse feeding system common to all compartments by the intermediary of a transverse feeding channel which coincides with the mutually parallel discharge positions for all compartments, and the transverse feeding channel being, when the gun is fired, successively fed with new rounds at the same rate as rounds are fed into the gun, from that compartment which lies most distal from the ramming position of the gun and which has not yet been emptied.

ADVANTAGES

A distinct advantage inherent in the magazine according to the present invention is that it may, since the discharge positions for the different round compartments coincide with the transverse feeding channel, be directly loaded right up to the ramming position of the gun without a successive and time-consuming stepwise feeding of the rounds for successive replenishment of a separate feeding channel. This latter situation is, otherwise, the normal arrangement in gun magazines for large quantities of rounds. These are, moreover, often placed in the gun mounting instead of directly on the piece. As soon as calibres in excess of the very smallest gun calibres of about 20 mm come into question, the gun-mounted magazines seldom accomodate more than from 10 to 20 rounds. The magazine according to the present invention can, because it may be made so compact, be built for 100 rounds and more even in calibres of from 40-57 mm.

The previously-mentioned simultaneous loading of the compartments and transverse feeding channel is effected in that the compartments are filled and the transverse feeding channel is also automatically filled. In order that the rounds in those compartments which are not yet in turn to supply further rounds to the transverse feeding channel during firing shall not disturb the round feeding operation along the transverse feeding channel, all compartments are provided with round hoists which are activated once the compartments have been filled. The round hoists then lift all rounds apart from the first in each compartment so that there is created a free channel between the first rounds located in the transverse feeding channel and remaining rounds. Furthermore, a sensor is disposed on a level with each compartment which, as soon as it is ascertained that no round is located in its section of the transverse feeding channel, activates the round hoist in the next compartment in the direction of feed so that the rounds located in this compartment are given free passage to the transverse feeding channel. The most distal compartment which, thus, is always to commence feeding rounds, has no round hoist. As a result of this arrangement, compartment after compartment will be successively emptied into the transverse feeding channel. For securing the round hoists in the raised position, use is made of self-locking toggle mechanisms of per se known type, and for the successive disengagement of these, use is made, according to the present invention, of compartment release blocks which are shiftable by the intermediary of the above-mentioned sensors and, when they have been shifted to the disengagement position, bridge the distance between the toggle mechanism and special triggering abutments which, on recoil of the gun, are shifted in a direction towards each respective toggle but which, without the triggering abutments as make-up pieces, do not reach all the way. This arrangement entails that the sensors only shift the compartment release blocks which possess slight natural mass, while release of the toggle mechanisms is catered for by the recoil of the gun.

Hence, activation of all round hoists is to be effected once the compartments have been filled. It may, therefore, be appropriate to provide the compartments with a common lid which is interconnected with a device which activates the round hoists when the lid is closed.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

The nature of the present invention and its aspects will be more readily understood from the following brief description of the accompanying Drawings, and discussion relating thereto.

In the accompanying Drawings:

Fig. 1 is an oblique projection of an anti-aircraft gun with two gun-mounted round magazines, one on each side;

Fig. 2 shows, on a larger scale, a cross-section through one of these magazines;

Fig. 3 is a section taken along the line III-III in Fig. 2;

Fig. 4 shows, on a yet larger scale and with more details, parts of the sections A-A and B-B of Fig. 3;

Figs. 5a and 5b show, on the same scale and wealth of detail as Fig. 4, parts of the section C-C of Fig. 3, Fig. 5a illustrating the incorporated linkage system in the released position and Fig. 5b showing the same linkage system in the captive position; and

Figs. 6a and 6b illustrate the principle for the triggering and release function of the linkage system of Figs. 5a and b, Figure 6a illustrating the captive position and Fig. 6b the released position.

Corresponding details have been given the same reference numerals in all figures.

DESCRIPTION OF PREFERRED EMBODIMENT

Referring to the Drawings, the anti-aircraft gun 1 illustrated in Fig. 1 is provided with two gun-mounted magazines 2 and 3 respectively. A vertical gun feed channel 4 is disposed between the round magazines and may receive rounds from either one of the magazines 2 or 3 and feed these into the ramming position of the gun. The magazines may be filled with different types of ammunition and the choice of magazine may be directly related to the target in question by means of separate command devices. The magazines are provided with opening lids for replenishment with new rounds from above. The lid 5 on the magazine 2 is shown in the half-open position.

The round magazine 2 illustrated in section in Fig. 2 comprises six compartments I-VI containing a total of 54 rounds numbered in the sequence they are fed towards the gun. Rounds numbers 1 and 2 are missing from the number series in the figure, since these rounds are loaded direct in the gun feeding channel 4. The different compartments I-IV each have their discharge position which together form the transverse feeding channel 6 of the magazine. Rounds 3-8 are located in this transverse feeding channel. A transverse feeding device 7 of the stepwise advancement type runs along the bottom of the transverse feeding channel 6. This will not be discussed in detail in the body of this disclosure and on the Drawings, since it does not, in actual fact, form part of the present invention. Its construction may also be designed in a number of different ways. Its general function is based on the circumstance that, for each round discharged by the gun, it advances the rounds located in the feeding channel 6 one step nearer and into the feed channel 4 of the gun.

On loading of the gun 1, the lid 5 is opened at each respective magazine, whereafter each respective compartment is filled with at least one round so that all discharge positions along the transverse feeding channel 6 are filled. Each compartment, apart from compartment I, which is, thus, the compartment most distal from the gun counting in the direction of feed of the transverse feeding channel 6, is provided with a round hoist generally designated 8. When the compartments are filled, these round hoists 8 must be in the disengaged position, i.e. they must leave the compartments completely free so that these may be filled completely right down even to each respective discharge position. Each compartment is further provided with a vertical feeder which guarantees uninterrupted feeding of the rounds along each respective compartment irrespective of the elevation of the gun. These vertical feeders are not shown on the Drawings since they do not form part of the present invention and are, moreover, of conventional construction. The vertical feeders may, for example, consist of hydraulically or spring-loaded feeding arms which act upon the uppermost round in each compartment. When the compartments have been filled with the desired number of rounds, rounds numbers 1 and 2 are placed in the gun feeding channel 4, whereafter the vertical feeders are activated.

Thereafter, the lid 5 of the magazine is closed. The lid is either directly interconnected with a special operating function or this function is activated separately. When the operating function is activated, the round hoists 8 -which, when the compartments were filled were in the disengaged position -are moved to the position illustrated in Figs. 2 and 4 where they lift all rounds in each compartment, apart from the rounds located in the discharge positions, a height sufficient to form a free channel between the rounds located along the transverse feeding channel 6 and the remaining rounds in the compartments. As has been pointed out above, compartment I has no round hoist. Hence, the rounds in this compartment enjoy free access to the discharge position of the compartment.

When the gun opens fire, the rounds are, thus, fed by the transverse feeder 7 successively along the transverse feeding channel 6 in the direction of the arrow b at the same time as the transverse feeding channel is replenished with fresh rounds, starting with compartment I. All compartments apart from compartment VI are, furthermore, provided with sensors generally designated 9 (see Fig. 4 and Figs. 6a and 6b). When the compartment which is currently in the process of feeding the transverse feeding channel 6 with fresh rounds is emptied, the sensors for the emptied compartment trigger the round hoist in the subsequent compart-

ment, seen in the feeding direction, which, thus, assumes the role of supplying new rounds to the transverse feeding channel. The sensors 9 are placed in the bottom of the transverse feeding channel 6 where they are acted upon by the rounds advanced along this channel. The more detailed function of the sensors 9 will be discussed in depth below, together with other mechanical arrangements according to the present invention. However, the invention should not be considered as restricted to those arrangements and solutions illustrated on the Drawings. These are rather to be considered as exemplifying preferred embodiments. The function of the round hoists 8 and the sensors 9 will primarily be apparent from Figs. 4-6.

When the compartments I-VI have been filled, the above-mentioned operating function for activating the round hoists is triggered.

This operating function may, for example, consist of a number of linkage arms which are interconnected with one another and with the lid, for example as follows. When it is closed, the lid 5 shifts a first link 10 from the position 10a to 10b and the arm 11 is thereby depressed the same distance about its shaft 15. A lock 12 and a spring buffer 13 are disposed on the arm 11. When the arm 11 is shifted, the lock 12 entrains the arm 14. However, when the arm 11 reaches the bottom position 10b, a fixed arrest 16 triggers the spring buffer 13 which, in its turn, triggers the lock 12 which releases its grip in the arm 14 which thereupon returns to its initial position under the action of a return buffer 17 disposed further ahead in the coupling chain. However, a number of things have happened before this position is reached. The arm 14 has a rear overhang 18 at which a link 19 is fixedly anchored. The link 19 is shifted in the direction of the arrow and, in its turn, shifts the links 20-24 in the direction of the arrows. The links 20, 21 and 22 are fixedly mounted on the same shaft and pivot as a unit. In its turn, the link 24 is fixedly mounted on the same shaft as the link 25 in Figs. 5a and b. In its turn, the link 25 is interconnected with the links 26 and 27.

The round hoist disposed in each compartment apart from compartment I is constructed in exactly the same way, for which the reason the component parts therein have the same reference numerals.

When the linkage system 24-27 is activated in the direction of the arrows, the angled arm 28 is shifted at the same time and, in its turn, acts upon the link 29 which in turn acts on a cranked link 30 which is journalled about a shaft 31 and is pivotally connected with the link 29 at its one arm 32 and with a second cranked link 34 at its other arm 33. The second cranked link 34 is, in its turn, connected, at its other end, to the pivot arm 33 which is fixedly retained on the same shaft as the previously-mentioned round hoist 8. When the entire link arm system now moves in the direction of the arrows on activation of the currently contemplated operating function, the second arm 33 of the cranked link 30 and the second cranked link 34 proper will be moved over to their captive toggled position shown in Figs. 5b and 6a. At this point, the round hoist 8 assumes the position illustrated in Figs. 2, 4 and 6a where the remaining rounds are lifted so that the rounds located in the transverse feeding channel will be given free passage. It should be observed that the link 29 is connected to the angled arm 28 by the intermediary of a slotted groove 29a which permits the link system 24-26 to return to its initial position when the lock 12 is triggered. The slotted groove 29a also permits securement of the toggle mechanism 31-33-34 without influencing the link system 24-28.

The successive release of the round hoists 8 of the compartments according as the compartments are emptied will be apparent from Figs. 6a and 6b, from which certain other details have been omitted. As will be apparent from Fig. 6a, the rounds are biased towards the discharge position of each compartment (apart from in the last compartment) by the spring-loaded sensing arm 9 (the spring = 36).

When the sensing arm 9 is no longer loaded by a round, in other words when the compartment has been emptied, the sensing arm shifts the link 37 in the direction of the arrow. On this movement, a compartment release block 38 is shifted from the first position beyond the toggle mechanism 31-33-34 to a second position where the compartment release block 38 bridges the distance between the tripping point of the toggle mechanism, i.e. the point which trips the lock if it is actuated in the right direction, and a tripping abutment 39 (only included on Figs. 6a and 6b) which is interactive with the gun recoil and, for each discharge recoil, passes the above-mentioned point but itself does not reach the critical point on the toggle mechanism. The result will thus be that the round hoist 8 will be released on the first recoil once the compartment release block 38 has been shifted to its second position. In order further to speed up the compartment release function, the round hoist 8 may be provided with a release spring (35, not shown on the Drawings) which actuates the round hoist 8 in the release direction.

The round hoists in all compartments function in the above-described manner and the system thus guarantees a reliable feed function until all compartments have been emptied.

Claims

1. An extremely compact, preferably gun-mounted round magazine (2) for fully-automatic artillery pieces, primarily anti-aircraft guns, characterised in that it comprises a plurality of preferably vertical round compartments (I-VI) disposed in mutually parallel side-by-side relationship, and each accomodating a plurality of parallel superposed rounds which may successively be fed down towards a discharge position specific for each compartment, from which discharge position the rounds are fed further towards the ramming position of the gun by a separate transverse feeding system (7) which is common for all compartments, by the intermediary of a transverse feeding channel (6) which coincides with the parallel discharge positions disposed in side-by-side relationship for the different compartments, and all compartments apart from the most distal compartment (1), seen in the direction of feed of the transverse feeding system, being provided with round hoists (8) which, in the activated position, lift all rounds in each respective compartment apart from that round which lies in each respective discharge position, above the transverse feeding channel (6) so that the rounds disposed therein are disengaged and free from other rounds until the compartment immediately beyond the compartment in question has been emptied, when the round hoist (8) in this compartment is released, so that the rounds in the compartment enjoy free access to the transverse feeding channel (6).

2. The magazine as claimed in claim 1, characterised in that the round hoists (8) at each respective compartment are interconnected each with their sensing device (9) disposed on a level with the discharge position for that compartment which, in the direction of feed of the transverse feeding channel, lies immediately ahead of that compartment to which the round hoist (8) relates, and said sensing devices being actuated to a first position by possible rounds located in each respective discharge position in order, when said sensing devices are no longer loaded by any round, to be moved by means of integral spring force (36), to a second position where they, in their turn, activate the release of the round hoists interconnected therewith.

3. The magazine as claimed in claim 1, characterised in that each respective round hoist (8) is secured in the raised position by means of a toggle securement mechanism (31-33-34), while each respective sensing device (9), on being shifted to its second, unbiased position, displaces a compartment release block (38) from a first position beyond said toggle mechanism to a second position where the compartment release block (38) bridges the distance between a point on the toggle mechanism which, when it is moved in a certain direction, releases the toggle mechanism (31-33-34) and a trip abutment (39) movable in said direction and, on recoil of the gun, moves in said direction that itself does not reach the toggle mechanism.

4. The magazine as claimed in any one of claims 1-3, characterised in that the round hoists (8) in all compartments are interconnected with a lid (5) common to all compartments, in such a manner that the round hoist is moved to the secured raised position when the lid is closed.

5. The magazines (2, 3) as claimed in claim 1, characterised in that they are mounted pairwise on either side of the piece which displays its own vertical feeding channel (4) for the rounds which may receive rounds from either of the transverse feeding channels (6) of the magazines and which discharges in the ramming position of the piece.

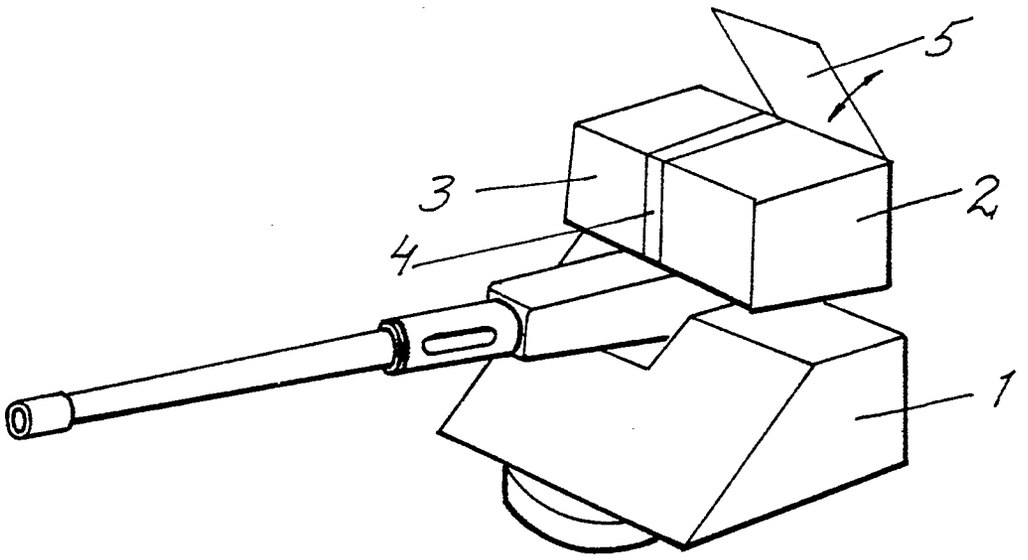

Fig.1

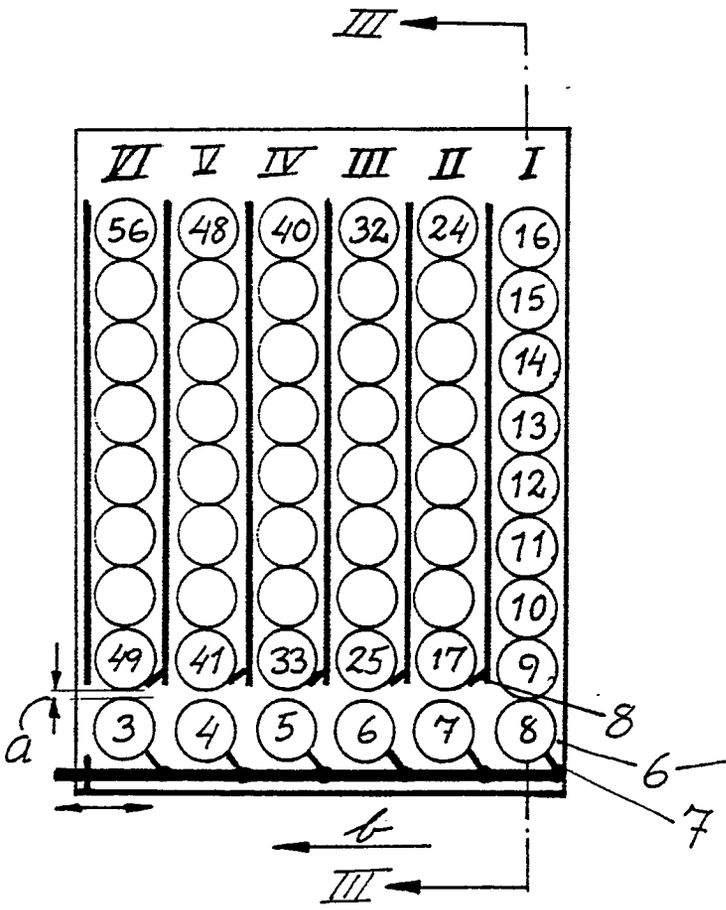

Fig.2

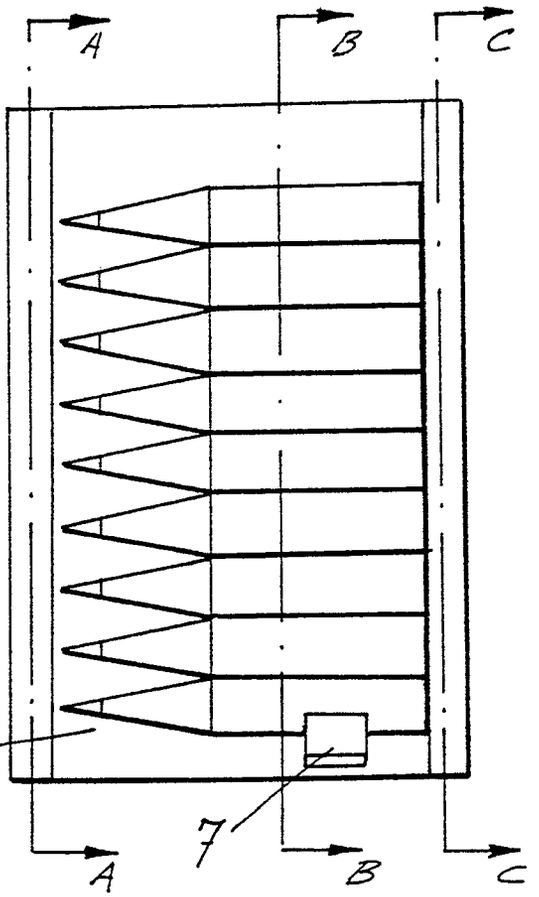

Fig.3

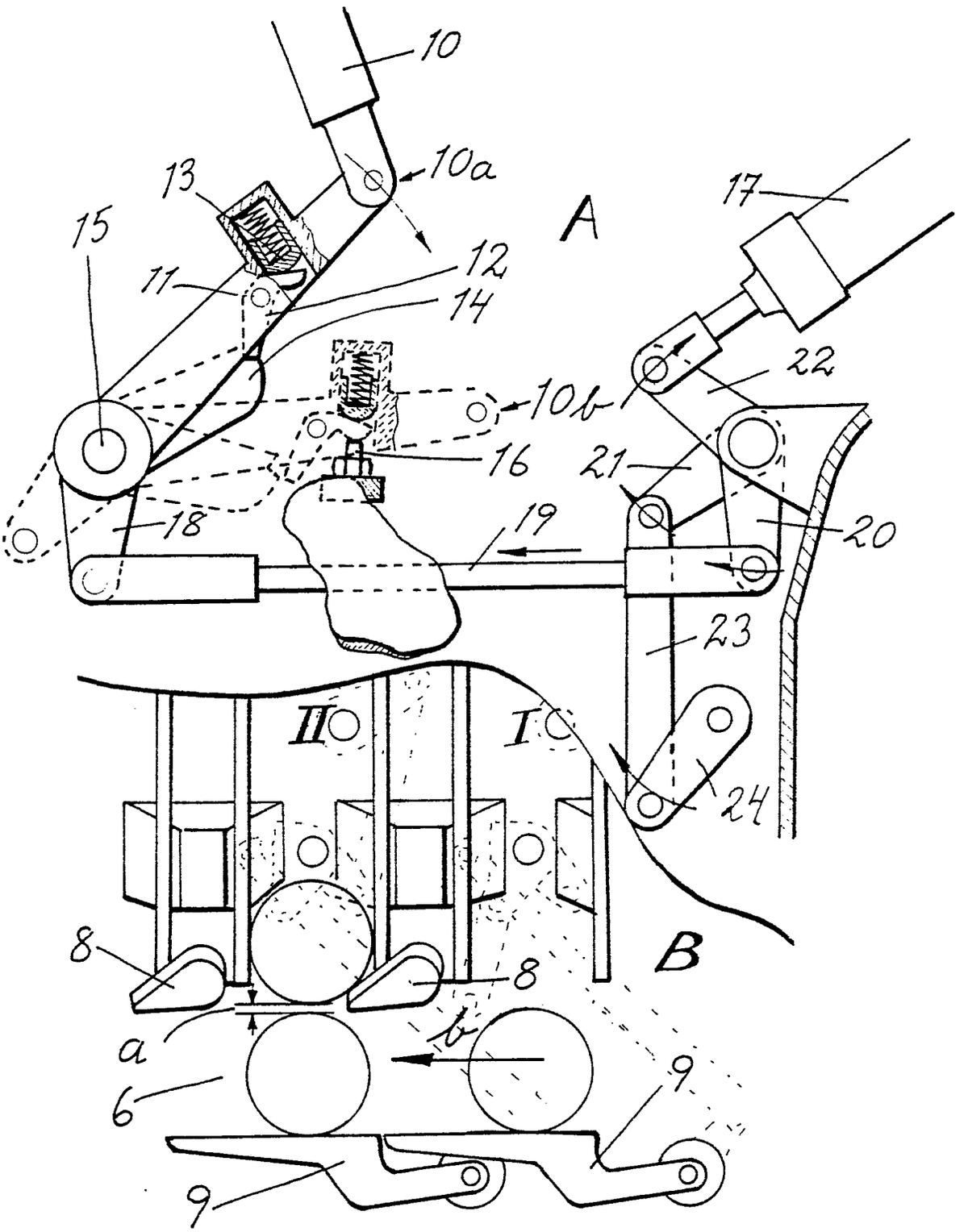

Fig.4

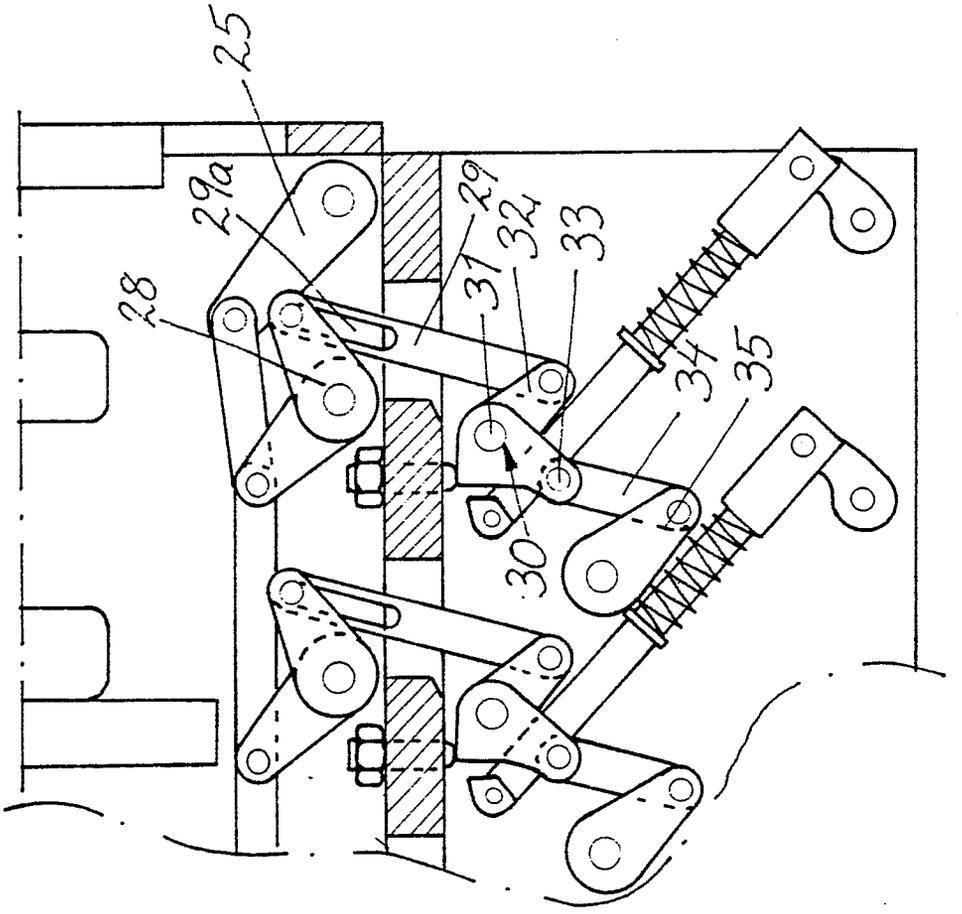

Fig. 5b

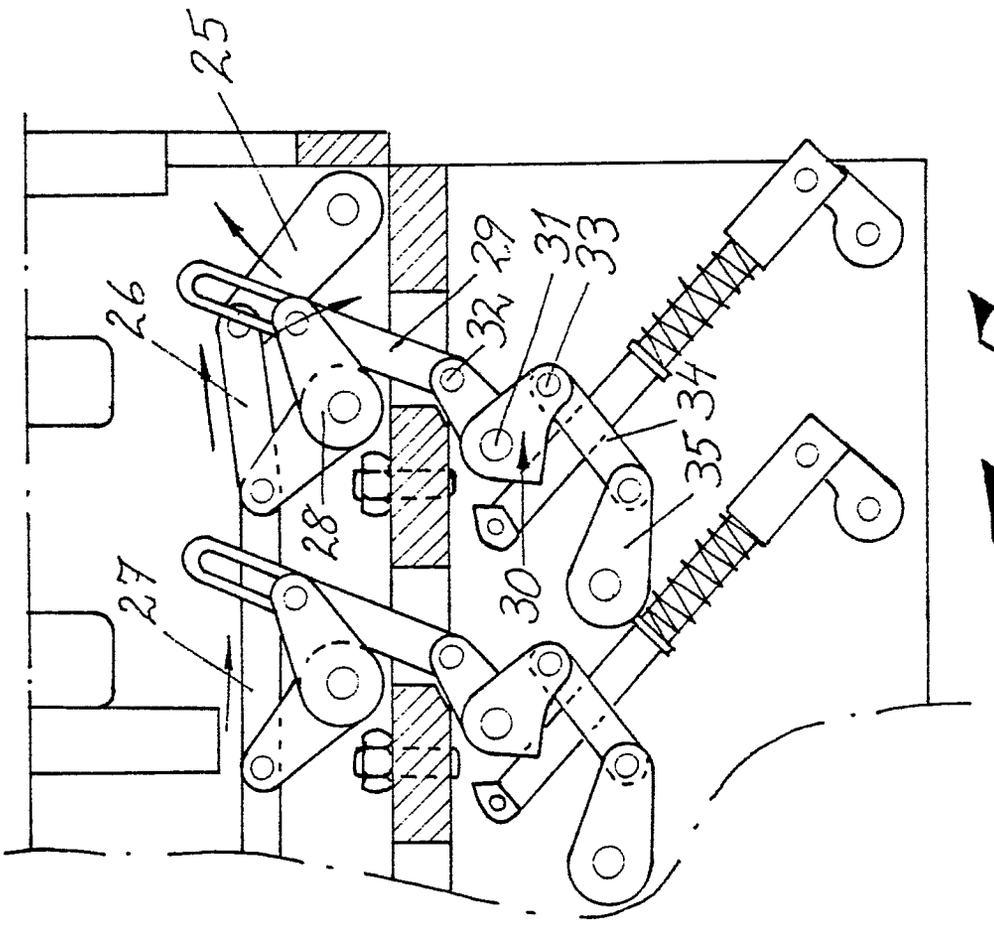

Fig. 5a

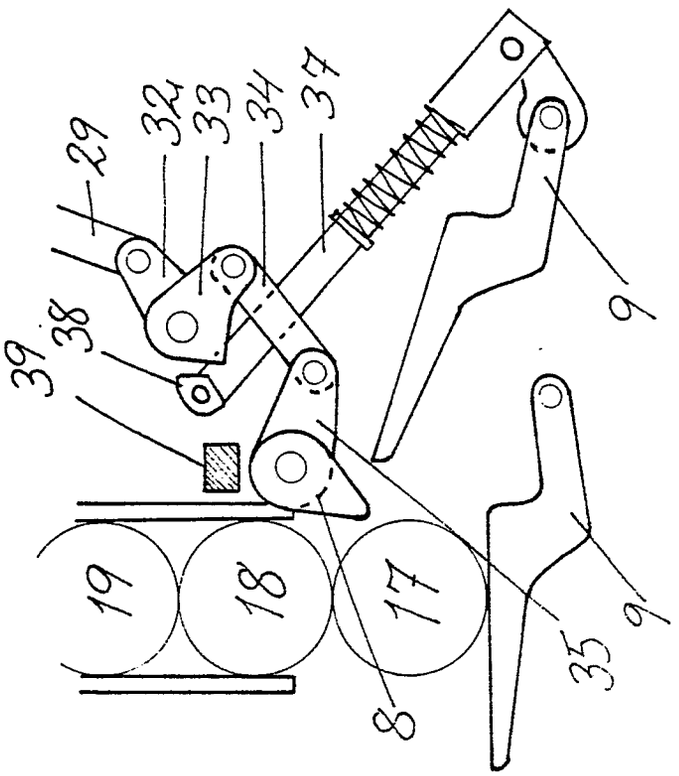

Fig. 6 b

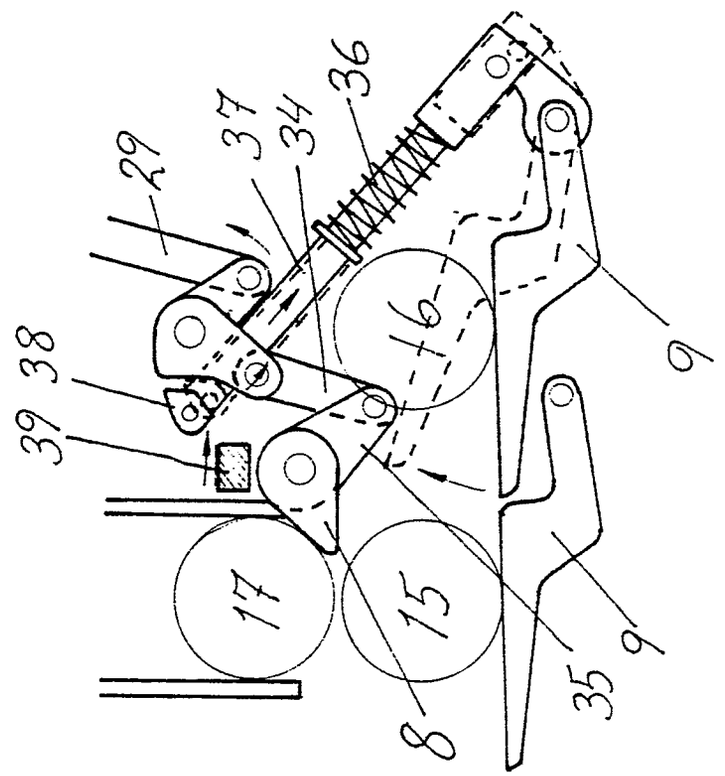

Fig. 6 a