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(54) **High-pressure trigger with force actuating mechanism using a double-elbow mechnism**

Hochdruckauslösehebel mit Kraftbetätigungsmechanismus mit doppeltem Übersetzungshebel

Gâchette haute pression munie d'un mécanisme de transmission de force à double rapport

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Description

Field of the Invention

[0001] The present invention generally relates to a trigger gun for a high-pressure washer, and in particular to the trigger mechanism of such a trigger gun. More specifically, the present invention relates to a trigger mechanism requiring only a small force from the grip of a users hand for opening the valve of a trigger gun.

Description of related art

[0002] A trigger gun for high-pressure washers generally comprises a handle, a trigger, and a valve. The flow of pressurized liquid is controlled by moving the trigger relative to the handle, which opens or closes the valve by way of a trigger mechanism. In the grip of a user's hand, the handle usually rests against the palm with the thumb oppositely placed from the rest of the fingers, of which some or all rest on the trigger. A certain minimum effort is required to operate the trigger gun. Firstly, the weight of the trigger gun and the components attached to the trigger gun has to be supported against the force of gravity. Secondly, the pushing force from the deployment of the pressurized liquid must be compensated for. Under certain circumstances the force of gravity can be counteracted by the pushing force, e.g. when pointing the trigger gun slightly downwards. Thirdly, a force of action is required for activating the trigger, which can be a tiring exercise when using a trigger gun over an extended period of time.

[0003] There are several techniques for lowering the required force of action on the trigger for opening the valve and maintaining an open valve. One example is a trigger that amplifies the force of action by way of a simple levering mechanism, where the trigger itself acts as the lever with the fulcrum or pivot point located close to the valve. Another example is disclosed in EP1389495, which involves a simple levering mechanism with a piston-like pulling mechanism driven by the pressurized liquid upstream from the closing element of the valve. The pulling mechanism provides a helping moment on the levering mechanism, making the trigger be easier and less tiresome to pull. However, the piston-like pulling mechanism requires a high-precision manufacturing and is vulnerable to impurities in the pressurized liquid. Another example of a technique for lowering the required force of action for controlling the valve is disclosed in DE19814663, which involves a mechanical linkage for obtaining a mechanical advantage at the actuation of the valve. However, the mechanical linkage only involves three effective links, which requires two of the effective links to have a variable length. This is achieved by having one of the joints following a sliding motion relative to the other two joints when pressing the trigger, which requires a high-precision manufacturing of the components involved. The high precision required in both of the refer-

enced techniques is a disadvantage as it increases the production cost and the vulnerability of the trigger gun.

[0004] Document US 2 107 686 discloses a trigger gun suitable for a high pressure washer according to the preamble of claim 1 and comprising a primary elbow link being part of a primary mechanical linkage.

[0005] Document US 5 284 301 discloses a trigger gun comprising two alternate pivot points, the first pivot point being used while the trigger moves the valve from the closed state to a first open state and the second pivot point being used while the trigger moves the valve from the first open state to a second open state.

Object of the Invention

[0006] An object according to the present Invention is to provide trigger gun for a high-pressure washer, where the trigger gun has a robust trigger mechanism that requires only a small force on the trigger to operate its valve. A particular feature of the present invention is that it provides a stronger amplification of the force applied to the trigger when opening a closed valve, than when opening an open valve even further. Another feature of the present invention is that the trigger mechanism may amplify the force in the grip formed between the thumb and the index, or the thumb and the long finger, the most, which allows a more balanced and ergonomic handling of the trigger gun. The force required of a users grip for activating the trigger gun, as well as the force required for continuously operating the trigger gun, may be reduced. Clearly, an advantage with the present invention is that the operating of the trigger requires a smaller effort.

Summary/Disclosure of Invention

[0007] In addition to the above object, the above advantage and the above feature. numerous other objects, advantages and features will be evident from the detailed descriptions given below of preferred embodiments according to the present invention. The objects, advantages and features are according to the present invention obtained by the trigger gun for a high-pressure washer of claim 1.

[0008] An advantage according to the first aspect of the present invention is that the five links of the trigger mechanism, i.e. the handle, trigger, primary elbow link, secondary elbow link, and rocker arm, do not require high-precision machining. A mechanical link of this kind can be made robust, without the use of high strength materials. This allows for the use of cheaper to manufacture and lighter trigger mechanisms. Further, the large number of possible geometric and spatial configurations of four-link mechanical linkages allows for an ergonomically optimized trigger gun, being both light weight and comfortable to handle.

[0009] The primary trigger mechanism may convert a force of action applied at the first area or point of contact to an amplified primary force of reaction at the second

area or point of contact acting on the actuation element. Alternatively or in addition, the secondary trigger mechanism may convert a force of action applied at the first area or point of contact to an amplified secondary force of reaction at the second area or point of contact acting on the actuation element. Clearly, this is an advantage as it makes the required effort of pulling the trigger and maintaining a fully pulled trigger smaller when operating the trigger gun.

[0010] Trigger guns for high-pressure washers commonly have valves with a valve seat between an upstream valve passage and a downstream valve passage. A valve body located in the downstream valve passage seat against the valve seat. When the valve is closed, the liquid under pressure only reaches the downstream valve passage, where the pressure generates a pressure force on the valve body. To open the valve the valve body has to be lifted against this pressure force. When the valve is open the pressurized liquid also defines the pressure in the downstream valve passage, which will counteract the earlier pressure force. Hence, a greater force is required to open this kind of valve from a closed state, than to from an already open state. Thus, it may be an advantage to have a trigger mechanism such that that, for the same force of action, the amplified primary force of reaction is greater than the amplified secondary force of reaction.

[0011] The handle may be connected to the trigger by a first joint or pivot, the trigger to the primary elbow link by a primary second joint or pivot, the trigger to the secondary elbow link by a secondary second joint or pivot, the primary elbow link to the rocker arm by a primary third joint or pivot, the secondary elbow link to the rocker arm by a secondary third joint or pivot, the rocker arm to the handle by a fourth joint or pivot. The second area or point of contact may then be located closer to the fourth joint or pivot than to any of the first, primary second, secondary second, primary third, and secondary third joints or pivots. This will allow the mechanical linkage to provide a high ratio of the force of reaction over the force of action, as this ratio increases with a decreased distance to the fourth joint or pivot. However, the distance over which the force of reaction can act decreases with a decreased distance to the fourth joint or pivot. Hence, a certain distance between the second area or point of contact and the fourth joint or pivot is required for the trigger mechanism to work.

[0012] The primary mechanical linkage may further constitute a first slot or guideway located on the trigger or the primary elbow link. This first slot or guideway disengage and guide the primary second joint or pivot when employing the trigger mechanism for changing the valve from its first open state to its second open state. Alternatively or additionally, the secondary mechanical linkage may further constitute a second slot or guideway located on the trigger or the secondary elbow link. This second slot or guideway disengage and guide the secondary second joint or pivot when employing the trigger

mechanism for changing the valve from its closed state to its first open state. Alternatively or additionally, the primary mechanical linkage may further constitute a third slot or guideway located on the primary elbow link or the rocker arm. This third slot or guideway disengage and guide the primary third joint or pivot when employing the trigger mechanism for changing the valve from its first open state to its second open state. Alternatively or additionally, the secondary mechanical linkage may further constitute a fourth slot or guideway located on the secondary elbow link or the rocker arm. This fourth slot or guideway disengage and guide the secondary third joint or pivot when employing the trigger mechanism for changing the valve from its closed state to its first open state.

[0013] The slots or guideways described here enable a robust trigger mechanism with a single trigger being a link in two different mechanical linkages operating in sequence after one another when the trigger is pulled. It may be an advantage to have the slots or guideways in connection with the primary and secondary second joints or pivots only, as it allows for a more compact construction of the trigger gun, since when disconnected the elbow links then may slide inside the trigger or the handle.

[0014] It is understood that the trigger mechanism may comprise more than two elbow links, where each elbow link is coupled to the trigger and/or the rocker arm by one or more slots or guideways accordingly. Thus, the trigger mechanism may enable more than two different amplification levels of the force of action. As an example of a particular trigger mechanism having three elbow links, when pulling the trigger to open the valve, the primary mechanical linkage gives a stronger amplification than the subsequent secondary mechanical linkage, which in turn gives a smaller amplification than the subsequent tertiary mechanical linkage. An advantage of having an additional tertiary mechanical linkage of this kind is that, when operating the trigger gun with the trigger fully pressed, less effort is required due to stronger amplification. As there is an inverse relationship between the size of the amplified force and the length over which it can be employed, the smaller amplification of the secondary mechanical linkage may be needed for opening the valve a certain length, allowing larger flows of the pressurized.

[0015] A line between the fourth joint or pivot and the first joint or pivot define an effective handle link, a line between the first joint or pivot and the primary second joint or pivot define a primary effective trigger link, a line between the primary second joint or pivot and the primary third joint or pivot define a primary effective elbow link, a line between the primary third joint or pivot and the fourth joint or pivot define a primary effective rocker link. Similarly, a line between the first joint or pivot and the secondary second joint or pivot define a secondary effective trigger link, a line between the secondary second joint or pivot and the secondary third joint or pivot define a secondary effective elbow link, a line between the secondary third joint or pivot and the fourth joint or pivot define a

secondary effective rocker link. The primary effective elbow link and/or the secondary effective elbow link may be shorter than any of the effective handle link, primary effective trigger link, primary effective rocker link, secondary effective trigger link, and secondary effective rocker link.

[0016] The distance the trigger needs to be pulled increases with the length of the primary and secondary effective elbow link. Hence, with the effective trigger link inside the grip of the user's hand, this particular feature allows for a more compact construction and a slimmer handle of the trigger gun. Further, it should be noted that it is not necessary for the second area or point of contact to be located on the effective rocker link; it only has to move in a pivotal motion defined by the rocker arm and the effective rocker link. Further, the primary effective elbow link may be longer than the secondary effective rocker link. This may be an advantage, as it also allows for a compact construction and a larger amplification of the primary force of reaction.

[0017] The primary effective trigger link and the primary effective elbow link jointly define a primary effective trigger angle; the secondary effective trigger link and the secondary effective elbow link jointly define a secondary effective trigger angle. The primary and secondary effective trigger angles may be obtuse and increase when pulling the trigger for opening the valve. With a trigger constructed for being pulled towards the palm of a user's hand, these constraints on the angles may give a ratio of the primary force of reaction over the force of action and a ratio of the secondary force of reaction over the force of action that increase with the pulling of the trigger, which in itself may be an advantage. Further, the obtuse and increasing primary and secondary effective trigger angles, combined with acute and increasing primary and secondary effective elbow angles, may be favourable where the valve is located in front of the gripping hand, as it allows for a compact design by bringing the primary and secondary effective trigger links closer to the effective handle link.

[0018] It is also contemplated that the primary and/or secondary effective trigger angles may be acute. Alternatively or additionally, the primary and/or secondary effective elbow angles may be obtuse. Thus, the joints of each of the primary and secondary mechanical linkages may define a complex, convex, or concave quadrilateral.

[0019] The handle may be constructed for being received in the palm of a user's hand so that the primary second joint or pivot and/or the secondary second joint or pivot are located closer to the index finger than the little finger of the user's hand. In a normal grip, where the thumb is opposed the other fingers, this relative positioning of the index finger and the third joint or pivot means that the index and long fingers performs the longest pulling motion when activating the trigger, as the effective trigger link performs a pivotal motion around the first joint or pivot. This is an advantage, since the index and long fingers are longer and contributes more to the strength

of a grip than the index and little finger.

[0020] The handle may be constructed for being received in the palm of a user's hand so that the trigger moves relative to the users palm when employing the trigger for opening the valve. Further, the handle may be constructed for being received in the palm of a user's hand so that a finger of the users hand is inside the closed loops of the primary and secondary mechanical linkages. Clearly, this will allow a more compact and less cumbersome construction of the trigger gun.

Brief description of the drawings

[0021] Additional objects and features according to the present invention will be more readily apparent from the following detailed description and appended claims, where the former is presented in conjunction with the drawings:

Fig. 1a illustrates a presently preferred embodiment of a trigger gun for a high-pressure washer with the valve of the trigger gun in its closed state,

Fig. 1b illustrates the trigger gun in Fig. 1a, but with the valve of the trigger gun in its first open state,

Fig. 1c illustrates the trigger gun in Fig. 1a, but with the valve of the trigger gun in its second open state.

Fig. 2a outlines the effective mechanical linkages of the trigger gun illustrated in Fig. 1a with the valve in its closed position.

Fig. 2b outlines the effective mechanical linkages of the trigger gun illustrated in Fig. 1b with the valve in its first open position.

Fig. 2c outlines the effective mechanical linkages of the trigger gun illustrated in Fig. 1c with the valve in its second open position.

Detailed description of the invention

[0022] A cross-sectional view of a presently preferred embodiment of trigger gun 1 for a high-pressure washer is shown in Fig. 1a. The handle 2 of the trigger gun 1 rigidly supports a valve 3 for controlling and limiting the flow of pressurized liquid from a high-pressure washer. When using the trigger gun together with a high-pressure washer, the pressurized liquid, usually having a pressure in the range 100-8000 bar, is led from the high-pressure washer to the trigger gun 1 by a hose, which is connected to the trigger gun 1 at the inlet connection 26. During operation the liquid flows from the inlet connection 26 through the valve 3 to the outlet connection 27, to which a hollow lance, wand or a similar tubular device can be coupled for employing the pressurized liquid at a distance from the trigger gun 1.

[0023] The valve 3 has an actuation element 6 extending outside the valve house for controlling the valve 3. The valve 3 is opened by pressing the actuation element 6 towards the valve body. Here, the valve 3 has the property that the actuation element 6 presents a greater resistance when opening the valve 3 from a closed state than from an already open state. This means that the needed force of reaction applied to the actuation element 6 is smaller for maintaining an open valve 3, or for opening the valve 3 further when already being open, than for opening the valve 3 when it is closed.

[0024] The trigger gun comprises a trigger mechanism having a primary mechanical linkage constituted by a handle 2, a trigger 4, a primary elbow link 37 and a rocker arm 8, which are connected in a closed loop, and a secondary mechanical linkage constituted by the same handle 2, trigger 4, and rocker arm 8, but with a different secondary elbow link 38 in another closed loop. Each of the mechanical linkages is connected by four joints, of which two, 10 and 13, are employed in both of the mechanical linkages, while two primary joints 11-12 complete the primary mechanical linkage, and the two secondary joints 39-40 complete the secondary mechanical linkage. The trigger 4 has a first area or point of contact 5, e.g. corresponding to the location at which the long finger of a user is placed when operating the trigger gun. The rocker arm has a second area or point of contact 9 for cooperating with the actuation element 6 by conveying a force component being parallel to the direction of movement of the actuation element 6. Thereby, the mechanical linkage can convert a force of action applied to the first area or point of contact 5 to a force of reaction at the second area or point of contact 9. As the valve 3 is rigidly supported by the handle 2, the movement of the trigger 4 relative to the handle 2 causes the actuation element 6 to be shifted relative to the valve house 36, thereby allowing the valve 3 to be manually opened by the trigger 4.

[0025] In an alternative embodiment, one or more of the joints 10-13 and 39-40 may be a pivot or a contraption with a similar function, where the joints pivotally connecting the links also may move relative to one another.

[0026] In Fig. 1 a the trigger 4 is not pulled, i.e. the trigger mechanism is not engaged and the valve 3 is in its closed state. When the trigger 4 is pulled, a second slot 47 allows the secondary second joint 39 to move relative to the trigger 4, which means that the secondary mechanical linkage is unengaged, and that the primary force of reaction applied to the actuation element 6 is defined by the primary mechanical linkage. The same presently preferred embodiment of a trigger gun 1 as in Fig. 1a is illustrated in Fig. 1b, but with trigger pulled so that the secondary second joint 39 has reached the end of the second slot 47, thereby engaging the secondary mechanical linkage. Simultaneously the first mechanical linkage is disengaged by letting the primary second joint slide in the first slot 46. At this point the valve has reached its first open position and the secondary force

of reaction applied to the actuation element 6 is now defined by the secondary mechanical linkage. The same presently preferred embodiment of a trigger gun 1 as in Fig. 1a and Fig. 1b is illustrated in Fig. 1c, but with trigger fully pulled. At this point the valve has reached its second open position and the primary second joint 11 has reached the end of the first slot 46, which hinders the functional movement of the secondary mechanical linkage.

[0027] Figs. 2a-c depict the effective links of the mechanical linkages in Figs. 1a-c, respectively, with solid lines corresponding to engaged mechanical linkages and dashed lines corresponding to unengaged mechanical linkages.

[0028] The location of the first 10, primary second 11, primary third 12, and fourth 13 joints define the primary effective mechanical linkage constituted by the effective handle link 14, primary effective trigger link 15, primary effective elbow link 16, and primary effective rocker link 17 connecting the joints 10-13 in a closed loop. The primary effective trigger link 15 and the primary effective elbow link 18 jointly define a primary effective trigger angle 29, while the primary effective elbow link 18 and the primary effective rocker link 17 jointly define a primary effective elbow angle 18. Similarly, the location of the first 10, secondary second 39, secondary third 40, and fourth 13 joints define the secondary effective mechanical linkage constituted by the effective handle link 14, secondary effective trigger link 41, secondary effective elbow link 42, and secondary effective rocker link 43 connecting the joints 10, 13 and 39-40 in a closed loop. The secondary effective trigger link 41 and the secondary effective elbow link 42 jointly define a secondary effective trigger angle 44, while the secondary effective elbow link 42 and the secondary effective rocker link 43 jointly define a secondary effective elbow angle 45.

[0029] The length of the primary effective elbow link 16 is longer than its secondary counterpart 42, while the primary effective trigger link 15 is shorter than its secondary counterpart 41. The primary 29 and secondary 44 effective trigger angles are obtuse, while both of the primary 18 and secondary 45 effective elbow angles are acute. These four angles all increase when pulling the trigger, i.e. when the primary 15 and secondary 41 effective trigger links perform a pivotal motion indicated by the first arrow 30.

[0030] Fig. 2a corresponds to an engaged primary mechanical linkage at the start of the pulling of the trigger with an unengaged secondary mechanical linkage. A force of action applied to the trigger is represented by the first arrow 30 being perpendicular to the primary effective trigger link 15. The primary mechanical linkage converts the force of action to a primary force of reaction, which is represented by the second arrow 31 being perpendicular to the primary effective rocker link 17. The mechanical advantage obtained, i.e. the ratio of the absolute primary force of reaction over the absolute force of action, or the length of the second arrow 31 over the

length of the first arrow 30, is greater than one, corresponding to an amplification of the applied force.

[0031] Fig. 2b corresponds to the situation where the primary mechanical linkage is disengaged, while the secondary mechanical linkage is simultaneously engaged. The force of action, having the an unchanged magnitude, is represented by the first arrow 30 having, which has the same length and acting at the same distance from the first joint 10 as previously, but from direction being perpendicular to the secondary effective trigger link 41 instead. Due to the length of and the angles between the secondary effective links 41-43, the mechanical advantage is now smaller than for the primary mechanical linkage, resulting in a smaller secondary force of reaction. This is represented by a shorter second arrow 31, which is now perpendicular to the secondary effective rocker link 43, but connecting at the same distance from the fourth link 13 as in the earlier situation.

[0032] Fig. 2c corresponds to the situation where the trigger is fully pulled, i.e. the primary mechanical linkage is still disengaged while the secondary effective angles 44-45 have increased to their maximum broadness. At this point the mechanical advantage of the secondary mechanical linkage has reached its maximum, which is represented by a longer second arrow 31 than in Fig. 2b.

[0033] The lengths of the arrows in Figs. 2a-c are only to show the qualitative, and not the actual quantitative, relationship between the force of action and the primary and secondary force of reaction. The first arrow 30 acts from a direction such that the mechanical advantage will increase when the primary 15 and secondary 41 effective trigger links 15 move in the direction indicated by the first arrow 30. If the direction of the first arrow 30 were to be reversed, the direction of the second arrow 31 would be the opposite and the mechanical advantage would decrease when the trigger link 15 moves in the reverse direction. Instead of defining the mechanical advantage as the ratio of the length of the second arrow 31 over the length of the first arrow 30, or the absolute value of the force of reaction over the absolute value of the force of action, it can be defined as the ratio of the distances travelled by the point of contact of the first arrow 30 over the distance simultaneously travelled by point of contact of the second arrow 31 when the trigger is pulled. Naturally, if the mechanical advantage changes, this definition is only relevant for small pulling motions.

[0034] The use of 'primary', 'secondary', 'tertiary', etc. is not to reflect any direct rank or order, but primarily to distinguish between elements and components having similar form or function. However, an effort has been made to make 'primary' reflecting components or functions primarily employed at the beginning of the pulling the trigger, and 'secondary' reflecting components or functions primarily employed at the end of the pulling of the trigger.

Item list

[0035]

- | | | |
|----|----|-----------------------------------|
| 5 | 1 | trigger gun |
| | 2 | handle |
| | 3 | valve |
| | 4 | trigger |
| | 5 | first area or point of contact |
| 10 | 6 | actuation element |
| | 8 | rocker arm |
| | 9 | second area or point of contact |
| | 10 | first joint or pivot |
| | 11 | primary second joint or pivot |
| 15 | 12 | primary third joint or pivot |
| | 13 | fourth joint or pivot |
| | 14 | effective handle link |
| | 15 | primary effective trigger link |
| | 18 | primary effective elbow link |
| 20 | 17 | primary effective rocker link |
| | 18 | primary effective elbow angle |
| | 26 | inlet connection |
| | 27 | outlet connection |
| | 29 | primary effective trigger angle |
| 25 | 30 | force of action |
| | 31 | force of reaction |
| | 37 | primary elbow link |
| | 38 | secondary elbow link |
| | 39 | secondary second joint or pivot |
| 30 | 40 | secondary third joint or pivot |
| | 41 | secondary effective trigger link |
| | 42 | secondary effective elbow link |
| | 43 | secondary effective rocker link |
| | 44 | secondary effective trigger angle |
| 35 | 45 | secondary effective elbow angle |
| | 46 | first slot or guideway |
| | 47 | second slot or guideway |

Claims

1. A trigger gun (1) for a high-pressure washer, said trigger gun (1) comprising a handle (2), a valve (3) rigidly supported by said handle (2), a trigger (4) having a first area or point of contact (5) for manually applying a force, and a trigger mechanism, wherein said valve (3) further comprises an actuation element (6) for the opening and closing said valve (3), and said trigger mechanism providing a cooperation between said trigger (4) and said actuation element (6) for enabling a manual control of said opening and closing of said valve (3), **characterized in that** said trigger gun (1) further comprises a rocker arm (8) having a second area or point of contact (9) for cooperation with said actuation element (6), a primary elbow link (37), and a secondary elbow link (38), wherein said trigger mechanism further comprises a primary mechanical linkage constituted by said han-

- dle (2), trigger (4), primary elbow link (37), and rocker arm (8) being pivotally connected in a closed loop, and a secondary mechanical linkage constituted by said handle (2), trigger (4), secondary elbow link (38), and rocker arm (8) being pivotally connected in a closed loop, said valve (3) further having a closed state, a first open state and a second open state, whereby said primary mechanical linkage is employed when changing said valve (3) from its closed state to its first open state, and said secondary mechanical linkage is employed when changing said valve from its first open state to its second open state.
2. A trigger gun (1) according to claim 1, wherein said primary mechanical linkage converts a force of action applied at said first area or point of contact (5) to an amplified primary force of reaction at said second area or point of contact (9) acting on said actuation element (6), and said secondary mechanical linkage converts a force of action applied at said first area or point of contact (5) to an amplified secondary force of reaction at said second area or point of contact (9) acting on said actuation element (6).
 3. A trigger gun according to claim 2 wherein, for the same force of action, said amplified primary force of reaction is greater than said amplified secondary force of reaction.
 4. A trigger gun (1) according to any of the claim 1 to 3, wherein said handle (2) is connected to said trigger (4) by a first joint or pivot (10), said trigger (4) is connected to said primary elbow link (37) by a primary second joint or pivot (11), said trigger (4) is connected to said secondary elbow link (38) by a secondary second joint or pivot (39), said primary elbow link (37) is connected to said rocker arm (8) by a primary third joint or pivot (12), said secondary elbow link (38) is connected to said rocker arm (8) by a secondary third joint or pivot (40), said rocker arm (8) is connected to said handle (2) by a fourth joint or pivot (13), and said second area or point of contact (9) is located closer to said fourth joint or pivot (13) than to any of said first (10), primary second (11), secondary second (39), primary third (12), and secondary third (40) joints or pivots.
 5. A trigger gun (1) according to claim 4, wherein said primary mechanical linkage further constitutes a first slot or guideway (46) located on said trigger (4) or said primary elbow link (37), said first slot or guideway (46) disengaging and guiding said primary second joint or pivot (11) when employing said trigger mechanism for changing said valve (3) from its first open state to its second open state.
 6. A trigger gun (1) according to any of the claims 4 to 5, wherein said secondary mechanical linkage further constitutes a second slot or guideway (47) located on said trigger (4) or said secondary elbow link (38), said second slot or guideway (47) disengaging and guiding said secondary second joint or pivot (39) when employing said trigger mechanism for changing said valve (3) from its closed state to its first open state.
 7. A trigger gun (1) according any of the claims 4 to 6, wherein said primary mechanical linkage further constitutes a third slot or guideway located on said primary elbow link (37) or said rocker arm (8), said third slot or guideway disengaging and guiding said primary third joint or pivot (12) when employing said trigger mechanism for changing said valve (3) from its first open state to its second open state.
 8. A trigger gun (1) according to any of the claims 4 to 7, wherein said secondary mechanical linkage further constitutes a fourth slot or guideway located on said secondary elbow link (38) or said rocker arm, said fourth slot or guideway disengaging and guiding said secondary third joint or pivot (40) when employing said trigger mechanism for changing said valve from its closed state to its first open state.
 9. A trigger gun (1) according to any of the claims 4 to 8, wherein a line between said fourth joint or pivot (13) and said first joint or pivot (10) defining an effective handle link (14), a line between said first joint or pivot (10) and said primary second joint or pivot (11) defining a primary effective trigger link (15), a line between said primary second joint or pivot (11) and said primary third joint or pivot (12) defining a primary effective elbow link (16), a line between said primary third joint or pivot (12) and said fourth joint or pivot (13) defining a primary effective rocker link (17), a line between said first joint or pivot (10) and said secondary second joint or pivot (39) defining a secondary effective trigger link (41), a line between said secondary second joint or pivot (39) and said secondary third joint or pivot (40), defining a secondary effective elbow link (42), a line between said secondary third joint or pivot (40) and said fourth joint or pivot (13) defining a secondary effective rocker link (43), said primary effective elbow link (16) and/or said secondary effective elbow (42) link being shorter than any of said effective handle link (14), primary effective trigger link (15), primary effective rocker link (17), secondary effective trigger link (41), and secondary effective rocker link (43).
 10. A trigger gun (1) according to claim 9, wherein said primary effective elbow link (16) is longer than said secondary effective rocker link (42).
 11. A trigger gun (1) according to any of the claims 9 to 10, wherein said primary effective trigger link (15)

and said primary effective elbow link (18) jointly define a primary effective trigger angle (29), said secondary effective trigger link (41) and said secondary effective elbow link (42) jointly defining a secondary effective trigger angle (44), said primary (29) and secondary (44) effective trigger angles being obtuse and increasing when pulling said trigger (4) for opening said valve (3).

12. A trigger gun (1) according to any of the claims 9 to 11, wherein said primary effective elbow link (16) and said primary effective rocker link (17) jointly define a primary effective elbow angle (18), said secondary effective elbow link (42) and said secondary effective rocker link (43) jointly defining a secondary effective elbow angle (45), said primary (18) and secondary (45) effective elbow angles being acute and increasing when pulling said trigger for opening said valve.
13. A trigger gun (1) according to any of the claims 4 to 12, wherein said handle (2) is constructed for being received in the palm of a user's hand so that said primary second joint or pivot (11) and/or said secondary second joint or pivot (39) are located closer to the index finger than the little finger of the user's hand.
14. A trigger gun (1) according to any of the claims 1 to 13, wherein said handle (2) is constructed for being received in the palm of a user's hand so that said trigger (4) moves relative to the user's palm when employing said trigger (4) for opening said valve (3).
15. A trigger gun (1) according to any of the claims 1 to 14, wherein said handle (2) is constructed for being received in the palm of a user's hand so that a finger of the user's hand is inside said closed loops of said primary and secondary mechanical linkages.

Patentansprüche

1. Triggerpistole (1) für einen Hockdruckreiniger, welche Triggerpistole (1) einen Griff (2), ein mit dem besagten Griff steif verbundenes Ventil (3), einen Auslöser (4) mit einem ersten Kontaktbereich oder Kontaktpunkt (5) zum manuellen Anlegen einer Kraft sowie einen Auslösemechanismus umfasst, worin das besagte Ventil (3) ferner ein Betätigungselement (6) zum Öffnen und Schliessen des besagten Ventils (3) umfasst und der besagte Auslösemechanismus ein Zusammenwirken zwischen dem besagten Auslöser (4) und dem besagten Betätigungselement (6) verursacht, um eine manuelle Kontrolle des besagten Öffnens und Schliessens des besagten Ventils (3) zu ermöglichen, **dadurch gekennzeichnet, dass** die besagte Triggerpistole (1) ferner einen

Kipphebel (8) umfasst mit einem zweiten Kontaktbereich oder Kontaktpunkt (9) zum Zusammenwirken mit dem besagten Betätigungselement (6), eine primäre Knieverbindung (37) und eine sekundäre Knieverbindung (38), worin der besagte Auslösemechanismus ferner eine primäre mechanische Verlinkung umfasst, welche aus der drehbaren Verbindung des besagten Griffs (2), des Auslösers (4), der primären Knieverbindung (37) und des Kipphebels (8) in einer geschlossenen Schleife besteht, und eine sekundäre mechanische Verlinkung, welche aus der drehbaren Verbindung des besagten Griffs (2), des Auslösers (4), der sekundären Knieverbindung (38) und des Kipphebels (8) in einer geschlossenen Schleife besteht, und das besagte Ventil (3) ferner einen geschlossenen Zustand, einen ersten offenen Zustand und einen zweiten offenen Zustand aufweist, wobei die besagte primäre mechanische Verlinkung bei der Umstellung des besagten Ventils (3) aus dem geschlossenen Zustand in den ersten offenen Zustand benutzt wird und die besagte sekundäre mechanische Verlinkung bei der Umstellung des besagten Ventils aus dem ersten offenen Zustand in den zweiten offenen Zustand benutzt wird.

2. Triggerpistole (1) gemäss Anspruch 1, worin die besagte primäre mechanische Verlinkung eine Aktionskraft, die an dem besagten ersten Kontaktbereich oder Kontaktpunkt (5) angelegt wird, an dem besagten zweiten Kontaktbereich oder Kontaktpunkt (9) in eine verstärkte primäre Reaktionskraft umwandelt, die auf das besagte Betätigungselement einwirkt, und die besagte sekundäre mechanische Verlinkung eine Aktionskraft, die an dem besagten ersten Kontaktbereich oder Kontaktpunkt (5) angelegt wird, an dem besagten zweiten Kontaktbereich oder Kontaktpunkt (9) in eine verstärkte sekundäre Reaktionskraft umwandelt, die auf das besagte Betätigungselement (6) einwirkt
3. Triggerpistole gemäss Anspruch 2, worin die besagte verstärkte primäre Reaktionskraft bei gleicher Aktionskraft grösser als die besagte verstärkte sekundäre Reaktionskraft ist.
4. Triggerpistole (1) gemäss einem jeglichen der Ansprüche 1 bis 3, worin der besagte Griff (2) durch ein erstes Gelenkstück oder Drehgelenk (10) mit dem besagten Auslöser (4) verbunden ist, wo der besagte Auslöser (4) durch ein primäres zweites Gelenkstück oder Drehgelenk (11) mit der besagten primären Knieverbindung (37) verbunden ist, wo der besagte Auslöser (4) durch ein sekundäres zweites Gelenkstück oder Drehgelenk (39) mit der besagten sekundären Knieverbindung (38) verbunden ist, wo die besagte primäre Knieverbindung (37) durch ein primäres drittes Gelenkstück oder Drehgelenk (12) mit dem besagten Kipphebel (8) verbunden ist, wo die

besagte sekundäre Knieverbindung (38) durch ein sekundäres drittes Gelenkstück oder Drehgelenk (40) mit dem besagten Kipphebel (8) verbunden ist, wo der besagte Kipphebel (8) durch ein viertes Gelenkstück oder Drehgelenk (13) mit dem besagten Griff (2) verbunden ist, und der besagte zweite Kontaktbereich oder Kontaktpunkt (9) sich näher an dem besagten vierten Gelenkstück oder Drehgelenk (13) befindet als an dem besagten ersten (10) bzw. primären zweiten (11) bzw. sekundären zweiten (39) bzw. primären dritten (12) bzw. sekundären dritten (40) Gelenkstück oder Drehgelenk.

5. Triggerpistole (1) gemäss Anspruch 4, worin die besagte primäre mechanische Verlinkung ferner eine erste Aussparung oder Führungsbahn (46) auf dem besagten Auslöser (4) oder der besagten primären Knieverbindung (37) darstellt, welche erste Aussparung oder Führungsbahn (46) das besagte primäre zweite Gelenkstück oder Drehgelenk (11) aushängt und führt, wenn der besagte Auslösemechanismus zur Umstellung des besagten Ventils (3) aus dem ersten offenen Zustand in den zweiten offenen Zustand benutzt wird.
6. Triggerpistole (1) gemäss einem jeglichen der Ansprüche 4 bis 5, worin die besagte sekundäre mechanische Verlinkung ferner eine zweite Aussparung oder Führungsbahn (47) auf dem besagten Auslöser (4) oder der besagten sekundären Knieverbindung (38) darstellt, welche besagte zweite Aussparung oder Führungsbahn (47) das besagte sekundäre zweite Gelenkstück oder Drehgelenk (39) aushängt und führt, wenn der besagte Auslösemechanismus zur Umstellung des besagten Ventils (3) aus dem geschlossenen Zustand in den ersten offenen Zustand benutzt wird
7. Triggerpistole (1) gemäss einem jeglichen der Ansprüche 4 bis 6, worin die besagte primäre mechanische Verlinkung ferner eine dritte Aussparung oder Führungsbahn auf der besagten primären Knieverbindung (37) oder dem besagten Kipphebel (8) darstellt, welche besagte dritte Aussparung oder Führungsbahn das besagte primäre dritte Gelenkstück oder Drehgelenk (12) aushängt und führt, wenn der besagte Auslösemechanismus zur Umstellung des besagten Ventils (3) aus dem ersten offenen Zustand in den zweiten offenen Zustand benutzt wird
8. Triggerpistole (1) gemäss einem jeglichen der Ansprüche 4 bis 7, worin die besagte sekundäre mechanische Verlinkung ferner eine vierte Aussparung oder Führungsbahn auf der besagten sekundären Knieverbindung (38) oder dem besagten Kipphebel darstellt, welche besagten vierte Aussparung oder Führungsbahn das besagte sekundäre dritte Gelenkstück oder Drehgelenk (40) aushängt und führt,

wenn der besagte Auslösemechanismus zur Umstellung des besagten Ventils aus dem geschlossenen Zustand in den ersten offenen Zustand benutzt wird

9. Triggerpistole (1) gemäss einem jeglichen der Ansprüche 4 bis 8, worin eine Gerade zwischen dem besagten vierten Gelenkstück oder Drehgelenk (13) und dem besagten ersten Gelenkstück oder Drehgelenk (10) eine effektive Griffverbindung (14) definiert, eine Gerade zwischen dem besagten ersten Gelenkstück oder Drehgelenk (10) und dem besagten primären zweiten Gelenkstück oder Drehgelenk (11) eine primäre effektive Auslöserverbindung (15) definiert, eine Gerade zwischen dem besagten primären zweiten Gelenkstück oder Drehgelenk (11) und dem besagten primären dritten Gelenkstück oder Drehgelenk (12) eine primäre effektive Knieverbindung (16) definiert, eine Gerade zwischen dem besagten primären dritten Gelenkstück oder Drehgelenk (12) und dem besagten vierten Gelenkstück oder Drehgelenk (13) eine primäre effektive Kippverbindung (17) definiert, eine Gerade zwischen dem besagten ersten Gelenkstück oder Drehgelenk (10) und dem besagten sekundären zweiten Gelenkstück oder Drehgelenk (39) eine sekundäre effektive Auslöserverbindung (41) definiert, eine Gerade zwischen dem besagten sekundären zweiten Gelenkstück oder Drehgelenk (39) und dem besagten sekundären dritten Gelenkstück oder Drehgelenk (40) eine sekundäre effektive Knieverbindung (42) definiert, eine Gerade zwischen dem besagten sekundären dritten Gelenkstück oder Drehgelenk (40) und dem besagten vierten Gelenkstück oder Drehgelenk (13) eine sekundäre effektive Kippverbindung (43) definiert, wo die primäre effektive Knieverbindung (16) und/oder die besagte sekundäre effektive Knieverbindung (42) kürzer ist als die besagte effektive Griffverbindung (14) bzw. die primäre effektive Auslöserverbindung (15) bzw. die primäre effektive Kippverbindung (17) bzw. die sekundäre effektive Auslöserverbindung (41) bzw. die sekundäre effektive Kippverbindung (43)
10. Triggerpistole (1) gemäss Anspruch 9, worin die besagte primäre effektive Knieverbindung (16) länger als die besagte sekundäre effektive Kippverbindung (42) ist.
11. Triggerpistole (1) gemäss einem jeglichen der Ansprüche 9 bis 10, worin die besagte primäre effektive Auslöserverbindung (15) und die besagte primäre effektive Knieverbindung (16) gemeinsam einen primären effektiven Auslöserwinkel (29) definieren, die besagte sekundäre effektive Auslöserverbindung (41) und die besagte sekundäre effektive Knieverbindung (42) gemeinsam einen sekundären effektiven Auslöserwinkel (44) definieren, wo der besagte

primäre (29) bzw sekundäre (44) effektive Auslöserwinkel ein stumpfer Winkel ist und sich vergrössert, wenn der besagte Auslöser (4) zum Öffnen des besagten Ventils (3) betätigt wird

12. Triggerpistole (1) gemäss einem jeglichen der Ansprüche 9 bis 11, worin die besagte effektive Knieverbindung (16) und die besagte primäre effektive Kippverbindung (17) gemeinsam einen primären effektiven Kniewinkel (18) definieren, die besagte sekundäre effektive Knieverbindung (42) und die besagte sekundäre effektive Kippverbindung (43) gemeinsam einen sekundären effektiven Kniewinkel (45) definieren, wo der besagte primäre (18) bzw sekundäre (45) effektive Kniewinkel ein spitzer Winkel ist und sich vergrössert, wenn der besagte Auslöser (4) zum Öffnen des besagten Ventils betätigt wird
13. Triggerpistole (1) gemäss einem jeglichen der Ansprüche 4 bis 12, worin der besagte Griff (2) zur Aufnahme in der Handfläche eines Benutzers ausgeformt ist, sodass das besagte primäre zweite Gelenkstück oder Drehgelenk (11) und/oder das besagte sekundäre zweite Gelenkstück oder Drehgelenk (39) sich näher am Zeigefinger als am Kleinfinger der Hand des Benutzers befindet.
14. Triggerpistole (1) gemäss einem jeglichen der Ansprüche 1 bis 13, worin der besagte Griff (2) zur Aufnahme in der Handfläche eines Benutzers ausgeformt ist, sodass sich der besagte Auslöser (4) im Verhältnis zur Handfläche des Benutzers bewegt, wenn der besagte Auslöser (4) zum Öffnen des besagten Ventils (3) benutzt wird.
15. Triggerpistole (1) gemäss einem jeglichen der Ansprüche 1 bis 14, worin der besagte Griff (2) zur Aufnahme in der Handfläche eines Benutzers ausgeformt ist, sodass sich ein Finger der Hand des Benutzers innerhalb der geschlossenen Schleifen der besagten primären und sekundären mechanischen Verlinkungen befindet.

Revendications

1. Pistolet gâchette (1) pour un laveur à haute pression, ledit pistolet gâchette (1) comprenant une poignée (2), une vanne (3) supportée de manière rigide par ladite poignée (2), une gâchette (4) ayant une première surface ou un premier point de contact (5) pour l'application manuelle d'une force, et un mécanisme de gâchette, où ladite vanne (3) comprend en outre un élément de transmission (6) pour l'ouverture et la fermeture de ladite vanne (3), et ledit mécanisme de gâchette pourvoyant une coopération entre ladite gâchette (4) et ledit élément de transmission (6) pour

permettre un contrôle manuel avec ladite ouverture et fermeture de ladite vanne (3), **caractérisé en ce que** ledit pistolet gâchette (1) comprend en outre un balancier (8) ayant une deuxième surface ou un deuxième point de contact (9) pour la coopération avec ledit élément de transmission (6), une biellette de liaison coudée primaire (37), et une biellette de liaison coudée secondaire (38), où ledit mécanisme de gâchette comprend en outre un embiellage mécanique primaire constitué par ladite poignée (2), ladite gâchette (4), ladite biellette de liaison coudée primaire (37) et ledit balancier (8) étant reliés de manière pivotable en une boucle fermée, un embiellage mécanique secondaire constitué par ladite poignée (2), ladite gâchette (4), ladite biellette de liaison coudée secondaire (38) et ledit balancier (8) étant reliés de manière pivotable en une boucle fermée, ladite vanne (3) ayant en outre un état fermé, un premier état ouvert et un deuxième état ouvert, par quel moyen ledit embiellage mécanique primaire est employé lorsque ladite vanne (3) passe de son état fermé à son premier état ouvert, et ledit embiellage mécanique secondaire est employé lorsque ladite vanne passe de son premier état ouvert à son deuxième état ouvert.

2. Pistolet gâchette (1) selon la revendication 1, dans lequel ledit embiellage mécanique primaire transforme une force d'action appliquée à ladite première surface ou ledit premier point de contact (5) à une force amplifiée primaire de réaction de ladite deuxième surface ou ledit deuxième point de contact (9) agissant sur ledit élément de transmission (6), et ledit embiellage mécanique secondaire transforme une force d'action appliquée à ladite première surface ou ledit premier point de contact (5) à une force amplifiée secondaire de réaction de ladite deuxième surface ou ledit deuxième point de contact (9) agissant sur ledit élément de transmission (6)
3. Pistolet gâchette (1) selon la revendication 2, dans lequel, pour la même force d'action, ladite force primaire amplifiée de réaction est plus importante que ladite force secondaire amplifiée de réaction.
4. Pistolet gâchette (1) selon l'une quelconque des revendications 1 à 3, dans lequel ladite poignée (2) est reliée à ladite gâchette (4) par un joint ou un pivot (10), ladite gâchette (4) étant reliée à ladite biellette de liaison coudée primaire (37) par un deuxième joint ou pivot primaire (11), ladite gâchette (4) étant reliée à ladite biellette de liaison coudée secondaire (38) par un deuxième joint ou pivot secondaire (39), ladite biellette de liaison coudée primaire (37) étant reliée audit balancier (8) par un troisième joint ou pivot primaire (12), ladite biellette de liaison coudée secondaire (38) étant reliée audit balancier (8) par un troisième joint ou pivot secondaire (40), ledit balancier

- (8) étant relié à ladite poignée (2) par un quatrième joint ou pivot (13), et ladite deuxième surface ou ledit deuxième point de contact (9) étant placé plus proche au quatrième joint ou pivot (13) qu'à n'importe lesquels desdits premier joint ou pivot (10), deuxième joint ou pivot primaire (11), deuxième joint ou pivot secondaire (39), troisième joint ou pivot primaire (12), et troisième joint ou pivot secondaire (40).
5. Pistolet gâchette (1) selon la revendication 4, dans lequel ledit embiellage mécanique primaire constitue en outre une première fente ou voie guidée (46) placée sur ladite gâchette (4) ou ladite biellette de liaison coudée primaire (37), ladite première fente ou voie guidée (46) dégageant et guidant ledit deuxième joint ou pivot primaire (11) lorsque ledit mécanisme de gâchette est employé pour faire passer ladite vanne (3) de son premier état ouvert à son deuxième état ouvert.
6. Pistolet gâchette (1) selon l'une quelconque des revendications 4 à 5, dans lequel ledit embiellage mécanique secondaire constitue en outre une deuxième fente ou voie guidée (47) placée sur ladite gâchette (4) ou ladite biellette de liaison coudée secondaire (38), ladite deuxième fente ou voie guidée (47) dégageant et guidant ledit deuxième joint ou pivot secondaire (39) lorsque ledit mécanisme de gâchette est employé pour faire passer ladite vanne (3) de son état fermé à son premier état ouvert
7. Pistolet gâchette (1) selon l'une quelconque des revendications 4 à 6, dans lequel ledit embiellage mécanique primaire constitue en outre une troisième fente ou voie guidée placée sur ladite biellette de liaison coudée primaire (37) ou ledit balancier (8), ladite troisième fente ou voie guidée dégageant et guidant ledit troisième joint ou pivot primaire (12) lorsque ledit mécanisme de gâchette est employé pour faire passer ladite vanne (3) de son premier état ouvert à son deuxième état ouvert.
8. Pistolet gâchette (1) selon l'une quelconque des revendications 4 à 7, dans lequel ledit embiellage mécanique secondaire constitue en outre une quatrième fente ou voie guidée placée sur ladite biellette de liaison coudée secondaire (38) ou ledit balancier, ladite quatrième fente ou voie guidée dégageant et guidant ledit troisième joint ou pivot secondaire (40) lorsque ledit mécanisme de gâchette est employé pour faire passer ladite vanne de son état fermé à son premier état ouvert.
9. Pistolet gâchette (1) selon l'une quelconque des revendications 4 à 8, dans lequel une ligne entre ledit quatrième joint ou pivot (13) et ledit premier joint ou pivot (10) définit une biellette de poignée efficace (14), une ligne entre ledit premier joint ou pivot (10) et ledit deuxième joint ou pivot primaire (11) définit une biellette de liaison coudée primaire efficace (16), une ligne entre ledit troisième joint ou pivot primaire (12) et ledit quatrième joint ou pivot (13) définit une biellette de balancier primaire efficace (17), une ligne entre ledit premier point ou pivot (10) et ledit deuxième joint ou pivot secondaire (39) définit une biellette de gâchette secondaire efficace (41), une ligne entre ledit deuxième joint ou pivot secondaire (39) et ledit troisième joint ou pivot secondaire (40) définit une biellette de liaison coudée secondaire (42), une ligne entre ledit troisième joint ou pivot secondaire (40) et ledit quatrième joint ou pivot (13) définit une biellette de balancier secondaire efficace (43), ladite biellette de liaison coudée primaire efficace (16) et/ou ladite biellette de liaison coudée secondaire efficace (42) étant plus courte(s) que n'importe lesquelles desdites biellette de poignée (14), de gâchette primaire (15), de balancier primaire (17), de gâchette secondaire (41) et de balancier secondaire (43) efficaces.
10. Pistolet gâchette (1) selon la revendication 9, dans lequel ladite biellette de liaison coudée primaire efficace (16) est plus longue que ladite biellette de liaison coudée secondaire efficace (42)
11. Pistolet gâchette (1) selon l'une quelconque des revendications 9 à 10, dans lequel ladite biellette de gâchette primaire efficace (15) et ladite biellette de liaison coudée primaire efficace (16) ensemble définissent un angle de gâchette primaire efficace (29), ladite biellette de gâchette secondaire efficace (41) et ladite biellette de liaison coudée secondaire efficace (42) définissant ensemble un angle de gâchette secondaire efficace (44), lesdits angles de gâchette primaire (29) et secondaire (44) efficaces étant obtus et augmentent lorsque la gâchette est tirée (4) pour ouvrir ladite vanne (3)
12. Pistolet gâchette (1) selon l'une quelconque des revendications 9 à 11, dans lequel ladite biellette de liaison coudée primaire efficace (16) et ladite biellette de balancier primaire efficace (17) définissent ensemble un angle de biellette de liaison coudée primaire efficace (18), ladite biellette de liaison coudée secondaire (42) et ladite biellette de balancier secondaire efficace (43) définissant ensemble un angle de biellette de liaison coudée secondaire efficace (45), lesdits angles primaire (18) et secondaire (45) de biellette de liaison coudée efficaces étant aigus et augmentent lorsque la gâchette est tirée pour ouvrir ladite vanne.
13. Pistolet gâchette (1) selon l'une quelconque des revendications 4 à 12, dans lequel ladite poignée (2)

est construite pour être reçu dans la paume de la main d'un utilisateur de manière à ce que ledit deuxième joint ou pivot primaire (11) et/ou ledit deuxième joint ou pivot secondaire (39) sont placés plus proche à l'index qu'à l'auriculaire de l'utilisateur. 5

14. Pistolet gâchette (1) selon l'une quelconque des revendications 1 à 13, dans lequel ladite poignée (2) est construite pour être reçu dans la paume de la main d'un utilisateur de manière à ce que ladite gâchette (4) se déplace par rapport à la paume de la main de l'utilisateur lorsque la gâchette (4) est utilisée pour ouvrir ladite vanne (3). 10

15. Pistolet gâchette (1) selon l'une quelconque des revendications 1 à 14, dans lequel ladite poignée (2) est construite pour être reçu dans la paume de la main d'un utilisateur de manière à ce qu'un doigt de la main de l'utilisateur se trouve à l'intérieur desdites boucles fermées desdits embellages mécaniques primaires et secondaires 15 20

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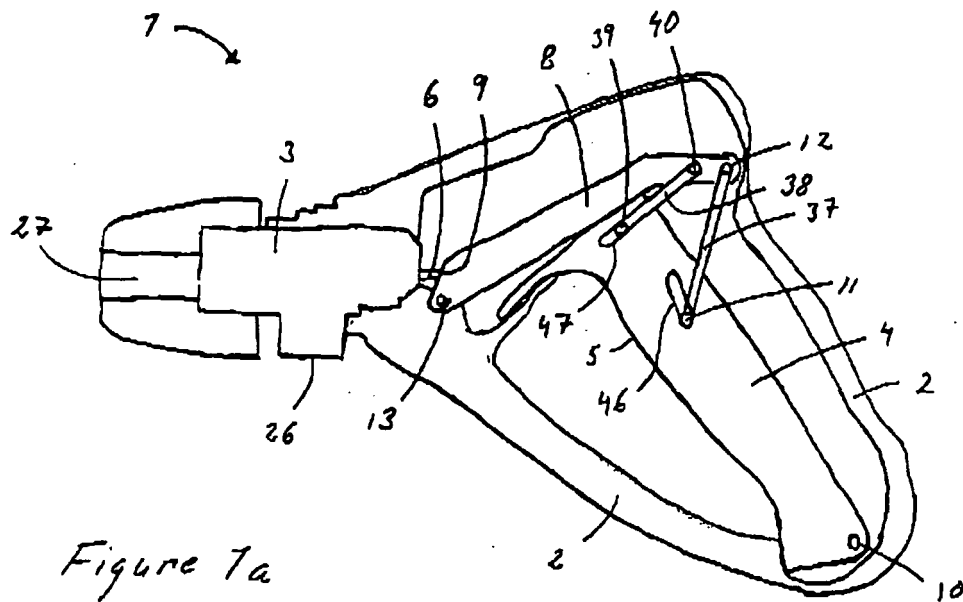
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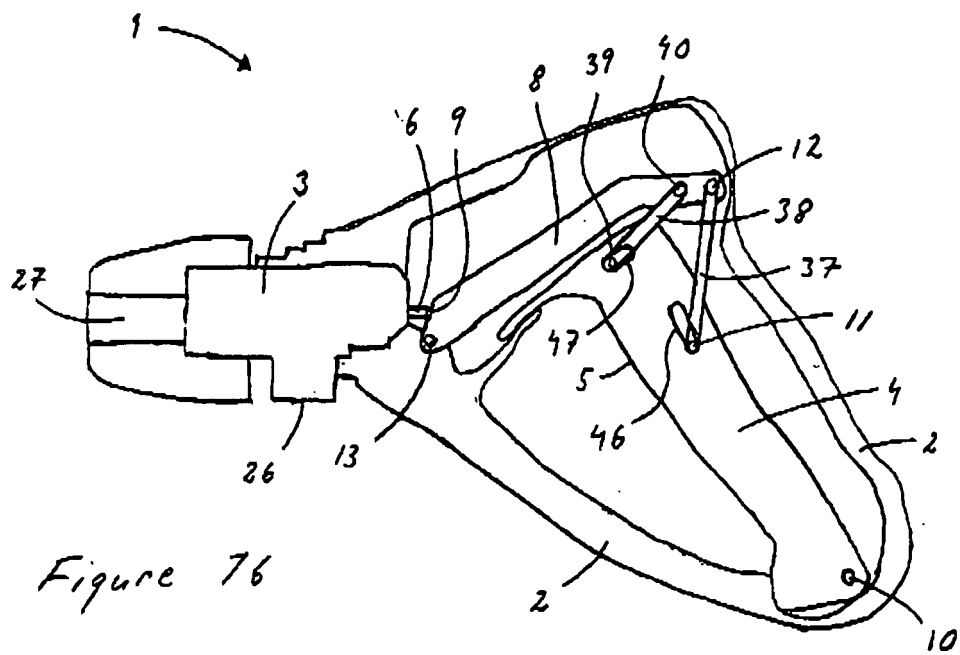


Figure 76

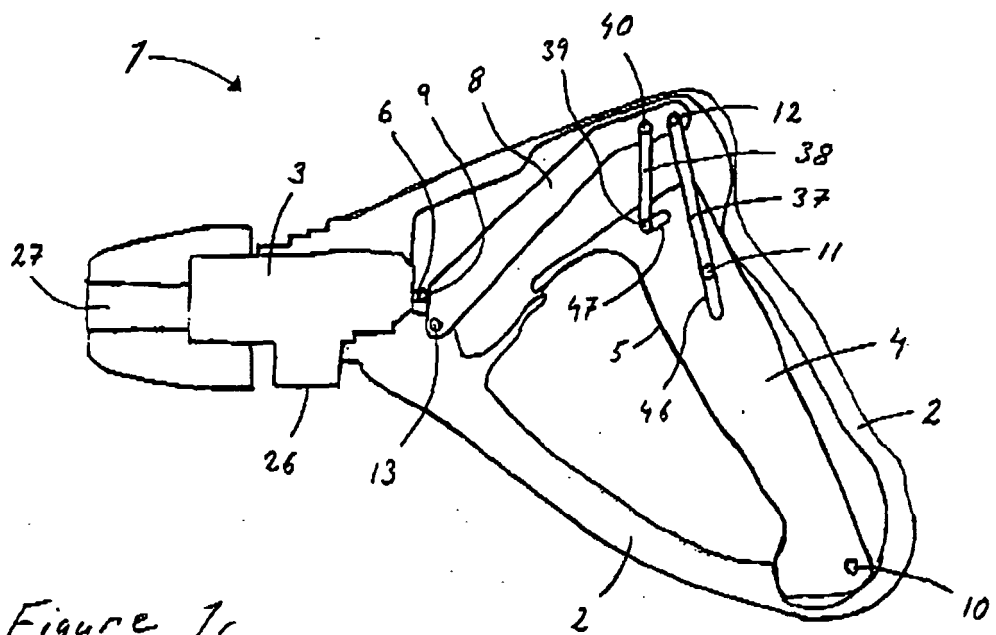


Figure 1c

Figure 2a

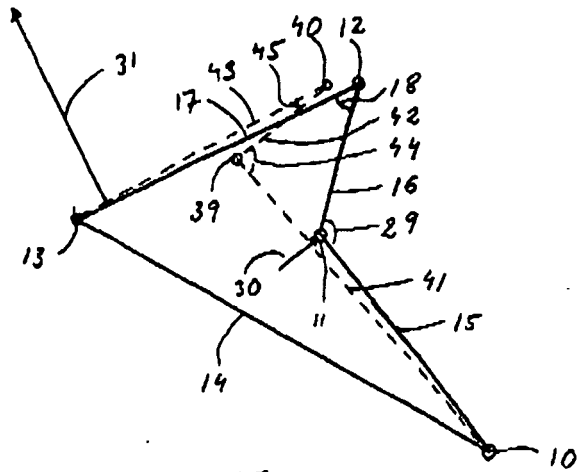


Figure 2b

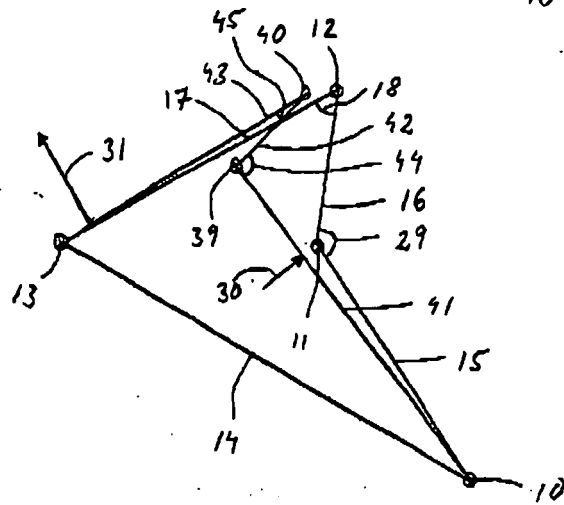
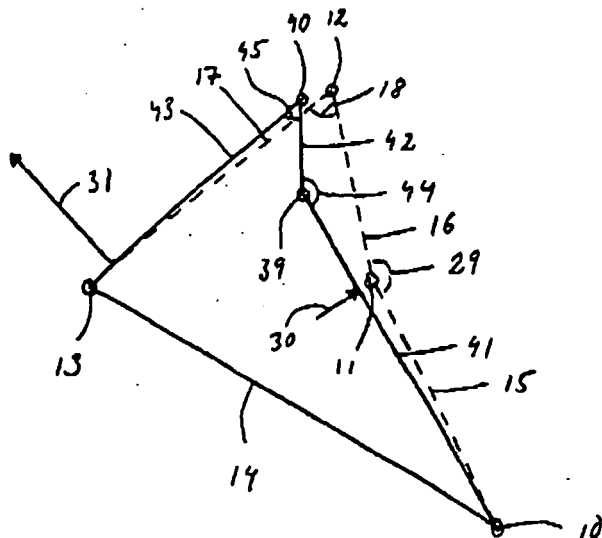


Figure 2c



REFERENCES CITED IN THE DESCRIPTION

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