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(71) Applicant(s): L&T TECHNOLOGY SERVICES LIMITED

(72) Inventor(s): Varadharajan, Lakshminarayanan

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(54) Title: AN ACTUATION MECHANISM FOR A TOOL ASSEMBLY AND A TOOL ASSEMBLY THEREOF

(57) Abstract: The present disclosure discloses an actuation mechanism (100) for a tool assembly (200). The tool assembly (200) comprises a shank (1), a tool housing (2), one or more first tools (3), one or more second tools (4), and an actuation mechanism (100). The actuation mechanism (100) comprises at least one plunger (5) and a plurality of actuating members (6). The at least one plunger (5) displaces between a first position (FP) and a second position (SP) to selectively engage at least one of the one or more first tools (3) and the one or more second tools (4), on pivoting of the plurality of actuating members (6). With such configuration, the tool assembly (200) may automatically switch tools accommodated in the tool housing (2) based on rotational speed of the tool assembly (200) and the time consumed in switching between tools may be substantially reduced or eliminated.

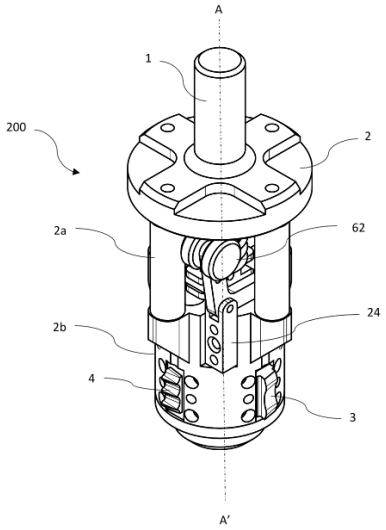

Figure 1a

FORM 2

THE PATENTS ACT 1970
(39 OF 1970)
&
The Patent Rules, 2003

Complete Specification

(See Section 10 and Rule 13)

1. TITLE OF THE INVENTION

AN ACTUATION MECHANISM FOR A TOOL ASSEMBLY AND A TOOL ASSEMBLY THEREOF

2. APPLICANT(S)

(a) NAME : **L&T TECHNOLOGY SERVICES LIMITED**
(b) NATIONALITY : **INDIAN**
(c) ADDRESS : **DLF IT SEZ Park, 2nd Floor – Block 3**
1/124, Mount Poonamallee Road,
Ramapuram, Chennai – 600 089,
INDIA.

3. PREAMBLE TO THE DESCRIPTION

COMPLETE

The following specification describes the invention and the manner in which it is to be performed

DESCRIPTION

TECHNICAL FIELD

[001] Present disclosure, in general, relates to the field of machine tools and manufacturing. Particularly, but not exclusively, the present disclosure relates to a mechanism for regulating operations performed by a tool assembly of a machine. Further, embodiments of the present disclosure relate to an actuation mechanism for the tool assembly to selectively operate one or more tools of the tool assembly based on operational requirement.

BACKGROUND OF THE DISCLOSURE

[002] Manufacturing processes involve a set of operations including, but not limited to, casting, forming, machining and the like. Each operation involves use of at least one machine and requires one or more tools for performing such operation. Large machines such as lathe machines, CNC machines, and among others are often fitted with multiple tools and fixtures for performing the machining operations. Such machining operations are often performed to obtain intricate shapes, dimensions, surface patterns, and among others, on workpieces. While such operations require switching the workpieces between machines or tools of the machines intended to perform various operations, it is also essential to reduce idle time of said machines during operations in order to increase profitability.

[003] Multiple tools and/or tool inserts, each having a unique profile, are conventionally fitted in a single machine such as a manual lathe to perform various operations on a workpiece by switching the tools or tool inserts. Such switching is often performed manually by an operator which is time consuming and requires precision while adjusting position and locking of the tools or the guide members in a specific orientation.

[004] With advancement in technology, various attempts have been made to reduce time consumed in changing/switching tools in the conventional machines. One such attempt involves automatic tool changing (ATC) assemblies often equipped in machinery such as a CNC machine for automatically switching the tools or tool inserts. Such automatic switching is based on a computer numerical control code for performing various operations with minimal human intervention. However, such ATC assemblies are expensive and may require a skilled operator. Further, even with ATC assemblies, while the tool is being interchanged the CNC machine is still non-operative and reduces productivity of the machine, which is not desirable.

Furthermore, such non-operative condition of the machine may increase lead time of the machining processes.

[005] The present disclosure is directed to overcome one or more limitations stated above or any other limitations associated with the conventional mechanisms.

SUMMARY OF THE DISCLOSURE

[006] One or more shortcomings of the prior art are overcome by a method and a system as claimed and additional advantages are provided through the method and the system as claimed in the present disclosure. Additional features and advantages are realized through the techniques of the present disclosure. Other embodiments and aspects of the disclosure are described in detail herein and are considered a part of the claimed disclosure.

[007] In one non-limiting embodiment of the present disclosure an actuation mechanism for a tool assembly is disclosed. The tool assembly includes a tool housing, one or more first tools and one or more second tools. The mechanism comprises at least one plunger and a plurality of actuating members. The at least one plunger is slidably positioned in the tool housing and is configured to displace between a first position and a second position to selectively engage at least one of the one or more first tools and the one or more second tools. The plurality of actuating members is connectable to a portion of the at least one plunger and is pivotable relative to the tool housing to displace the at least one plunger from the first position to the second position. The at least one plunger displaces to the second position and configured to engage and actuate the at least one of the one or more first tools and the one or more second tools, on pivoting of the plurality of actuating members.

[008] In an embodiment, the at least one plunger is defined with at least one flange portion to receive one end of the plurality of actuating members.

[009] In an embodiment, the at least one plunger is defined with at least one first portion defined by a taper, configured to engage and actuate with at least one of the one or more first tools and the one or more second tools.

[0010] In an embodiment, the actuation mechanism comprises an engaging member operatively coupled between the at least one plunger and the one or more second tools.

[0011] In an embodiment, the engaging member having at least one second portion is configured to engage with the at least one first portion to selectively displace the one or more second tools based on displacement of the at least one plunger.

[0012] In an embodiment, the actuation mechanism comprises at least one first biasing member positioned between the tool housing and the at least one flange portion, the at least one first biasing member is configured to selectively bias the at least one plunger based on rotation speed of the tool assembly.

[0013] In an embodiment, each actuating member of the plurality of actuating members is defined with a weight on an other end opposite to the one end.

[0014] In an embodiment, each of the plurality of actuating members is defined by an arm pivotably connectable a portion of the tool housing, and wherein the plurality of actuating members pivots relative to the tool housing.

[0015] In an embodiment, the actuation mechanism comprises at least one second biasing member connectable between the at least one plunger and at least one of the one or more first tools and the one or more second tools, wherein the at least one second biasing member is configured to bias at least one of the one or more first tools and the one or more second tools based on displacement of the at least one plunger.

[0016] In another non-limiting embodiment of the present disclosure a tool assembly for a machine is disclosed. The tool assembly comprises a shank, a tool housing, one or more first tools, one or more second tools, and an actuation mechanism. The shank is rotatably connectable to a portion of the machine. The tool housing is defined with at least one first cavity and at least one second cavity. The one or more first tools are connectable to the tool housing. The one or more second tools are slidably accommodated within the at least one first cavity. The mechanism comprises at least one plunger and a plurality of actuating members. The at least one plunger is slidably positioned in the tool housing and is configured to displace between a first position and a second position to selectively engage at least one of the one or more first tools and the one or more second tools. The plurality of actuating members is connectable to a portion of the at least one plunger and is pivotable relative to the tool housing to displace the at least one plunger from the first position to the second position. The at least one plunger displaces to the second position and configured to engage and actuate the at least

one of the one or more first tools and the one or more second tools, on pivoting of the plurality of actuating members.

[0017] The foregoing summary is illustrative only and is not intended to be in any way limiting. In addition to the illustrative aspects, embodiments, and features described above, further aspects, embodiments, and features will become apparent by reference to the drawings and the following detailed description.

BRIEF DESCRIPTION OF THE ACCOMPANYING DRAWINGS

[0018] The novel features and characteristic of the disclosure are set forth in the appended claims. The disclosure itself, however, as well as a preferred mode of use, further objectives and advantages thereof, will best be understood by reference to the following detailed description of an illustrative embodiment when read in conjunction with the accompanying figures. One or more embodiments are now described, by way of example only, with reference to the accompanying figures wherein like reference numerals represent like elements and in which:

[0019] Figure 1a is a perspective view of the tool assembly, in accordance with an embodiment of the present disclosure.

[0020] Figure 1b is another perspective view of the tool assembly, in accordance with an embodiment of the present disclosure.

[0021] Figure 1c is a front view of a tool assembly, in accordance with an embodiment of the present disclosure.

[0022] Figure 1d is a side view of the tool assembly, in accordance with an embodiment of the present disclosure.

[0023] Figure 2a is an exploded isometric view of the tool assembly, in accordance with an embodiment of the present disclosure.

[0024] Figure 2b is an exploded front view of the tool assembly, in accordance with an embodiment of the present disclosure.

[0025] Figure 3 is an isometric view of a tool housing without the tools, in accordance with an embodiment of the present disclosure.

[0026] Figure 4a is an isometric view of one or more first tools, in accordance with an embodiment of the present disclosure.

[0027] Figure 4b is an isometric view of one or more second tools, in accordance with an embodiment of the present disclosure.

[0028] Figure 5a illustrates different views of the at least one plunger, in accordance with an embodiment of the present disclosure.

[0029] Figure 5b illustrates different views of a flange portion of the at least one plunger, in accordance with an embodiment of the present disclosure.

[0030] Figure 5c illustrates an assembled view of the at least one plunger, in accordance with an embodiment of the present disclosure.

[0031] Figure 6a illustrates different views of a plurality of actuating members, in accordance with an embodiment of the present disclosure.

[0032] Figure 6b illustrates different views of a weight of the plurality of actuating members, in accordance with an embodiment of the present disclosure.

[0033] Figure 7a is an isometric sectional view of the tool housing of the tool assembly, in accordance with an embodiment of the present disclosure.

[0034] Figure 7b is an isometric view of the tool housing fitted with an actuation mechanism, in accordance with an embodiment of the present disclosure.

[0035] Figure 8a is an isometric view of the actuation mechanism depicting one or more first tools and one or more second tools, in accordance with an embodiment of the present disclosure.

[0036] Figure 8b is an isometric view of the actuation mechanism depicting the at least one plunger in a first position, in accordance with an embodiment of the present disclosure.

[0037] Figure 8c is an isometric view of the actuation mechanism depicting the at least one plunger in a second position, in accordance with an embodiment of the present disclosure.

[0038] Figure 9a is a sectional view of the tool assembly, in accordance with an embodiment of the present disclosure.

[0039] Figure 9b is side sectional view of the tool assembly, in accordance with an embodiment of the present disclosure.

[0040] Figure 9c is a sectional view of the tool assembly depicting the at least one plunger in the first position, in accordance with an embodiment of the present disclosure.

[0041] Figure 9d is a sectional view of the tool assembly depicting the at least one plunger in the second position, in accordance with an embodiment of the present disclosure.

[0042] The figures depict embodiments of the disclosure for purposes of illustration only. One skilled in the art will readily recognize from the following description that alternative embodiments of the system and method illustrated herein may be employed without departing from the principles of the disclosure described herein.

DETAILED DESCRIPTION

[0043] While the embodiments in the disclosure are subject to various modifications and alternative forms, specific embodiment thereof has been shown by way of example in the figures and will be described below. It should be understood, however, that it is not intended to limit the disclosure to the particular forms disclosed, but on the contrary, the disclosure is to cover all modifications, equivalents, and alternative falling within the scope of the disclosure.

[0044] The terms “comprises”, “comprising”, or any other variations thereof used in the disclosure, are intended to cover a non-exclusive inclusion, such that a device, assembly, mechanism, that comprises a list of components does not include only those components but may include other components not expressly listed or inherent to such system, or assembly, or device. In other words, one or more elements in a system proceeded by “comprises… a” does not, without more constraints, preclude the existence of other elements or additional elements in the system or method.

[0045] Embodiments of the present disclosure discloses a tool assembly for a machine is disclosed. The tool assembly comprises a shank, a tool housing, one or more first tools, one or more second tools, and an actuation mechanism. The shank is rotatably connectable to a portion of the machine. The tool housing is defined with at least one first cavity and at least one second cavity. The one or more first tools are connectable to the tool housing. The one or more second tools are slidably accommodated within the at least one first cavity. The mechanism comprises at least one plunger and a plurality of actuating members. The at least one plunger is slidably positioned in the tool housing and is configured to displace between a first position and a second position to selectively engage at least one of the one or more first tools and the one or more second tools. The plurality of actuating members is connectable to a portion of the at least one plunger and is pivotable relative to the tool housing to displace the at least one plunger from the first position to the second position. The at least one plunger displaces to the second position and configured to engage and actuate the at least one of the one or more first tools and the one or more second tools, on pivoting of the plurality of actuating members. With such configuration, the tool assembly may automatically switch between tools accommodated in the tool housing based on rotational speed of the tool assembly and the time consumed in switching between tools may be substantially reduced or eliminated.

[0046] The disclosure is described in the following paragraphs with reference to Figures 1a to 9d. In the figures, the same element or elements which have same functions are indicated by the same reference signs. It is to be noted that, the machine is not illustrated in the figures for the purpose of simplicity. One skilled in the art would appreciate that the actuation mechanism and the tool assembly as disclosed in the present disclosure may be used in any machine including but not liming to CNC machines, automatic lathe machines, grinding machines, and the like. The mechanism and the assembly of the present disclosure may also be implemented in machines having rotating tool assemblies for machining where rotational speed of such tool assemblies may be varied without deviating from the principles of the present disclosure.

[0047] Figures 1a and 1b illustrate an exemplary embodiment of the present disclosure which depict a tool assembly (200) for a machine [not shown explicitly in figures]. The machine may be including, but not be limited to, a CNC machine, a lathe machine, a grinding machine, a milling machine, and the like. In an embodiment, the machine may be a horizontal machining centre [also referred as HMC], a vertical machining centre [also referred as VMC], a computer program controlled machine, and the like. The machine includes at least one motor or a driver

(not shown in figures) coupled to at least a portion of a tool assembly (200). The tool assembly (200) may comprise a shank (1) rotatably connectable to a portion of the machine such as at least one motor or a driver. In an embodiment, the shank (1) of the tool assembly (200) may be rotatably coupled to a tool holder of the machine through a chuck [not shown explicitly in figures]. The tool assembly (200) comprises a tool housing (2) structured to extend from a portion of the shank (1) and defined with an elongated structure to accommodate one or more first tools (3) and one or more second tools (4). In an embodiment, the tool housing (2) may resemble one of a cylindrical profile, a spherical profile and the like.

[0048] Referring now to figures 1c and 1d, the tool housing (2) may be defined with a top portion (2a) and a bottom portion (2b). The top portion (2a) may be defined by a plurality of cylindrical members connectable to the shank (1). The bottom portion (2b) may be defined by a cylindrical profile to accommodate one or more first tools (3) and the one or more second tools (4) along outer surface. Such configuration of the top portion (2a) and the bottom portion (2b) is illustrated to accommodate one or more first tools (3) and one or more second tools (4) and an actuation mechanism (100) as can be clearly seen in Figure 1c and the same shall not be construed as a limitation. In an embodiment, the top portion (2a) and the bottom portion (2b) may be either integrally connected or may be detachably coupled to the shank (1). In an embodiment, the shank (1) may be rotatably disposed in the top portion (2a) and may be fixedly coupled to a portion of the bottom portion (2b) to transmit rotation from the at least one motor or driver. The bottom portion (2b) may be defined with a plurality of cylindrical extensions (25) to accommodate the plurality of cylindrical members as can be seen in Figure 1d. The plurality of cylindrical extensions (25) may be defined by at least one of a tapered end, an arcuate end and the like. In the illustrative embodiment, the plurality of cylindrical extensions (25) is defined with a tapered end as can be clearly seen in Figures 1c and 1d to direct metal chips, dust and scraps during machining of the workpiece away from the tool assembly (200) to prevent any damage to the tool assembly (200). Further, profiles of the top portion (2a) and the bottom portion (2b) may be varied based on design requirements of the tool assembly (200). The one or more first tools (3) and the one or more second tools (4) may be configured to engage with at least a portion of a workpiece [not shown explicitly in Figures] and the actuation mechanism (100) may be configured to selectively actuate at least one of the one or more first tools (3) and the one or more second tools (4).

[0049] Referring now to Figures 2a and 2b, the tool housing (2) may be defined with at least one first cavity (21) and at least one second cavity (22). The at least one first cavity (21) may be defined in the bottom portion (2b) to accommodate the one or more second tools (4). The at least one second cavity (22) may be defined along a longitudinal axis (AA') of the tool housing (2) as can be clearly seen in Figure 2. For sake of explanation, the tool housing (2) is depicted with two first cavities defined diametrically opposite along the outer surface of the bottom portion (2b) to accommodate two second tools (4) of the one or more second tools (4). In an embodiment, the bottom portion (2b) may also define at least one third cavity (23) to accommodate one or more first tools (3) based on design requirements of the tool assembly (200). In an embodiment, the at least one first cavity (21) may extend in a radial direction relative to the longitudinal axis (AA') and the at least one second cavity (22) may extend through the bottom portion (2b) parallel to the longitudinal axis (AA'). In the illustrative embodiment, the bottom portion (2b) defines two first cavities and two second cavities alternatively along the outer surface to alternatively accommodate the one or more first tools (3) and the one or more second tools (4) at an angle. The angle between each of the one or more first tools (3) and the one or more second tools (4) may be in a range of 10 to 90 degrees.

[0050] Referring again to Figures 2a to 4b, the one or more first tools (3) and the one or more second tools (4) may be configured to engage with at least a portion of the workpiece. In an embodiment, each of the one or more first tools (3) and the one or more second tools (4) may be defined with a tail portion (4a) connectable to the bottom portion (2b) and a body (4b) defined with a profile to engage with the workpiece. The body (4b) may be extending away from the tool housing (2) and the tail portion (4a) may be connectable to the tool housing (2) as can be seen in Figures 2a and 2b. In an embodiment, the one or more first tools (3) may be fixedly coupled to the tool housing (2) in the at least one third cavity (23) and the one or more second tools (4) may be slidably positioned in the at least one first cavity (21). The one or more first tools (3) and the one or more second tools (4) may be either integrally connected to each of the guide member (8) or may be detachably coupled to the guide member (8) as can be seen in Figures 4a and 4b. In the illustrative embodiment, the one or more first tools (3) and the one or more second tools (4) are depicted to be detachably coupled to the guide members (8) to allow removal and insertion of tools with different profiles based on required operation to be performed by the machine. In an embodiment, the guide members (8) may also be detachably coupled to the tool housing (2). In the illustrative embodiment, profiles of the one or more first tools (3) and the one or more second tools (4) are depicted to be different from each other to

perform different operations on the workpiece. In an embodiment, material of the one or more first tools (3) and the one or more second tools (4) may be selected from one of high carbon high steel [HCHS], high speed steel [HSS], low carbon steel, solid carbide and combinations thereof. Further, the one or more first tools (3) and the one or more second tools (4) may be configured to perform operations including, but not limited to, face milling, profile milling, finishing operations and the like.

[0051] Referring again to Figures 2a and 2b, the tool assembly (200) comprises an actuation mechanism (100) accommodated in the tool housing (2) to selectively engage and actuate at least one of the one or more first tools (3) and the one or more second tools (4). The actuation mechanism (100) comprises at least one plunger (5) slidably positioned in the tool housing (2).

[0052] Referring now to Figure 5a to 5c, the at least one plunger (5) may be defined by an elongated structure extending along the longitudinal axis (AA') of the tool housing (2) as can be seen in Figure 5a. The at least one plunger (5) may be defined with a first end (5a) and a second end (5b) defined away from the first end (5a). The at least one plunger (5) may be defined with at least one first portion (51) defined by a taper (51a) proximal to the second end (5b), configured to engage and actuate with at least one of the one or more first tools (3) and the one or more second tools (4). In the illustrative embodiment, the at least one plunger (5) may be slidably positioned in the at least one second cavity (22) of the tool housing (2) to slide vertically between a first position (FP) and a second position (SP) along the longitudinal axis (AA') of the tool housing (2) to selectively engage with the one or more second tools (4). For sake of explanation, the at least one plunger (5) is depicted with one first portion (51), however, the number of first portions may be varied based on design requirements and the same shall not be considered a limitation. In an embodiment, sliding movement of the at least one plunger (5) may be varied by varying profile of the at least one second cavity (22). In the illustrative embodiment, the at least one second cavity (22) is defined along the longitudinal axis (AA') to allow displacement of the at least one plunger (5) between the first position (FP) and the second position (SP).

[0053] Further, the at least one plunger (5) may be defined with at least one flange portion (52) extending from a portion of the at least one plunger (5). In an embodiment, the at least one flange portion (52) may be integrally defined on the at least one plunger (5) or may be detachably coupled to the first end (5a) of the at least one plunger (5). For sake of explanation, the at least one flange portion (52) is depicted to be detachably coupled to the first end (5a) by

plurality of apertures (53) and a plurality of fasteners as illustrated in Figures 5a and 5b, where the at least one flange portion (52) may also be defined with corresponding apertures (53) to receive the plurality of fasteners as can be seen in Figure 5b. A portion of the at least one flange portion (52) may be hollow to accommodate the first end (5a) of the at least one plunger (5). In an embodiment, the actuation mechanism (100) may include at least one receiving member (11) positioned within the at least one second cavity (22) to slidably receive the at least one plunger (5). The at least one receiving member (11) may be defined with at least one third portion (12) extending perpendicular to the at least one second portion (91) to restrict downward movement beyond a predetermined length of the at least one plunger (5) as can be seen in Figure 5c. The at least one receiving member (11) may be integrally formed in the at least one second cavity (22) or may be detachably coupled to the bottom portion (2b). In the illustrative embodiment, the at least one receiving member (11) is depicted to be detachable coupled to the bottom portion (2b) for ease of assembly and disassembly of the at least one plunger (5) and the same shall not be considered a limitation.

[0054] Referring again to Figures 4a and 4b the actuation mechanism (100) may comprise an engaging member (9) operatively coupled between the at least one plunger (5) and the one or more second tools (4). The at least one engaging member (9) may be structured to define at least one second portion (91) configured to engage with the at least one first portion (51). In an embodiment, the at least one first portion (51) and the at least one second portion (91) may be defined by at least one of a tapered portion, an arcuate portion and the like. In an embodiment, the engaging member (9) may be defined by an elongated profile. The engaging member (9) may be either integrally defined or may be detachably connected at the tail portion (4a) of the one or more second tools (4). The at least one second portion (91) may engage with the at least one first portion (51) to displace the one or more second tools (4) radially relative to the tool housing (2) to selectively engage the one or more second tools (4) with the workpiece. In an embodiment, the engaging member (9) may displace the one or more second tools (4) away from the tool housing (2) to engage with the workpiece upon displacement of the at least one plunger (5) from the first position (FP) to the second position (SP). The engaging member (9) may displace the one or more second tools (4) towards the tool housing (2) to disengage the one or more second tools (4) from the workpiece upon displacement of the at least one plunger (5) from the second position (SP) to the first position (FP). In the illustrative embodiment, the at least one plunger (5) is depicted to displace the one or more second tools (4), where the one or more first tools (3) is fixedly connected to the bottom portion (2b) to engage the one or more

first tools (3) at the first position (FP) of the at least one plunger (5) and to engage the one or more second tools (4) at the second position (SP) of the at least one plunger (5).

[0055] Further, the one or more second tools (4) are in a non-operative condition when the one or more second tools (4) are engaged with the workpiece at second position (SP) of the at least one plunger (5). Such configuration of the one or more first tools (3) and the one or more second tools (4) shall not be considered a limitation, as the bottom portion (2b) may accommodate plurality of tools and the at least one plunger (5) may be defined with corresponding portions to engage at least one tool of the plurality of tools selectively based on requirement such that at least one tool may be engaged with the workpiece and at least one tool may be disengaged from the workpiece. In an embodiment, the bottom portion (2b) may receive a cover (13) configured to enclose a portion of the bottom portion (2b) and restrict downward movement of the at least one plunger (5) beyond the first position (FP). The cover (13) may be detachably connectable to the bottom portion (2b) or may be integrally defined on the bottom portion (2b).

[0056] Referring to Figures 6a and 6b in conjunction with Figures 7a and 7b, the actuation mechanism (100) comprises a plurality of actuating members (6) connectable to a portion of the at least one plunger (5) and connectable to a portion of the tool housing (2). Each actuating member (6) of the plurality of actuating members (6) may be structured to pivot relative to the tool housing (2) and may be connected to the at least one flange portion (52) to displace the at least one plunger (5) upon pivoting. In an embodiment, each of the plurality of actuating members (6) may be defined with an arm (63) extending toward the at least one plunger (5) as can be seen in Figure 7b. In an embodiment, the arm (63) may be integrally defined on the bottom portion (2b) or may be detachably coupled to the bottom portion (2b). Each actuating member (6) may be defined by one of an L-shaped profile, an arcuate profile, a V-shaped profile and the like, defined with an intermediate portion (61) connectable to the tool housing (2). For sake of explanation, the profile of each actuating member (6) of the plurality of actuating members (6) is depicted as an L-shaped profile extending upwards relative to the bottom portion (2b) of the tool housing (2). However, the plurality of actuating members (6) may extend downward relative to the bottom portion (2b) based on design requirements. In an embodiment, the bottom portion (2b) may be defined with one or more extensions extending from the bottom portion (2b) toward the top portion (2a) and configured to pivotally receive the intermediate portion (61) of the plurality of actuating members (6). The one or more

extensions may be integrally defined on the bottom portion (2b) or may be detachably coupled to the bottom portion (2b). The one or more extensions may be configured to restrict vertical displacement of the plurality of actuating members (6) and allow pivotal displacement of the plurality of actuating members (6).

[0057] Further, the plurality of actuating members (6) may be defined with one or more apertures (53) to connect to the at least one flange portion (52) and the one or more extensions correspondingly. In an embodiment, the at least one flange portion (52) may be defined with at least one slot to receive an end of the plurality of actuating members (6) as can be seen in Figure 7a. The plurality of actuating members (6) may be defined with a weight (62) on an other end opposite to the one end as can be seen in Figure 7b. In the illustrative embodiment, the weight (62) is defined away from the tool housing (2), where the plurality of actuating members (6) pivots relative to the at least one extension (24) due to centrifugal force of the weight (62) upon rotation speed of the tool assembly (200).

[0058] Referring now to Figures 8a to 8c, the actuation mechanism (100) is depicted to be engageable with the one or more second tools (4) as clearly seen in Figure 8b. The actuation mechanism (100) is configured to actuate the one or more second tools (4) based on rotational speed of the tool assembly (200). In an embodiment, the actuation mechanism (100) may actuate the one or more second tools (4) at a predetermined rotational speed of the tool assembly (200). Such a predetermined rotational speed of the tool assembly (200) may be proportional to the weight (62) defined on the plurality of actuating members (6) and force required to displace the at least one plunger (5) between the first position (FP) and the second position (SP). For example, the predetermined rotational speed of the tool assembly (200) may be in a range of 1100 to 1300 revolutions per minute [rpm] to operate the one or more second tools (4), where the one or more first tools (3) may be operated at a rotational speed in a range of 700 to 900 revolutions per minute [rpm].

[0059] The actuation mechanism (100) includes a set of two actuating members (6) or a set of three actuating members (6) and any number of actuating members (6) such that the weights on either side of the at least one plunger (5) are balanced by each other. The actuating members (6) may be defined radially where the plurality of actuating members (6) are equidistant from each other for balancing the weights. For example, radial distance between a set of two actuating members (6) may be in a range of 180 degrees to balance the weights on either side of the at least one plunger (5) as can be seen in Figure 8c. In the illustrative embodiment, the

one or more first tools (3) are depicted to engage with the workpiece at rotational speeds below the predetermined rotational speed, whereas the one or more second tools (4) are actuated at and above the predetermined rotational speed of the tool assembly (200) as can be seen in Figure 8c.

[0060] Further, the plurality of actuating members (6) may be pivoted about the one or more extensions to displace the at least one plunger (5) from the first position (FP) to the second position (SP) while the tool assembly (200) rotates at a speed equal to or above the predetermined rotational speed. The one or more second tools (4) are displaced radially to protrude from the guide member (8) and engage with the workpiece upon pivoting of the plurality of actuating members (6) as can be seen in Figure 8c. The plurality of actuating members (6) may pivot in a clockwise direction at a rotational speed of the tool assembly (200) below the predetermined rotational speed to displace the at least one plunger (5) from the second position (SP) to the first position (FP). Such displacement of the at least one plunger (5) may displace the one or more second tools (4) toward the tool housing (2) as can be seen in Figure 8b to disengage the one or more second tools (4) from the workpiece and engage the one or more first tools (3) with the workpiece.

[0061] Referring now to Figures 9a to 9d, the actuation mechanism (100) may include at least one first biasing member (7) positioned between the tool housing (2) and the at least one flange portion (52). The at least one first biasing member (7) may be configured to selectively bias the at least one plunger (5) based on rotation speed of the tool assembly (200). In an embodiment, the at least one first biasing member (7) may be configured to bias the at least one plunger (5) between the first position (FP) and the second position (SP) based on rotational speed of the tool assembly (200). In the illustrative embodiment, the at least one first biasing member (7) may be configured to bias the at least one plunger (5) from the second position (SP) to the first position (FP) while the rotational speed of the tool assembly (200) may be reduced to a rotational speed less than the predetermined rotational speed after rotation at or above the predetermined rotational speed. The tool assembly (200) may switch between the one or more first tools (3) and the one or more second tools (4) just by variation in rotational speed and may eliminate or substantially reduce time consumed in switching the tools.

[0062] Further, the actuation mechanism (100) may include at least one second biasing member (10) connectable between the at least one plunger (5) and at least one of the one or more first tools (3) and the one or more second tools (4). In an embodiment, the engaging member (9)

may be slidably coupled to inserts by a plurality of rods defined on the engaging member (9) and a plurality of apertures (53) as can be seen in Figure 9a. In an embodiment, the at least one plunger (5) may be defined with the at least one first portion (51) to engage and actuate the one or more second tools (4), where remaining portion of the at least one plunger (5) may be planar and may not engage with the one or more first tools (3) as can be seen in Figure 9b. The at least one second biasing member (10) may be positioned between the guide member (8) and the engaging member (9) to bias at least one of the one or more first tools (3) and the one or more second tools (4) based on engagement of the at least one first portion (51) and the at least one second portion (91). In the illustrative embodiment, the at least one second biasing member (10) is positioned between the engaging member (9) and the guide member (8) of the one or more second tools (4) to engage and actuate the one or more second tools (4) based on displacement of the at least one plunger (5). The at least one first biasing member (7) and the at least one second biasing member (10) may be compressed upon displacement of the at least one plunger (5) from the first position (FP) to the second position (SP) at or above the predetermined rotational speed of the tool assembly (200) as can be seen in Figure 9d. The at least one first biasing member (7) and the at least one second biasing member (10) may bias the at least one plunger (5) from the second position (SP) to the first position (FP) and bias the one or more second tools (4) towards the tool housing (2) respectively while the tool assembly (200) may be rotating below the predetermined rotational speed as can be seen in Figure 9c. Such biasing of the at least one plunger (5) and the one or more second tools (4) by the at least one first biasing member (7) and the at least one second biasing member (10) respectively may automatically disengage the one or more second tools (4) from the workpiece based on displacement of the at least one plunger (5) from the second position (SP) to the first position (FP) and may reduce lead time in machining the workpiece.

[0063] In an embodiment, the number of tools accommodated in the bottom portion (2b) may be varied based on design requirements, wherein the tools may be defined along longitudinal direction or radial direction and combinations thereof. Further, the at least one plunger (5) may be defined with a plurality of portions corresponding to the number of tools and position of the tools along the bottom portion (2b).

[0064] In an embodiment, the tool assembly (200) may include one or more stiffeners connectable between the bottom portion (2b) and the one or more second tools (4) to avoid

vibrations of the one or more second tools (4) upon engagement with the workpiece and avoid displacement of the one or more second tools (4) relative to the bottom portion (2b).

[0065] In an embodiment, the number of the plurality of actuating members (6) may be varied based on design requirements of the tool assembly (200).

[0066] In an embodiment, the engaging member (9) may be pivotally coupled to the bottom portion (2b) or the guide member (8) to pivot upon engagement with the at least one first portion (51) to displace the one or more second tools (4) upon displacement of the at least one plunger (5) between the first position (FP) and the second position (SP).

[0067] In an embodiment, the tool assembly (200) may automatically switch between tools accommodated in the tool housing (2) based on rotational speed of the tool assembly (200) and the time consumed in switching between tools may be substantially reduced or eliminated.

EQUIVALENTS

With respect to the use of substantially any plural and/or singular terms herein, those having skill in the art can translate from the plural to the singular and/or from the singular to the plural as is appropriate to the context and/or application. The various singular/plural permutations may be expressly set forth herein for sake of clarity.

It will be understood by those within the art that, in general, terms used herein, and especially in the appended claims (e.g., bodies of the appended claims) are generally intended as "open" terms (e.g., the term "including" should be interpreted as "including but not limited to," the term "having" should be interpreted as "having at least," the term "includes" should be interpreted as "includes but is not limited to," etc.). It will be further understood by those within the art that if a specific number of an introduced claim recitation is intended, such an intent will be explicitly recited in the claim, and in the absence of such recitation no such intent is present. For example, as an aid to understanding, the following appended claims may contain usage of the introductory phrases "at least one" and "one or more" to introduce claim recitations. However, the use of such phrases should not be construed to imply that the introduction of a claim recitation by the indefinite articles "a" or "an" limits any particular claim containing such introduced claim recitation to inventions containing only one such recitation, even when the same claim includes the introductory phrases "one or more" or "at least one" and indefinite articles such as "a" or "an" (e.g., "a" and/or "an" should typically be

interpreted to mean "at least one" or "one or more"); the same holds true for the use of definite articles used to introduce claim recitations. In addition, even if a specific number of an introduced claim recitation *is* explicitly recited, those skilled in the art will recognize that such recitation should typically be interpreted to mean *at least* the recited number (e.g., the bare recitation of "two recitations," without other modifiers, typically means *at least* two recitations, or *two or more* recitations). Furthermore, in those instances where a convention analogous to "at least one of A, B, and C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., "a system having at least one of A, B, and C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). In those instances where a convention analogous to "at least one of A, B, or C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., "a system having at least one of A, B, or C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). It will be further understood by those within the art that virtually any disjunctive word and/or phrase presenting two or more alternative terms, whether in the description, claims, or drawings, should be understood to contemplate the possibilities of including one of the terms, either of the terms, or both terms. For example, the phrase "A or B" will be understood to include the possibilities of "A" or "B" or "A and B."

In addition, where features or aspects of the disclosure are described in terms of Markush groups, those skilled in the art will recognize that the disclosure is also thereby described in terms of any individual member or subgroup of members of the Markush group.

While various aspects and embodiments have been disclosed herein, other aspects and embodiments will be apparent to those skilled in the art. The various aspects and embodiments disclosed herein are for purposes of illustration and are not intended to be limiting, with the true scope and spirit being indicated by the following claims.

Referral numeral:

Component	**Referral numeral**
Mechanism	100
Tool assembly	200
Shank	1
Tool housing	2

Top portion	2a
Bottom portion	2b
At least one first cavity	21
At least one second cavity	22
At least one third cavity	23
at least one extension	24
Cylindrical extensions	25
One or more first tools	3
One or more second tools	4
Tail portion	4a
At least one plunger	5
First end	5a
Second end	5b
First portion	51
Taper	51a
Flange portion	52
Apertures	53
Plurality of actuating members	6
Intermediate portion	61
weight	62
arm	63
At least one first biasing member	7
Guide member	8
Engaging member	9
Second portion	91
At least one second biasing member	10
Receiving member	11
Third portion	12
Cover	13
Longitudinal axis	AA’
First position	FP
Second position	SP

WE CLAIM:

1. An actuation mechanism (100) for a tool assembly (200) comprising a tool housing (2), one or more first tools (3), and one or more second tools (4), the actuation mechanism (100) comprising:

at least one plunger (5) slidably positioned in the tool housing (2), the at least one plunger (5) configured to displace between a first position (FP) and a second position (SP), to selectively engage at least one of the one or more first tools (3) and the one or more second tools (4); and

a plurality of actuating members (6) connectable to a portion of the at least one plunger (5), the plurality of actuating members (6) being pivotable relative to the tool housing (2) to displace the at least one plunger (5) from the first position (FP) to the second position (SP), and

wherein the at least one plunger (5) displaces to the second position (SP) and configured to engage and actuate the at least one of the one or more first tools (3) and the one or more second tools (4), on pivoting of the plurality of actuating members (6).

2. The actuation mechanism (100) as claimed in claim 1, wherein the at least one plunger (5) is defined with at least one flange portion (52) to receive one end of the plurality of actuating members (6).

3. The actuation mechanism (100) as claimed in claim 1, wherein the at least one plunger (5) is defined with at least one first portion (51) defined by a taper (51a), configured to engage and actuate with at least one of the one or more first tools (3) and the one or more second tools (4).

4. The actuation mechanism (100) as claimed in claim 3, comprises an engaging member (9) operatively coupled between the at least one plunger (5) and the one or more second tools (4).

5. The actuation mechanism (100) as claimed in claim 4, wherein the engaging member (9) having at least one second portion (91) configured to engage with the at least one first portion (51) to selectively displace the one or more second tools (4) based on displacement of the at least one plunger (5).

6. The actuation mechanism (100) as claimed in claim 2, comprises at least one first biasing member (7) positioned between the tool housing (2) and the at least one flange portion (52), the at least one first biasing member (7) is configured to selectively bias the at least one plunger (5) based on rotation speed of the tool assembly (200).

7. The actuation mechanism (100) as claimed in claim 2, wherein each actuating member (6) of the plurality of actuating members (6) is defined with a weight (62) on an other end opposite to the one end.

8. The actuation mechanism (100) as claimed in claim 1, wherein each of the plurality of actuating members (6) is defined by an arm (63) pivotably connectable to a portion of the tool housing (2), and wherein the plurality of actuating members (6) pivots relative to the tool housing (2).

9. The actuation mechanism (100) as claimed in claim 1, comprises at least one second biasing member (10) connectable between the at least one plunger (5) and at least one of the one or more first tools (3) and the one or more second tools (4), wherein the at least one second biasing member (10) is configured to bias at least one of the one or more first tools (3) and the one or more second tools (4) based on displacement of the at least one plunger (5).

10. A tool assembly (200) for a machine, comprising:

a shank (1) rotatably connectable to a portion of the machine;

a tool housing (2) defined with at least one first cavity (21) and at least one second cavity (22);

one or more first tools (3) connectable to the tool housing (2);

one or more second tools (4), slidably accommodated within the at least one first cavity (21);

an actuation mechanism (100), comprising:

at least one plunger (5) slidably positioned in the tool housing (2), the at least one plunger (5) configured to displace between a first position (FP) and a second position (SP), to selectively engage at least one of the one or more first tools (3) and the one or more second tools (4); and

a plurality of actuating members (6) connectable to a portion of the at least one plunger (5), the plurality of actuating members (6) being pivotable relative to the tool housing (2) to displace the at least one plunger (5) from the first position (FP) to the second position (SP), and

wherein the at least one plunger (5) displaces to the second position (SP) and configured to engage and actuate the at least one of the one or more first tools (3) and the one or more second tools (4), on pivoting of the plurality of actuating members (6).

Dated this 07th day of September 2023

-- Digitally Signed--
Bhanu Prasad
(INPA No: **3253**)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

ABSTRACT

“AN ACTUATION MECHANISM FOR A TOOL ASSEMBLY AND A TOOL ASSEMBLY THEREOF”

The present disclosure discloses an actuation mechanism (100) for a tool assembly (200). The tool assembly (200) comprises a shank (1), a tool housing (2), one or more first tools (3), one or more second tools (4), and an actuation mechanism (100). The actuation mechanism (100) comprises at least one plunger (5) and a plurality of actuating members (6). The at least one plunger (5) displaces between a first position (FP) and a second position (SP) to selectively engage at least one of the one or more first tools (3) and the one or more second tools (4), on pivoting of the plurality of actuating members (6). With such configuration, the tool assembly (200) may automatically switch tools accommodated in the tool housing (2) based on rotational speed of the tool assembly (200) and the time consumed in switching between tools may be substantially reduced or eliminated.

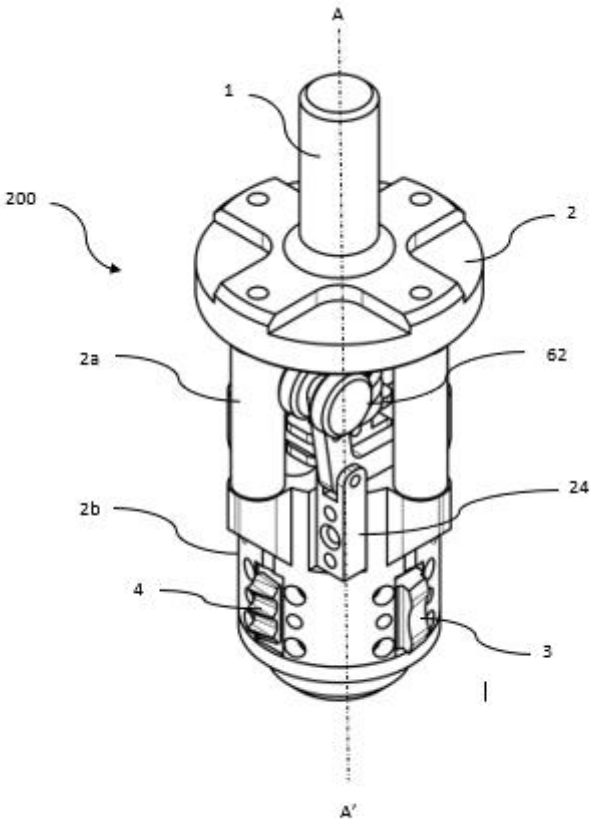

Figure 1a

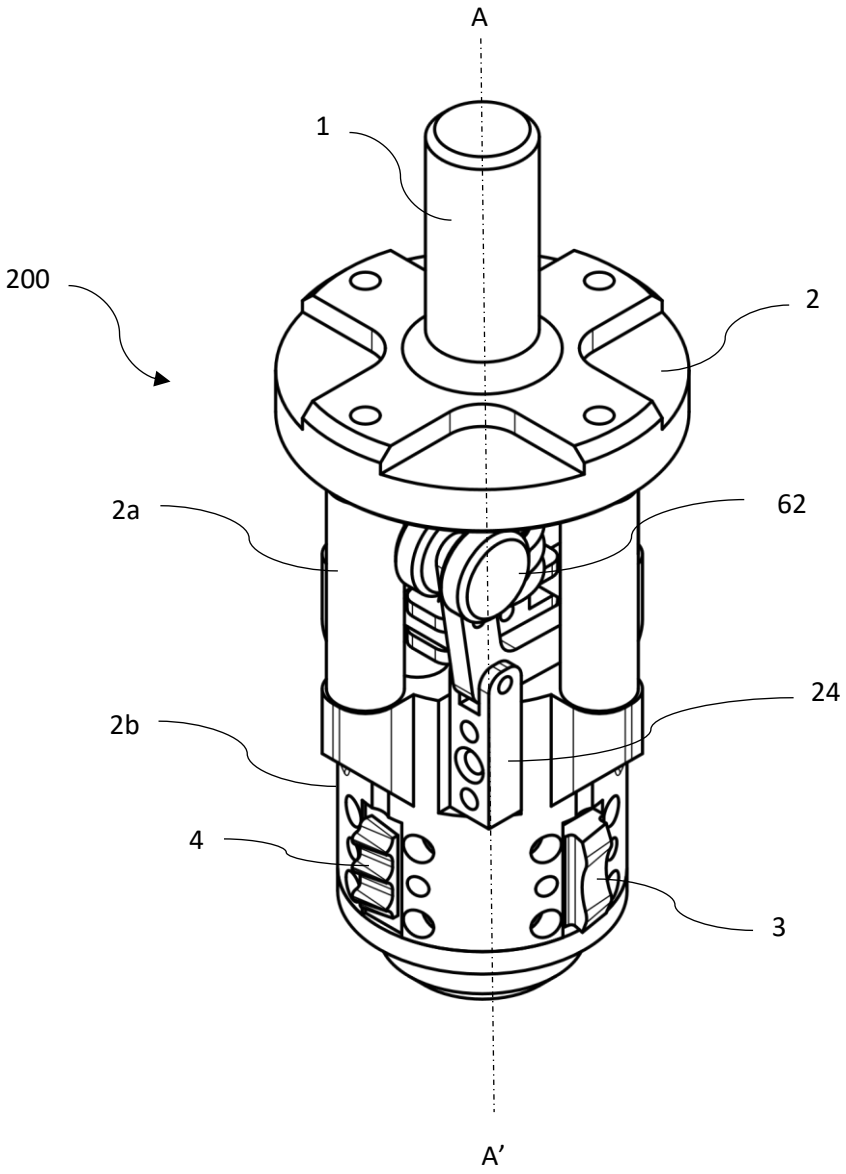

Figure 1a

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

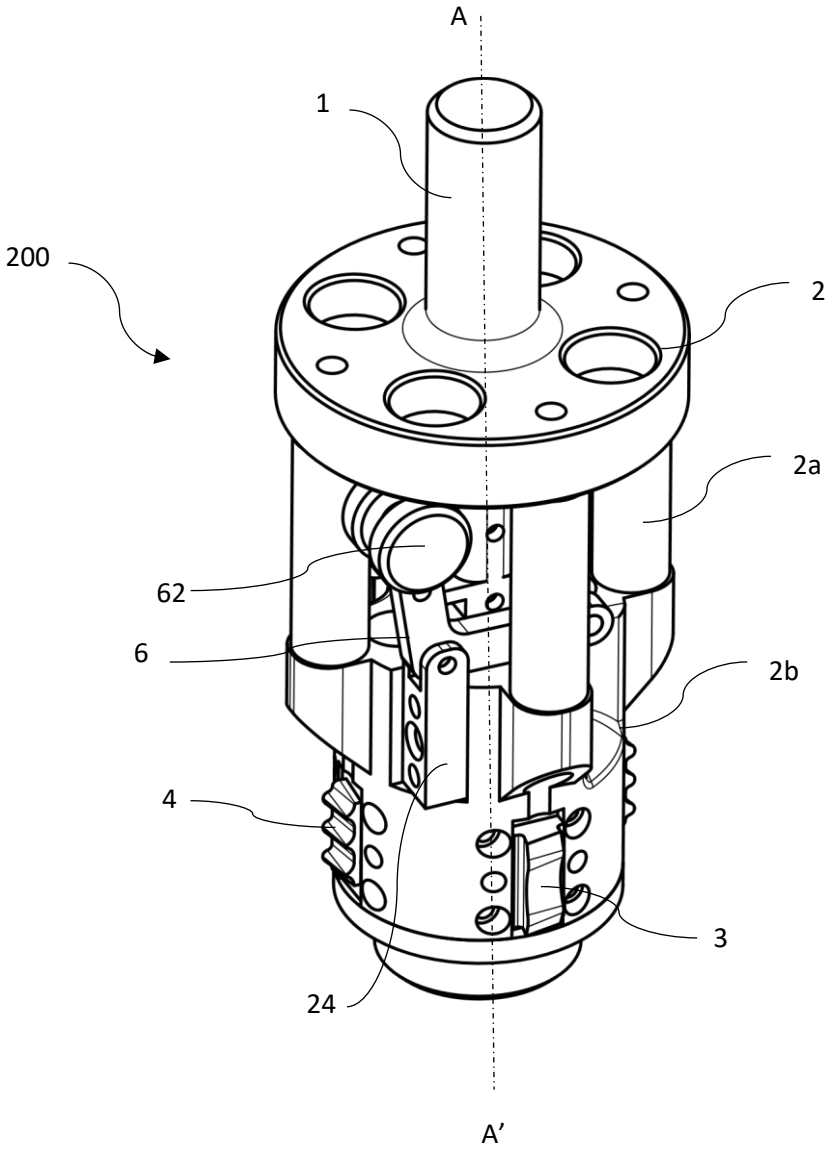

Figure 1b

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

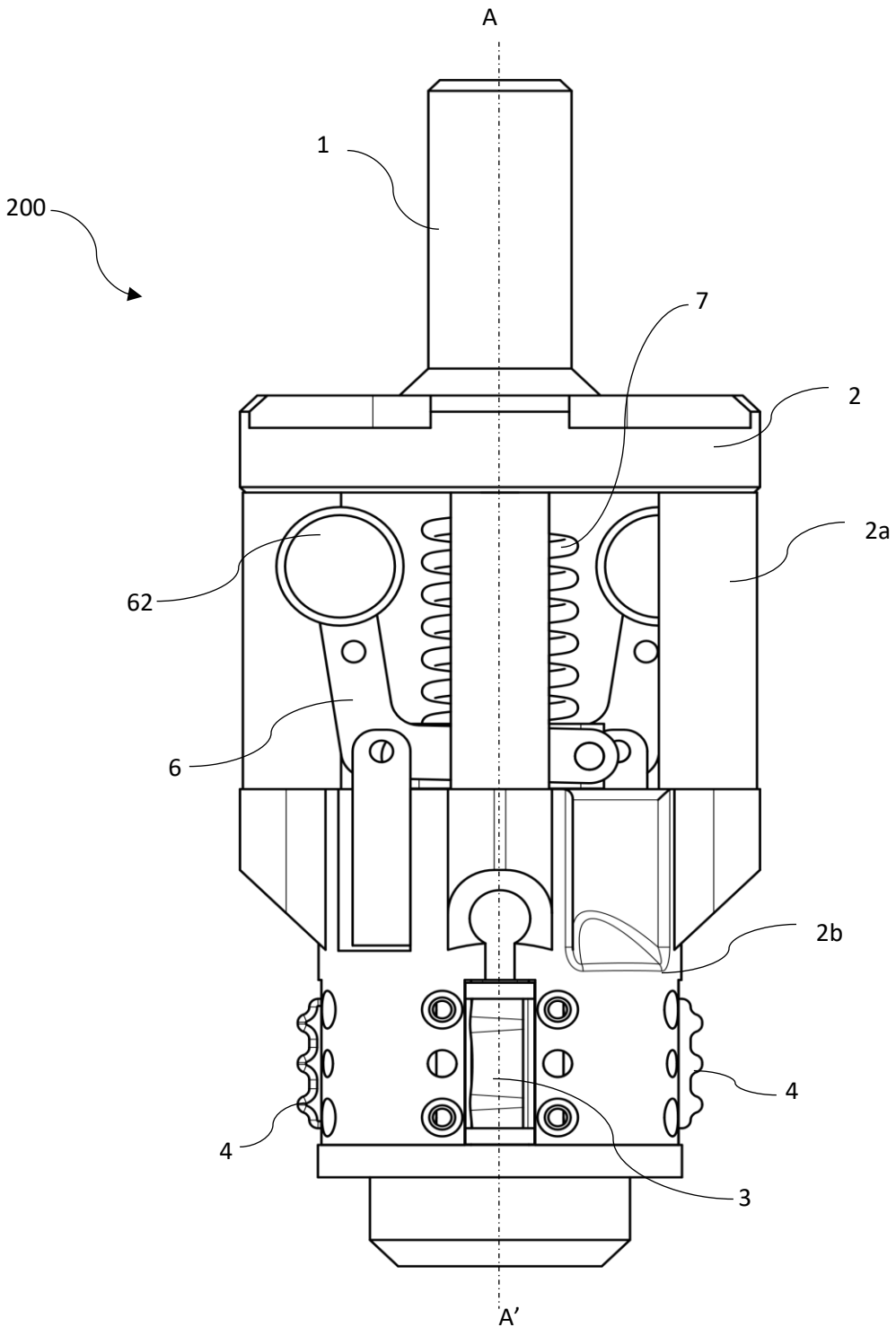

Figure 1c

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

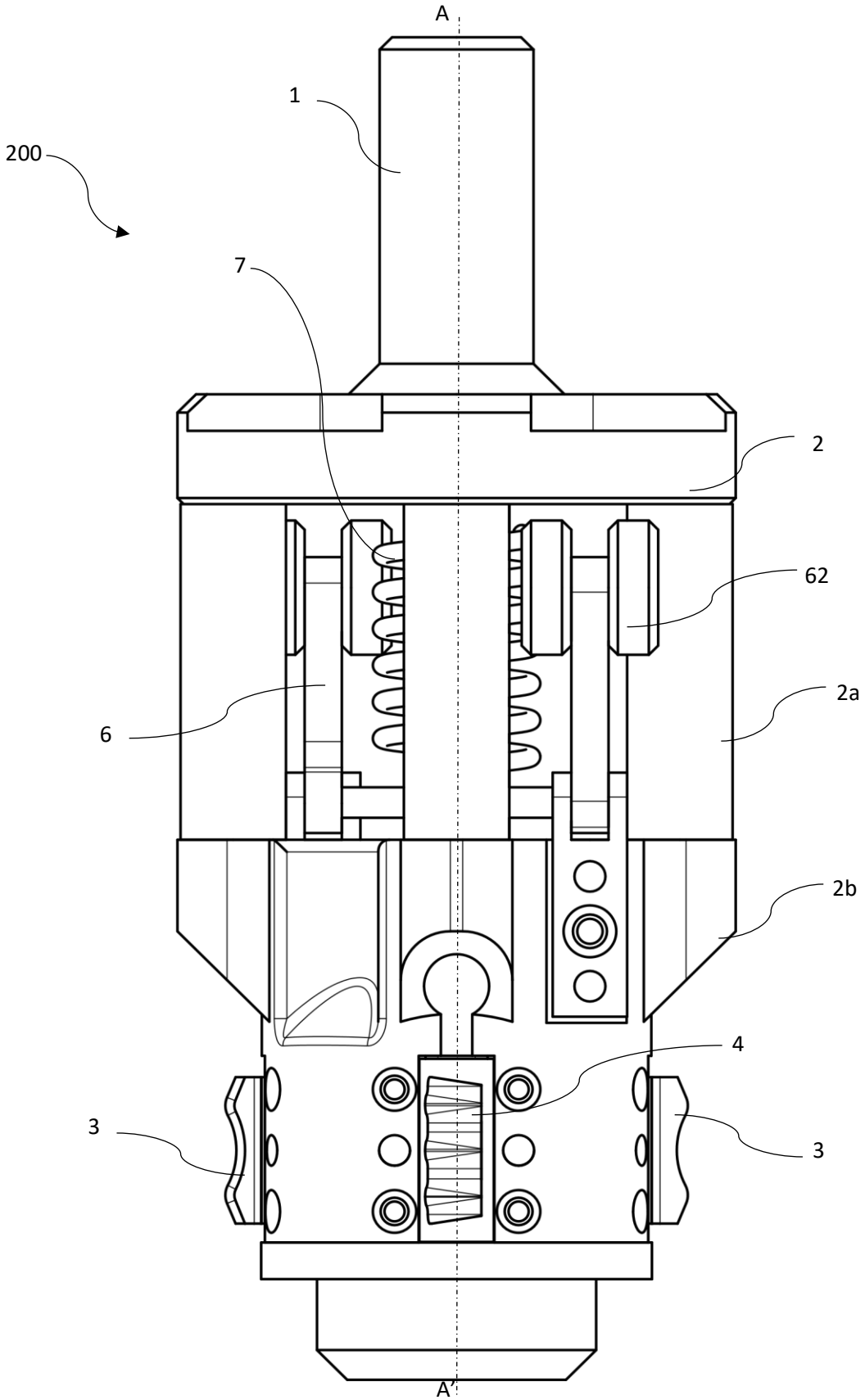

Figure 1d

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

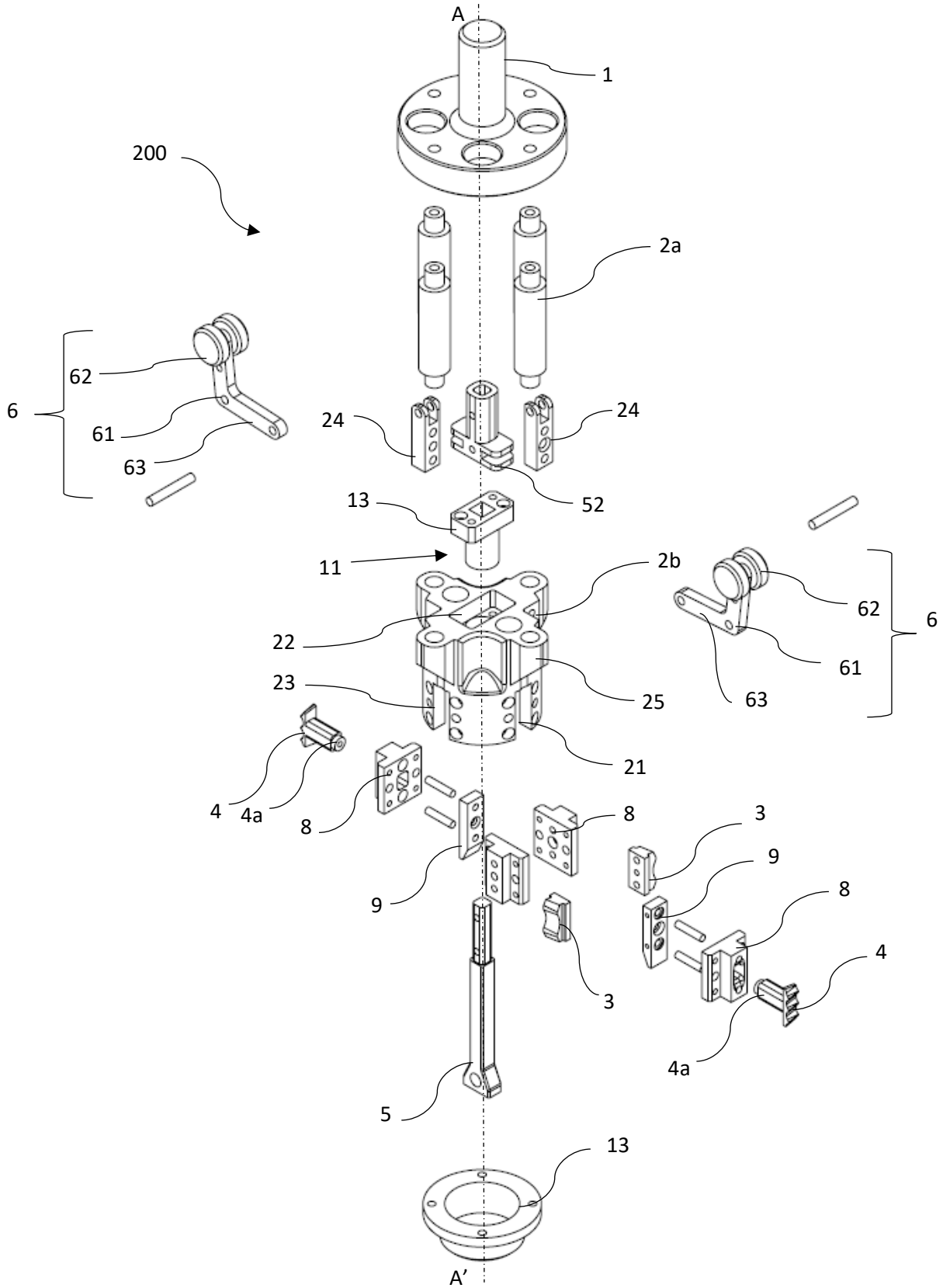

Figure 2a

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

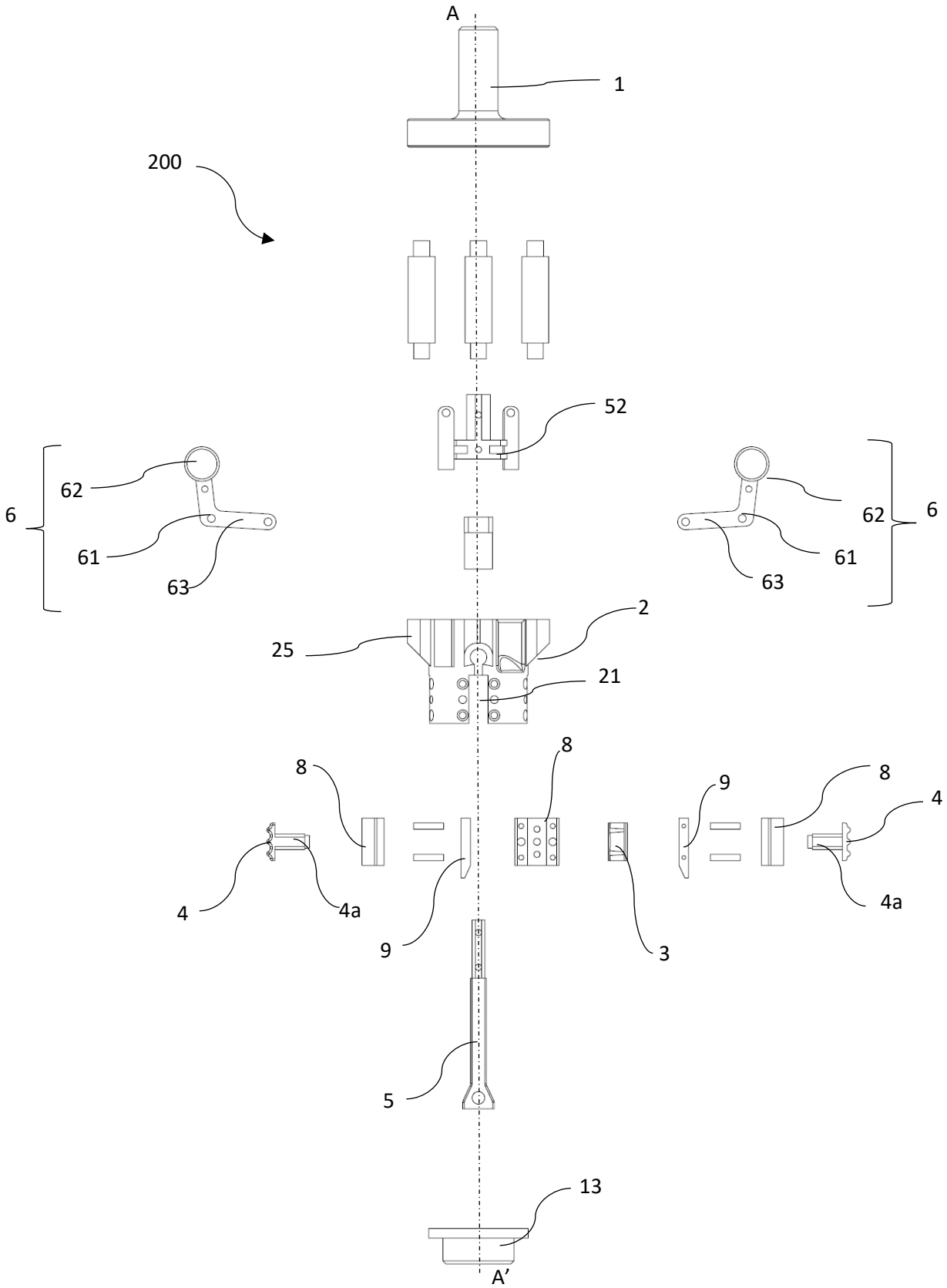

Figure 2b

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

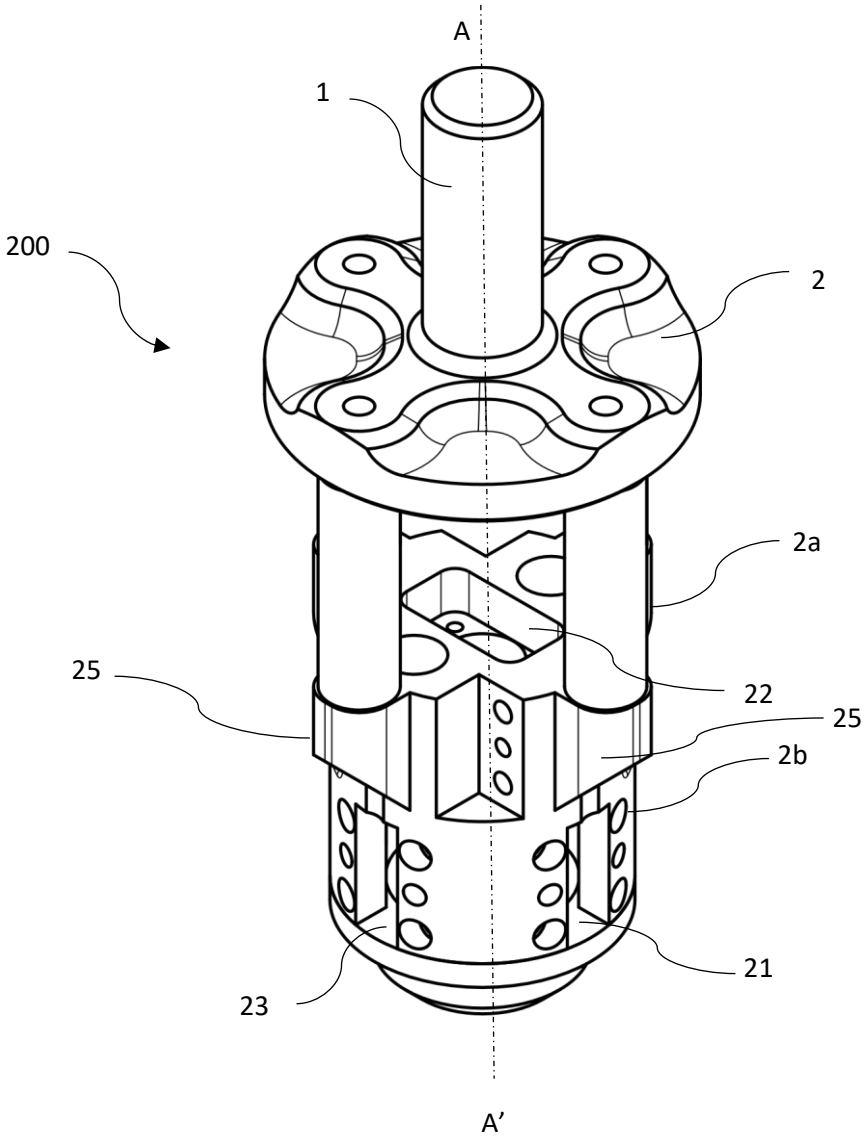

Figure 3

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

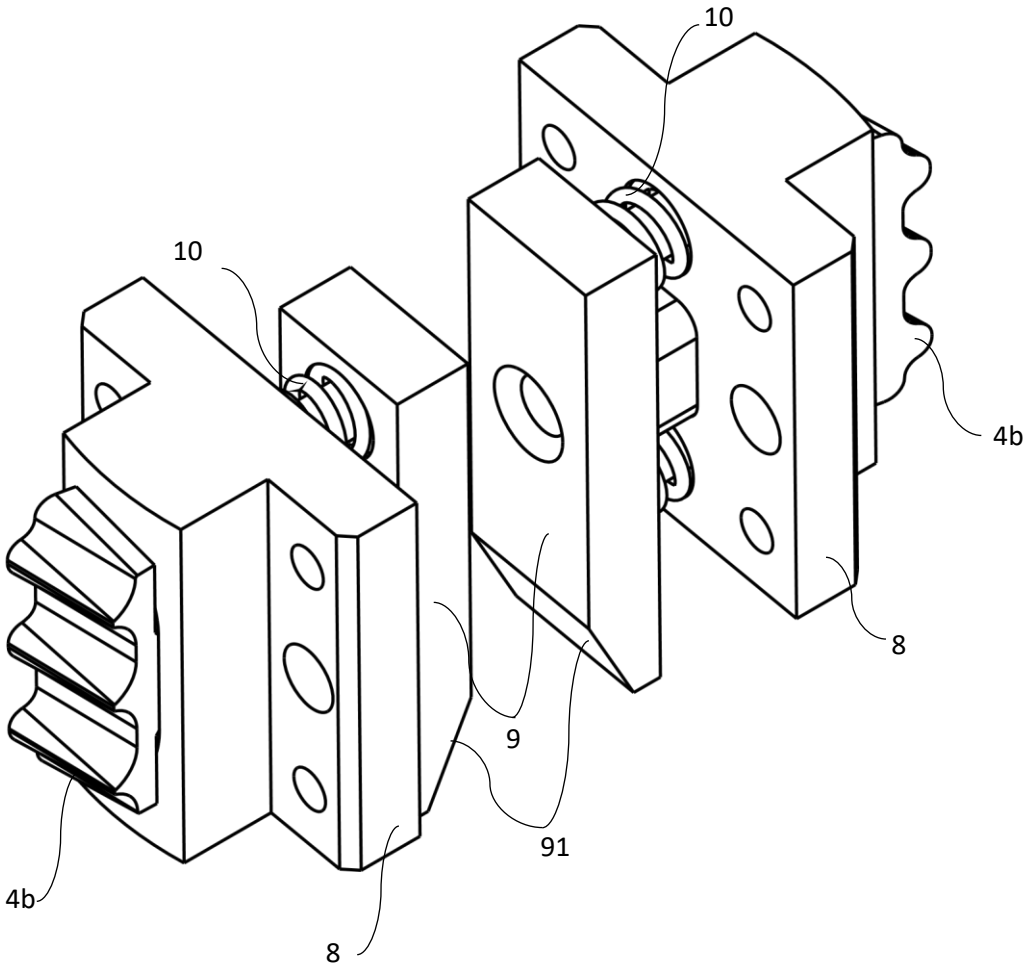

Figure 4a

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

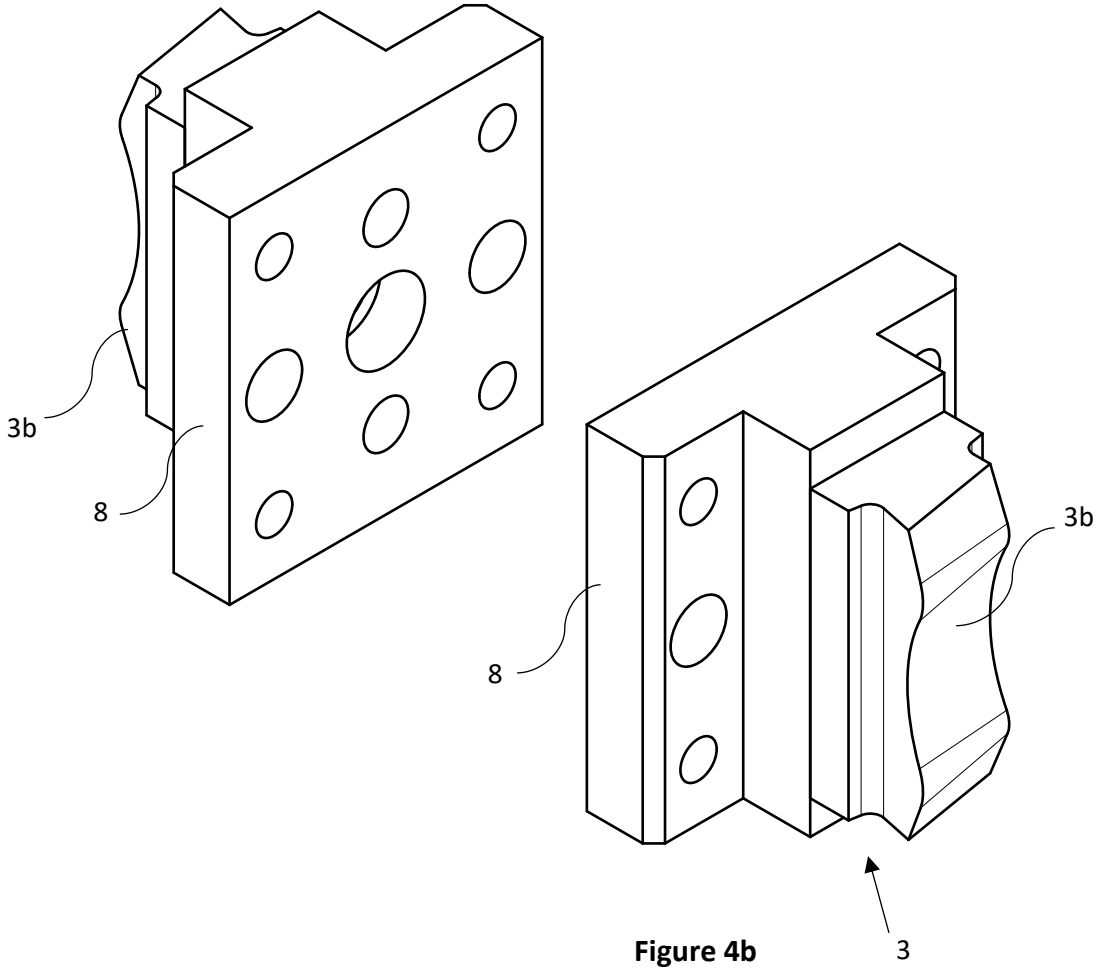

Figure 4b

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

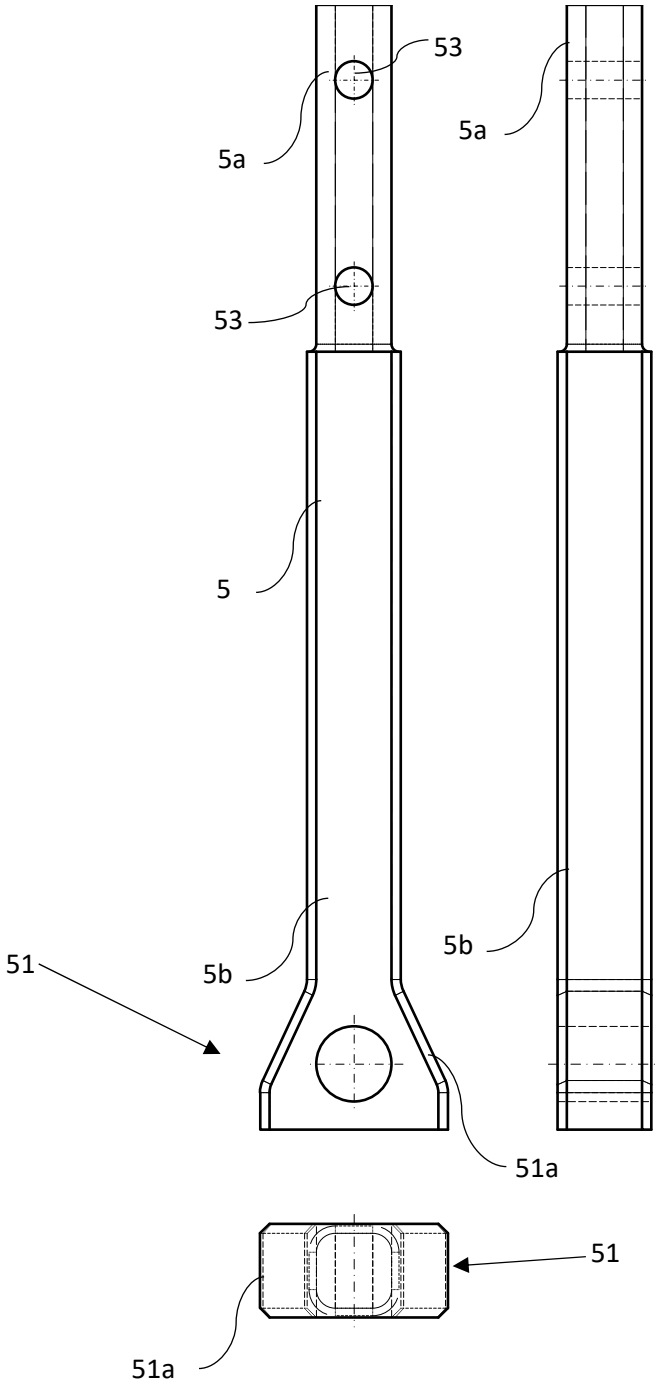

Figure 5a

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

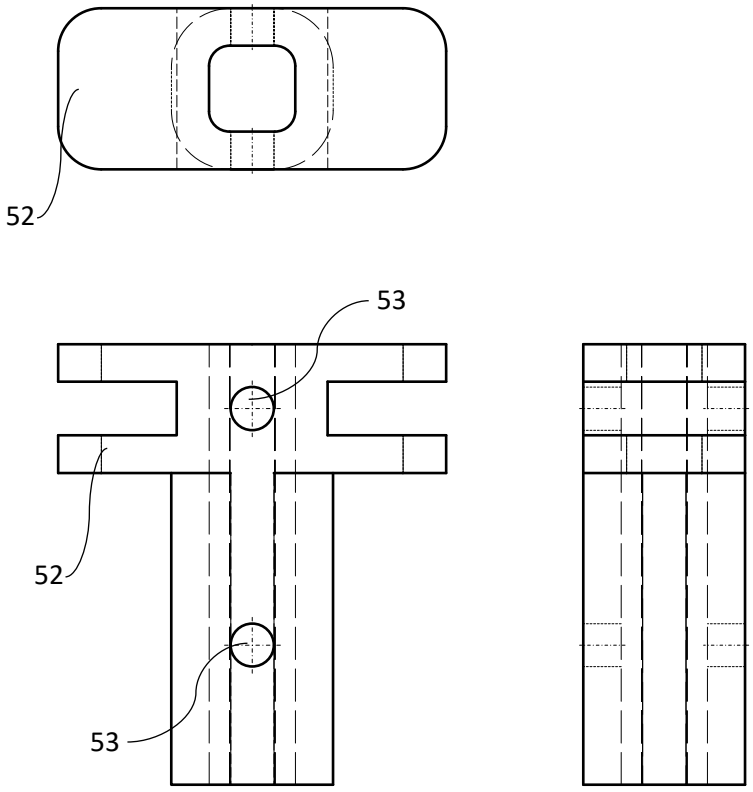

Figure 5b

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

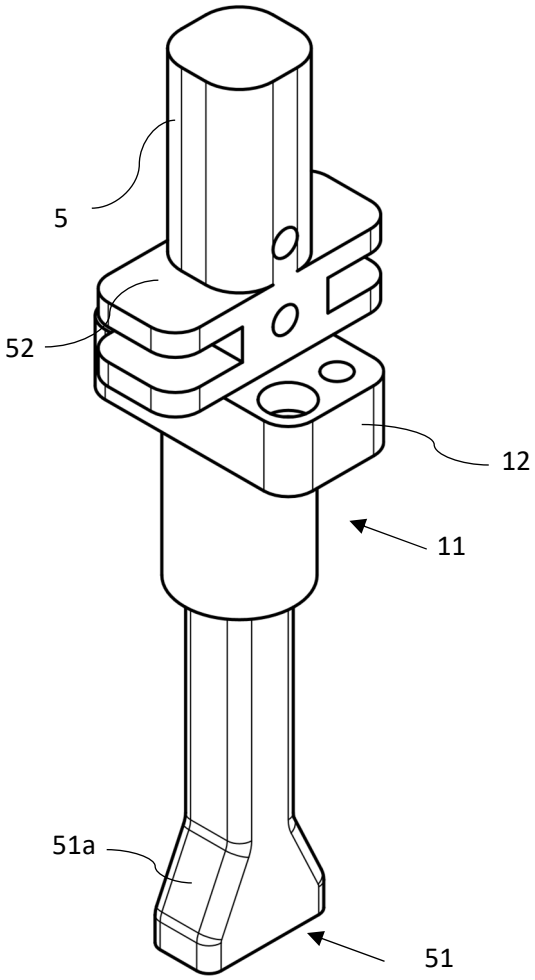

Figure 5c

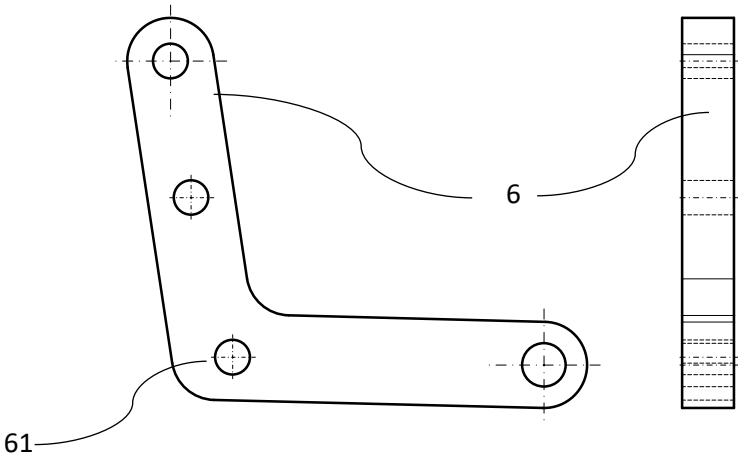

Figure 6a

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

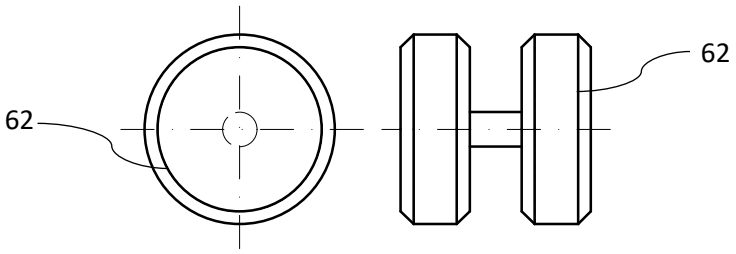

Figure 6b

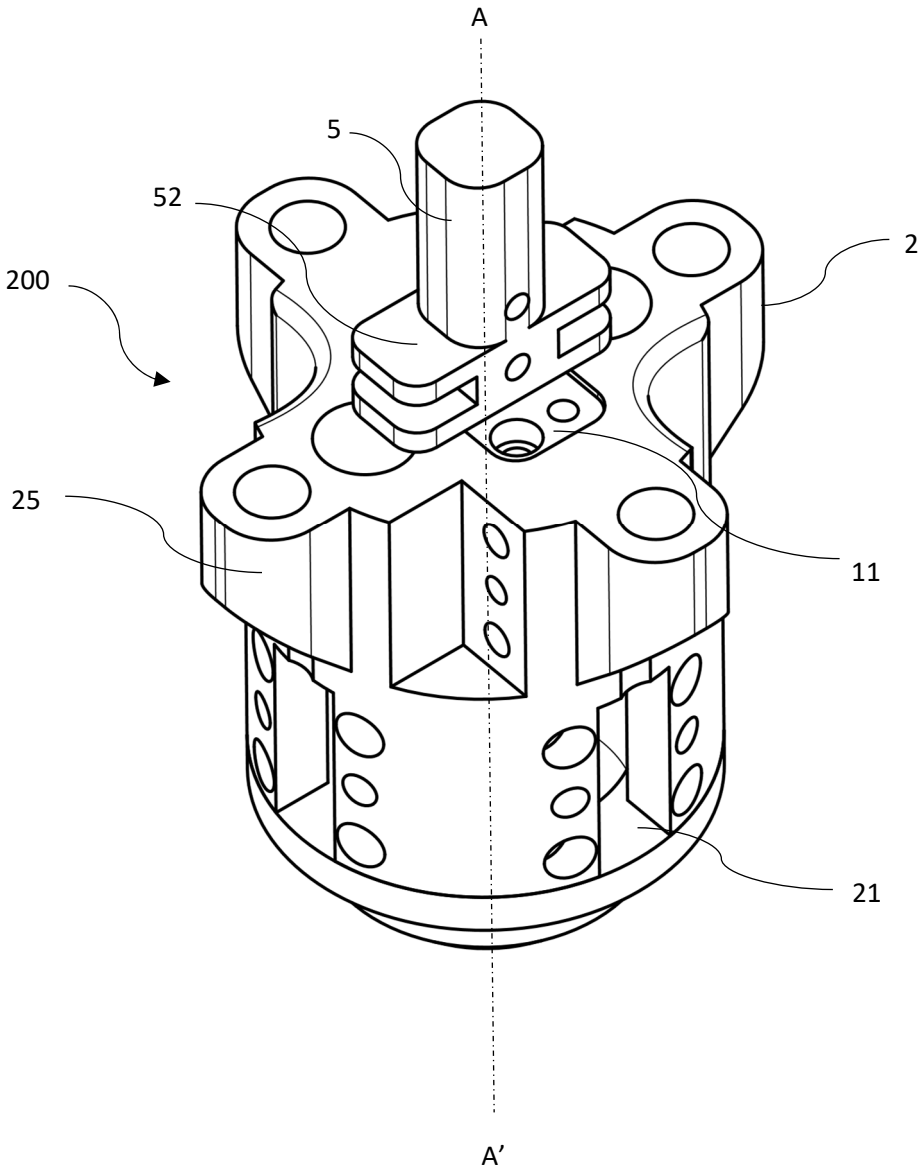

Figure 7a

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

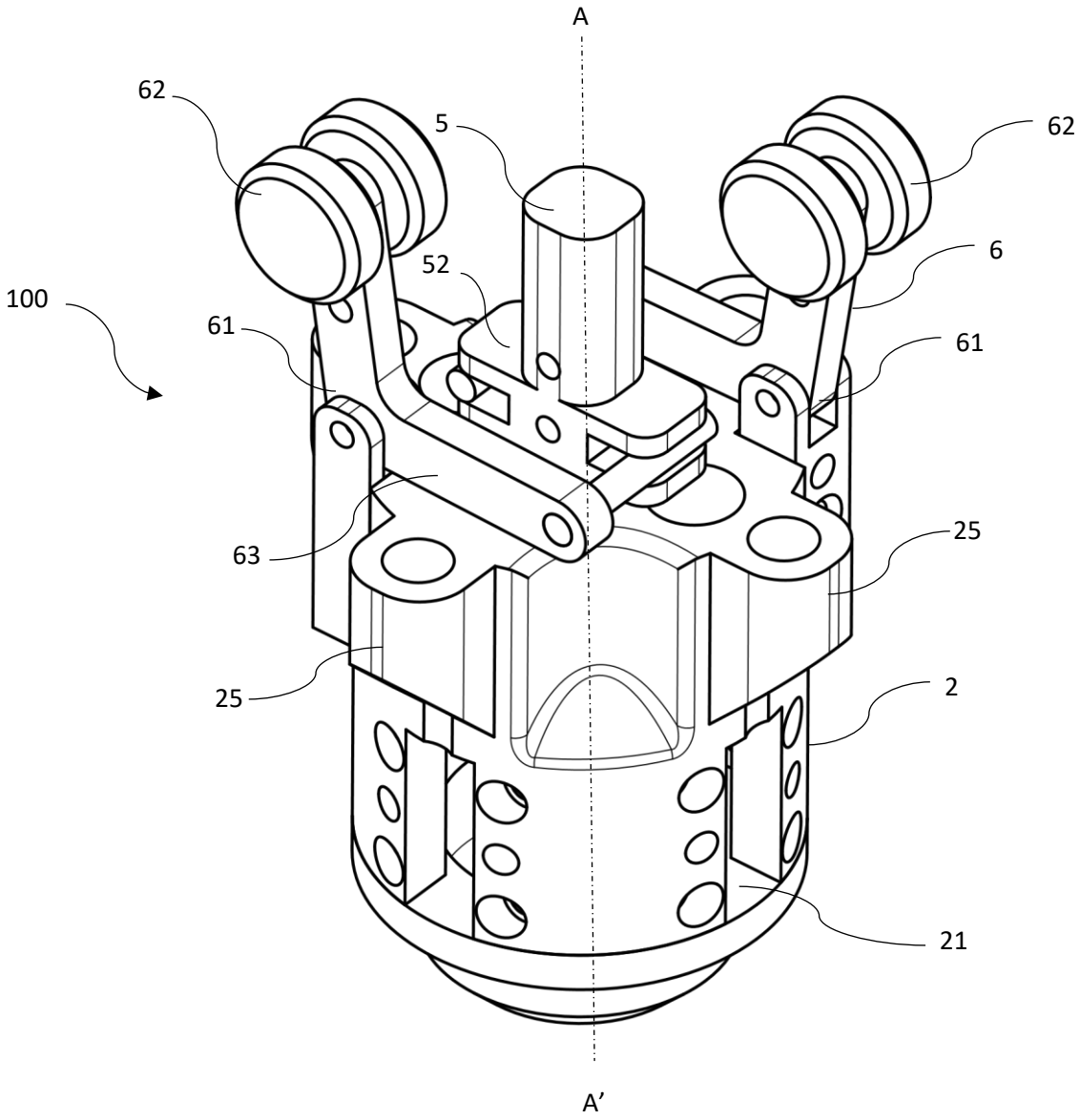

Figure 7b

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

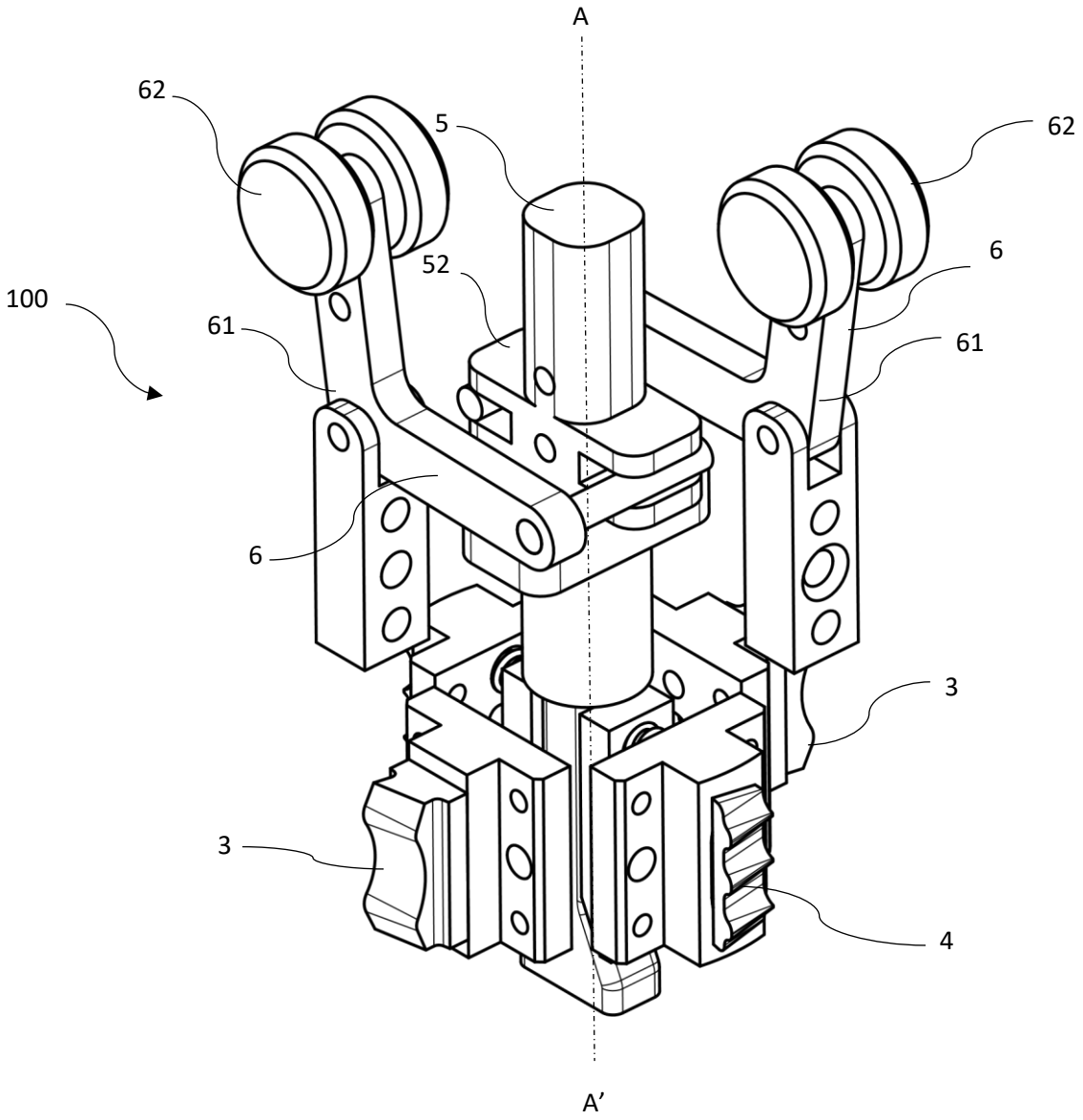

Figure 8a

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

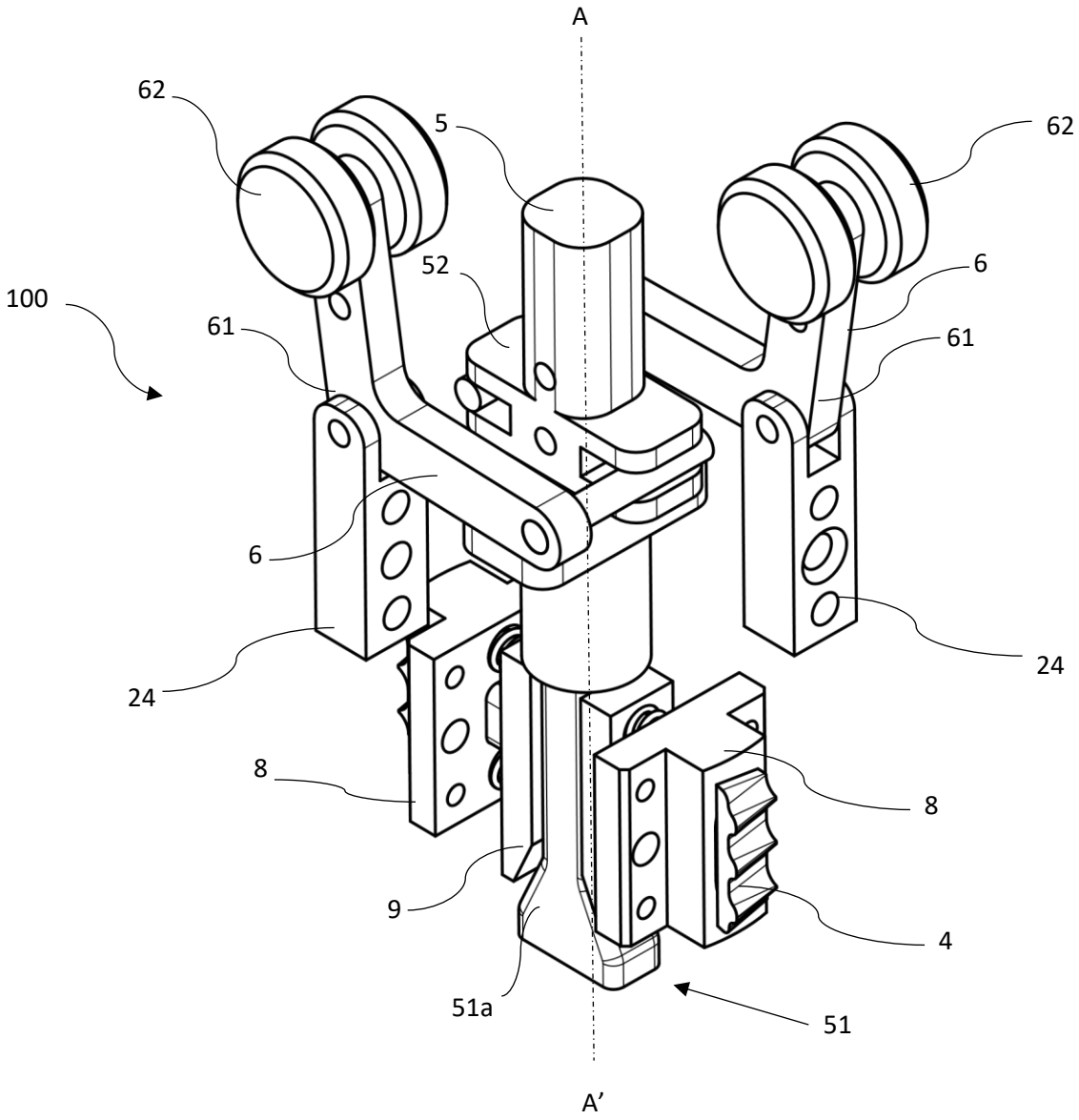

Figure 8b

--Digitally Signed--
Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

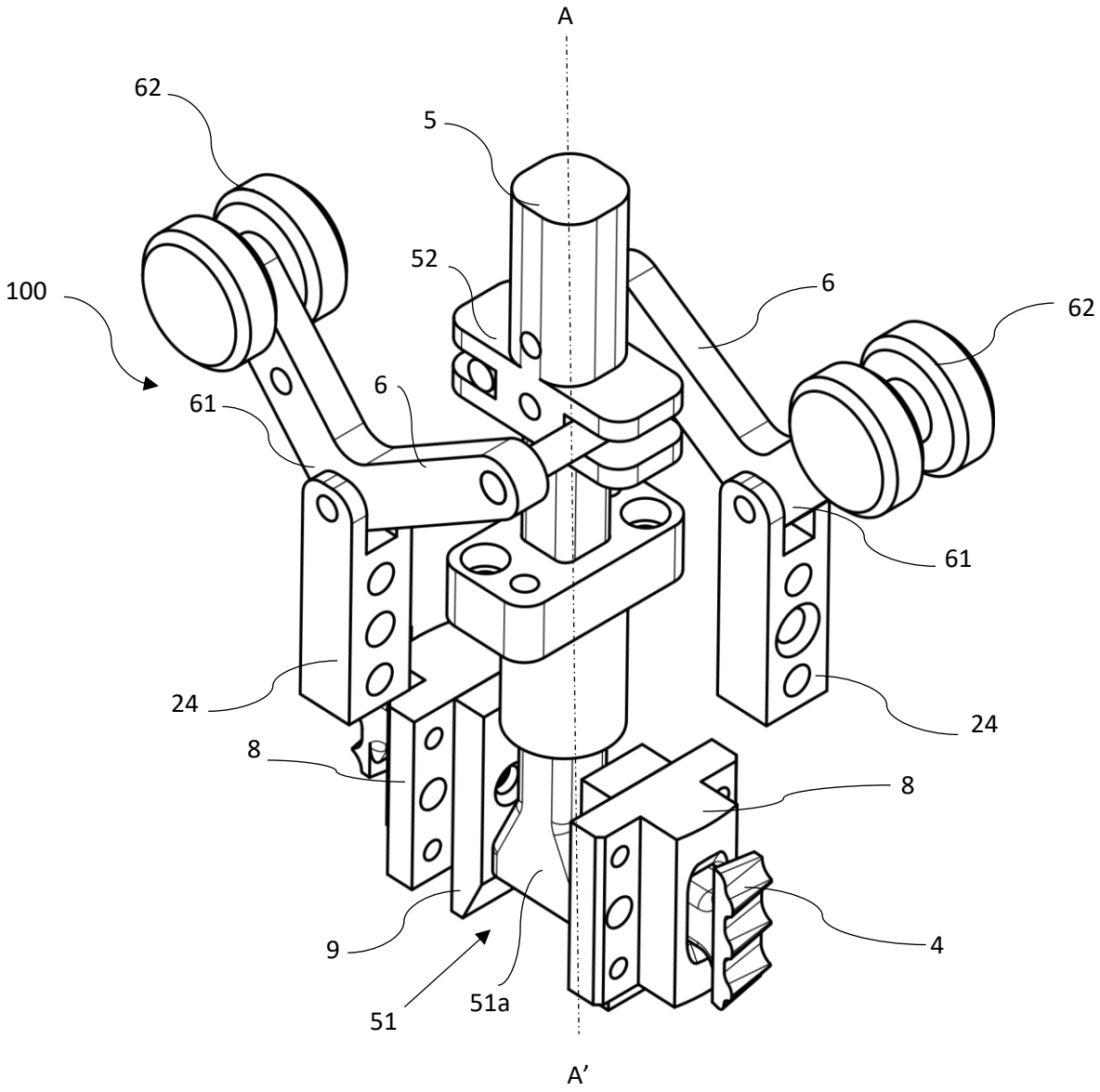

Figure 8c

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

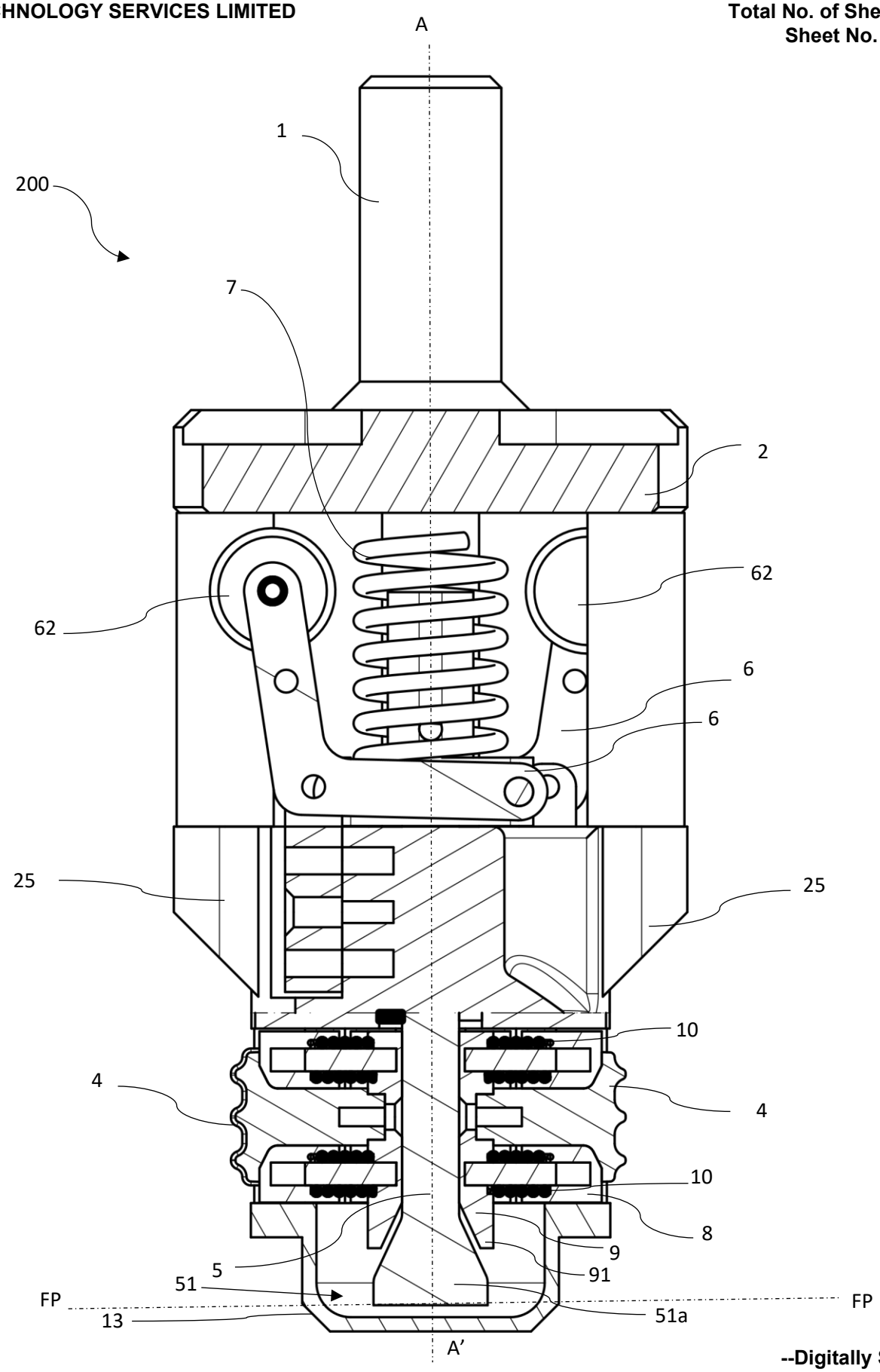

Figure 9a

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

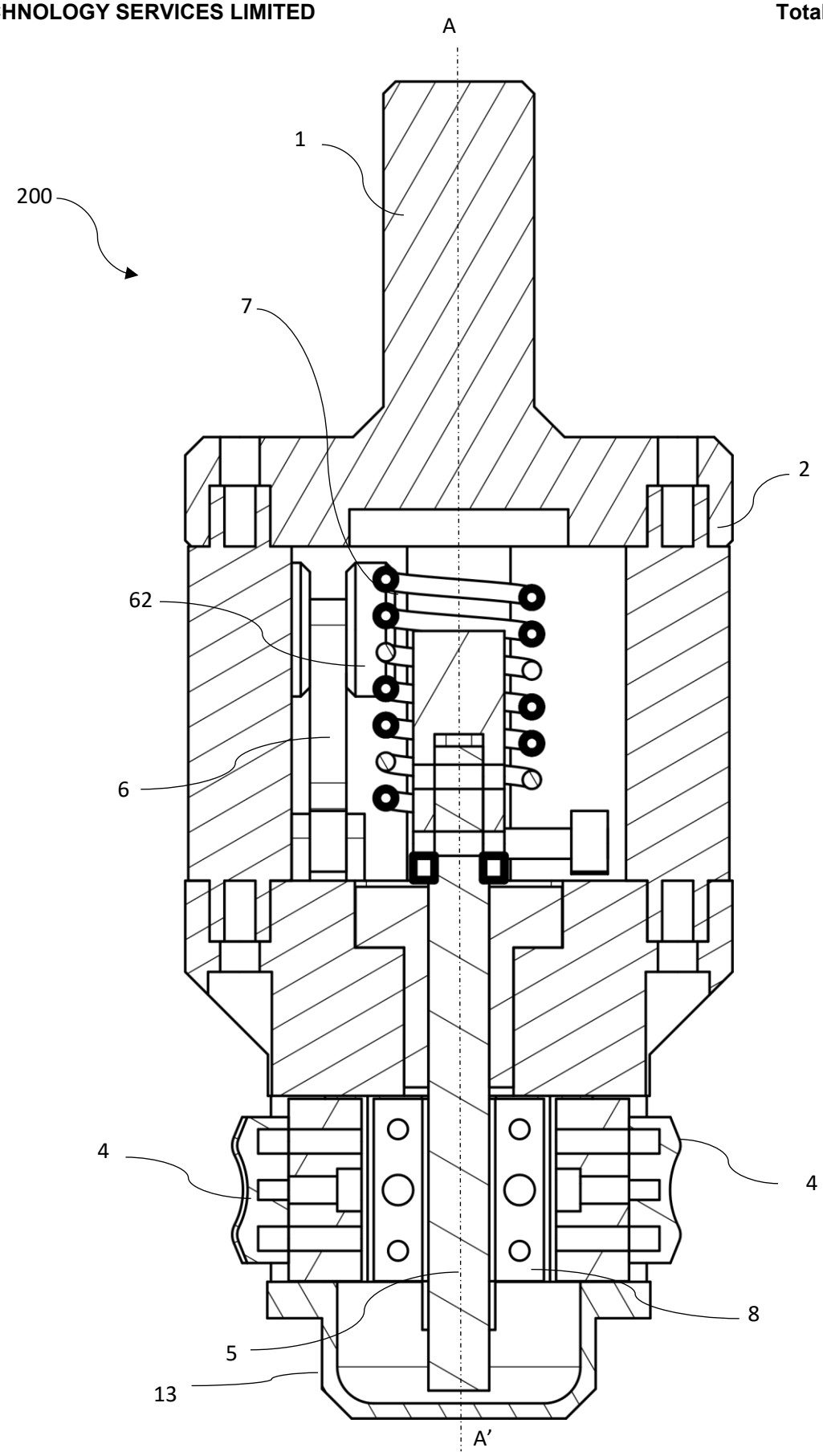

Figure 9b

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

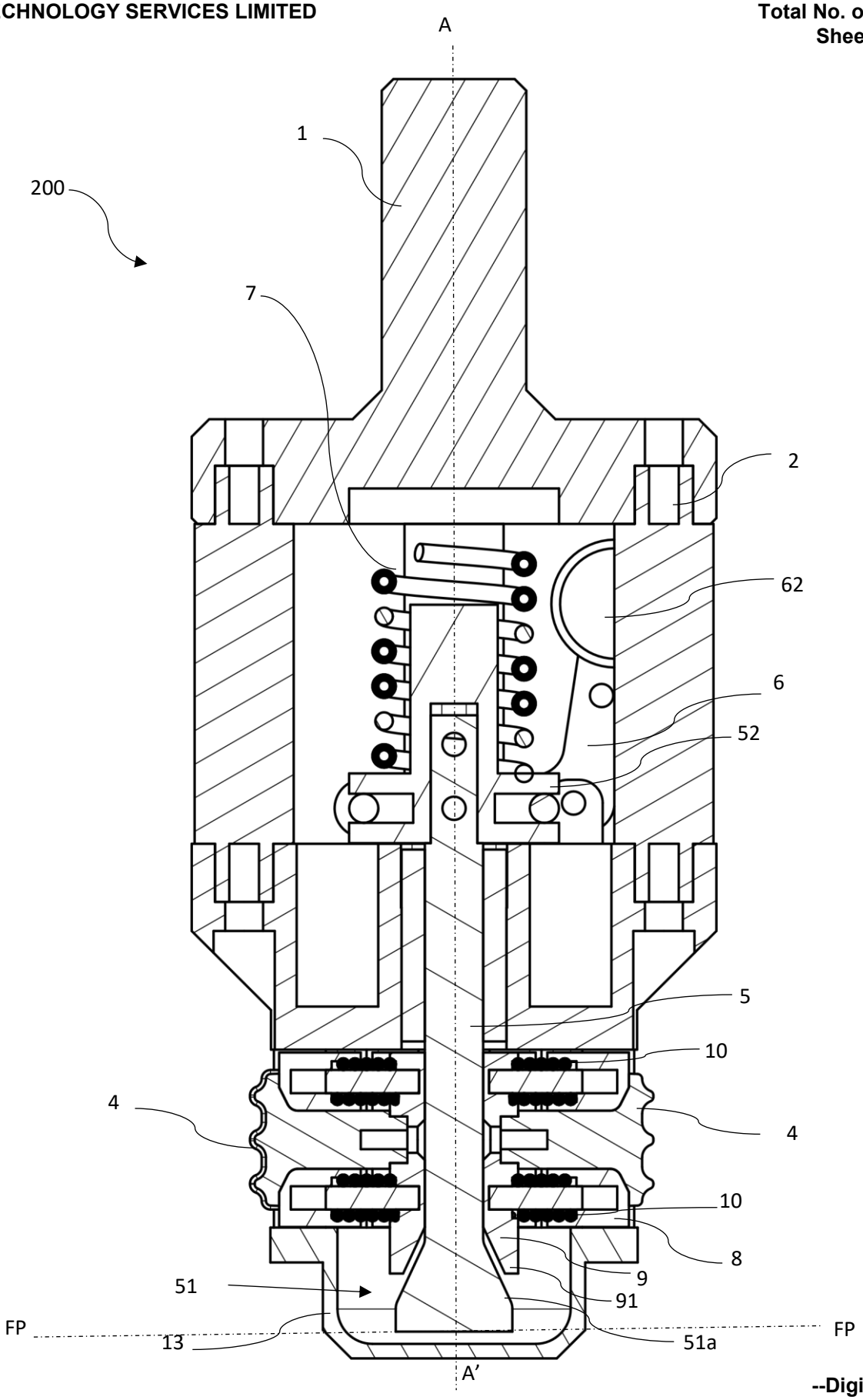

Figure 9c

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Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.

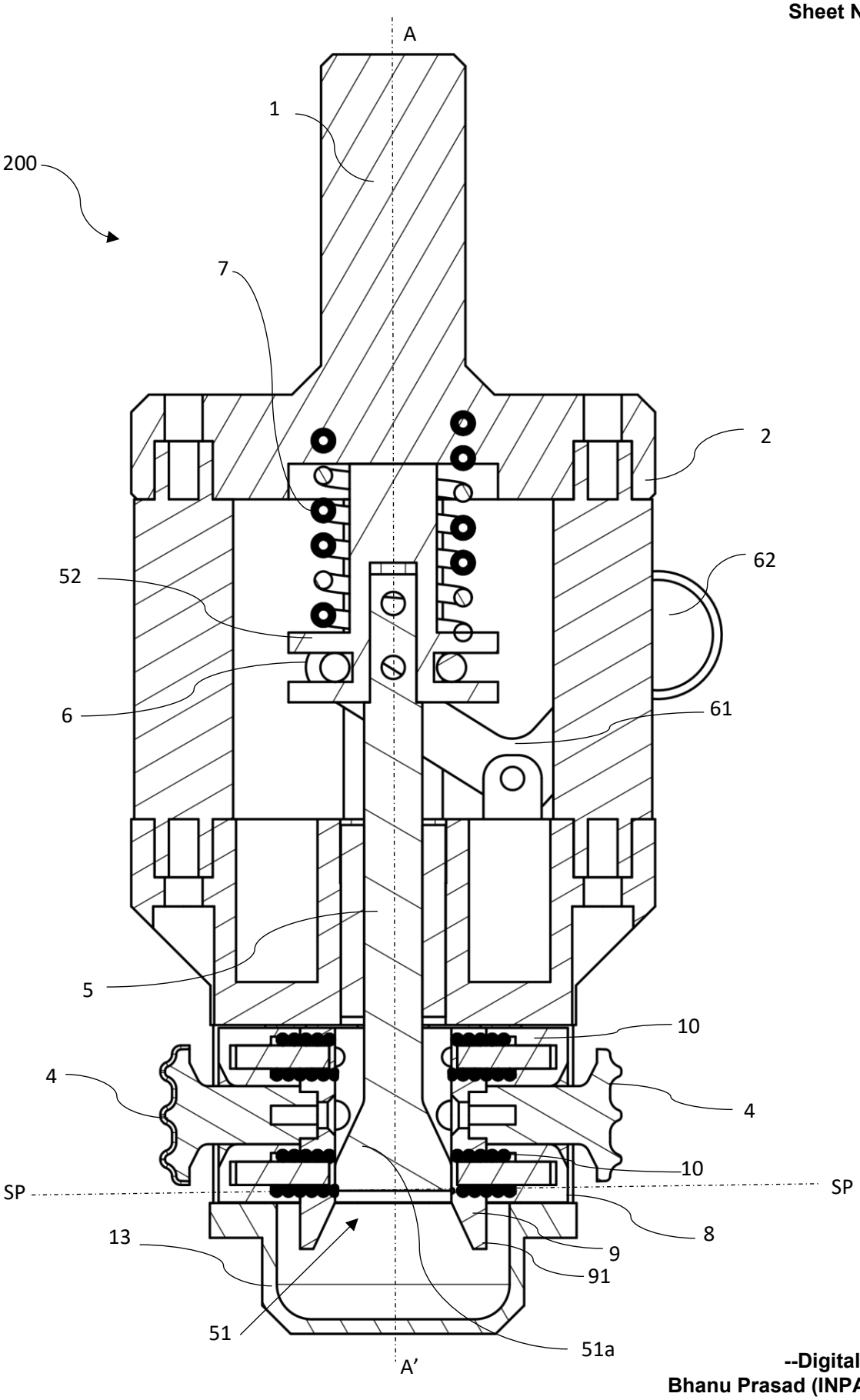

Figure 9d

--Digitally Signed--
Bhanu Prasad (INPA No: 3253)
Head, IPR Dept.,
L&T Technology Services Limited,
DLF 3rd Block, 2nd Floor,
Manapakkam, Chennai - 600089.