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(54) Title: TENSION FED FASTENER INSTALLATION TOOL AND RELATED METHODS OF USE

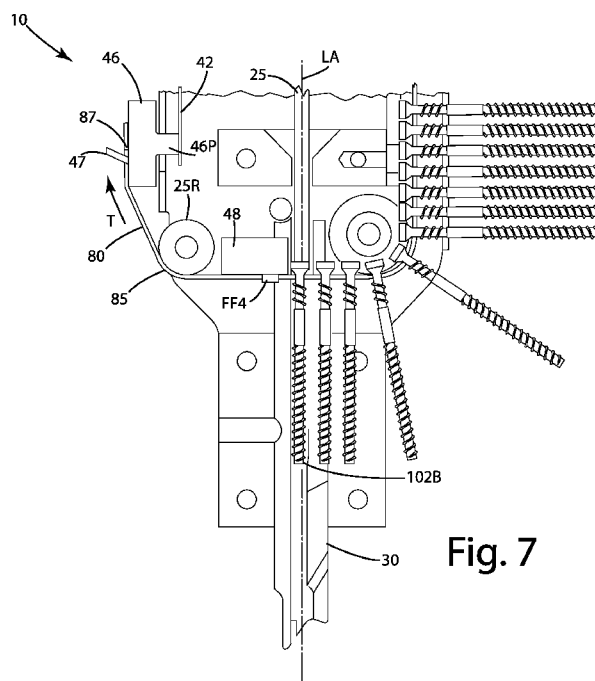


Fig. 7

(57) Abstract: An installation tool and related methods are provided. The tool can pull a strip of collated fasteners along a collated fastener path to a guide, where individual fasteners are sequentially separated from the strip and advanced into a workpiece. The tool can include a tension feeder located downstream of the guide. The tension feeder is configured to apply tension to the strip between the guide and a leading end of the strip. The tool can include a driveshaft configured to attach to a conventional drive tool chuck or a drive tool having hexagonal type drive components. The guide can be one piece and replaceable, with a guide body and a guide head. A strip slot can be defined in the same to align a fastener head with a backstop and facilitate entry of a fastener shank in a feed slot. Related methods of use are provided.



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What is claimed is:

1. A method of installing a fastener in a workpiece comprising:
 - providing an installation tool including a frame, a guide defining a bore configured to receive and constrain a fastener, and a tension feeder joined with the frame downstream of the bore;
 - providing a strip of collated fasteners, the strip including an elongated carrier and a plurality of fasteners disposed between a leading end and a trailing end;
 - engaging a head of the first fastener against a backstop;
 - applying tension to the carrier with the tension feeder to sequentially pull each of the plurality of fasteners into alignment with the bore, the tension applied below the head so that a tip of the first fastener swings toward a wall of the bore to align the first fastener with the bore;
 - advancing a first fastener from the plurality of fasteners through the bore and into a workpiece,
 - wherein during the advancing, the first fastener separates from the carrier.
2. The method of claim 1,
 - wherein the tension applied to the carrier is substantially the only force applied to sequentially pull each of the plurality of fasteners into alignment with the bore.
3. The method of claim 1,
 - wherein the guide includes a guide wall adjacent the bore,
 - wherein a first fastener includes a head and a shank,
 - wherein the carrier is joined with the shank, under the head,

wherein during the applying tension step, the head engages a backstop, and the carrier pulls the shank so as to tilt the shank against the guide wall so as to align the shank with the bore.

4. The method of claim 3,

wherein the carrier pulls the shank to create a moment about a point of contact of the head against the backstop, thereby rotating the shank in a plane within which a longitudinal axis of the fastener is disposed to align the fastener with the bore.

5. The method of claim 1, engaging a shank of the first fastener against the wall of the bore while the head engages the backstop.

6. The method of claim 1, comprising:

engaging a drive element against the first fastener during the advancing step;

rotating the first fastener with the drive element;

allowing the first fastener to exit the bore;

positioning a second fastener of the plurality of fasteners in the bore after the first fastener is advanced through the bore;

advancing the second fastener through the bore and into the workpiece.

7. The method of claim 1 comprising:

engaging only the leading end of the carrier with the tension feeder, and engaging no other part of the carrier with the tension feeder, to sequentially pull each of the plurality of fasteners into alignment with the bore, one at a time.

8. The method of claim 1 comprising:

engaging a first recess along a first edge of the elongated carrier with a first hook of an attachment element;

engaging a second recess along a second edge of the elongated carrier with a second hook of the attachment element,

wherein the first hook and second hook apply the tension directly to the elongated carrier.

9. The method of claim 1 comprising:

engaging a hold element of the tension feeder, the hold element adapted to retain an elongated member of the tension feeder temporarily in a fixed, extended position so that the elongated carrier can be joined with the elongated member,

wherein the hold element is adapted to release so that the elongated member can apply tension to the elongated carrier in the applying step.

10. A method of installing a fastener in a workpiece comprising:

attaching a tension feeder to only a leading end of a strip of collated fasteners;

pulling on the strip of collated fasteners at a location downstream of a guide defining a bore, with the tension feeder pulling on the carrier at only the location downstream of the guide, the strip including a carrier and a plurality of fasteners;

advancing a first fastener from the plurality of fasteners through the bore and into a workpiece;

wherein a trailing end of the carrier remains upstream of the guide during the pulling step.

11. The method of claim 10 wherein the trailing end of the carrier is guided in a channel.

12. The method of claim 11,

wherein a portion of the carrier between the trailing end and the guide is under no tension during the pulling step and during the advancing step.

13. The method of claim 12 comprising:

aligning the first fastener with the bore by engaging a head of the first fastener against a backstop of the guide and pulling on a shank of the first fastener with the carrier so that a tip of the first fastener swings into alignment with the bore.

14. The method of claim 13 comprising:

applying no force, from any location upstream of the guide, to move the carrier toward the guide.

15. The method of claim 10 comprising:

rolling the elongated member onto itself to form an elongated member roll.

16. The method of claim 15,

wherein the elongated member is joined with a tensioner spring,

wherein the tensioner spring retracts the elongated member toward the tensioner spring.

17. The method of claim 10 comprising:

securing a tension feeder pin to the carrier at a leading end of the strip; and

passively guiding a trailing end of the carrier upstream of the guide with a guide channel.

18. The method of claim 17,

wherein the carrier includes a leading edge and a trailing edge, and a downstream portion located downstream of the bore, and an upstream portion located upstream of the bore,

wherein a feeder is joined with the carrier near the leading edge,

wherein the feeder performs the pulling step,

wherein the feeder is the only part of the tool that moves the carrier past the bore,

wherein the carrier includes right and left sides,

wherein the right and left sides are void of notches along a continuous majority of a length of the carrier.

19. A fastener installation tool comprising:

a frame,

a guide joined with the frame, the guide defining a bore;

a backstop adjacent the bore;

a drive element adapted to advance a fastener through the bore, the fastener including a head and a shank; and

a tension feeder joined with the frame, the tension feeder configured to pull a strip of collated fasteners including a carrier along a collated fastener path, the tension feeder located downstream of the bore and configured to apply tension to a portion of the strip between the bore and a leading end of the strip,

wherein the backstop is configured to engage the head of the fastener so that the carrier pulls the shank to create a moment about a point of contact of the head against the backstop, thereby rotating the shank in a plane within which a longitudinal axis of the fastener is disposed to align the fastener with the bore.

20. The fastener installation tool of claim 19 comprising:

a guide wall adjacent the bore; and

a fastener stop adjacent the guide wall,

wherein the fastener stop is configured to arrest movement of a fastener along the collated fastener path so that a tip of the fastener swings into alignment with the bore.

21. A fastener installation tool comprising:

a frame,

a guide joined with the frame, the guide defining a bore;

a feeder joined with the frame, the feeder configured to move a strip of collated fasteners along a collated fastener path past the guide;

a drive element adapted to advance a fastener through the bore; and

a driveshaft extending through the frame from an installation end adjacent the drive element to a drive end including a main drill drive attachment body,

wherein the main drill drive attachment body includes an exterior surface configured to engage a chuck of a first drive tool when the main drill drive attachment body is inserted within the chuck,

wherein the main drill drive attachment body has a first dimension taken perpendicular to a longitudinal axis of the driveshaft, the first dimension measured from a first portion of the exterior surface to a second portion of the exterior surface across the longitudinal axis of the driveshaft,

wherein the main drill drive attachment body defines a socket configured to receive and rotationally restrain a replaceable drive bit, so that a first portion of the replaceable drive bit extends into the driveshaft, and so that a second portion of the replaceable drive bit extends outward beyond the main drill drive attachment body for attachment to a chuck of a second drive tool,

wherein the socket has a second dimension taken perpendicular to the longitudinal axis of the driveshaft, the second dimension being less than the first dimension,

whereby an operator of the fastener installation tool can selectively connect either the chuck of the first drive tool to the exterior surface of the main drill drive attachment body, or the chuck of the second drive tool to the second portion of the replaceable drive bit that extends outward beyond the main drill drive attachment body, depending on which drive tool is available to the operator.

22. The fastener installation tool of claim 21 comprising a locking element that releasably engages an annular recess of the replaceable drive bit to secure the replaceable drive bit to the main drill drive attachment body.

23. The fastener installation tool of claim 22,
wherein the locking element includes a locking ring slidable along the longitudinal axis and a spring configured to engage the locking ring to a locked mode,

wherein in the locked mode, the locking ring urges a ball into the annular recess of the replaceable drive bit so that the bit cannot be removed from the socket.

24. The fastener installation tool of claim 21,
wherein the socket is hexagonal in shape, and
wherein the exterior surface includes a plurality of angled facets configured to interface with a plurality of corresponding surfaces of the chuck of the first drive tool.

25. The fastener installation tool of claim 21,
wherein the first portion of the replaceable drive bit includes a drive feature that is at least one of usable and worn out,

wherein the drive feature is concealed within the driveshaft when the replaceable drive bit is received in the socket,

wherein the second portion of the replaceable drive bit, that extends outward beyond the main drill drive attachment body, is hexagonal in shape.

26. The fastener installation tool of claim 21,
wherein the frame includes a handle,
wherein the frame surrounds the driveshaft so as to prevent operator contact with the driveshaft when the driveshaft rotates.

27. The fastener installation tool of claim 21,

wherein the drive element includes another replaceable drive bit and is configured to fit within another socket defined in the installation end of the driveshaft.

28. A fastener installation tool comprising:

a guide defining a bore,

a driveshaft having an installation end and a drive end distal from the installation end, the drive end including a main drill drive attachment body,

a guide defining a bore adjacent the installation end;

wherein the main drill drive attachment body includes an exterior surface configured to engage a chuck of a first drive tool;

wherein the main drill drive attachment body defines a socket configured to receive and rotationally restrain a replaceable drive bit, so that at least one of a worn out and a usable drive feature of the replaceable drive bit extends in the driveshaft, and so that a second portion of the replaceable drive bit extends outward beyond the main drill drive attachment body for attachment to a chuck of a second drive tool,

whereby an operator of the fastener installation tool can selectively connect either the chuck of the first drive tool to the exterior surface of the main drill drive attachment body, or the chuck of the second drive tool to the second portion of the replaceable drive bit that extends outward beyond the main drill drive attachment body, depending on which drive tool is available to the operator.

29. The fastener installation tool of claim 28 comprising:

a feeder joined with the frame, the feeder configured to move a strip of collated fasteners sequentially along a collated fastener path past the guide.

30. A method of using a fastener installation tool comprising:

providing a fastener installation tool including a guide defining a bore, and a driveshaft having an installation end and a drive end distal from the installation end, the drive end including a main drill drive attachment body,

installing a first replaceable bit adjacent or in the installation end;

installing a second replaceable bit in a socket defined by the main drill drive attachment body, so that at least one of a usable and a worn out drive feature is inaccessible and disposed within the driveshaft, and so that a second portion extends from the main drill drive attachment body;

joining a first drive tool with the second portion;

rotating the first replaceable bit; and

advancing a fastener through the bore with the first replaceable bit.

31. The method of claim 30 comprising:

moving a strip of collated fasteners along a collated fastener path past the guide with a feeder.

32. The method of claim 30 comprising:

removing the first replaceable bit from the installation end;

removing the second replaceable bit from the drive end;

installing the first replaceable bit in the socket; and

advancing another fastener through the bore with a third replaceable bit.

33. The method of claim 30 comprising:

after the rotating and advancing steps;

removing the second replaceable bit from the drive end; and

joining a second drive tool with the main drill attachment body so that the second drive tool engages an exterior surface of the main drill attachment body.

34. A fastener installation tool guide comprising:

a guide body defining a guide bore and including a sidewall defining a feed slot configured so that a shank of a fastener can enter the guide bore through the feed slot;

a guide head joined with the guide body, the guide head above the guide bore, the guide head including a backstop configured to engage a head of a fastener to facilitate tilting of the shank so as to align the fastener with the guide bore,

wherein a carrier slot is defined below the backstop and above the feed slot, the carrier slot configured to slidably receive a collated fastener carrier carrying the fastener.

35. The fastener installation tool guide of claim 34,

wherein the guide body and the guide head are integral with one another to form a single piece guide unit,

wherein the carrier slot is defined through the single piece guide unit.

36. The fastener installation tool guide of claim 34 comprising:

a locking member configured to engage a frame of a fastener installation tool thereby removably joining the guide body and guide head with the frame.

37. The fastener installation tool guide of claim 36,

wherein the locking member includes a recess and a locking fastener,

wherein the recess is defined by the guide body,

wherein the locking fastener projects through a portion of the frame and into the recess to join the guide body with the frame.

38. The fastener installation tool guide of claim 34,

wherein the carrier slot is configured to surround the carrier when the carrier travels along a feed path,

wherein the carrier slot is of a rectangular cross section with an uninterrupted lower wall upon which the carrier slides.

39. The fastener installation tool guide of claim 34,

wherein the carrier slot is located below the backstop and above the feed slot.

40. The fastener installation tool guide of claim 35,

wherein the carrier slot is downstream of the guide bore,

wherein the carrier slot includes an upper surface and an opposing surface configured to receive the collated fastener therebetween,

wherein the lower surface is planar from a first carrier slot sidewall to a second carrier slot sidewall,

wherein the guide body is joined with a plate offset at an angle relative to an alignment projection so that the plate and alignment projection can set the guide body at a predetermined angle relative to a workpiece.

41. A strip of collated fasteners for use in an associated fastener driving tool for driving a fastener from the strip, in sequential order, into a workpiece, the strip of collated fasteners comprising:

a row of a plurality of fasteners arranged substantially parallel to each other, each fastener having a shank and a head, the head being larger in diameter than the shank, the shanks being spaced apart from each other so that the head of a fastener does not contact the shank of an adjacent fastener, each shank defining an axis, each fasteners having a length;

a carrier including a leading edge and a trailing edge, and opposing left and right sides between which the row of the plurality of fasteners is disposed,

wherein the carrier includes an upper surface and a lower surface, with the head of each fastener being entirely above the upper surface and the shank being below the lower surface,

wherein the carrier includes a starter tab extending rearward from the leading edge to a starter tab end that is closer to the leading edge than a first fastener of the plurality of

fasteners, the starter tab being void of any fastener therein before installation in the fastener driving tool,

wherein the starter tab is of a length sufficient to engage the starter tab with a feeder element and pull a remaining portion of the carrier,

wherein the plurality of fasteners are disposed only in the remaining portion, between the starter tab end and the trailing edge,

wherein the starter tab defines a feeder element aperture

wherein the carrier defines a first fastener hole within which a first fastener is disposed,

wherein the carrier defines a second fastener hole within which a second fastener is disposed,

wherein the first fastener hole is disposed a first distance from the second fastener hole,

wherein the feeder element aperture is disposed a second distance from the first fastener,

wherein the second distance is greater than the first distance.

42. The strip of collated fasteners of claim 41,

wherein the feeder element aperture includes a first notch on a first side of the carrier and a second notch on a second side of the carrier,

wherein the first and second sides are void of any other notches along a majority of each of the respective first and second sides.

43. The strip of collated fasteners of claim 41,

wherein the guide includes a guide wall adjacent the bore,

wherein a first fastener includes a head and a shank,

wherein the carrier is joined with the shank, under the head,

wherein during the applying tension step, the head engages a backstop, and the carrier pulls the shank so as to tilt the shank against the guide wall so as to align the shank with the bore.

44. The strip of collated fasteners of claim 43,

wherein each of the plurality of fastener holes are separated from one another by a hole gap,

wherein the hole gap is less than a head diameter of each of the plurality of fasteners.

45. The strip of collated fasteners of claim 41,

wherein respective heads of each of the plurality of fasteners contact one another when the plurality of fasteners are disposed in the respective plurality of fastener holes.

46. The strip of collated fasteners of claim 41,

wherein the starter tab extends the length from the leading edge of the carrier to the starter tab end,

wherein the length is at least $\frac{3}{4}$ inch,

wherein the starter tab defines a plurality of fastener holes that are unfilled by fasteners before the carrier is installed in a tool.

47. The strip of collated fasteners of claim 41,

wherein the carrier is of a single layer of polymeric material of a uniform thickness from the leading edge to the trailing edge,

wherein the lower surface is substantially planar, with no projections other than the shanks of the plurality of fasteners extending downward from the lower surface,

wherein the heads of each of the plurality of fasteners are disposed entirely above the upper surface, without projecting downward to the lower surface before the carrier is installed on the fastener driving tool,

wherein the carrier defines a plurality of fastener holes in the remaining portion so the plurality of fasteners in the remaining portion have an average frequency of at least two screws per inch along a longitudinal axis of the carrier,

wherein each of the plurality of fastener holes have centers,

wherein the centers of adjacent ones of the plurality of fastener holes are spaced a distance of 0.200 inches to 0.260 inches from one another,

wherein each fastener of the plurality of fasteners includes a head that has a diameter of 0.120 inches to 0.200 inches.

wherein the carrier is void of any apertures extending through the thickness in areas adjacent the fastener holes.

48. The strip of collated fasteners of claim 41,

wherein a feeder element aperture is defined rearward from the leading edge,

wherein the plurality of fasteners are disposed through a plurality of fastener holes defined by the carrier, each of the fastener holes separated from an adjacent fastener hole by a first distance,

wherein the feeder element aperture is spaced a second distance from a first fastener hole within which the first fastener is disposed,

wherein the second distance is at least 150% of the first distance.

49. A strip of collated fasteners for use in an associated fastener driving tool for driving a fastener from the strip, in sequential order, into a workpiece, the strip of collated fasteners comprising:

a row of a plurality of fasteners arranged substantially parallel to each other, each fastener having a shank and a head, the head having a diameter that is greater than a diameter of the shank, the shanks being spaced apart from each other so that the head of a

fastener does not contact the shank of an adjacent fastener, each shank defining an axis, the fasteners each having a length;

a carrier including a leading edge and a trailing edge, and opposing left and right side between which the row of the plurality of fasteners is disposed,

wherein the carrier includes a starter tab extending rearward from the leading edge, the starter tab being void of any fasteners therein,

wherein the carrier includes a loaded portion with which all of the plurality of fasteners are joined,

wherein the loaded portion extends from the trailing edge to the starter tab.

50. The strip of collated fasteners of claim 49,

wherein the starter tab extends from the leading edge to the loaded portion of the carrier,

wherein the starter tab is $\frac{1}{2}$ inch to $1\frac{3}{4}$ inches in length and configured to engage a feeder element to facilitate movement of the loaded portion of the carrier,

wherein the starter tab includes a plurality of empty fastener holes between the leading edge and first fastener.

51. The strip of collated fasteners of claim 49,

wherein the starter tab defines a feeder element aperture configured to engage a feeder element,

whereby the feeder element can move the carrier through a guide of an installation tool.

52. The strip of collated fasteners of claim 51,

wherein the feeder element aperture is spaced from a first hole of a plurality of fastener holes a second distance, the second distance being greater than a first distance separating each adjacent one of the plurality of fastener holes.

53. The strip of collated fasteners of claim 49,
wherein the loaded portion defines a first fastener hole separated a first distance from an adjacent second fastener hole defined by the loaded portion,
wherein the first hole is separated from a feeder element aperture defined by the starter tab a second distance,
wherein the first distance is less than the diameter of the head,
wherein the second distance is greater than the diameter of the head.
54. The strip of collated fasteners of claim 49,
wherein the starter tab is at least 1 inch in length,
wherein the plurality of fasteners includes at least 50 fasteners,
wherein the carrier is 18 inches to 24 inches long,
wherein the carrier defines a plurality of fastener holes,
wherein each of the plurality of fastener holes have centers,
wherein the centers of adjacent ones of the plurality of fastener holes are spaced a distance of 0.201 inches to 0.260 inches from one another.
55. The strip of collated fasteners of claim 49,
wherein the starter tab is of a sufficient tear strength to withstand at least 5 pounds of pulling force to pull the carrier through a fastener installation tool.
56. The strip of collated fasteners of claim 49,
wherein the plurality of fasteners includes a lead fastener that is the closest of the plurality of fasteners to the leading edge,
wherein each of the plurality of fasteners are equidistant from one another,
wherein the starter tab defines a feeder element aperture,
wherein the feeder element aperture is closer to the leading edge than the lead fastener.

57. A method of using a strip of collated fasteners, the method comprising:
- providing a carrier including a leading edge and a trailing edge, the carrier joined with a plurality of fasteners, the carrier including a starter tab extending rearward from the leading edge, the starter tab being void of any fasteners therein,
 - extending the carrier through a guide along a collated fastener path so that the starter tab projects forward of the guide, and a loaded portion of the carrier, with which all of the plurality of fasteners are joined, projects rearward of the guide, the loaded portion extending from the trailing edge to the starter tab; and
 - engaging the starter tab with a feeder to sequentially advance the plurality of fasteners through the guide.
58. The method of claim 57,
- wherein the feeder pulls on substantially only the starter tab to advance the plurality of fasteners.
59. The method of claim 57,
- wherein during the engaging step, the starter tab pulls the loaded portion through the guide.

STATEMENT UNDER ARTICLE 19(1)

Independent claim 1 has been amended to include certain limitations of original dependent claim 5, with support from the same. Specifically, independent claim 1 has been amended to claim an embodiment where the method includes engaging a head of a fastener against a backstop, and apply tension below the head so that a tip of the fastener swings toward a wall of the bore to align the fastener with the bore. None of the cited references D1-D5 even contemplate such a feature to promote the reliable and consistent feed and alignment of fasteners, shown in purely exemplary form at Fig. 5A, and described at Paragraph 0096, of the present disclosure. Dependent claim 5 has been amended to include features also found in Fig. 5A and described at Paragraph 0096.

Independent claim 10 has been amended to include certain limitations of dependent claim 11 with support from at least original claim 11, which was deemed novel and to include inventive step. Dependent claim 11 has been amended to recite the traveling end is guided in a channel, which finds support at Paragraph 0076.

Independent claim 19 has been amended to include certain limitations of original dependent claim 4, with support from the same, Fig. 5A and Paragraph 0096 of the original disclosure. None of the cited references D1-D5 even contemplate such a feature to present the reliable and consistent feed and alignment of fasteners.

Independent claim 41 has been amended to include certain limitations of original dependent claim 48, which was deemed novel and to include inventive step over references D1-D5, none of which has such spaced fastener holes nor feeder element apertures — and none of which would utilize the same because they have completely different feed mechanisms.

No claims have been added in this Amendment. In addition, no new matter is added via this Amendment.