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(54) FASTENER CARRIER ASSEMBLY AND METHOD OF USE

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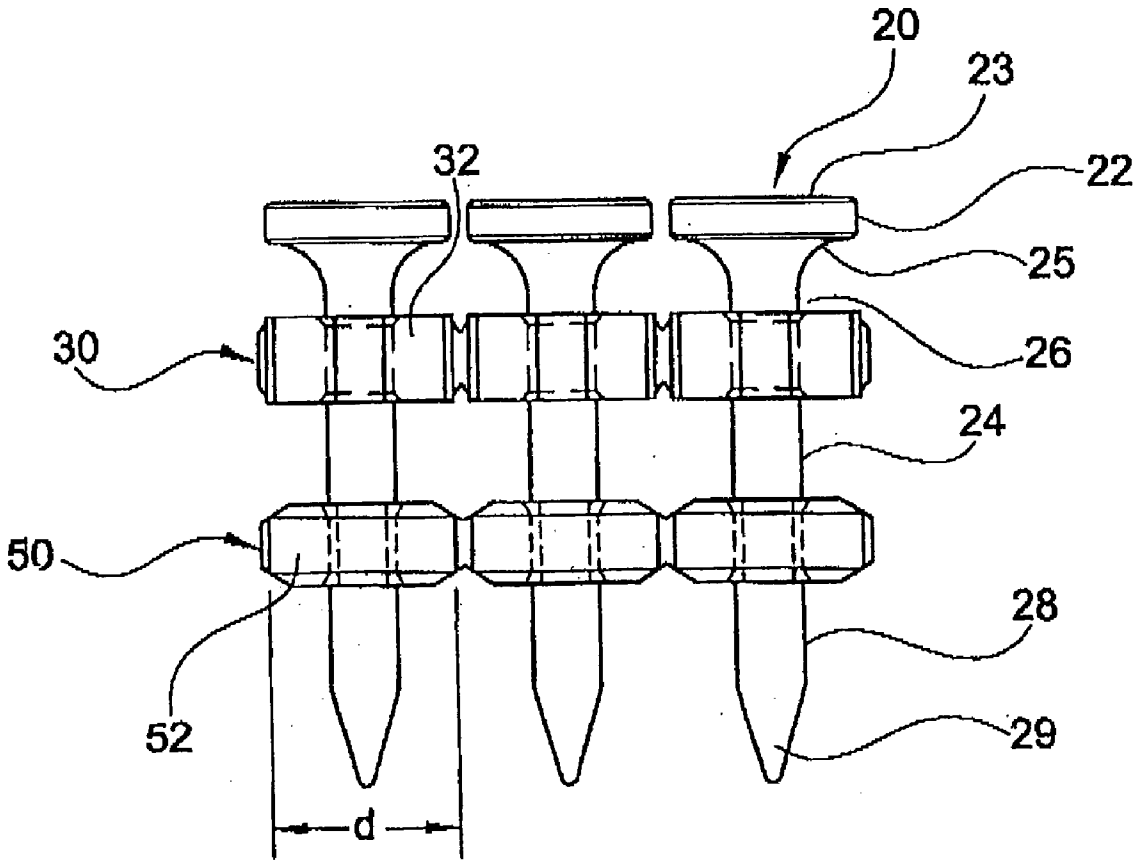
(57) **ABSTRACT**

A fastener carrier assembly used to secure rows of fasteners in a workpiece using a conventional driving tool. The fastener carrier assembly includes a plurality of fasteners, an upper strip and a separate lower strip. The upper strips include a plurality of interconnected, frangible collating elements. The lower strip includes sleeves that are intended to stay with the fastener after the fastener is embedded into a workpiece.



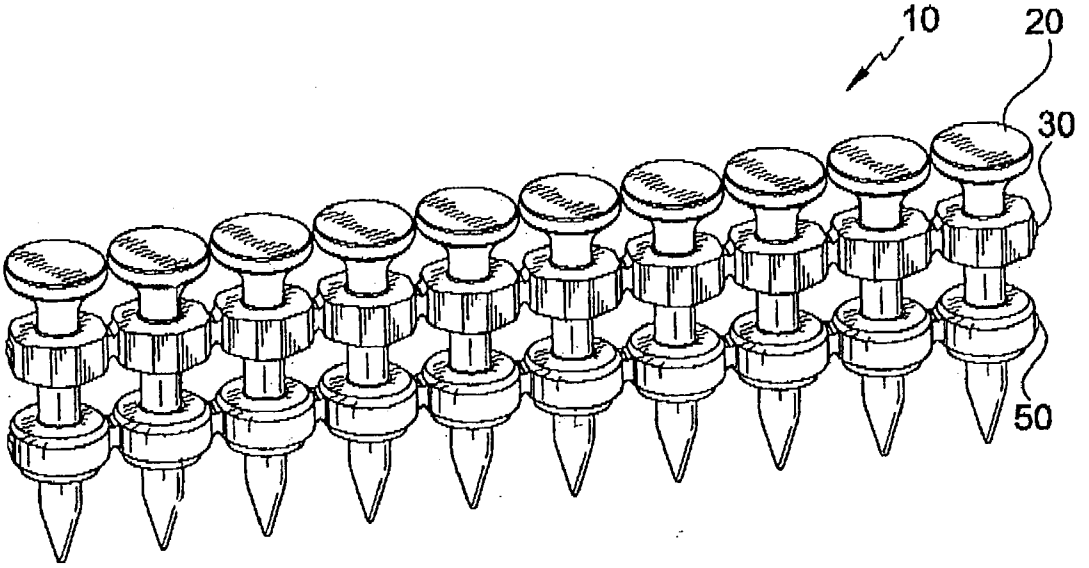


FIG.1a

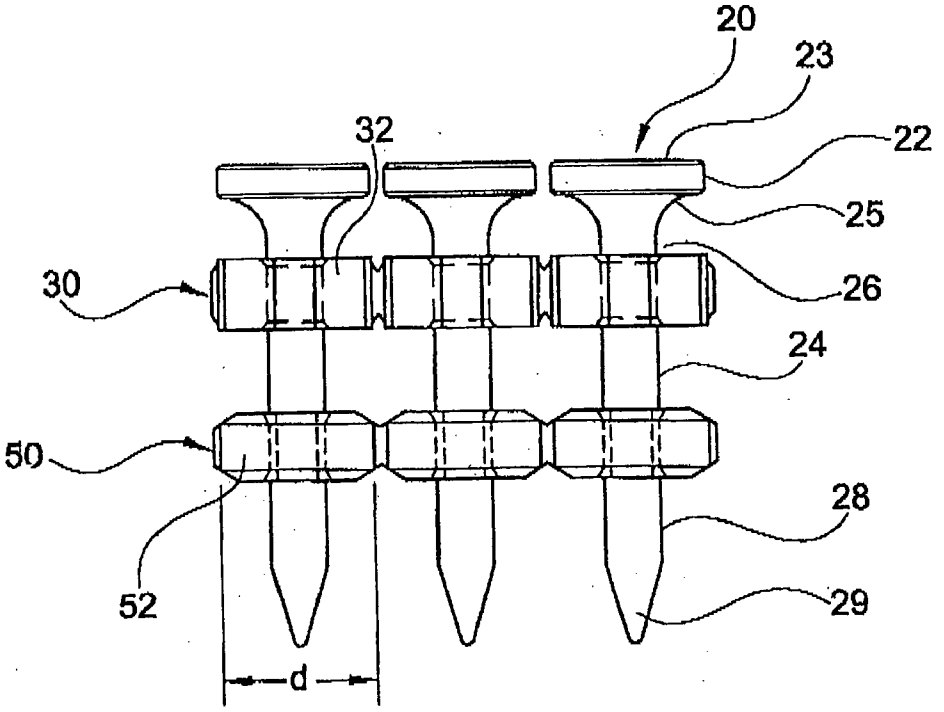


FIG.1b

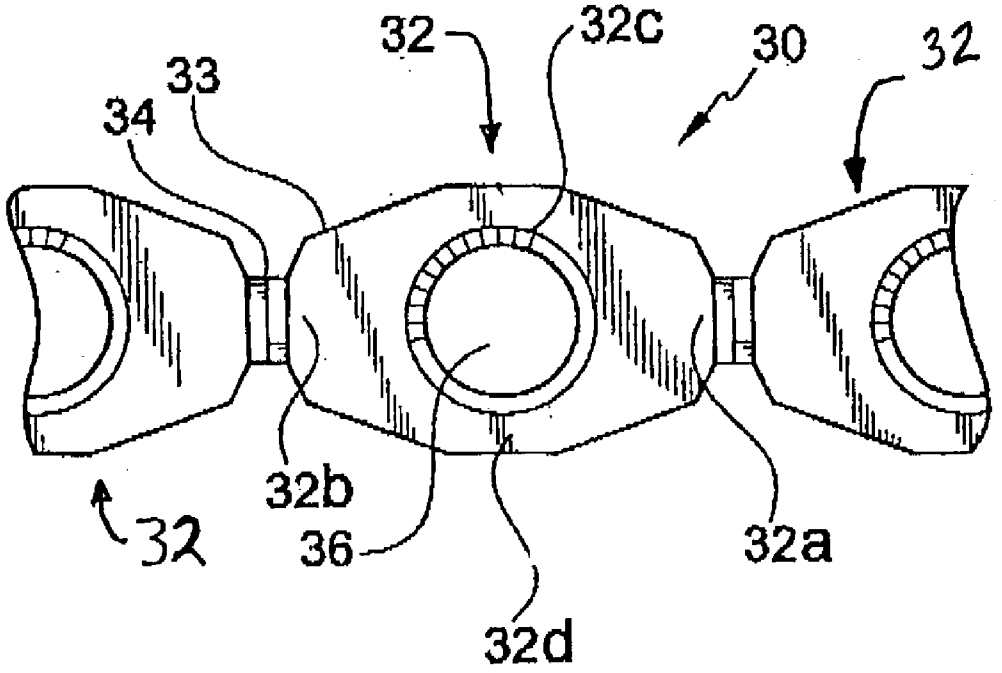


FIG.2a

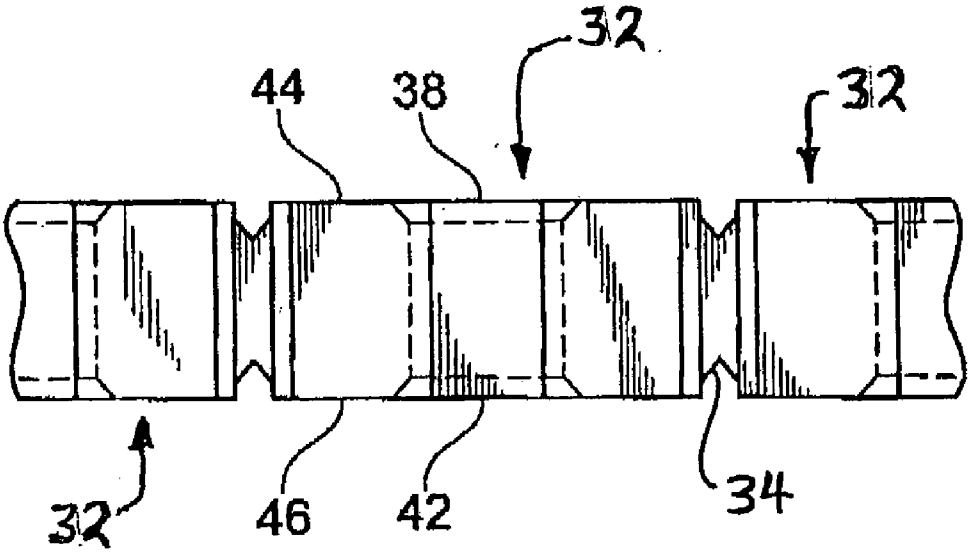


FIG.2b

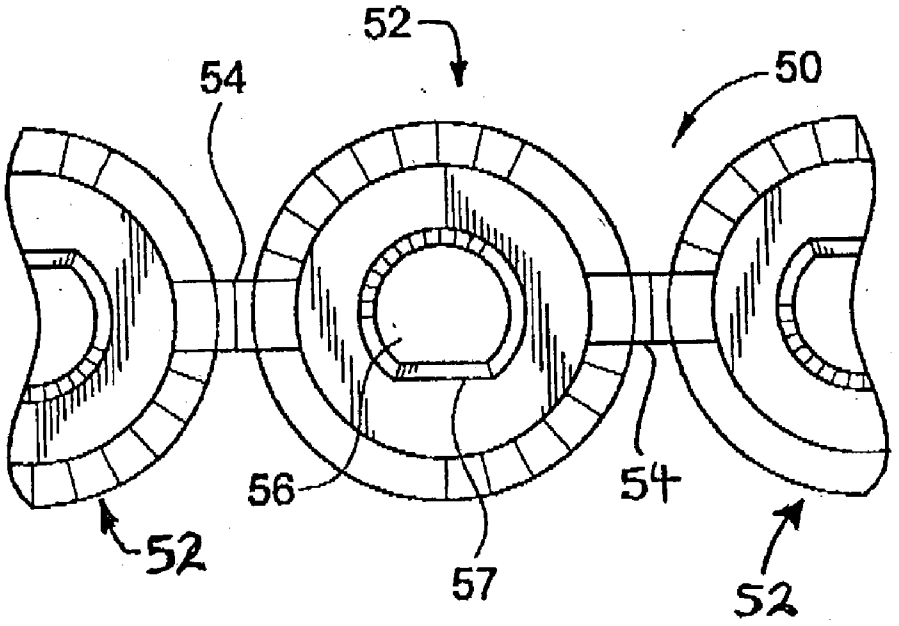


FIG.3a

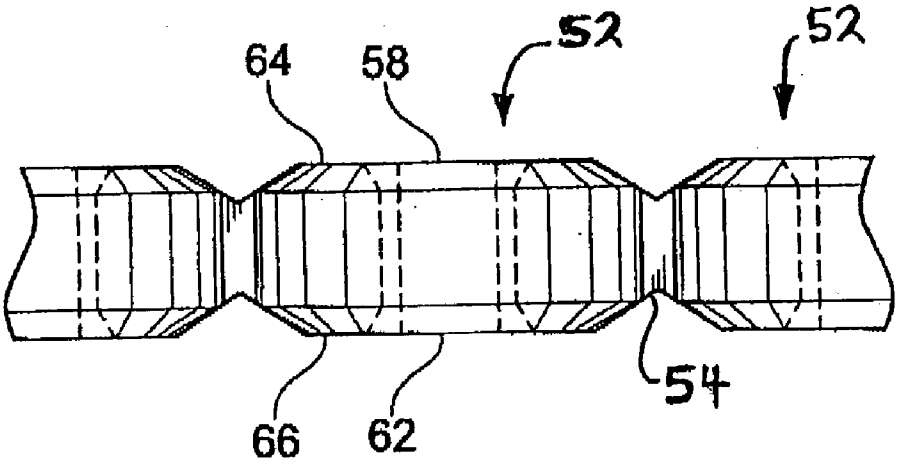


FIG.3b

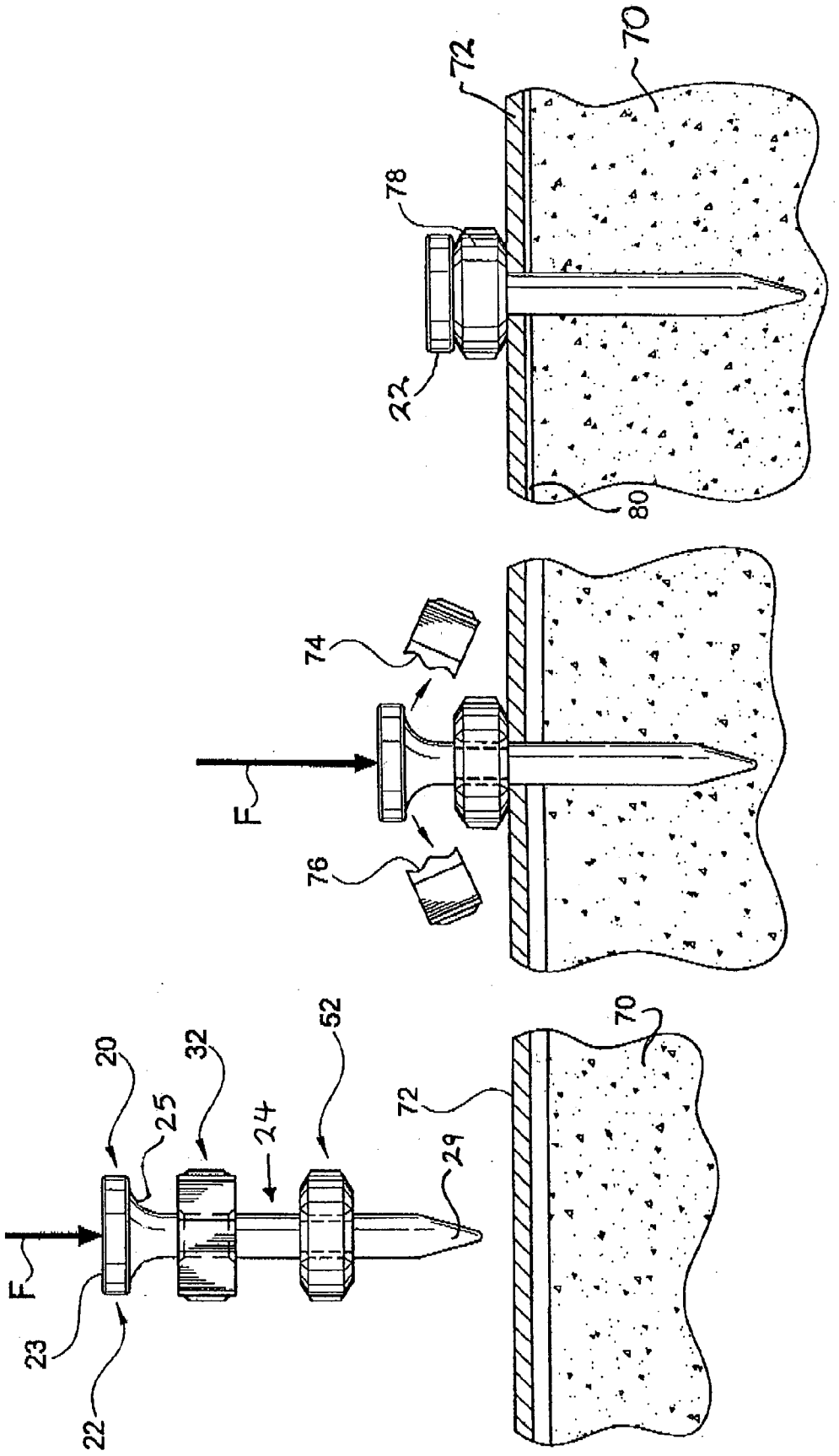


FIG.4c

FIG.4b

FIG.4a

FASTENER CARRIER ASSEMBLY AND METHOD OF USE

[0001] The invention relates generally to a fastener carrier assembly and method of use for securing fasteners in a workpiece using a driving tool, such as a nail gun.

BACKGROUND OF THE INVENTION

[0002] Fastener carrier assemblies for securing rows of fasteners in a driving tool such as a nail gun are known, as in U.S. Pat. No. 6,394,268. This patent discloses a single strip of interconnected collar members disposed upon a plurality of fasteners within a driving gun. In U.S. Pat. No. 5,931,622, fasteners are maintained in position by a single strip of carrier sleeves that include breakable portions which detach from the fasteners as each fastener is driven into a workpiece. In U.S. Pat. No. 5,069,340, a single strip of fastener sleeves includes an annular portion formed with a breakable portion. The annular portion is intended for being kept with the fastener after it has been driven into a workpiece and the breakable portion is intended for removal from the annular portion after the fastener has been driven into the workpiece.

[0003] It would be desirable to have a fastener carrier assembly that includes a first, frangible carrier portion which collates a plurality of fasteners and a second carrier portion that stays with the fastener after it has been driven into a workpiece, but which reliably maintains its structural integrity after the fastener has been driven into a workpiece and/or which may be fashioned in various ways, such as a washer and/or structural damper, without imposing design constraints on the first carrier portion. It would also be desirable to have a carrier assembly that allows one to replace a second part of a carrier strip intended to stay with a fastener with a different second part that is better suited for a particular application, without affecting or causing to replace or re-design a first frangible carrier strip that collates the fasteners. It would further be desirable that such a generally two-piece carrier assembly would be cost-efficient to manufacture and capable of providing all of the collating functions necessary for proper functioning in standard driving tools, but without compromising the aforementioned attributes relating to a two-piece design.

SUMMARY OF THE INVENTION

[0004] The above needs are met, and the shortcomings of prior art are overcome by the fastener carrier assembly of the invention. In particular, the invention provides a fastener carrier assembly of the type used to secure rows of fasteners using a driving tool, wherein the fastener carrier assembly includes a first and second carrier portion. The first carrier portion is removed from a fastener as it is being driven into a workpiece and the second carrier portion remains with the embedded fastener.

[0005] According to one embodiment, a fastener carrier assembly includes a plurality of drivable fasteners, an upper strip and a plurality of washers which may be interconnected. The upper strips include a plurality of interconnected, frangible collating elements attached in a row. The collating elements and washers are secured to the fastener shanks and spaced from each other such that the collating elements are disposed near the fastener head and the washers are disposed near the fastener tip. The collating elements may be made of the same material, or a different material from the washers, and one or both of the collating elements and washers may have the same widthwise extent as the diameter of the fastener head.

[0006] In another embodiment, a carrier assembly adapted for collating fasteners for use with a driving tool includes a plurality of frangible collating elements and sleeves, each pair of which being disposed at respective upper and lower portions of a fastener shank, wherein each sleeve is adapted for being lodged between the respective fastener head and workpiece when the fastener is embedded in the workpiece. The sleeves may correspond to washers having a torus shape, or the sleeves may describe some other geometric body which is generally axially symmetric. The collating elements may have a first cross section that is substantially thinner than a second section, so as to promote fracture of the collating element along a predetermined line. The sleeves may be made from a relatively elastic material, while at the same time the collating elements may be made from a more brittle material.

[0007] In another embodiment, a method for securing fasteners to a workpiece includes the steps of providing a fastener carrier assembly including a plurality of securing members and interconnected collating members secured to each fastener, inserting the fastener carrier assembly into a magazine of a driving tool having a firing bore, advancing each of the fasteners into the firing bore, and discharging the driving tool. As each one of the fasteners is driven into the workpiece, the collating element is broken off and fully removed from the fastener. After the collating element has been fully removed from the fastener, the washer advances upwardly along the shank until the fastener has been driven to its final depth in the workpiece.

[0008] Additional features and advantages of the invention will be set forth or be apparent from the description that follows The features and advantages of the invention will be realized and attained by the structures and methods particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0009] It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory and are intended to provide further explanation without limiting the scope of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The accompanying drawings, which are included to provide a further understanding of the invention, are incorporated in and constitute a part of this specification, illustrate preferred embodiments of the invention and together with the description serve to explain the principles of the invention. In the drawings:

[0011] **FIG. 1***a* is an isometric view of one embodiment of a fastener carrier assembly incorporating the principles of the invention.

[0012] **FIG. 1***b* is a side view of the fastener assembly of **FIG. 1***b*.

[0013] **FIG. 2***a* is a plan view of a portion of an upper carrier strip of the fastener assembly of **FIG. 1***a*.

[0014] **FIG. 2***b* is a side view of the upper carrier strip portion of **FIG. 2***a*.

[0015] **FIG. 3***a* is a top view of a portion of a lower carrier strip of the fastener assembly of FIG. **1***a*.

[0016] **FIG. 3***b* is a side view of the lower carrier strip portion of **FIG. 3***a*.

[0017] **FIGS. 4***a* through **4***c* are side views of a representative fastener being driven into a workpiece according to the principles of invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] A fastener carrier assembly of the invention includes a plurality of fasteners, an upper carrier portion and a lower carrier portion. A preferred embodiment of the fastener assembly is illustrated in **FIGS. 1***a*-**1***b*. The fasteners, which have drivable heads, e.g., nails or pins, are collated by one or both of the carrier portions so that they may be driven into a workpiece using any conventional pneumatic or combustion powered driving tool. The carrier portions include respective upper and lower sleeves which grip the fasteners at positions along the fasteners' shanks. When located within the driving tool's magazine, the carrier portions promote proper alignment of the fasteners as they are advanced within the magazine, and then positioned within the nose of the driving tool. When in the nose of the driving tool, a fastener is driven into the base material (or workpiece) by the tool's driving mechanism, which will typically both separate the fastener from the row of remaining fasteners and apply a driving force to the fastener head. As the fastener is driven into the base material, the upper sleeve is removed from the shank while the lower sleeve remains with the fastener. Thus, after the fastener has been driven into the workpiece, the lower sleeve remains lodged between the workpiece and head of the fastener.

[0019] One example of a fastener assembly incorporating the principles of invention is illustrated in **FIGS. 1***a*-**3***b*. In this embodiment, a fastener carrier assembly **10** includes a plurality of nail-type fasteners **20**, collated by two separate upper and lower carrier strips **30** and **50**.

[0020] Referring to **FIGS. 1***a* and **1***b*, each fastener **20** includes a drivable head **22** and an elongated shank **24**. Shank **24** includes a taper **25** formed at its upper end near head **22** and a pointed tip **29** at its lower end adapted for piercing through a workpiece, such as wood, drywall, metal, concrete or a combination thereof. In the disclosed embodiment, fastener **20** is adapted for being driven into concrete-like material. Fastener head **22** and shank **24** are suitably sized for use in any conventional pneumatic or combustion driving tool, such as the Trakfast driving tool. In the disclosed embodiment, shank **24** is of circular cross-section. Each fastener **20** is made from material of suitable strength, e.g., high strength steel. Strip **30** includes a plurality of upper sleeves **32** connected by upper frangible bridges **34**. Sleeves **32** are preferably positioned to grip fasteners **20** at upper portions **26** of their respective shanks **24**.

[0021] Lower carrier strip **50** is separate and spaced apart from upper strip **30**. Strip **50** includes a plurality of lower sleeves **52** which may be interconnected by frangible lower bridges **54**. Sleeves **32** are preferably positioned to grip fasteners **20** at lower portions **28** of their respective shanks **24**.

[0022] Each of sleeves **30** and **50** are preferably manufactured from the same material, e.g., high density polyethylene. Carrier assembly **10** may be assembled by inserting fasteners **20** into preformed strips **30** and **50**, or carrier assembly **10** may be assembled by directly molding carrier strips **30** and **50** onto a row of fasteners. In the former case, the holes formed by each sleeve of strips **30** and **50** may be sized for snugly receiving a respective fastener so that inadvertent removal of fasteners **20** from strips **30** and **50** during normal handling activities (e.g., assembly, packaging, and loading) is minimized.

[0023] As can be seen in **FIG. 1***b*, each of an upper sleeve **32** and lower sleeve **52** of strips **30** and **50**, respectively, may have a lateral extent d that is approximately equal to a diameter of head **22**. By sizing the lengths of sleeves **32** and **52** according to head **22** diameter, fastener **20** will tend to maintain proper alignment within the driving bore of the driving tool nose when impacted by the driving mechanism. This is because head **22**, sleeve **32**, and in particular sleeve **52** will bear against the walls of the bore before any substantial misalignment occurs within the bore. Such a sizing of sleeves according to head **22** diameter may also minimize the extent that one fastener may rotate relative to other fasteners when in a tool's magazine, without a need to stiffen bridges **34** and/or **54** since the ends of adjacent sleeves **52** will abut before fastener **20** rotates a significant amount.

[0024] **FIGS. 2***a* and **2***b* illustrate respective top and side views of upper sleeve **32**., Sleeve **32** is formed so as to provide adequate strength for maintaining proper alignment of fasteners **20** as carrier assembly **10** is fed through the magazine of the driving tool, yet is easily breakable and removable from fastener **20** as fastener **20** is driven into a workpiece by the tool's driving mechanism. Upper sleeve **32** may have a polygonal outer surface **33** including straight-edged side portions **32***c* and **32***d*, and end portions **32***a* and **32***b* to achieve this purpose. A preformed, circular hole **36** extends through sleeve **32** and preferably has a diameter sized to achieve a firm grip of fastener **20** about upper portion **26**. Chamfers **38** and **42** may also be formed along one or both of openings **38** and **42** to assist with guiding fasteners into sleeve **32** during assembly of carrier assembly **10**.

[0025] Side portions **32***c* and **32***d* are preferably sized to provide a relatively thin cross-section for sleeve **32**, as compared to end portions **32***a* and **32***b*. More specifically, the thickness of side portions **32***c* and **32***d*, as best illustrated in **FIG. 2***a*, are sufficiently thin so that sleeve **32** will fail at one or both of portions **32***c* and **32***d* when fastener **20** is driven into the workpiece. Frangible bridges **34** are formed between adjoining end portions **32***a* and **32***b* of sleeves **32** so as to retain sleeves and fasteners in the desired collated fashion. Bridges **34** may be sized to provide sufficient structural support to keep upper sleeves **32** connected during normal handling activities (e.g., assembly, packaging, and loading), but also to permit rapid and easy separation of sleeve **32** from adjoining sleeves during the fastener driving process.

[0026] Referring to **FIG. 2***b*, first and second surfaces **44** and **46** of sleeve **32** are preferably substantially flat. However, notches may be formed along the upper surface of side portions **32***c* and **32***d* to encourage fracture at pre-designated

areas of sleeve **32**. As discussed in greater detail below, when fastener **20** is driven into the base material, sleeve **32** will fail at one or both of portions **32***c* and **32***d* due to opposed compressive forces of lower sleeve **50** and head **22**, and outwardly directed forces exerted on inner walls of hole **36** by taper **25** as sleeve **30** is forced into head **22**.

[**0027**] **FIGS. 3***a* and **3***b* illustrate respective top and side views of lower sleeve **52**. Unlike sleeve **32**, lower sleeve **52** is intended to remain with fastener **20** after fastener **20** has been driven into the workpiece. In the preferred embodiment, sleeve **52** resembles a torus, but may take on various other shapes, e.g., a shape defined by an elliptical, rather than circular, cross section, or a cylindrical cross section. As mentioned above, the lateral extent of sleeve **52** may approximate the outer diameter d of fastener head **22** to assist with maintaining proper co-axial alignment of fastener in the bore of the driving tool nose, and/or to maintain proper alignment between fasteners **20**.

[**0028**] Lower sleeve **52** has a preformed circular-like hole **56**, which preferably has a diameter that achieves a firm grip of fastener **20** about lower portion **28** of fastener shank **24** when shank **24** is inserted into hole **56** during assembly. A tighter fit between shank **24** and hole **56** may be achieved by, e.g., forming a boss **68** along a wall of hole **56**, thereby increasing the elastic holding forces in sleeve **52** as shank **24** is forced through undersized hole **56**. Referring to **FIG. 3***b*, sleeve **52** preferably includes substantially flat upper and lower surfaces **64**, **66**, circumscribing openings **58**, **62** of hole **56**. In other embodiments, sleeve **52** may have a protruding flange formed along the upper and/or lower surfaces that is adapted for being flattened out as sleeve **52** is squeezed between head **22** and the workpiece. A protruding flange may be desired for purposes of minimizing movement between a fixture and fastener **20**, such as when fastener **20** cannot be fully driven into the workpiece.

[**0029**] Sleeves **52** may be interconnected by frangible bridges **54**, as shown. Bridges **34** and **54** may have a comparable length and cross section, and they may be made from the same material. However, it may be desirable to have detached sleeves **52**, or sleeves **52** which are connected by bridges **54** having reduced strength properties as compared to bridges **34**. Such a need may arise if, e.g., there is concern that the bridge connecting sleeves **52** is not cut at essentially the same time as upper bridge **34**, thereby inducing a twisting moment when the fastener is acted upon by the driving mechanism.

[**0030**] Fasteners **20** may be used to secure fixtures, such as furring strips or channels, to a base material such as a concrete wall. **FIGS. 4***a*, **4***b* and **4***c* illustrate the sequence of events from fastener **20** being impacted by the driving mechanism to fastener **20** being embedded into a concrete base material **70** for purposes of retaining, e.g., a metal fixture **72** to the concrete. Referring to **FIG. 4***a*, a blow is applied to head **22** at surface **23** by the driving mechanism (illustrated as externally applied force F). Sleeves **32** and **52** are severed from connecting sleeves, either by the shear stress induced across the bridges by force F, and/or by providing a cutting blade in the driving mechanism which is applied to bridges **34** and **54** simultaneously with F. As mentioned above, sleeve **52** may, or may not be interconnected by a bridge, but it is preferred that sleeve **52** is interconnected by a bridge.

[**0031**] After fastener **20** has begun to penetrate fixture **72** and base **70**, sleeve **52** is pushed upwards along shank **24**, mates with sleeve **32** and then pushes sleeve **32** into taper **25**. Referring to **FIG. 4***b*, as sleeve **32** is forced into contact with taper **25** and head **22**, the combined compressive forces of head **20** and sleeve **52**, and outwardly directed forces exerted upon sleeve **32** by taper **25** cause sleeve **32** to break off from fastener **20** by failure along one or both of side portions **32***c* and **32***d* (as illustrated by sleeve pieces **74** and **76**). Lower sleeve **52** is preferably significantly less prone to fracture than upper sleeve **32** since it is intended to stay with fastener **20**. At least for this reason, sleeve **52** is preferably shaped to be axially symmetric to minimize stress concentrations that may result during the fastener driving process.

[**0032**] **FIG. 4***c* illustrates a final position of fastener **20**. As shown, a compressed or uncompressed sleeve **78** is lodged between head **22** and fixture **72**. In some instances, fastener **20** fails to be completely driven into the workpiece, such as where an impervious rock is disposed in the concrete, or a tool simply does not have sufficient driving force to fully drive fastener **20** into the workpiece. In such situations, a gap **80** forms, which allows an undesirable freedom of motion between head **22** and base **70**. For example, gap **80** may lead to relatively high airborne and/or mechanical noise transmission as fixture **72** is allowed to vibrate due to the gap, or gap may ultimately lead to fastener **20** being removed from workpiece **70** by repeated vibration of fixture **72**. In either case, the presence of sleeve **78** lodged between head **22** and fixture **72** may assist with absorbing the vibration energy transmitted between fastener **20** and fixture **72**. As such, sleeve **54** may alternatively be thought of as a dampening structure.

[**0033**] As mentioned above, in the preferred embodiment sleeves **32** and **52** are made from the same material. However, in an alternative embodiment, sleeve **52** may be made from a more elastic material than sleeve **32**. A more elastic sleeve **52** may enhance its dampening function when lodged between a fixture **72** and the fastener head **22**. In this sense, the invention provides leeway for such alternative designs, i.e., composite carrier assembly, because the upper and lower strips **30** and **50** are separate pieces. On the one hand, upper sleeve **32**, which is intended to be broken away, may be so designed to enhance or improve upon the repeatability of its fracture regions for each fastener **20** when acted upon by the tool's driving mechanism, but without compromising the function of lower sleeve **52**, which is intended to stay with fastener **20** and act as a load-bearing component thereof. On the other hand, if it is desired to use a material for sleeve **52** which, e.g., has a higher damping coefficient, such a design may be implemented without affecting the function of sleeve **32**.

[**0034**] Although the foregoing description is directed to the preferred embodiments of the invention, it is noted that other variations and modifications will be apparent to those skilled in the art, and may be made without departing from the spirit or scope of the invention.

What is claimed is:

1. A fastener carrier assembly of the type used with a driving tool, comprising:

a plurality of fasteners, each of which including a drivable head and an elongated shank terminating at a tip;

an upper strip including a plurality of interconnected, frangible collating elements, each of which being connected to a respective shank at a location proximal the head; and

a plurality of washers, each of which being connected to a respective shank at a location proximal the tip and spaced from a respective collating element.

2. The fastener carrier assembly of claim 1, wherein the plurality of washers are interconnected to each other by frangible bridges.

3. The fastener carrier assembly of claim 1, wherein each of the shanks have a longitudinal axis and each of the respective washers connected to the shanks describe a shape that is essentially axially symmetrical about the longitudinal axis.

4. The fastener carrier assembly of claim 3, wherein each of the collating elements describe a polygonal shape having a first and second thickness when viewed in a plane that is perpendicular to the longitudinal axis.

5. The fastener carrier assembly of claim 1, wherein the fasteners are one of pins and nails.

6. A two-piece carrier assembly adapted for holding a plurality of fasteners, the carrier assembly being of the type used with a driving tool, wherein each of the fasteners include a drivable head and an elongated shank terminating at a tip, and each of the fasteners are drivable into a workpiece by the driving tool, the two-piece carrier assembly comprising:

an upper strip including a plurality of interconnected, frangible collating elements, each of which being connected to a respective shank at a location proximal the head; and

a lower strip including a plurality of sleeves, each of which being connected to a respective shank at a location proximal the tip, spaced from a respective collating element and adapted for being lodged between the respective fastener head and workpiece when the fastener is fully embedded in the workpiece.

7. The carrier assembly of claim 6, wherein each of the sleeves describe a first, asymmetric shape when viewed in a plane perpendicular to the shank longitudinal axis, and each of the collating elements describe a second, symmetric shape when viewed in the plane.

8. A method for securing fasteners to a workpiece, comprising the steps of:

providing a fastener carrier assembly including a plurality of fasteners, each of which having a head, shank and a tip, a plurality of securing members disposed near the tip of each of the respective fasteners, and a separate, upper strip including a plurality of collating members, each of which gripping a fastener at a location between the securing member and the head;

inserting the fastener carrier assembly into a magazine of a driving tool, the driving tool having a firing bore;

advancing each of the fasteners into the firing bore; and

discharging the gun, wherein as each one of the fasteners is driven into the workpiece by the gun, the upper sleeve is broken off and fully removed from the fastener, and after the upper sleeve has been fully removed from the fastener, the lower sleeve advances upwardly along the shank until the fastener has been driven to its final depth in the workpiece.

9. A method for securing fasteners to a workpiece as in claim 8, wherein the providing step further includes providing a plurality of interconnected securing members.

10. A method for securing fasteners to a workpiece as in claim 8, wherein the providing step further includes providing a plurality of circular shaped securing members.

* * * * *