Again, as can be seen in Fig. 5, the illustrated preferred embodiment of the present invention has two diametrically opposite stoppers 28, which are respectively upward bent from the rear end of the barrel body portion 23 to a sidewardly projected position.

The drill structure 30 includes a chip guard 31 and a drill 32. As can be seen in Fig. 3, the chip guard 31 includes two side covers 33, which are extended from the internally threaded body portion 22 and bent toward each other to together cover a front end of the internally threaded body portion 22. It is noted two slits 35 are formed at two lateral sides of the joint of each side cover 33 and the internally threaded body portion 22. The drill 32 consists of two drill bits 34, which are forward projected from top surfaces of the two side covers 33.

The expansion structure 21 further includes at least one coupling device 40, which consists of a lug portion 41 and a notch portion 42 correspondingly located opposite to the lug portion 41, such that the lug portion 41 and the notch portion 42 can be engaged with and locked to each other.

Figs. 7A to 7C illustrate the steps of installing the self-drilling expansion fastener 20 on sheet workpieces. First, as shown in Fig. 7A, apply a rotating force on the barrel body portion 23 of the self-drilling expansion fastener 20, so that the drill 32 is brought to drill through multiple layers of sheet workpieces, such as an attached object 50 and a supporting object 51, for the stoppers 28 to tightly press against the attached object 50. In addition to the two layers of sheet workpieces shown in the embodiment, more than two layers may be fastened by the fastener of the invention. At this point, as shown in Fig. 7B, the force-distributing bars 25 are located behind the supporting object 51 and the retaining wings 27 are embedded in a peripheral wall

What is claimed is:

1. A self-drilling expansion fastener 20 being integrally formed of a sheet metal material for use with an externally threaded element to tightly lock multiple layers of sheet workpieces to one another, comprising:

~~an expansion structure 21 having a plurality of internal threads 24 and a plurality of force-distributing bars 25; and~~

an expansion structure 21 having an internally threaded body portion 22 and a barrel body portion 23;

wherein a plurality of force-distributing bars 25 are formed on the barrel body portion 23; and

wherein the barrel body portion 23 includes at least one retaining wing 27 for embedding in a peripheral wall of the drilled hole on an outermost sheet workpiece of the multiple layers of sheet workpieces, so that the self-drilling expansion fastener 20 is firmly associated with the outermost sheet workpiece; and

a drill structure 30 being integrally formed at a head of the expansion structure 21; the drill structure 30 including a chip guard 31 connected to the expansion structure for covering the head of the expansion structure 21, and a drill 32 forward projected from the chip guard 31 for self-drilling a hole on the multiple layers of sheet workpieces, so that the expansion structure 21 can be extended through the sheet workpieces and tightly received in the drilled hole with the force-distributing bars 25 fully located behind the sheet workpieces;

whereby when the externally threaded element is screwed deeper into the expansion structure 21 to mesh with the internal threads 24, the force-distributing bars 25 are gradually pulled backward to expand outward and are finally compressed into a fully folded state to tightly press against an inner side of the multiple layers of sheet workpieces, so that the sheet workpieces are firmly locked together.

2. The self-drilling expansion fastener 20 as claimed in claim 1, wherein the chip guard 31 includes two side covers 33, which together cover the head of the expansion structure 21; and wherein the drill 32 consists of two drill bits 34, which are forward projected from top surfaces of the two side covers 33.

3. ~~The self-drilling expansion fastener 20 as claimed in claim 1, wherein the expansion structure 21 is integrally formed to have an internally threaded body portion 22 and a barrel body portion 23; the internal threads 24 being formed in the internally threaded body portion 22; and the force-distributing bars 25 being formed on the barrel body portion 23.~~

~~4. The self-drilling expansion fastener 20 as claimed in claim 3, wherein the barrel body portion 23 includes at least one retaining wing 27 for embedding in a peripheral wall of the drilled hole on an outermost sheet workpiece of the multiple layers of sheet workpieces, so that the self-drilling expansion fastener 20 is firmly associated with the outermost sheet workpiece.~~

~~5.~~ The self-drilling expansion fastener 20 as claimed in claim ~~3~~1, wherein the internally threaded body portion 22 is a cylindrical hollow body and the barrel body portion 23 is a hexagonal hollow body internally defining a hex bore.

~~6~~4. The self-drilling expansion fastener 20 as claimed in claim ~~4~~1, wherein the retaining wing 27 is formed by outward stamping a wall of the barrel body portion 23, such that the retaining wing 27 extends at an angle relative to a horizontal rear end of the barrel body portion 23.

~~7~~5. The self-drilling expansion fastener 20 as claimed in claim 1, wherein the expansion structure 21 includes at least one stopper 28 formed on a rear end thereof.

~~8~~6. The self-drilling expansion fastener 20 as claimed in claim 1, wherein the

expansion structure 21 further includes at least one coupling device 40; and the coupling device 40 consisting of a lug portion 41 and a notch portion 42 correspondingly located opposite to the lug portion 41, such that the lug portion 41 and the notch portion 42 can be engaged with and locked to each other.

~~9~~7. A method of integrally forming a self-drilling expansion fastener 20 from a sheet metal material through a series of punching and stamping, comprising the following steps:

obtaining a sheet metal material having dimensions required for forming the self-drilling expansion fastener 20, and defining an expansion structure zone 60 and a drill structure zone 70 on the obtained sheet metal material;

stamping the expansion structure zone 60 at a specified location, which is defined as a thread forming zone 64, to obtain threads having required dimensions;

punching the expansion structure zone 60 at a specified location, which is defined as a barrel body forming zone 66, to obtain a plurality of force-distributing bars 65;

punching the drill structure zone 70 at a predetermined location to obtain a required chip guard 74, wherein the chip guard 74 includes two side covers 33;

punching the drill structure zone 70 at a predetermined location to obtain a required drill 75; and

stamping the thread forming zone 64 and the barrel body forming zone 66 to

obtain required configurations for these two zones;

wherein the barrel body forming zone 66 is stamped at a predetermined location to obtain at least one outward protruded retaining wing 67, and the retaining wing 67 being slant at a fixed angle relative to a horizontal rear end of the barrel body forming zone 66.

~~10~~8. The self-drilling expansion fastener forming method as claimed in claim ~~9~~7, wherein the ~~chip guard 74 includes two side covers 71 and the~~ drill 75 includes two drill bits 72.

~~11. The self-drilling expansion fastener forming method as claimed in claim 9, wherein the barrel body forming zone 66 is stamped at a predetermined location to obtain at least one outward protruded retaining wing 67, and the retaining wing 67 being slant at a fixed angle relative to a horizontal rear end of the barrel body forming zone 66.~~

~~12~~9. The self-drilling expansion fastener forming method as claimed in claim ~~9~~7, wherein the thread forming zone 64 is stamped into a near-cylindrical hollow body, and the barrel body forming zone 66 is stamped into a hexagonal hollow body internally defining a hex bore.

~~13~~0. The self-drilling expansion fastener forming method as claimed in claim ~~9~~7, wherein the barrel body forming zone 66 is punched at a predetermined location to obtain at least one stopper 62.

~~14~~1. The self-drilling expansion fastener forming method as claimed in claim ~~9~~7,

wherein the expansion structure zone 60 is punched at a specified location to obtain at least one coupling device 61 for coupling two longitudinal sides of the expansion structure zone 60 to each other to complete the forming of the self-drilling expansion fastener 20.