April 17, 1956 R. L. HALLOCK 2,741,939

SELF-LOCKING NAILS HAVING CHANNEL-SHAPED DEFORMABLE SHANKS

Filed Sept. 15, 1951

Fig. 1.

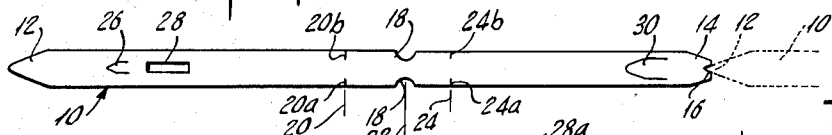


Fig. 2.

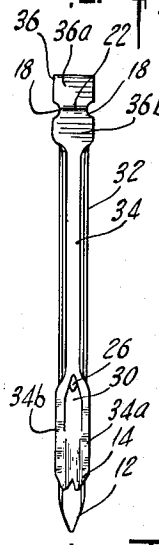


Fig. 3.

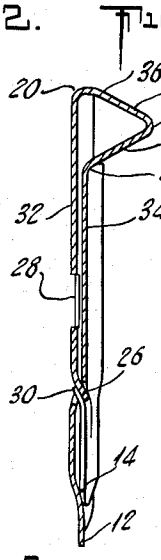


Fig. 4.

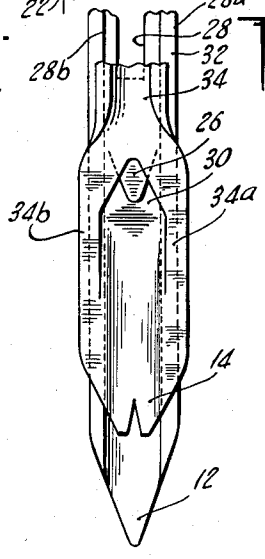


Fig. 5.

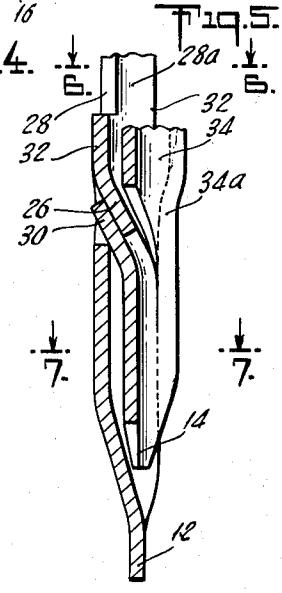


Fig. 6.

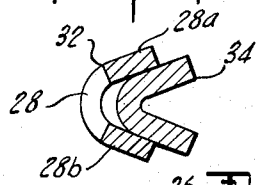


Fig. 7.

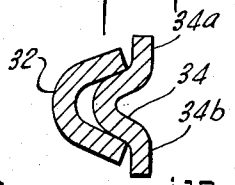


Fig. 10.

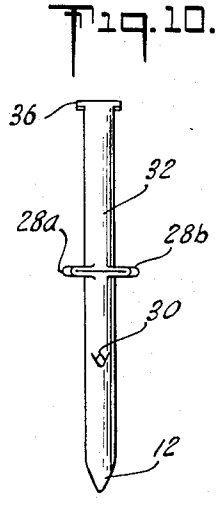


Fig. 8.

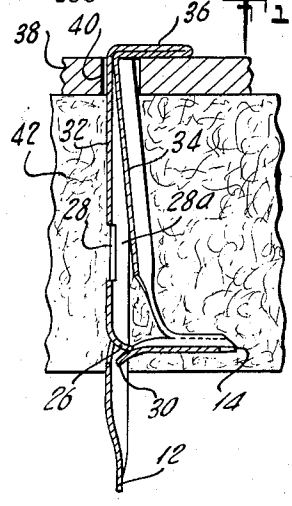
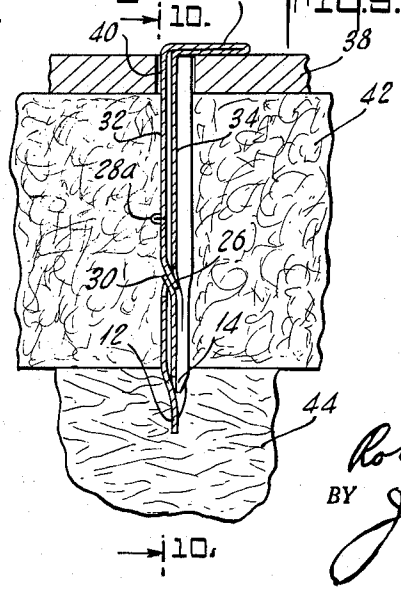


Fig. 9.



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SELF-LOCKING NAILS HAVING CHANNEL-SHAPED DEFORMABLE SHANKS

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Application September 15, 1951, Serial No. 246,763

3 Claims. (Cl. 85—23)

The present invention relates to self-locking nails and has particular reference to integral sheet metal nails which effect locking by distortion to spread a part of the nail laterally when the nail is driven home so as to grip and hold in or behind artificial building materials of such nature that the ordinary nail will not provide sufficient holding power. More specifically, the present invention relates to sheet metal nails of the above general character provided with two adjacent legs or shanks of channel form connected at the head end of the nail by a collapsible head which is collapsed when the nail is driven home to cause relative longitudinal movement between the two legs, which interengage at a point intermediate their ends and are otherwise so constructed that the lower or foot portion of one of the shanks is bent outwardly to a position approximately at right angles to the axis of the nail. Still more particularly, the invention is an improvement upon the kinds of nails disclosed in U. S. Patent No. 2,603,121 granted July 15, 1952 on my copending application Serial No. 634,485.

Nails of the kind disclosed in the aforesaid patent have become widely used in building construction of the kind in which the commonly used wood siding or sheathing has been replaced by insulating and other types of artificial wall boards, usually of cellulosic fibrous material or of gypsum or other mineral substance, or mixtures, a common characteristic of which is inability to provide holding power for ordinary nails.

Nails of the general character under discussion have proved highly successful for the purpose of attaching shingles or other outer surfacing elements to such artificial boards and in that use so called facing nails are required, the heads of which are exposed after the nails have been driven. Largely for the sake of appearance, these nails are ordinarily made from stainless steel to avoid ultimate unsightly rusting and for reasons of cost and also to provide exposed heads which shall be as inconspicuous as possible, such nails are made as small and light as possible for the required purpose.

Nails of the kind embodying the inventions disclosed in my aforesaid patent have proved to be highly successful commercially in substantially all desired applications but when made in the form of the relatively very light facing nail require care in application to avoid as far as possible the driving of the nail through relatively soft board, for which the nail is intended, into relatively much harder and denser material such as wood. Artificial boards are usually applied in building construction by nailing them to wooden studs or beams, depending upon whether the structure is a side wall or a roof deck, and when nails of earlier design were driven through soft boards overlying such wooden studs or beams and into the latter, the density of the material prevented the bending of the holding foot of the nail outwardly into the material to any substantial extent. This in effect locked the two shanks of the nail against their intended longitudinal relative movement and in turn prevented the proper collapsing of the head of the nail in its intended

fashion. The result in such cases was collapse of the head end portion of the nail in such a way as to leave an exposed head of increased and relatively unsightly area.

The general object of the present invention is to improve upon the earlier forms of nail structure and to provide a construction in which the nail may be used without reference to the location of studs or other members of dense material into which the nail may have to penetrate, and with the head of the nail collapsing in its properly intended fashion, regardless of whether or not the holding foot of the nail is able to bend outwardly into the material or not. A further object of the invention is to improve upon the form of the portion of the shank which provides the holding foot, so as to provide a better bending action of the material at the place where the foot bends away from the axis of the nail and to increase the holding power of the foot of a nail of given size.

Other and more detailed objects will appear as the ensuing portion of this specification proceeds with the description of a preferred embodiment of nail, disclosed by way of example but without limitation, to which reference may be had in conjunction with the accompanying drawings forming a part hereof, in which:

Fig. 1 is a plan view of a sheet metal blank from which the nail is made;

Fig. 2 is an elevation of a nail formed from the blank shown in Fig. 1;

Fig. 3 is a section taken on the line 3—3 of Fig. 2;

Fig. 4 is an enlarged fragmentary view of a part of the nail shown in Fig. 2;

Fig. 5 is an enlarged fragmentary section of a part of the nail shown in Fig. 3;

Fig. 6 is a section taken on the line 6—6 of Fig. 5;

Fig. 7 is a section taken on the line 7—7 of Fig. 5;

Fig. 8 is a section showing the nail after being driven through soft artificial material permitting the foot of the nail to bend outwardly;

Fig. 9 is a view similar to Fig. 8 showing the nail driven through soft material and penetrating a supporting stud or the like of material not permitting outward bending of the foot; and

Fig. 10 is a view of the nail only taken on the line 10—10 of Fig. 9.

Referring now more particularly to Fig. 1 of the drawings, 10 indicates a blank of thin flat sheet metal for facing nails of the kind previously mentioned as advantageously of stainless steel. At one of its ends the blank is cut to provide a sharp V-shaped point 12, and for manufacturing and material saving reasons the opposite end is cut to generally V-shaped form as shown at 14, there being a small reentrant notch 16 at this end left by the point 12 of the next succeeding blank 10, shown in dotted lines, the blanks being cut from a continuous strip or skelp of sheet material. So far as the functioning of the nail is concerned the particular configuration of the generally pointed end 14 is not critical.

Slightly to one side of the mid-point of the length of the blank the side edges are notched by confronting notches 18 which are advantageously semi-circular.

At 20, 22 and 24 transverse bending lines are advantageously established by slightly indenting the metal and the edges are preferably transversely sheared along line 20 at 20*a* and 20*b*, sheared edge portions also being provided at 24*a* and 24*b* along line 24.

Adjacent to the pointed end 12 of the nail the metal is sheared to form a longitudinally extending finger-like tongue 26 pointed at its free end and bent downwardly from the plane of the blank. Adjacent to this tongue and on the side remote from the pointed end 12 a narrow elongated aperture or window 28 is formed, this aperture

extending longitudinally of the blank along the central axis thereof.

Adjacent to the other end 14 of the blank a second finger-like tongue 30 pointed at its end and pointing away from the adjacent end 14 of the blank is provided. This tongue is both longer and wider than the tongue 26 and is also bent away from the plane of the blank on the same side as the tongue 26.

By suitably bending and forming operations of known character and forming no part of the present invention the blank just described is bent back upon itself to form a nail as shown in Figs. 2–7 inclusive. As shown in these figures the end portions of the blank, at each side of the bend lines 20 and 24, are bent to channel form to provide the two channelled legs or shanks 32 and 34 of unequal length, the longer shank 32 constituting the driving shank of the nail and the shorter constituting the holding shank. The blank is bent at the bend lines to form a head 36 comprising two flat plate portions 36*a* and 36*b* connected respectively to the shanks 32 and 34 and angularly related to form a triangular V-shaped head extending laterally to one side of the axis of the nail. The formation of the shanks to channel form, while retaining the flat plate-like form of the head portions 36*a* and 36*b* is facilitated by the sheared lines 20*a*, 20*b* and 24*a* and 24*b*.

As shown, the shanks are bent into parallel adjacent relation, with the channel portion of the shorter or holding shank nested in the channel of the longer or driving shank. As seen more particularly in Fig. 6, the channels are made relatively sharp and deep, with the webs of the channels forming between them a sharply acute angle.

As appears more clearly from Figs. 4 and 5, the bent tongues 26 and 30 are brought into overlapping interengagement, the tongue 26 projecting into the opening created by the forming of tongue 30 and the tongue 30 projecting into the opening created by the formation of tongue 26.

From a place just above the tongue 30 on the holding shank 34, the outer edges of the webs of the channel are flared outwardly to provide ligaments 34*a* and 34*b* which extend across the edges of the webs of the channel of the driving leg 32 and lie in a plane at right angles to the median plane of the nested channels. As will be seen more particularly from Fig. 4, these ligaments lie at either side of the tongue 30.

In accordance with prior practice the pointed or penetrating end at the driving shank is off-set slightly so that that point is in alignment with the base or root of the channel of the holding shank 34, the penetrating end portion of the driving shank thus substantially masking the end of the holding shank.

As shown most clearly in Figs. 5 and 6, the bending of the driving shank to channel form provides a section above the tongues 26 and 30 where material of the shank is removed at the root of the channel due to the presence of the centrally located window 28, at the sides of which the ligaments 28*a* and 28*b* formed by portions of the webs of the channel due to their acute angular relationship, may be said to be in substantially confronting relation.

Turning now more particularly to Fig. 8, the nail just described is shown after being driven in a typical application wherein a shingle 38 of well-known kind such as asbestos or the like and having a preformed hole 40 for the passage of the nail, is secured to a board 42 of relatively soft artificial material such as "Celotex" or gypsum.

When driving the nail in such an application the two shanks remain in their parallel fixed relationship, without relative movement, until the portion 36*b* of the head, where it joins the shank 34, strikes the face of the shingle which acts as an abutment preventing further inward or penetrating movement of the holding shank. As the nail is driven home the head collapses, this being facilitated by the notches and sheared parts at the bend lines, the collapse of the head being accompanied by relative longitudinal movement between the driving and holding shanks, the former moving toward the head end of the nail relative to the latter as the head collapses. This relative movement causes the portion of the holding shank below the interengaging tongues 26 and 30, which constitutes the foot portion of the shank, to be bent outwardly away from the driving shank with a pivotal movement about the tongue 26 as a fulcrum point.

Due to the sheared-out tongue 30, which advantageously at its base is substantially as wide as the channelled portion of the foot, thus leaving only the two flat and relatively narrow ligaments 34*a* and 34*b*, a place is provided in the holding shank where the foot joins the upper portion of the shank that is relatively very weak in resistance to bending as compared with the remaining portions of the shank. As will be observed from Fig. 5, the fulcrum point established by the interengaging tongues 26 and 30 is displaced laterally a substantial distance from the plane of the ligaments 34*a* and 34*b*, so that when relative movement between the shanks occurs a force acting through a substantial moment arm is applied to the ligaments to bend them and cause the pivotal movement of the foot.

The disposition of the ligaments with respect to the plane of the bending provides for an improved and more reliable bending than in previous nails operating in accordance with the same general principle. From Figs. 4 and 7 it will be seen that the plane of the ligaments is at right angles to the plane of bending and consequently the required bends are made across the rolled surface of the metal. The result is that the bend can be effected with less strain being developed in the material and less likelihood of fracture at the bend point, as compared with a bending action in which the bend is made substantially in the plane of the material at right angles to the rolled surfaces.

As will also be seen from the drawings, the ligaments 34*a* and 34*b* result in the formation of a foot portion which is wider laterally than would be the case if these ligaments were not provided, thus giving greater bearing area for the foot. Experience has shown that the widening of the foot portion of the holding shank, which is still substantially masked by the off-set penetrating end of the driving shank, does not in any way interfere with the driving action of the nail or produce premature collapse of the head by failing to follow the driving shank without movement relative thereto as the nail penetrates the material.

Referring now to Figs. 9 and 10, the action of the nail when encountering relatively hard material is illustrated. In these views the nail is shown as having been driven for the purpose of attaching shingle 38 to board 42 at a place where the latter overlies a supporting stud 44. In this case the ends of the two shanks have penetrated the dense material of the stud by the time the nail is driven to the extent that the head should begin to collapse due to abutment against the face of the shingle. In the usual functioning of the nail, the relative longitudinal movement between the shanks required to permit the proper collapse of the head is permitted by the outward bending movement of the foot of the holding shank, but in the present case such bending movement of the foot is prevented by the dense nature of the material in which it is embedded, the foot in effect being locked against the driving shank. Under such circumstances the required relative movement between the shanks at the head end of the nail is provided by the confronting ligaments 28*a* and 28*b*, which, under the impact of driving blows, and with the foot locked, buckle outwardly away from each other to a bellows-like form as shown in Fig. 10, to permit the upper portion of the driving shank to move downwardly relative to the upper portion of the holding shank and permit normal collapse of the head. The outward bending movement of the ligaments at the sides of the window is made possible because of the relatively soft nature of

the material in which that portion of the nail is embedded when the head is collapsed.

The window aperture provides a weakened place in the driving shank as compared with the remainder of the shank (the aperture left by the small tongue **26** having negligible effect), but the nature of the weakening is entirely different from that at the weakened place in the holding shank. The holding shank is weak against lateral bending, while the disposition of the ligaments **28***a* and **28***b* is such that the window aperture has no practical adverse effect upon the lateral rigidity of the driving shank as a whole. Instead, the presence of the window provides a place of relative weakness in compression and it is to be noted that the width and consequent strength of the adjacent ligaments, which constitute the major portion of the section of the shank, provide sufficient resistance to compression to enable the nail to be driven with the driving leg acting as a completely rigid element in cases where the conditions for which the nail is primarily intended are encountered. Even under the abnormal conditions which produce buckling of the ligaments in the driving leg, that leg remains straight, the effect of the bending of the ligaments being merely to shorten the leg by compressing it along the axis of the nail. Other specific expedients may be resorted to for providing a place in the driving shank that is relatively weak against compression and will permit the shank to shorten itself when subjected to abnormal compressive stress, but I have found that the arrangement illustrated which results in the outward buckling of the ligaments is not only simple and wholly effective but alsos provides a further affirmative advantage. When, as shown in Figs. 9 and 10, the nail is partially driven into a wooden stud, the penetration of the shanks into the wood may or may not provide holding power equivalent to that produced by bending the foot outwardly into or behind softer material, but, under such conditions, the buckled ligaments provide laterally extending projections of substantial area which provide, with whatever holding power is afforded by the wood, sufficient strength to adequately hold the nail against normally encountered forces tending to withdraw it.

From the foregoing it will be evident that by virtue of the present invention a nail of more general applicability for the intended purpose has been provided, which is useful independently of the presence or absence of dense materials underlying the material with which the nail is intended primarily to be used, and which provides for improved holding power and bending action as compared with previous nails of the same general type.

While for purposes of disclosure a preferred example has been described and illustrated it will be apparent to

those skilled in the art that the specific design may be modified in numerous ways without departing from the principles of the invention, the scope of which is to be understood as embracing all articles falling within the purview of the appended claims.

I claim:

1. A self-locking nail comprising a metal body providing a driving shank of channel form in cross section and a holding shank connected at the head end of the nail by a collapsible head and longitudinally movable relative to each other upon collapse of said head when the nail is driven, said driving shank being relatively more rigid against lateral bending than said holding shank and being adapted to be driven straight into the material with which the nail is used, said holding shank having a weakened place intermediate its ends for weakening the shank against lateral bending, means on said shanks interengaging adjacent to said weakened place for causing the free end portion of the holding shank to be bent away from the driving shank upon said longitudinal relative movement between the shanks, and said driving shank having means additional to said interengaging means providing a weakened portion between the place of interengagement of said interengaging means on the two shanks and the head end of the nail, said weakened portion being distortable upon the application of abnormal compressive force to the shank to shorten the driving shank by permitting continued penetrating movement of the head end portion of the shank without corresponding penetrating movement of the penetrating end portion of the shank, said weakened portion comprising an aperture formed in the base portion of the channel of the driving shank, said aperture extending substantially the entire width of said channel base portion and being elongated lengthwise of the driving shank, whereby to leave two spaced relatively narrow web portions resistant to lateral bending as the connection between the portions of the driving shank on either end of said aperture.

2. A nail as defined in claim 1 in which the cross section of the channel at the weakened portion is V-shaped with the webs of the V including between them an acute angle.

3. A nail as defined in claim 2 in which the aperture is substantially rectangular and is confined substantially to the apex portion of the V-shaped cross section of the shank.

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