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F. S. SILLARS
FASTENER PACKAGES

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Fig. 1

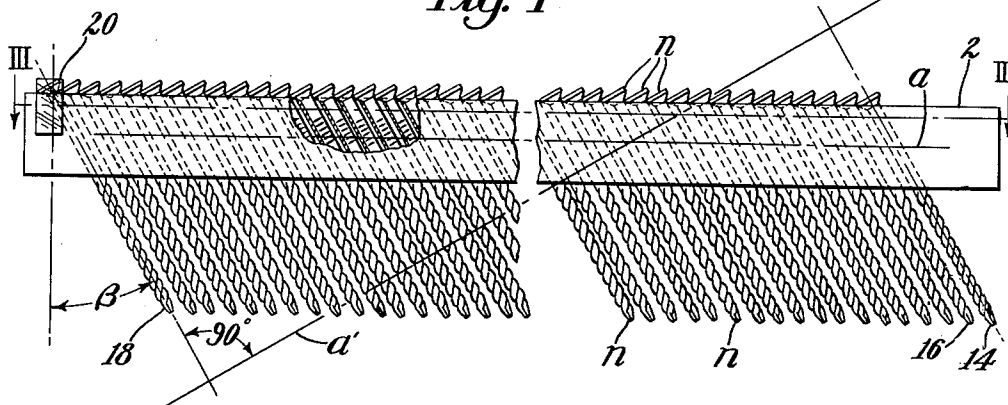


Fig. 2

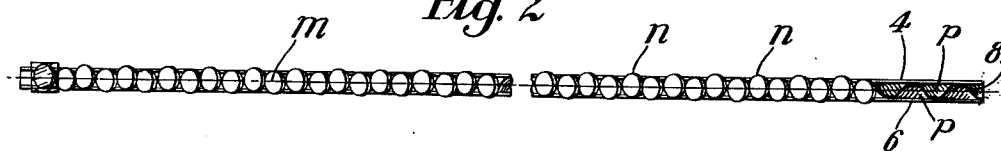


Fig. 3

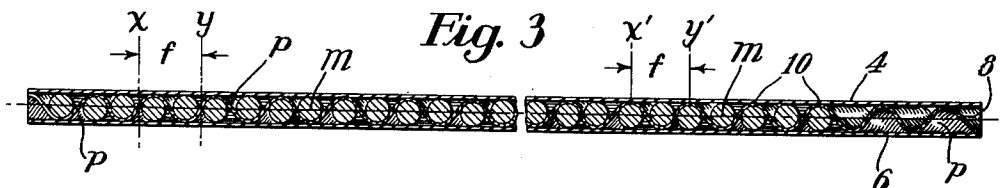
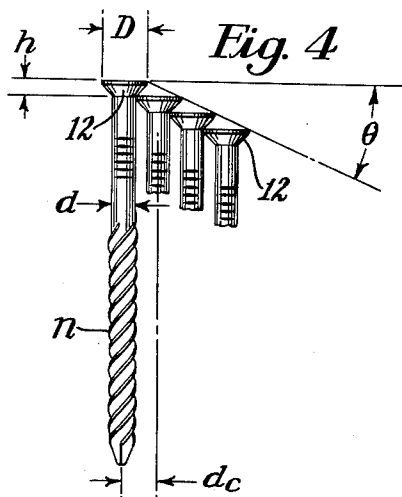


Fig. 4



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FASTENER PACKAGES

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3 Claims. (Cl. 1—56)

This invention relates to fasteners and more particularly to a fastener containing package which may be employed with inserting tools. There are a number of automatic and semiautomatic tools available for driving fasteners, such as nails and the like, which are supplied with oriented fasteners from either a separate and remotely located feeding device or from a self-contained raceway in which fasteners are placed by hand. Inherent shortcomings exist in both methods of supplying fasteners. For example, the separate feeding devices, while usually continuous and automatic, are frequently bulky and complex, therefore costly. Furthermore, they are usually limited to in-plant applications. The tool requiring fasteners to be placed in its raceway by hand, while generally lightweight and readily portable, has the disadvantage of lost time incurred by frequent manual loading.

It is an object of this invention to provide fasteners in prepackaged form for use with inserting tools which will eliminate the need for a separate feeding device and not require frequent loading.

It is another object of this invention to provide a fastener package containing a large number of oriented fasteners, which package may be readily handled without the necessity of supplemental equipment.

Another object is to produce an inexpensive, expendable package containing pre-oriented fasteners.

Numerous attempts have been made to produce prepackaged and oriented fasteners for use with portable inserting tools. However, they have for the most part been either too expensive or too difficult to handle conveniently. It is a requirement that the maximum number of fasteners be accommodated in the minimum space for the package to be of commercial value. One attempt in producing such a fastener package resulted in a strip having a plurality of pockets into which fasteners, such as nails or pegs, were inserted, such as the type shown in United States Letters Patent No. 415,175, issued November 12, 1889, to J. R. Prouty. This package, while inexpensive, has proved to be unfeasible for use with modern inserting tools because of the relatively few fasteners it is capable of containing per linear foot and further is excessively flexible, being readily bent. Another fastener package is of the type shown in United States Letters Patent No. 1,306,107, issued June 10, 1919, to W. E. Elliott, in which a plurality of fasteners, such as nails, are inserted in a paper strip of indefinite length. This package also, while inexpensive, is unsuitable for modern inserting equipment both because of its inefficient spacing of the nails and further because the paper carrying strip is also very flexible and does not lend itself readily to feeding.

Therefore, it is an additional object of this invention to produce a fastener package utilizing the best features of both of the above-identified inventions while having none of the obvious disadvantages.

In accordance, therefore, with these objects there is provided an inexpensive, expendable fastener containing package comprising two parallel flat side pieces of fibrous material having between them a fibrous web of corrugated material forming continuous flutes. The flutes and the side pieces form fastener receiving pockets on both sides of the web between the side pieces with the number of pockets equal to twice the number of flutes minus one. The pockets are arranged relative to the side pieces to

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hold the fasteners in staggered relationship on both sides of the median line between the side pieces and are also of predetermined size to maintain fasteners in engagement with each other. The pockets and consequently the axes of the fasteners contained therein are formed and positioned at an acute angle with the longitudinal axis of the package and the heads of the fasteners are in overlapping or shingled relationship. The length of the package and the number of flutes or pockets per unit of length of the package is a function of the size of a fastener and particularly of the sum of its head and shank diameters.

The above and other features of the invention including various novel details of construction and combinations of parts will now be more particularly described with reference to the accompanying drawings and pointed out in the claims.

In the drawings,

FIG. 1 is a side elevation of a fastener package embodying the invention;

FIG. 2 is a plan view of the package shown in FIG. 1; FIG. 3 is a sectional view taken on the line III—III of FIG. 1; and

FIG. 4 is a detail view, slightly enlarged, of a group of 6d screw type nails arranged in the manner in which they may be contained in the package of FIG. 1.

It will be appreciated that the subject invention may be employed for the packaging of numerous types and sizes of fasteners other than nails and particularly other than the type herein illustrated. Furthermore, the package shown in the drawings and described hereinafter is by way of illustration only and not by way of limitation of the invention.

Referring first to FIG. 4, a group of 6d screw type nails are shown on a slightly enlarged scale. Each nail has a conical head of diameter D and head height h plus a shank of diameter d .

Next referring to FIGS. 1 through 3, an expendable nail package 2 will be seen comprising two parallel side pieces 4 and 6 of fibrous material separated by a web 8 also of fibrous material and in the form of continuous corrugations 10. Each corrugation forms a flute f the length of which is one complete sine wave of corrugated web material measured along the median line m between the two parallel side pieces 4 and 6, as for example, from the point x to the point y in FIG. 3. A flute may also be defined as the web material between adjacent points of tangency of the corrugated web material 8 and one of the parallel sides, as for example, between points x' and y' on the side 4. The nails n are inserted in pockets p formed by the flutes between the side pieces 4 and 6 on both sides of the web.

The pockets p and consequently the nails are arranged at the angle β which is the angle between their axes and a line normal to the major axis a of the fastener package 2 (FIG. 1). The angle β will always be acute relative to the axis of the package. The nails' axes are parallel with the head of one nail engaging the shank of the adjacent nail just below its head in the manner shown in FIG. 4. The heads of the illustrated screw type nails have a conical lower portion 12 but it is obvious that if the fasteners contained by the package were common nails which have flat rather than conical heads, the head of one nail would engage the shank of the adjacent nail immediately below its head in the same manner as the screw type but with less slope. However, the upper surface of the head of one common nail would engage the undersurface of the next. The angle of the slope of adjacent fasteners, or, as shown in FIG. 4, the angle between the plane of the head of a nail and a line joining any two common points on adjacent nails is the angle θ .

Because the nails are arranged in overlapping or shingled relationship, the nail 14 at the leading or the

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right-hand end of the package, as viewed in FIG. 1, cannot move upwardly out of the package until the nail 16 next adjacent to it has been removed. The same is true of all the nails in the package except the endmost or last inserted nail 18 at the trailing or left-hand end, as viewed in FIG. 1. Consequently, to assure that all of the nails will not fall from the package should it be turned upside down, it is only necessary to prevent the endmost nail from being removed, this done by a strip of pressure sensitive tape 20 covering its head.

A package made in accordance with this invention is particularly advantageous for use with a fastener driving tool which removes the leading fastener 14 and those that follow it one at a time by driving them or otherwise forcing them axially downwardly through the package. Fasteners oriented in the manner disclosed, i.e. with their axes parallel, will always be presented to the driving tool uniformly aligned by advancing the package in equal increments along its own axis a . This is not readily accomplished where the package is flexible. If the axes of the nails all lie in the same plane, the theoretical minimum spacing between nails is obtained when the heads are arranged in shingled relationship head-to-shank, as shown. However, the spacing is further advantageously reduced by the nails being staggered or offset relatively to each other and to the median line m , as shown in FIGS. 2 and 3. This latter advantage, of course, is not obtainable with the packages of either of the above-identified patents.

Because each pocket p accommodates one nail n , and since the flutes make pockets on both sides of the web, a package made in accordance with this invention is capable of holding substantially twice as many nails per unit length as a package of the type shown in the Prouty patent. It will be seen that the exact number of nails or pockets in the illustrative package is twice the number of complete flute lengths minus one, or, expressed mathematically:

$$\begin{aligned} N &= P \\ N &= 2F - 1 \\ P &= 2F - 1 \end{aligned}$$

where:

N is the total number of nails n in a package
 F is the total number of complete flutes f in a package,
 and
 P is the total number of pockets p in a package.

For example, a package of four full flutes will accommodate seven nails. From a practical standpoint, packages of 50 or 100 nails are most convenient and it will be easily seen that a package of 50 nails requires only 25 full flutes plus one half of the next or twenty-sixth flute. However, 50 nails packaged in the manner taught by Prouty would require 50 full flutes and be twice as long.

As seen in FIG. 4, the center distance or the distance between the axes of adjacent nails n is equal to one-half of the head diameter D plus one-half of the shank diameter d , or expressed mathematically:

$$d_c = \frac{D}{2} + \frac{d}{2}$$

or

$$d_c = \frac{D+d}{2}$$

where:

d_c = center distance of adjacent nails n
 d = shank diameter of a nail n
 D = head diameter of a nail n

The number of nails, therefore, which may be accommodated per linear unit of a package is the total number of nails N in a package divided by its length. It is also

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the reciprocal of the center distance measured in the same units or, expressed mathematically:

$$n_i = \frac{1}{d_c}$$

where n_i is the number of nails per inch.

However, simultaneously solving the following formulae

$$d_c = \frac{D+d}{2}$$

and

$$n_i = \frac{1}{d_c}$$

the number of nails per inch will be found to equal

$$n_i = \frac{2}{D+d}$$

therefore, the number of nails per foot n_f , being twelve times the number per inch, is:

$$n_f = 12n_i$$

$$n_f = 12 \left(\frac{2}{D+d} \right)$$

$$n_f = \frac{24}{D+d}$$

with D and d expressed in inches.

Corrugated fiber board, from which the package 2 may be made, is normally manufactured with 32, 42 or 54 flutes per linear foot measured normal to the flutes. These sizes are known in the trade as sizes A, C and B, respectively. While these are the most convenient and popular sizes of corrugated board, it is possible to obtain intermediate sizes thereby to accommodate the fasteners exactly. This would, however, be more expensive. To find either the nominal, or the exact size of the corrugated board if desired, it is necessary to ascertain the number of flutes per foot (f_f) required. This is best seen from a specific example.

A popular size floor fastening readily adaptable to packaging in accordance with this invention is the 6d screw type nail shown enlarged in FIG. 4 and having a diameter D of .200", a shank diameter d of .106" and a head height h of .063". The number of 6d nails per foot (n_f) arranged in the manner shown in FIG. 4 will be found from the formula

$$n_f = \frac{24}{D+d}$$

to be 78.43. Obviously, a fractional part of a nail is a practical impossibility. Therefore, either 78 or 79 nails will be packaged per linear foot of stock measured normal to the nails' axes.

In accordance with the formula $N=2F-1$ it will be found that a package having 40 flutes will hold 79 nails and one having 39 flutes will hold 77. Therefore, the nominal size "C" corrugated board will be used which will actually hold 83 nails per linear foot measured normal to the nails' axes if the board is cut with complete flutes left intact.

The angle θ may also be readily ascertained. Assembling nails at this angle produces maximum closeness or spacing efficiency and will be seen from FIG. 4 as the slope of the heads of the shingled nails. The vertical spacing of the nail heads per inch is equal to the number of nails per inch multiplied by the height of a nail head in inches. The vertical deflection per inch being the tangent of the angle θ , it follows that:

$$\tan \theta = n_i \times h$$

therefore

$$\theta = \tan^{-1} n_i \times h$$

where n_i is the number of nails per inch and h is the height of a nail head in inches.

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Substituting the values of h and n_1 , which may be obtained from the known values of D and d , and solving the equation it will be seen that $\tan \theta = .4118$ and θ approximately $= 22^\circ 20'$.

As stated above, maximum packaging efficiency occurs when nails are assembled as shown in FIG. 4. However, cutting the corrugated board into strips with the angle β equal to the angle θ and making the strips one foot in length produces a package which will hold less than the number of nails calculated above. This is because the package length upon which the calculations are based must be measured normal to the nail pockets or flutes, which is along the axis a' as distinguished from the axis a , FIG. 1. Knowing the size of angle β , and knowing the length of the package measured along either axis, it is possible to ascertain the length measured along the other axis. The relationship being:

$$l_{a'} = l_a \cos \beta$$

where

l_a is the length of the package measured along the axis a
 $l_{a'}$ is the length of the package measured normal to the pockets or flutes, and
 β is the angle between the axes of the pockets and a line normal to the axis a .

Substituting the values for the 6d nail, and considering l_a to be one unit in length (as for example one foot), $l_{a'}$ equals 1.081 units, which is only slightly larger than the theoretical or calculated one foot length for the particular illustrated 6d nail.

It will be obvious from the foregoing that fastener packages made in accordance with this invention may be varied in actual size from the theoretical sizes as dictated by manufacturing tolerances as well as the uses to which the package will be made. For example, it may be more convenient to make packages containing exact numbers of nails, such as 50 or 100, rather than a package having an exact length. Furthermore, it may be more important to increase the angle β from the theoretical angle θ of maximum efficiency, whereupon the package length also increases. However, neither of the foregoing will depart from the spirit or scope of this invention.

Having thus described my invention, what I claim as new and desired to secure by Letters Patent of the United States is:

1. A package of fasteners having heads and shanks comprising a strip cut from corrugated board on a bias angle and including two parallel flat side pieces having between them a web forming a plurality of continuous flutes, which, together with the side pieces, form pockets open at both ends in which pockets the fasteners are held with their axes parallel and at an acute angle with the major axis of the strip and with the head of each fastener extending out of said strip and at all times overlapping the head of the adjacent fastener and with its shank portion directly beneath the head at all times engaging the head

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of said adjacent fastener, the number of fasteners per unit length of the package being substantially equal to:

$$\frac{2}{D+d}$$

where D is the head diameter of a fastener, and d is the shank diameter of the fastener.

2. A package of fasteners having heads and shanks comprising a strip cut from corrugated board on a bias angle and including two parallel flat side pieces having between them a web forming a plurality of continuous flutes, which, together with the side pieces, form pockets open at both ends in which pockets the fasteners are held with their axes parallel and at an acute angle with the major axis of the strip and with the head of each fastener extending out of said strip and at all times overlapping the head of the adjacent fastener and with its shank portion directly beneath the head at all times engaging the head of said adjacent fastener, the angle of slope between adjacent fasteners being substantially equal to:

$$\tan^{-1} n_1 \times h$$

where n_1 is the number of fasteners per unit length of the package, and h is the height of a fastener head.

3. A package of fasteners having heads and shanks comprising a strip cut from corrugated board on a bias angle and including two parallel flat side pieces having between them a web forming a plurality of continuous flutes, which, together with the side pieces, form pockets open at both ends in which pockets the fasteners are held with their axes parallel and at an acute angle with the major axis of the strip and with the head of each fastener extending out of said strip and at all times overlapping the head of the adjacent fastener and with its shank portion directly beneath the head at all times engaging the head of said adjacent fastener, said bias angle being substantially equal to:

$$\tan^{-1} \frac{2}{D+d} \times h$$

where D is the head diameter of a fastener, d is the shank diameter of the fastener, and h is the height of a fastener head, whereby the maximum number of fasteners are contained in a unit length of the strip.

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