June 29, 1971 L. H. FELDBERG 3,588,962

BUNDLING STRAP

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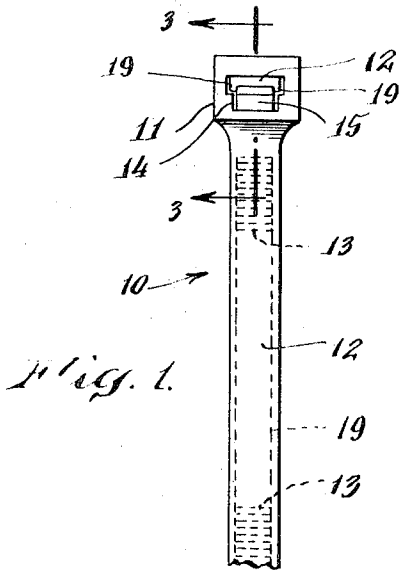

Fig. 1.

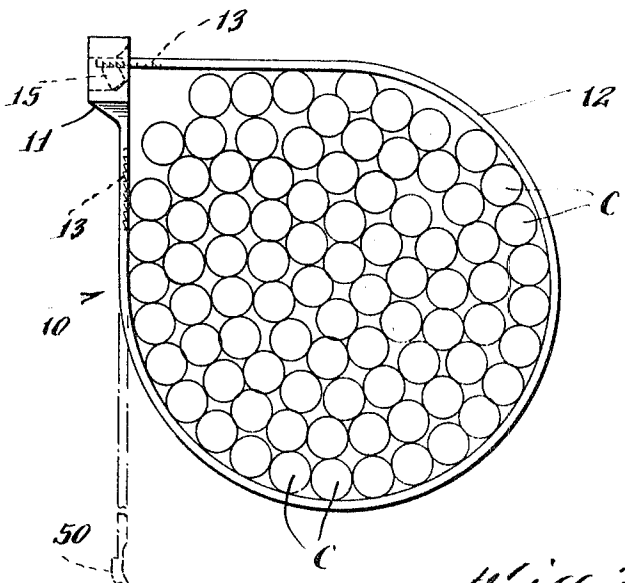

Fig. 2.

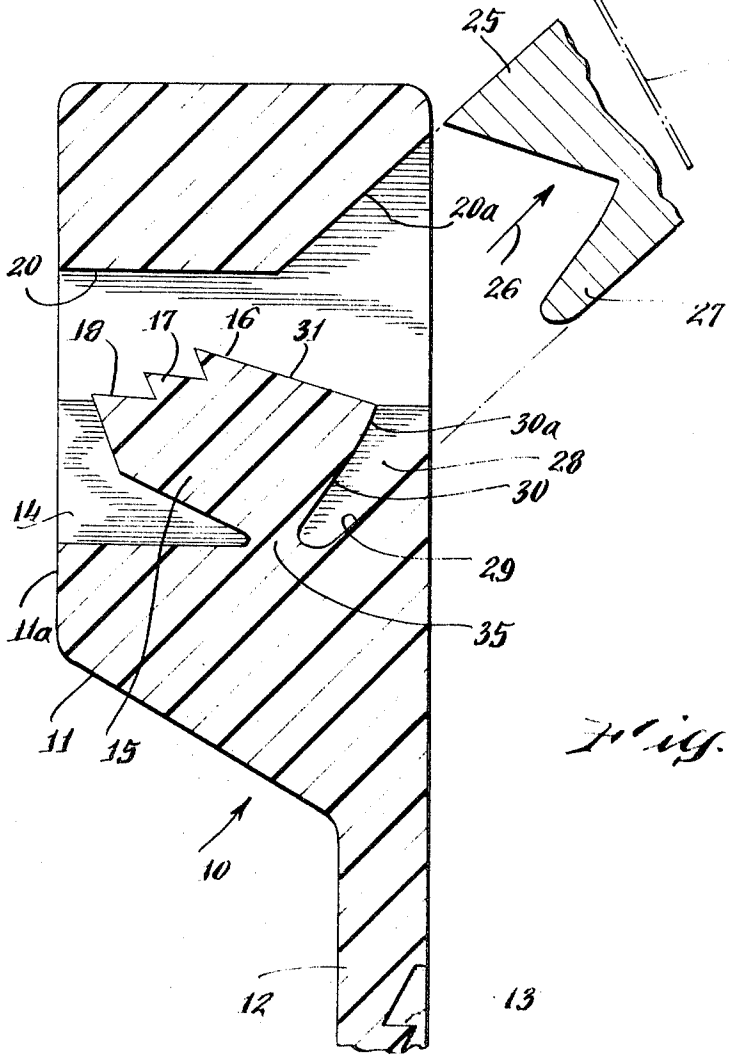

Fig. 3.

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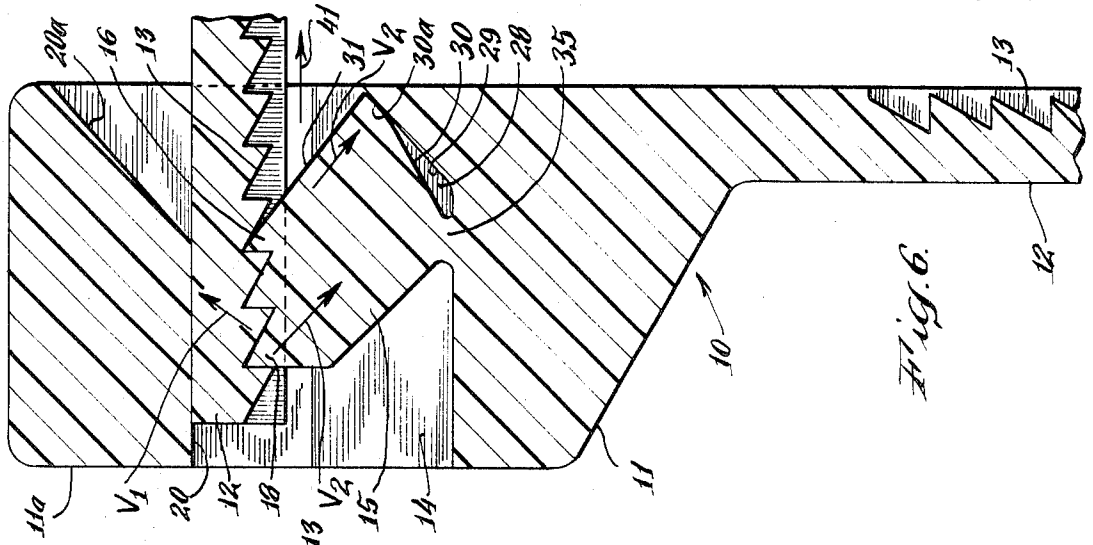

Fig. 6.

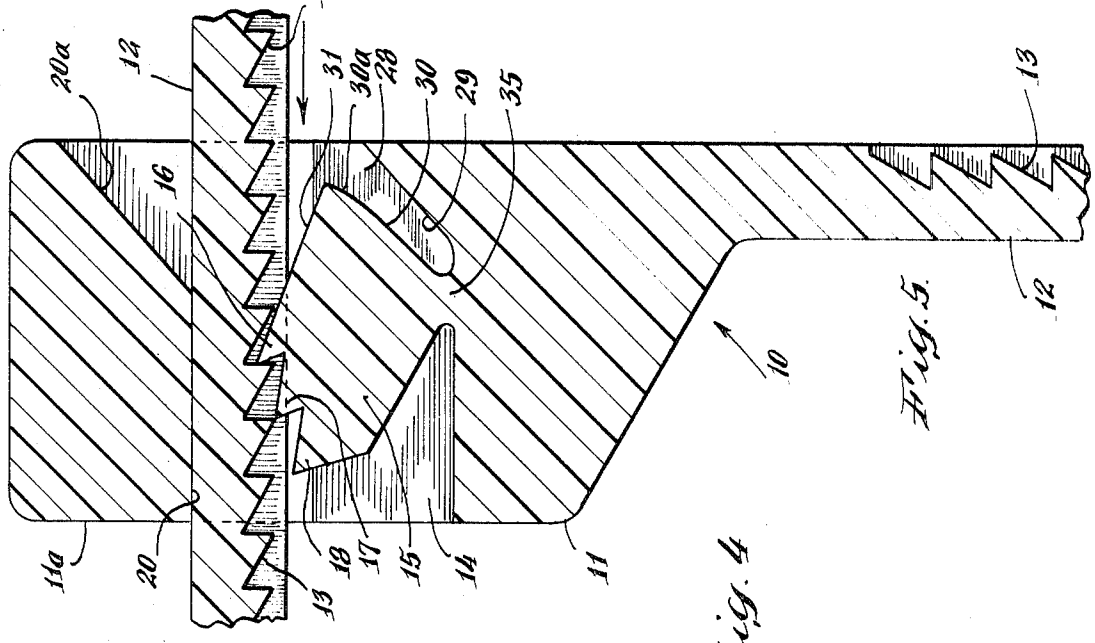

Fig. 5.

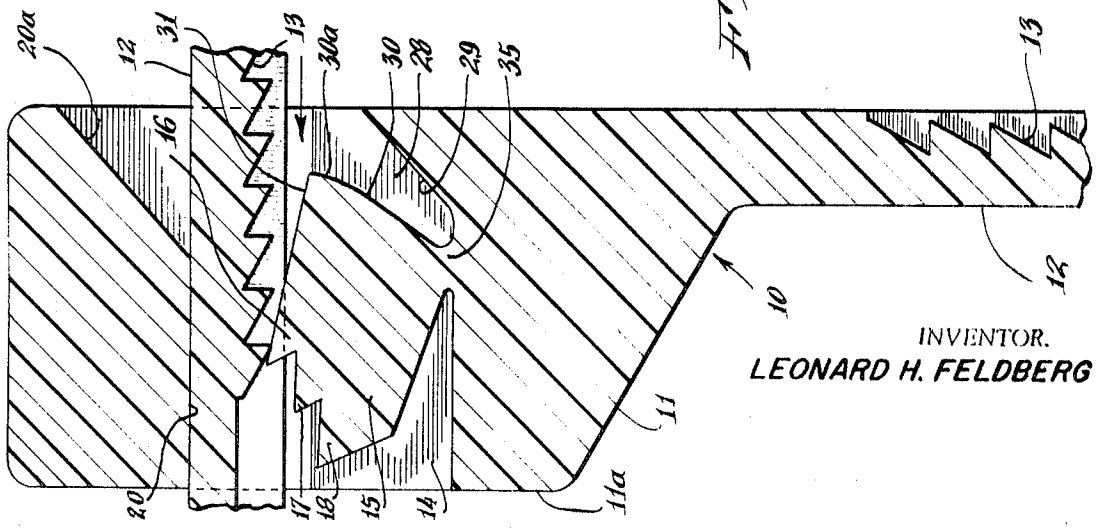

Fig. 4

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United States Patent Office 3,588,962
Patented June 29, 1971

3,588,962

BUNDLING STRAP

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Filed Mar. 12, 1970, Ser. No. 18,885
Int. Cl. B65d 63/00
U.S. Cl. 24—16PB 6 Claims

ABSTRACT OF THE DISCLOSURE

A plastic bundling strap is formed by making an integral plastic casting including a head and a ratcheted strap. The strap is inserted into a locking slot in the head and is locked by a pawl against release. The pawl is integral with the head and flexes to allow insertion of the strap into the locking slot, after which the pawl locks the strap within the slot against reverse movement. A stop surface for the pawl is formed between the pawl and the head by using an angularly moving core to form a narrow separating slot between the pawl and the head. This separating slot allows flexing of the pawl when the strap is inserted into the locking slot, but limits flexing in a reverse direction through the surfaces thereof acting as a stop. The surfaces are at that angle to the pawl and the strap and the locking slot whereby to accept perpendicularly thereof the forces exerted by the pawl developed by attempted release movement of the strap.

FIELD OF INVENTION

This invention relates to a bundling strap of the type used for tying together a series of electric wires, cables, tubes or the like. Straps of this class are used in large quantities by automobile manufacturers, airplane manufacturers, and similar industrial users.

PRIOR ART AND BACKGROUND OF INVENTION

Many patents have issued to inventors covering various types of bundling straps. The art is highly developed, and many inventors are attempting at all times to improve the constructions of bundling straps available to industry.

Generally, a bundling strap, and a head for the strap, are cast together from a plastic material such as nylon. The head is formed with a transverse locking slot into which the strap of the one piece device is inserted, after it has been wrapped about a series of conductors or tubes that are to be maintained in a bundled position. The strap is ratcheted, and is locked within the slot of the head by a pawl that is cast integrally with the head. While there are many devices of the particular class, as already indicated, there appears to be no effective construction available in which the pawl will flex readily in order to allow easy insertion of the strap, and yet will move swiftly into a position to accept the stresses that are applied thereto by a pull on the strap, such as will be exerted by the conductors or tubes that are bundled.

It is extremely desirable that the strap, after being moved into tightened relation to the bundle, and locked by the pawl in the head, move slightly backward from its fully tensioned and tightened position upon being released. The reason for this is that the end of the strap, after being pulled through the locking slot for holding the wires or tubes in bundled position, must be cut so that no portion of the strap will extend beyond the head. It is naturally difficult to cut the strap very closely to the head. Therefore, if the strap moves rearwardly into the locking slot of the head after being cut and released, it is obvious that no part of the strap will protrude from the head where it may do injury to the operator. It is believed that prior workers in the art have encountered considerable difficulty in meeting required conditions, because no really effective means for reinforcing the pawl and controlling its movement, have been found.

Also, no effective locking means for locking a flexing pawl in a bundling strap combination, seem to have been developed. One device of the prior art does use a pawl that, after moving into locking engagement with a strap, will move with the strap rearwardly when released so that a portion of the pawl will strike a vertical surface of the locking slot of the head. However, the contact between the flexible pawl and the locking strap is such relatively to the surface against which the pawl is pressed by the strap, that shearing of the pawl will take place. This is due to the fact that the surface contacted by the pawl will not be effective to prevent sliding and shearing movement of the pawl. It is believed that difficulties in locking the pawl have been encountered because, as those skilled in the art understand, the locking slot in the head, together with the pawl, are formed by casting the head and pawl together, utilizing a core for the locking slot. A conventional core adapted to be moved in a conventional manner in the mold, will not form a stop surface that will effectively resist the releasing movement of the pawl nor the shearing of the pawl at its point of connection with the head of the strap.

The degree of the problem presented is appreciated when it is considered that to meet the problem, one inventor has contributed a construction in which the pawl is manufactured of metal and is forced into the head to a position for locking the strap. Obviously, a construction of this type is costly and is subject to considerable difficulty in manufacture and in operation.

OUTLINE OF THE INVENTION

In the construction of this patent application, a pawl integral with the head is formed so that it moves relatively to the head on a relatively small neck. This facilitates flexing of the pawl. One side of the pawl is formed as a surface of a narrow slot, the slot being the means through which the pawl is cast integrally with the head while partially separated therefrom for flexing. Therefore, the pawl will swing away from the opposed or base surface of the slot through which it is formed, herein to be termed a separating slot. Such swinging movement away from the base surface of the separating slot occurs as the strap is moved into the locking slot of the head, the pawl flexing back and forth to allow the ratchet teeth of the strap to move past the pawl. However, the base surface acts as a stop against free reverse swinging of the pawl, and is so angularly positioned because of the manner of forming of the separating slot, that it accepts perpendicularly thereto, the forces exerted against the pawl by the strap.

Under the concept of this invention, the narrow separating slot between the pawl and the head at one side of the pawl, is formed by a core that is also part of the core forming the locking slot. Further, the core is shaped so that it is inserted into the mold in an angular position relatively to the locking slot, with the movement of the core in an angular direction forming the separating slot at an angle to the locking slot of the head. The locking slot is of course transverse of the head as is common in the art.

Further, because of the utilization of the angular separating slot, and the general arrangement of the pawl, it is possible, as a feature of the invention, to use multiple teeth on the pawl. Still further, rotation of the pawl will cause the multiple teeth to interlock with the ratchet teeth of the strap, so that there will be an interlocking of several teeth of the ratcheted strap and the pawl. This

interlocking takes place simultaneously with the movement of the pawl surface of the separating slot against the base surface of the separating slot. The coaction of the surfaces is extremely effective, because the base surface of the separating slot, together with the pawl surface of the separating slot, are positioned at contact so that the stresses against the pawl exerted by the strap and transmitted to the base surface of the separating slot, are substantially perpendicular to the base surface of the separating slot. Therefore, the separating slot surfaces accept any stresses exerted against the pawl, and will prevent shearing of the pawl, while holding the pawl in a very effective locking position relatively to the strap.

Further, as a valuable feature, the arrangement of the rotating pawl teeth is such that the movement of the teeth into locking position relatively to the strap will move the end of the strap, after it has been cut, into the head of the strap so that there will be no part of the cut strap protruding from the head.

DESCRIPTION OF THE DRAWINGS

In the drawings, FIG. 1 is a partial vertical view of the integral strap and head of the invention. FIG. 2 is a side view of the assembly of FIG. 1. FIG. 3 is an enlarged sectional view illustrating the head of the bundling strap together with the integral pawl, as cast in the mold, as well as the movement of the core utilized for forming part of the locking slot and the pawl. FIGS. 4, 5 and 6 are views similar to FIG. 3 illustrating the strap and pawl in various positions.

DESCRIPTION OF A PREFERRED FORM OF THE INVENTION

In FIGS. 1 and 2 the bundling strap is indicated generally by the reference numeral **10**, and is formed with a head portion **11** and a strap portion **12**. The strap portion **12** is formed so that it has small upstanding flanges **19** at each side thereof, and between the flanges there are formed ratchet teeth **13**, best shown in FIGS. 4, 5 and 6. As is common in the art, the straps are adapted to be wrapped around a series of conductors or the like designated generally by the reference letter C in FIG. 2, after which the end of the strap is inserted into what is termed a locking slot **14** formed in the head **11**. The pawl of the invention is designated by reference numeral **15**, and is obviously adapted to coact with the ratchet teeth **13** for locking the strap within the locking slot **14**. Pawl **15** is formed with a series of teeth **16**, **17** and **18**, and these teeth are spaced at different distances from the transverse end surface **20** of the slot **14** in the normal position of the pawl seen in FIG. 3.

Under the concept of the invention, slot **14** is formed by suitable cores, the cores being so designed as to outline the pawl **15** as well as the slot **14**. Thus, one of the cores adapted to form one side of the locking slot **14** and part of the outline of the pawl, is designated by reference numeral **25** in FIG. 3, and is adapted to move into and out of the mold along a line designated by reference numeral **26**. The core has a part **27** that is adapted to form what has heretofore been generally described as the separating slot. This separating slot **28** has what is termed a base surface **29** and a pawl surface **30**. The core **25** is also adapted to form the surface **31** of the pawl **15**, as is obvious. The teeth of the pawl, and the remaining portion of the locking slot **14**, are formed by a core or cores entering the locking slot in an opposed direction to core **25** and in a conventional manner.

It is necessary to appreciate, that the pawl **15** will be secured to the base of the head **11**, after being formed, by a neck portion **35**. This neck portion will be sufficiently narrow, so that the pawl **15** will flex readily. It may be well to indicate further, that the part **27** of the core **25** is so formed that a part **30***a* of the pawl surface **30** of the separating slot **28**, will be slightly angularly offset. This not only acts to strengthen the core portion **27**, but is also useful in the forming of the surfaces **30**, **30***a* of the pawl so as to bring about effective control of the pawl to accept the stresses applied thereto by the strap.

In FIG. 4, the initial insertion of the strap into locking slot **14** is shown, and it will there be seen that the pawl **15** has flexed away from the transverse end surface **20** of slot **14**, this flexing having been made possible by the formation of the neck **35**. In FIG. 5 the strap portion **12** has moved further inwardly of the locking slot **14**, and the three teeth **16**, **17** and **18** of pawl **15** are in a position to engage three ratchet teeth **13** of the strap. However, the pawl **15** is maintained in a flexed position by an end portion of one of the ratchet teeth **13** of the strap **12**, with teeth **17** and **18** away from the strap teeth. This will generally be the position of the parts when the strap has been pulled about a bundle of conductors or pipes or tubes as presented in FIG. 2 and is held under tension. Now, in this position of the parts, the strap is cut by a suitable cutting device, as closely to the surface **11***a* of the head **11** as is possible, and is released.

In FIG. 6, the strap is shown after it has been cut and released and allowed to move under the stress exerted by the bundle and held thereby. The strap presses against the teeth of the pawl **15** and urges the pawl to a position in which the pawl substantially closes the separating slot **28**, bringing the pawl surface **30***a* against the base surface **29** of the separating slot. It will be noted that all three of the teeth **16**, **17** and **18** of the pawl **15** are now firmly engaged with ratchet teeth **13** of the strap **12**, and that through this engagement, tension on the strap **12** in the direction of the arrow **41** in FIG. 6, has rotated the pawl on its neck **35** into the stop position indicated. This rotation has brought the end of the strap that was severed, well within the locking slot **14** as is very desirable in the art. Naturally, this movement is made possible because of the rotation of the pawl **15** from any of the three positions illustrated in FIGS. 3, 4 and 5 to the stop position of FIG. 6.

In the position of FIG. 6, it will be noted that the force exerted by the strap **12**, when moving in the direction of the arrow **41**, will exert a force against the pawl along the direction of the vector arrow V_1 and that the force thus exerted will be accepted by the pawl **15** along the direction of vector arrows V_2. Vector arrows V_2, it will be noted, are substantially perpendicular to the base surface **29** of the separating slot **28**, so that this base surface will act as a stop in a most effective manner. Acually, it would require crushing of the pawl **15** in order to release the strap. Further, the surface **29** will so accept the forces exerted against the pawl, that there will be practically no stress exerted against the neck portion **35**.

It is believed that the contribution of the invention to the art will now be appreciated. Also, it will be well to understand further, that it is the concept of the novel form of coring described in connection with FIG. 3, that makes simple the formation of the pawl and the particular separating slot. At this point it will be well to indicate also that because of the utilization of the core **25**, a part of the transverse end surface **20** of the locking slot **14** will be cut away as at **20***a*. This does not in any way make less effective the locking of the strap **12**, since the strap and the pawl **15** will effectively fill the transverse section of the locking slot **14** when the strap is locked by the pawl, all as is seen in FIG. 6.

In order to prevent insertion of the strap **12** in a direction opposed to that in which it must be inserted as shown in FIG. 2, a small lug **50** may be formed on the strap as shown in FIG. 2. This lug is so formed that it will not interfere with the movement of the strap into a correct relationship to the head **11**, but will prevent movement in a reverse or incorrect direction. It will also be noted that a portion **12***a* of the strap is bent upwardly as shown in FIG. 2. The purpose of this arrangement is to permit the operator to grasp the strap when it is desired to use it for the bundling operation.

What is claimed is:

1. A bundling strap of the type comprising a head from which extends longitudinally a strap adapted to be inserted through a transverse locking slot formed in the head and then to be locked against retraction from the locking slot, said transverse locking slot being defined by a transverse end surface and a base, a pawl formed integrally with said base to extend into said locking slot toward said end surface and separated from said base at one side by a narrow separating slot and at the other side by a space so as to leave said pawl secured to the base by a relatively narrow bridge whereby said pawl is free to flex, said narrow separating slot being formed at an acute angle to said transverse end surface and having a base surface and a pawl surface, a tooth on said pawl, ratchet teeth on said strap, said tooth on said pawl constricting the locking slot so as to require ratcheting flexing of the pawl and widening of said narrow separating slot to allow movement of the end of the strap into the locking slot to engage lockingly the tooth of said pawl, and the attempted withdrawal of said strap thereafter effecting swinging movement of said pawl on its bridge to close the locking slot by forcing the strap against the transverse end surface thereof, said swinging movement of the pawl being stopped by the contacting of the base surface of said separating slot by the pawl surface, the acute angular position of said separating slot relatively to the end surface of the locking slot making possible the acceptance by said base surface substantially perpendicularly thereto the forces exerted by said strap against said pawl.

2. In the combination of claim 1, the feature that there are additional teeth on said pawl normally lying at increasingly spaced distances from said transverse end surface of the locking slot, the flexing movement of said pawl by a pull on said strap in a direction to effect closing of the separating slot bringing said teeth equidistant to said end surface and into engagement with ratchet teeth on said strap.

3. In the combination of claim 2, the feature that said

movement of said pawl into full locking position is accompanied by endwise movement of said strap, so that severance of the end of the strap extending beyond the slot after it is drawn through the locking slot and held for severance, will bring about movement of the cut end of the strap into the slot upon normal stress of the bundled material held by the strap.

4. In the combination of claim 1, the feature that said head and strap are formed as a plastic casting and that said separating slot and one surface of the pawl and a part of said locking slot are formed by a core adapted to be moved into and out of the casting mold angularly in the direction in which said separating slot lies relatively to the transverse end surface of said locking slot.

5. In the combination of claim 1, the feature that said strap is formed relatively to said slot so that it can be moved into said slot in but one direction.

6. The method of casting the transverse locking slot in the head of a bundling strap together with a locking pawl integral with the head and positioned in said locking slot, that comprises utilizing a core for one end of the locking slot that moves in and out of the casting mold at an angle to the normal direction of the slot, and forming on said core an end surface for casting a surface of the pawl, utilizing a relative long flange on said core for forming a separating slot between the pawl and the head whereby the slot is formed in the casting to allow flexing of said pawl while through its angular position limiting the movement of the pawl by a stop surface positioned at an effective angle.

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