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PATENT SPECIFICATION

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(54) BAND CLAMPING DEVICE

(71) We, KABUSHIKI KAISHA SUDA SEISAKUSHO, a Body Corporate existing under the laws of Japan, of 2—4, Kachidoki 4-chome, Chuo-Ku, Tokyo-To, Japan, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a device for clamping one object to another with a band, or, more particularly, it is concerned with a band clamping device which comprises a flexible band and a clamping means.

The band clamping device according to the present invention finds its use, for example, in attaching power cable, tubing for electric wire, and so forth along the lengthwise direction of a pole or mast so as to fix such wire materials to the pole, or in fixing a bracket for mounting thereon various devices and appliances for telecommunication and power supply, or advertising material, street lighting, and so forth on the pole.

The present invention is also useful in fixing a bracket for the abovementioned appliances and equipment for telecommunication and power supply, or attaching various sign boards onto the pole or mast, either standing upright or being laid down, at various places, such as, for example, railway stations. Or, in the case of temporary mounting of such things as electric power supply appliances, of sign boards, onto such things as scaffolding, pillars, or piles, or in the case of fitting clamp metal for joining the intersecting parts of the abovementioned scaffolding pillars to each other, or in the case of binding together a plurality of lengths of material such as lumber, and in many other uses.

For such various uses as mentioned above, there has been known a band clamping device which comprises a flexible band and a clamping means, wherein the clamping means comprises a bearing seat in the form of a channel in a rectangular seat

plate arranged to support a band take-up shaft, and wherein the band to be clamped is wound around the pole, mast, scaffolding or pillar, (hereinafter referred to by the general term "pole"), and a bent portion at one end thereof is hooked at a hooking slot in the clamp member main body, and the other end is wound up on the take-up shaft and clamped firmly so as not to loosen.

It is an object of the present invention to provide an improved band clamping device, wherein, by means of return preventive locking of the band take-up shaft after clamping of an object by the band by either automatic or simple one-touch operation, the band take-up shaft of the device is caused to stop at its right position for the clamping so as not to allow any slackening of the band, and wherein the band take-up shaft can be easily released from its locked state at any time as required.

It is another object of the present invention to provide an improved band clamping device, wherein the necessary clamping force can still be maintained even when the object bodies bundled by such band clamping device become thin with lapse of time.

According to the present invention a band clamping device comprises in combination: a channel shaped, e.g. U-shaped, main body with the bottom part thereof constituting a seating member, and with both sides extending up from said seating member to constitute a pair of support members; at least one slot formed in the seating member and adapted in use to engage one end of a flexible band which in use is hooked through the said slot, e.g. one end of the band may be provided with a folded edge for being hooked through the said slot; a band take-up member provided with at least one band insertion slot and which is rotatably held by said pair of support members; a ratchet wheel arranged to rotate with said band take-up member and a return preventive mechanism comprising an engaging pawl provided on one of the support members arranged to

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engage the said ratchet wheel, the said support members each extending outwardly beyond the perpendicular from the seating member whereby the said ratchet wheel can be disengaged from the said engaging pawl by compressing the said support members inwardly against their elasticity. The angle between each support member and the seating member is preferably 91 to 92°.

Various kinds of metal materials, synthetic resins such as, for example, nylon, or polypropylene, can be used for the main body of the flexible band tightening device. When the device is to be used in corrosive environments e.g. in contact with salt spray non-rusting steel material e.g. stainless steel preferably used. In this case, the band take-up shaft of a structure, in a conventional bolt, is too expensive to be suitable for practical uses. It is therefore the object of the present invention to manufacture the band take-up shaft of rust-proof material which can be made into inexpensive, mass-producible press-formed articles.

The invention may be carried into practice in various ways, but two specific embodiments thereof will now be described by way of example only, and with reference to the accompanying drawings, in which:—

Figure 1 is a view seen from below the band clamping device according to the present invention in its state of use;

Figure 2 is a view of the band clamping device shown in Figure 1 above taken along the arrow II in Figure 1;

Figure 3 is an exploded view of the band clamping device according to the present invention;

Figure 4 is a side elevational view of the band clamping device;

Figure 5 is a view similar to Figure 2 of another embodiment of the band clamping device according to the present invention;

Figure 6 is a view similar to Figure 2 showing a state wherein the band clamping device is slackened;

Figure 7 is a side elevational view of the band clamping device shown in Figure 5 taken along the arrow VII in Figure 8;

Figure 8 is a view seen from below of the band clamping device shown in Figure 5 in its state of use;

Figure 9 is a perspective view of the band take-up shaft of the band clamping device; and

Figure 10 is a perspective view of a cam member for fixing the band take-up shaft unmovable.

Referring to Figure 1, the clamping device according to the present invention for clamping, for example, electric cable tubing M along the longitudinal direction of a pole P is constructed with a flexible band 1, the main body of the clamping device 2, a band take-up shaft 3, a head part 4 of the

band take-up shaft, and a return preventive ratchet wheel 5 for the band take-up shaft.

The clamping device main body 2 is constructed in such a manner that a rectangular seating plate 2a contacts the peripheral surface of the pole P. The main body has a pair of mutually opposed support members 2b₁ and 2b₂ which are formed by bending both ends of the seat plate 2a in a channel-form, and cushion member 2c extending in a lengthwise direction of the seating plate 2 and bent in the form of an inverted letter V. The main body 2 is integrally formed by the press-shaping or moulding. The opening angle α between the seat plate 2a and the support members 2b₁ and 2b₂ is approximately 91 to 92 degrees.

The clamping device further comprises a receiving port 6 formed in each of the support members 2b₁ and 2b₂. Band hooking slots 7a and 7b are formed at appropriate positions in the seating plate 2a. An engaging pawl 8 is provided at one position on either of the support members 2b₁ or 2b₂ (in the drawing, it is shown as provided on the support member 2b₁) and is arranged to be engaged with the ratchet wheel 5. The pawl 8 may be formed by extrusion moulding. The band take-up shaft 3 is formed by pressing a blank sheet material.

The embodiment of the band take-up shaft 3 shown in Figures 1 to 4 is formed in such a way that the head part 4 is substantially in the form of a parallelepiped. The shaft 3 has a pair of opposed arcuate leg members 3a and 3b constituting the band take-up shaft together with the head 4 form a letter "T". A gap 9 between the pair of arcuate leg members 3a and 3b serves as a passage, through which a clamping band is caused to pass.

The embodiment of the band take-up member 31 shown in Figures 5 to 10 (especially Figure 9) is shaped by press-forming a piece of blank sheet material in the form of a letter "U". The band take-up member 31 has a slot 10 through which the band can be passed. The slot 10 is at the bent portion of the band take-up member and a head portion 41 projects from one end of the U-shaped band take-up member 31. The width d of the leg portion in the U-shaped member is made substantially equal to the diameter of the receiving port 6 for the band take-up member 31.

The ratchet wheel 5 cut out from blank sheet material, in the embodiment shown in Figures 1 to 3, is so designed that an engagement piece 5b for the band passage 9 of the band take-up shaft 3 is formed in the diametral direction of the ratchet wheel where the receiving holes 5a for the shaft is formed. This keys the shaft 3 to the ratchet wheel 5 and enables them to rotate together. The receiving hole 51a in the shaft of the

ratchet wheel 51 is similarly shaped to take the U-shaped take-up member 31 shown in Figures 5 and 8. The member 31 and the wheel 51 are keyed together and can rotate together.

In the embodiment shown in Figure 3, the band take-up shaft 3 is inserted in the shaft holes 5a of the ratchet wheel 5, then caused to pass through the receiving ports 6 of the support members 2b₁ and 2b₂ formed integrally with the clamping device main body 2. The shaft 3 is then fitted at its tip end with a washer 11 outside the support member 2b₂, and finally caulking pieces 12 formed at the tip end of the band take-up shaft 3 are bent outwardly to fix the shaft to the support members 2b₁ and 2b₂.

In the embodiment shown in Figures 5 to 10, a cam 13 serving for preventing slipping of the band take-up member 31 from the clamping device main body and for clamping and loosening thereof is provided at the end of the band take-up member 31 remote from its head 41. The band take-up member 31 is clamped to the main body 2 by means of the cam surfaces 13a formed on both legs of a substantially U-shaped cam 13 inserted in a locking hole 14 of the band take-up member 31. When the cam 13 is raised as shown in Figure 6 by an operating pawl 13b as shown in Figure 10, the band take-up member 31 becomes loosened. A projection 15 protrudes from one part of the band take-up member 31 and is for stabilizing the relative setting position of the main body 2 and the band take-up member 31.

The clamping band 1 is cut in a length which is longer by 12 to 13 cm than the circumference of the pole P. A length of several centimetres of one end of this band 1 is passed through the slots 7a and 7b and then bent inwardly to the peripheral surface of the pole P, while the other free end of the band is wound around the pole P and this free end is inserted into the band passage 9 of the band take-up shaft 3. The band 1 may be wound around the pole for any number of turns as desired. When the band 1 is taken up on the band take-up shaft 3 by causing it to rotate through operation of a tool such as pincers, or a screw driver, the ratchet wheel 5 also rotates, while riding over the tooth of the engagement pawl 8. As soon as this rotation is stopped the ratchet tooth is engaged by the pawl 8, to automatically perform the return preventive action on the band take-up shaft 3. When this occurs the support member 2b₂ for the band take-up shaft 3 bends inwardly to relax the force required for the abovementioned over-riding. Also, the engagement between the engagement pawl and the ratchet wheel is non-continuous for each pitch of the ratchet teeth, and the tightening force of the

clamping device between one pitch and another is adjusted by the cushion part 2c, whereby a continuous clamping force is achieved.

In order to release the return preventive engagement of the band take-up shaft once it has been clamped tight, the ratchet wheel 5 can be disengaged from the engaging pawl 8 by first grasping the pair of supporting members 2b₁ and 2b₂ for the band take-up shaft 3 with a tool such as pincers, to cause the same to be flexed inwardly as shown by the dashed line in Figure 4.

In the embodiment shown in Figures 5 to 10, the cam 13 is pulled down to the operating state as shown in Figure 7 to perform the take-up operation by engaging the ratchet wheel 51 with the engaging pawl 8. Disengagement of the ratchet wheel 51 from the pawl 8 can be done by raising the cam 13 through the operating pawl 13b as shown in Figure 6 to impart to the band take-up member 31 a slackening in the direction of the axial line.

In the present invention, the band clamping device main body, band take-up shaft, the ratchet wheel, and all other component parts, inter alia, the band take-up shaft, can be manufactured by press-forming metal blank sheet, or by moulding synthetic resin. Accordingly, these component parts can be easily produced in an industrialized scale for mass-production from rust-resistant materials such as stainless steel.

In the embodiment shown in Figures 1 to 4, the opening angle α of the supporting members for the band take-up shaft in the clamping device main body is made slightly larger than an right angle to impart elasticity to the support members, whereby the engaging force between the ratchet wheel and the engaging pawl can be made large, and, at the time of the band take-up action, the resistance between the over-riding ratchet teeth and the engaging pawl can be reduced, whereby disengagement therebetween can be done smoothly.

In the case of the embodiment in Figures 5 to 10, the tight clamping can be released by raising the cam.

By the compressive stress of the inverted V-shaped portion 2c of the seating plate 2b of the main body at the time of the band clamping, it becomes possible to adjust excessive tension imparted to the band accompanied by non-continuous engagement between adjacent pitches of the ratchet teeth as mentioned above, and to thereby obtain a rigid clamping force. At the same time, its restitutive elasticity functions to maintain sufficient clamping force, in case the band slightly stretches or lumber bound together by the clamping device of the present invention become

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thinner to a certain extent with lapse of time.

WHAT WE CLAIM IS:—

5 1. A band clamping device comprising a channel shaped main body with the bottom part thereof constituting a seating member, and with both sides extending up for said seating member to constitute a pair of support members; at least one slot being
10 formed in the seating member and adapted in use to engage one end of a flexible band which in use is hooked through the said slot; a band take-up member provided with at least one band insertion slot and rotatably
15 mounted on the pair of support members; a ratchet wheel arranged to rotate with said band take-up member and a return preventive mechanism comprising an engaging pawl provided on one of the
20 support members arranged to engage the said ratchet wheel, the said support members each extending outwardly beyond the perpendicular from seating member, whereby the said ratchet wheel can be
25 disengaged from the said engaging pawl by compressing the said support members inwardly against their elasticity.

30 2. A band clamping device as claimed in Claim 1, in which the said band take-up member comprises a parallelepiped head part and a pair of opposed arcuate shaft members, the head and the shaft members forming a T-shape, a gap between said
35 opposing pair of the arcuate member being utilised as a band insertion slot and an engaging member for keying said ratchet wheel to said band take-up member.

40 3. A band clamping device as claimed in Claim 1, in which the said band take-up member is constructed with a U-shaped body, and engagement projection for said

ratchet wheel is provided at one end of said U-shaped body which serves as the head part therefor, and a band passage slot
45 formed in one part of the bent portion of said U-shaped body.

50 4. A band clamping device as claimed in Claim 3, wherein a U-shaped cam has a joint portion and, at both ends thereof, a pair of legs provided with cam surfaces, the said
55 band take-up member having an opening, in which the said joint portion of the said cam is fitted at the opposite end of its head part in a pivotally oscillatable manner, the said cam being such that, when it is raised up
60 away from the band take-up member, the said band take-up member is loosened in the axial direction with respect to the said support members so that it can be rotated, and when it is pulled down towards the
band take-up member, the said band take-up member is locked to the said support members.

65 5. A band clamping device as claimed in any one of Claims 1 to 4, in which a V-shaped section is provided on an extension of the said seating member of the main body to increase the band clamping force by the
70 compressive stress to be exerted thereby at the time of clamping the band, the V-shaped section extending outwardly away from the position which will be occupied by the surface of the pole when the band clamping device is in use.

75 6. A band clamping device substantially as specifically described herein with reference to Figures 1 to 4, or to Figures 5 to 10 of the accompanying drawings.

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thinner to a certain extent with lapse of time.

WHAT WE CLAIM IS:—

1. A band clamping device comprising a channel shaped main body with the bottom part thereof constituting a seating member, and with both sides extending up for said seating member to constitute a pair of support members; at least one slot being formed in the seating member and adapted in use to engage one end of a flexible band which in use is hooked through the said slot; a band take-up member provided with at least one band insertion slot and rotatably mounted on the pair of support members; a ratchet wheel arranged to rotate with said band take-up member and a return preventive mechanism comprising an engaging pawl provided on one of the support members arranged to engage the said ratchet wheel, the said support members each extending outwardly beyond the perpendicular from seating member, whereby the said ratchet wheel can be disengaged from the said engaging pawl by compressing the said support members inwardly against their elasticity.

2. A band clamping device as claimed in Claim 1, in which the said band take-up member comprises a parallelepiped head part and a pair of opposed arcuate shaft members, the head and the shaft members forming a T-shape, a gap between said opposing pair of the arcuate member being utilised as a band insertion slot and an engaging member for keying said ratchet wheel to said band take-up member.

3. A band clamping device as claimed in Claim 1, in which the said band take-up member is constructed with a U-shaped body, and engagement projection for said

ratchet wheel is provided at one end of said U-shaped body which serves as the head part therefor, and a band passage slot formed in one part of the bent portion of said U-shaped body.

4. A band clamping device as claimed in Claim 3, wherein a U-shaped cam has a joint portion and, at both ends thereof, a pair of legs provided with cam surfaces, the said band take-up member having an opening, in which the said joint portion of the said cam is fitted at the opposite end of its head part in a pivotally oscillatable manner, the said cam being such that, when it is raised up away from the band take-up member, the said band take-up member is loosened in the axial direction with respect to the said support members so that it can be rotated, and when it is pulled down towards the band take-up member, the said band take-up member is locked to the said support members.

5. A band clamping device as claimed in any one of Claims 1 to 4, in which a V-shaped section is provided on an extension of the said seating member of the main body to increase the band clamping force by the compressive stress to be exerted thereby at the time of clamping the band, the V-shaped section extending outwardly away from the position which will be occupied by the surface of the pole when the band clamping device is in use.

6. A band clamping device substantially as specifically described herein with reference to Figures 1 to 4, or to Figures 5 to 10 of the accompanying drawings.

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