An apparatus for fastening a superposed mass of sheet-like materials wherein there is provided a device for clamping an incoming superposed mass of sheet-like materials from above and below; the clamping device is carried to a feeder of heat contactible tape while holding the superposed mass; the tape is drawn out by being initially pressed against the forward end face of the superposed mass to be wound about the forward end face, top and bottom surfaces of the clamped mass; when the tape is further drawn out, those portions of the tape which extend outward from the top and bottom surfaces of the mass at its rear end are welded together; at the same time that looped portion of the tape which is wound about the mass is cut off to be separated from the feeder with the other portion being drawn out therefrom left uncut; the superposed mass thus wound are conducted to a heating device in a clamped state for thermal contraction of the tape so as to be tightly fastened together, and finally the fastened mass is taken outside by a withdrawing device.
APPARATUS FOR FASTENING A SUPERPOSED MASS OF SHEET-LIKE MATERIALS

This invention relates to an apparatus for fastening a superposed mass of sheet-like materials and more particularly to a fastening apparatus which consists in forwarding successively incoming superposed masses of sheet-like materials in a state clamped on both crosswise sides to a heating device for thermal contraction of the tape wound about said superposed mass so as to fasten it tightly.

The apparatus of this invention continuously carries out the sequential steps of clamping the superposed mass on both crosswise sides, winding a looped tape around those portions of the peripheral surface of the superposed mass which are defined between its clamped sides, thermally contracting the looped tape and removing the fastened mass. Therefore, the operating efficiency of said apparatus is prominently elevated.

According to the invention, the superposed mass may be clamped with its cross section in its travelling direction purposely bent, so as to cause it to be fastened all the more firmly by a looped tape when it is thermally contracted.

Further according to the invention, when the looped portion of the tape is cut off to be separated from the feeder, the other portion being drawn out therefrom is left uncut ready for use with the succeeding superposed mass and also the welded joint of the looped tape can be prevented from being formed at two places.

The present invention can be more fully understood from the following detailed description when taken in conjunction with reference to the appended drawings, in which:

FIG. 1 is an elevation showing the arrangement of the main parts of a fastening apparatus according to an embodiment of this invention;

FIG. 2 is a perspective view of a forwarding device mounted on a transporting mechanism, for example, a belt conveyor so as to further more forward the superposed mass already brought there;

FIG. 3 is a perspective view of a clamping device for holding the crosswise sides of the superposed mass placed on the mounting members of the device by the forwarding device of FIG. 2;

FIG. 4a illustrates the condition of the clamping device of FIG. 3 before holding the superposed mass;

FIG. 4b is a sectional view of said clamping device after holding the superposed mass;

FIG. 5 is a sectional view of the superposed mass clamped by the clamping device of FIG. 3 and further bound with a looped tape;

FIG. 6 is a general elevation including a tape feeder, clamped superposed mass, tape welding device and tape cutting device;

FIG. 7 is a sectional view of the heating device of FIG. 1;

FIG. 8 is a detailed perspective view of the superposed mass withdrawing device of FIG. 1;

FIGS. 9a, 9b and 9c are elevations showing the positional relationship of the fastened superposed mass with the pushing means of the withdrawing device of FIG. 8;

FIG. 10 is an elevation of a modified clamping device; and

FIG. 11 is an elevation of a tape feeder for preventing two welded joints from being formed in the looped tape.

Referring to FIG. 1, numeral 1 denotes a transporting device which includes a plurality of rollers 2; a plurality of belts 3 stretched over said rollers 2; and urging certificates, paper notes and cards, but also other similar nonpaper materials.

According to this invention, the superposed mass clamped on both crosswise sides can be bound tightly and reliably with a looped tape, which is later thermally contracted, without being disturbed in the superposed form.
means 6 to be pressed against the rear end of the superposed mass 5, for example, superposed post cards carried along in the direction of the indicated arrow 4 from the right side of FIG. 1 by being placed on the belts 3, thereby forwarding the superposed mass 5 toward a clamping device 7. When brought into the clamping device 7, the superposed mass 5 has its crosswise sides clamped thereby. The clamping device 7 is fixed on a base 8 movable on a rail 11. Above the passage of the superposed mass 5 is disposed a tape feeder 9. A heat contractable tape 10 supplied from the feeder 9 is pressed against the forward end face of the superposed mass 5 and further drawn out in the direction of the indicated arrow 4 by being conducted over guide members 12, for example, rollers. As a result, the tape 10 is wound around the forward end face, top and bottom surfaces of the superposed mass 5. When the mass further travels in the direction of the indicated arrow 4, a tape welding device 13 is put into operation to weld together those portions of the wound tape 10 which extend outward from the top and bottom surfaces of the superposed mass 5 near its rear end. Substantially at the same time, a cutting device 14 is actuated to cut off the looped portion of the tape 10, with the other portion being drawn out from the feeder 9 left uncut. The superposed mass 5 bound with the looped tape 10 and still clamped on both crosswise sides are further brought into a heating device 15. Since the looped tape 10 is thermally contracted in the furnace of said heating device 15, the superposed mass 5 is tightly fastened. When the fastened mass 5 is taken outside of the furnace, the pushing means 21 of the later described withdrawing device 16 is pressed against the rear end of the superposed mass 5 to throw it into a receptacle 17 disposed ahead. The moment the superposed mass 5 is removed, the clamping device 7 is driven opposite to the direction of the indicated arrow 4 back to its original position as illustrated, ready to clamp the succeeding superposed mass.

The transporting device 1 comprises, as shown in FIG. 2, four rollers 2a to 2d each provided with a belt groove and penetrated by a common rotatable shaft; belts 3a to 3d stretched over said rollers 2a to 2d; erected pressing means 19 having a plurality of comb-like projections 18 formed along part of the bottom edge at right angles to said means 19, said projections 18 being so arranged as to be each disposed between the individual belts 3a to 3d and extend in the direction of the indicated arrow 4, that is, the direction in which superposed mass 5 is carried; and drive means 20 for operating said pressing means 19. This drive means 20 includes an air cylinder 24 to drive a plunger 23 for reciprocating the pressing means 19 in the direction of the indicated double arrow 22; and another air cylinder 27 for actuating a plunger 26 so as to reciprocate the first mentioned air cylinder 24 vertically in the directions of the indicated double arrow 25, the latter cylinder 27 being fixed to a frame (not shown). When the superposed mass 5 placed on the belts 3a to 3d are brought to a prescribed position, the arrival is detected by a photoelectric detector. Upon generation of said detection signal, the pressing means 19 which is normally positioned above the belts 3 is brought down by the action of the air cylinder 27 to cause the aforesaid projections 18 to be forced into the inter spaces between those portions of the belts 3a to 3d which are brought just behind the rear end of the superposed mass 5. At this time the pressing means 19 is driven forward by the action of the air cylinder 24 in the direction of the indicated arrow 4 at a greater speed than that at which the belts 3 are moving. Thus the superposed mass is advanced similarly in the direction of the indicated arrow 4.

The clamping device 7 comprises, as illustrated in FIGS. 1 and 3, clamping means 28, 28 for holding both crosswise sides of the superposed mass 5 parallel with the direction (FIG. 1) in which it is travelling; a base 8 for supporting the clamping means 28, 28 through driving means connecting both base 8 and clamping means; and guide member 11, for example, rails (FIG. 1) for conducting said base 8 forward so as to move said clamping means 28, 28 along the tape feeder 9, welding device 13, cutting device 14 and heating device 15. Said clamping means 28, 28 include mounting members 29a and 29b to receive the superposed mass 5 thereon when pushed by the pressing means 19; and compressing members 30a and 30b for clamping the crosswise sides of the superposed mass 5 in cooperation with said mounting members 29a and 29b. To the outside of the vertical wall of said compressing members 30a and 30b are fitted rack members 32, 32, which are made to reciprocate in the directions of the indicated double arrow 36 by the rotation of pinions 35 fixed to both ends of a rotatable shaft 34 having a pinion gear 33 disposed at the center. The rotation of the pinion gear 33 is effected by the reciprocation of a rack member 38 driven by an air cylinder 37 fixed to the base 8, the operation of said air cylinder 37 being controlled by detection means (not shown) for detecting the time when the superposed mass 5 is placed on the mounting members 29a and 29b. The air cylinder 37 is provided with compressed air pipes 39a and 39b. The reciprocation of the rack member 38 is adjusted through control of the pressure of compressed air supplied to the air cylinder 37 by the aforesaid detection means (not shown).

The mounting members 29a and 29b have a ridge 40 formed at the center so as to extend at right angles to the direction in which they are made to travel. Accordingly, each mounting member presents an angular cross section along the moving direction. The top plates of the compressing members 30a and 30b located above the mounting members 29a and 29b are similarly bent to form a ridge 42. To the undersides of the compressing members 30a and 30b are fitted, for example, elastic strips 43a, 43a, and 43b, 43b (the latter two are not shown). Each of said elastic strip has its base end fixed to said underside and its free end directed slantly downward toward the crosswise edges of the superposed mass 5 at which it is to be clamped. The tip of the free end is turned upward to prevent the surface of the superposed mass from being damaged when said free end is pressed against it (FIG. 4a).

FIGS. 4a and 4b show the cross sections of those portions of the superposed mass 5 which are sandwiched between the ridge 42 formed on the top plate of the compressing members 30a and 30b and the ridge 40 formed on the mounting members 29a and 29b by way of illustrating the manner in which the superposed mass 5 is clamped. The superposed mass 5 pushed forward by the pressing means 19 of FIG. 2 have its crosswise sides placed on the mounting members 29a and 29b. Under this condition, the air cylinder 37 is actuated to rotate the pinion gear 33 in such a direction as to cause
the compressing members 30a and 30b to be brought down. The free end of each elastic strip 43 touches the top surface of the superposed mass 5 preliminarily to depress it. When the compressing members 30a and 30b are further brought down, the free end of each elastic strip 43 travels toward the crosswise sides of the superposed mass 5 on which it is to be clamped, while stretching the top surface of said mass 5, and finally clamps said crosswise sides tightly as illustrated in FIG. 4b. Accordingly, the superposed mass 5 is clamped in such a manner that its cross section in its travelling direction is bent upward, without having its upper central portion unnecessarily swollen.

If, in this case those parts of the compressing members 30a and 30b which contact the upper surface of the superposed mass 5 are perforated with air escape holes, then the clamping operation can be conducted quickly and reliably. The aforementioned elastic members 43 may consist of a compression coil spring, and fitted only to the underside of the compressing members 30a and 30b or to both said underside and the upper surface of the mounting members 29a and 29b. The superposed mass 5 is clamped as shown in FIG. 4b is brought to the tape feeder 9 of FIG. 6 when the base 8 is driven along the rails 11. The feeder 9 has rollers 45 and 46 for drawing out or taking up a heat contractible tape 44. The tape 44 is drawn out in the moving direction of the clamped superposed mass 5 by being initially pressed against its forward end face 47 in a manner to intersect said moving direction at right angles in a vertical plane. Above and below the passage of the superposed mass 5 are disposed tape guiding members, for example, rollers 48 and 49, which are spaced from each other at a sufficient interval 50 to allow the free passage of the superposed mass 5. Numerical 44a denotes the drawn out portion of the tape 44. Said rollers 45 and 46 used in feeding or taking up the tape 44 make a free rotation when the tape 44 is drawn out. There will now be described the operation of a tape welding device 13 having tape welding blades 52 and 53 and a tape cutting device 14 having a cutting blade 54 disposed between said welding blades 52 and 53. These devices 13 and 14 are located above the passage of the superposed mass 5, while a cradle 57 for receiving said blades 52, 53 and 54 is placed below said passage. Each blade has substantially the same length as the width of the tape 44. The welding and cutting devices 13 and 14 are reciprocated by an air cylinder 59 through a plunger 58 in the directions of the indicated double arrow 60. When the clamped superposed mass 5 is advanced, then the tape 44a is drawn out to be wound about the forward end face 47, top and bottom surfaces of the mass 5. When the mass 5 takes the indicated position, the air cylinder 59 is actuated to bring down the welding and cutting devices 13 and 14 to the two-dot dash line of FIG. 6. Since the welding blades 52 and 53 are heated by a heater disposed in the welding device 13, those portions of the tape which are wound about the top and bottom surfaces of the superposed mass 5 are welded together near its rear end. The welding blades 52 and 53 are spatially arranged in the traveling direction of said mass 5. Those portions of the tape which are wound about the top and bottom surfaces of the superposed mass are welded together along two separate lines perpendicularly intersecting the passage of the superposed mass 5. At the same time, the tape is cut off by the cutting blade 54 between said two lines. As a result, there is formed a loop of tape 62 around the forward and rear end face, top and bottom surfaces of the superposed mass 5. Since that portion of the tape which is drawn out from the feeder 9 still remains welded by the welding blades 53, it is not cut off, but is ready to be wound about the succeeding superposed mass 5. When wound with the looped tape, the superposed mass 5 presents the cross section shown in FIG. 5 along its passage. FIG. 7 indicates an example of the heating device 15 used in the apparatus of this invention. Numerical 63 represents a heating casing provided with an inlet 64 and outlet 65 for the superposed mass 5 and containing heat elements 66 fitted to the upper and lower inner walls of said casing 63. There are located across said inlet and outlet 64 and 65 air discharging ducts 68 communicating with exhaust pipes 67 and air sucking ducts 70 communicating with suction pipes 69, thereby providing air curtains 72 and 73. Through the inlet air curtain 72 is introduced the clamped and tapewound superposed mass 5 into the heating device 15. The furnace which has its internal atmosphere shut off from the outside enables the thermal contraction of the looped tape with small power requirements. Under this condition, the superposed mass 5 is fastened by a tape indicated in two-dot dash lines in FIG. 5. The fastened mass is further carried by the clamping device 7 in the direction of the indicated arrow 4. When the clamped and tape-wound superposed mass 5 leaves the heating device 15, the air cylinder 37 is actuated to push up the compressing members 30a and 30b, thereby releasing the superposed mass 5 from a clamped state. At this time the superposed mass 5 is relieved of its bent form and straightened out on the surface, thereby to be all the more firmly fastened by the tape. The mass 5 is further forwarded in the direction of the indicated arrow 4 with both crosswise sides placed on the mounting members 29a and 29b. On the outlet side of the heating device 15 is provided a mounting table 81 having an inclined surface to receive the central part of successively incoming superposed masses already fastened. Accordingly, they are transferred from the mounting members 29a and 29b to said mounting table 81. Upon completion of said transfer, the clamping device 7 is brought back to its original position on the rails 11 by the action of the base 8.

The withdrawing device 16 comprises, as illustrated in FIG. 8, pushing means 21 for urging the fastened superposed mass 5 and drive means for operating said pushing means 21. The drive means includes a fitting member 74 engageable with the pushing means 21; an arm 76 one end of which supports the fitting member 74 and the other end of which is fixed to a plungcr 75; and a fixed air cylinder 77 for reciprocating the plunger 75. The pushing means 21 has its bottom edge directed at right angles to the moving direction of the superposed mass 5, and rotates about a pin 78 attached to the fitting member 74. The pushing means 21 is further provided with a spring 79 and stop pin 80 so as to freely clockwise, but be only allowed to swing counterclockwise until it is positioned at right angles to the traveling direction of the superposed mass 5.

When the superposed mass 5 is brought on to the mounting table 81 through the outlet air curtain 73, then the pushing means 21 rotates clockwise as shown in FIG. 9a to cause its bottom edge 71 to slide over the
top surface of the superposed mass 5 and then swings counterclockwise to cause its bottom edge 71 to be pressed against the rear end of the superposed mass 5 as shown in FIG. 9b. At this time, the air cylinder 77 drives the plunger 75 in the direction of the indicated arrow 82 (FIG. 9c), thereby enabling the superposed mass 5 to be thrown from the mounting table 64 into the receptacle 17. As previously mentioned, the superposed mass 5 released from a clamped state regains its original form due to its righting moment so as to have its top and bottom surfaces straightened out, thereby to be all the more tightly bound. It is possible to conduct the clamped superposed mass 5 to the heating device 15 and draw it out therefrom after releasing it from a clamped state while it is placed in the furnace of said device 15.

When the looped tape 62 is wound about the superposed mass 5 the roller 45 of the tape feeder 9 absorbs the sagging of the tape in cooperation with the roller 46 so as to enable the looped tape 62 to regain its original state even after cutting. However, there is still the possibility of two welded joints appearing on a looped tape wound about the immediately following superposed mass 5. To avoid such occurrence, there is presented a modified type of tape feeder 9 in FIG. 11. The reduction of welded joints to a single place not only minimizes the possibility of the welded portions of the tape being separated at such joint but also elevates the visual appeal of the tape-wound superposed mass 5. Referring to FIG. 11, numerals 45a and 46a represent tape feed rollers, and 48a and 49a tape guide rollers. Those portions of the tape 44 indicated in solid lines show the condition which the tape 44 presents after it was wound about the preceding superposed mass 5, the welded joint being indicated at 83. Under this condition, the succeeding superposed mass 5 is moved in the direction of the indicated arrow 82 so as to have its forward end face 47 pressed against said welded joint 83. While the succeeding superposed mass 5 is further travelling in the direction of the indicated arrow 82, the tape 44 is drawn out only from the roller 46a so as to cause the welded joint 83 to be brought to a point indicated by dotted lines when said mass 5 is moved to a position surrounded by dotted lines. Under this condition, the tape welder 13a, tape cutter 14a and cutter blade cradle 57 are drawn close to each other, thereby to form a looped tape 62. This process allows only one joint to be formed in the looped tape 62. In this case it is possible to shift the joint 83 in advance toward the guide roller 48a and thereafter press the tape 44 against the forward end face of the succeeding superposed mass 5.

The clamping device included in the fastening apparatus of this invention may be so arranged as illustrated in FIG. 10. Numerical 84 represents a belt conveyor corresponding to the mounting members 29a and 29b of the aforesaid embodiment. The conveyor 84 consists of two parallel spaced belts which travel in the direction of the indicated arrow 87 by being guided by rollers 85a, 85b, 85c and 85d and a tension roller 86. Numerical 89 is another system of belt conveyor for transporting a superposed mass 5 up to the fastening apparatus, which is moved similarly in the direction of the indicated arrow 87 by being guided by the common roller 85d. The latter conveyor 89 may consist of a single belt. Numerical 90 is a belt forwarded in the direction of the arrow 87 by being guided by the common roller 85a.

Numerical 91 denotes still another system of belt conveyor corresponding to the compressing members 30a and 30b of the preceding embodiment. This conveyor 91 consists of two parallel belts which are guided by rollers 92a to 92d and a tension roller 93. The distance between the belt conveyors 84 and 91 so designed as to become progressively narrower from the roller 92c to the roller 92b. The superposed mass 5 transported by the belt conveyor 89 up to the fastening apparatus is further carried with its crosswise sides mounted on the two parallel belts conveyor 84 and brought to a position indicated by dotted lines with said crosswise sides clamped between the belt conveyors 84 and 91. Across that section of the passage of the superposed mass 5 which is defined between rollers 92a and 92b is supplied a tape 44 from feed rollers 45b and 46b. Numerals 94a, 94b, 48b and 49b are guide rollers and numeral 95 a tension roller. The tape welder 13, tape cutter 14 and cutter blade cradle 57 are disposed in the same position as in the embodiment of FIG. 6 with respect to the passage of the superposed mass 5. Obviously, therefore, the tape 44 can be unfailingly wound about said mass 5. The operation of thermally contracting the wound looped tape and removing the resultant fastened mass 5 can be easily conducted simply by modifying the arrangement of FIG. 1, and description thereof is omitted. This arrangement enables the clamping device to be more simplified in construction.

What we claim is:

1. An apparatus for fastening a superposed mass of sheet-like materials which comprises a transporting device for forwarding said superposed mass; a clamping device for holding both crosswise sides of the transported mass parallel with its travelling direction and moving it in a direction perpendicularly intersecting a line connecting said crosswise sides; a tape feeder for drawing out a heat contractible tape in the moving direction of the mass by initially pressing it against the forward end face defined between the clamped crosswise sides of the mass, thereby winding it about the end face, top and bottom surfaces of the mass in a manner to intersect the passage of the mass at right angles in a vertical plane; a welding device for welding together those portions of the tape which extend outward from the top and bottom surfaces of the mass at its rear end, thereby winding the tape about those portions of the peripheral surface of the mass which are defined between the clamped crosswise sides; a tape cutting device for cutting off said wound looped tape to separate it from the feeder with the portion of the tape being drawn out from the feeder left uncut; a heating device for heating the superposed mass still clamped and loosely wound with the tape so as to thermally contract the looped tape and tightly fasten said mass; and a withdrawing device for taking out the fastened mass which has left said heating device.

2. A fastening apparatus according to claim 1 wherein the clamping device includes clamping means for holding both crosswise sides of the superposed mass parallel with its travelling direction; a base for supporting said clamping means; and a guide member for guiding said clamping means along the tape feeder, welding device, cutting device and heating device by guiding said base.

3. A fastening apparatus according to claim 2 wherein the clamping device consists of mounting members for receiving on the surface both crosswise
sides of the forwarded superposed mass; and movable compressing members located above said mounting members for depressing both crosswise sides of the superposed mass being clamped.

4. A fastening apparatus according to claim 3 wherein the mounting members have the central part raised upward parallel with its travelling direction; and the compressing members have a depressing surface formed substantially parallel with the mounting surface of said mounting members, thereby causing the superposed mass to present a bent cross section along its moving direction.

5. A fastening apparatus according to claim 3 wherein the compressing members includes elastic members fixed to the depressing surface, said elasting members being designed to depress both crosswise sides of the superposed mass so as to cause the mass as a whole to be stretched toward said crosswise sides.

6. A fastening device according to claim 5 wherein each elastic member has its base end fixed to the depressing surface of the compressing member and its free end directed slantwise downward toward one of crosswise sides of the superposed mass being clamped.

7. A fastening apparatus according to claim 1 wherein the transporting device includes a belt conveyor consisting of rollers and belts stretched over said rollers with one end disposed near the clamping device; and means for pushing the rear end of the superposed mass already transported by the belt conveyor further in its travelling direction so as to place said mass on the mounting members of the clamping device.

8. A fastening apparatus according to claim 7 wherein the belt conveyor includes a plurality of spaced rollers provided with a belt groove and a plurality of parallel belts stretched over said rollers; and the superposed mass pushing means comprises a pressing member provided with comb-like teeth inserted, where required, between said plural parallel belts and drive means for urging said pressing member in the travelling direction of the superposed mass as well as in a direction at right angles to said travelling direction.

9. A fastening apparatus according to claim 1 wherein the clamping device consists of a first pair of parallel belts for receiving on the surface those crosswise sides of the superposed mass already brought by the transporting device which are to be clamped; and a second pair of parallel belts disposed above said first paired belts with the distance therebetween progressively reduced so as to clamp the crosswise sides of the superposed mass in cooperation with said first belts for further movement of the mass.

10. A fastening apparatus according to claim 9 wherein the tape feeder draws out a heat contractible tape so as to cause it to travel continuously between the first paired belts as well as between the second paired belts.

11. A fastening apparatus according to claim 1 wherein the tape feeder is provided with tape guide rollers disposed on that side of said feeder from which the tape is drawn out in the moving direction of the superposed mass with a slightly larger space than the thickness of said superposed mass allowed therebetween.

12. A fastening apparatus according to claim 1 wherein the tape feeder includes a feed roller and a tape up roller which make a free rotation when the tape is drawn out according to the movement of the superposed mass; and at least one of said rollers is so operated as to prevent the welded joint of the portion of a tape previously conducted by both rollers from appearing on a looped tape being wound about the succeeding superposed mass brought after the preceding portion of the tape is cut off.

13. A fastening apparatus according to claim 1 wherein the heating device has a tunnel-shaped heating chamber through which the superposed mass clamped on both crosswise sides is carried along and a device for providing air curtains at both inlet and outlet of said heating chamber.

14. A fastening apparatus according to claim 1 wherein the tape welding device includes a first welding blade for welding those portions of the tape which extend outward from the top and bottom surfaces of the superposed mass along a first line of welding and a second welding blade for welding said tape along an adjacent second line of welding; and the cutting device has a cutting blade disposed between said first and second welding blades, said welding and cutting devices further including a common blade cradle.

15. A fastening apparatus according to claim 14 wherein the welding blades and cutting blade are fixed to a plunger reciprocating relative to the blade cradle.

16. A fastening apparatus according to claim 1 wherein the superposed mass withdrawing device includes a pushing member for urging the fastened mass placed on the mounting members of the clamping device; and drive means for actuating said pushing member.

17. A fastening apparatus according to claim 16 wherein the pushing member is a plate member so fitted to said drive means as to be limited in rotation under an urging force acting opposite to the direction in which said fastened mass is driven, but freely rotate under an opposite urging force said plate, when urged in the latter direction, sliding over the top surface of the superposed mass and, when further rotated, being pressed against the rear end of said mass for its further movement.

* * * * *
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,766,708
Dated October 23, 1973

Inventor(s) Mitsuo KUBO et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

IN THE ABSTRACT:
line 6, after "mass;" insert --and--;
line 10, after "mass" delete "; when" and insert
--. When--;
line 13, after "together" delete ";" and insert --and--;
change "that" to --the--;
line 16, after "uncut" delete "; the" and insert --. The--;
line 17, change "are" to --is--;
line 19, after "together" change ";" to --,--;

Column 1, between lines 34 and 35 insert --Summary of the Invention--;
line 38, change "parallel" to --parallel--;
line 57. change "clamped" to --clamped--;

Column 2, line 1, change "certificates" to --certificates--;
line 29, delete "with reference";

Column 6, line 5, change "draun" to --drawn--;
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION


Inventor(s) Mitsuo KUBO et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

-Page 2-

Column 8, line 67, change "consists of" to --comprises--;
Column 9, line 7, change "raided" to --raised--;
   line 14, change "includes" to --include--;
   line 15, change "elasting" to --elastic--;
   lines 20 and 21, change "its" (both occurrences) to --a--;
   line 26, change "consisting of" to --comprising--;
   line 37, after "teeth" insert --selectively--;
   lines 37 and 38, delete "where required";
   line 43, change "consists of" to --comprises--;
   line 44, change "the" to --their--;
Column 10, line 11, change "tape" to --take--;
   line 21, change "chmber" to --chamber--;
   line 23, before "inlet" insert --the--;
   line 37, change "receprocating" to --reciprocating--;
   line 46, change "is" to --comprises--;
UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION


Inventor(s) Mitsuo KUBO et al

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

-Page 3-

Column 10, lines 46 and 47. change "so fitted" to
--coupled--;

line 47. after "means" insert --so--;

line 49, after "but" insert --to--;

line 50, after "force" insert --;--.

Signed and sealed this 23rd day of April 1974.

(SEAL)
Attest:

EDWARD H. FLETCHER, JR. C. MARSHALL DANN
Attesting Officer Commissioner of Patents