June 6, 1961 J. A. KILMARTIN 2,987,108

WEB BUTT SPLICER

Filed Feb. 2, 1959 4 Sheets-Sheet 1

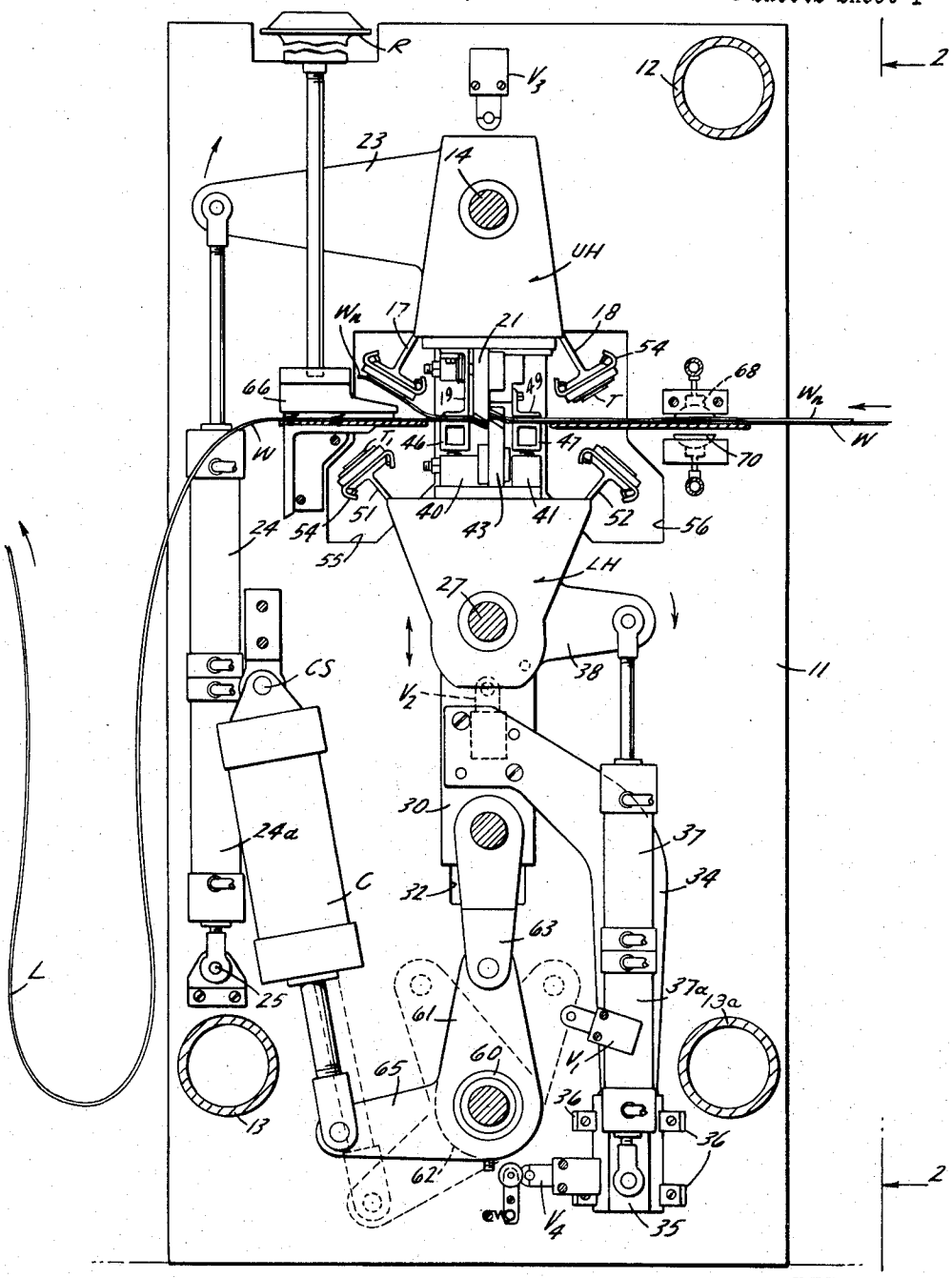

FIG. 1

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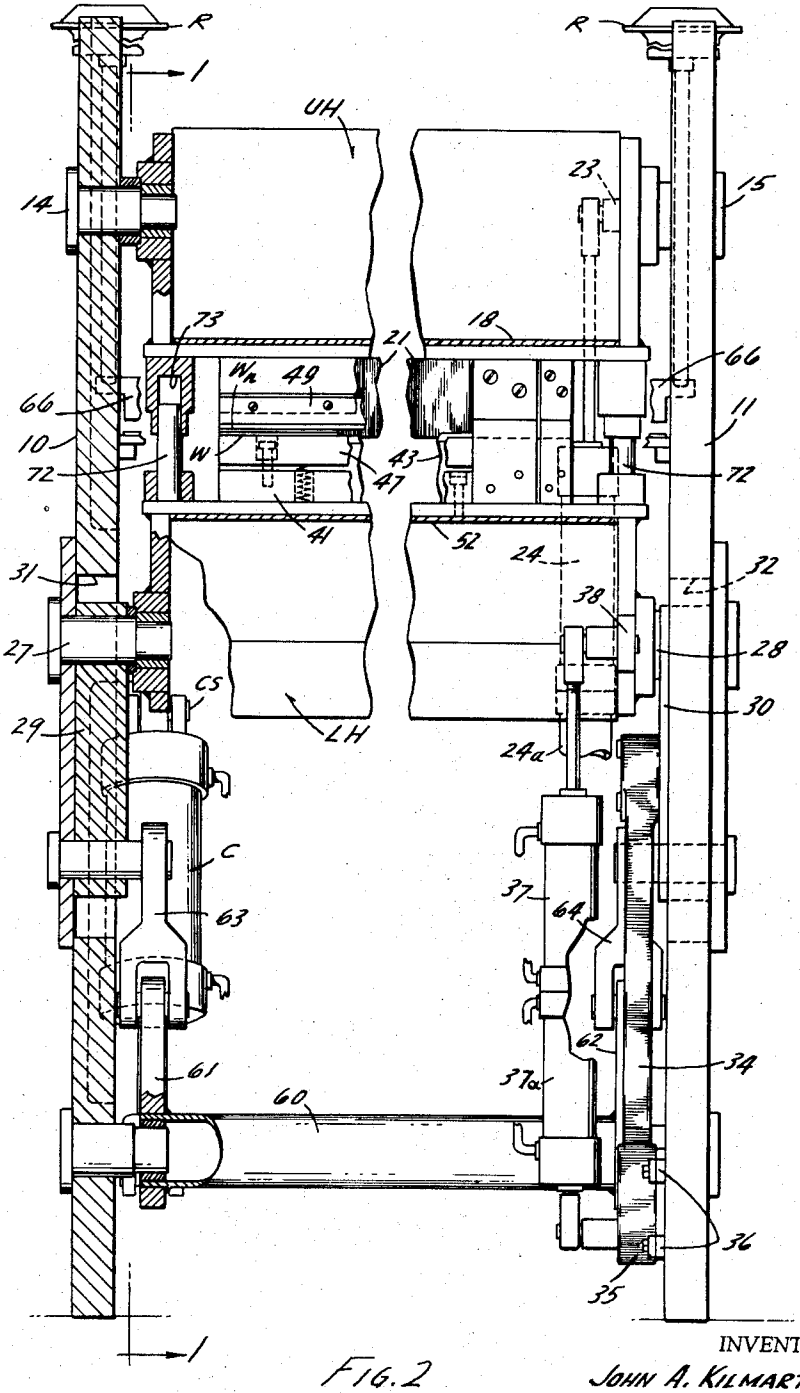

FIG. 2

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FIG. 3

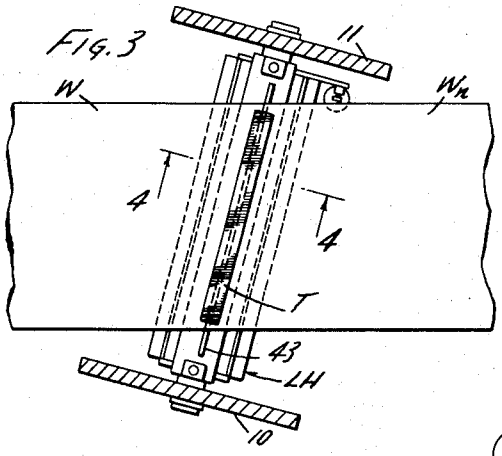


FIG. 4

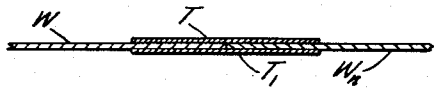


FIG. 6

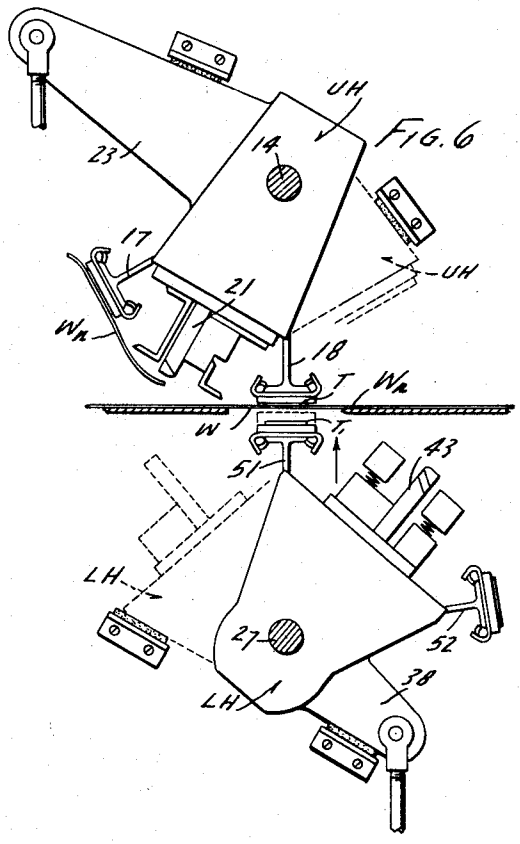
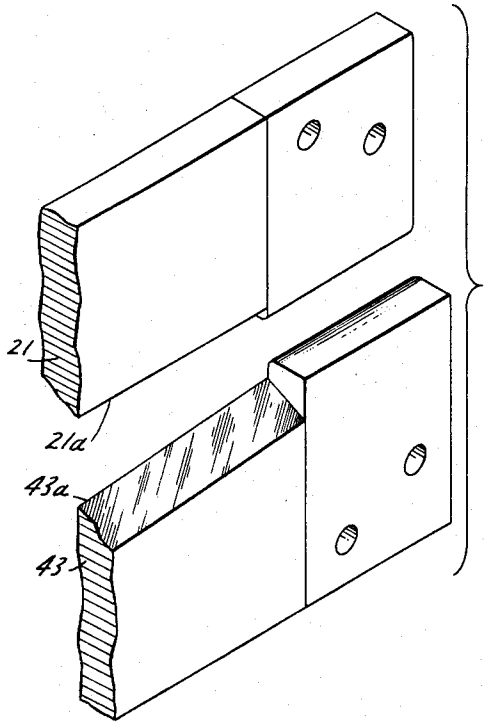


FIG. 8



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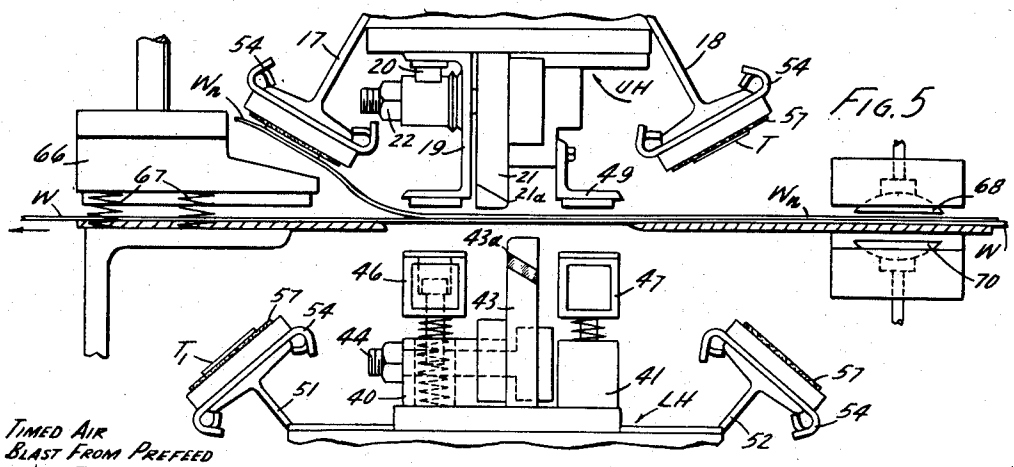

FIG. 5

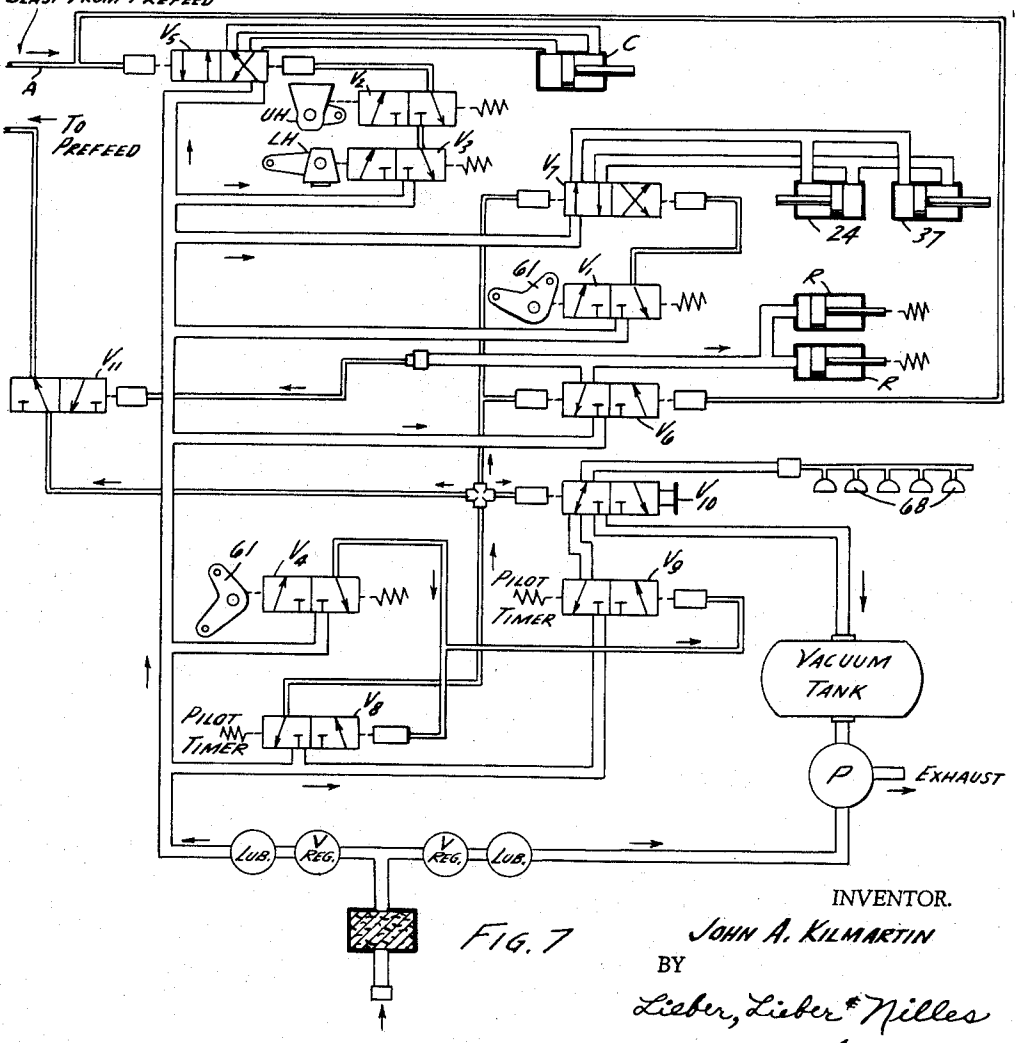

FIG. 7

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2,987,108

WEB BUTT SPLICER

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Filed Feb. 2, 1959, Ser. No. 790,649
3 Claims. (Cl. 154—42.3)

This invention relates to web handling machines and more particularly to a splicer for forming a butt joint in the web.

In this type of equipment in general, the web is moving at a high speed and a new roll of web material must be spliced to the old one in a rapid, positive and accurate manner. The joint so formed should be smooth and strong so as not to impede the travel of the web through the printers, punch presses or other machine operations.

Machines for forming a splice are necessarily large and are of considerable weight. As they must operate at high speeds, it is desirable to hold the weight and number of the moving parts, and consequently the inertia and momentum problems, to a minimum.

In accordance with the present invention, a butt splicer for a web material has been provided which is economical to manufacture, has relatively few and comparatively light-weight moving parts, is compact in design, simple in operation and efficient in forming a smooth, strong and accurate butt joint.

Another and important aspect of the invention provides a butt splicer that can be used with web supply machines which feed the new web from a position either above or below the running web. The conversion from one type of feed to the other is made by using many common parts, some of which perform dual functions, and which contribute to a versatile and economically produced machine.

These and other objects and advantages will appear later as this disclosure progresses, reference being had to the accompanying drawings, in which:

FIGURE 1 is a front elevational view of a machine made in accordance with the present invention, the view being taken generally along the line 1—1 in FIGURE 2 and showing the heads in the web-cutting position, certain parts being broken away or removed for the sake of clarity;

FIGURE 2 is an elevational view taken from the infeed side of the machine and generally along the line 2—2 in FIGURE 1, parts being broken away, in section or removed for clarity;

FIGURE 3 is a schematic plan view showing the position of the machine relative to a web moving therethrough;

FIGURE 4 is an enlarged sectional view through a completed butt joint and along line 4—4 in FIGURE 3;

FIGURE 5 is a fragmentary view showing the oscillatable heads in the normal operating position with the bottom head in the lowered position, as when the web is running through the machine;

FIGURE 6 is another fragmentary view of the heads showing them in the tape-applying poisition;

FIGURE 7 is a diagram of the pneumatic circuit for the machine for operation when the new web is fed into the machine from a position above the old traveling web, and

FIGURE 8 is an enlarged, fragmentary, perspective view of one end of the knives.

The machine will first be described as used when a new web is fed into the machine on top of the traveling web to which it is to be spliced. The construction of the machine, however, is such that it can also make a splice when the new web is fed from beneath the old web, and this can be accomplished merely by the operator throwing a

switch. Many of the parts of the machine can thus perform dual functions, depending on the relative locations of the two webs to be joined. Such convertability is highly desirable and practical because the splicer can thereby be used with a shuttle-type roll stand wherein the new web is fed into the splicer from above the old web, and the next time from below the old web. The flexibility of the splicer in this respect is accomplished by the use of parts having common toolage as well as serving in dual capacities.

As shown in FIGURE 3, the machine can be placed at various angles relative to the direction of web travel to thereby form a non-right angular splice which is generally stronger than a right angular splice and one which distributes the web tension more advantageously across the web width.

The splicer provided by this invention applies a piece of tape T and T_1 across the top and bottom of the joint as shown in FIGURE 4, to connect the old web W with the new web W*n*.

Referring in greater detail to the drawings, the main frame of the machine is comprised of two vertical side walls **10** and **11** which are spaced apart and arranged in parallelism, and are rigidly secured together by tubular cross braces **12**, **13** and **13***a* (FIGURE 1).

An upper head UH in the form of a weldment is oscillatably mounted on shafts **14** and **15** which are fixed in sides **10** and **11**, respectively. The upper head carries a pair of spaced arms **17** and **18** which are welded thereto and are of T-shape cross-section and extend generally coextensively with the width of the head proper. This head has a channel member **19** secured along its length by cap bolts **20** and to which a knife **21** is secured by bolt means **22**. This upper knife has a cutting edge **21***a* which does not taper from one of its ends to the other. An arm **23** extends from one side of the upper head and is pivotally attached to the extensible double-acting air motor **24** by which the head is oscillated between the positions shown in FIGURES 1 and 6. The air motor **24** has another double-acting air motor **24***a* secured in head end-to-head end relationship therewith, which motor **24***a* is pivotally attached by its piston rod to the main frame at **25** and is used when the operation of the machine is reversed, as will later appear, when feeding the new web from beneath the old web.

A lower head LH is mounted within the main frame and as well as being oscillatably mounted, is also vertically slidable in the frame, This head is oscillatingly mounted on shafts **27** and **28** which, in turn, are carried in their respective blocks **29** and **30** slidably mounted in slots **31** and **32** in the side walls. A large bracket **34** is bolted at its upper end to block **30** and is secured at its lower end to a guide block **35** slidably mounted on the inside of wall **11** between guides **36**. A double-acting air motor **37** is pivotally attached to the arm **38** of this lower head and is also rigidly connected in tandem to a similar air motor **37***a* secured at its lower end to block **35**. Thus, the lower head, the large bracket **34** and the tandem motors **37** and **37***a* are vertically positionable as a unit by means to be described. Motor **37** will be referred to specifically first as only it is actuated when the new web is fed from above the old web.

The lower head includes a pair of square bars **40** and **41** which extend in spaced relationship to one another along the upper part of the head LH. A lower blade **43** is secured by bolt means **44** to bar **40** and has a cutting edge **43***a* which tapers along the length of the blade so as to make initial contact with its complementary knife edge **21***a* only at one end thereof. A pair of spring-loaded holding tubes **46**, **47** are mounted on the lower head along opposite sides of the lower knife and bear against, respectively, the channel member **19** and

angle iron member 49 of the upper head. The webs of material are thus firmly held as they are cut by the knife blades.

The lower head also has a pair of tape-holding arms 51 and 52 which are similar to arms 17 and 18 of the upper head, and all of which have a channel-shaped sheet metal bar 54 that is slipped on from one end thereof and through the openings 55 or 56 in the side walls of the machine. These bars 54 each have a piece of resilient material 57, such as rubber, cemented along their outer surfaces, and on which a piece of tape T and T_1 may be applied with an adhesive side facing outwardly. The operator can easily remove these bars from their arms, place a new piece of tape thereon, and then slide the bars back over their arms.

Arms 18 and 51 are adapted to swing directly opposite to one another and into the central position shown in FIGURE 6 where they act to press their respective pieces of tape along the web joint, when the lower head is raised, as follows.

A torque tube 60 is oscillatingly mounted in the side walls 10 and 11 and has crank arms 61 and 62 rigidly secured at opposite ends thereof. These crank arms are, in turn, pivotally connected through their respective bifurcated links 63 and 64 to their slide blocks 29 and 30. Another crank arm 65 is also secured to the tube and its free end is pivotally attached to one end of a large double-acting air motor C. This motor is pivotally secured at its upper end to the side wall 10 by stub shaft CS. In this manner, the large air cylinder unit C acts through the bell crank formed by arms 65 and 61 to oscillate the torque tube 60 and thereby vertically shift the side block 29 and 30 and its associated lower head LH through the toggle linkage located at each end of the tube.

In operation, as the old web W is being pulled through the machine, the lower head is in the lowermost and central position (FIGURE 5), the holding clamp 66 is held upwardly by the springs 67 at each of its ends, and the suction cups 68 are inactive. The new web W*n* is then brought in over the moving web W and its leading end is secured to the tape carried by arm 17, where it is held in the position shown in FIGURES 1 and 5. At this time, the operator also manually operates the valve V10 (FIGURE 7) to thereby activate suction cups 68 which firmly hold the new web W*n* on the other side of the knife. Tapes have also been previously applied by the operator to arms 18 and 51. Arm 52 and lower suction cups 70 are not used during this particular operation wherein the new web is fed from above.

FIGURE 5 thus represents the arrangement at the time a splicing operation is to be commenced. The lower head is down because the tube 60 (FIGURE 1) is at its counterclockwise position as indicated by the left-hand dotted position of crank 61.

The other machines in the line need not be stopped during the splicing operation because of the loop L of the web W which has been stored up and which is partially used up during the splicing process.

To begin the splicing operation, the robot air cylinder units R are actuated to cause the clamp 66 to be lowered into position where it firmly holds the old web from moving. The air cylinder unit C is simultaneously contracted to rotate the tube in a clockwise direction until the arm 61 contacts valve V1. During this clockwise rotation, the lower head has been raised and lowered. Thereupon, cylinder unit C is extended to immediately return the tube in a counterclockwise direction to its starting position, and during this return rotation of the tube, the head has again been raised and lowered.

More specifically, to start the operation, the operator stops the pulling action on the web W, or pre-feed, by operating a valve (not shown) to give a timed air blast from the pre-feed via line A. This blast switches valve V5 and also switches valve V6. Valve V6 throws air to both of the clamping cylinders R and also shuts valve V11. Valve V11 is thus set so it is ready for subsequent use, as will appear. Valve V5 acts to reverse air to the air motor C (motor C is always loaded) to thereby start movement of the linkage, that is, rotation of the tube in the clockwise direction.

It is during the first upward movement of the lower head that the cutting action of the two webs occurs, as illustrated in FIGURE 1 wherein the tube is being rotated in the clockwise direction and the lower head has reached the upper limit of its travel.

For preliminarily guiding the lower head into exact registry with the upper head, a guide or leader pin 72 (FIGURE 2) is carried by each end of the lower head and these leader pins 72 enter their respective bores 73 in the upper head. For a final registry of the knife blades relative to one another, the adjacent corners (FIGURE 5) of the leading ends of the blades are slightly rounded to insure smooth contact therebetween. As previously mentioned, the lower blade is tapered from one end to the other which causes the blades to engage one another, first at one end (the right hand end as viewed in FIGURE 2) and a slight interfering fit is provided between the blades at this leading end to insure a positive contact between the blades all along their length as the cutting action takes place progressively therealong.

With the present knife arrangement wherein one of the knife blades is fixed and the other is accurately guided in reciprocatory movement in respect thereto, a precise and clean cut is made through both webs which insures the alignment of the abutting edges.

After the cut has been completed, the tension on the remaining or unused part of the old web causes it to be quickly snapped out from the infeed side of the machine. The tube continues its rotation in a clockwise direction and the arm 61 likewise continues its movement until it actuates the spring-returned air valve V1.

Valve V1 then reverses valve V7 which, in turn, reverses the air cylinder units 24 and 37. (Cylinders 24 and 37 are also normally kept loaded to prevent them from moving.) This causes the heads to be rotated to the position shown in FIGURE 6, at which time the lower head is also down. As the heads thus rotate, the arm 17 carries the severed portion of the new web out of the way, and the heads actuate their respective air valves V2 and V3 which are in series. Actuation of both of the valves V2 and V3 causes air motor C to retract, thereby rotating tube 60 counterclockwise to its original position. In doing so, the toggle links are again straightened which raises the lower head, forcing the tapes carried by the resilient pads on arms 18 and 51 to be firmly pressed into engagement with the web, thus completing the joint.

The thickness of the resilient pads on the arms may be varied to thereby vary the pressure with which they bear against one another, it being unnecessary to provide an adjustment in the toggle linkages themselves for that purpose.

More specifically, the last part of the operation of the machine and its circuitry is as follows. As the linkage is returned to the starting position by cylinder unit C, a spring-returned valve V4 (FIGURES 1 and 7) is actuated momentarily which permits air pressure to move valves V8 and V9, which are timed to stay closed for a few seconds. Valve V9 allows air to go to valve V10 for a few seconds and valve V8 sends air to valve V10 which returns manual vacuum valve V10 to normal. When valve V10 goes to normal, air from valve V9 goes through V10 to the vacuum cups 68 to thereby blow the new web off. Valve V8 also sends air to move valve V6 to normal and unloads cylinders R to unclamp the web. Valve V6 also then removes air pressure from valve V11 which is then spring-returned to normal. Valve V8 furthermore moves valve V7 which returns cylinder units 24 and 37 to normal, and it also sends air

through the previously opened valve V11 to start the web pre-feed again.

When it is necessary to use the above described machine for feeding the new web from underneath the old web, the operation is generally the same except the lower set of suction cups 70 would be used, as would the air motors 24*a* and 37*a* instead of their tandem counterparts 24 and 37. This serves to reverse the direction of swing for the heads, and arms 17 and 52 would then be used to apply the sealing tapes across the butt joint. Arm 51 would be used to remove the unused leading portion of the new web. Arm 52 and the upper set of suction cups would be unused in this feed situation.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. A butt splicer for webs passable therethrough comprising, an upper head having a knife blade and taping means, said head being oscillatably mounted for alternately swinging said blade and taping means into an operative position, a lower head reciprocal toward and away from said upper head, said lower head having a knife blade engageable with said first blade to cut said web and also having taping means engageable with said first taping means to join said webs, said lower head also being oscillatably mounted for alternatively swinging its said blade and taping means into alignment with their corresponding upper head blade and taping means, means for reciprocating said lower head towards said upper head twice for every splice, and means for alternately swinging said heads into blade-aligned position for one reciprocation of said lower head and into said taping means alignment as said lower head is reciprocated the second time.

2. A butt splicer for splicing an old web to a new web which is fed from either above or below said old web, said splicer comprising, an upper head having a knife blade and also a taping means located on each of two opposite sides of said blade, said head being oscillatably mounted for selectively swinging said blade and taping means into an operative position, a lower head reciprocal between an operative and an inoperative position and having a knife blade cooperable with said first blade to cut said web and also having taping means located on each of two opposite sides of its blade which are cooperable with said upper head taping means to join said webs, said lower head also being oscillatably mounted for selectively swinging its said blade and taping means into alignment with their corresponding upper head blade and taping means, means for reciprocating said lower head into its said operative position twice for every splice, and means for swinging said heads into blade operative position for cutting the webs on one reciprocation of said head and then swinging one pair of said taping means into alignment just prior to said lower head being reciprocated the second time to tape the abutting edges of the webs together when said second reciprocation occurs.

3. A device as defined in claim 1, further characterized in that said means for alternately swinging said heads into blade alignment for one reciprocation of said head and into said taping means alignment as said lower head is reciprocated a second time, is actuated by movement of said reciprocating means.

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