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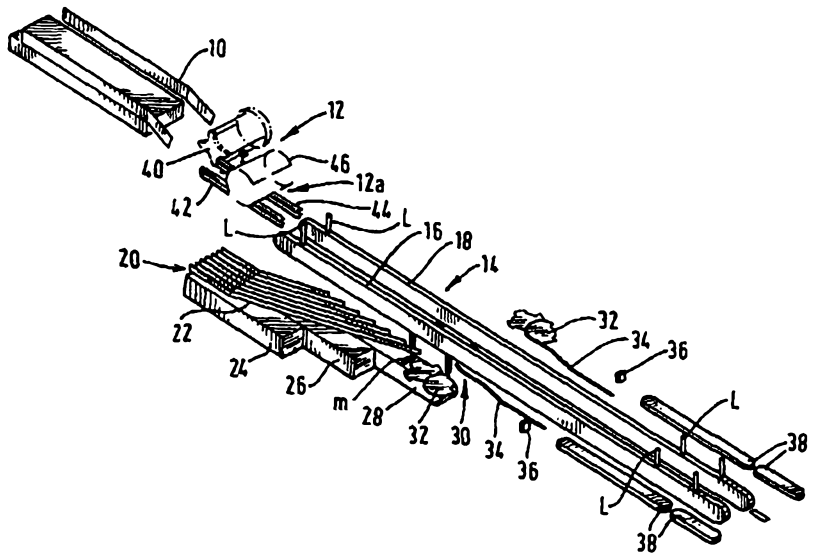


(57) Abstract

A carton feeding and erecting mechanism for a machine for packaging articles such as beverage containers (c) into cartons (ct) includes a carton conveyor (16, 18) for conveying an open-ended carton (ct) through the machine. The feeding and erecting mechanism includes a vacuum conveyor (42a, 44a) for engaging a lower surface of a collapsed carton (ct) and moving the carton (ct) onto the carton conveyor (16, 18), and a feeder (40) beneath the vacuum conveyor (42a, 44a) for selecting a collapsed carton (ct) from a carton supply (10) and placing the carton (ct) on the vacuum conveyor (42a, 44a). An erector (46) above the vacuum conveyor (42a, 44a) has vacuum cups (46a) for engaging an upper surface of the collapsed carton (ct) and moving the panel upwardly with respect to the lower surface thereby erecting the carton (ct). A series of upper carton engaging elements (481) above and synchronously moving with the vacuum conveyor (42a, 44a) engages the erected carton (ct) to maintain the carton (ct) in erected condition until moved onto the carton conveyor (16, 18).

PACKAGING MACHINE FOR MULTI-PACKS

This invention relates to a packaging machine which is especially suitable for processing multipacks of articles such as beverage containers from blank form to completed filled cartons. The machine is readily adjustable to accommodate a wide range of carton sizes without undue time being taken to adapt the machine from running one size of carton to running a different size of carton.

In accordance with one aspect of the present invention, a carton feeding and erecting mechanism is provided for a packaging machine for packaging articles such as beverage containers or the like into cartons, the packaging machine including a carton conveyor for conveying an open-ended carton through the machine, the feeding and erecting mechanism comprising a vacuum conveyor for engaging a lower surface of a collapsed carton and moving the carton onto the carton conveyor, a feeder disposed generally beneath the vacuum conveyor for selecting a collapsed carton from a carton supply and placing the carton on the vacuum conveyor, an erector disposed above the vacuum conveyor and having vacuum engagement means for engaging an upper surface of the collapsed carton and moving the panel upwardly with respect to the lower surface thereby erecting the carton, and a series of upper carton engaging elements disposed above and for synchronous movement with the vacuum conveyor for engaging the erected carton to maintain the carton in erected condition until moved onto the carton conveyor.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings in which:-

Figure 1 is a general schematic layout of a packaging machine according to the invention;

Figure 2 is a schematic plan view of a known article metering system for end-loading cartons;

Figure 3 is a schematic perspective view showing further detail of the machine shown generally in Figure 1;

Figure 4 is a side elevation of the machine shown in Figure 3;

Figure 5 is a top plan view of the machine shown in Figure 3;

Figure 6 is an end elevation as seen from the infeed end of the machine shown in Figure 3;

Figure 7 is a schematic perspective view of the metering and loading section of the machine;

Figure 8 is a plan view of the arrangement shown in Figure 7;

Figures 9 and 10 are a first and second perspective views of a metering bar and carrier incorporated in the metering and loading section of the machine;

Figure 11 is a schematic perspective view of one of the main lug chain assemblies of the machine;

Figure 12 is a perspective view of the drive and adjustment means of the assembly shown in Figure 11;

Figure 13 is a schematic end view of the main lug chain assemblies of the machine adjusted to process a wide carton;

Figure 14 is a view similar to Figure 13 but showing the main lug chain assemblies adjusted for a smaller width package; and

Figure 15 is a schematic end view of the machine showing only one of the main lug chain assemblies in an operative position.

Referring to the drawings, Figure 1 shows a machine according to the invention in schematic form for erecting cartons and filling the cartons with articles such as beverage cans, bottles and the like. The machine comprises, in series, a hopper 10 adjacent to infeed end of the machine, in which carton blanks to be processed through the machine are stored and fed to a feeding and erecting station 12, 12a at the infeed end of the machine.

The main carton conveying and filling line 14 of the machine comprises a pair of spaced side by side main parallel lug chain assemblies 16, 18 each of which includes a pair of endless lug chains 16a, 16b and 18a, 18b respectively, which carry an endless series of carton conveying lugs 'L'. The lugs of one chain are adjustable with respect to the lugs on the adjacent chain so that the distance between the lugs on one chain from those of the lugs on the second chain of the pair can be adjusted depending upon the size (breadth) of carton to be conveyed. Adjustment is described in more detail with reference to Figures 11 and 12.

An article infeed assembly 20 is provided alongside the upstream end of one of the lug chain assemblies 16 and comprises a series of guides 22 which converge towards the conveying and filling line 14, a series of infeed conveyers 24 and 26, and an article group-forming conveyor 28 by means of which the cans to be loaded into cartons processed along the conveying and filling line 14 by the

lug chain assemblies are directed towards the open ends of the carton. In general terms, the particular technique by which the beverage cans are grouped or metered within the divergent guides as they pass across the infeed conveyors is known from EP 0 017 333 although the particular metering elements and their operation in the present machine have not hitherto been disclosed.

The metering or grouping function is achieved by an endless series of metering bars 'm', described in more detail with reference to Figures 7 to 10 and which interrupt the infeed path of the articles within the convergent guides alongside the adjacent lug chain assembly 16 to group and ultimately to cause the articles to be end-loaded into the cartons passing along the line 14. A packaging machine which incorporates metering bars which extend across the full width of a carton conveying and filling line of a packaging machine is disclosed in the aforesaid European Patent 0 017 333. However, by way of illustration, the metering function of such metering bars is considered more specifically with reference to Figure 2. Figure 2 shows, schematically, the function of metering bars to end-load groups of cans 'c' into a series of cartons. The cartons 'ct' are held between and conveyed by an endless series of metering bars 'b' moving over a support platform 'p'. The cans 'c' are conveyed towards the carton feed path 'f' with convergent guides 'g'. The metering bars 'b' have wedge-shaped ends 'w' which gradually enter the can infeed line 'ℓ' so as to create a metered group of cans, in this illustration six cans, for loading. Ultimately, the forward movement of the metering bars in the feed direction 'f' in conjunction with the convergent guides 'g' causes each group of cans so metered to be corralled into the open end of an adjacent carton 'ct'. A similar mirror image arrangement exists on the opposite side of the centre line x-x in which the metering bars extend across the feed path.

However, in the present machine the cartons are conveyed not by metering bars but by the lug chain assemblies or at least one of them with the endless series of metering bars operating alongside one or perhaps both of the lug chain assemblies as described later.

Downstream of the loading station the machine comprises an end flap closing station 30 which includes rotatable closure wheels 32 and fixed end flap closure guides 34. A gluing station 36 is provided adjacent the downstream end of the end flap closing station followed by end flap side compression belts 38 which hold the glued end flaps together while the glue applied at station 36 sets.

A machine according to present invention is adjustable in a number of respects so as to be able to process cartons containing numerous configurations of groups of cans to create a range of carton size from a 4-can carton (2 x 2) to a 30-can carton (6 x 5) without undue amounts of downtime being spent in adjusting the machine. Indeed, the machine can be readily adapted to process cartons to produce a wide range of cartons having numerous can group configurations.

The specific significant elements of the machine are now described in more detail.

Referring first to Figures 3, 4, 5 and 6 of the drawings, at the infeed end of the machine the feeder assembly 12 comprises a rotary feeder 40 provided with an annular series of vacuum cups 40a positioned beneath the feed path 'fp' of cartons to be processed through the machine. Feeder 40 is located adjacent a pair of parallel side by side carton blank transfer belt assemblies 42 and 44. The feeder 40 collects successive single cartons from the hopper supply 10 and transfers them into a horizontal

position in which they are taken up between the transfer belt assemblies and moved downstream towards the carton opening assembly 12a in the feed direction of the machine. The lowermost belts 42a and 44a of each of the carton transfer belt assemblies are constructed as vacuum belts so that as the carton leaves the nip between the upper belts 42b, 44b and the lower belts 42a, 44a, it is retained in flat collapsed condition against the face of the lower vacuum belts. The carton is moved under the operative paths of a twin overhead rotary carton opening device 46 and an overhead vertically disposed lug chain 48 and into the operative paths of a pair of parallel side lug chain infeed assemblies 50 and 52 respectively.

The twin overhead rotary carton opening device also includes a series of vacuum cups 46a which are constrained to face in the direction of the adjacent exposed carton (top) panel and engage that panel so that when vacuum is applied the exposed upper panel is moved upwardly away from the opposed panel which is held against the lower vacuum belts 42a, 44a. The panel is moved into the path of movement of both the vertical overhead lug chain 48 and the pair of infeed side lug chains 50, 52. The side lug chains operate in a substantially horizontal plane alongside each of the carton transfer and vacuum belt assemblies 42, 44 between which the overhead vertical lug chain 48 is disposed.

The side lug chains 50, 52, the overhead lug chain and the twin overhead rotary opening device 46 are synchronised so that as the opening device 46 initially erects a carton against the resistance of the vacuum belts, it is put into position so that the leading face of that carton (in terms of the feed direction of the machine) is bought to bear against one of the lugs 48ℓ in the upper lug chain assembly 48 whereas the trailing face of that carton is engaged by lugs 50ℓ and 52ℓ carried by

the side lug chain assemblies 50, 52. The initial carton set-up by the rotary opening device 46 is such that the loading and trailing faces of the carton hinge against the feed direction, ie. hinge upstream. The speed of the upper lug chain assembly 48 is set to be somewhat slower than the side lug assemblies so that the carton, whilst it is conveyed by both the overhead and side lug assemblies, it is in effect 'squeezed' so that the carton is fully squared up into its fully set up condition ready for loading.

As the carton leaves the downstream end of the overhead and side lug chain assemblies it is engaged against its trailing face by the moving lugs L of the main carton conveying lug chain assemblies 16, 18 (or at least one of those assemblies depending on the size of the carton being processed). For the purpose of this part of the description, it will be assumed that the carton size is such that both the main lug chain assemblies are employed to convey the open ended carton through the machine for loading. End-loading of the cartons is achieved by the cooperation between the can infeed conveyors 24 and 26 and group-forming conveyor 28, the convergent guides 22 and the metering bars 'm' at the article infeed assembly.

Reference is now made to Figures 7 and 8 which show schematically the way in which loading of the cans into the open ends of the cartons is achieved. As described with reference to Figure 2, the technique, in principle, is known in a different metering bar arrangement but which nevertheless involves a series of metering bars gradually to interfere with and pass across an infeed line of cans which are constrained to move between guides which converge towards the carton feed path. As can be seen by reference to Figures 7 and 8, in this way the shaped ends of the metering bars 'm' gradually create a group of cans

between adjacent bars which, by virtue of the convergent nature of the guides, are corralled into the open ends of the carton disposed alongside adjacent metering bars. In the present embodiment of the invention the metering function is carried out along one side only of the machine and, therefore, an endless series of metering bars is required to move across the convergent guide section 22 of the article infeed section 24-26.

The spacing between adjacent metering bars is dependent upon the size of the cans and the number of cans to be placed into each group. To facilitate adjustments of the machine to load different carton and/or can sizes, the metering bars are detachable as described in detail herein. Thus metering bars 'm' may be removed and/or metering bars of different sizes may be substituted to prepare the machine to package different cans and/or cartons.

To this end, group-forming conveyor 28 includes an endless series of detachable and retractable metering bars 'm' which are carried by two sets of paired chains and sprockets 54, 56. The cartons for loading are carried along the main lug chain assemblies. At the upstream end 'EU' of the metering bar assembly, the bars are required to move around sprockets 54 into operative position with clearance from the immediately adjacent ends of the carton end flaps. However, in order to ensure that the cans 'c' are correctly loaded into the adjacent cartons 'Ct', the inboard ends of the metering bars should be located between adjacent cartons so that the side wall end flaps are properly supported and cans are properly guided. In order to accomplish this, as the metering bars 'm' move downstream together with the cartons 'Ct', the inboard ends of the metering bars are constrained to move inwardly between adjacent cartons by virtue of a cam and follower arrangement 68, 69 until the loading process is complete

at the downstream end 'DE' of the assembly, whereafter, the metering bars are gradually brought back into their original position for return upstream in the return path of the metering bar assembly. The specific details of a detachable and retractable flight bar used in this embodiment of the machine is shown in Figures 9 and 10 of the drawings, to which reference is now made.

Referring now to Figures 9 and 10, details of the retractable and detachable metering bars is shown. Each metering bar 'm' includes a bar element 58 having an outboard wedge-shaped end 58a and a downwardly dependent key 60 of substantially T-shaped cross section which engages in a complementary key-way 62 provided in a carrier 64. A series of carriers 64 are mounted along the carrier chain drive, which incorporates the twin chain and sprocket assemblies 54, 56. The carrier includes spring loaded shafts 66 so that the carrier can be resiliently moved transversely of the direction of movement along the carrier chain drive. The base of the carrier includes a cam follower 68 which engages in a suitably shaped cam track 69 (shown schematically in Figure 8) alongside the carrier chain drive to cause the metering bar unit comprising the carrier and the metering bar itself to move inwardly between a pair of adjacent cartons being processed through the machine during the metering and loading process and, thereafter to be retracted so that the metering bar can return along the return path of the metering bar chain assembly. The metering bar can be readily detached from its carrier by slidingly disengaging the key from the carrier keyway. Such detachment between metering bars and carriers is desirable to adjust the spacing between adjacent bars in accordance with the size (breadth) of carton being processed. Selected ones of the metering bars may be removed or added to adjust machine pitch, while different size metering bars may be

substituted to vary the size of the space between adjacent metering bars.

The cartons themselves are conveyed through the machine by means of the lug chain conveying assemblies 16, 18. Each of these assemblies includes a pair of lug chains which are adjustable relative to one another. One such assembly is shown in more detail with reference to Figures 11 and 12 which may be assumed to show the arrangement with reference to main lug chain assembly 16. Assembly 18 is of similar construction.

The lugs identified as L1 are driven by lug chain 16a and the lugs identified by reference L2 are driven by lug chain 16b in the same assembly. Lug chain 16a is driven by servo-motor M1 (Figure 12) and lug chain 16b is driven by servo-motor M2. Motor M1 drives shaft 1 and sprocket 1 and motor M2 drives shaft 2 which in turn serves as a transmission for sprocket 2. The two drive sprockets S1 and S2 are disposed on the same shaft. Sprocket S1 is firmly keyed to shaft 1 whereas sprocket S2 is carried by shaft 1 but is rotatable with respect thereto by shaft 2. Sprocket S1 carries lug chain 16a and sprocket S2 carries lug chain 16b. In Figure 11 of the drawings, the lug chains are adjusted so that the distance between adjacent lugs L1, L2 is equal and this would be a typical configuration required for a relatively small carton. Larger sized cartons are accommodated when the spacing between the adjacent lugs of the separate chains are minimised. Thus, when the lugs of chain 16a are closed up into abutment with the lugs of chain 16b then the spacing between successive lug pairs is at a maximum to allow the greatest width carton. Adjustment is carried out by incrementing the servo-motors to move the chains 16a, 16b relative to one another whereas in normal operation the chains 16a and 16b are driven in synchronism by the servo-motors. Appropriate control circuitry for the motors (not

shown) including a programmable control device is provided to carry out this operation. It will be understood by those skilled in the art how such controls can be constructed and programmed to carry out the operations described herein.

In order to provide for the adjustability between the main lug chain assemblies 16, 18, as opposed to the adjustability between adjacent lugs within each unit, lug chain assembly 18 remote from the article metering and loading side of the machine is adjustable transversely towards and away from the other assembly 16 alongside the article infeed station which is fixed relative to the article infeed assembly 20.

Thus, with reference to Figures 13 and 14, lug chain assemblies 16, 18 are shown in Figure 13 at the maximum spacing apart for supporting and conveying larger sized cartons. Lug chain assembly 18 is moved transversely towards and away from lug chain assembly 18 by screw driven slide guides (not shown but which are known per se). In the arrangement shown in Figure 13, retractable support platforms 70, 72 are provided to give additional support to the underside of a carton 'ct' intermediate the lug chain assemblies 16 and 18. These support platforms are carried by arcuate rods 74, 76 which move in guides 78, 80 and which include a series of teeth which mesh with screw threaded adjustment shafts 82 and 84 respectively. Thus by rotating the adjustment shaft the guide rods can be extended to put the support platforms 70, 72 beneath the carton 'ct' carried by the lug chain assemblies 16 and 18 or retracted along the guides 78, 80 provided in the lug chain assemblies. Normally when the support platforms are in their retracted position as shown in Figure 14, lug chain assembly 18 will have been adjusted to move inwardly so that it is closely adjacent the fixed lug chain assembly 16. In this configuration the lug chain

assemblies are configured to process an intermediate size carton as illustrated in Figure 14. In some arrangements, where it is required to process small cartons of, say, 2 x 2 can configurations, the lug chain assembly 18 can be moved to an inoperative position so that the carton is supported and conveyed only by lug chain 16. This general arrangement is shown in Figure 15 where lug chain assembly 18 is shown in a lowered inoperative position. The lug chain assembly 18 is raised and lowered simply by means of cranks and guides as is well known in the art.

Thus, main lug chain assembly 18 is adjustable both transversely and vertically with respect to lug chain assembly 16 in accordance with the size of package to be processed through the machine. Likewise, as described, the spacing between successive metering bars 'm' is adjustable by removing or adding metering bars to the endless series of carriers provided in the metering bar chain and sprocket assembly 54, 56.

Adjustment of the spacing between adjacent lugs in each main lug chain assembly is also provided as described.

Moreover, at the infeed end of the machine, adjustment of various machine components to accommodate carton blanks of a range of sizes is provided. Thus, the transfer belt assemblies 42, 44 are adjustable transversely relative to one another normally by shifting assembly 44 with respect to assembly 46. If appropriate in relation to carton size only belt assembly 42 may be operative. Likewise, the side lug assemblies 50, 52 are transversely adjustable to the same end normally by shifting side lug assembly 52 relative to assembly 50. The two units of the twin overhead rotary carton opening devices 46 also are adjustable both transversely relative to one another and vertically to account for varying

heights of different carton sizes. Likewise, the overhead lug chain assembly 48 is height adjustable for the same reason. The specific mechanisms for effecting such adjustments are not critical and can be put into effect by those skilled in the art.

What is claimed is:

1. A carton feeding and erecting mechanism for a packaging machine for packaging articles such as beverage containers or the like into cartons, the packaging machine including a carton conveyor for conveying an open-ended carton through the machine, the feeding and erecting mechanism comprising a vacuum conveyor for engaging a lower surface of a collapsed carton and moving the carton onto said carton conveyor, a feeder disposed generally beneath said vacuum conveyor for selecting a collapsed carton from a carton supply and placing the carton on said vacuum conveyor, an erector disposed above said vacuum conveyor and having vacuum engagement means for engaging an upper surface of said collapsed carton and moving said panel upwardly with respect to said lower surface thereby erecting said carton, and a series of upper carton engaging elements disposed above and for synchronous movement with said vacuum conveyor for engaging the erected carton to maintain the carton in erected condition until moved onto said carton conveyor.

2. A packaging machine as claimed in claim 1, wherein said feeder includes a wheel having mounted thereon a plurality of vacuum cups, and wherein rotary movement of said wheel advances said cups into engaging contact with said collapsed carton at said carton supply, and further rotary movement of said wheel advances said cups to carry said collapsed carton to said vacuum conveyor.

3. A packaging machine as claimed in claim 2, wherein said wheel is mounted for rotary movement in a plane perpendicular to the direction of movement of said vacuum conveyor.

4. A packaging machine as claimed in claim 1, wherein said erector includes a second wheel disposed for rotary movement above said vacuum conveyor, and wherein said vacuum engagement means includes a plurality of vacuum

cups mounted to said wheel, rotary movement of said wheel causing said cups to engage said upper surface of said collapsed carton as said carton is moved past said second wheel on said vacuum conveyor, further rotary movement of said wheel causing upward movement of said panel to erect said carton.

5. A packaging machine as claimed in claim 4, wherein said second wheel is mounted for rotary movement in a plane perpendicular to the direction of movement of said vacuum conveyor.

6. A packaging machine as claimed in claim 1, wherein said series of carton engaging elements includes a plurality of carton engaging lugs, said lugs mounted on means for synchronously moving said lugs with said vacuum conveyor for engaging the erected carton.

7. A packaging machine as claimed in claim 6, wherein said lug moving means includes at least one chain, and means for driving said chain in path parallel to and spaced above said vacuum conveyor.

8. A packaging machine substantially as herein described with reference to Fig. 1 and Figs. 3 to 15 of the accompanying drawings.

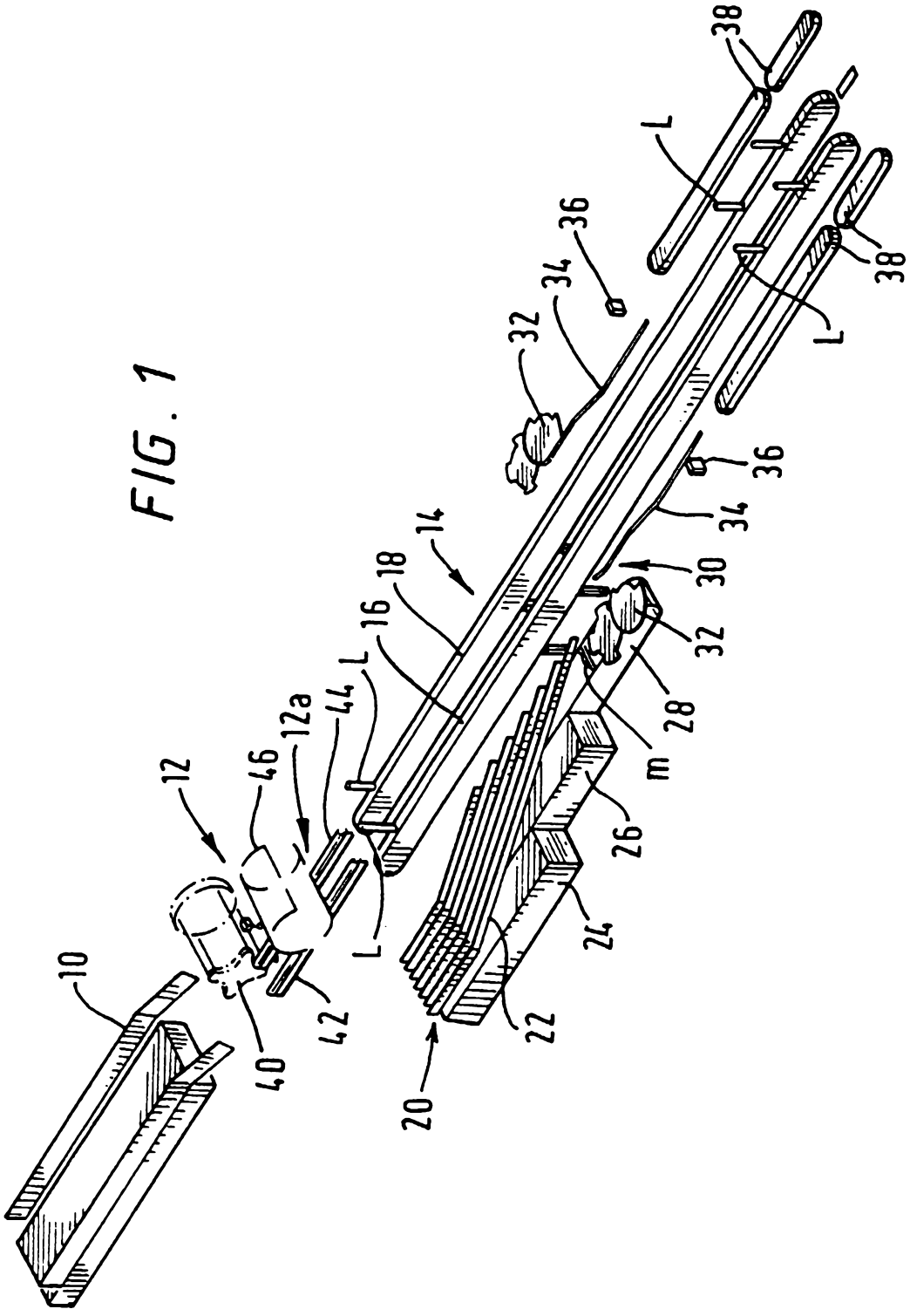
DATED this Twentieth Day of March 1998

The Mead Corporation

Patent Attorneys for the Applicant/Nominated Person

SPRUSON & FERGUSON

FIG. 1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L
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34
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12a
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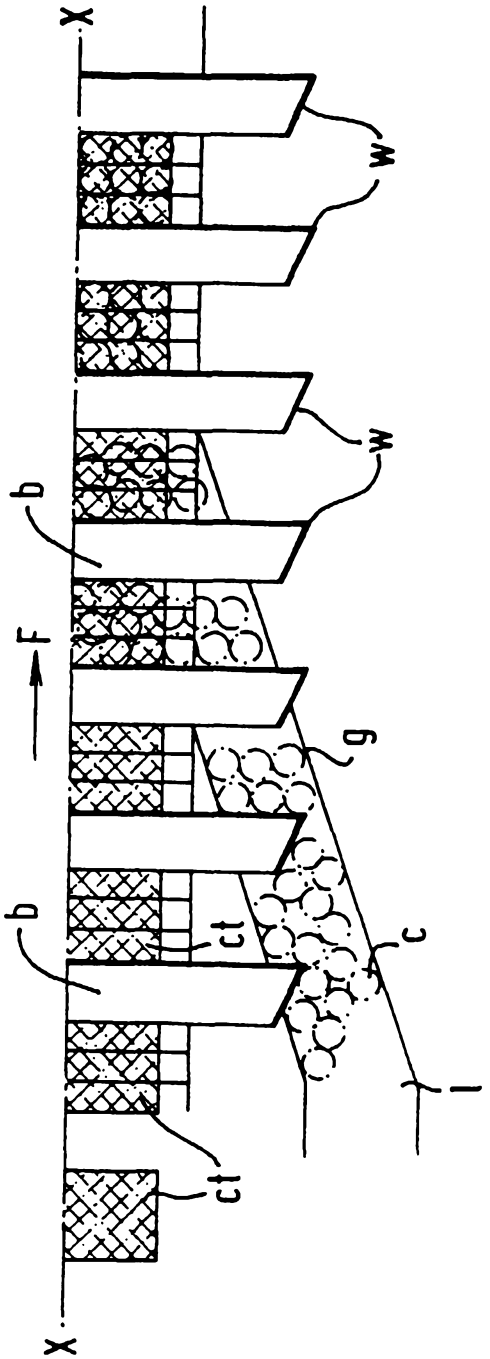
42
40
10

FIG. 2



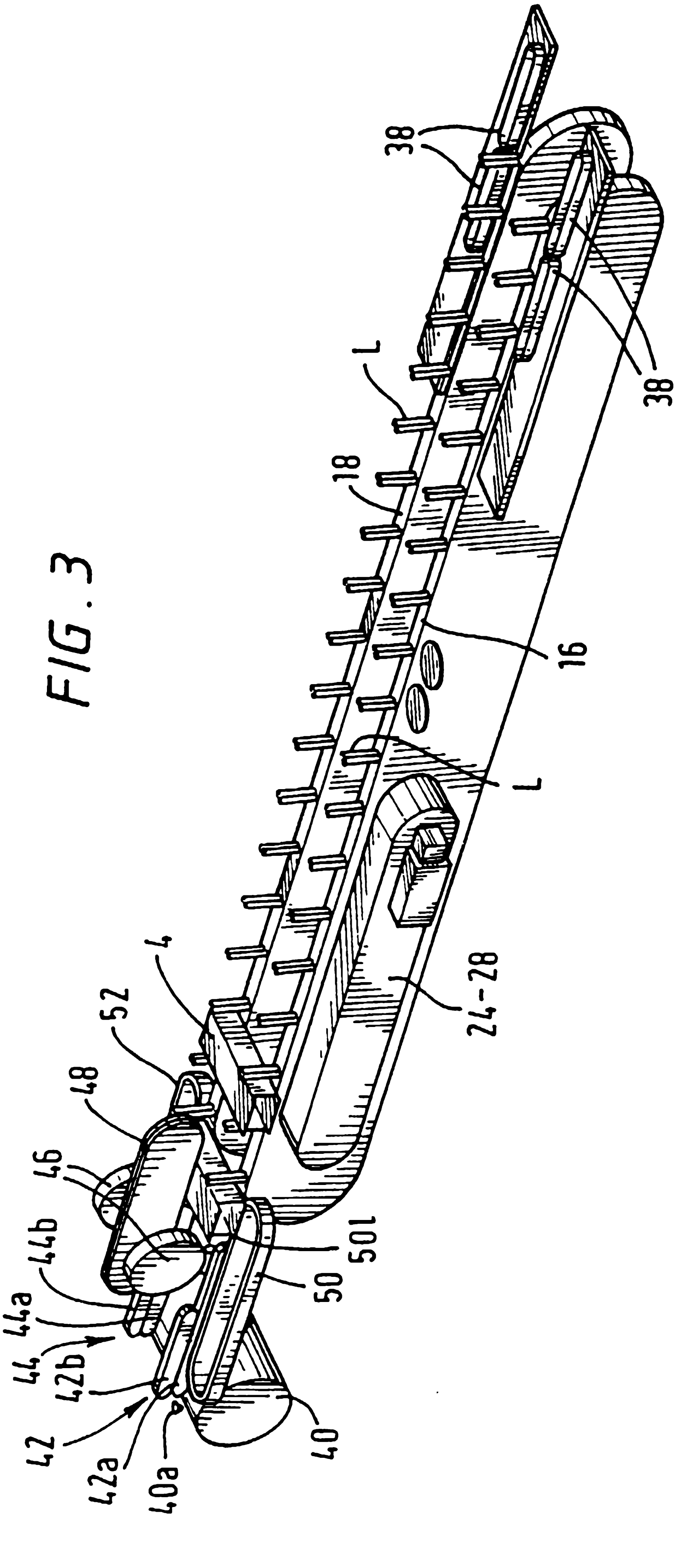
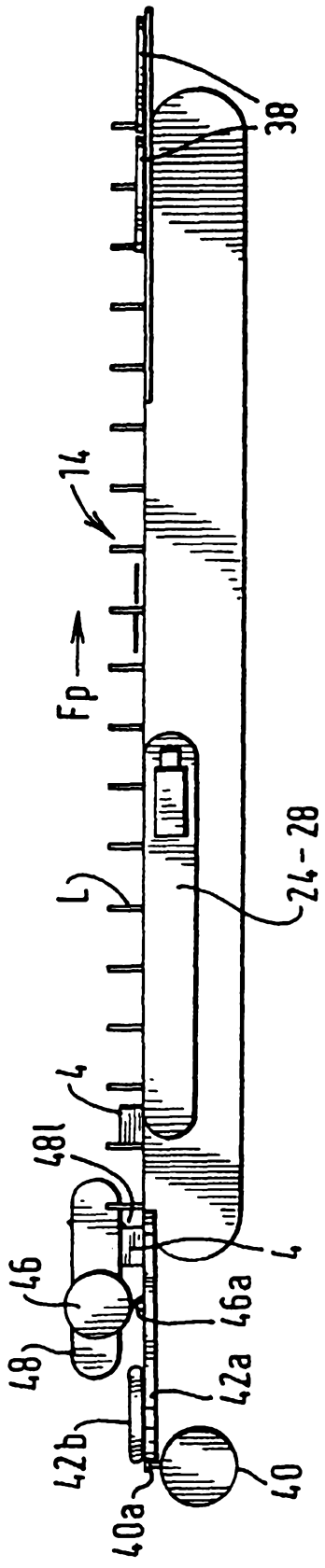


FIG. 3

FIG. 4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14
Fp
L
24-28
4
48
46
46a
42a
42b
40
40a

FIG. 5

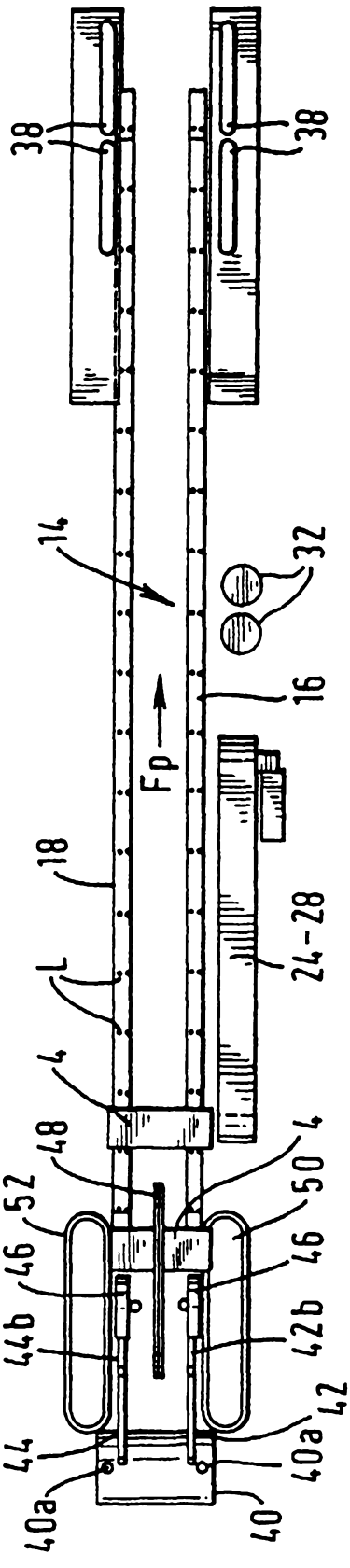
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FIG. 6

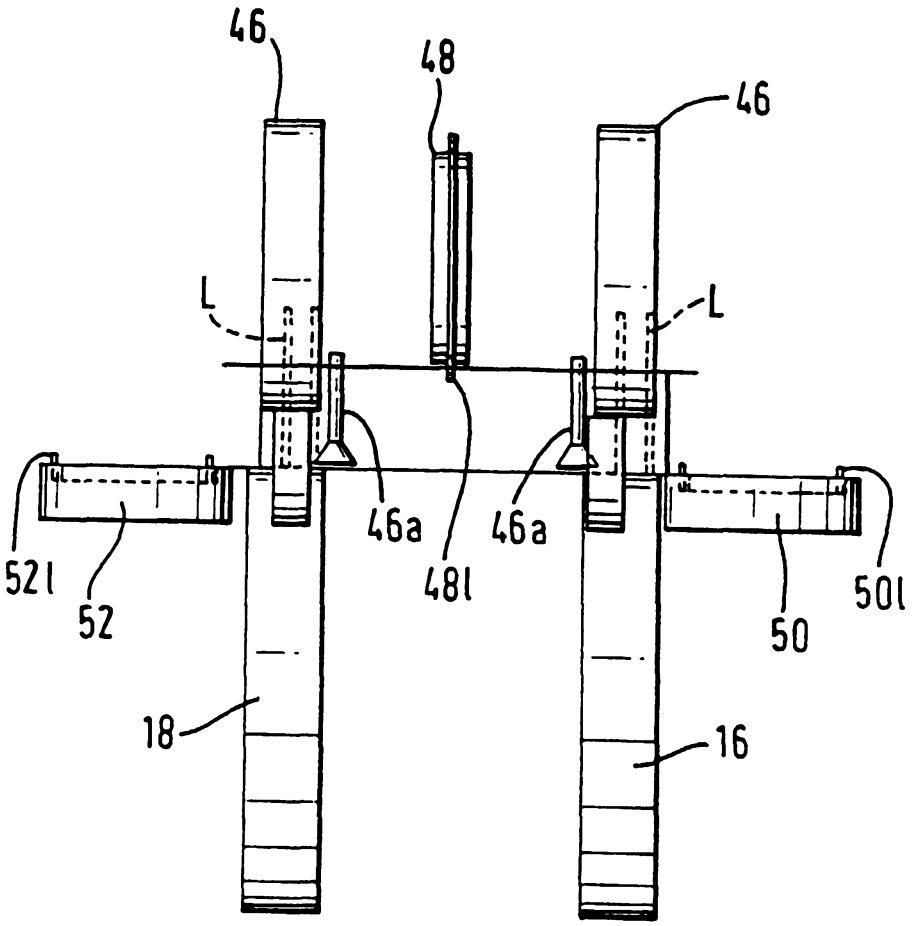


FIG. 7

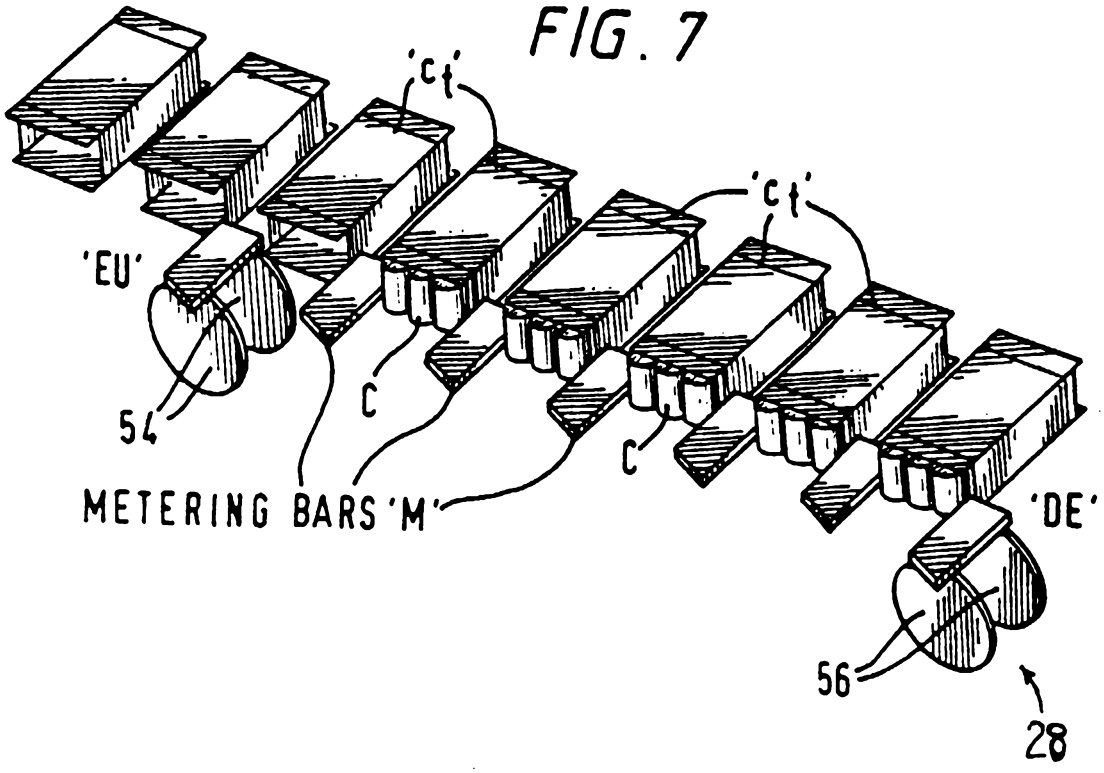
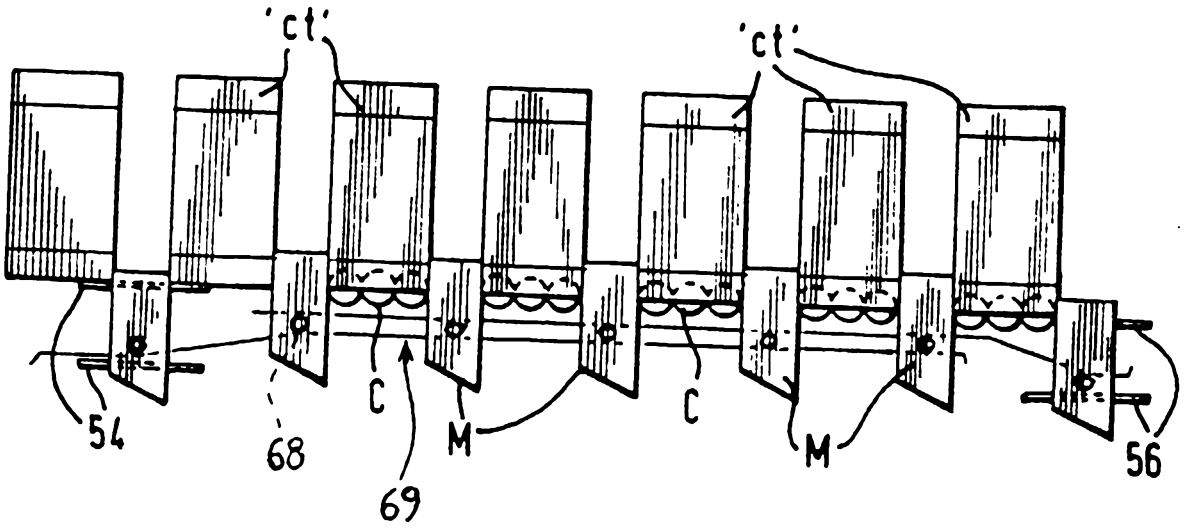


FIG. 8



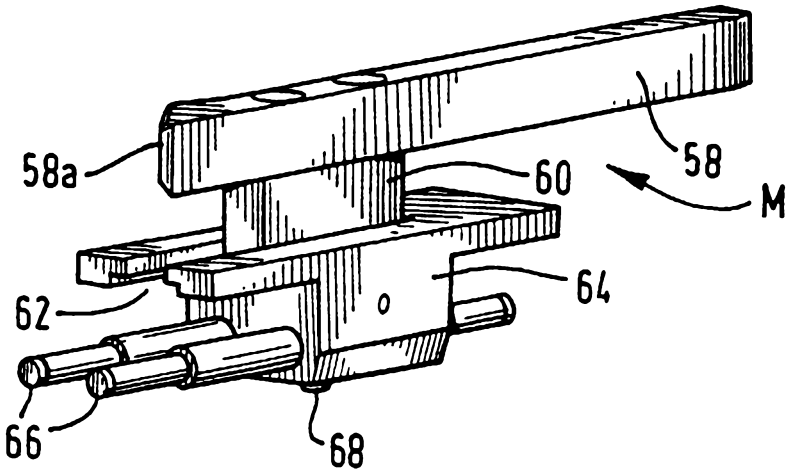


FIG. 9

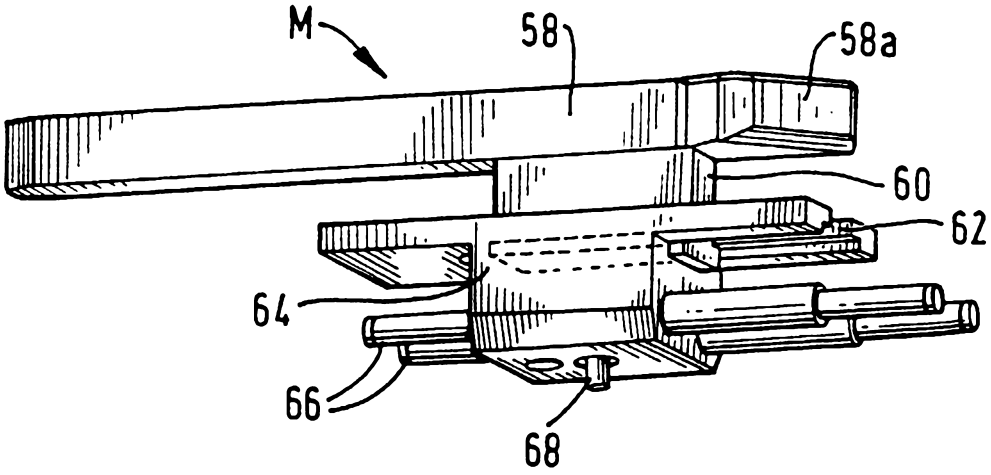


FIG. 10

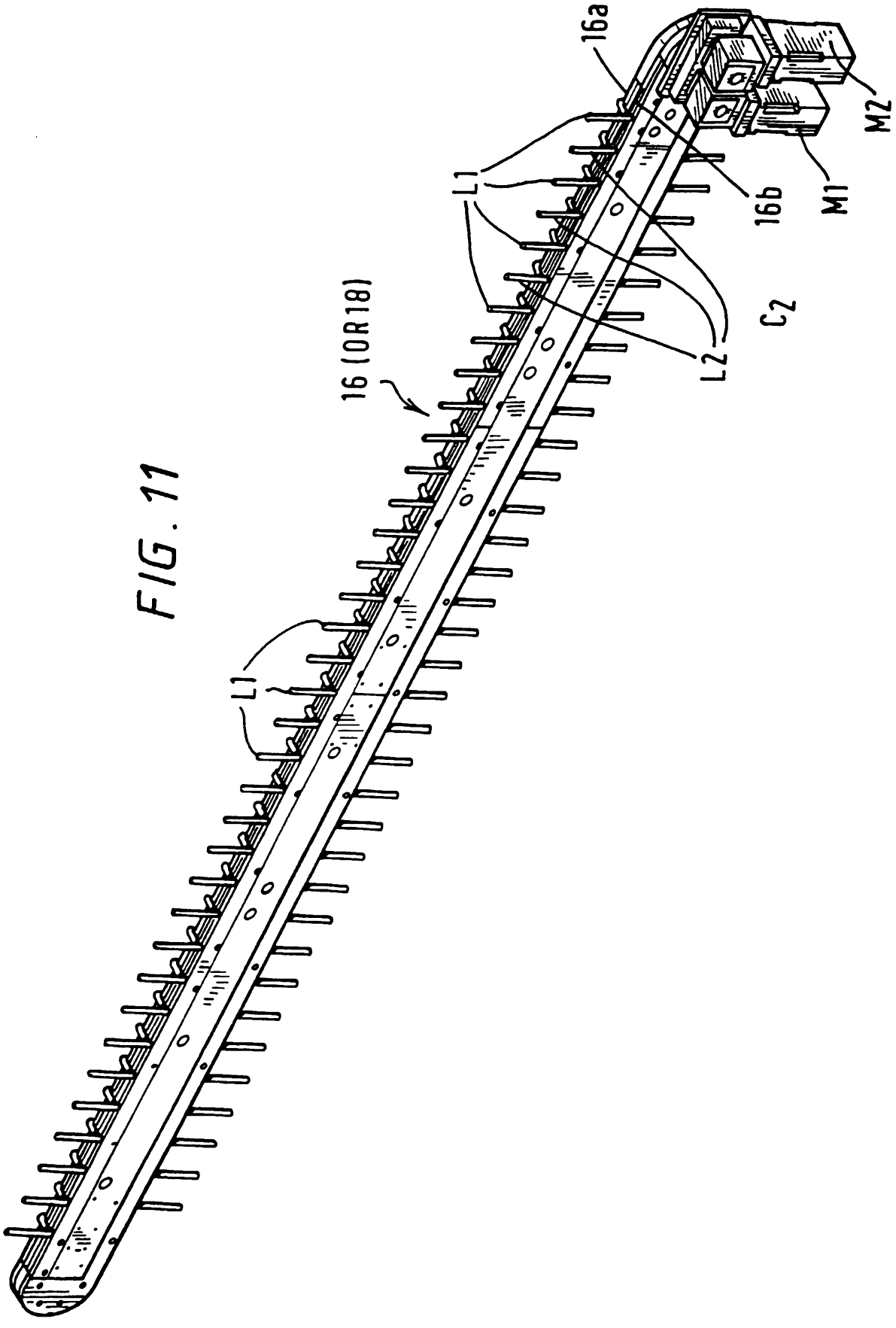
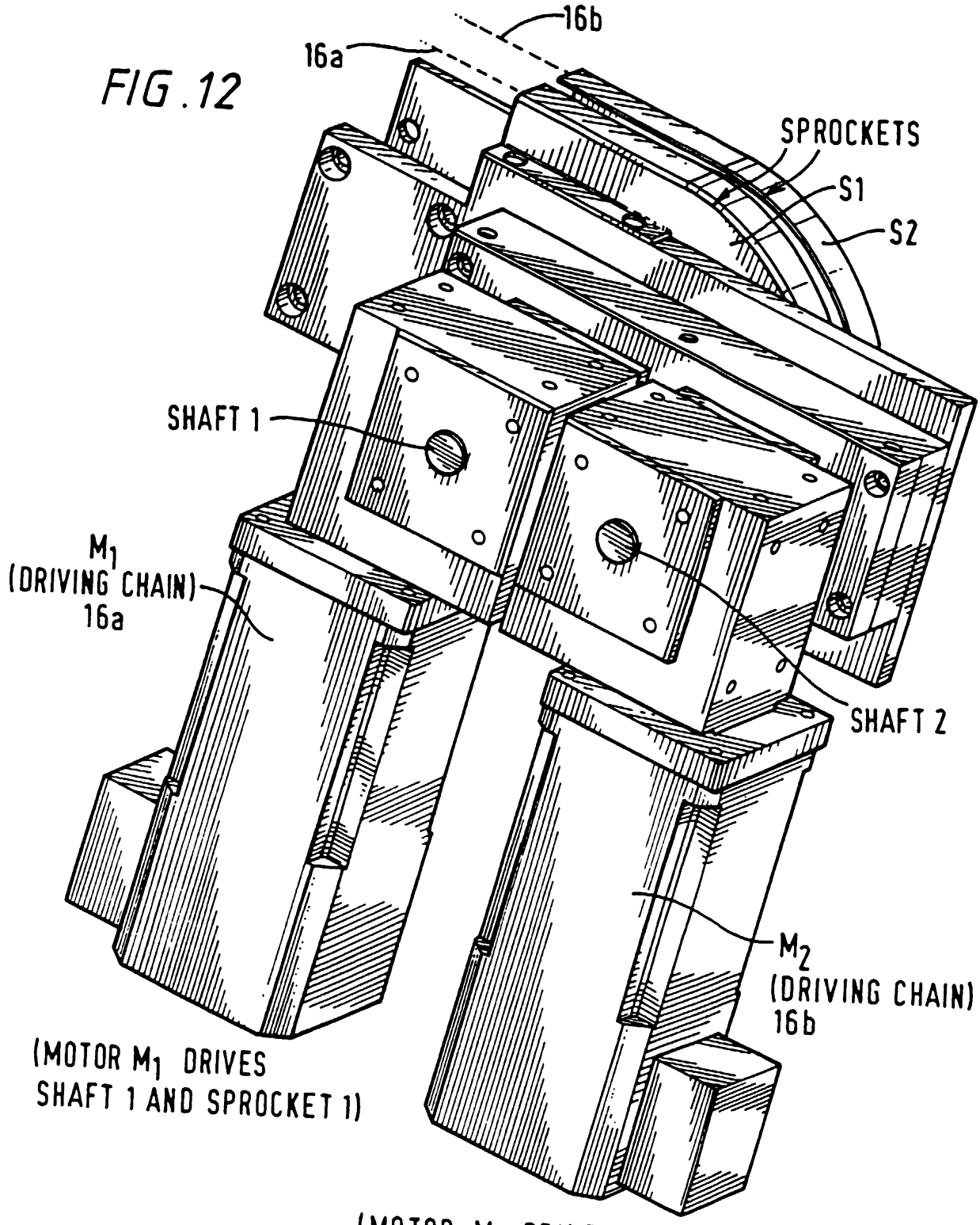


FIG. 11

FIG. 12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(DRIVING CHAIN)
16b
(MOTOR M_1 DRIVES SHAFT 1 AND SPROCKET 1)
(MOTOR M_2 DRIVES SHAFT 2 WHICH IN TURN SERVES AS TRANSMISSION FOR SPROCKET 2 (S_2) WHICH DRIVES SHAFT 1)*

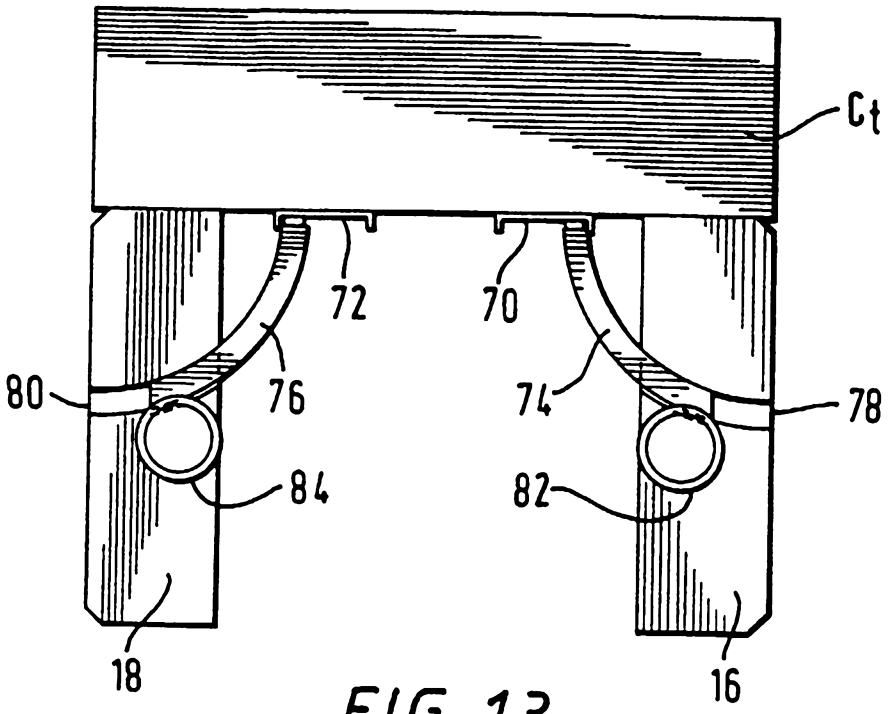

FIG. 13

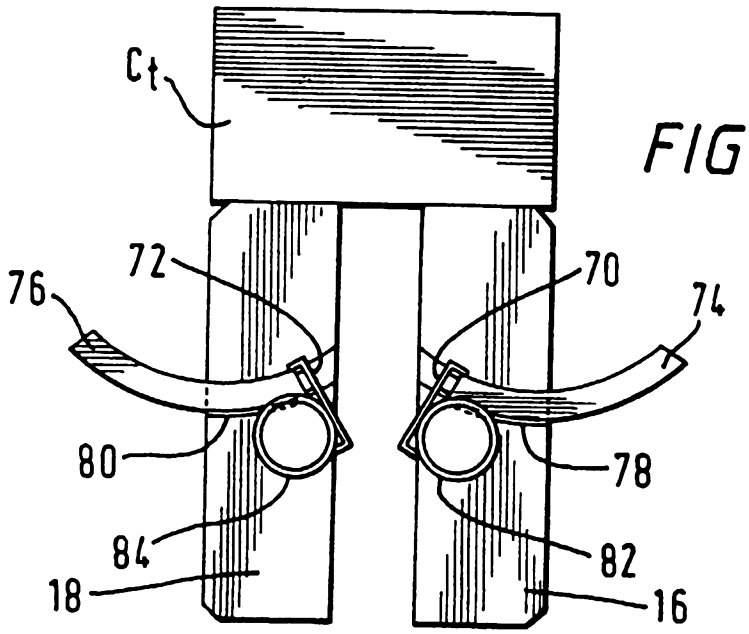

FIG. 14

FIG. 15