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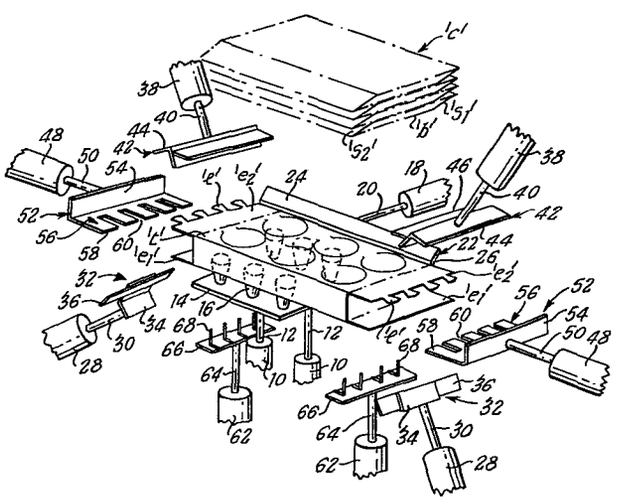
(54) Machine and method for erecting a carton.

(57) The invention provides a machine and method for erecting, from a collapsed condition to an erected condition, a carton having a tray-like configuration. The machine comprises means for withdrawing a collapsed carton from a supply, means for moving apart top and bottom wall panels of the carton to bring the carton into a tubular configuration, means for causing a first end closure panel at each end of the tubular structure to be brought into a position to close the ends of the tubular structure, means for causing a second end closure panel at each end of the tubular structure to be brought into overlapping relationship with respect to said first end closure panels, and means for causing portions of said second end closure panels to be inserted into openings provided in one of the top or bottom wall panels of the carton to maintain the carton in its erected condition.



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MACHINE AND METHOD FOR ERECTING A CARTON

This invention relates to a machine and method for erecting, from a collapsed condition to an erected condition, a carton of the kind comprising a top wall panel, and a bottom wall panel interconnected by spaced side wall panels to form a tubular structure with the top and bottom walls substantially parallel to one another, and end closure panels at each end of the carton to close the ends of the tubular structure.

Such carton is hereinafter referred to as "a carton of the kind described."

It is known, for example, from U.S. patent No. 4,053,099 to provide a tray in the form of a flat carton with openings in the top into which containers are inserted so that they stand upright on the bottom of the tray and project above the top of the tray. The trays disclosed in U.S. patent No. 4,053,099 take the form of a sleeve of foldable sheet material, comprising top and bottom walls hingedly joined by a pair of opposite side walls, the sleeve being closed at its ends by panels hinged to the top and bottom walls forming end walls of

the tray. One of the end wall panels at each end of the tray includes a series of tabs which are disposed in overlapping abutting engagement with the top side of the tray to hold the sleeve in its tray-like configuration.

A suitable machine for erecting such a carton is known and includes suitable components to enable the tray to be erected from a flat condition and to engage the tabs in overlapping abutting engagement with the top side of the tray to hold the sleeve in its tray-like configuration.

One aspect of the present invention provides a machine for erecting from a collapsed condition to an erected condition a carton "of the kind described", which machine comprises means for withdrawing a collapsed carton from a supply, means for moving apart the top and bottom wall panels of the carton to bring the carton into its tubular configuration, means for causing a first end closure panel at each end of the tubular structure to be brought into a position to close the ends of the tubular structure, means for causing a second end closure panel at each end of the tubular structure to be brought into overlapping relationship with respect to said first end closure panels, and means for causing portions of said second end closure panels to be inserted into openings provided in one of said top or bottom wall panels to maintain the carton in its erected configuration.

Another aspect of the present invention provides a method of erecting a carton "of the kind described" which method comprises the steps of withdrawing the carton from a supply and causing the top and bottom walls to be moved apart from one another so that the carton adopts a tubular configuration, causing a first end closure panel at each end of the tubular structure to

be folded into a position to close the ends of the tubular structure, causing a second end closure panel at each end of the tubular structure to be folded into overlapping relationship with respect to said first end closure panels, and causing portions of said second end closure panels to be inserted into openings provided in one of said top or bottom wall panels to maintain the carton in its erected configuration.

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 schematic exploded perspective view of the basic components of a machine suitable for erecting a carton "of the kind described",

Figure 2 is a schematic front view of the machine showing a carton after having being brought into a tubular configuration,

Figure 3 is a schematic front view of the machine showing bottom wall end closure panels of the carton engaged by inclined rams for folding the end closure panels into a position to close the ends of the tubular structure,

Figure 4 is a schematic front view of the machine shown after completion of folding of the bottom wall end closure panels with the inclined rams retracted,

Figure 5 is a schematic front view of the machine showing further inclined rams extended to fold top wall end closure panels of the carton into overlapping relationship with respect to the bottom wall end closure panels,

Figure 6 is a schematic front view of the machine showing a pair of central rams extended to engage the folded end closure panels and to support portions of the carton bottom wall preparatory to locking,

Figure 7 is a schematic front view of the machine showing a pair of lower rams having locking components extended to cause locking tabs carried by the top wall end closure panels to be inserted into openings provided in the bottom wall of the carton, and

Figure 8 is a schematic front view of the machine showing the carton in its completed erected configuration with all the machine rams retracted.

Referring first to Figure 1 of the drawings there is shown schematically the basic components of a machine suitable for erecting a carton "of the kind described". A stack of collapsed cartons "c" is held vertically above the carton erecting components of the machine in a suitable hopper (not shown) such that, in operation, the cartons may be withdrawn sequentially from the machine.

A pair of pneumatically operable rams 10 are located vertically beneath the supply of collapsed cartons "c" and each ram 10 includes an extensible and retractable piston rod 12 which carries at its free end a base plate 14 positioned at a suitable distance below the lowermost collapsed carton 'c' in the supply. The base plate 14 is provided with a series of vacuum operated suction cups 16 which are operable to engage and hold the bottom wall of the lowermost collapsed carton in the supply.

An ejector ram 18, which also is pneumatically operable, is located towards the rear of the machine and includes an extensible and retractable piston rod 20 which carries at its free end an ejector bar 22. The ejector ram 18 is operable so as to cause the ejector bar 22 to move in a plane substantially parallel to that of the base plate 14. The ejector bar 22 includes a backwardly sloping ramp surface 24 from which depends a vertical surface 26.

The machine is operated cyclically and, in order to erect a carton, during the first sequence of the cycle the base plate rams 10 are activated so that the piston rods 12 are extended to raise the base plate 14 to enable the suction cups 16 to engage the bottom wall "b" of the lowermost carton in the supply hopper. Vacuum is then applied and the piston rods 12 retract a short distance in order to withdraw the lowermost carton from the hopper. In so doing, the side wall "S1" of the lowermost carton (which is located towards the rear of the machine) is caused to be drawn down across the inclined ramp surface 24 of the ejector bar 22. Side wall "S2" of the lowermost carton is suitably restrained to prevent forward movement of the carton while it is being withdrawn. Thus, the lowermost collapsed carton is brought into a set up condition in which the top wall "t" and the bottom wall "b" are moved apart so that the carton adopts a substantially rectilinear tubular configuration as shown.

The carton and the carton erecting components of the machine at the completion of this machine sequence are then substantially as shown in Figure 2 of the drawings.

Referring now to Figures 1 and 3 of the drawings, the erecting machine further includes a pair of lower rams 28 located below and on either side of the base plate 14. Rams 28 are mounted in an inclined attitude with respect to the vertical. The rams 28 are pneumatically operable and each ram includes an extensible and retractable piston rod 30 which carries at its free end an angle bracket 32. As best seen in Figure 1 of the drawings each angle bracket 32 comprises a mounting bar 34 to which is connected an elongate fold bar 36.

During the second sequence of the cycle, the lower rams 28 are activated simultaneously so that the piston rods 30 extend upwardly so that each elongate bar 36 engages the underside of a bottom wall end closure panel "e_1" at respective ends of the carton. As the piston rods 30 continue to extend, the elongate bars 36 cause the bottom wall end closure panels "e_1" to be folded upwardly into a position to close the ends of the tubular structure, as shown in Figure 3. Preferably, the bottom wall end closure panels "e_1" are pushed inwardly of the carton to adopt an inclined attitude within the space defined between the side walls "s_1" and "s_2". This gives rigidity to the ends of the carton and enables the carton ends to resist collapse when subjected to vertical force, in use.

The bottom rams 28 are then reactivated so that the piston rods 30 together with angle brackets 32 are retracted. The carton and the carton erecting components of the machine at the completion of this machine sequence are then substantially as shown in Figure 4 of the drawings.

Referring now to Figures 1 and 5 of the drawings, the erecting machine further includes a pair of upper rams 38 which are located above and on either side of the base plate 14. The upper rams 38 are pneumatically operable and located in an inclined attitude with respect to the vertical. Each upper ram 38 includes an extensible and retractable piston rod 40 which carries at its free end an angle bracket 42. As best seen in Figure 1 of the drawings, each angle bracket 42 includes a fold bar 44 to which is attached a horizontally extending retaining plate 46.

During the third sequence of the cycle, the pneumatic rams 38 are activated simultaneously so that each piston rod 42 extends downwardly until the fold bar 44 of the associated angle bracket 42 engages respective ones of the top wall end closure panels "e_2". As the pistons 40 continue to extend each of the top wall end closure panels "e_2" are caused to be folded downwardly into overlapping relationship with respective ones of the previously folded bottom wall end closure panels "e_1". When the piston rods 42 are fully extended, as shown in Figure 5, the retaining bars 46 engage the top wall "t" of the carton at its opposite ends. The carton and carton erecting components of the machine at the completion of this machine sequence are then substantially as shown in Figure 5 of the drawings.

Referring now to Figures 1 and 6 of the drawings, the erecting machine further includes a pair of central rams 48, which are located on either side of base plate 14 and intermediate top and bottom rams 28, 38, respectively. The centre rams 48 are pneumatically operable and located in a plane generally parallel with respect to the plane of base plate 14. Each centre ram 48 includes an extensible and retractable piston rod 50 which carries at its free end an angle bracket 52. As best seen in Figure 1, of the drawings, each angle bracket 52 comprises an upright plate 54 attached to the end of the piston rod 50 and a horizontal plate 56 having a series of five fingers 58 spaced apart by slots 60.

During the fourth sequence of the cycle, the central rams 48 are activated simultaneously so that each piston 50 extends horizontally until each angle bracket 52 is brought into engagement with respective ends of the carton. This causes

each of the horizontal plates 56 to engage and fold downwardly extending locking tabs "1" into overlapping relationship with respect to the base "b" of the carton. At the same time, the vertical plate 54 of each angle bracket 52 is engaged with the outermost surface of each end closure panel "e_2". The angle bracket 52 is constructed such that the slots 60 between each of the fingers 68 is of smaller width than the locking tabs "1" carried by each top end closure panel "e_1", and are positioned such that each locking tab "1" is engaged by adjacent portions of neighbouring fingers 58.

The carton and carton terecting components of the machine at the completion of this machine sequence are then substantially as shown in Figure 6 of the drawings.

Referring now to Figures 1 and 7 of the drawings, the erecting machine further includes a pair of vertical lower rams 62 which are located on either side of and below the base plate 14. The vertical lower rams 62 are pneumatically operable and each ram 62 includes an extensible and retractable piston rod 64 which carries at its free end an elongate plate 66 from which extend a series of spaced vertical locking fingers 68.

During the fifth sequence of the cycle, the vertical lower rams 62 are activated simultaneously so that each piston rod 64 extends upwardly to cause the locking fingers 68 to be inter-digitated with the fingers 58 carried by each angle bracket 52. In so doing, the locking fingers 68 cause the locking tabs "1" at each end of the carton to be thrust into cooperating openings "a" formed in the base "b" of the carton. The locking tabs "1" and the cooperating openings are sized so that once the tabs "1" are inserted within the openings the tabs "1" are held in locked

engagement. This is a known locking arrangement and is not described in further detail.

It will be appreciated that during the locking operation the retaining plates 46 overlying the top wall "1" of the carton prevent any tendency for the carton to move upwardly away from the suction cups 16. Furthermore, the slotted horizontal plates 56 give stability to the bottom wall "b" of the carton particularly in those areas on either side of the openings "a" so as to ensure that positive locking is effected.

The carton and carton erecting components of the machine at the completion of this machine sequence are then substantially as shown in Figure 7 of the drawings.

During the sixth sequence of the cycle, the top rams 38 centre rams 48, and vertical lower rams 62 are then reactivated so that their piston rods are retracted. The carton and carton erecting components of the machine at the completion of this machine sequence are then substantially as shown in Figure 8 of the drawings.

The carton is now fully erected with the end closure panels at each end of the carton closing the ends of the tubular structure and locked so as to maintain the carton in its erected configuration.

Referring again to Figure 1 of the drawings, during the final sequence of the cycle, the vacuum pressure exerted by the suction cup 16 is then relieved and the piston rods 12 retract to lower the base plate 14. Simultaneously, or shortly thereafter the ejector ram 18 is activated in order

to cause the piston rod 20 to extend. Thus, the vertical surface 26 of the ejector bar 22 thrusts against side wall "S_1" of the carton to eject the completed carton forwardly out from the machine. The carton may then be removed to be filled with product.

The machine cycle is then repeated to erect the next suceeding carton "c" from the supply.

It is envisaged that the carton erecting machine described may be installed as the first station of a carton erecting and filling machine. In such an arrangement, once the erected carton has been ejected, it would be transferred directly to a filling station to be filled with product.

It is further envisaged that the locking tabs "l" could be formed integrally with the bottom wall end closure panels "e_1" and the cooperating openings formed in the top wall "t" of the carton. In this case the method of erection would be such that the top wall end closure panels "e_2" would be folded before the bottom end closure panels "e_1" and the machine components and cycle altered accordingly.

MACHINE AND METHOD FOR ERECTING A CARTON

CLAIMS

1. A machine for erecting a carton having a tray-like configuration from a collapsed condition to an erected condition, said machine comprising means (14,16) for withdrawing a collapsed carton from a supply, means (24,26) for moving apart top and bottom walls of the carton to bring the carton into a tubular configuration characterized by first folding means (32) for causing a first end closure panel at each end of the tubular structur to be brought into a position to close the ends of the tubular structure, second folding means (42) for causing a second end closure panel at each end of the tubular structure to be brought into overlapping relationship with respect to said first end closure panels, and locking means (52,66) for causing portions of said second end closure panels to be inserted into openings provided in one of the top or bottom wall panels of the carton to maintain the carton in its erected condition.

2. A machine according to claim 1 further characterized in that said first and second folding means each comprise a fixed folding tool (36,44) carried by a reciprocal arm (30,40).

3. A machine according to claim 2 further characterized in that said locking means comprises a guide and support tool (52)

carried by a reciprocal arm (50), said guide and support tool being located intermediate the first and second folding tools and locking fingers (68) carried by a reciprocal arm (64) for cooperation with said guide and support tool.

4. A machine according to claim 1 further characterized in that a carton ejector tool (22) is provided for ejecting an erected carton from the machine, said ejector tool including a ramp surface (24,26) to aid in moving apart the top and bottom walls of the carton.

5. A method of erecting a carton having a tray like configuration from a collapsed condition to an erected condition, which method is characterized by the steps of withdrawing the carton from a supply and causing top and bottom walls of the carton to be moved apart from one another so that the carton adopts a tubular configuration, causing a first end closure panel at each end of the carton to be folded into a position to close the ends of the tubular structure, causing a second end closure panel at each end of the tubular structure to be folded into overlapping relationship with respect to said first end closure panels, and causing portions of said second end closure panels to be inserted into openings provided in one of said top or bottom wall panels to maintain the carton in its erected configuration.

6. A package comprising a tray in the form of a sleeve formed from foldable sheet material having top (t), bottom (b) and side walls (S_1, S_2), the top of the tray having openings into which containers may be received, and the ends of the sleeve being closed by panels (e) hinged to the top and bottom walls forming a double wall construction, characterised in that each of the end walls (e2) hinged to the top wall include a plurality of spaced locking tabs (1) which are received in cooperating openings (a) formed in the bottom wall of the sleeve to hold the sleeve in its tray-like configuration.

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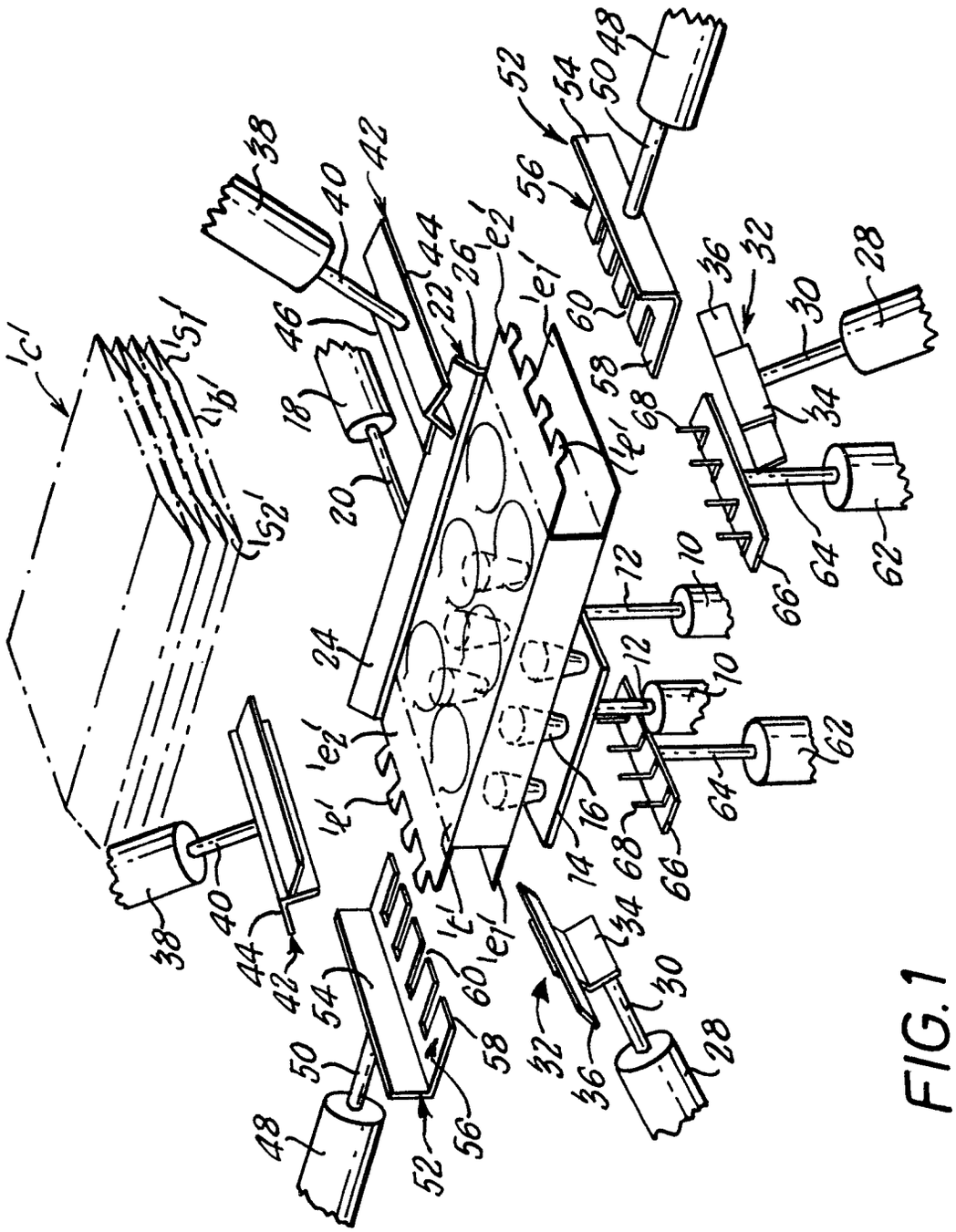

FIG. 1

FIG. 2

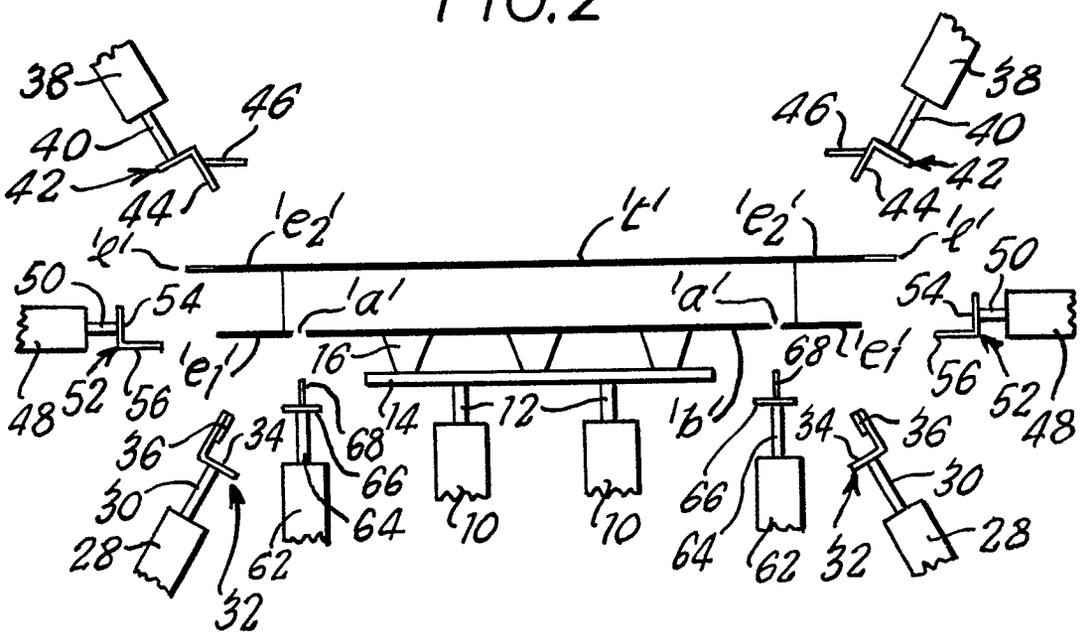
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FIG. 3

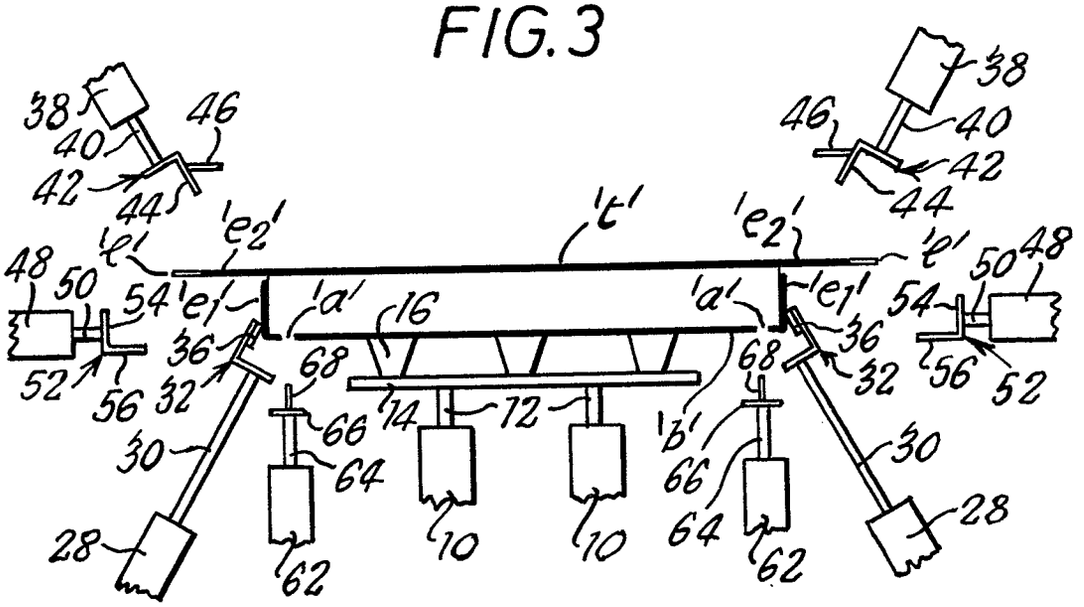
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FIG. 4

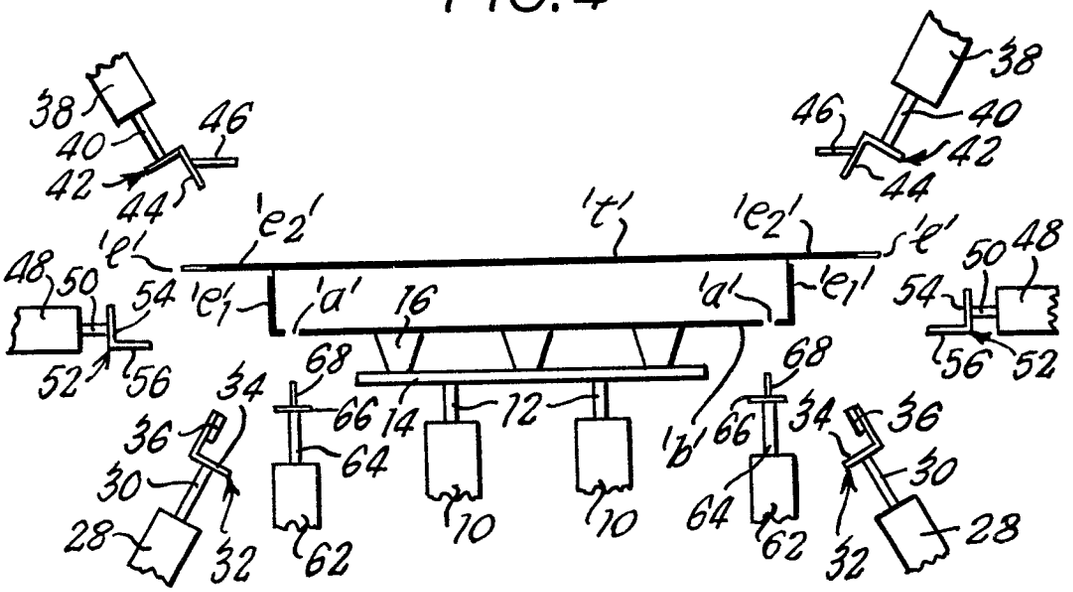

FIG. 5

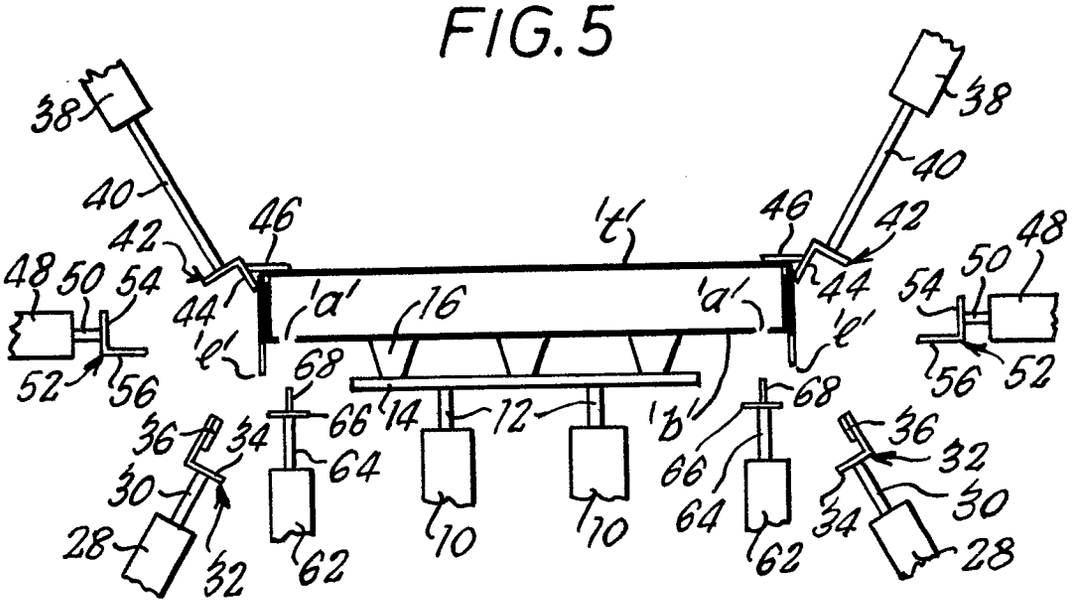

FIG.6

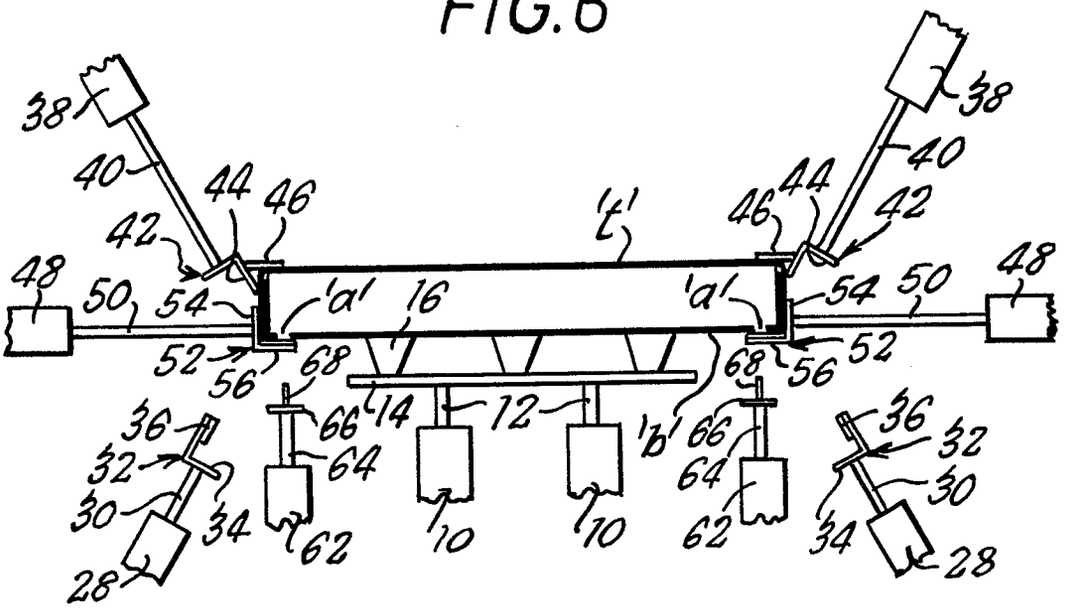
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FIG.7

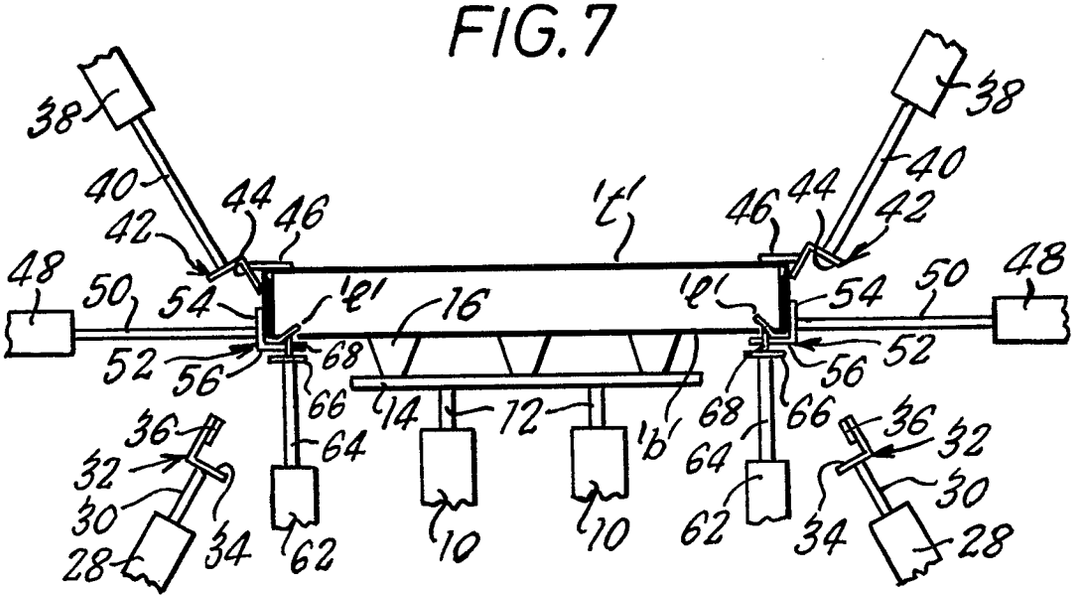
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FIG.8