June 14, 1960 C. D. GRABER 2,940,810

ELEVATOR FILING APPLIANCE

Filed Nov. 21, 1957 6 Sheets-Sheet 1

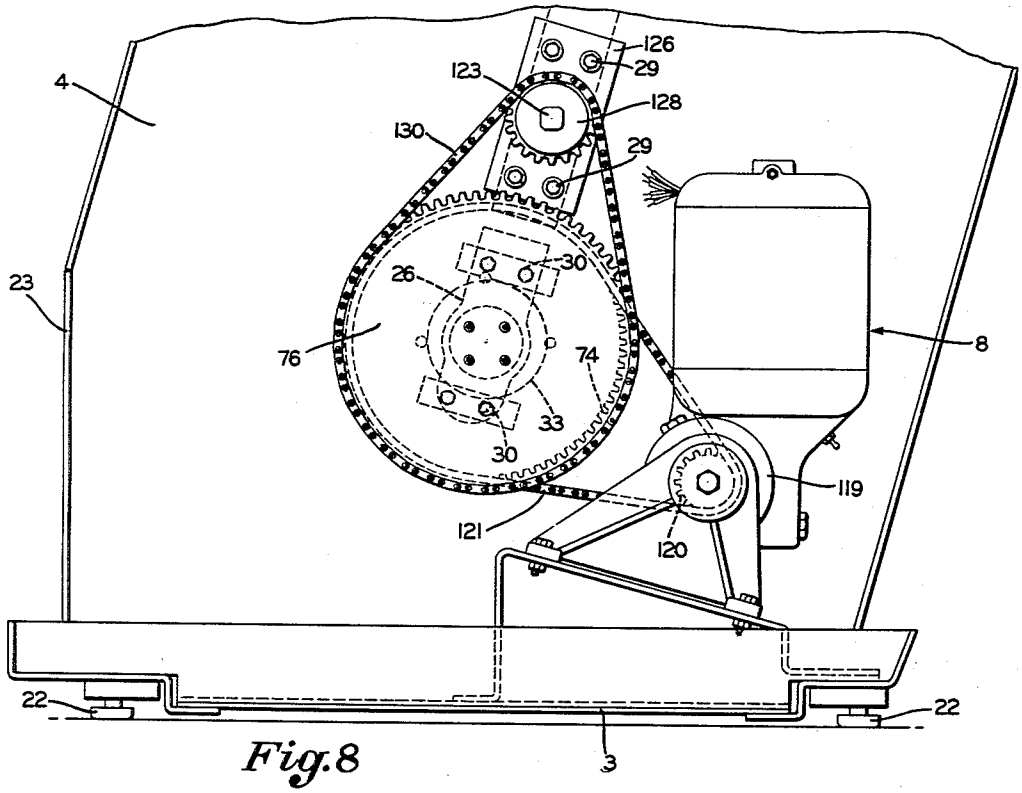


Fig. 8

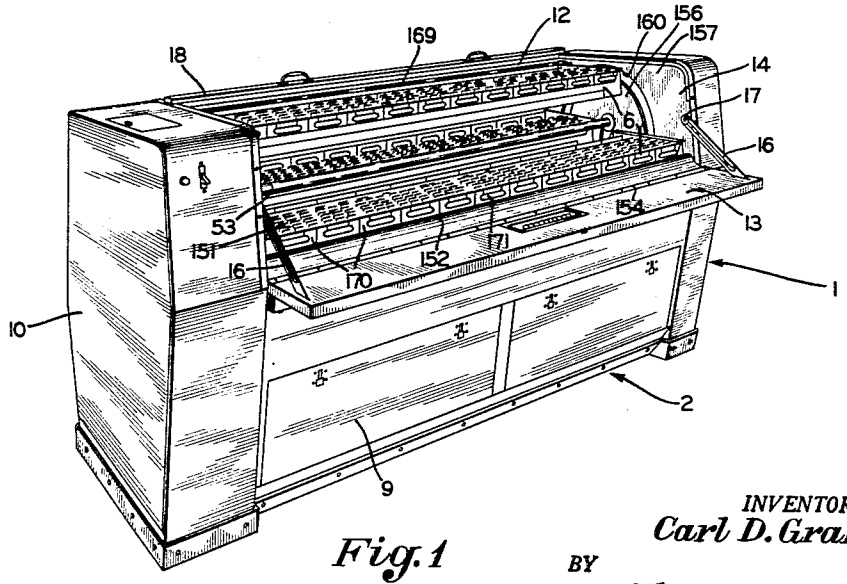


Fig. 1

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ELEVATOR FILING APPLIANCE

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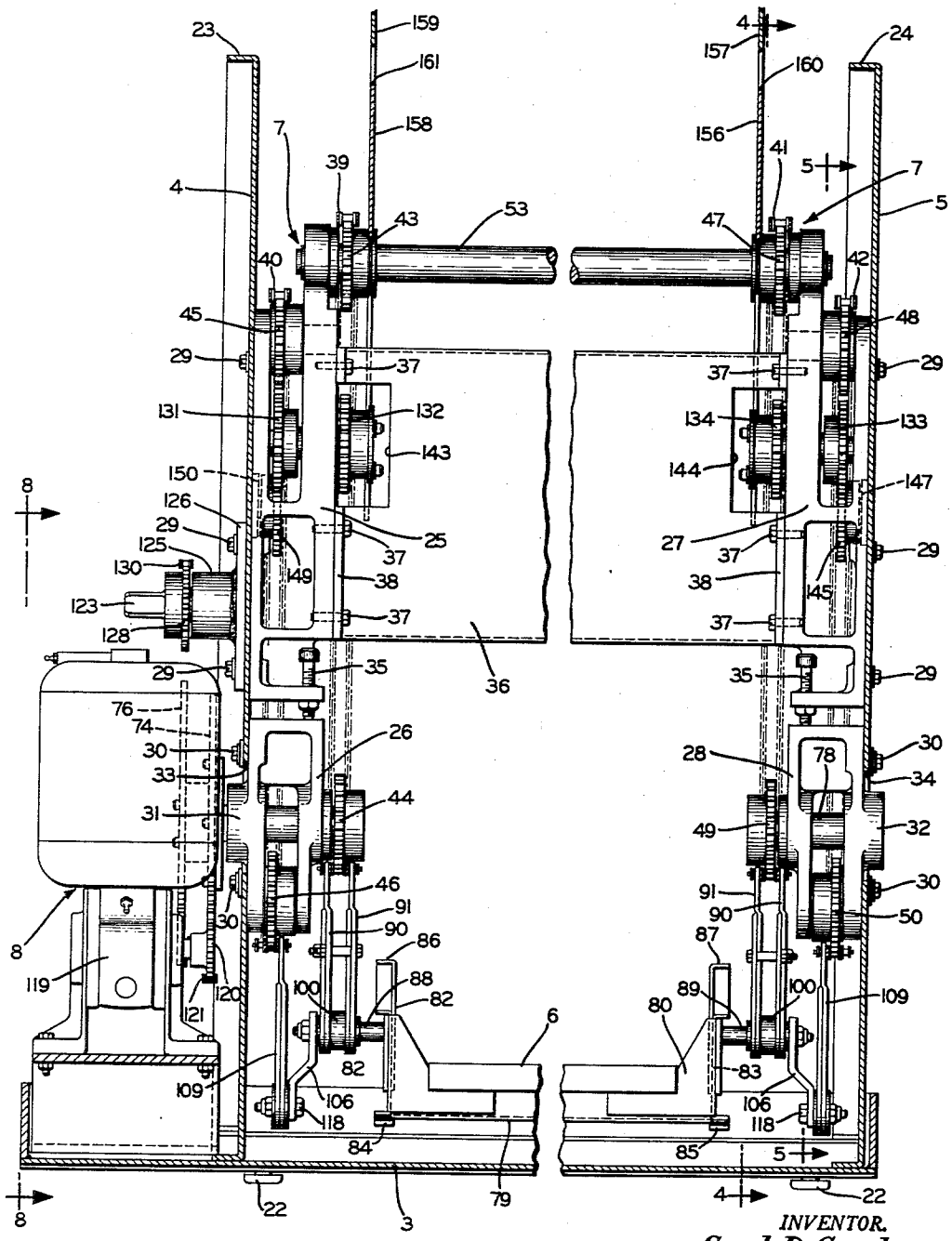


Fig. 2

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ELEVATOR FILING APPLIANCE

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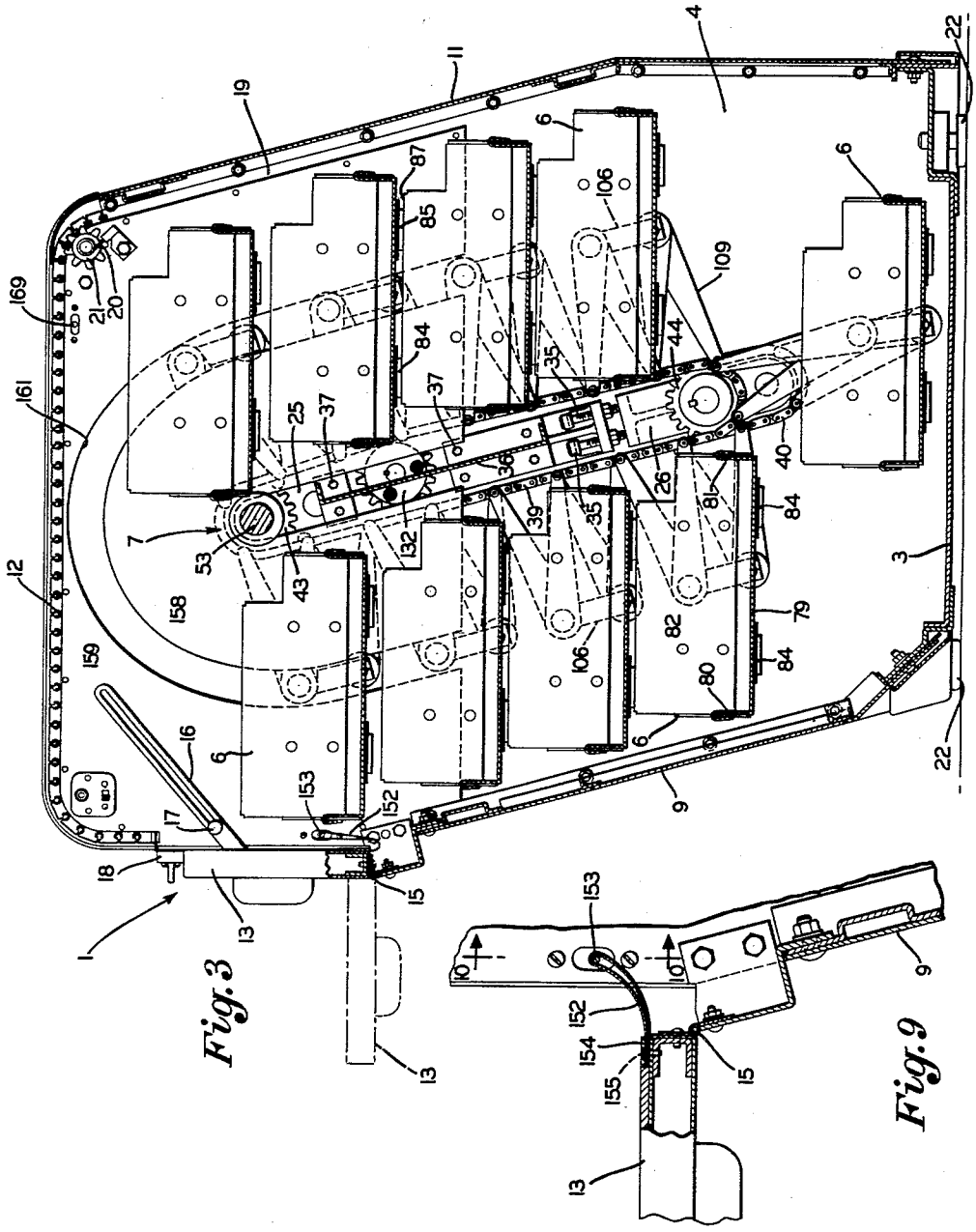


Fig. 3

Fig. 9

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ELEVATOR FILING APPLIANCE

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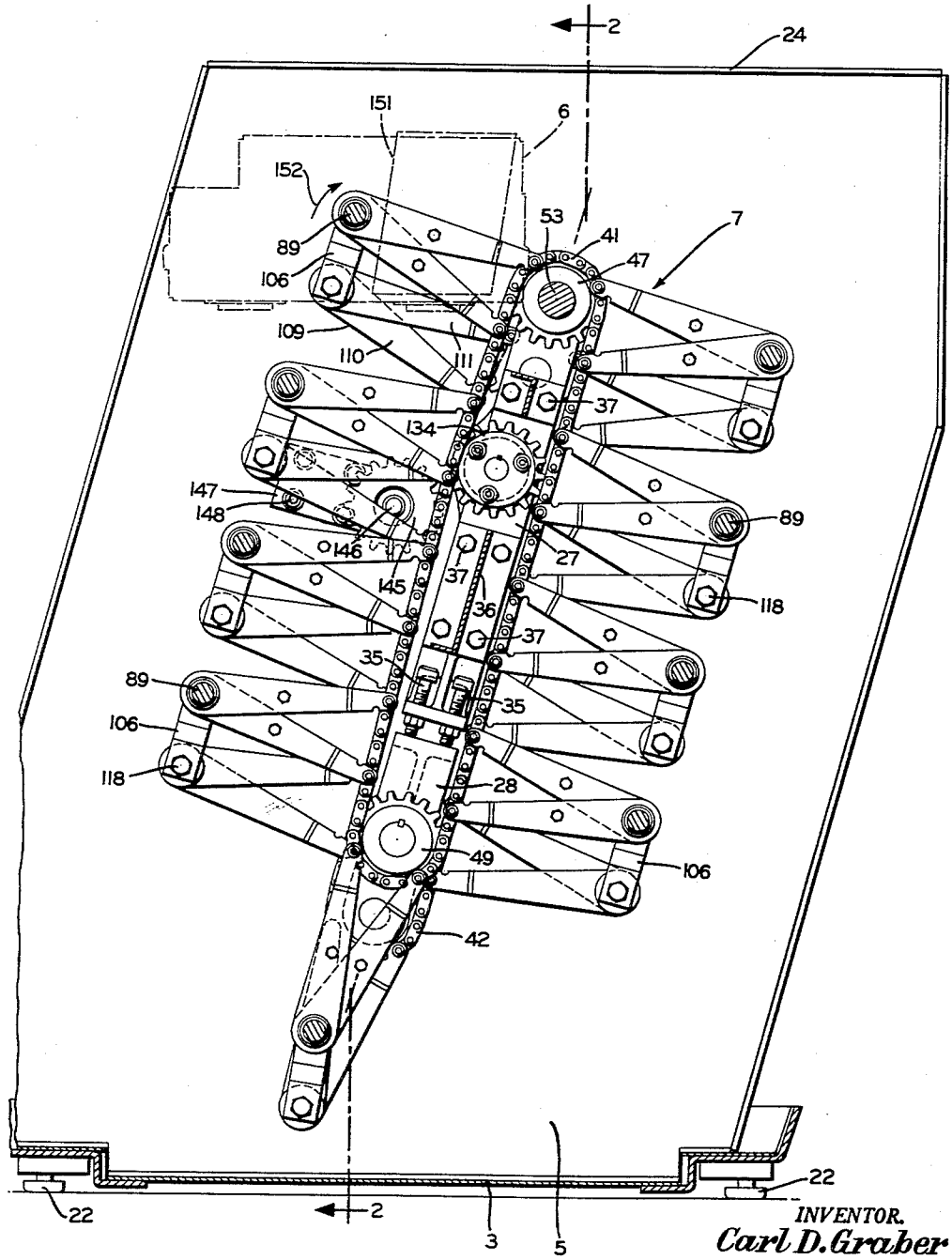


Fig. 4

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ELEVATOR FILING APPLIANCE

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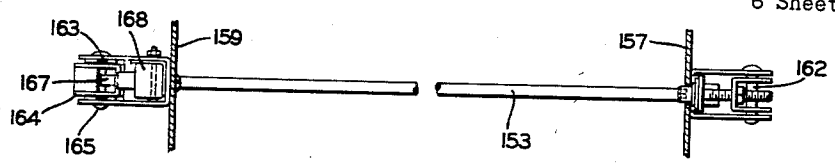


Fig. 11

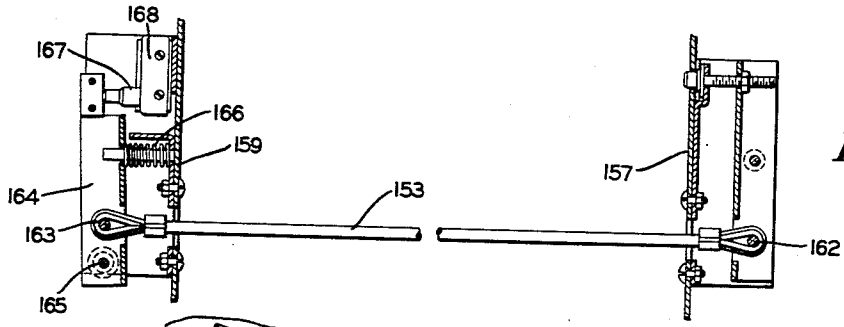


Fig. 10

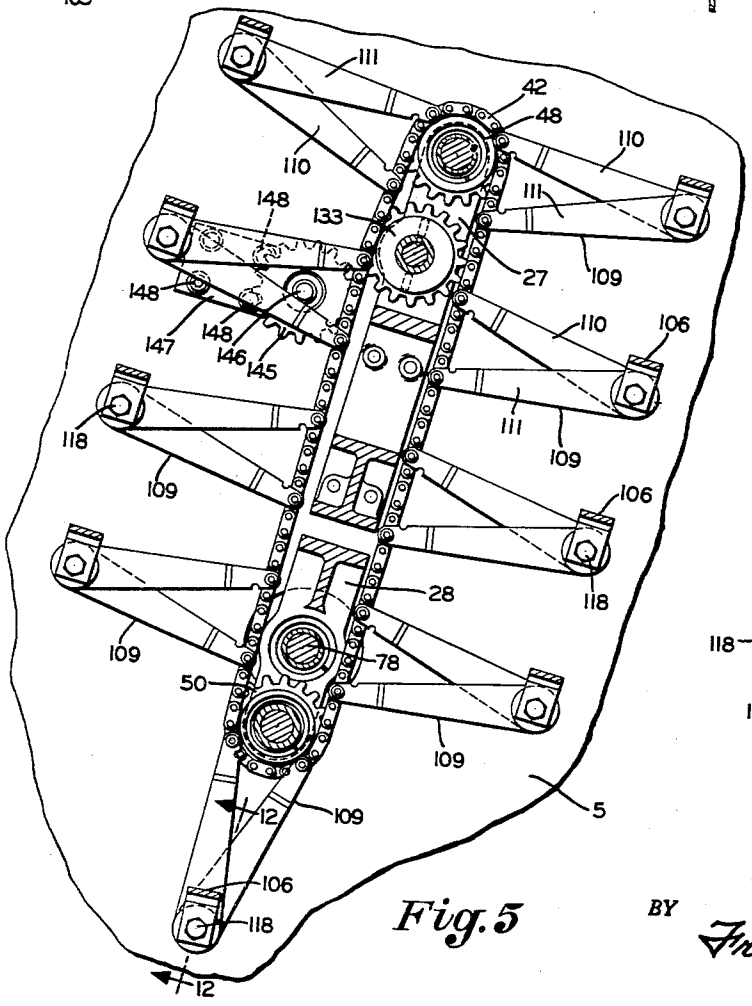


Fig. 5

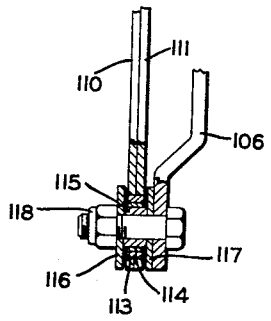


Fig. 12

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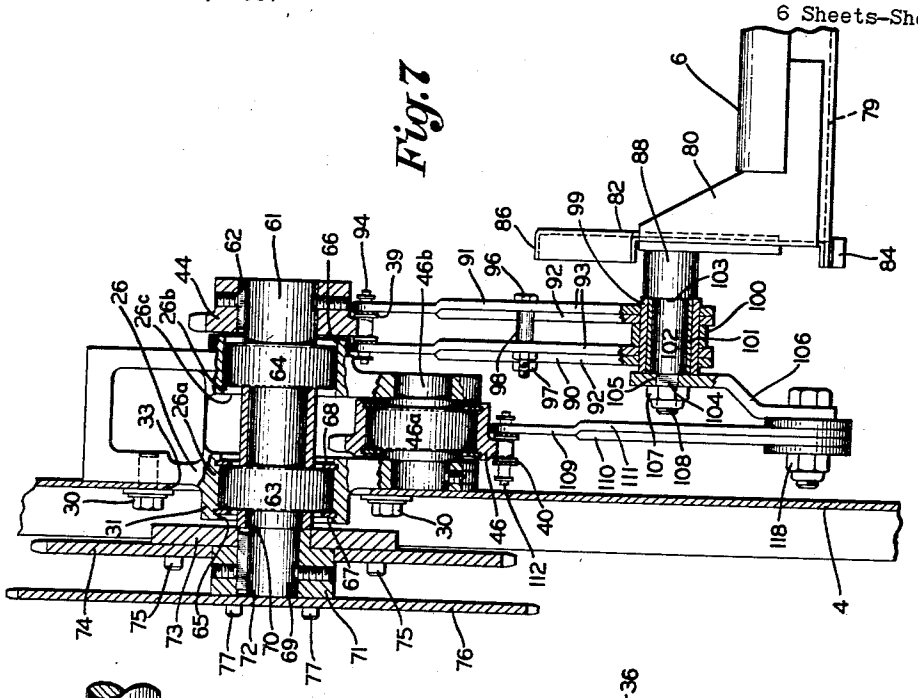
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Fig. 7



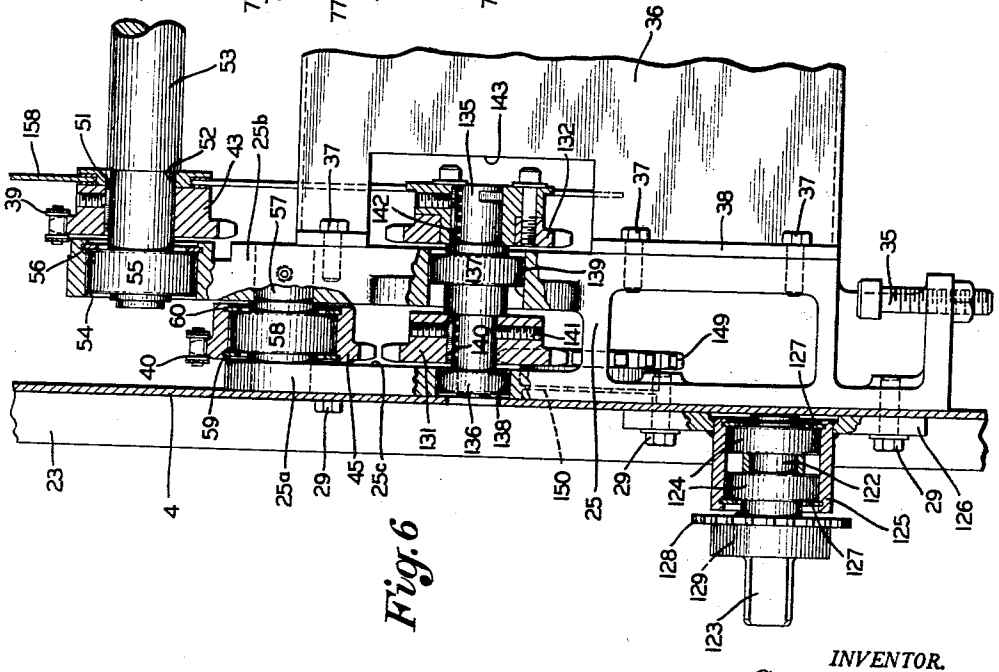


Fig. 6

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United States Patent Office 2,940,810 Patented June 14, 1960

2,940,810

ELEVATOR FILING APPLIANCE

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Filed Nov. 21, 1957, Ser. No. 697,972

9 Claims. (Cl. 312—268)

The invention relates to filing appliances, and more particularly to a filing appliance for holding record cards as in a card index system in such manner as to make large blocks of cards selectively accessible to the operator; and to such a filing appliance having a compact arrangement of parts occupying a minimum of floor space for a maximum capacity of cards; and to such a filing appliance having mechanisms for maintaining smooth and noiseless operation of the file and for preventing rough and noisy operation due to irregularities such as unbalanced loading of the card-holding trays.

One type of filing appliance generally known as an "elevator file" includes a number of card-holding trays arranged between spaced continuous chains which are mounted on vertically spaced sprockets, whereby the trays are successively presented at an accessible position or opening in the housing of the appliance. A more recent development in elevator files has provided for the horizontal spacing of the upper and lower chain sprockets as well as the vertical spacing whereby the chains are disposed at an angle so that the housing for the filing appliance is slanted downwardly and rearwardly from the access opening in order to provide knee and foot room as well as a tray position closer to the operator.

Also recent elevator filing appliances have included a pair of continuous chains of the same length at each end of the trays where the trays are relatively long in dimension for the purpose of maintaining the trays upright at all times. One chain of each pair of chains at each end is disposed over and around a pair of spaced sprockets on axes below and aligned with the axes of the sprockets for the other chain. This construction together with suitable mounting means by which the trays are attached to the chains is intended to maintain the trays upright at all times and under all circumstances.

However, unbalanced loading of the trays in prior elevator files has caused the trays to swing out of normal horizontal position which results in interference between or jamming of the trays during operation of the file. Such interference which arises from tolerances occurring in the manufacture of chains, and which ordinarily is of little or no consequence, results in a number of highly undesirable operational defects in the use of an elevator file in which the clearance between trays should be a minimum in order to provide a maximum card capacity.

More particularly, the chains sag due to the manufacturing tolerances therein. Thus measures must be taken to prevent or compensate for sag. One disadvantage resulting from chain sag is that it reduces the desired minimum spacing between adjacent trays sufficiently to require greater than desirable minimum clearances between trays for storage of cards of a given dimension.

Another difficulty created by chain sag is that the file operates in a rough manner causing bumping and excessive noise between adjacent trays and other parts. Moreover, chain sag causes the chains or trays to rub or scrape against other parts of the file, such as the frame

members mounting the chain sprockets on the filing appliance housing.

Another difficulty resulting from chain sag is possible interference at the point of departure of the trays from straight line travel at the sprocket positions at the upper and lower ends of chain travel. This interference resulting from movement of a pair of chains in an unsynchronized or unparallel manner causes the lever arms for the trays to lock or bind, and may stall operation of the file as the trays go over the top of the orbit of travel.

Moreover, another difficulty may develop where the card trays are loaded in an unbalanced manner so that a torque is imparted to the lever arms which mount the trays on the chains. If the file is provided with synchronizing means, the torque may tend to disengage the synchronizing means, thus defeating its purpose; that is, to synchronize the movement of each pair of chains in order to prevent the difficulties inherent in chain sag.

Finally, another difficulty encountered in the construction and operation of prior elevator filing appliances is that due to the close clearances which are provided between various or inaccessible parts of the file, movement of the file can be jammed by objects temporarily placed on one or more of the trays, if left at such location through inadvertence of the operator who thereafter operates the file without removing the object.

Accordingly, it is a general object of the present invention to provide a novel and improved elevator filing appliance of the type described which eliminates the indicated disadvantages of prior elevator files of the same general type.

It is another object of this invention to provide an improved elevator file construction which includes a mechanism for positively preventing sagging of the chains.

Also it is an object of the invention to provide an improved elevator file construction which includes means for compensating for variations in the length of chains on which trays are mounted.

It is another object of this invention to provide a new elevator file construction in which minimum clearance between adjacent trays may be provided and maintained.

It is another object of this invention to provide an improved elevator file construction which operates in a smooth and noiseless manner.

It is another object of this invention to provide an improved elevator file construction in which minimum clearance between adjacent parts is maintained without contact between stationary and moving parts.

It is another object of this invention to provide an improved elevator file construction including tray supporting chains which are synhcronized or timed with respect to each other in order to prevent interference at the point of departure of travel of the trays from straight line movement in an orbit of travel.

It is another object of this invention to provide an improved elevator file construction including tray supporting chains, in which the chains are maintained in proper operative engagement with chain synchronizing means notwithstanding unbalanced loading of the trays.

Moreover, it is an object of this invention to provide an improved elevator file construction having safety means remote from the operator to stop operation of the file by contact with a foreign object which may have been left inadvertently on a tray and which might jam the filing appliance unless operation thereof is stopped.

Finally, it is an object of this invention to provide an improved elevator filing appliance which accomplishes the foregoing objects and desiderata in a simple, effective, and inexpensive manner.

These and other objects and advantages apparent to those skilled in the art from the following description and claims may be obtained, the stated results achieved, and

the described difficulties overcome by the discoveries, principles, apparatus, parts, combinations, subcombinations, and elements which comprise the present invention, the nature of which is set forth in the following statement, a preferred embodiment of which—illustrative of the best mode in which applicant has contemplated applying the principles—is set forth in the following description, and which is particularly and distinctly pointed out and set forth in the appended claims forming part hereof.

Generally, the improved elevator file construction of the present invention may be stated in general terms as including a pair of longitudinally spaced support members extending upwardly from a base, a first pair of vertically and horizontally spaced sprockets journaled on each support member, the axes of rotation of the sprockets defining an inclined plane extending upwardly from the base, a second pair of vertically and horizontally spaced sprockets journaled on each support member below the first pair of sprockets and being disposed in the inclined plane, the spacing between all pairs of sprockets being equal, first endless chains operatively connecting the sprockets of each first pair, second endless chains operatively connecting the sprockets of each second pair, a plurality of card trays located between said support members in two inclined rows and carried on the first endless chains for movement to and from an access position in elevator fashion in an orbit of travel in one direction or another upwardly in one row and downwardly in the other row parallel to said plane, each tray having a bottom wall and longitudinally spaced end walls extending upwardly from the bottom wall, the end walls having a height equal with clearance to the vertical spacing between the bottom walls of adjacent trays when said trays are disposed in the inclined rows, a trunnion extending outwardly from each end wall of each tray, the trunnions on each tray being aligned, the trunnions of each tray being journaled on corresponding pairs of lever arms extending from the first endless chains; means for maintaining the trays upright including a second pair of lever arms on each second chain for each tray, a connecting link between corresponding first and second pairs of lever arms on each end of the trays, one end of each link being rotatably mounted on the second pair of lever arms, and the other end of each link being fixed to the corresponding trunnion of each tray; preferably flexible spacer means or rubber pads mounted on the undersurface of each bottom wall abuttable with the upper ends of the end walls of the adjacent tray; preferably a pair of chain-synchronizing sprockets fixedly mounted on a stud shaft journaled in each support member, the axis of rotation of each stud shaft being offset from the plane passing through the axes of the upper and lower spaced sprockets, one of each chain-synchronizing sprockets engaging the first endless chain and the other of said sprockets engaging the second endless chain on each support member, and an idler sprocket mounted on each support member engaging each corresponding second endless chain and holding said second chain in engagement with the corresponding chain-synchronizing sprocket; an electric motor operatively connected with the first endless chains for driving the trays about their orbit of travel, and preferably a safety cable extending across and near the upper end of the orbit of travel of the trays remote from said access position, for automatically stopping the electric motor when the cable is actuated.

Referring to the drawings, in which a preferred embodiment of the invention is shown by way of example:

Figure 1 is a perspective view of the novel elevator filing appliance with the curtain open and the working counter in operative position;

Fig. 2 is a vertical sectional view looking from the front to the rear of the interior of the filing appliance, taken on the line 2—2 of Fig. 4, and showing the operating parts without the housing;

Fig. 3 is a transverse sectional view showing the positions of the card trays within the housing and showing the curtain and working counter in the closed positions;

Fig. 4 is a transverse sectional view showing the tray-carrying chain and lever arms, taken on the line 4—4 of Fig. 2;

Fig. 5 is a fragmentary transverse sectional view showing the tray stabilizer chain and lever arms, taken on the line 5—5 of Fig. 2;

Fig. 6 is an enlarged fragmentary vertical sectional view showing the upper half of the left-hand support member and attached sprockets, as viewed in Fig. 2;

Fig. 7 is an enlarged fragmentary vertical sectional view showing the lower half of the left-hand support member and attached sprockets, as viewed in Fig. 2;

Fig. 8 is a fragmentary end elevational view showing the electric motor and drive means for operating the filing appliance, taken on line 8—8 of Fig. 2;

Fig. 9 is an enlarged fragmentary view showing the working counter in the open position hingedly mounted to the front of the housing and showing a safety cable with attached apron extending to the inner end of the working counter;

Fig. 10 is a vertical sectional view taken on the line 10—10 of Fig. 9, showing the safety cable and the manner in which it is attached to opposite ends of the filing appliance;

Fig. 11 is a plan view, partly in section, showing the safety cable of Fig. 10; and

Fig. 12 is an enlarged fragmentary view, taken on the line 12—12 of Fig. 5, showing the manner in which the tray lever arms on the tray stabilizing chain are attached to the connecting link.

Similar numerals refer to similar parts throughout the drawings.

In Fig. 1 the improved filing appliance is generally indicated at 1. It includes a housing 2, a base 3 and spaced upright plates or support members 4 and 5 (Fig. 2), a plurality of card trays 6, means for supporting and moving the trays generally indicated at 7 (Fig. 2), and drive means or reversible motor generally indicated at 8.

As shown in Fig. 1, the housing 2 includes a front wall 9 and an end wall 10, a second end wall parallel and similar to the end wall 10 but not shown in any of the various figures of the drawings, a rear wall 11 (Fig. 3), a retractable hood or curtain 12, and a working counter 13. The curtain 12 and counter 13 form an opening 14 in the upper part of the housing 2 where the greatest concentration of active records is provided with fast easy accesibility by touching a control button for bringing the desired records to the fingertips of the operator in an average time of only three seconds.

As shown more particularly in Fig. 3, the front wall 9 is inclined downwardly and rearwardly from the counter 13 in order to provide knee, leg and foot room for the operator. The means 7 for supporting and moving the trays 6 is substantially parallel to the inclined front wall 9 in order to conserve space within the housing.

Moreover, as shown in Fig. 3, the counter 13 is pivotally mounted on a piano-type hinge 15 for movement between the closed and open (broken line) positions. The counter 13 is supported in the open position by a pair of hangers 16 of conventional construction which are slidably mounted on similar pins 17 on the file. In the closed position the upper end of the counter 13 meets the lower end 18 of the curtain 12 to provide a completely closed unit. However, the counter 13 may be permanently mounted in the open (broken line) position, in which case the lower end 18 of the curtain 12 may extend further down to completely close the opening otherwise closed by the counter 13 in the closed position of Fig. 3.

Finally, the curtain 12 moves between the closed position of Fig. 3 and the open position of Fig. 1, in the latter of which positions the curtain is disposed in a track 19 at opposite ends of the curtain along the rear wall 11. To facilitate the opening and closing of the curtain

it is provided with a booster spring 20 (Fig. 3) including a sprocket 21 for facilitating opening and closing of the curtain. The booster spring 20 and sprocket 21 are of conventional construction so that once the curtain is started in either direction, the spring moves the curtain in the direction started.

The base 3 is a rigid channelized member extending across the bottom of the filing appliance 1 as shown in Figs. 2, 3, 4, and 8. Leg stabilizers 22 of conventional construction are provided at four corners of the base so that the filing appliance may be installed in a horizontal position.

The support plates 4 and 5 include similar rigidizing peripheral flanges 23 and 24, respectively, and the plates 4 and 5 are secured to the base 3 in a conventional manner such as by welding. The support plates 4 and 5 provide the basic support for the various members of the housing 2. More important, the support plates 4 and 5 support the means 7 for supporting and moving the trays 6.

The means 7 on the support plate 4 includes an upper frame 25 and a lower frame 26. Likewise, the means 7 on the support plate 5 includes an upper frame 27 and a lower frame 28. The frames 25–28 are preferably castings and include a number of journal openings on which various sprockets are mounted in a manner described hereinbelow.

The upper frames 25 and 27 are similar except they are reversed of each other. Likewise, the lower frames 26 and 28 are similar but reversed from each other. In other words, neither the frames 25 and 27 nor the frames 26 and 28 are reversible parts.

As shown in Fig. 2, the upper frames 25 and 27 are secured to the support plates 4 and 5, respectively, by similar bolts 29. Likewise, the lower frames 26 and 28 are secured to the plates 4 and 5, respectively, by similar bolts 30. The lower frames 26 and 28 include protruding portions 31 and 32, respectively, that extend into apertures 33 and 34 in the plates 4 and 5. In addition, the upper frames 25 and 27 include similar adjusting bolts 35 by which minor adjustments may be made between the upper and lower frames during fabrication of the appliance.

Finally, as shown in Fig. 4, a stretcher or channel member 36 extends between and reinforces the upper frames 25 and 27. The member 36 is attached by similar bolts 37 in similar end flanges 38 to the frames 25 and 27. In addition, the channel member 36 maintains the necessary spacing between the upper frames 25 and 27, which spacing is determined by the length of the several card trays 6.

In addition to the frames 25–28, the means 7 for supporting and moving the trays includes a pair of chains adjacent each support plate 4 and 5, as well as a number of sprockets for supporting the chains. The pair of chains adjacent the support plate 4 includes a tray support chain 39 and a tray stabilizing chain 40. Likewise, the pair of chains adjacent the support plate 5 includes a tray support chain 41 and a tray stabilizing chain 42. The chains 39–42 are endless link chains of the same length. Each chain is disposed between a pair of spaced sprockets.

Thus, the upper end of the chain 39 is disposed on and around a sprocket 43 and the lower end on a sprocket 44. The upper end of the chain 40 is mounted on and around a sprocket 45 and the lower end on a sprocket 46. Similarly, the chains 41 and 42 are mounted on upper sprockets 47 and 48 and lower sprockets 49 and 50, respectively. All of the sprockets 43–50 have the same pitch line diameter and number of sprocket teeth and are generally similar in construction and mounting. Likewise, the axes of rotation of all of the sprockets 43–50 are similarly spaced and located with regard to their corresponding upper and lower frames 25–28. In Fig. 4, the tray support chain 41 is shown disposed between the spaced sprockets 47 and 49. Similarly, in Fig. 5, the tray stabilizing chain 42 is shown between the upper sprocket 48 and the lower sprocket 50.

A plane passing through the centers or axes of rotation of the several sprockets 47–50 is inclined at an angle to the horizontal base plate 3 or the floor on which the filing appliance 1 is mounted. The inclined plane is parallel to the front wall 9 of the appliance. On the other side of the file the tray support chain 39 and tray stabilizing chain 40 are mounted on their respective sprockets 43–46 in a manner similar to the chains 41 and 42. Moreover, the centers or axes of rotation for the sprockets 43–46 are disposed in the same inclined plane as that of the sprockets 47–50 on which the chains 41 and 42 are mounted.

The several sprockets on which the chains 39–42 are mounted are attached to the upper and lower frames 25–28 as shown in greater detail in Figs. 6 and 7 with regard to the particular sprockets 43–46. For the sake of brevity only the manner in which the sprockets 43–46 are mounted is described, it being understood that the corresponding sprockets 47–50 are mounted in a similar manner on their corresponding frames.

On the upper frame 25 as shown in Fig. 6, the sprocket 43 is fixedly mounted by a key 51 on a reduced portion 52 at one end of an elongated shaft 53 which extends (Fig. 2) across and between the upper ends of the upper frames 25 and 27 and on which at the other end the sprocket 41 is similarly mounted. The upper frame 25 (Fig. 6) includes an opening 54 in which a bearing 55 for the end of the shaft 53 is seated. The bearing 55 is retained in the opening 54 by a lock ring 56. The opposite end of the shaft 53 is similarly journaled in the upper end of the upper frame 27.

At a spaced distance below the sprocket 43 the sprocket 45 is rotatably mounted on a stub shaft 57, the extremities of which shaft 57 are seated in bifurcated portions 25*a* and 25*b* of the upper frame 25 forming a space 25*c* in which the sprocket 45 is located. As shown in Fig. 6, the sprocket 45 is provided with a bearing 58 retained by spaced lock rings 59 and 60.

The sprocket 44 (Fig. 7) is mounted on the end of a stub shaft 61 by a key 62. A central portion of the stub shaft 61 is mounted in bearings 63 and 64 located in openings 65 and 66, respectively, in bifurcated portions 26*a* and 26*b* of the lower frame 26. The bearing 63 is retained in place by spaced lock rings 67 and 68 and a part of the bifurcated portion 26*a* includes the protruding portion 31 of the lower frame 26 which extends through the aperture 33 as described above. The end of the stub shaft 61 opposite that on which the sprocket 44 is mounted includes a reduced portion 69 which provides a shoulder 70. An annular mounting member 71 is secured on the reduced end portion 69 of the shaft 61 by a key 72. The end of the member 71 abuts the shoulder 70 as shown in Fig. 7. In addition, an annular plate 73 is fixedly secured in a conventional manner on the mounting member 71 and a sprocket wheel 74 is secured to the plate 73 by bolts 75. At the outer end of the mounting member another sprocket wheel 76 is mounted by bolts 77.

The sprocket 46 is mounted on a bearing 46*a* on a stub shaft 46*b*, the extremities of which are seated in the bifurcated portions 26*a* and 26*b* forming a space 26*c* in which the sprocket is located.

The sprockets 47–50 (Fig. 2) are mounted on members similar to the members on which the sprockets 43–46 are mounted with the exception of the sprocket 49. The sprocket 49 is mounted on a stub shaft 78 which differs from the stub shaft 61 in that the shaft 78 does not include an outer reduced end portion such as the reduced portion 69 of the shaft 61. In all other respects the mounting and construction of the shaft 78 are similar to that of the shaft 61.

As shown in Fig. 3, the filing appliance 1 includes pref-

erably nine card trays 6 which are mounted on and between the chains 39–42 and movable therewith about a substantially oval orbit of travel including inclined front and rear straight paths of travel as well as upper and lower arcuate paths of travel.

As shown in Figs. 2 and 3, each tray 6 includes a bottom wall 79, front and rear side walls 80 and 81, and opposite end walls 82 and 83. The undersurface of each tray includes flexible bumper members or rubber pads 84 and 85 in alignment with out-turned flanges 86 and 87 at the upper side of the end walls 82 and 83, respectively. Moreover, each tray 6 is provided with a pair of aligned shafts or trunnions 88 and 89, the former of which is attached to the end wall 82 and the latter of which is attached to the end wall 83. The trays 6 are pivotally mounted on and between the chains by the trunnions in a manner to be described hereinbelow.

As shown in Fig. 3, the chain 39 is provided with preferably a plurality of spaced sets of forked levers, the preferred number of which sets is nine and equal to the number of trays 6. The sets of forked levers are equally spaced about the chain 39 and each set includes a pair of levers 90 and 91 (Fig. 7) having similar arm portions 92 and 93. The arm portions 92 and 93 of each pair 90 and 91 have a V-like arrangement as shown (Fig. 3) and are connected at their inner ends to extended chain link pins 94 (Fig. 7) at equal intervals along the chain 39. Each pair of arm portions 92 in each set is secured together by a nut and bolt assembly 96 substantially centrally thereof and each pair of arm portions 93 is likewise secured together by nut and bolt assemblies 97. In addition, an annular spacer 98 is mounted on each bolt 96 and 97 between each pair of arms.

The outer ends of the arm portions 92 and 93 of each pair of levers 90 and 91 are pivotally connected on a circular bearing housing 99 and an annular spacer 100 is mounted around the housing 99 and between the spaced arm portions 93 and 92 of the pairs of levers 90 and 91. An annular bearing 101 is mounted within each housing 99 and a reduced end portion 102 of each trunnion 88 is mounted within the bearing 101. The inner ends of the bearing housing 99 and bearing 101 are seated against a shoulder 103 formed by the reduced end portion 102 of the trunnion 88.

The trunnion 88 also includes a squared shaft portion 104 (Fig. 7) over which a squared opening 105 of a connecting link 106 is engaged and held in place by a nut 107 on a threaded end portion 108 of the trunnion.

As shown in Fig. 5 for a nine tray file, the continuous stabilizing chain 42 is provided with preferably nine pairs of forked lever arms 109 which are equally spaced along the chain 42 and which include a pair of similar arm portions 110 and 111 having a V-like arrangement as shown. Likewise, the stabilizing chain 40 is provided with an equal number of similar forked levers 109 having similar arm portions 110 and 111 as shown in Fig. 7. All of the arm portions 110 and 111 are connected at their inner ends to their respective chains 40 and 42 by extended chain link pins 112 at intervals along the chains. The outer ends of the arm portions 110 and 111 are pivotally connected to a bearing assembly including an annular bearing housing 113 and an annular bearing 114 as shown in Fig. 12.

In addition, the bearing assembly 113—114 includes an annular spacer 115, the opposite ends of which are seated against annular washers 116 and 117. The members 114, 116, and 117 are secured to the end of the connecting link 106 by a nut and bolt assembly 118 whereby the ends of the arm portions 110 and 111 are pivotally connected to the end of the connecting link 106, as also shown in Fig. 7.

This construction with one end of the connecting link 106 attached to the outer end of the adjacent lever 109 and the other end fixed to the outer squared end 104 of the trunnion 88 (Fig. 7) mounted at the ends of the levers 90 and 91, provides means for maintaining the trays upright at all times. Thus, the trays are maintianed upright because the chains are all of the same length and move simultaneously in the same direction at the same rate through the same length of travel.

The drive means for the primary chain drive shaft 53 of the filing appliance includes the reversible motor 8 having a gear box 119 and a sprocket 120, a drive chain 121 extending between the sprocket 120 and the sprocket wheel 74 (Figs. 7 and 8). The motor 8 turns the sprocket 120 and drives the sprocket wheel 74 through the drive chain 121. In turn the stub shaft 61 on which the sprocket wheel 74 is fixedly mounted turns the sprocket 44 (Fig. 7) which drives the chain 39. The chain 39 drives the sprocket 43 and the shaft 53. Rotation of shaft 53 turns sprocket 47 on the other side of the file which drives chain 41. The chains 39 and 41 together with their respective pairs of levers 90 and 91 constitute the primary supports and drives of the trays 6. On the other hand, the stabilizing chains 40 and 42 are driven by forces transmitted through the connecting links 106 and levers 109 from the chains 39 and 41. As the stabilizing chains 40 and 42 are moved around their respective sprockets, they maintain the trays 6 upright around their orbit of travel.

In addition, the distance between the centers of the upper sprockets for the chains 39 and 41 and the upper sprockets for the chains 40 and 42 are equal to the distance between the centers of the lower sprockets for the chains 39 and 41 and the lower sprockets for the chains 40 and 42, which distance in turn is equal to the operative length of the connecting links 106, that is, the distance between the center of the trunnions 88 and 89 and the bolts 118 (Figs. 2 and 12).

In case of power failure rendering the motor 8 inoperative, emergency manual operation is available. For this purpose a stub shaft 122 (Fig. 6) having a squared outer end portion 123 is mounted within a pair of similar bearings 124 which are seated within an annular bearing housing 125 which is attached to an annular mounting plate 126. The spaced bearings 124 are retained within the housing 125 by similar lock rings 127. In addition, a sprocket 128 is fixedly mounted as by a key 129 on the stub shaft 122 so that the sprocket 128 is in the same plane as the sprocket wheel 76 (Figs. 7 and 8). A continuous linked chain 130 is disposed over and around the sprocket 128 and the sprocket wheel 76. A hand crank (not shown) may be attached to the squared end portion 123 of the stub shaft 122 and rotated to operate the file in the event of power failure.

The foregoing construction provides a substanially direct drive means for the tray-carrying drive chains 39 and 41 and an indirect drive means for the tray stabilizing chains 40 and 42. That construction together with other factors such as the slight expansion of the chains due to manufacturing tolerances, unbalanced loading of the trays, and the weight of all of the loaded trays, may cause the drive and stabilizing chains to operate out of synchronization with each other. For example, the upper portions of the chains carrying the greater weight may be stretched a much greater amount than the lower portions of the chains so that the tray-carrying chains 39 and 41 will move around their upper sprockets 43 and 47 less smoothly than the tray synchronizing chains 40 and 42 which carry only a minor portion of the total weight of the trays. As a result the chains may "fight" each other, causing uneven, rough, bumpy, and noisy operation of the file.

More important, however, is the additional disadvantage that as a result of the uneven stretching of some of the chains due to the manufacturing tolerances, the combined weight of the loaded trays may cause the chains to sag between their upper and lower sprockets out of parallel with the inclined plane extending through the centers of rotation of the several sprockets. Thus,

the trays 6 on the front side (right side of Fig. 4), i.e., adjacent the front wall 9, tend to pull the sagging chain away from the straight path of movement, causing the desired spacing between adjacent trays to be slightly increased, and causing the chains on the back side to sag toward said inclined plane out of their straight path of movement and thereby slightly reduce the spacing between the adjacent trays.

In other words, due to chain sag the portions of the chains on the front side sag toward the front wall 9 and away from the plane of chain travel. Such sag separates the trays 6 slightly from the desired closely stacked arrangement. On the other hand, when the chains on the back side sag, the trays 6 move closer together vertically, which causes several difficulties. The first is interference with the maintenance of a definite minimum spacing between the trays, which spacing is specifically designed to accommodate a file card of a certain size in the trays. Another difficulty is excessive bumping of trays resulting in a noisy operation and uneven movement of the chains. Still another difficulty is interference at the point of departure of the trays from the straight line travel to the circular path around the sprockets and particularly at the upper ends of the chains.

The flexible bumper members or rubber pads 84 and 85 prevent the occurrence of the foregoing difficulties. Thus the rubber pads 84 and 85 on the undersurfaces of the several trays 6 in alignment with the flanges 86 and 87 (Fig. 2), are compressed (Fig. 3) between the undersurfaces and flanges of adjacent trays when the trays are moving in straight line travel particularly at the back side (right side Fig. 3) of the inclined planes of the sprockets. Inasmuch as the normal spacing between the trays 6 is slightly less than that of the uncompressed rubber pads 84 and 85, the pads are compressed between the adjacent trays to clamp the trays against one another during the straight line travel. This results in a stacked unitary tray assembly moving in straight line travel on the back or right side (Fig. 3) of the file where inward chain sag can occur if not prevented, with the lower trays physically contributing to the support of the upper trays to prevent relative movement between the trays due to chain sag, and at the same time maintaining the tray spacing in a rigid non-sagging assembly moving up or down in a smooth silent manner.

The rigid assembly of the several trays prevents the chains from sagging at the back side of the file and thereby maintains the chains in their paths of straight line travel. At the same time the minimum clearance between adjacent trays is maintained to guarantee the required card clearance. Moreover, by providing the block or unitary stack assembly of trays 6 on the back side which prevents the chains from sagging inward against the frame, another source of bumping and noise in the movement of the trays is avoided.

The various forces acting on the chains including the combined weight of the trays and their contents tends to stretch the upper portions of the chains 39 and 41 most around the sprockets. Thus, movement of the tray-carrying chains 39 and 41 may get out of synchronized movement with the unstretched tray stabilizing chains 40 and 42 which support only a minor portion of the total weight of the trays.

Such lack of synchronized movement must be prevented for smoother operation of the file. Thus, means is provided for synchronizing the movement of each pair of chains 39 and 40 at one end and the chains 41 and 42 at the other end. As shown in Fig. 2, the means for synchronizing movement of the chains is provided at each end of the filing appliance 1. The means includes a pair of sprockets 131 and 132 on the upper frame 25 for the chains 40 and 39, respectively, and the means also includes (Figs. 2 and 5) a pair of synchronizing sprockets 133 and 134 on the upper frame 27 for the chains 42 and 41, respectively. As shown in Fig. 2, the channel member 36 is provided with an opening 143 and 144 at opposite ends to provide clearance for the sprockets 132 and 134, respectively.

The sprockets 131 and 133 are similar to each other and the sprockets 132 and 134 are also similar to each other, both in construction and mounting. The manner in which the synchronizing sprockets are mounted is shown in Fig. 6 for the pair of sprockets 131 and 132. A stub shaft 135 is rotatably mounted in a pair of bearings 136 and 137 which are disposed in openings 138 and 139 in the bifurcated portions 25*a* and 25*b*, respectively, of the upper frame 25.

The sprocket 131 is disposed on the stub shaft 135 in the spacing 25*c* between the bifurcated portions 25*a* and 25*b* and is fixed on the shaft by a key 140 and a set screw 141. Likewise, the sprocket 132 is mounted on the inner end of the shaft 135 by a key 142. The sprocket 131 is disposed in the plane of the sprockets 45 and 46 (Fig. 2) and engages the chain 40, and the sprocket 132 is disposed in the plane of the sprockets 43 and 44 and engages the chain 39. The sprocket 134 is disposed in the plane of the sprockets 47 and 49 and engages the chain 41, as shown in Fig. 4. Similarly, the sprocket 133 is disposed in the plane of the sprockets 48 and 50 and engages the chain 42 as shown in Fig. 5. The sprockets 131 and 132 engage the chains 40 and 39, respectively, in a manner similar to the engagement of the sprockets 133 and 134 with the respective chains 42 and 41 as shown in Figs. 4 and 5.

Both pairs of synchronizing sprockets 131 and 132 on one end and sprockets 133 and 134 on the other end function to move their corresponding pairs of chains in a synchronized and parallel manner. The sprockets of each pair rotate together on their shafts to coordinate or tie the movements of the corresponding pairs of chains together and thereby compensate for the effects of different forces acting on each chain. Thus the more heavily loaded chains 39 and 41 which tend to stretch more than the stabilizing chains 40 and 42 are provided with a direct connection with the stabilizing chains, causing them to move together in unison in a smooth, even, synchronized manner.

In Figs. 4 and 5, an idler gear 145 is shown mounted on the support plate 5 on a gear shaft 146, the end of which is secured to a mounting plate 147 by similar bolts 148. The idler gear 145 engages the stabilizing chain 42 at a point below the synchronizing gear 133. Likewise, a similar idler gear 149 is provided on the support plate 4 for the stabilizing chain 40. The idler gear 149 is similarly mounted on the support plate 4 by a mounting plate 150.

The idler gears 145 and 149 hold the respective stabilizing chains 40 and 42 against the corresponding synchronizing sprockets 131 and 133. This is particularly important when one tray 6 is loaded in an unbalanced manner by a group of cards 151 (Fig. 4) in the front half of the tray, leaving the rear portion empty. Under such unbalanced loading the tray is subjected to torque around the trunnions 88 and 89 in the direction of the arrow 152. As a result, a rearward thrust reacts on arm 110 of the lever 109 mounted on the stabilizing chains 40 and 42 and a forward thrust reacts on arm 111. These thrust forces, when trays are loaded in the unbalanced manner described, may move the stabilizing chains 40 and 42 a sufficient distance away from their corresponding synchronizing gears 131 and 133 to destroy the effectiveness of the gears in maintaining synchronism of chain travel. The idler gears 145 and 149, being disposed slightly below and on the opposite side of the chains, counteract or compensate for these forces and hold the stabilizing chains 40 and 42 in synchronizing engagement with sprockets 131 and 133 at all times. Thus the effect of an unbalanced loading in the trays does not destroy synchronized movement of both pairs of chains.

Referring to Figs. 1, 3, and 9, the filing appliance 1 is provided with a curtain 152 preferably formed of a flexible or pliant material. The curtain 152 is an elongated sheet-like member folded along its central axis and mounted on an elongated cable 153 which extends across the front of the file from one end to the other as shown in Fig. 10. The overlapping edges of the curtain 152 are secured together at the inner edge of the working counter 13 where they are retained in placed by an elongated mounting strip 154 secured in place by a plurality of spaced screws 155. The curtain 152 serves as a guard panel between the inner edge of the counter surface and a zone adjacent the front side of the trays to minimize the possibility of accidentally dropping an object such as a card into the gap covered by the curtain. In addition the cable 153 provides a usual safety device extending across the front of the trays 6 adjacent the counter position.

As shown more particularly in Figs. 1, 2, and 3, a pair of shield plates 156 and 157 are provided at the right end of the appliance. Another pair of shield plates 158 and 159 are disposed at the left-hand end of the file to cover the moving parts of the file including the chains, sprockets, etc. As shown in Fig. 1, the pair of shield plates 156 and 157 provide an arcuate opening 160 and, as shown in Fig. 3, the shield plates 158 and 159 provide an arcuate opening 161 aligned with the opening 160. The openings 160 and 161 coincide with the path of movement of the trunnions 89 and 88. The shield plates 156–159 are attached to the various framework and housing members of the filing appliance 1.

The cable 153 extends between the shield plates 157 and 159 and has one end anchored at a stationary pin 162 (Fig. 10). The other end of the cable 153 is anchored on a pin 163 on a lever 164 pivoted at 165 and sustained in the position shown by a spring 166. The upper end of the lever 164 actuates a plunger 167 on a microswitch 168, which switch is connected in series with the circuit for the motor 8. Accordingly, if the operator of the filing appliance desires to make an emergency stop, the slightest pressure on the panel guard curtain 152 moves the cable 153 sufficiently to cut off all power and stop the file instantly.

An additional safety cable 169 is provided remote from the working counter 13 at the top of the file near the rear wall (Figs. 1 and 3) to protect the mechanism and contents of the file. The cable 169 is located close to the path of travel of the trays and is mounted at opposite ends in a manner similar to the cable 153, as shown in Figs. 10 and 11. The cable 169 prevents jamming of or injury to the trays either when the contents are not properly placed therein and extend above the upper permissible limit, or when an object, such as a purse, is inadvertently left on the top of the cards 151. Any such object or improper loading, upon moving past the cable 169, strikes and deflects the safety cable 169 and immediately stops the file.

As shown in Fig. 1, each tray may include a plurality of removable tray units or pans 170 which are adapted to contain a specific number of file cards 151. The trays include finger openings 171 at front and rear ends so that a particular tray unit 170 may be lifted from the particular tray 6.

The device of the present invention thus avoids prior art difficulties. It operates in a smoother, noiseless manner. Two means are provided for overcoming or compensating for chain sag, the first including the flexible pads mounted on the undersurface of the trays so that the adjacent trays move as a unitary stack in a straight path in the orbit of travel. The rigid assembly of stacked trays prevents the chains from sagging.

The other compensating means includes a pair of synchronizing gears operatively engaging the tray-carrying chains and the tray stabilizing chains so that the chains move together in a synchronized manner without bucking each other.

Finally, the improved file includes means for maintaining the synchronized relation, whereby the synchronizing chains are maintained in operative engagement with the corresponding synchronizing sprockets compensating for any unbalanced loading of one or more trays.

Thus the mechanisms of the improved filing appliance of the present invention maintain the minimum spacing between the trays for the designed card size, eliminate noise and uneven movement of the trays due to chain sag, and obviate interference or "fighting" between the corresponding pairs of chains during operation.

In the foregoing description certain terms have been used for brevity, clearness and understanding, but no unnecessary limitations are to be implied therefrom beyond the requirements of the prior art, because such words are used for descriptive purposes herein and are intended to be broadly construed.

Moreover, the embodiments of the improved construction illustrated and described herein are by way of example, and the scope of the present invention is not limited to the exact details of construction shown.

Having now described the features, constructions and principles of the invention, the characteristics of the elevator filing appliance and the advantageous, new and useful results provided; the new and useful discoveries, principles, parts, elements, combinations, subcombinations, structures and arrangements, and mechanical equivalents obvious to those skilled in the art are set forth in the appended claims.

I claim:

1. In a filing appliance, a base, longitudinally spaced first and second upright support members on the base, a first pair of vertically spaced sprockets journaled on and in a plane adjacent to each support member, a second pair of vertically spaced sprockets journaled on and in a plane remote from each support member, the sprockets having parallel axes of rotation, the spacing between all pairs of sprockets being equal, a first endless chain disposed between and around each first pair of sprockets, a second endless chain being disposed between and around each second pair of sprockets, a plurality of card trays located between said support members, said trays being vertically spaced and horizontally disposed; common drive means for said sprockets, a trunnion fixed to and extending from each end of each tray, lever arms connected to the first and second chains at intervals and extending laterally outward from the chains, the lever arms connected to the second chains being pivotally connected to the trunnions, a connecting link fixedly secured at one end to each trunnion, the lever arms connected to the first chains being pivotally connected to the other end of the connecting links, a pair of chain synchronizing sprockets mounted on each support member for simultaneous rotation, each pair of chain synchronizing sprockets engaging the pairs of first and second chains on each support member, and each pair of chain synchronizing sprockets being independent of the common drive means for said first and second pairs of sprockets, whereby each pair of the first and second chains on each support member move together in response to operation of the drive means.

2. In a filing appliance, a base, longitudinally spaced vertical first and second upright support members on the base, a first pair of vertically and horizontally spaced sprockets journaled on and in a plane adjacent to each support member, the sprockets having parallel axes of rotation in an inclined plane extending upwardly from the base, a second pair of vertically and horizontally spaced sprockets journaled on and in a plane remote from each support member, said second pair of sprockets having parallel axes of rotation in said inclined plane, the spacing between all pairs of sprockets being equal, a first endless chain disposed between and around each first pair of sprockets, a second endless chain being disposed between and around each second pair of sprockets; a plurality of card trays located between said support members, said

trays being vertically spaced and horizontally disposed, common drive means for said sprockets, a trunnion fixed to and extending from each end of each tray, lever arms connected to the first and second chains at equal intervals and extending laterally outward from the chains; the lever arms connected to the second chains being pivotally connected to the trunnions, a connecting link fixedly secured at one end to each trunnion, the lever arms connected to the first chains being pivotally connected to the other end of the connecting links, and sprocket means for maintaining the chains taut between their respective sprockets, whereby the chain portions between the sprockets are prevented from sagging out of straight line travel, thereby maintaining the proper spacing between adjacent trays.

3. In a filing appliance, a base, longitudinally spaced vertical first and second upright support members on the base, a first pair of vertically and horizontally spaced sprockets journaled on and in a plane adjacent to each support member, the sprockets having parallel axes of rotation in an inclined plane extending upwardly from the base, a second pair of vertically and horizontally spaced sprockets journaled on and in a plane remote from each support member, said second pair of sprockets having axes of rotation in said inclined plane, the spacing between all pairs of sprockets being equal, a first endless chain disposed over and around each first pair of sprockets, a second endless chain being disposed between and around each second pair of sprockets, a plurality of card trays located between said support members, said trays being vertically spaced and horizontally disposed, each tray having a bottom wall and longitudinally spaced end wall means extending upwardly from the bottom wall, the end wall means having a height substantially equal to the vertical spacing between the bottom walls of adjacent trays, common drive means for said sprockets, a trunnion fixed to and extending from each end wall of each tray, lever arms connected to the first and second chains at intervals and extending laterally outward from the chains; the lever arms connected to the second chains being pivotally connected to the trunnions, a connecting link fixedly secured at one end to each trunnion, the lever arms connected to the first chains being pivotally connected to the other end of the connecting links, and flexible pad means mounted on the undersurface of each tray bottom wall abuttable with the upper ends of the end wall means of the adjacent tray, whereby the chain portions between the sprockets are prevented from sagging out of straight line travel by the rigid clamping of adjacent trays against relative movement through compression of the pad means therebetween.

4. In a filing appliance, a base, longitudinally spaced vertical first and second upright support members on the base, a first pair of vertically and horizontally spaced sprockets journaled on and in a plane adjacent to each support member, the sprockets having axes of rotation in an inclined plane extending upwardly from the base, a second pair of vertically and horizontally spaced sprockets journaled on and in a plane remote from each support member, said second pair of sprockets having parallel axes of rotation in said inclined plane, the spacing between all pairs of sprockets being equal, a first endless chain disposed between and around each first pair of sprockets, a second endless chain being disposed between and around each second pair of sprockets; a plurality of card trays located between said support members, said trays being vertically spaced and horizontally disposed, common drive means for said sprockets, a trunnion fixed to and extending from each end of each tray, lever arms connected to the first and second chains at intervals and extending laterally outward from the chains; the lever arms connected to the second chains being pivotally connected to the trunnions, a connecting link fixedly secured at one end to each trunnion, the lever arms connected to the first chains being pivotally connected to the other end of the connecting links, a pair of chain synchronizing sprockets fixedly mounted on a stub shaft that is rotatably mounted on each support member for simultaneous rotation of the synchronizing sprockets, and each pair of chain synchronizing sprockets engaging the pairs of first and second chains on each support member, whereby each pair of the first and second chains on each support member move together in response to operation of the drive means.

5. In a filing appliance, a base, longitudinally spaced first and second upright support members on the base, a first pair of vertically spaced sprockets journaled on and in a plane adjacent to each support member, a second pair of vertically spaced sprockets journaled on and in a plane remote from each support member, the sprockets having parallel axes of rotation, the first pair of sprockets being vertically spaced from the second pair of sprockets, the spacing between all pairs of sprockets being equal, a first endless chain disposed between and around each first pair of sprockets, a second endless chain being disposed between and around each second pair of sprockets, a plurality of card trays located between said support members and being vertically spaced and horizontally disposed, common drive means for said sprockets, a trunnion fixed to and extending from each end of each tray, lever arms connected to the first and second chains at intervals and extending laterally outward from the chains; the lever arms connected to the second chains being pivotally connected to the trunnions, a connecting link fixedly secured at one end to each trunnion, the lever arms connected to the first chains being pivotally connected to the other end of the connecting links, a pair of chain synchronizing sprockets mounted on each support member for simultaneous rotation, each pair of chain synchronizing sprockets engaging the pairs of first and second chains on each support member, each pair of chain synchronizing sprockets being independent of the common drive means for said first and second pairs of sprockets, and flexible pad means mounted on each tray and abuttable with an adjacent surface on an adjacent tray during movement of adjacent trays between the sprockets, whereby the chain portions between the sprockets are prevented from sagging out of straight line travel and thereby maintain the proper spacing between adjacent trays.

6. The construction as set forth in claim 5 in which the first and second pairs of sprockets have axes of rotation in an inclined plane extending upwardly from the base.

7. The construction as set forth in claim 5 in which an idler sprocket is mounted on each support member for engagement with each corresponding first chain and holds said chain in engagement with the corresponding chain synchronizing sprocket, whereby each pair of first and second chains on each support member moves together in response to operation of the drive means.

8. The construction as set forth in claim 5 in which the first and second pairs of sprockets have axes of rotation in an inclined plane extending upwardly from the base and in which an idler sprocket is mounted on each support member for engagement with each corresponding first chain and holds said chain in engagement with the corresponding chain synchronizing sprocket, whereby each pair of first and second chains on each support member moves together in response to operation of the drive means.

9. The construction as set forth in claim 5 in which a work table is provided at the upper end of one side of the appliance, and in which safety cable means extends longitudinally across and near the upper end of the orbit of travel of the trays at the other side of the appliance remote from said table for automatically stopping the drive means when the cable is struck by an object projecting from a tray.

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