Sept. 29, 1970 R. C. RAABE ET AL 3,531,171

VERTICAL MECHANICAL FILING CABINET

Filed July 5, 1968 3 Sheets-Sheet 1

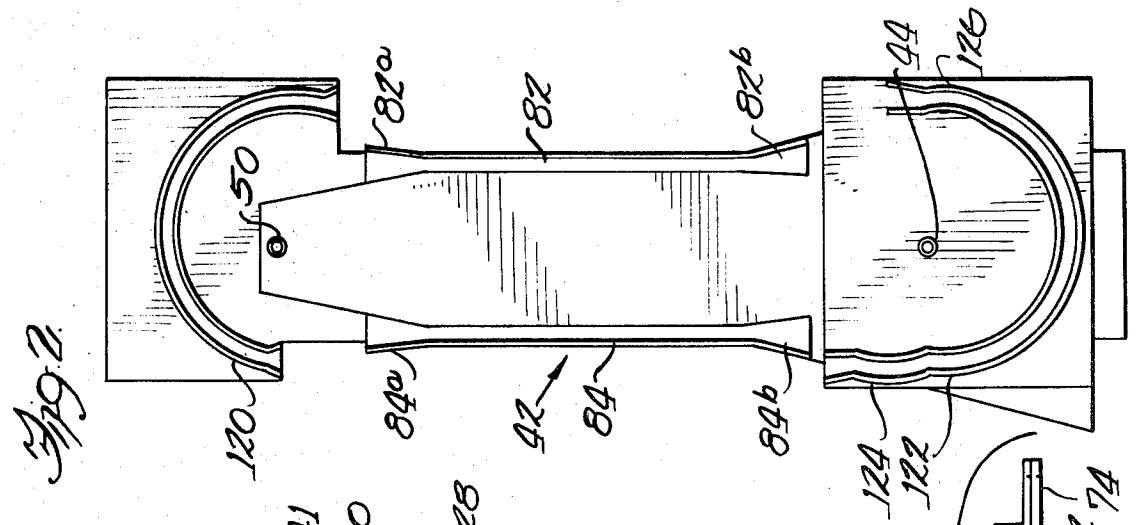


Fig. 2

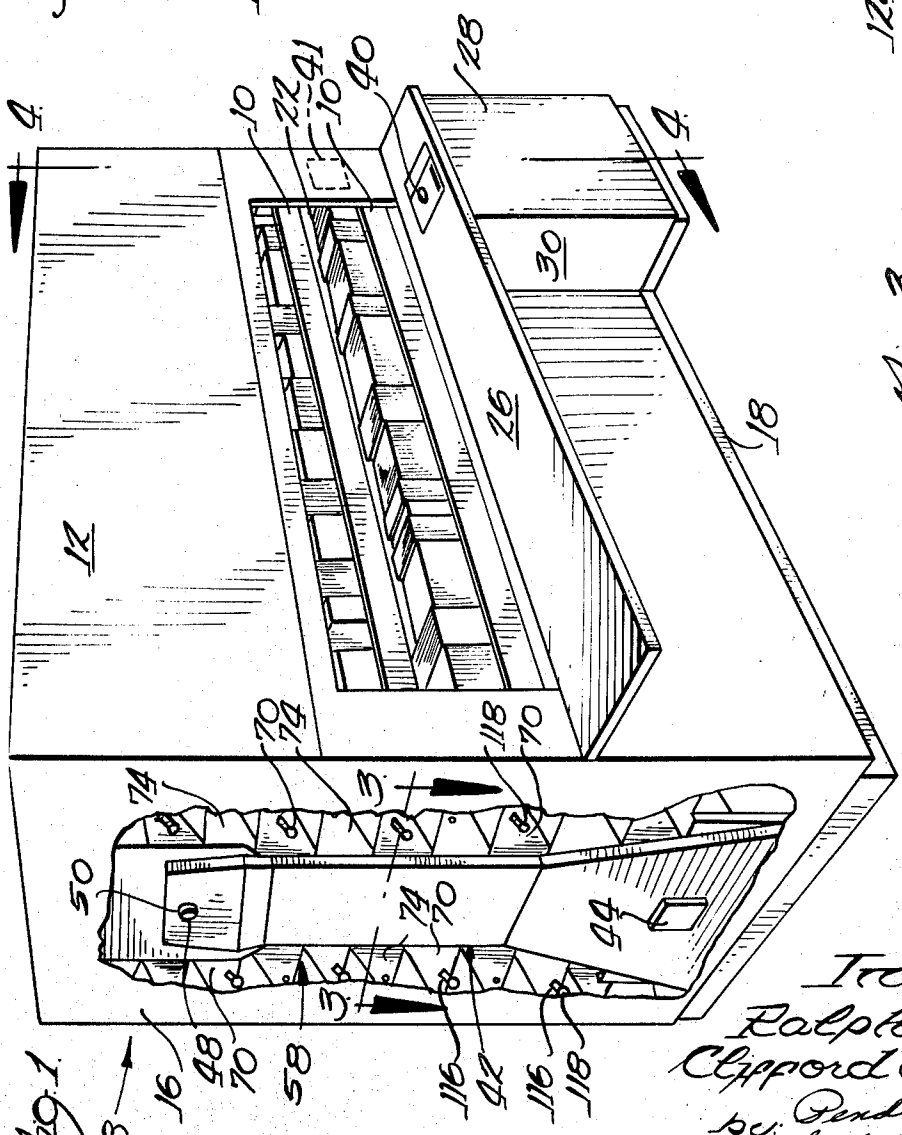


Fig. 1

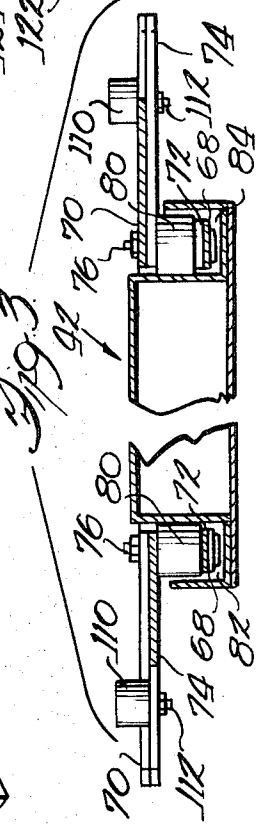


Fig. 3

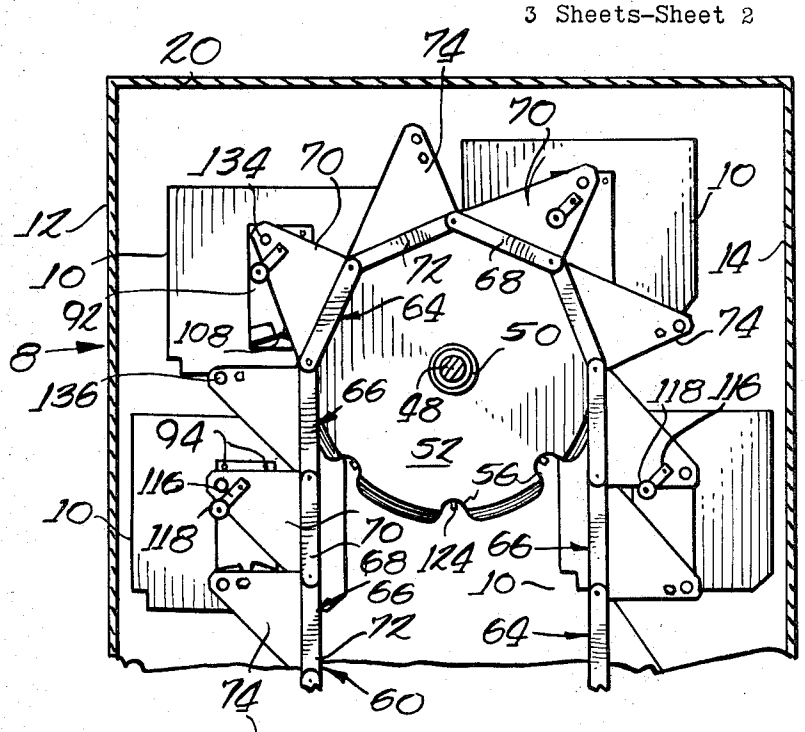
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Fig. 4



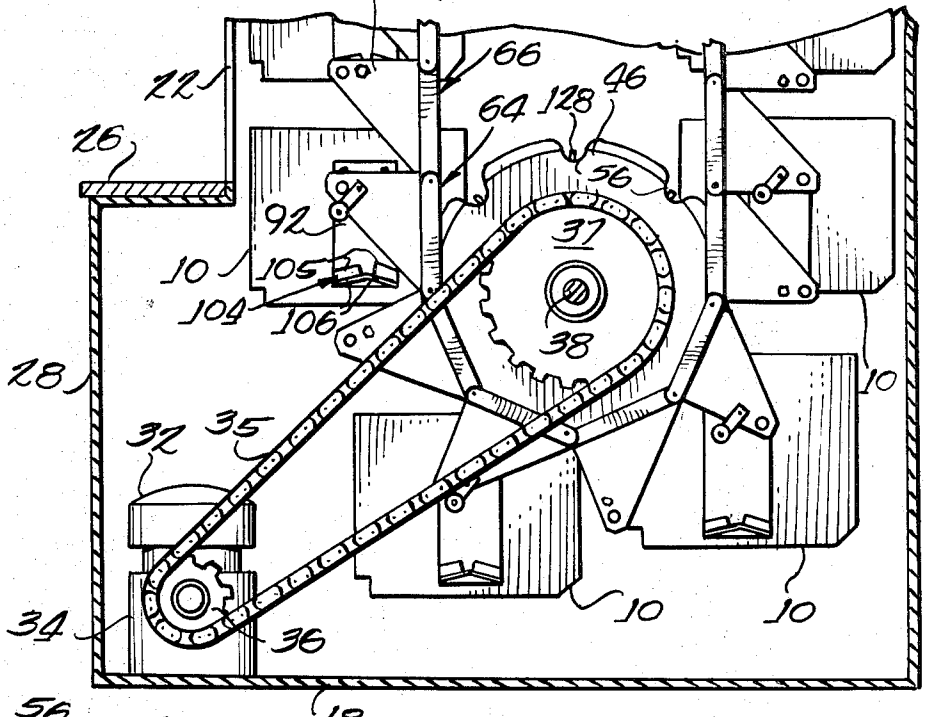
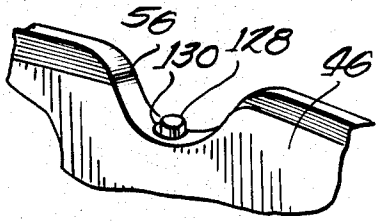


Fig. 5



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VERTICAL MECHANICAL FILING CABINET

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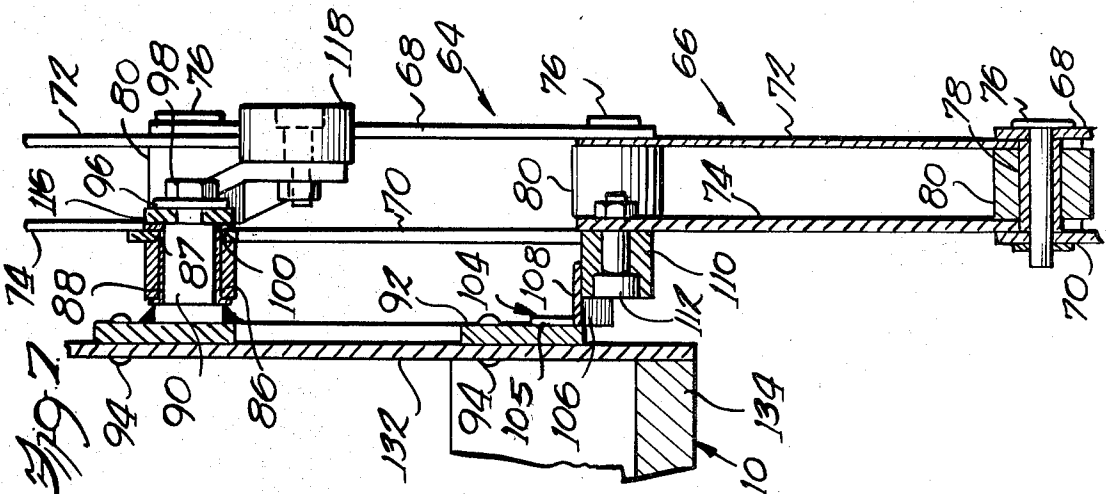


Fig. 7

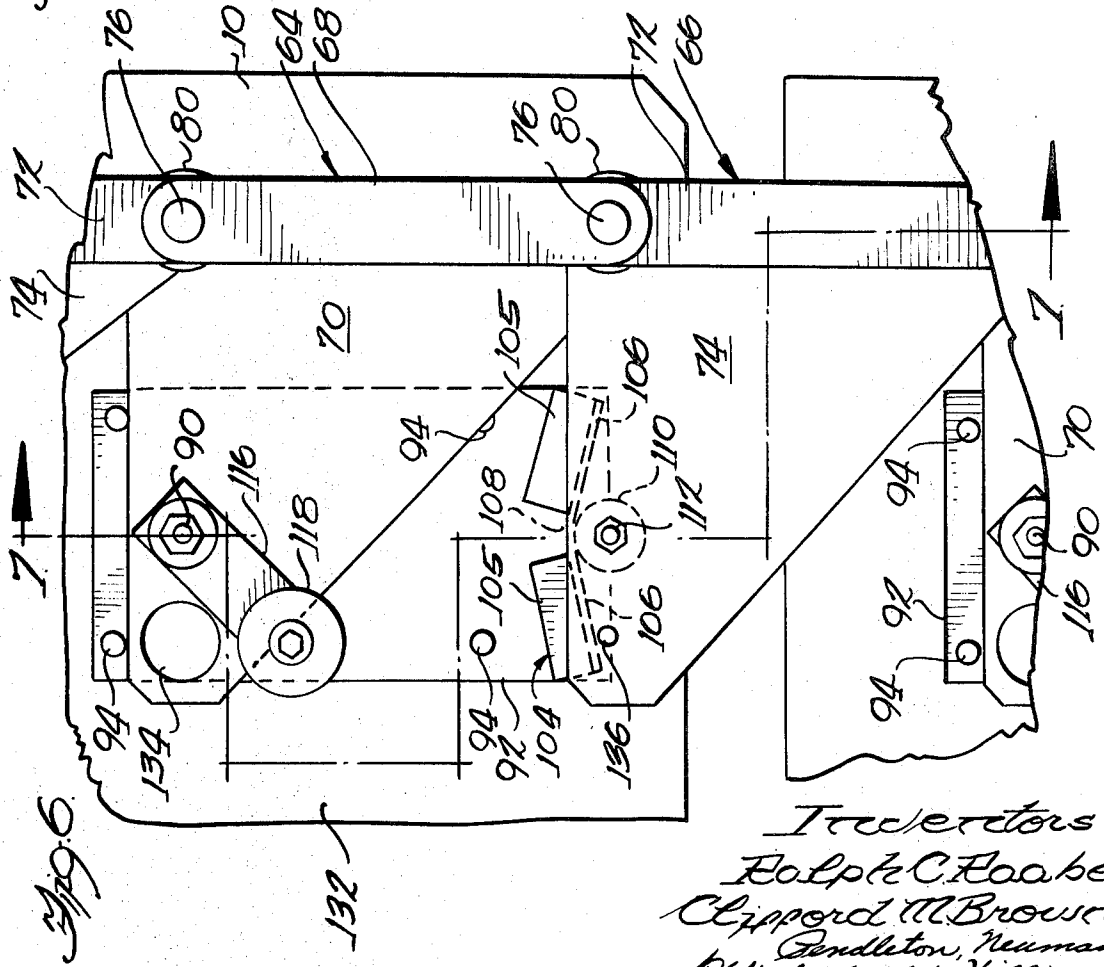


Fig. 6

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VERTICAL MECHANICAL FILING CABINET

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Int. Cl. A47b 49/00
U.S. Cl. 312—268 8 Claims

ABSTRACT OF THE DISCLOSURE

A vertical power-operated filing cabinet having regular octal sprocket wheels and carrier support chains consisting of rigid links, each link being of an effective length corresponding to the chordal dimension of the sprocket wheels and including an offset support extending outwardly from its pivotal connection with an adjacent link, and a series of carriers pivotally suspended on the offset supports of alternate links by end pivot pins engaging the offset supports directly outward of such link connections, the remaining links having rollers engaging alignment detents on the superjacent carriers during traversing of the vertical runs of the chains to stabilize the carriers during their vertical travel.

CROSS REFERENCE TO RELATED APPLICATION

This application pertains to vertical mechanical filing cabinets of the general type disclosed in the copending application of Robert D. Gutting, Ser. No. 604,467, filed Dec. 23, 1966, now Pat. No. 3,442,564.

BACKGROUND OF THE INVENTION

Field of the invention

This invention pertains to mechanical filing cabinets, and more particularly to such filing cabinets of the type having a sprocket, support chain and carrier arrangement designed to support two carriers above the axis of rotation of the upper sprockets and two carriers below the axis of rotation of the lower sprockets.

Description of the prior art

The prior art includes a wide variety of support drive arrangements for mechanical or power-operated file cabinets. However, a continuing consideration in such filing structures is to obtain the most efficient use of the storage space. Within a given set of cabinet dimensions, and prescribed dimensions of depth and clearance between carriers, this efficiency may be considered primarily in terms of the length of shelf space, or the number of carriers which can be provided.

The aforementioned application of Gutting discloses a vertical power-operated file apparatus wherein the number of carriers or shelves within a given space is increased by providing a sprocket and support chain arrangement for supporting two extra carriers in a given space, as compared to prior art constructions. Gutting describes an embodiment including square sprocket wheels, with carrier chains formed of rigid chain links, each of an effective length corresponding to the effective length of the side of a sprocket wheel. Thus, the sprocket wheels and chains are of a configuration to support two carriers above the axis of rotation of the upper sprocket wheels and two carriers below the axis rotation of the lower sprocket wheels at all times. However with square sprocket wheels, certain problems have been presented due to the lateral or horizontal pulsing movement of the vertical runs of the supporting chains and the attached carriers.

SUMMARY OF THE INVENTION

It is an object of this invention to provide further improvement in file systems of the general type to which said Gutting application pertains. It is a further more specific object of this invention to provide an improved file apparatus retaining the space efficiency advantages of the arrangement described by Gutting in the aforementioned application, and wherein there is little or no horizontal movement of the carriers during their movement along the vertical runs of the support chains. Further objects of this invention are to provide such file apparatus which is of simple and economical construction and which has dependability of operation as well as adaptability for use in various filing, storage and retrieval operations.

In general, the foregoing objects are achieved in one illustrative embodiment of the invention by providing mechanical file apparataus comprising two pairs of sprocket wheels mounted for rotation about two vertically spaced horizontal axes with the upper pair of wheels aligned with the lower pair, each of said sprocket wheels having eight chain-engaging portions arranged in a regular octal configuration at a predetermined chordal spacing, a pair of support chains each extending about and engaging corresponding aligned sprocket wheels of said pairs of sprocket wheels and each being formed of a series of rigid links pivotally joined to one another, each of said rigid links being of an effective length corresponding to said predetermined chordal spacing, and a plurality of carriers each pivotally suspended on said pair of chains with successive carriers being pivotally supported on alternate links of said chains.

For a more complete understanding of the invention, reference should now be had to the drawings wherein an embodiment is illustrated, as described below, by way of example of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a power driven vertical file employing teachings of this invention, with a portion of the cabinet covering broken away;

FIG. 2 is an enlarged front elevation view of an end support and guide structure of the file of FIG. 1;

FIG. 3 is a cross-sectional view taken along line 3—3 of FIG. 1 and looking in the direction of the arrows;

FIG. 4 is a partially schematic elevation view of the sprocket wheels, support chain, file carriers and drive mechanism of the file of FIG. 1, taken generally along the plane of line 4—4 of FIG. 1 and looking in the direction of the arrows;

FIG. 5 is an enlarged partial view of one sprocket root of the sprockets of the file of FIG. 1;

FIG. 6 is an enlarged elevation view of a portion of the carrier chain, and

FIG. 7 is a cross-sectional view taken on the irregular line 7—7 of FIG. 6 and looking in the direction indicated by the arrows.

DESCRIPTION

FIG. 1 illustrates generally a vertical power operated file **8** of the type wherein a plurality of shelves or carriers **10** are supported on a pair of conveyor chains, with one chain being trained around a vertically aligned pair of sprockets at each end of the file. The file includes a cabinet having a front wall **12**, a rear wall **14**, side walls **16**, a base **18** and a top **20** (see also FIG. 4). The front wall is formed with a rectangular access opening **22** which may be closed by a suitable retractable closure or door (not shown). A counter **26** is provided, normally at desk height, in order to provide a convenient working space for file clerks or others using the file **8**.

An extension of the cabinet housing is provided beneath one end of the counter, being enclosed by a front

wall **28** and side walls **30**. Referring also to FIG. 4, a suitable drive motor **32**, such as a reversible electric motor, and a speed reduction mechanism **34** is provided within the housing extension. A roller chain **35** engages an output sprocket wheel **36** and a sprocket wheel **37** keyed to a drive shaft **38**. Selector controls **40** are mounted in counter **26**, or may be conveniently mounted in an available portion of wall **12**, as at **41**, for controlling the operation of the motor **32** to bring any selected carrier to the work position at opening **22**.

Referring to FIGS. 1–4, the support frame of the file **8** includes a pair of upright end supports, as at **42**, with one of these supports at each side of the cabinet. Only the left end support **42** is shown for illustration, the support at the opposite side being a mirror image version of the illustrated support **42**, except as noted below. The drive shaft **38** extends horizontally across the lower portion of the cabinet, being journaled at its opposite ends in suitable bearings provided at **44** in the end supports.

A pair of sprocket wheels **46** are affixed to shaft **38**, with one such sprocket wheel being adjacent each of the upright supports. A pair of stub shafts are provided, as at **48**. Each such stub shaft has one end mounted in a bearing, as at **50**, in the respective end support and extends inwardly therefrom, along a common horizontal axis parallel to and vertically aligned with shaft **38**, a sufficient distance to rotatably support an upper sprocket wheel **52** disposed adjacent the respective end support. The two upper wheels thus are journaled on separate stub shafts for rotation about a common axis parallel to the axis of the lower sprocket wheels. The sprocket wheels **46** and **52** adjacent each end support are vertically aligned with one another.

It will be noted that each of the sprocket wheels **46** and **52** is formed with eight notches, or sprocket roots **56** regularly spaced about its periphery for engagement with appropriate transverse drive elements of the carrier support chains.

A pair of carrier support chains are provided, being indicated generally at **58** (FIG. 1) and **60** (FIG. 4), with each chain trained about and engaging the aligned sprocket wheels adjacent one of the upright end supports. Referring to FIGS. 4, 6 and 7 wherein chain **60** is illustrated in greater detail, each of the carrier support chains constitutes a series of rigid links **64** and **66** each of an effective length corresponding to the spacing of notches **56**. The carriers **10** are pivotally suspended on the links **64** which constitute alternate links in the chains, whereby a carrier is supported at each unit of chain length corresponding to two such links.

Referring particularly to FIGS. 6 and 7, each link **64** is formed of spaced link elements **68** and **70**, whereas each link **66** is formed of spaced elements **72** and **74**. The adjacent overlapping ends of adjacent links are joined to one another in series by pins **76** and sleeve bushings **78** to form the sprocket chains. The spacing between the center lines of adjacent pins **76** of each chain corresponds to the spacing between the center lines of the notches **56**. A roller **80**, which may be formed of any suitable material such as Celcon, is rotatably mounted on the bushing on each pin **76** to engage in the sprocket recesses **56** as the sprocket wheels are rotated (see FIG. 4). The outer link elements **68** and **72** are relatively narrow and are adapted to be received, along with rollers **80**, in vertical guide channels **82** and **84** (see FIGS. 2 and 3) provided in the respective support **40** along the vertical runs of the chains. These tracks are flared at the ends, as at **82***a*, **82***b*, **84***a* and **84***b* to facilitate smooth entry and egress of the chains and rollers.

Each of the link elements **70** is of a generally triangular configuration and extends outwardly from the line defined by the pins **76**. It will be appreciated that the sprocket wheels may be rotated in either direction by motor **32** to drive the chains and carriers in either direction of orbit. However, for convenience, the edge of link elements **70** perpendicular to the chain will be referred to as the leading edge.

A sleeve **86** is welded to each link element **70**, at an opening **87**, in a position wherein its center line is spaced outwardly of a pin **76** along a line normal to the length of the respective link, i.e., on a line normal to a line passing through the center lines of the pins **76** which support the respective link and intersecting the pin **76** adjacent the leading edge, as illustrated. A bushing **88** in sleeve **86** receives a pivot pin **90** for pivotally supporting one end of a carrier shelf **10**.

Each pin **90** is affixed to a carrier plate **92** which is secured to the adjacent end **132** of a carrier **10**, as by rivets **94**. A washer **96** and nut **98** retain an arm **116** (described below) on each pin **90** and also retain the pin **90** in the respective sleeve **86**. A bearing washer **100** is interposed between arm **116** and link element **70**. The opposite end of each carrier is similarly supported on chain **58**. The pins **90** are located on the vertical center line of each end of each carrier, and are disposed above the center of gravity of the respective carrier whereby each carrier is suspended by a pair of axially aligned pivot pins **90** engaging the carrier chains at opposite sides of the cabinet **12**.

An alignment tab **104** is affixed to the lower portion of each of plates **92**, as by welding flange ears **105** thereof to the plate. These tabs **104** include a pair of inclined ramp sections **106**, and a centering guide detent **108** on the vertical center line of the respective carrier.

Each link **66** includes a link element **74** of a configuration similar to that of the link element **70**. A locking roller **110** is journaled on a pin **112** secured to the outwardly extending link **74** adjacent its leading edge and positioned to be in vertical alignment with and midway between the sleeves **86** of adjacent links **64** in the vertical runs of the chains. Thus, the distance between the axis of each support pin **90** and each adjacent alignment roller **110** is the same over the vertical runs of the chains. The tabs **104** also are uniformly spaced from the pins **90**, whereby each respective detent **108** is engaged by the subjacent locking roller **110** during movement of the carriers along each of the vertical runs of the chains. The ramps or wings **106** on the aligner tabs **104** serve to guide the rollers **110** into the detents **108** in the turn-around areas.

A stabilizing arm **116** is affixed to each pin **90** and carries a guide roller **118**. These rollers engage appropriate arcuate guide channels **120** and **122** in the respective end support **42** to avoid excessive shelf swing when traversing the top and bottom sprockets. The arms **116** on chain **58** extend downwardly and rearwardly, e.g. at an angle of 45° to the horizontal, as seen in FIG. 1. However, the arms **116** on chain **60** extend downwardly and forwardly at a similar angle as seen in FIG. 4. The arcuate channel guides of each end support are appropriately eccentric with reference to the axis of the respective sprocket wheels to accommodate the respective offset rollers **116** on arms **118**. Extending arms **116** in different directions precludes both of the stabilizing rollers **118** of a carrier from being in a "neutral" position, i.e., with arm **116** perpendicular to the guide track, at the same time. This avoids the possibility of excess tilting or rocking motion of the carriers that otherwise may occur in such a position. Short arcuate channel portions **124** and **126** at either end of channel **122** accommodate the slight horizontal pulsing of the carriers at these points to facilitate and assure the aligning and seating of rollers **118** in the superjacent tabs **104** as the carriers move from the lower sprocket wheel into the vertical runs. The ends of the guide channels **120** and **122** are flared, similar to channels **82** and **84**, to facilitate the capture therein of the guide rollers **118**. Engagement of the link elements **68** and **72** and of the rollers **80** within the guide channels **82** and **84** provide lateral stabilization during the vertical runs.

Referring to FIG. 5, an insert **128** of a suitable plastic or rubber, is secured in a recess **130** in each tooth root of

each sprocket and projects slightly above the adjacent surface to provide noise reduction in the operation of the sprocket wheels and chains.

Several important facets of the disclosed structure should be noted. Each of the sprocket wheels is provided with eight uniformly spaced notches or sprocket roots **56**, thereby in effect forming a regular octal or effectively octagonal sprocket wheel. Since a carrier is mounted on each support link **64**, and the support links comprise alternate links in the chains, it will be appreciated that at all times two carriers will be supported above the horizontal plane defined by the axis of the upper sprocket wheels. Similarly, two carriers will at all times be supported beneath a horizontal plane through the axis of rotation of the lower sprocket wheels. Thereby, the advantages of he previously noted Gutting file structure are maintained. Moreover, as compared to a square sprocket wheel drive, the horizontal pulsing movement is reduced by about 75%. For instance,, with square sprocket wheels having effective side lengths of 12" a horizontal pulsing movement of 2.485" is obtained, whereas regular octal sprocket wheels having effective side lengths of 6" provide pulsing movement of only 0.596". The later theoretical movement can be controlled readily or eliminated by use of the guides **82** and **84**. Use of larger sprocket wheels with more chain units (one "unit" corresponding to the length of chain for each carrier) on the sprocket wheels increases the requisite cabinet depth when enough offset is provided to clear the carriers at the ends.

Further, providing rigid links with each carrier mounting point offset directly outwardly from one pivot pin assures maximum turning radius and thus maximum separation of the carriers in each turn-around area with a given distance of such offset. This permits adequate clearance between carriers with a minimum distance of offset, thereby reducing the depth along the vertical runs for conservation of cabinet space (minimum cabinet depth). Minimizing the offset also tends to reduce the differential in carrier speed between the vertical runs and the turn-around areas and minimizes side force or torque on the chain links. To these ends, with each carrier **10** of an effective combined length of a pair of links **64** and **66**, it has been found that a distance of offset equal to slightly greater than ⅓ the depth of the carriers provided adequate clearance.

To illustrate the foregoing in one specific example, a file was constructed assuming a carrier storage space height of about 10½". The height of the carrier end walls **132** was 9½" above the floor **134**. Adding shelf floor structure adequate for rigidity (about 1") and allowing for spacing between carriers resulted in a unit length of chain (one pair of links **64** and **66**) of about 11¾". Thus, the chain links were each of 5⅞" effective length, and the spacing of the notches of the octal sprocket wheels, between center lines, was also 5⅞". For standard letter files, carriers of 12" horizontal depth were supported with the center lines of pins **90** offset 4¼" from the center line through pins **76** as illustrated in the drawings. This provided an offset equal to about 0.35 times the carrier depth. For legal size files, carriers of 15" depth were supported with pins **90** offset 5¾" from the center line through pins **76**, as by placing the sleeves **86** at the outer openings **134** in link elements **70** and mounting the pins **110** in openings **136** of link elements **74**. This provided an offset equal to about 0.38 times the carrier depth. The pivot pins **90** were located on the vertical center lines of the carriers about ⅔ of the carrier height (6") above the bottoms of the carriers. This maintained the support pivots above the center of gravity of the carriers, whether empty or filled, to automatically maintain proper carrier orientation, while minimizing the turning moments and hence the tendency of the carriers to swing when accelerated or decelerated in the turn-around areas.

It will be obvious that various other modifications of the specific embodiments shown and described may be made without departing from the spirit and scope of the invention.

It will thus be seen that an improved file system has been provided which meets the aforestated objects of this invention and which will provide various other efficiencies and advantages.

While particular embodiments of this invention have been shown, it will be understood, of course, that the invention is not limited thereto since modifications may be made by those skilled in the art, particularly in light of the foregoing teachings. Therefore, it is contemplated by the appended claims to cover any such modifications as incorporate those features which may be said to constitute the essential features of these improvements, within the true spirit and scope of the invention.

We claim:

1. Mechanical file apparatus comprising a first pair of sprocket wheels mounted for rotation about a second horizontal axis, a second pair of sprocket wheels mounted for rotation about a second horizontal axis vertically spaced from said first axis, said sprocket wheels of said second pair being disposed in alignment with said sprocket wheels of said first pair, each of said sprocket wheels having eight chain-engaging portions arranged in a regular octal configuration about its periphery at a predetermined chordal spacing, a pair of support chains each extending about and engaging corresponding aligned sprocket wheels of said pairs of sprocket wheels and each being formed of a series of rigid links pivotally joined to one another, each of said rigid links being of an effective length corresponding to said predetermined chordal spacing, each alternate link of each of said chains providing a carrier support disposed outwardly of the line defined by the pivotal connections of each such link to the adjacent links in the respective chain and disposed at the same end of each such link, and a plurality of carriers, each of said carriers pivotally engaging one of said carrier supports of each of said chains and thereby being pivotally suspended on said pair of chains, successive carriers being pivotally supported on successive alternate links and each of said carriers being of a vertical height only slightly less than the combined effective length of two of said links.

2. Mechanical file apparatus as in claim **1** wherein each of said carrier supports is disposed on a line normal to the length of the respective link and intersecting the pivotal connection at said end thereof.

3. Mechanical file apparatus as in claim **1** wherein each of said carrier supports is spaced outwardly of said line a distance equal to about ⅓ of the horizontal depth of the respective carrier.

4. Mechanical file apparatus as in claim **1** including guide elements secured to each of said carriers and disposed in spaced relation to the pivotal engagement of the respective carrier and carrier support, and guide means engaging said guide elements for stabilizing said carriers during their vertical travel between said pairs of sprocket wheels.

5. Mechanical file apparatus as in claim **4** including guide means engaging said guide elements for stabilizing said carriers during their travel around the periphery of each of said pairs of sprocket wheels.

6. Mechanical file apparatus as in claim **1** wherein each of said carriers is suspended on such links by pivot means disposed below the upper edge of the respective carrier.

7. Mechanical file apparatus as in claim **6** wherein said pivot means are disposed to provide a pivot support axis for each carrier spaced above the bottom of the respective carrier a distance equal to about ⅔ of the height of the carrier.

8. Mechanical file apparatus as in claim **2** wherein each of said carrier supports is spaced outwardly of said line

a distance equal to about ⅓ of the horizontal depth of the respective carrier.

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JAMES T. McCALL, Primary Examiner

U.S. Cl. X.R.

221—76

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,531,171 Dated September 29, 1970

Inventor(s) Ralph C. Raabe and Clifford M. Brown

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

Column 1, line 3, "Hon Industries Inc.," should read -- HON INDUSTRIES Inc.,-- . Column 2, line 3, "improvement" should read -- improvements -- ; line 17, "apparataus" should read -- apparatus -- . Column 5, line 15 (third occurrence) "he" should read -- the -- ; line 42, after "effective" and before "combined" insert -- height only slightly less than the effective -- . Column 6, line 20, claim 1, "second" should read -- first -- .

SIGNED AND
SEALED
DEC 8 - 1970

(SEAL)
Attest:

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Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents