

[54] **WEIGHING AND PRINTING APPARATUS**
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[22] Filed: **Feb. 27, 1974**
[21] Appl. No.: **446,404**

Related U.S. Application Data

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[52] U.S. Cl. **177/10, 177/13**
[51] Int. Cl. **G01g 23/38**
[58] Field of Search **177/2, 10, 13**

References Cited

UNITED STATES PATENTS

1,291,363 1/1919 Bain 177/10 X
2,040,073 5/1936 Brandel 177/13
2,070,011 2/1937 Hadley et al. 177/13 X

2,111,127 3/1938 Rast 177/13 X
2,301,946 11/1942 Hahn 177/13 X
2,354,301 7/1944 Carliss 177/13
2,634,965 4/1953 Singleton 177/13
2,948,465 8/1960 Allen 177/13 X
3,097,709 7/1963 Farmer et al. 177/2 UX
3,346,061 10/1967 Johnston et al. 177/2

Primary Examiner—George H. Miller, Jr.
Attorney, Agent, or Firm—Strauch, Nolan, Neale, Nies & Kurz

[57] **ABSTRACT**

A dial scales with printer in which the mechanical read-out mechanism indexes the printing mechanism through angular displacement of the dial indicator shaft.

10 Claims, 39 Drawing Figures

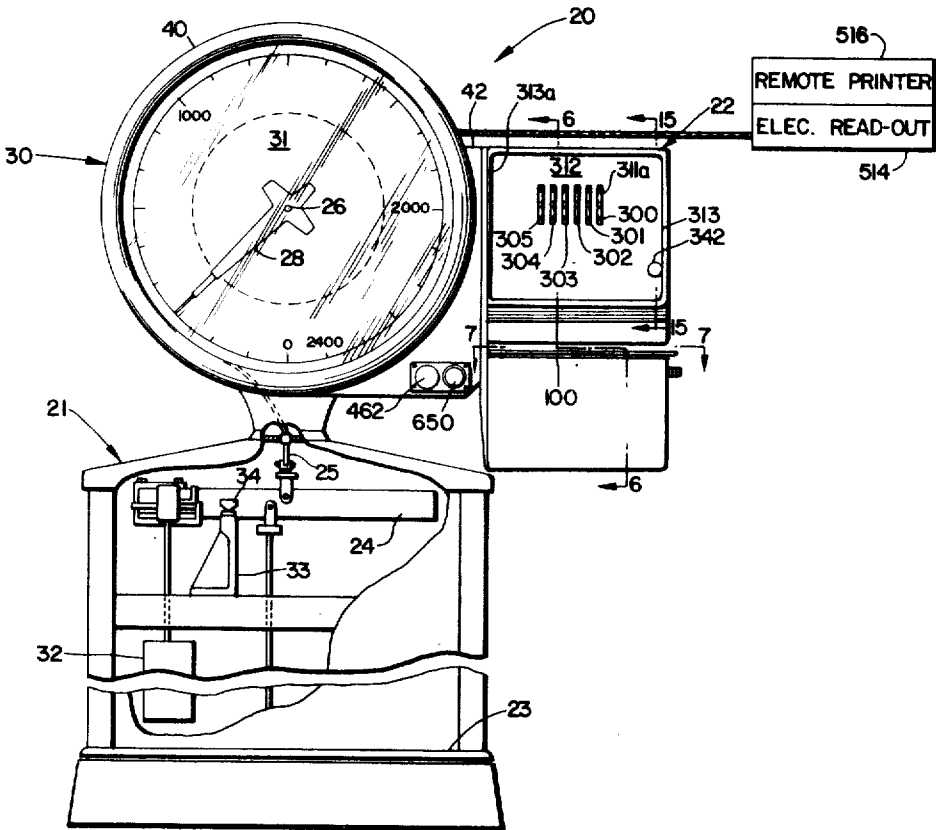


FIG 1

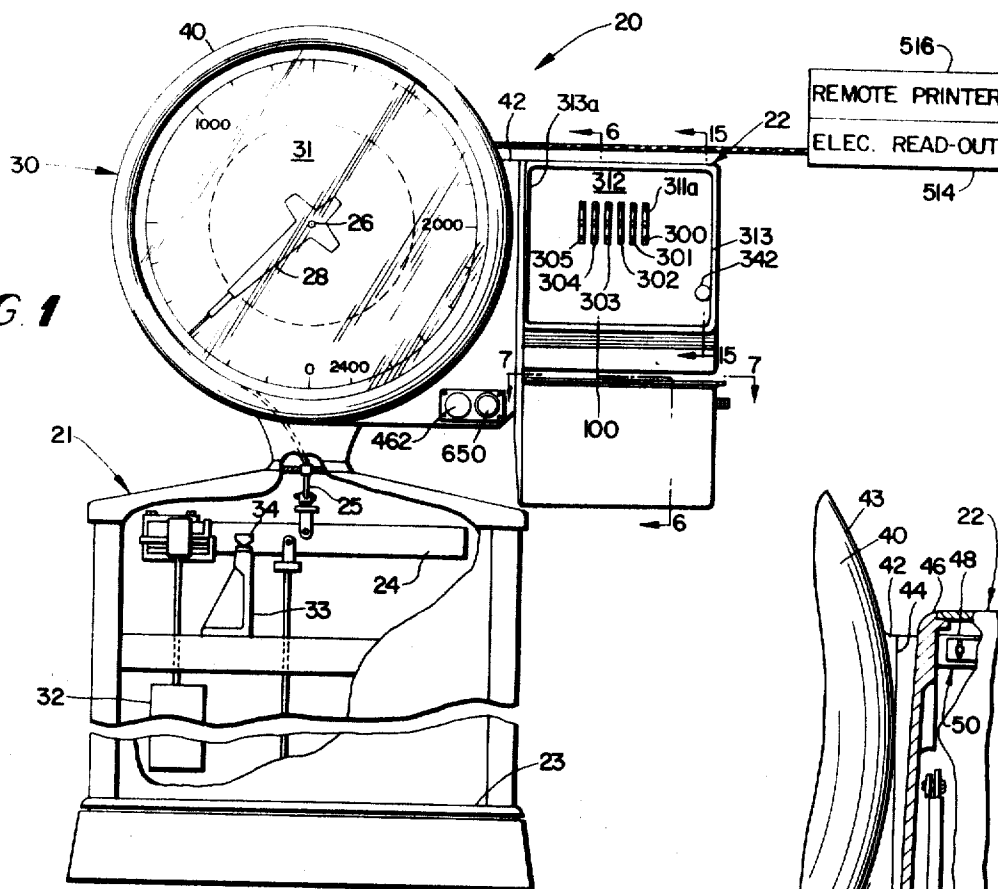


FIG 2

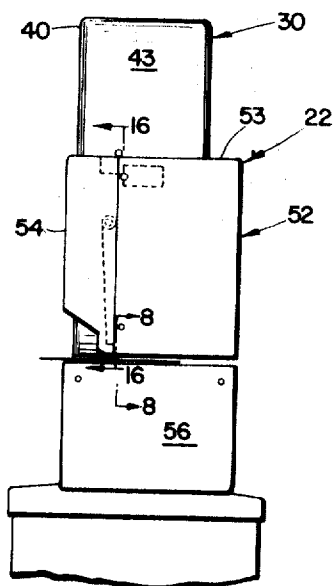
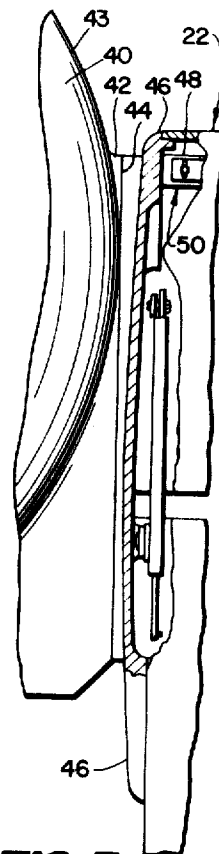


FIG 3



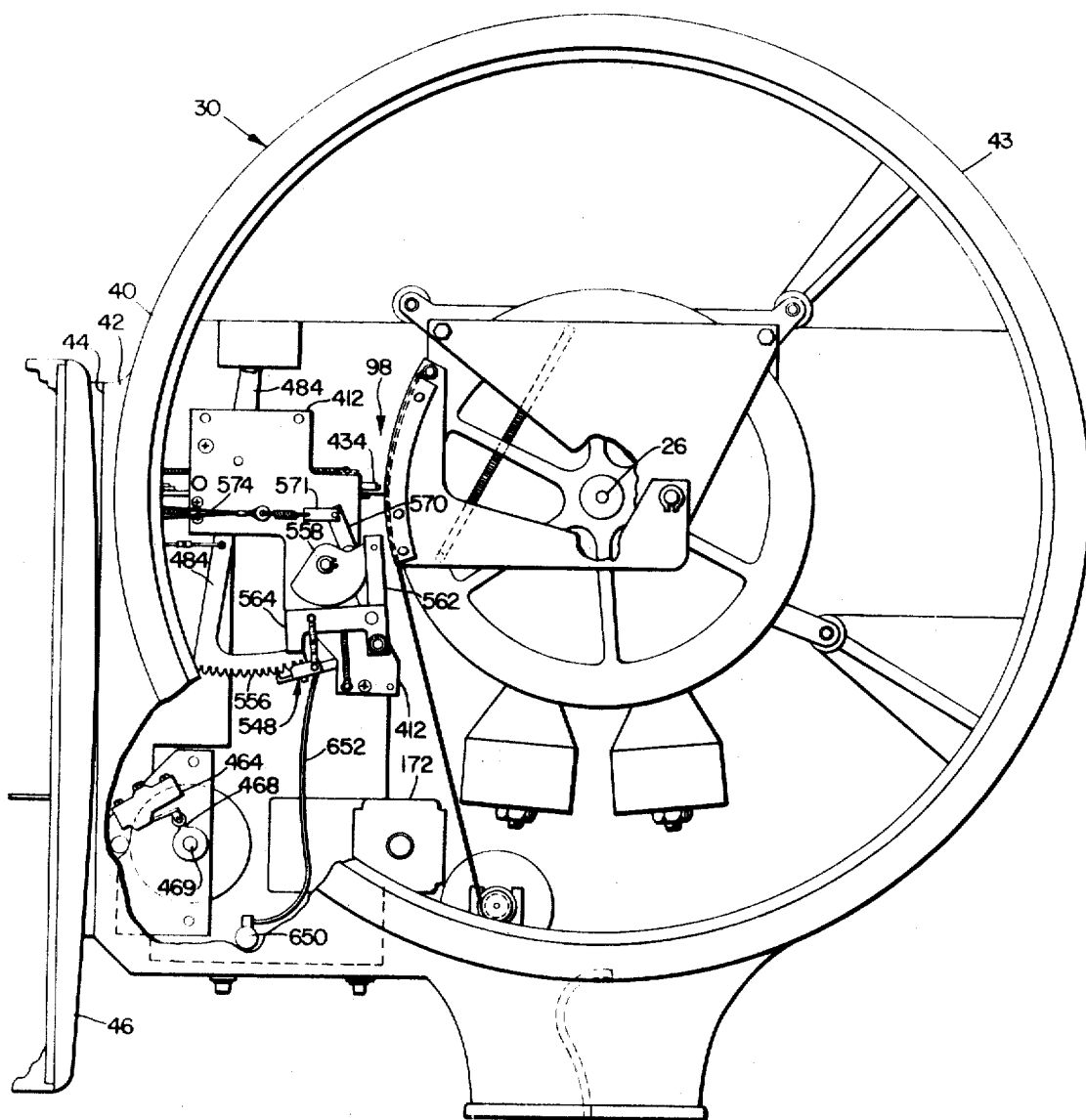
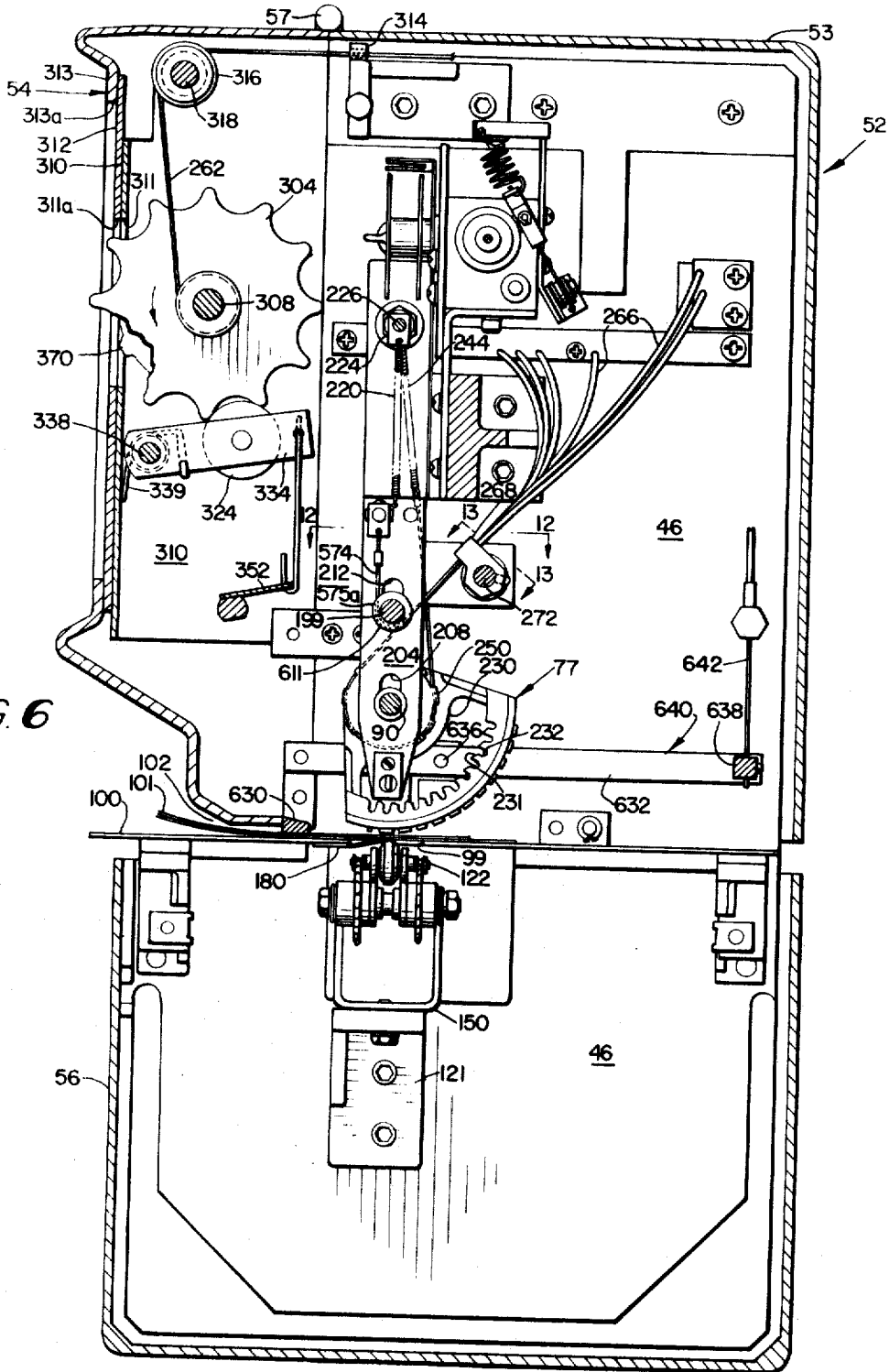
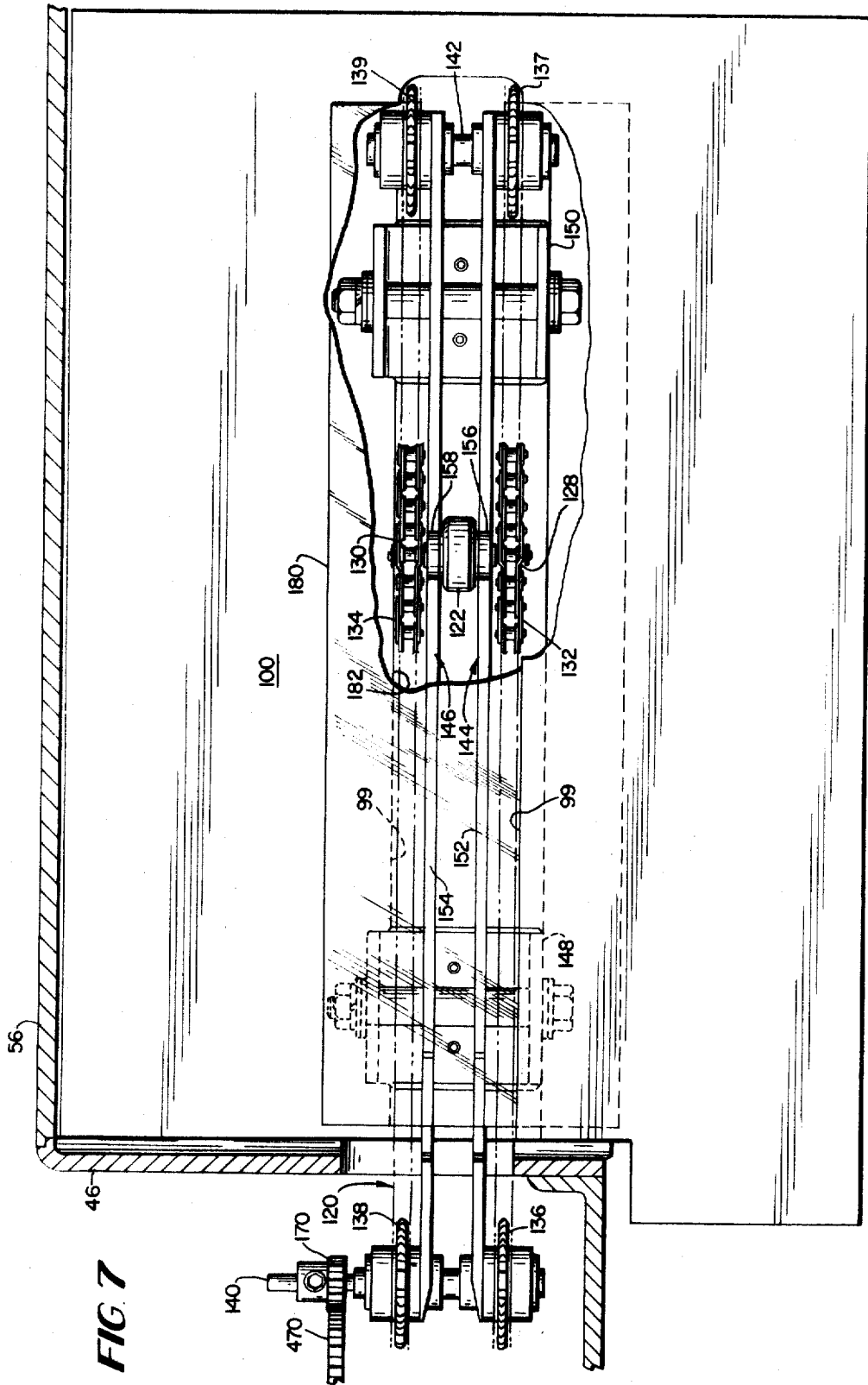
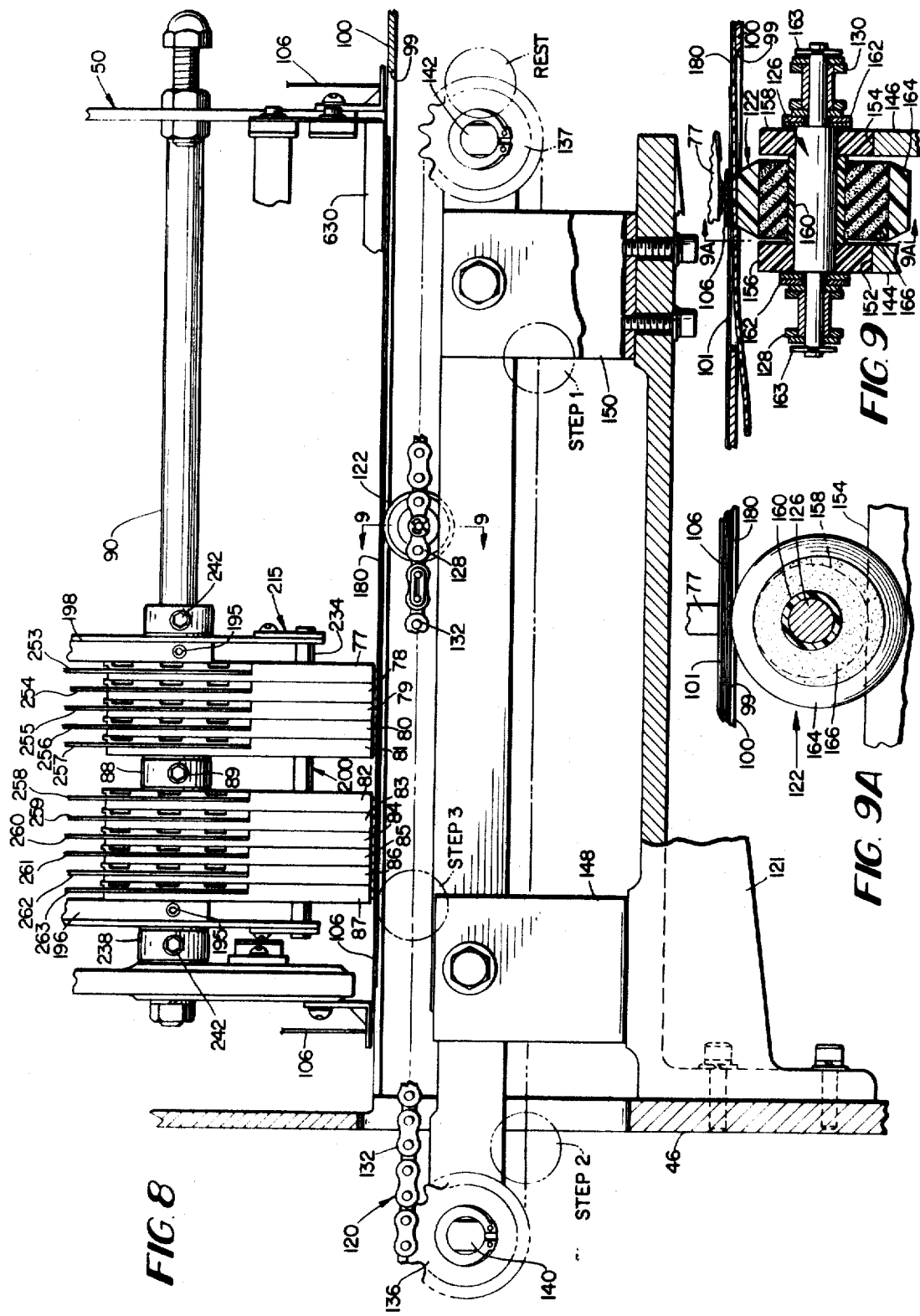


FIG. 4

FIG. 6







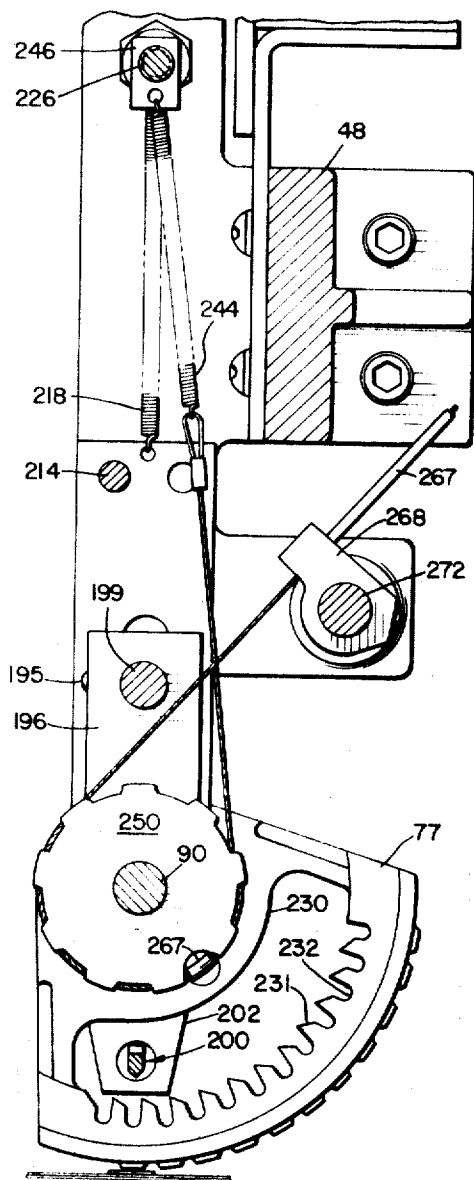


FIG. 10

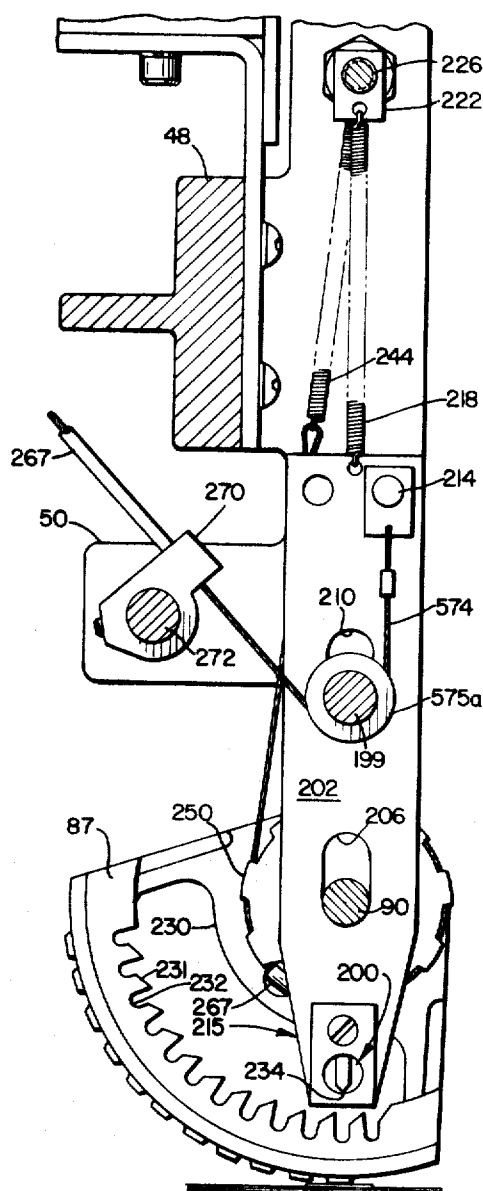


FIG. 11

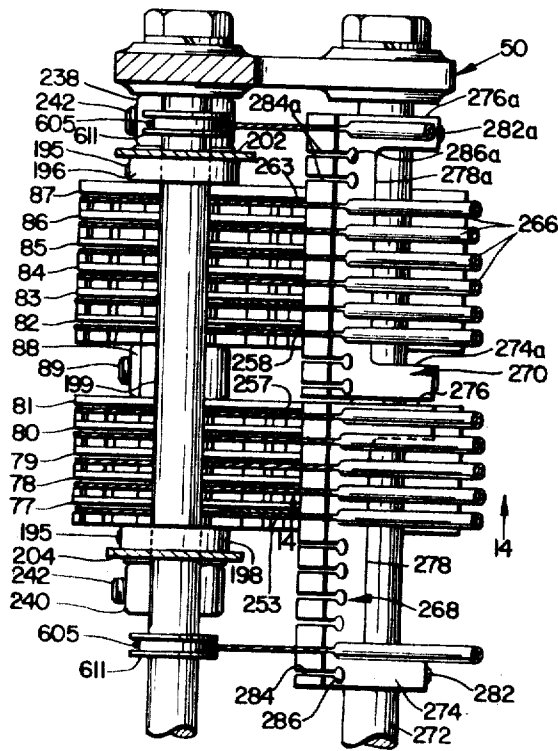


FIG. 12

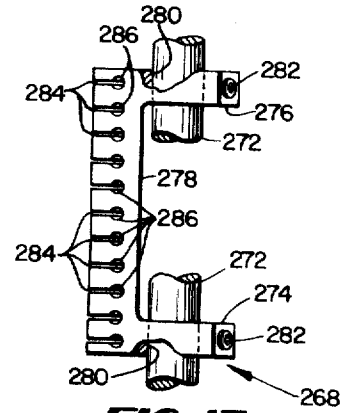


FIG. 13

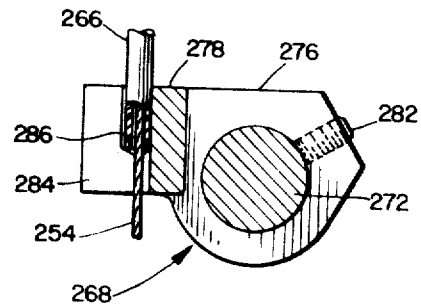


FIG. 14

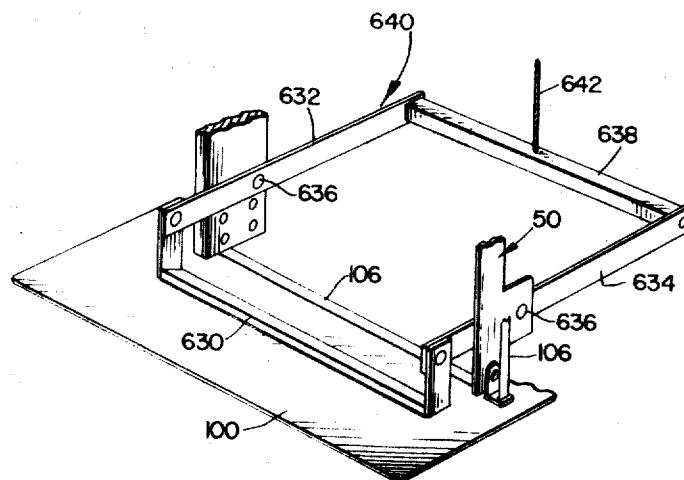


FIG. 29

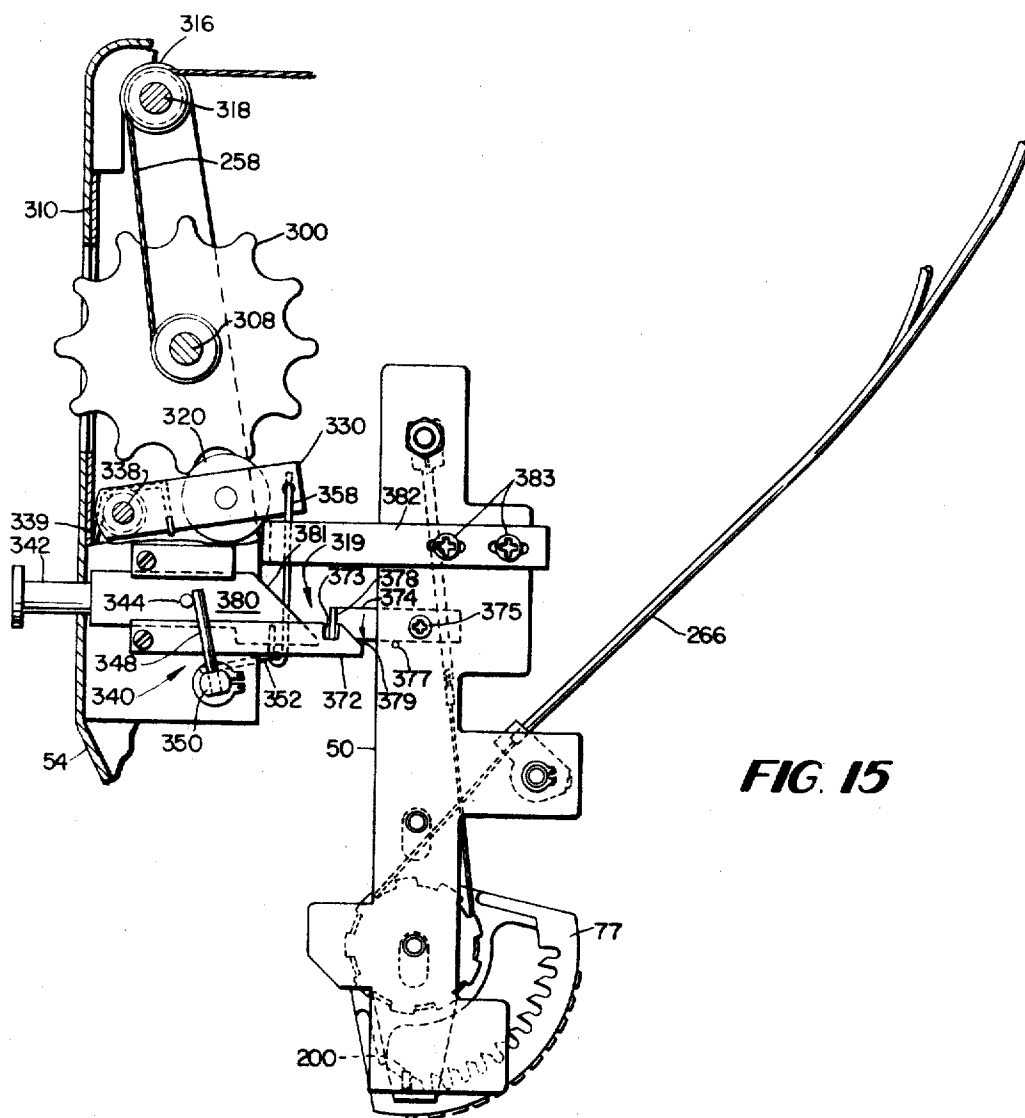


FIG. 15

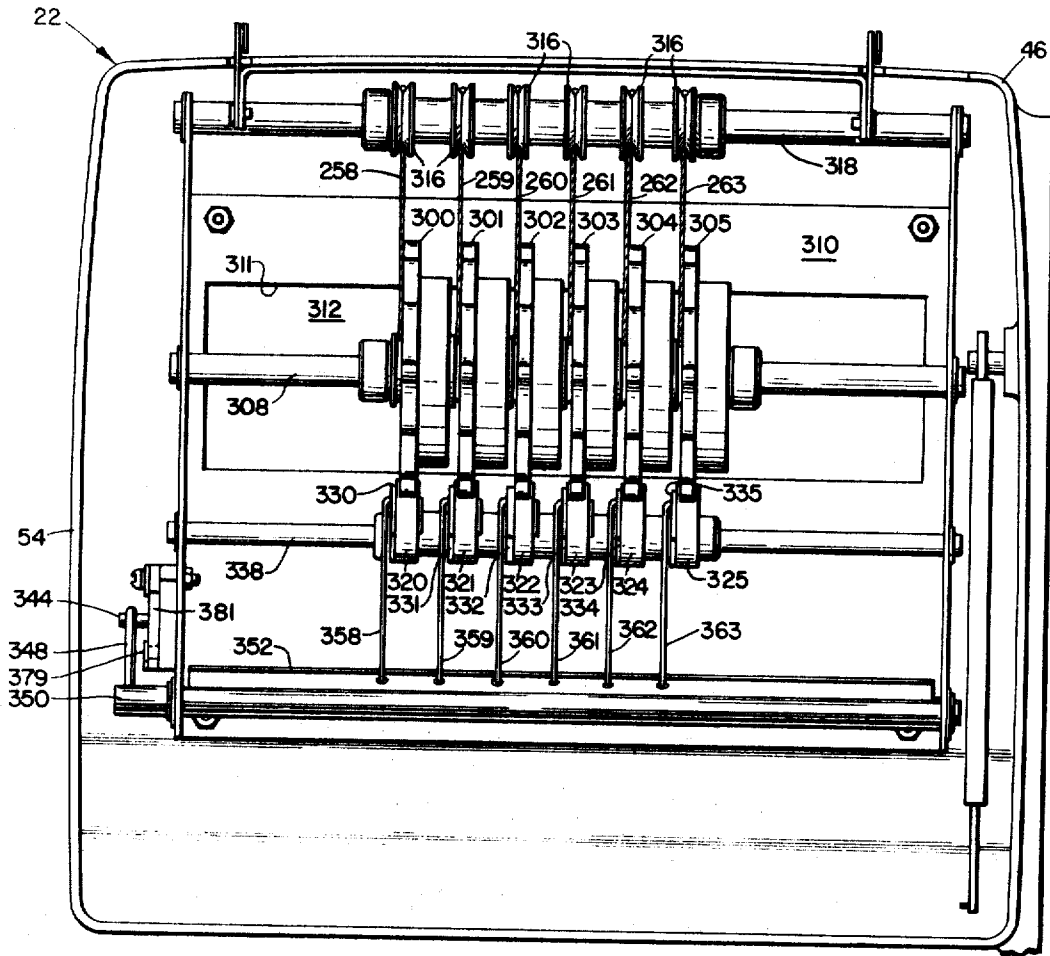


FIG. 16

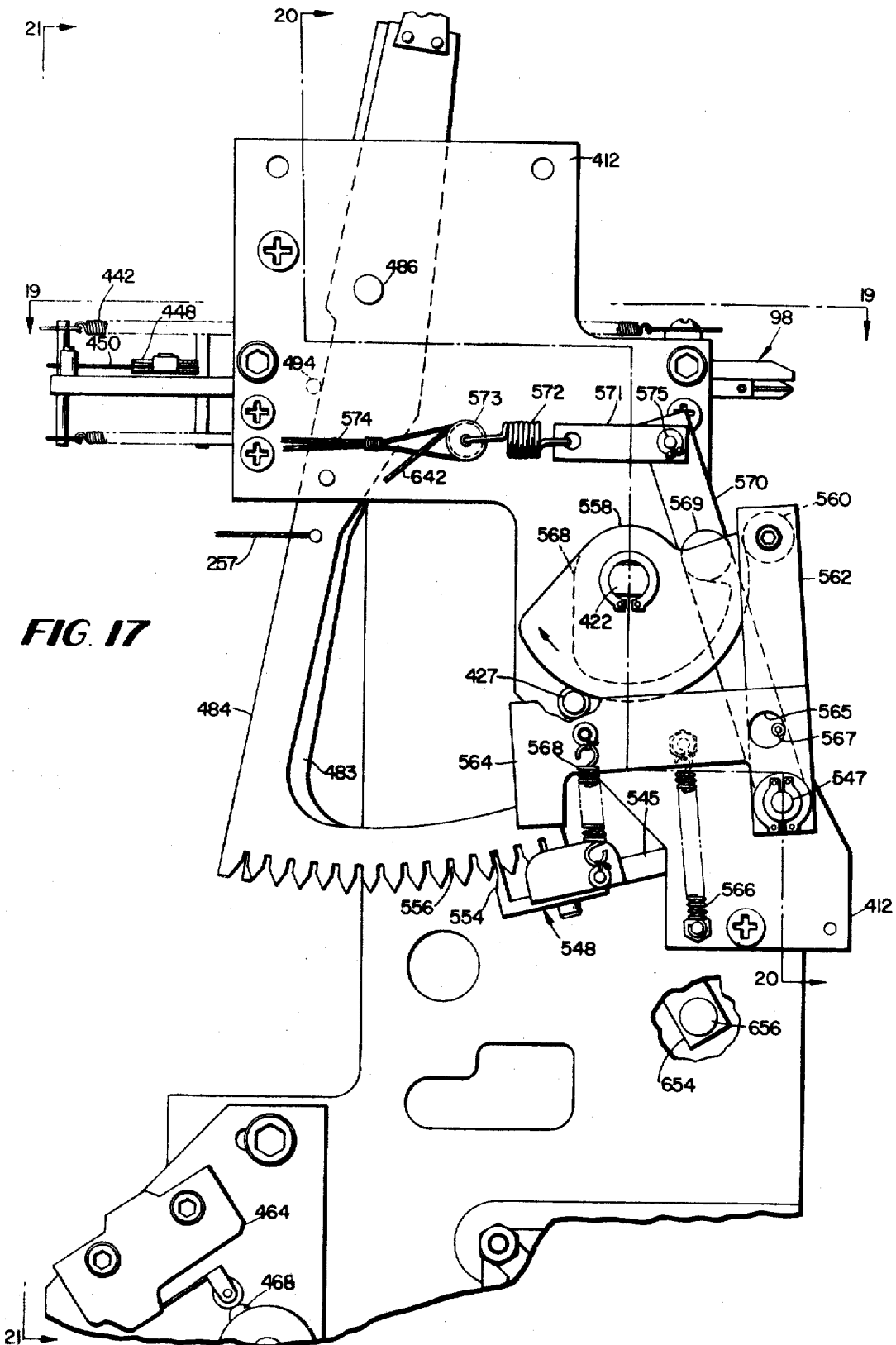


FIG 18

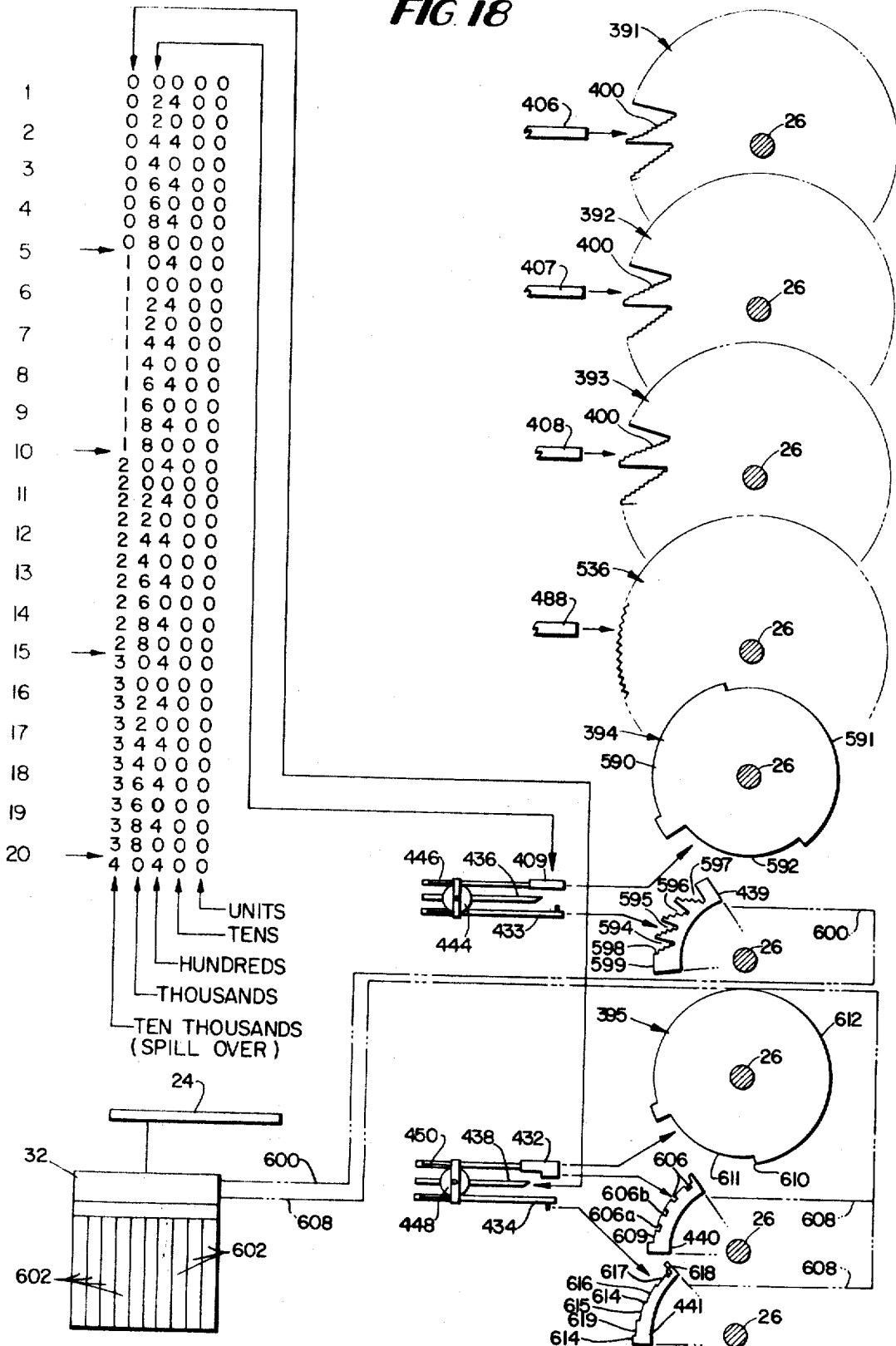


FIG. 19

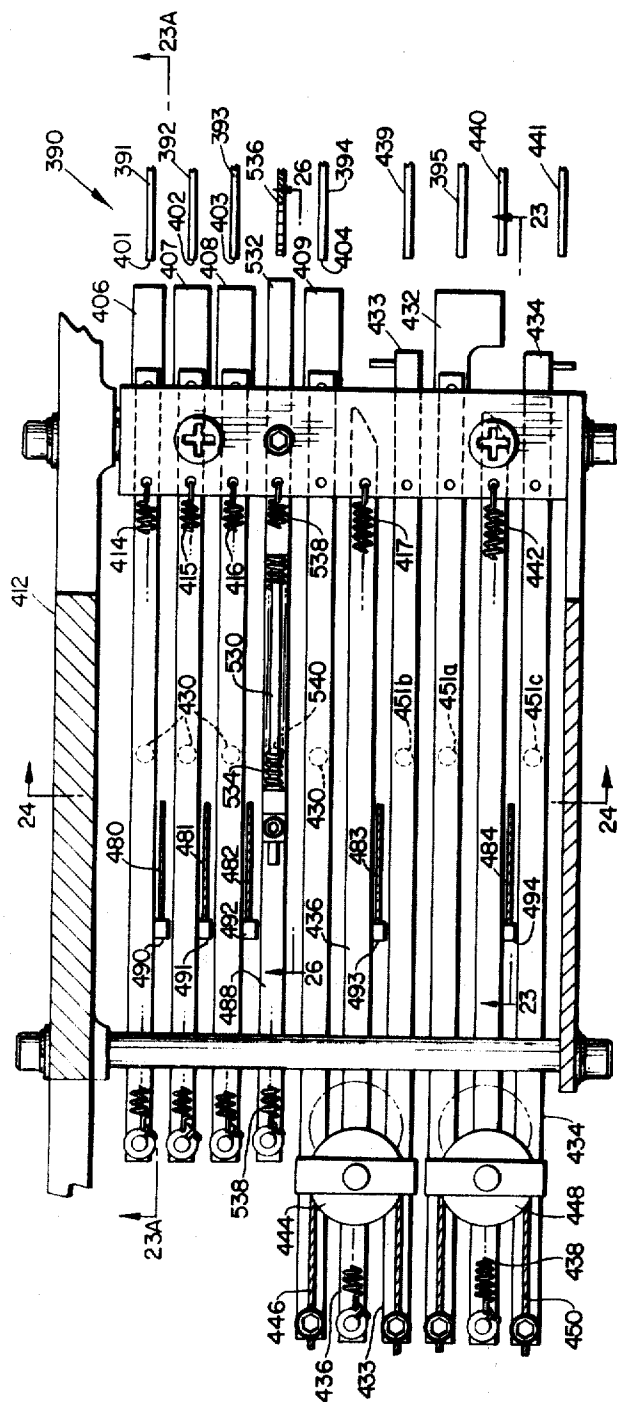
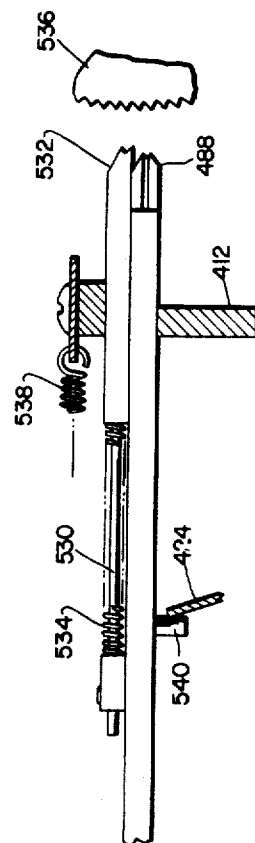


FIG. 26

FIG 20

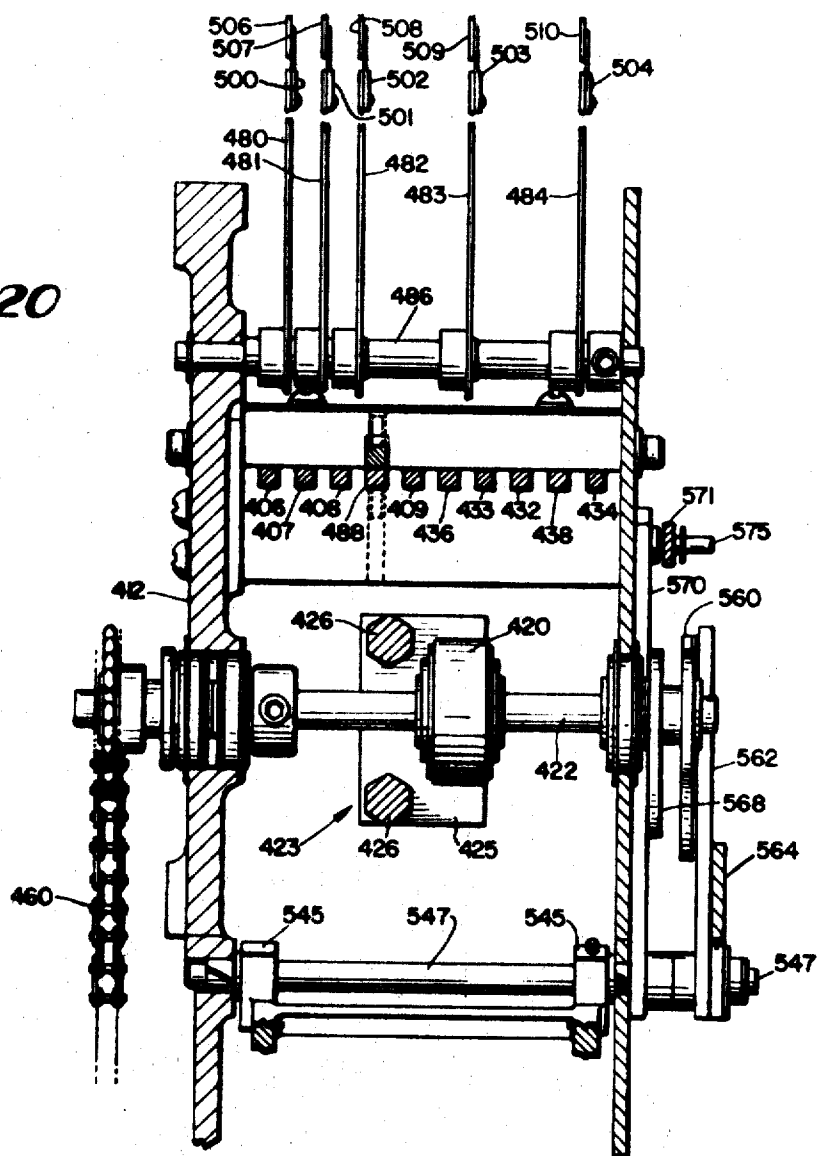


FIG 24

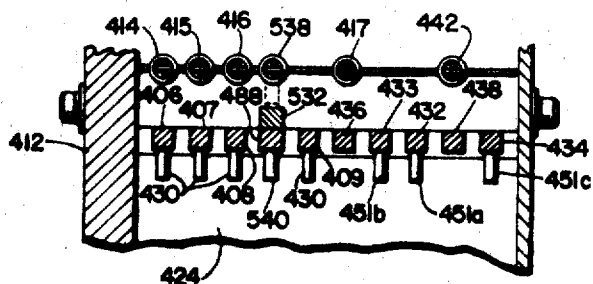


FIG 21

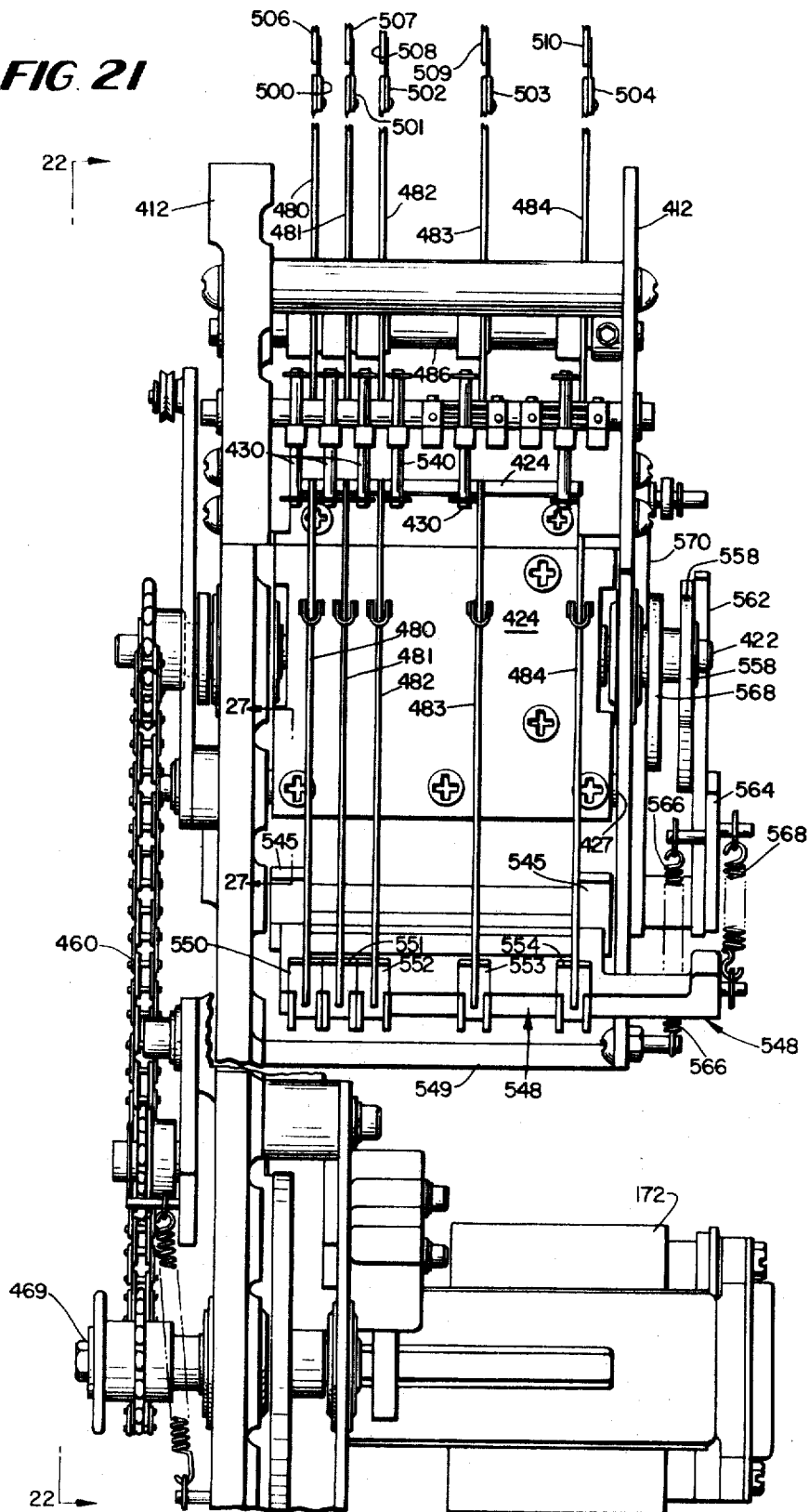
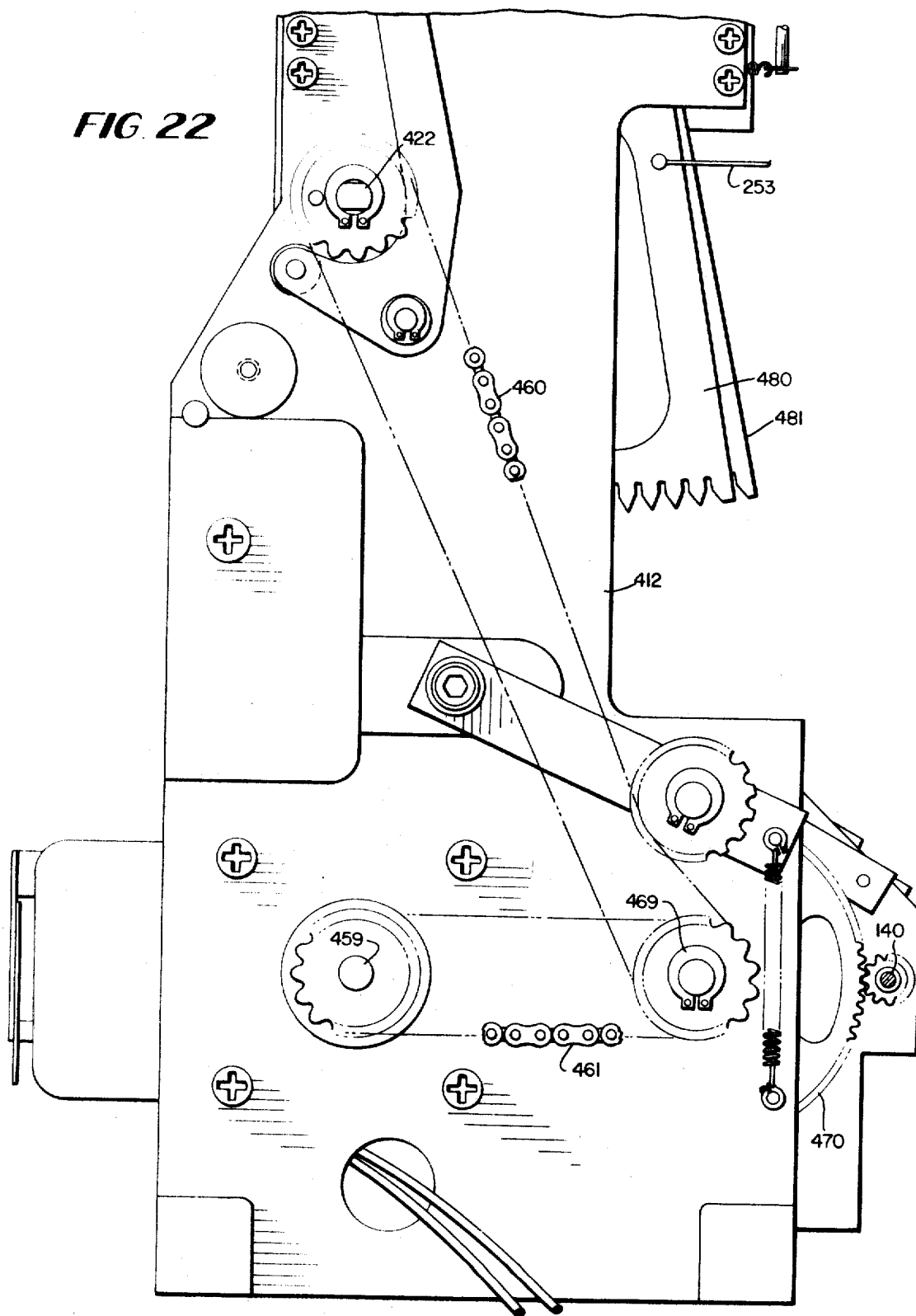


FIG 22



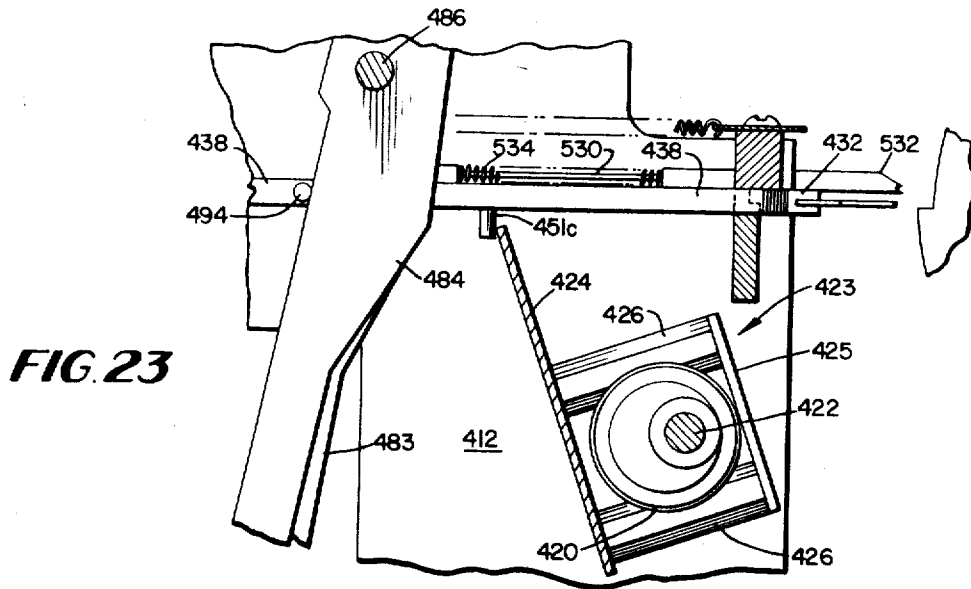


FIG. 23

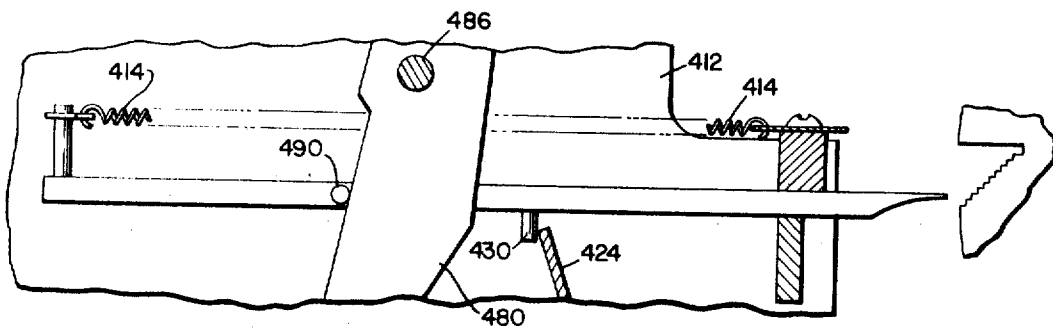


FIG. 23A

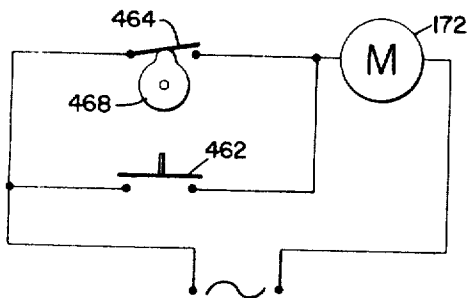


FIG. 25

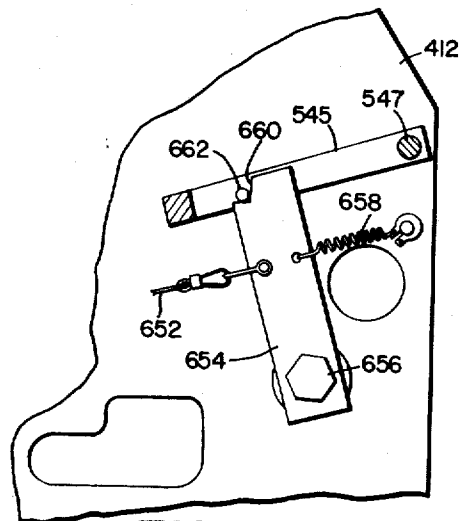


FIG. 27

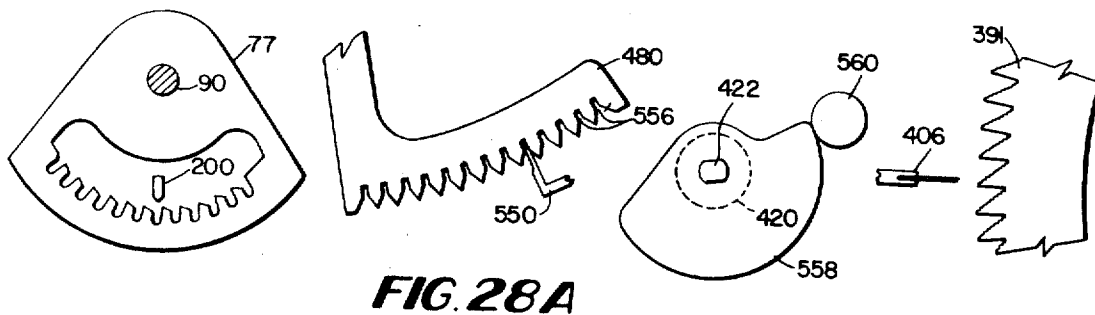
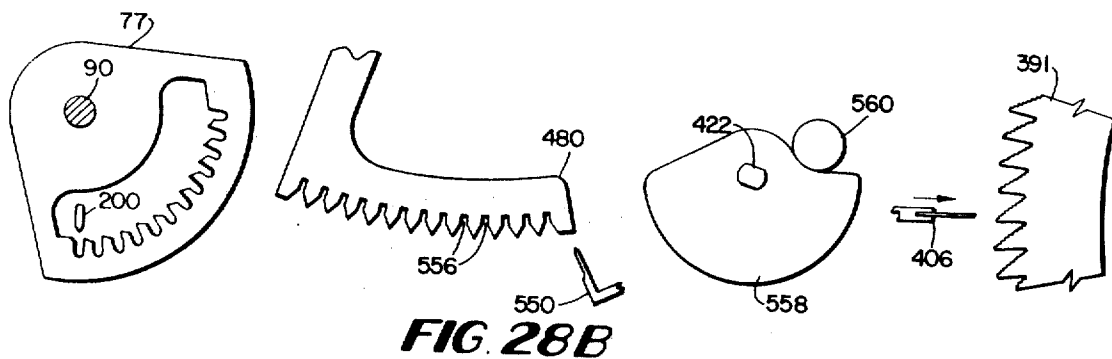
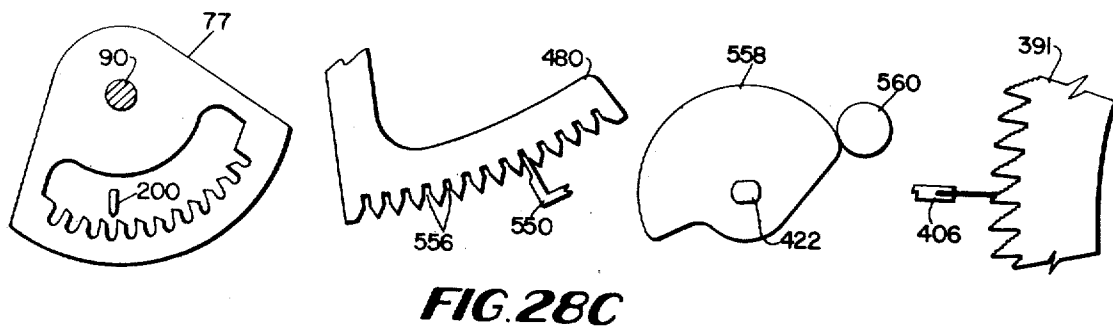
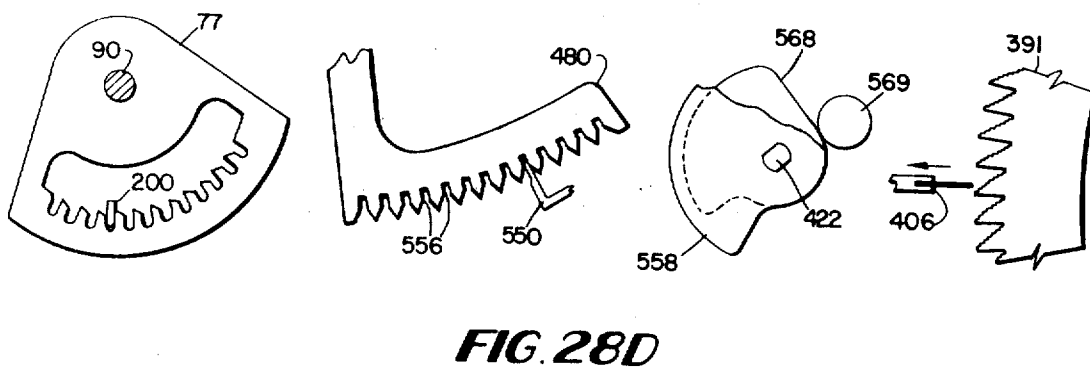


FIG. 31

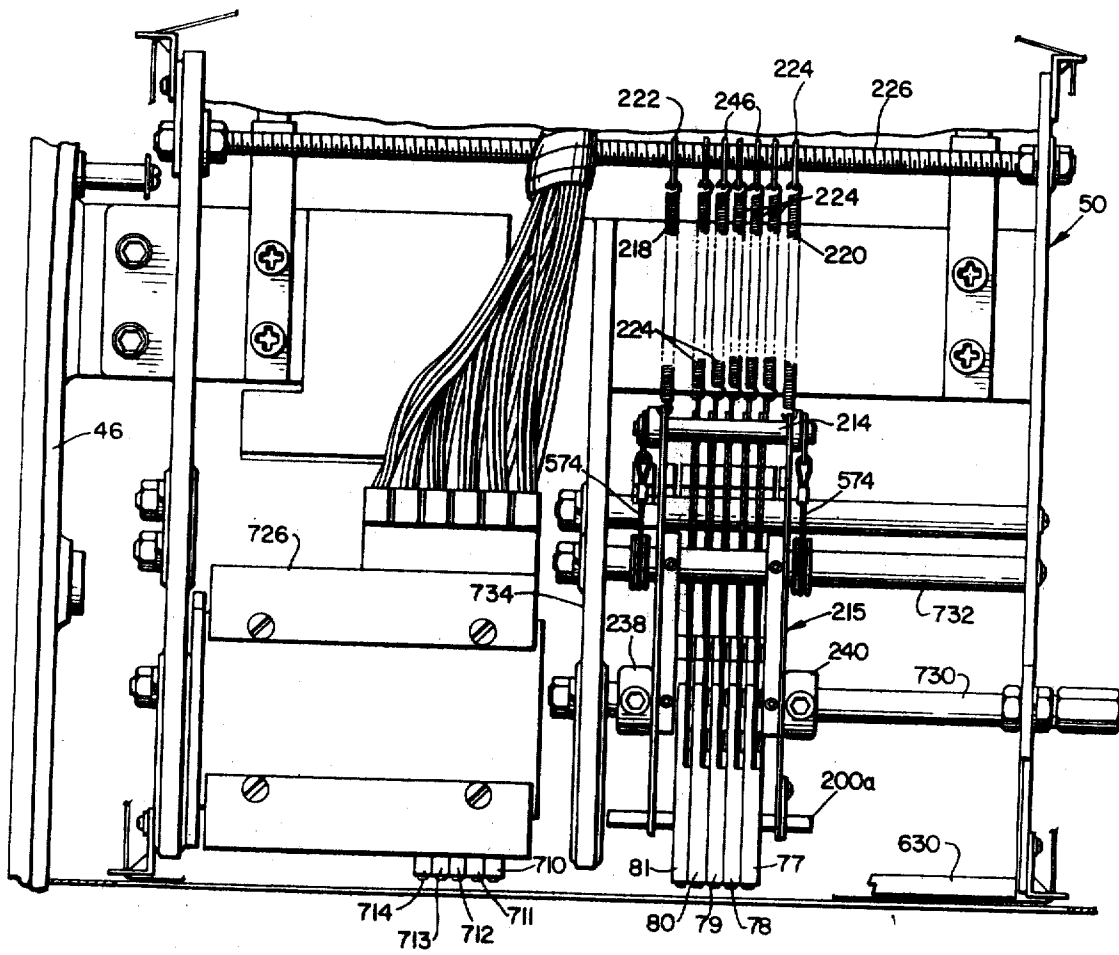


FIG. 32

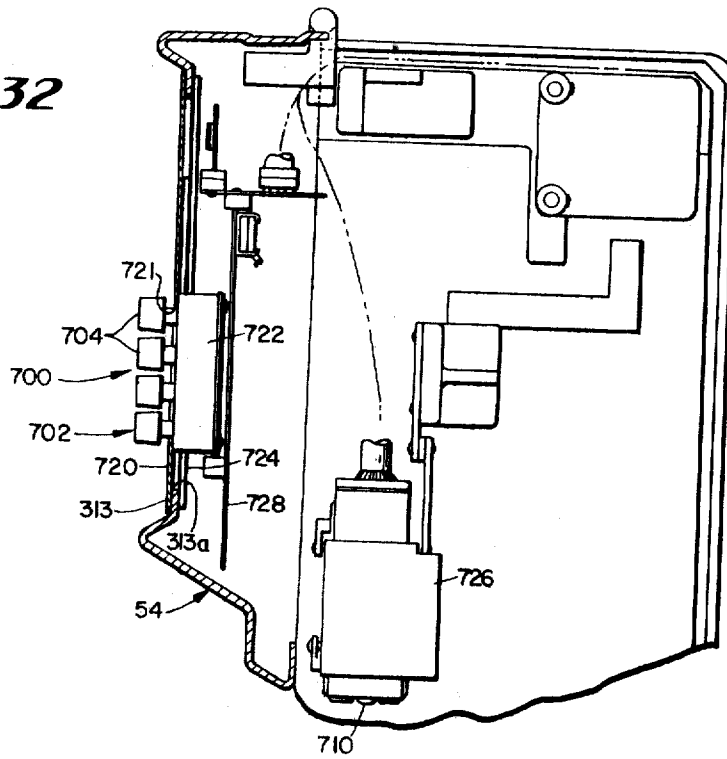
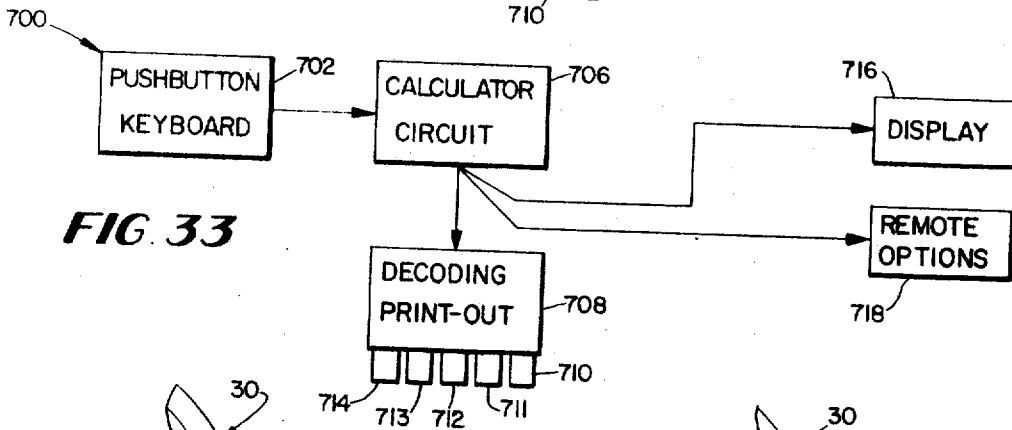


FIG. 33

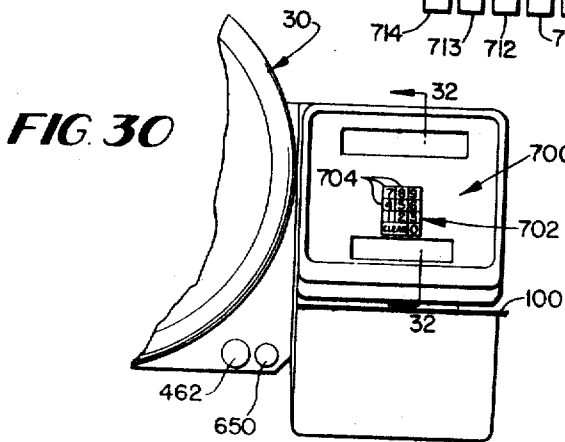
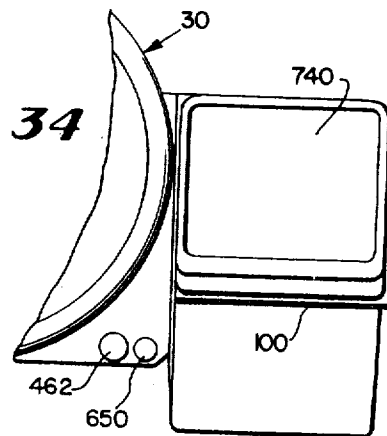


FIG. 30

FIG. 34



WEIGHING AND PRINTING APPARATUS

This is a division, of application Ser. No. 309,879, filed Nov. 27, 1972.

FIELD OF THE INVENTION

This invention relates to weighing and printing apparatus and is particularly concerned with apparatus for printing the weight of a weighed load.

BACKGROUND

Prior to this invention various weight recording systems have been proposed in which a printer is controlled by a weighing apparatus to print the weight of a load on a ticket or other record medium.

For example, dial scales may be provided with a printer as described in United States Letters Pat. No. 3,346,061 issued on Oct. 10, 1967 to G. F. Johnston, et al. for Weight Recording System. In such a weight recording apparatus, the printer is controlled by a mechanical read-out mechanism that indexes the weight representing, angular displacement of the dial indicator shaft by converting it into a digitized form of mechanical motion.

The read-out mechanism in the scale typically comprises a series of index cams and a corresponding series of indexing fingers. The index cams are non-rotatably mounted on the dial indicator scale shaft and the indexing fingers are selectively movable into engagement with the index cams. Vernier-like arrangements of steps on the index cams limit the displacement of the indexing fingers to distances that are respectively proportional to the digits in different decades of a multi-digit number that represents the weight of the weighed load. Sometimes, the digit-representing motion of the indexing fingers is mechanically transmitted to rotatably set printing type carriers to positions for printing the weight of the load. For example, gear trains have been used to transmit the motion of the indexing fingers to the type carriers.

In the foregoing arrangement it sometimes has been the practice to lock up an intermediate motion transmitting gear in each gear train for the purpose of preventing the type carriers from being inadvertently rotated away from their printing positions prior to printing the weight on a record medium. This lock-up arrangement is not satisfactory for retaining the type carriers in their correct printing positions because of play or lost motion that is introduced by the gear or gears between the locked-up gear and the type carrier. This lost-motion permits sufficient rotation of the type carrier by vibration or other forces that the digits are not fully or clearly printed.

As far as applicants are aware, prior read-out mechanisms of the foregoing type are also disadvantageous because they do not retain a mechanical memory of the weight that allows repeat printing of the weight after the load is removed from the scale.

Some prior printers have a print roller and a means for advancing the print roller along an endless path that has a portion lying in the vicinity of the type carriers. The ticket or other record medium on which information is to be printed is adapted to be inserted between the print roller and the carriers so that as the print roller advances along the above-mentioned portion of its endless path it engages the underside of the ticket and cooperates with the carriers to print information on the ticket.

Print roller arrangements of the foregoing type are disadvantageous because engagement of the print roller with the ticket sometimes causes the ticket to wrinkle and/or creep.

With the foregoing print roller arrangement it is sometimes desirable to accommodate tickets or other record mediums of different thicknesses. For example, some tickets are made up of only one sheet, while others may have two or more sheets and carbon paper between the sheets.

To accommodate tickets of different thicknesses in printers using the foregoing type of print roller, it has previously been proposed to pivotally mount the type carriers and to bias the carriers about their pivot axes by a spring. The pivotal mounting and spring bias for the type carriers adds to the cost of manufacture and complicates the mounting structure for the type carriers.

In some types of prior printers it is the practice to use a motion-transmitting cable to rotatably set each printing type carrier to its printing position. Each type carrier is customarily biased by a spring to a home position. As far as applicants are aware, prior carrier arrangements of this type do not lend themselves to the axial adjustment of type carriers because no adequate provision is made for correspondingly adjusting the biasing springs and the motion transmitting cables.

Another shortcoming of prior weighing and printing machines is the lack of a simplified, inexpensive arrangement for printing selected information, such as an identification number, along with the weight of the weighed load.

As far as applicants are aware, prior weighing and printing machines of the foregoing type do not lend themselves to certain options such as alternatively and optionally providing electrical inputs and mechanical inputs for printing selected information.

Also, as far as applicants are aware, prior printers of the type that are mounted on scale dial housings are constructed in such a manner that access to the components of the printer is generally inconvenient and sometimes difficult for the purpose of repairing or replacing the printer components.

SUMMARY AND OBJECTS OF INVENTION

A major object of this invention is to provide a novel printing apparatus.

Another major object of this invention is to provide a novel apparatus for weighing a load and for printing the weight of the weighed load.

According to one aspect of this invention, a novel housing arrangement for the printer and a novel arrangement for mounting the printer on a scale dial housing makes the printer easy to service and provides more space to house the printer components and accessories as compared with prior constructions.

In this invention, the housing for the printer mainly comprises an upper forwardly opening part that receives the printing type carriers, a front cover that selectively closes the top front of the upper part, and a lower, upwardly opening part that is disposed vertically below the upper housing part. A table for supporting a ticket or other record medium on which information is to be printed is positioned between the upper and lower housing parts.

In the preferred embodiment, a printing roller is mounted for advancement along an endless path in the

lower housing part. The table supports the ticket between the print roller and the type carriers. For a portion of its travel along its endless path, the printing roller partially extends through an opening in the ticket support table to cooperate with the type carriers for printing information on the ticket.

The cover and the upper and lower housing parts are detachably mounted on a support frame independently of each other so that each may be removed without requiring the removal of the other parts of the printer housing. The ticket table and the operative components of the printer are mounted on the support frame independently of the upper and lower housing parts so that the upper and lower housing parts may be removed without the removal of the operative printer components or the ticket table. Furthermore, the cover is hinged on the support frame so that it is swingable to an opened raised position. Thus, by removing the upper and lower housing parts and by raising the cover the operative printer components are fully exposed for inspection and servicing.

The support frame is mounted on and extends laterally from a mounting plate, and the mounting plate is detachably mounted on a vertical side face of the scale dial housing so that the printer of this invention is arranged in side-by-side relation with the scale dial. With this arrangement, the mounting interface between the printer and the dial housing is vertical, enabling the printer to be easily mounted and to be located in a position where its size is not restricted by the scale.

With the foregoing in mind, a more specific object of this invention is to provide for a novel housing assembly for a printer that is mounted on the dial housing of a dial type scale.

A further object of this invention is to provide a novel arrangement of mounting a printer on a scale dial housing.

According to another feature of this invention, a flexible sheet is positioned along the opening in the ticket support table between the table-supported record medium and the print roller below the table so that the print roller engages underside of the flexible sheet, rather than the record medium as it advances along the portion of its endless path where it cooperates with the printing type carriers to print information on the record medium. The flexible sheet may be formed from plastic and constitutes an inexpensive, simplified means for preventing the ticket or other record medium from creeping or wrinkling under the influence of the travelling print roller.

Thus, another object of this invention is to provide a novel means for preventing the ticket or other record medium from creeping or wrinkling under the influence of the travelling print roller.

The above-mentioned flexible sheet is preferable shingled through the opening in the ticket support table in such a manner that the forward marginal edge of the flexible sheet underlies the portion of the ticket support table disposed forwardly of the opening in the table and the rearward marginal edge of the flexible sheet overlies the portion of the ticket support table disposed rearwardly of the opening in the table. With this arrangement the leading edge of the ticket or other record medium cannot butt and jamb against the forward edge of the flexible sheet or the forwardly facing edge of the opening in the support table because the former is positioned below the support table and the latter is

covered by the flexible sheet. The ticket or record medium is therefore easily inserted into the printer of this invention without jamming.

Accordingly, another object of this invention is to provide a novel arrangement of the flexible sheet whereby the ticket or other record medium may be inserted into the printer without jamming against the forward edge of the flexible sheet or the forwardly facing edge of the opening in the ticket support table.

Still another object of this invention is to provide a print roller construction that accommodates tickets or other record mediums of different thicknesses.

According to the last-mentioned object, the print roller of this invention comprises a relatively rigid rim and an elastically deformably annular insert coaxially mounted in the rim. The print roller is journaled on a mounting shaft which extends coaxially through the annular insert and which is engaged by drive means, such as a chain drive, for advancing the print roller along its endless path. The elastically deformable insert permits the print roller to be yieldably and resiliently urged eccentrically of the mounting shaft by the thickness of the ticket, thereby accommodating tickets of different thicknesses. Thus, the construction of the print roller in this invention eliminates the need for pivotally mounting and spring biasing the printing type carriers as was previously done to compensate for different thicknesses of tickets.

In the printer of this invention the printing type carriers are axially adjustable along a support shaft and are each biased by a spring to a home position. Means are positioned on the carrier-biasing springs to anchor them in such a manner that the carrier-biasing springs may selectively be shifted axially of the rotational axes of the carriers to reposition them in accordance with the axially adjusted positions of the type carriers. With this construction, the carrier-biasing springs may properly be aligned with their associated carriers to bias the carriers to their home positions.

According to the preferred embodiment of this invention, each carrier-biasing spring is anchored to a threaded rod by a tab. The threaded rod freely extends through apertures in the tabs, and the carrier-biasing springs yieldably urge the tabs to seat in the roots between threads on the rod. In this manner, the threaded rod provides for the axial retention of the tabs and their associated springs in their adjusted positions along the threaded rod. The carrier-biasing springs are easily and quickly repositioned simply by lifting the tabs, by shifting them axially along the threaded rod to a new position, and then by releasing the tabs to allow them to reseat in the roots of the threaded rod. Thus, a simple and inexpensive construction is provided for selectively adjusting the carrier-biasing springs axially of the rotational axes of the axially adjustable carriers.

Accordingly, another object of this invention is to provide a novel simplified and inexpensive construction for selectively adjusting the carrier-biasing springs axially of the rotational axes of the type carriers.

The printer of this invention also provides for a novel cable retainer block for retaining motion-transmitting drive cables for the type carriers. The cable retainer block is supported for selective displacement axially of the rotational axes of the type carriers to permit the cables to be repositioned relative to the axially adjustable type carriers. The drive cables for a complete set of type carriers are therefore conveniently shiftable as a

unit axially of the rotational axes of the type carriers simply by axially shifting the cable retainer block in one direction or the other.

According to the preferred embodiment of this invention, the cable retainer block is formed with a row of through bores through which the carrier drive cables freely extend. The corresponding ends of sheaths receiving the drive cables are slidably inserted into the through bores in the cable retainer block and seat against internal stop abutment shoulders in the bores so that they cannot be axially pulled through the bores. Outwardly opening slots, which are formed in the cable retainer block, intersect the cable-receiving through bores in the retainer block to provide for the removal of the drive cables from the retainer block without disconnecting them. The width of each slot is greater than the diameter of each drive cable, but smaller than the diameter of the cable-receiving sheath. When the ends of the cable-receiving sheaths are received in the through bores in the cable retainer block, they prevent the drive cables from being removed through the slots since the sheaths cannot be pulled through the slots along with the drive cables. Thus, the cable sheaths cooperate with the cable retainer block to releasably prevent the drive cables from being removed through the slots in the retainer block. Axial withdrawal of the cable sheaths from the bores in the retainer block permits the drive cables to be slid through the slots in the retainer block, thereby freeing the cables from the retainer block.

Accordingly, another object of this invention is to provide for a novel cable retainer block for cable-driven printing type carriers in a printing apparatus.

According to a further feature of this invention, the printer is provided with a lock bar or member that is directly engageable with the printing type carriers to lock the printing type carriers against rotation from their printing positions. In the preferred embodiment of this invention, aligned openings are formed through the carriers, and corresponding edges of the openings are each formed with a row of teeth. The lock bar extends through the openings in the carriers and is selectively displaceable between a locking position where it engages between adjacent teeth on each carrier, and an unlocking position where it is disengaged from the teeth on each carrier.

Direct engagement of the lock members with the carriers to lock the type carriers against rotation assures that the type carriers are correctly positioned for printing the desired information and avoids the occurrence of any lost motion that would permit the carriers to rotate away from their printing positions. This construction for locking the type carriers in their printing positions is furthermore simplified and inexpensive.

Thus, a further object of this invention is to provide a novel arrangement for releasably locking printing type carriers against rotation from their printing positions.

Still another object of this invention is to provide for a novel hold-down bar arrangement for clamping a ticket or other record medium against the ticket support plate to prevent the ticket from being shifted from its proper printing position.

According to another feature of this invention, two sets of rotatable mounted printing type carriers are positioned along the endless path of the above-mentioned print roller so that the print roller serves both sets of

printing type carriers to print the information at the printing positions of both sets of printing type carriers in a preselected order on a ticket or other record medium. One set of printing type carriers is connected to the scale mechanism for printing the weight of the weighed load, and the carriers in the other set are adapted to selectively be set to print selected information, such as an identification number. The carriers for printing selected information other than weight may be electrically set by a pushbutton operated circuit or mechanically set by a thumb wheel arrangement.

Accordingly, a further object of this invention is to provide a novel printing apparatus having a first set of printing type carriers that is controlled by a weighing apparatus to print the weight of a weighed load and a second set of printing type carriers that are selectively set to print selected information, with both sets of printing type carriers being positioned along the endless print roller path so that the print roller serves both sets of printing type carriers.

According to the preferred embodiment of this invention, the above-mentioned thumb wheels are mounted on the casing cover and are mechanically connected to the associated carriers by motion transmitting cables. Mounted on the inside of the casing cover is a novel thumb wheel reset mechanism. According to this feature of the invention, the thumb wheels are selectively reset to their home positions by depressing a single pushbutton.

According to a further feature of this invention, an interlock mechanism permits the thumb wheel-carrying cover of the printer casing to be opened only upon resetting the thumb wheels to their home positions. If the cover of the printer casing were opened when the thumb wheels were in positions other than their home positions, undesirable strain would be applied to the drive cables and other motion transmitting parts drive connecting the thumb wheels to the type carriers. The interlocking feature of this invention avoids the application of strain by releasably locking the cover in its closed position until the thumb wheels are reset by operation of the abovementioned reset pushbutton.

Accordingly, another object of this invention is to provide a novel interlock that requires resetting of the thumb wheels before the thumb wheel-carrying cover of the printer casing can be opened.

According to still another feature of this invention, the cover of the printer casing is in the form of a frame in which the following structures may optionally and interchangeably be mounted: the previously mentioned thumb wheel selector and a mounting plate or board therefor, the previously mentioned pushbutton selector and a mounting plate or board therefor, and a blank plate or board in the event that it is optionally desired not to equip the printer for printing selected information, such as an identification number, along with the weight of the weighed load. With this construction, the casing of the printer requires no modification to accommodate the thumb wheel or other selected form of mechanical selector, the pushbutton or other selected form of electrical selector, or the deletion of such selectors from the printer mechanism. Costs of manufacturing a printer that meets selected customer requirements are therefore reduced.

In view of the foregoing, another object of this invention is to provide a novel arrangement whereby the printer may optionally be equipped with different se-

lectors for providing an input to print selected information.

When the printer of this invention is equipped with an electrical selector, it will be appreciated that the type carriers of one set are set to selected printing positions by an electrical input, while the type carriers in another set are set to printing positions by a mechanical input for printing the weight of a weighed load.

Thus, a further object of this invention is to provide for a novel printing apparatus having a first set of printing type carriers in which the carriers are set to printing positions by a mechanical input and a second set of printing type carriers in which the carriers are set to printing positions by an electrical input.

Still a further object of this invention is to provide a novel printing apparatus having a first set of printing type carriers under the control of a weighing apparatus for printing the weight of a weighed load and a second set of printing type carriers in which the carriers are set to printing positions by thumb wheels on the cover of a casing for the printer.

According to another feature of this invention, a dial scale read-out mechanism is provided with a selectively operable memory lock that mechanically retains or memorizes the weight measurement after the load has been removed from the scale and the scale mechanism has been released to enable repeat printing of the weight measurement. This is accomplished by providing for the selective operation of the mechanism that locks the output members of the read-out mechanisms in their weight-representing positions, and by a special motion transmitting connection between the indexing fingers and the displaceable output members of the read-out mechanism that permit the output members to be locked in weight-representing positions without locking the indexing fingers on the dial indicator shaft.

In this invention, the locking mechanism for the output members of the read-out mechanism may be selectively operated to retain and thereby memorize the weight-representing output of the read-out mechanism for as long as desired after the indexing fingers have been withdrawn from the index cams.

By selectively retaining the output member of the read-out mechanism in their weight-representing positions, the type carriers will be positioned to print the memorized weight. Thus, by selective, repeated operation of the printer, the memorized weight may repeatedly be printed.

Also, the output members of the read-out mechanism may be connected to a mechanical-to-electrical transducer that converts the weight-representing mechanical motion of the output members into an electrical output. Thus, when the displaceable output members of the read-out mechanism are selectively retained in their weight-representing positions, the electrical output of the transducer is also retained. This electrical output may be applied to some form of read-out device that indicates the weight of the weighed load.

With this invention, repeated printing of the weight of the weighed load is easily, conveniently and inexpensively accomplished. Also, the electrical output from the abovementioned transducer may be held as long as is desired.

With the foregoing in mind, another object of this invention is to provide a novel dial scale read-out mechanism in which a memory lock is selectively operable to

retain the weight representing output of the mechanism.

Prior to this invention multi-range weight mechanisms have been utilized in dial type and other scales for increasing the capacity of the scale without reducing the sensitivity of the scale and without reducing the resolution of the graduations on the scale dial. The multi-range weight mechanism has so-called range or drop weights that are selectively placed on the weigh beam in counterbalancing relation to the load being weighed. In this manner, the scale dial pointer moves over the same dial region in the various weight ranges that are determined by the range weights.

In the apparatus of this invention, the net weight range registered on the scale dial is somewhat greater than the weight range provided by each range weight. For example, the net dial weight range may be 2,400 pounds and the incremental range change provided by each range weight may be only 2,000 pounds. Therefore, the weight range on the dial overlaps the next higher weight range that is obtained by applying a range weight to the weigh beam.

In the foregoing example the overlap is 400 pounds. For weights of weighed loads falling within the overlapping portions of the successive ranges, the novel dial scale readout mechanism of this invention is equipped to set the appropriate printing type carrier or carriers to proper printing positions when the range weight is either applied or not applied. In brief, this is accomplished by a novel indexing finger assembly that coacts with cams which are driven by the dial scale indicator shaft and with additional cams that are driven by the multi-range weight mechanism.

Accordingly, a further object of this invention is to provide a multi-range dial scale and printing apparatus with a novel read-out mechanism for setting the printing type carriers to their printing positions for printing the weight of the weighed load.

DESCRIPTION OF DRAWINGS

FIG. 1 is a partially schematic, front elevation of a dial scale and printing apparatus incorporating the principles of this invention;

FIG. 2 is a fragmentary side elevation of the dial scale and printing apparatus shown in FIG. 1;

FIG. 3 is an enlargement of a portion of the apparatus shown in FIG. 1 and illustrating the structure for mounting the printer on the dial scale housing;

FIG. 4 is an enlarged, fragmentary rear elevation of the dial scale shown in FIG. 1 and with the back plate of the dial scale housing removed to illustrate internal components of the mechanism;

FIG. 5 is a fragmentary front elevation of the printer shown in FIG. 1 with the cover of the printer housing raised to its opened position;

FIG. 6 is a section taken substantially along lines 6—6 of FIG. 1 and also of FIG. 5;

FIG. 7 is a section taken substantially along lines 7—7 of FIG. 1;

FIG. 8 is a section taken substantially along lines 8—8 of FIG. 2;

FIG. 9 is a section taken substantially along lines 9—9 of FIG. 8;

FIG. 9A is a section taken substantially along lines 9A—9A of FIG. 9;

FIG. 10 is a section taken substantially along lines 10—10 of FIG. 5;

FIG. 11 is a section taken substantially along lines 11—11 of FIG. 5;

FIG. 12 is a section taken substantially along lines 12—12 of FIG. 6;

FIG. 13 is a section taken substantially along lines 13—13 of FIG. 6 and illustrating one of the cable retainer blocks with the cables removed;

FIG. 14 is a section taken substantially along lines 14—14 of FIG. 12;

FIG. 15 is a section taken substantially along lines 15—15 of FIG. 1;

FIG. 16 is a section taken substantially along lines 16—16 of FIG. 2;

FIG. 17 is a fragmentary enlargement of the left-hand portion of the dial mechanism shown in FIG. 4;

FIG. 18 is a schematic view of the cam and indexing finger elements in the read-out mechanism shown in FIGS. 4 and 17;

FIG. 19 is a section taken substantially along lines 19—19 of FIG. 17;

FIG. 20 is a section taken substantially along lines 20—20 of FIG. 17;

FIG. 21 is a section taken substantially along lines 21—21 of FIG. 4;

FIG. 22 is a section taken substantially along lines 22—22 of FIG. 21;

FIG. 23 is a section taken substantially along lines 23—23 of FIG. 19;

FIG. 24 is a section taken substantially along lines 24—24 of FIG. 19;

FIG. 23A is a section taken substantially along lines 23A—23A of FIG. 19;

FIG. 25 is a schematic diagram of the motor-control circuit for the scale and printing apparatus shown in FIG. 1;

FIG. 26 is a section taken substantially along lines 26—26 of FIG. 19;

FIG. 27 is a fragmentary section taken substantially along lines 27—27 of FIG. 21;

FIGS. 28A, 28B, 28C and 28D are schematic views illustrating the sequences of operation of various components of the scale and printer apparatus of FIG. 1;

FIG. 29 is a fragmentary perspective view illustrating the ticket hold-down bar arrangement shown in FIGS. 5 and 6;

FIG. 30 is a fragmentary front elevation of the previously illustrated scale and printing apparatus, but with the mechanical thumb wheel selector of FIG. 1 replaced with an electrical push button selector;

FIG. 31 is an elevation of the printer shown in FIG. 30, with the cover of the printer housing raised to its open position similar to FIG. 5;

FIG. 32 is a section taken substantially along lines 32—32 of FIG. 31;

FIG. 33 is a schematic view of the circuit for the electrical push button selector shown in FIGS. 30—32; and

FIG. 34 is another fragmentary front elevation of the scale and printing apparatus of FIG. 1, but with both the mechanical and the electrical selectors removed and replaced by a blank panel.

DETAILED DESCRIPTION

Referring to the drawings and more particularly to FIGS. 1 and 2, the weighing and printing apparatus incorporating the principles of this invention is generally indicated by the reference numeral 20. Apparatus 20

comprises a dial scale 21 and a printer 22. Scale 21 may be of the multi-range weight type.

Scale 21 has a horizontal, load-receiving platform 23 that is connected to a fulcrumed balanced beam 24. Beam 24 is connected by a suitable motion transmitting linkage 25 to a rotatably mounted dial indicator shaft 26. Shaft 26 non-rotatably carries a dial pointer 28 in a dial head 30. Pointer 28 cooperates with a dial or chart 31 in head 30 for indicating the weight of a load placed on platform 23. A multi-range or drop weight assembly 32 is suspended from beam 24 in the usual manner. Beam 24 is pivotally mounted on a rigid base structure 33 by any suitable means such as a knife edge and load-bearing assembly 34.

The scale mechanism thus far described is of conventional form. It will be appreciated that forms of load-receiving structures other than a platform may be used.

Although the preferred embodiment incorporates a multi-range weight dial scale and a printer, it will become apparent as the description proceeds, that certain features of this invention pertain to the printer alone, other features pertain to the combination of the printer and any suitable form of weighing apparatus, and still other features pertain to the combination of the printer and a dial scale mechanism that does not necessarily incorporate a drop weight assembly.

As shown in FIGS. 1 and 3, dial head 30 comprises a housing 40 that is integrally formed with a side mounting boss 42 for printer 22. Boss 42 extends laterally from an arcuate wall 43 of housing 40 and terminates in a vertical, flat mounting surface 44 that faces laterally away from the dial head. Wall 43 extends circumferentially around dial 31 between the front and back faces of the dial head.

A vertical mounting plate 46 is seated against surface 42 and is rigidly, detachably fixed to boss portion 40 by machine screws or other suitable means. A series of rigid, horizontally extending structural support arms 48 (FIG. 5) are rigidly fixed to mounting plate 46. Support arms 48 extend laterally from the side of plate 46 that faces laterally away from housing 40. Support arms 48 form a part of a support frame 50 for mounting components of printer 22. The interface between plate 46 and boss 42 lies in a vertical plane that is parallel to and spaced laterally apart from the rotational axis of shaft 26.

As shown in FIGS. 1, 2 and 6, the housing or casing assembly for printer 22 is designated at 52. Housing 52 comprises an upper hollow casing or housing part 53, a hinged, front cover 54 and a lower hollow casing or housing part 56. Parts 53 and 56 and cover 54 are formed separately of each other and they may be fabricated from suitable material such as plastics. The front, bottom and right side of casing part 53 are open. Part 56 opens upwardly and is also open at its right side. Cover 54 selectively closes the open front of casing part 53. The open right-hand sides of parts 53 and 56 are closed by plate 46.

Casing part 56 is vertically below part 53 so that the open bottom of part 53 is in registry with the open top of part 56. Parts 53 and 56 and cover 54 are detachably mounted independently of each other on frame 50 by any suitable means. Thus, part 53 may be removed independently of part 56 and cover 54, part 56 may be removed independently of part 53 and cover 54, and cover 54 may be removed independently of parts 53 and 56.

A pair of hinges 57 (see FIGS. 5 and 6), extending along the top wall of the casing assembly, mounts cover 54 on the topmost support arm 48 for pivotal or swinging movement about a horizontal axis. The pivot axis of cover 54 is normal to surface 44.

From its lowered, closed position, cover 54 is swingable upwardly to a raised, open position as shown in FIG. 5. Casing assembly 52 is supported laterally to one side of dial head 30 so that housing 52 and dial 31 are arranged in side-by-side relation.

Casing part 53 has a top wall, a rear wall, and a side wall on its left side. Casing part 56 has spaced front and back walls, a bottom wall, and a side wall on its left side.

From the foregoing description it will be appreciated that the interfacing between dial housing 40 and printer 22 is along a vertical plane that is parallel to and spaced laterally to one side of the horizontal axis of dial indicator shaft 26. This mounting arrangement enables the printer to be easily mounted in place. Furthermore, the size of the printer is not restricted by the cabinet of the scale that houses beam 24.

Referring to FIG. 5, printer 22 comprises a set of sector type printing type carriers 77, 78, 79, 80 and 81. Raised numbers are positioned on the periphery of each of the carriers 77-81 for printing a five-digit number. Carriers 77-81 are received in casing part 53 and are rotatably mounted on a common horizontal support shaft 90 which is non-rotatably mounted on frame 50. The axis of shaft 90, about which carriers 77-81 are rotatable, is horizontal, normally intersects a plane containing boss surface 44, and is contained in a vertical plane that perpendicularly intersects the rotational axis of dial shaft 26. Any desired number of type carriers may be included in printer 22 depending upon the number of decades in the number to be printed.

As will be described in detail later on, a weight read-out mechanism 98 (FIG. 4) is operatively connected to shaft 26. Mechanism 98 translates the weight registered by the scale into information for rotatably positioning or indexing carriers 77-81.

It will be appreciated that the angular magnitude through which shaft 26 is rotated is proportional to the weight of the load on platform 23. This weight-representing analog motion of shaft 26 together with the weight-represented by any range weights applied to beam 24 is converted by mechanism 98 into a series of mechanical outputs, each corresponding to a different order in a multi-digit number to be printed by printer 22. The mechanical outputs of mechanism 98 are transmitted mechanically to the type carriers 77-81 of corresponding order in such a manner that carriers 77-81 will be positioned to print the weight of the load on platform 23. Carriers 77-81 are arranged to print numbers in successively ascending orders such as units, tens, hundreds, and so on.

Printer 22 is constructed in such a manner that a set of selectively operated type carriers 82, 83, 84, 85, 86 and 87 may optionally be included in the printer mechanism. Carriers 82-87 are of the same construction as carriers 77-81 and are used to print a selected identification number on a ticket or other record medium.

As shown in FIG. 5, carriers 82-87 are received in casing part 53 and are rotatably mounted on shaft 90. The two sets of carriers 77-81 and 82-87 are in side-by-side relation and are spaced axially apart by a collar

88. Collar 88 is coaxially mounted on shaft 90 and is fixed thereto by an allen head screw 89.

The mechanism for selectively setting carriers 82-86 to print a selected number will be described later on. It will be appreciated that any desired number of type carriers may be included in this second set of carriers, depending upon the number to be printed.

Referring to FIGS. 6-8, type carriers 77-87 are supported vertically above a rectangular opening 99 in a horizontal, flat sided ticket support plate 100. Plate 100 is mounted directly on frame 50 to support a ticket, card, or other record medium on which the weight and other information is to be printed. The ticket is indicated at 101 in FIGS. 6 and 9. Plate 100 is disposed horizontally between casing parts 53 and 56 and covers the open top of casing part 56. A forwardly opening slot 102 (FIG. 6) for receiving the ticket or other record medium is defined between plate 100 and bottom of cover 54. Ticket 101 is insertable into slot 102 from a position disposed forwardly of the printer.

As shown in FIG. 5, a type ribbon mechanism 104 is mounted on frame 50 in the casing part 53 and comprises a type ribbon 106 that is wound around drive and idler spools 108 and 110. Ribbon 106 is trained over guides in such a manner that it has a horizontal portion (see FIG. 8) extending through slot 102 vertically below carriers 76-87.

As best shown in FIGS. 7 and 8, a print roller and drive mechanism 120 is mounted on a support bracket or arm 121 in casing part 56. Arm 121 is rigidly fixed to and extends laterally from plate 46.

Referring to FIGS. 7-9, mechanism 120 comprises a print roller 122. Roller 122 is rotatably mounted on horizontal shaft 126 between a pair of chain links 128 and 130. Links 128 and 130 are rotatably mounted on reduced diametered end sections of shaft 126.

Links 128 and 130 respectively form parts of a pair of endless drive chains 132 and 134. Chain 132 is trained about a pair of spaced apart sprocket wheels 136 and 137, and chain 134 is similarly trained about a pair of spaced apart sprocket wheels 138 and 139.

Sprocket wheels 136 and 138 are non-rotatably coaxially mounted on a drive shaft 140. Sprocket wheels 137 and 139 are coaxially mounted on an idler shaft 142. The axes of shafts 140 and 142 are horizontal, are parallel with each other, and are contained in vertical planes that normally intersect the longitudinal axis of shaft 90.

Shafts 140 and 142 are rotatably supported on opposite ends of a pair of parallel spaced apart print roller guide rails 144 and 146. Guide rails 144 and 146 are rigidly mounted on arm 121 by a pair of bracket and nut and bolt assemblies 148 and 150.

Guide rails 144 and 146 are coextensive and have top, flat, horizontal edge surfaces 152 and 154. Edge surfaces 152 and 154 are contained in a common horizontal plane that is parallel to a horizontal plane containing the rotational axes of shafts 140 and 142.

Roller 122 is mounted on shaft 126 between a pair of annular wheels 156 and 158. Wheels 156 and 158 are in rolling engagement with edge surfaces 152 and 154 respectively and are non-rotatably, coaxially fixed on shaft 126.

As shown in FIG. 9, a sleeve bearing 160 for journaling roller 122 on shaft 126 is coaxially mounted on shaft 126 and is axially confined between wheels 156 and 158. Each of the links 128 and 130 is axially con-

finished between a thrust washer assembly 162 and a lock ring 163. Wheel 156 is axially between one of the washer assemblies 162 and bearing 160, and wheel 158 is axially between the other washer assembly 162 and bearing 160.

Still referring to FIG. 9, roller 122 has a rigid rim 164 and an annular elastically deformable insert 166. Rim 164 is preferably formed from a plastics material such as nylon. Insert 166, which is coaxially received in and fixed to rim 164, is formed from an elastically and resiliently deformable material such as rubber. Insert 166 may be bonded to the internal, cylindrically smooth periphery of rim 164.

Shaft 126 coaxially extends through bearing 160, and bearing 160 coaxially extends through the hole in insert 166.

A pinion 170 is non-rotatably mounted on shaft 140 and is drive connected to an electric motor 172 (FIG. 4) by means to be described later on. Advancement roller 122 along its endless path is coordinated with the operation of printer 22 and read-out mechanism 98 in a manner to be described later on. Because of the arrangement of rails 144 and 146, the upper leg of the path in which roller 122 is advanced is horizontal and is vertically below carriers 77-87.

During advancement along this upper leg of its endless path, roller 122 extends partially through opening 99 to exert a force that compresses the ticket or other record medium between ribbon 106 and a flexible, clear, smooth plastic sheet 180. Sheet 180 is carried by plate 100 and overlies roller 122 in the region of opening 99. The ticket or record medium, when inserted into slot 102, overlies sheet 180 and underlies the horizontal portion of ribbon 106. Advancement of roller 122 along the upper horizontal leg of its endless path therefore causes the numbers set up on carriers 76-87 to be printed on the ticket.

The thicknesses of different types of tickets or other record mediums may vary. For example, the ticket may be a single copy or it may be a thicker, multiple copy having two or more recording sheets and carbon paper between adjacent sheets. When a print roller, such as roller 122, is used, it is important to compensate for tickets of different thicknesses. Without such compensation, a printer capable of receiving a relatively thick ticket may print too lightly on a relatively thin ticket. By the same token, a printer capable of printing satisfactorily on a relatively thin ticket, may print too heavily on a relatively thick ticket, or it may not be possible to insert the relatively thick ticket between the type carriers and the print roller.

The previously described construction of print roller 122 accommodates tickets or other record mediums of different thicknesses in the following manner.

Insert 166, being of elastically deformable material, normally biases rim 164 to a position where it is concentric with the axis of shaft 126. Being deformable, insert 166 allows rim 164 to move eccentrically of the axis of shaft 126 under the influence of radial pressure or force. When roller 122 is in the upper horizontal leg of its endless travel path and when rim 164 is concentric with the axis of shaft 126, the vertical spacing between rim 164 and carriers 77-87 will be less than the combined thickness of sheet 180 and any ticket to be used in the printer. Thus, when rim 164 engages the underside of sheet 180, the combined thickness of sheet 180 and ticket 101 exerts a radial pressure or force on

rim 164, causing insert 166 to deform, and this deformation of insert 166 enables rim 164 to be shifted downwardly and eccentrically of the axis of shaft 126 by a magnitude that is determined by the thickness of ticket 101. The eccentric movement of rim 164 that is caused by the combined thickness of sheet 180 and ticket 101 is illustrated in FIG. 9A.

It will be appreciated that deformation of insert 166 and eccentric movement of rim 164 will be caused by the combined thickness of sheet 180 and ticket 101 because carriers 77-87 cannot move upwardly.

After roller 122 has travelled beyond sheet 180 and ticket 101, the radial pressure on rim 164 is relieved, allowing insert 166 to resume its relaxed undeformed configuration where it yieldably urges rim 164 into concentricity with the axis of shaft 126. Thus, tickets having a wide range of thicknesses may be used in the printer of this invention by virtue of the construction of roller 122.

In this invention, roller 122, instead of engaging the underside of the inserted ticket or other record medium, engages and rolls along the underside of sheet 180 because the inserted ticket overlies sheet 180. Sheet 180 thus prevents the inserted ticket from wrinkling or creeping under the influence of the travelling print roller 122.

As shown in FIG. 9, sheet 180 lies in and extends at both ends beyond aperture 99 to provide a ticket support surface that keeps the ticket from sagging into aperture 99.

Sheet 180 is preferably shingled through opening 99 in such a manner that its forwardly facing edge underlies plate 100 in a region disposed forwardly of opening 99 and its rearwardly facing edge overlies the region of plate 100 behind aperture 99. Thus, sheet 180 extends through opening 99 and provides a smooth and slightly curved upwardly facing surface that overlies the forwardly facing edge of aperture 99 for guiding the inserted ticket or other record medium smoothly into its printing position in slot 102.

The leading edge of the ticket inserted into slot 102 cannot butt or jamb against the forwardly facing edge of aperture 99 or the forwardly facing edge of sheet 180 because the former is covered by sheet 180 and the latter is on the underside of table 100. Sheet 180 may be fixed to plate 100 by any suitable means such as adhesive.

Referring to FIG. 5, the assembly of carriers 77-87 is axially confined between a pair of parallel, spaced apart, vertically extending plates 196 and 198. Plates 196 and 198 are slidably mounted on shaft 90 and on a further shaft 199 for a purpose to be described shortly. Shaft 199 is non-rotatably mounted on frame 50. Allen head screws 195 fixed plates 196 and 198 to shafts 90 and 199 in axially adjusted positions. Abutment of carriers 87 and 77 with plates 196 and 198 respectively confine carriers 77-87 against axial displacement along shaft 90.

As shown in FIGS. 5, 8 and 10, an alignment or lock bar 200 is vertically displaceable for locking carriers 77-87 in their printing positions. Bar 200 is fixed at opposite ends to a pair of parallel, spaced apart, vertically extending support plates 202 and 204. The assembly of carriers 77-87 and plates 196 and 198 is disposed axially between plates 202 and 204.

Referring to FIGS. 6 and 11, shaft 20 extends through aligned apertures 206 and 208 in plates 202

and 204 respectively, and shaft 199 extends through aligned apertures 210 and 212 in plates 202 and 204 respectively. Plates 202 and 204 are mounted on a rod 214 (FIG. 5) that extends through the upper ends of plates 202 and 204. Rod 214 and plates 202 and 204 form a frame 215 for supporting lock bar 200. Apertures 206, 208, 210 and 212 are vertically elongated to allow for guided vertical displacement of frame 215 and lock bar 200 perpendicularly of shafts 90 and 199. Displacement of the assembly of frame 215 and lock bar 200 is confined to a vertical path by engagement of shaft 199 with the straight side edges of apertures 210 and 212 and engagement of shaft 90 with the straight side edges of apertures 206 and 208.

To bias lock bar 200 to an unlocking position, the lower ends of a pair of coiled springs 218 and 220 (FIG. 5) are respectively secured to the upper ends of plates 202 and 204. The upper ends of springs 218 and 220 are respectively anchored to tabs 222 and 224. A horizontal, threaded rod 226 extends through aligned apertures in tabs 222 and 224. Rod 226 is fixed on frame 50. The axis of rod 226 is parallel to the axes of shafts 90 and 199. The assembly of frame 215 and lock bar 200 is thus yieldably supported from rod 226 by springs 218 and 220. Springs 218 and 220 bias lock bar 200 to a raised, unlocking position.

As shown in FIGS. 5, 8 and 10, lock bar 200 spans the space between plates 202 and 204 and extends freely through enlarged, arcuately elongated apertures 230 (FIG. 10) in carriers 77-87. The upwardly facing bottom edge of each aperture 230 is formed with a circumferentially extending row of radially inwardly protruding teeth 231 to define a series of circumferentially spaced apart, radially inwardly opening grooves 232.

Lock bar 200 is formed with a downwardly facing knife edge 234 which is adapted to seat in one of the grooves 232 in each aperture 230 to lock each of the carriers 77-87 in its printing position. The grooves 232 in each carrier are properly located to lock the type carrier in its different printing positions.

After either or both sets of carriers 77-81 and 82-87 are rotated to their printing positions, the assembly of frame 215 and lock bar 200 is pulled vertically downwardly against the bias of springs 218 and 220 to seat lock bar 200 in those grooves 232 that align with the lock bar. By seating bar 200 in the aligning ones of grooves 232, carriers 77-87 are locked against rotation from their printing positions.

Thus, lock bar 200 prevents carriers 77-87 from being inadvertently or accidentally rotated away from their printing position before printing occurs. Also, if any of the carriers 77-87 have not been precisely rotated to the desired printing position, the engagement of knife edge 234 with teeth 231 will cause the type carrier to rotate to its proper printing position where knife edge 234 fully seats in the selected groove 232.

Thus, carriers 77-87 are locked against rotation from their printing position by direct engagement with lock bar 200. As a result, no lost motion or play exists between lock bar 200 and carriers 77-87.

After printing, the assembly of frame 215 and lock bar 200 is released, allowing springs 218 and 220 to bias the assembly frame 215 and bar 200 upwardly to position bar 200 in its raised, unlocked position where it is raised above teeth 231. The manner in which the assembly of frame 215 and bar 200 is displaced be-

tween the locking and unlocking positions will be explained in detail later on.

As shown in FIG. 5, collars 238 and 240 are fixed to shaft 90 by allen head screws indicated at 242. Plate 202 is confined against axial displacement between collar 238 and plate 196, and plate 204 is confined against axial displacement between collar 240 and plate 198.

Referring to FIGS. 5 and 10, each of the carriers 76-87 is independently biased by a coiled, carrier return spring 244 to a home position. The lower ends of springs 244 are respectively secured by cables 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, and 263 (see FIGS. 8 and 12) to carriers 77-87. The upper end of each spring 244 is secured to a tab 246. Rod 226 extends through an aperture in each tab 246 to thus mount tabs 246. Carriers 77-87 are therefore independently biased in counterclockwise direction as viewed from FIG. 10. Tabs 246 are sufficiently thin to seat in the roots between threads on rod 226. Likewise tabs 222 and 224 are also sufficiently thin to seat in the roots between threads on rod 226. Tabs 222, 224 and 246 are biased into the roots on rod 226 by springs 218, 220 and 244 respectively.

Carriers 77-87 are formed with drum portions 250. Cables 253-263 are trained partially around and anchored to the drum portions of their respective carriers 77-87. Slugs 267 (FIGS. 10 and 11) may be used to anchor the cables to the drum portion of carriers 77-87. The ends of cables 253-257 remote from springs 244 are operatively connected to readout mechanism 98 in a manner to be described in detail later on. The ends of cables 258-263 remote from springs 244 are operatively connected to a thumb wheel selector as will be described in detail later on. Rotation of each carrier 77-87 to its printing position is against the bias of its spring 244. Each of the cables 253-263 extends through sheath 266.

As shown in FIGS. 12 and 13, two cable retainer blocks 268 and 270 are provided for, one for cables 252-257 and the other for cables 258-263. Blocks 268 and 270 are mounted side-by-side on a horizontal shaft 272. Shaft 272 is fixed on frame 50 rearwardly of shaft 90 and at a level slightly above carriers 77-87. The axis of shaft 272 is parallel to the axis of shaft 90.

Block 268 is formed with a pair of spaced apart ears 274 and 276 extending from a cable-retaining, body portion 278. Ears 274 and 276 formed with axially aligned through bores 280 that slidably and coaxially receive shaft 272. Set screws 282 fix block 268 on shaft 272. Screws 282 may be loosened to permit block 268 to be axially shifted along shaft 272 and also to permit block 268 to be rotated about shaft 272. In this manner, block 268 may selectively be axially and rotatably adjusted to a desired position.

As best shown in FIGS. 13 and 14, block portion 278 is formed with a series of narrow, parallel spaced apart slots 284. At one end, each slot 284 opens at an exterior face of block 268. At its inner end, each slot 284 is bored out to form a cylindrically smooth bore 286. Each bore 286 extends only partially through block 268 as shown in FIG. 14. Corresponding ends of the sheaths 266 for cables 253-257 are slidably received in bores 286 and seat against the bottoms of bores 286 so that they cannot be pulled downwardly through the bores. The width of slots 284 are smaller than the diameter of bores 286 and sheaths 266, but larger than the diameters of cables 253-257. Cables 253-257 extend

beyond sheaths 266, and pass slidably through the unbored inner portions of slots 284. From there, they are routed to drum portions 250 on carriers 77-81.

When the ends of sheaths 266 are seated in bores 286, cables 253-257 cannot be removed from retainer block 268 by sliding them through slots 284 transversely of bores 286 because the bore-received ends of sheaths 266 will jamb in slots 284. In this manner, the ends of sheath 266 that are received in bores 286 cooperate with retainer block 268 to radially retain cables 253-257, while permitting unrestricted axial motion of the cables.

To detach cables 253-257 from block 268, it is first necessary to withdraw sheaths 266 from bores 286. Then, cables 253-257 may be slid through slots 286 in a direction extending radially or transversely of bores 286, thereby detaching cables 253-257 without requiring each cable to be disconnected at either end from either its associated type carrier or from read-out mechanism 98. Sheaths 266 are easily removed from bores 286 by retracting each sheath and cable assembly a short distance axially of the sheath-receiving bore in the retainer block.

Block 270 is of the same construction as block 268. Accordingly, like reference number suffixed by the letter *a* have been applied to designate like portions of block 270. Correspondingly ends of the sheaths for cables 258-263 are slidably received in bores 286*a*, and the portions of cables 258-263 extending beyond their sheaths pass freely through the unbored regions of slots 284*a*, all in the same manner as described in connection with block 268. Radial retention and detachment of cables 258-263 is accomplished in the same manner as described for cables 253-257. Each of the blocks 268 and 270 is rotatably and axially adjustable independently of the other.

Carriers 77-87 are axially adjustable along shaft 90 simply by loosening screws 89, 195 and 242, by axially shifting the assembly of frame 215, lock bar 200, plates 196 and 198, collars 88, 238 and 240, and carriers 77-87, in one direction or the other, and by retightening screws 89, 195 and 242 to secure the entire assembly in the adjusted position. Axial adjustment of carriers 77-87 may be desirable to accommodate different forms of tickets or other record mediums.

Springs 244 are easily aligned with the axially adjusted positions of carriers 77-87 simply by lifting tabs 246 against the bias of springs 244 and by axially shifting tabs 246 along the axis of rod 226 to a position where springs 244 properly aligned with the anchorage points on their associated type carriers. In this manner, spring 244 exert the proper biasing force on carriers 77-87, and cables 253-263 will not bind or become untrained from drum portions 250.

Springs 218 and 220 are also easily repositioned to accommodate the adjusted positions of plate 202 and 204 simply by lifting tabs 222 and 224 against the bias of springs 218 and 220, by axially shifting them in one direction or the other, and by reseating them on rod 226 in positions where springs 218 and 220 are in alignment with their anchorage points to plates 202 and 204. Retainer blocks 268 and 270 are also easily adjustable in the manner previously described. In this manner, cables 253-263 are easily and quickly repositioned.

It also will be appreciated that the axial spacing between the two sets of carriers 76-81 and 82-87 may be

easily, selectively varied by replacing collar 88 with one of a different length. Furthermore, the set of carriers 82-87 may optionally be left out of printer 22 without requiring the replacement or structural modification of any structural part, with the possible exception of lock bar 200. If carriers 82-87 are not included in the printer, collar 88 is omitted from the assembly, and carriers 76-81 are axially confined between plates 196 and 198. When carriers 82-87 are not included in the printer, it may be desirable to replace lock bar 200 with one of a somewhat shorter length.

Referring to FIG. 16, a set of thumb wheels 300, 301, 302, 303, and 304 and 305 (see also FIG. 1) are rotatably mounted on a shaft 308 for respectively and selectively positioning carriers 82-87. Shaft 308 is fixed on a support frame 310 which is detachably mounted on the inside of cover 54. Segments of thumb wheels 300-305 project through an aperture 311 (FIG. 16) in frame 310 and also through elongated, rectangular apertures 311*a* (FIG. 1) in a front panel 312 so that the thumb wheels are each accessible for rotation from the exterior of casing assembly 52 without opening cover 54.

The front wall of cover 54 is in the form of a frame 313 (FIG. 1) which borders a rectangular opening 313*a*. Panel 312 is detachably mounted on the inside of cover 54, is bordered by frame 313, and covers opening 313*a*. The purpose of this construction will be described later on.

As shown in FIGS. 5 and 16, cables 258-263 are routed upwardly in casing assembly 52 and through bores in a guide bar 314. From there, cables 258-263 are partially trained around pulleys 316 and have their ends secured to thumb wheels 300-305 respectively.

Pulleys 316 are rotatably mounted on a shaft 318. Shaft 318 is fixed to frame 310 in the inside of cover 54. Shafts 318 and 308 are parallel with each other and with shaft 90.

Selective rotation of thumb wheels 300-305 respectively rotate carriers 82-87 to selected printing positions through the motion transmitting connections provided by cables 258-263. Indicia on the peripheries of thumb wheels 300-305 indicate the number that will be printed by the selected printing positions of carriers 82-87.

When cover 54 is raised to its opened position, it pulls on cables 258-263 to rotate carriers 82-87 against the bias of the return springs 244 for carriers 82-87. The extension of springs 244 permits cover 54 to be raised to its opened position without disconnecting the motion-transmitting connections between thumb wheels 300-305 and carriers 82-87. As will be described in detail shortly a novel interlock 319 (see FIG. 15) between cover 54 and frame 50 prevents cover 54 from being opened unless thumb wheels 300-305 are reset to their home positions. This feature prevents the application of undue strain on cables 258-263 and their springs 244 when cover 54 is opened.

As shown in FIG. 16, detent wheels 320, 321, 322, 323, 324 and 325 are provided for thumb wheels 300-305 respectively. Wheels 320-325 are respectively mounted on levers 330, 331, 332, 333, 334, and 335 (see also FIG. 15). Levers 330-335 are pivotally mounted on a shaft 338. Shaft 338 is fixed to frame 310 along an axis that is parallel to the axis of shaft 308. Levers 330-335 are thus pivotal about a common axis and

are each biased by a spring 330 (FIG. 15) into engagement with the notched peripheries of thumb wheels 300-305 respectively.

Engagement of detent wheels 320-325 with thumb wheels 300-305 respectively releasably lock thumb wheels 300-305 in the positions to which they have been rotated. The assembly of detent wheels 320-325, shaft 338, springs 339 and a thumb wheel reset mechanism 340 (FIG. 15) are all mounted on frame 310 on the inside of cover 54.

As shown in FIGS. 15 and 16, reset mechanism 340 comprises a reset pushbutton 342 that is slidably mounted on frame 310. Pushbutton 342 projects through an aperture in panel 312, and on the inside of cover 54 it mounts a pin 344 that is engageable with another pin 348. Pin 348 is mounted on the end of a rockable shaft 350 that is rotatably supported by frame 310. The axis of pin 348 is normal to the rotational axis of shaft 350, and the rotational axis of shaft 350, and the rotational axis of shaft 350 is parallel to the axis of shaft 338.

A plate 352 is fixed on shaft 350 for rocking motion therewith. Stiff wire members 358, 359, 360, 361, 362 and 363 respectively connect levers 330-335 to plate 352.

When pushbutton 342 is selectively pushed in, pin 344 engages pin 348 to cause shaft 350 to rotate in a clockwise direction as viewed from FIG. 15. Clockwise rotation of shaft 350 rotates levers 330-335 against the bias of springs 339 to disengage detent wheels 320-325 from thumb wheels 300-305 and to swing them away from the peripheries of thumb wheels 300-305. As a result, the bias exerted by the springs 244 for carriers 82-87 return thumb wheels 300-305 to their home positions where the strain on cables 258-263 is minimized.

When pushbutton 342 is released, springs 339 bias detent wheels 320-325 into engagement with thumb wheels 300-305. Pushbutton 342 will be urged outwardly to its original position under the bias applied by springs 339 and exerted through members 358-363, shaft 350 and pins 348 and 344.

A unidirectional stop 370 (FIG. 6) is mounted on each thumb wheel and is abutable with the inside face of panel 312 to prevent its associated thumb wheel from free-wheeling in a counterclockwise direction as viewed from FIG. 6.

Referring to FIG. 15, a cover locking bracket 372 is fixed to frame 310 and is formed with an upwardly opening notch 373 for receiving the end of a locking arm 374. Locking arm 374 is pivotally mounted at 375 on frame 50. A stop pin 377, which is fixed on frame 50, limits counterclockwise pivotal motion of arm 374 under the influence of its own weight. Arm 374 extends horizontally as shown when its lower edge butts against stop pin 377. Arm 374 is bent at its free end to provide a transverse end portion 378 that removably seats in notch 373 to releasably lock cover 54 in its downwardly swung, closed position.

When cover 54 is open, arm 374 butts against stop pin 377. As cover 54 is pivoted to its downwardly swung, closed position, an inclined camming edge surface 379 on the end of bracket 372 engages end portion 378, causing arm 374 to pivot upwardly and clockwise. As a result, arm 374 rides upwardly on camming surface 379 during closing movement of cover 54, and end portion 378 will drop into notch 373 under the influ-

ence of its own weight upon movement of cover 54 to its fully closed position.

With end portion 378 seated in notch 373, cover 54 is locked in its closed position and cannot be opened until arm 374 is raised.

Still referring to FIG. 15, a part 380, which is mounted on the inner end of pushbutton 342, mounts pin 344 and is formed at its inner end with an inclined camming surface 381. By pushing pushbutton 342, part 380 is also displaced inwardly along a path that causes camming surface 381 to butt against end portion 378 when cover 54 is closed and end portion 378 is seated in notch 373. Inward displacement of part 380 thus causes arm 374 to ride upwardly along camming surface 381, thereby pivoting arm 374 upwardly to raise end portion 378 clear of notch 373. Cover 54 is now unlocked and may be raised to its opened position.

From the foregoing it is clear that cover 54 remains locked to frame 50 in its closed position until pushbutton 342 is depressed, or more particularly pushed inwardly, to reset thumb wheels 300-305 to their home position. As a result, application of undue strain on cable 258-263 is avoided.

As shown in FIG. 15, a rigid bumper 382 is abutable with frame 310 for limiting the closing movement of cover 54. Bumper 382 is adjustably mounted on frame 50 by screws 383 that extend through elongated apertures in bumper 382. Bumper 382 is adjusted to establish alignment of notch 373 with end portion 378 when cover 54 is in its fully closed position where frame 310 butts against bumper 382.

The construction of casing assembly 52, the arrangement for mounting the operative components of printer 22 and the arrangement for mounting printer 22 on dial housing 40 provides for easy, and convenient inspection and repair of the printer components that are housed by casing assembly 52. More particularly, it will be appreciated from the foregoing description that casing parts 53 and 56 and cover 54 are mounted on frame 50 independently so that they each may be removed independently of each other. Furthermore, with the exception of the thumb wheel assembly and its reset mechanism on the inside of cover 54, the operative components of printer 22 are all mounted directly on frame 50 independently of casing assembly 52. The components carried by cover 54 are conveniently accessible simply by raising cover 54. The component housed by casing 53 above table 100 are conveniently accessible simply by removing casing part 53, and the components housed by casing part 56 below table 100 are conveniently accessible simply by removing casing part 56.

It will be appreciated that neither casing part 56 nor casing part 53 carry any of the operative components of the printer. These casing parts may therefore be removed without requiring the detachment or removal of the operative printer components and without interfering with the operation of the printer. Operation of printer 22 may therefore be observed with casing parts 53 and 56 removed. Furthermore, cover 54 may be opened to observe the printer in operation as far as printing the weight of the weighed load is concerned.

Because of the configuration and arrangement of casing parts and because of the manner in which the casing parts and operative components of the printer are mounted, maximum exposure of the printer components is achieved by removing the casing parts and/or

opening cover 54 to make the printer easy to inspect and work on.

Referring to FIGS. 4, 18 and 19, readout mechanism 98 comprises a cam wheel assembly 390 having a series of indexing cam wheels 391, 392, 393, 394 and 395 fixed on shaft 26 for rotation therewith. Wheels 391-395 are respectively associated with type carriers 77-81.

Cam wheels 391-394 are of conventional construction and preferably are of the same construction as described in the previously identified U.S. Pat. No. 3,346,061.

As best shown in FIG. 18, cam wheels 391-394 are respectively provided at their peripheries with stepped cam surfaces 400, 401, 402 and 403. Cam surfaces 400-402 respectively provide ten vernier like divisions of each step in cam surfaces 401-403. The vernier like stepped cam surfaces 401-403 provide for a four-digit weight measurement, such as units (wheel 391), tens (wheel 392), hundreds (wheel 393) and thousands (wheel 394), measurement in the ten-thousands decade is achieved by cam wheel 395 and other cams in a manner to be described later on.

As best shown in FIG. 19, readout mechanism 98 further includes a series of index fingers 406, 407, 408 and 409 that are respectively engageable with the cam surfaces of cam wheels 391-394. Index fingers 406-409 are slidably mounted on a frame 412 for linear movement independently of each other along parallel paths. The parallel paths extend transversely of cam wheel assembly 390. Each of the index fingers 406-409 is linearly reciprocable along its path between a retracted position where it is spaced from and therefore disengaged from the stepped periphery of its associated cam wheel and an indexing position where it engages the stepped cam surface of its associated cam wheel.

After a load is placed on platform 23 and the dial scale comes into balance, fingers 406-409 are advanced to their indexing positions where they engage the cam surfaces of wheels 391-395 respectively. Because of the vernier like divisions on the cam wheel surfaces 400-403, the displacement of fingers 406-409 from their retracted positions to their cam-engaging positions will be proportional to the digits in different decades of the multi-digit number representing the weight of the load that is indicated by pointer 28 within the weight range of the dial scale chart 31.

Index fingers 406-409 are respectively biased to their indexing, cam wheel-engaging positions by springs 414, 415, 416 and 417 (see FIG. 19). Displacement of fingers 406-409 to their cam wheel-engaging positions under the influence of springs 414-417 is under the control of a cam or eccentric 420 (FIG. 20).

Referring to FIGS. 20 and 23, cam 420 is eccentrically mounted on a shaft 422. Shaft 422 is rotatably mounted on frame 412. The rotational axis of shaft 422 is parallel to the rotational axis of shaft 26. Cam 420 rotates in a follower cage 423 that is defined by a pair of parallel spaced apart plates 424 and 425. Plate 425 is fixed to plate 424 by screws 426, and plate 424 is pivotally mounted on a shaft 427 (see FIG. 17). Plates 424 and 425 are on diametrically opposite sides of cam 420 so that cage 423 will follow cam 420 because of the engagement of the cam periphery with plates 424 and 425. In this manner, plate 424 will be rocked about the axis of shaft 427 by rotation of cam 420.

The upper free end of plate 424 engages depending pins 430 (see FIGS. 19, 23 and 24) that are fixed one to each of the fingers 406-409. Springs 414-417 normally bias pins 430 into abutment with plate 424. Thus, by rotation of cam 420 through part of one revolution, plate 424 will rock in a counterclockwise direction as viewed from FIG. 23 to urge fingers 406-409 to their retracted position. Rotation of cam 420 through the remainder of the revolution rocks plate 424 clockwise, allowing springs 414-417 to urge fingers 406-409 into indexing engagement with cam wheels 391-394. Shaft 427 is mounted on frame 412 in parallel relation with shaft 422.

As shown in FIGS. 18 and 19, read-out mechanism 98 further includes a series of cam-engageable fingers 432, 433 and 434, a pair of bars 436 and 438, three range weight cam sectors 439, 440 and 441 and a cam wheel 395. As will be described in detail later on, the purpose of cam wheel 395, cam sector 439-441, fingers 432-434, bars 436 and 438 and cam wheel 395 together with other structures yet to be described is to provide mechanism 98 with an output that takes into account the range or drop weights applied to weigh beam 24. Bars 436 and 438 and fingers 432-434 are supported on frame 412 for linear reciprocating motion along paths that are parallel to the motion paths of fingers 406-409. Bar 436 is mounted between and in parallel relation to fingers 409 and 433. Bar 438 is mounted between and in parallel relation to fingers 432 and 434.

Still referring to FIG. 19, bar 436 is connected to fingers 409 and 433 by a pulley 444 and a motion transmitting cable 446. Pulley 444 is mounted on bar 436. Cable 446 is trained partially around pulley 444 and is anchored at its opposite ends to fingers 409 and 433. Spring 417 is secured at one end to bar 436 and at its other end to frame 412 for biasing bar 436 towards cam assembly 390. The bias applied by spring 417 to bar 436 is applied through pulley 444 and cable 446 to bias fingers 409 and 433 forwardly towards their cam-engaging positions. The purpose of cable 446 and pulley 444 will be explained later on in connection with finger 433.

Still referring to FIG. 19, bar 438 is connected to fingers 432 and 434 by a similar pulley and cable arrangement comprising a pulley 448 and a cable 450. Pulley 448 is mounted on bar 438. Cable 450 is trained partially around pulley 448 and is anchored at its opposite ends to fingers 432 and 434. A spring 442 is secured at one end to frame 412 and at its other end to bar 438 to bias bar 438 forwardly towards cam assembly 390. The bias applied by spring 442 is transmitted by pulley 448 and cable 450 to bias fingers 432 and 434 forwardly toward their cam-engaging positions. The purpose of pulley 448 and cable 450 will be described later on in connection with fingers 432 and 434.

As shown in FIG. 24, plate 424, in addition to engaging pins 430, also engages depending pins 451a, 451b and 451c. Pins 451a, 451b and 451c are respectively fixed to fingers 432-434. Thus, rocking motion of plate 424 is a counterclockwise direction (as viewed from FIG. 23) will urge fingers 432-434 to their illustrated, cam-disengaging positions along with fingers 406-409. Bar 436 will also be urged in a corresponding direction through the motion transmitting connection provided by cable 446 and pulley 444, and bar 438 will likewise be urged in a corresponding direction through the mo-

tion transmitting connection provided by cable 450 and pulley 448.

Cam 420 is contoured in such a manner that at one preselected angular position it will cause plate 424 to position bars 436 and 438 and fingers 406-409 and 432-434 at their illustrated retracted positions where the fingers are out of engagement with their associated cams.

As cam 420 is rotated in a preselected direction, it will allow fingers 406-409 and 432-434 to move to their cam-engaging positions under the bias exerted by spring 414-417 and 442. Continued rotation of cam 420 in the same direction then urges fingers 406-409 and 432-434 rearwardly to their illustrated, retracted positions. Thus, one revolution of cam 420 will result in the advancement of fingers 406-409 and 432-434 to their cam-engaging positions and the return fingers 406-409 and 432-434 to their retracted positions, thus completing one indexing cycle.

As shown in FIG. 22, shaft 422 is drive connected to the power output shaft 459 of motor 172 by a pair of endless chain drive and sprocket wheel assemblies 460 and 461. As shown in FIG. 25, operation of motor 172 is controlled by a manually depressible spring-loaded push button switch 462 and a cam operated switch 464. Switch 462 is located on the front of housing 40 for convenient access. Switch 464 is controlled by a cam element 468 (see FIG. 4) that is mounted on a shaft 469. Shaft 469 is drive connected to motor shaft 459 by assembly 461 as shown in FIG. 22. Switch 462 is connected in series with motor 172 across a suitable power source. Switch 464 is in parallel with switch 462 and in series with motor 172. Motor 172 is selectively energized by momentarily closing switch 462 to rotate shafts 469 and 459. Upon rotation of shaft 469 through one revolution, switch 464 is opened by cam 468 to de-energize the motor. Shaft 469 rotates through one revolution for each revolution of shaft 459. In this manner motor 172 will rotate cam 420 through only one revolution upon momentary closure to switch 462. A large gear 470 (see FIGS. 4, 7 and 220) is non-rotatably mounted on shaft 469 and constantly meshes with pinion 170. Energization of motor 172 therefore rotates shaft 140 to advance roller 122 along its endless path. The gear ratio of gears 170 and 470 is so selected that for one revolution of shaft 459 and consequently of shafts 469 and 422, roller 122 will advance through only one cycle or revolution, so that it will start from and stop at the same location along its endless path.

To impart the indexing motion of fingers 406-409 and 432-434 to type carriers 77-81, a series of index levers 480, 481, 482, 483 and 484 (see FIGS. 17, 19 and 21) are each pivotally mounted on a shaft 486 independently of each other. Shaft 486 is non-rotatably mounted on frame 412 and extends horizontally above fingers 406-409 and 432-434 along an axis that is parallel to the axis of shaft 422. Levers 480-484 are in vertical parallel spaced apart planes.

As best shown in FIG. 19, lever 480 extends between fingers 406 and 407, lever 481 extends between fingers 407 and 408, lever 482 extends between fingers 408 and an elongated locking pawl 488, lever 483 extends between bar 436 and finger 433, and lever 484 extends between bar 438 and finger 434. The type carrier positioning cables 253-257 are respectively anchored to levers 480-484. The return springs 244 of carriers 77-81 thus bias levers 480-484 in a clockwise direction

as viewed from FIG. 17 and into abutment with pins 490, 491, 492, 493 and 494 respectively. Pins 490-492 are respectively fixed to and extend laterally from fingers 406-408, and pins 493 and 494 are respectively fixed to and extend laterally from bars 436 and 438.

Pins 490-494 respectively butt against the edges of levers 480-484 at a region below the axis of shaft 486. Thus, when fingers 406-408 and bars 436 and 438 are urged toward cam assembly 390 upon rotation of cam 420, levers 480-484 will be rotated in counterclockwise direction as viewed from FIG. 17. The angles through which levers 480-482 are rotated in a counterclockwise direction will be respectively proportional to the magnitude of linear indexing displacement of fingers 406-408 from their retracted, cam wheel-disengaging positions to their indexing, cam wheel-engaging positions. Thus, levers 480-482 will be rotated counterclockwise through angular distances that are proportional to the values of digits in different decades of the weight-representing multi-digit number. As will be described in greater detail later on, the angle through which lever 483 is rotated in its indexing, counterclockwise direction is determined by fingers 409 and 433, and the angle through which lever 484 is rotated in its indexing, counterclockwise direction is determined by fingers 432 and 434. The weight representing rotational motion of levers 480-484 constitutes the output of mechanism 98.

The counterclockwise digit-representing rotation of levers 480-484 is against the bias of return springs 244 of type carriers 77-81. Cables 253-257 transmit the counterclockwise motion of levers 480-484 to carriers 77-81 respectively to rotate carriers 77-81 to their printing positions.

Fixed to the upper ends of levers 480-484 are wipers 500, 501, 502, 503 and 504 (see FIG. 21) which advance along contacts in separate contact banks 506, 507, 508, 509 and 510. There are ten strip contacts in each of the banks 506-510 to provide a decimal output. The contacts in each of the banks 506-510 are connected in a suitable, conventional electrical circuit 514 (see FIG. 1). Counterclockwise, weight-representing rotation of levers 480-484 advances wiper 500-504 by proportional angular distances to positions in contact banks 506-510 that correspond to the digit in each decade of the multi-digit number representing the weight of the weighed load.

Thus, read-out mechanism 98 provides an electrical weight-representing output, as well as a mechanical weight-representing output. The electrical read-out circuit containing wipers 500-504 and contact banks 506-510 may become same as that described in the previously identified U.S. Pat. No. 3,346,061 or in U.S. Letters Pat. No. 2,898,419 issued on Aug. 4, 1959 to C. E. Roessler, Jr. for Printer Circuit Digital Read-out Mechanism For Weighing Scales.

As shown in FIG. 1, read-out circuit 514 may be connected to a suitable, electrically actuatable, remote printer 516 to operate printer 516 for printing the weight of the load represented by the positions of wipers 500-504 in contact banks 506-510 respectively. It will be appreciated that printer 516 together with the associated electrical readout circuit 514 is optional to facilitate remote printing or read-out of the weight of the load weighed by scale 21. It also will be appreciated that printers 22 and 516 may alternately and selectively be utilized to print the weight of the weighed load.

Also, both printers 22 and 516 may be utilized concomitantly for printing the weight of the same weighed load. Also, the electrical outputs of banks 506-510 may be used for other purposes.

Referring to FIGS. 19 and 26, a rod 530 is fixed to and extends longitudinally along pawl 488. A locating pawl 532 is slidably mounted on rod 530 for linear reciprocable motion along a path that is parallel to the motion paths of pawl 488 and fingers 406-409 and 432-434. A spring 534 peripherally surrounding rod 530 reacts against a part on pawl 488 to lightly bias pawl 532 forwardly of pawl 488. A spring 538 anchored at opposite ends to frame 412 and pawl 488 biases pawls 488 and 532 to positions where they engage a star wheel 536. Wheel 536 is non-rotatably mounted on indicator shaft 26. The peripheral edge of star wheel 536 is formed with a series of uniformly spaced apart teeth.

As shown in FIG. 26, a depending pin 540 is fixed to pawl 488 and is engaged by plate 424. The combined bias of springs 414-417, 442 and 538 urges plate 424 into engagement with the periphery of cam 420.

When plate 424 is pivoted counterclockwise (as viewed from FIG. 23) by cam 420 to displace fingers 406-409 and 432-434 to their retracted, cam-disengaging positions, it will also urge the assembly of pawls 488 and 532 to their retracted, unlocking position where they are disengaged from star wheel 536. Under these conditions, shaft 26 is free to rotate in response to the weight of an applied load. The dial scale mechanism is therefore released to respond to and indicate the weight of a load placed on platform 23.

When fingers 406-409 and 432-434 are advanced toward their cam-engaging positions upon rotation of cam 420, pawls 488 and 532 will also be advanced toward their star wheel-engaging positions under the bias of spring 538. Before engagement of fingers 406-409 and 432 and of pawl 488 with their associated wheels, pawl 532 will engage star wheel 536 to locate wheel 536 for engagement of pawl 488. Then, pawl 488 will engage star wheel 536 to lock shaft 26 against rotation just before fingers 406-409 and 432 engage their associated cam wheels on shaft 26. Thus, engagement of fingers 406-409 and 432 with their associated cam wheels on shaft 26 will not result in the inadvertent angular displacement of cam wheel assembly 390. Continued rotation of cam 420 in direction will then reversely displace fingers 406-409 and 432-434 and pawls 488 and 532 towards their disengaged, retracted positions. The cycle is completed in one revolution of cam wheel 420 when fingers 406-409 and 432-434 and pawls 488 and 532 are returned to their fully retracted positions by cam 420.

The foregoing locking pawl and star arrangement is conventional, and from the foregoing description it will be appreciated that locking pawl 488 serves to lock indicator shaft 26 in its weight-representing position to prevent its inadvertent displacement. While shaft 26 is locked against rotation by pawl 488 it is clear that the dial scale mechanism cannot respond to a change in weight on platform 23.

The mechanism for releasably locking levers 480-484 against rotation, as will now be described, is separate and independent of the locking pawl and star wheel and pawl mechanism for locking shaft 26 against rotation.

Referring to FIGS. 17 and 21, a pair of support arms 545 are rotatably mounted on a shaft 547. Mounted on

the free ends of arms 545 is a lever lock assembly 548. Lock assembly 548 is swingable or pivotable about the axis of shaft 547 between a lowered, unlocking position and a raised locking position where it engages and locks levers 480-484 against rotation. Shaft 547 is mounted on frame 412 and is parallel to shaft 422.

Still referring to FIGS. 17 and 21, lock bar assembly 548 comprises a support bar 549 that is fixed on the free ends of arms 545. Mounted on bar 549 are a series of locking pawls 550, 551, 552, 553 and 554. The lower, arcuate peripheral edges of levers 480-484 are disposed vertically above locking pawls 550-554 respectively and are formed with a series of circumferentially spaced apart downwardly opening notches indicated at 556 in FIG. 17.

Locking pawls 550-554 are swingable upwardly in a clockwise direction as viewed from FIG. 17 to engage in the notches 556 of levers 480-484 respectively. In these locking positions, locking pawls 550-554 respectively lock levers 480-484 against rotation. When locking assembly 548 is swung downwardly in a counterclockwise direction, locking pawls 550-554 are withdrawn from notches 556 to thereby release levers 480-484 for rotation about the axis of shaft 486.

As best shown in FIG. 17, a contoured cam 558 is non-rotatably mounted on shaft 422. A follower in the form of a roller 560 rides along on the contoured periphery of cam 558 and is mounted on a lever 562. Lever 562 is rotatably mounted on shaft 547.

A further lever 564 is rotatably mounted on shaft 547, and a coiled spring 566 anchored at opposite ends to frame 412 and lever 564 biases lever 564 in a counterclockwise direction as viewed from FIG. 17.

Still referring to FIG. 17, a spring 568 is anchored at opposite ends to lever 564 and arm 545 to thus bias lock assembly 548 upwardly towards its lever-locking position and in a clockwise direction about the axis of shaft 547. To transmit motion of lever 562 to lever 564, a pin 567 is fixed to lever 562 and is received in an enlarged circular aperture 565 that is formed through lever 564. When lever 564 is in its lowered, unlocking position, pin 567 butts against the edge of aperture 565 so that when lever 562 is rocked in a clockwise direction (as viewed from FIG. 17) lever 564 will also be rocked in the same direction by engagement of pin 567 with the edge of aperture 565. In the position of parts shown in FIG. 17, the engagement of pin 567 with the edge of aperture 565 holds lever 564 in its illustrated position against the bias of spring 566. When cam 558 is rotated clockwise from its position illustrated in FIG. 17 to permit counterclockwise rotation of lever 562, the bias of spring 566 causes counterclockwise rotation of lever 564, and lever 562 will follow in a counterclockwise direction because of the engagement of the edge of aperture 565 with pin 567.

From the position of parts shown in FIG. 17, one revolution of cam 558 will retract locking pawls 550-554 downwardly to their unlocking positions where levers 480-484 are released for rotation about the axis of shaft 486 and then back to the illustrated position of parts when locking pawls 550-554 engage and lock levers 480-484 against rotation.

From the foregoing construction, it will be appreciated that rotation of cam 558 swings levers 562 and 564 to displace pawls 550-554 between their locking positions where they lock levers 480-484 against rotation and their retracted unlocking positions where le-

vers 480-484 are released for rotation. Cam 558 is contoured in such a manner that during movement of fingers 406-409 and 432-434 toward cam assembly 390, pawls 550-554 will be retracted to their unlocking positions, releasing levers 480-484 for rotation about the axis of shaft 486. Thus, levers 480-484 will be rotated through angular distances corresponding to the distances through which fingers 406-408 and bars 436 and 438 are respectively displaced from their retracted positions. The weight-representing angular displacement of levers 480-484 is transmitted by cables 253-257 to rotate carriers 77-81 to positions for printing the weight represented by the weight-representing counterclockwise angular displacement of levers 480-484.

Before fingers 406-409 and 432-434 are disengaged and retracted from cam wheels 391-395 and cams 439-441 by cam 420, cam 558 will cause levers 562 to rotate in a clockwise direction as viewed from FIG. 17, thereby causing pawls 550-554 to be swung upwardly and into locking engagement with the notches 556 in levers 480-484. Levers 480-484 will therefore be locked against rotation at their weight-representing positions before fingers 406-409 and 432-434 disengage from their associated cams. The contour of cam 558 is such that levers 480-484 will remain locked by lock assembly 548 until another revolution of cam 558 is initiated by energizing motor 172. As long as levers 480-484 remain locked in their weight-representing positions, carriers 77-81 will also be held in their positions for printing the weight of the load. Once pawls 550-554 disengage from levers 480-484 to release them, the memorization of the weight is released.

Referring to FIG. 17, displacement of lock bar 200 between its carrier locking and unlocking positions is controlled by a cam 568. Cam 568 is non-rotatably mounted on shaft 422. A follower 569, in the form of a roller, engages the contoured periphery of cam 568 and is mounted on a lever 570. Lever 570 is pivotally mounted at one end on shaft 547 and is swingable or rockable about the axis of shaft 547.

The free end of lever 570 is connected to frame 215 by a motion transmitting assembly comprising a tab 571, a coiled spring 572, a sheave 573 and a flexible cable 574. Tab 571 is pivotally secured to the upper free end of lever 570 by a pin 575. Spring 572 is secured to and interconnects tab 571 and sheave 573. An intermediate portion of cable 574 is trained around sheave 573.

As shown in FIGS. 5, 6 and 11, the ends of cable 574 are routed into the printer housing 52 and are trained partially around a pair of sheaves 575a. Sheaves 575a are mounted on shaft 199 axially on opposite sides of frame 215. The ends of cable 574 are secured by tabs to rod 214. Follower 569 is biased into engagement with the periphery of cam 568 by springs 218, 220 and 572.

The periphery of cam 568 is contoured in such a manner that in one revolution of shaft 422, lever 570 will first be rocked in a clockwise direction (as viewed from FIG. 17), then held substantially at the limit of its clockwise rotation, and finally rocked back in a counterclockwise direction to its original position. By rocking lever 570 in a clockwise direction, lock bar 200 will be pulled down into locking engagement with carriers 77-87 and will be held in locking engagement with carriers 77-87 until lever 570 is rocked back in a counter-

clockwise direction. Upon rocking lever 570 back in a counterclockwise direction, springs 218 and 220 will pull lock bar 200 upwardly to its raised, unlocking position where it again disengages from carriers 77-87.

In the apparatus of this invention, the net weight range registerable on dial 31 is somewhat greater than the weight of each drop or range weight in range weight assembly 32. For example, the net weight range of dial 31 may be 2,400 pounds as indicated in FIG. 1, and each range weight in assembly 32 may be 2,000 pounds, thereby providing an overlap of 400 pounds between successive ranges. For this example, the first range, which has no range weight applied to beam 24, will be 0-2400 pounds. The next range with one range weight applied to beam 24 will be 2,000-4400 pounds, the third range with two range weights applied to beam 24 will be 4,000-6,400 pounds, and so on as indicated in FIG. 18. Dial 31 may conventionally be provided with a scale for each range to permit the proper numerical value of weight to read directly from the dial.

Cam wheels 391-394 are of suitable conventional construction. Cam wheel 394, as shown in FIG. 18, has two radial steps to provide three peripheral surfaces 590, 591 and 592 of different diameters. Surfaces 590, 591 and 592 respectively provide for the read-out of 0, 1 and 2 in the thousands decade of the multi-digit, weight-representing number. Fingers 409 and 433 are respectively engageable with cam wheel 394 and cam sector 439.

As shown in FIG. 18, cam sectors 439-441 are rotatably mounted on shaft 26 and are rotated to read-out positions by range weight assembly 32. Sector 439 is formed with four radially outwardly opening notches 594, 595, 596 and 597, each having a series of four equal, circumferentially extending steps that are indicated at 598. The four steps 598 in each notch respectively provide for the read-out of the digits 2, 4, 6 and 8 in the thousands decade. Zero read-out is provided by sector 439 when finger 433 engages the outer periphery of sector 439 which is indicated at 599. Notches 597-599 are respectively, circumferentially spaced from notches 594-596 by distances equal to one of the steps 598. The dimensions of steps 598 are equal.

Still referring to FIG. 18, cam sector 439 is connected by a motion transmitting cable 600 or other suitable motion transmitting means, such as linkage, to range weight assembly 32 in such a manner that it will be rotated counterclockwise by a distance equal to one of the steps 598 upon application of each range weight (indicated at 602) in assembly 32. Cable 600 will also cause sector 439 to be rotated clockwise by a distance equal to one of the steps 598 upon the removal of each range weight that was applied to beam 24.

Range weight assembly 32 may be of any suitable, conventional construction. For example, assembly 32 may be of the same as that disclosed in United States Letters Pat. No. 3,229,779 issued on Jan. 18, 1966 to J. P. Marzendorfer, et al. for Mechanical Apparatus, or it may be the same as that disclosed in United States Letters Pat. No. 3,232,365 issued on Feb. 1, 1966 to G. C. Mayer, et al. for Multi-Range Weighing Apparatus and Method. Dial 31 may be the same as that disclosed in U.S. Pat. No. 3,229,779. Cable 600 may be connected to the cable (29), the lever (54) or any other suitable part or parts in the range-weight mechanism disclosed in U.S. Pat. No. 3,229,779 to effect the desired angular displacement of sector 439.

When no range weights are applied to beam 24, sector 439 will be rotated to a position where finger 433 engages periphery 599 one step away from notch 594. When finger 433 engages periphery 599, it will provide a zero read-out. When the first 2000 pound range weight is applied to beam 24, sector 439 will be rotated through an angular distance equal to one step to engage in the outermost step 598 in notch 594. The resulting increment of linear displacement of finger 433 will provide a read-out equivalent to the digit 2 in the thousands decade in a manner to be described in greater detail later on.

When the next 2,000 pound range weight is applied to beam 24, sector 439 will be rotated through another angular increment of one step to bring the next step adjacent to the outermost step 598 into alignment with finger 433. The radial depths of steps 598 are all equal so that when finger 433 engages in the second step 598, the resulting linear displacement of finger 433 will provide a read-out equivalent to the digit "4" in the thousands decade. When the fifth range weight is applied to beam 24, sector 439 will be rotated to a position where finger 433 engages the portion of periphery 599 between notches 594 and 595 to again provide a read-out that is equivalent to zero.

The operation just described is the same for notches 595-597. When the sixth range weight is applied, finger 433 will seat in the outermost step 598 in notch 595 to again provide a read-out of the digit 2, and so on.

From the foregoing it is clear that the successive application of twenty range weights will respectively provide read-outs of the values 2, 4, 6, 8, 0, 2, 4, 6, 8, 0, 2, 4, 6, 8, 0, 2, 4, 6, 8 and 0.

The assembly of cable 446 and pulley 444 constitute a summing differential that provides bar 436 with a linear indexing movement (from left to right in FIGS. 18 and 19) that is equal in magnitude to one-half of the linear travel of finger 409 plus one-half of the linear travel of finger 433. The inherent characteristic of a block and tackle arrangement such as pulley 444 and cable 446 will divide the sum of the two inputs at opposite ends of cable 446 by two. Therefore, the depths of each step on cam wheel 394 is made twice the depth of the steps on cam wheels 391-393, and the depth of each step of cam sector 439 is made four times the depth of the steps on cam wheels 391-393.

The resulting linear indexing movement of bar 436 is imparted to lever 483 as previously described to rotate lever 483 through a corresponding distance.

If the weight of the load being weighed is less than 1000 pounds, fingers 409 and 433 will respectively engage surface 590 and periphery 599 so that lever 483 will be positioned to locate carrier 80 at its zero printing position. If the weight of the load is more than 999 pounds, but less than 2000 pounds, fingers 409 and 433 will respectively engage surface 591 and periphery 599. The increment of motion of finger 409 is transmitted by bar 436 and lever 483 to position carrier 80 for printing the digit 1.

If the weight of the load is between 2000 pounds and 2400 pounds and if no range weights are applied to beam 24, fingers 409 and 433 will respectively engage surface 592 and surface 599. The indexing motion of finger 409 will therefore be transmitted to rotate carrier 80 to its position for printing the digit 2. If the weight of the load is between 2,000 pounds and 2400 pounds and the first 2,000 pound range-weight is ap-

plied to beam 24, cam wheel 394 will be rotated back to a position where finger 409 will engage surface 590, but cam sector 439 will be rotated through an angular distance corresponding to one step 598 so that finger 433 will now engage in the outermost step 598 in notch 594. Thus, while finger 409 provides an input to the summing differential (pulley 444 and cable 446) that is equivalent to zero, the increment of indexing motion of finger 433 will provide an input to the summing differential that is equivalent to the digit 2. Carrier 80 will therefore be rotated to its position for printing the digit 2.

If the weight of the load is, say, between 3000 pounds and 4000 pounds, finger 409 and 433 will respectively engage surface 591 and the outermost step 598 in notch 594. As a result, the inputs that fingers 409 and 433 respectively provide to the summing differential (444, 446) will respectively be equivalent to the digits 1 and 2. These inputs will be summed by the differential defined by pulley 444 and cable 446 to cause carrier 80 to be rotated to a position for printing the digit 3. Operation in the remainder of the scale range corresponds to that just described.

Pulley 448 and cable 450 also constitute a block and tackle type summing differential in the same manner as pulley 444 and cable 446. The linear indexing travels of fingers 432 and 434 are added and divided by the assembly of pulley 444 and cable 446 to provide bar 438 with a linear travel that is equal to one-half of the sum of the linear indexing travel of finger 432 and the linear indexing travel of finger 434. Thus, the travel of fingers 432 and 434 constitute the inputs to the summing differential defined by pulley 448 and cable 450 and the resulting linear travel of bar 438 constitutes the output of the differential in the same manner as described for pulley 444 and cable 446.

As shown in FIG. 18, cam sector 440 is formed with a series of four equiangularly spaced apart, radially outwardly opening notches 606 of uniform depth. A motion transmitting assembly 608 is connected to range weight assembly 32 and to cam sector 440 to rotate sector 440 through an angular distance that is equal to the spacing between adjacent notches 606 for every five range weights applied to or removed from beam 24. For every fifth range weight applied to or removed from beam 24, cam sector 440 will be rotated to a position where one of the notches 606 is in alignment with finger 432 to receive the finger upon its forward, indexing motion.

As will be explained shortly, cam wheel 395 prevents finger 432 from entering an aligned one of the notches 606 whenever the indicated weight is less than 2,000 pounds plus the weight of any range weights on beam 24. By entering one of the notches 606, the travel of finger 432 provides an input of such magnitude that the output of the summing differential (448, 450) will be equivalent to the digit 1 in the ten-thousands decade or order. If finger 432 engages the outer periphery 609 of sector 440 the input to the summing differential will be equivalent to zero.

When no range weights are applied to beam 24, cam sector 440 is rotated by assembly 608 to a position where finger 432 would engage periphery 609 at a point that is angular spaced below the lowermost notch 606 by a distance that is equal to the angular spacing between adjacently disposed notches 606. Thus, upon application of the fifth range weight to beam 24 the

lowermost notch 606 will be in alignment with finger 432.

Assembly 608 may be of any suitable construction for imparting the desired rotation to cam sector 440, and it may be connected to any appropriate part in the range weight mechanism that is disclosed in U.S. Pat. No. 3,229,779. For example, assembly 608 may comprise a motion transmitting linkage interconnecting the lever 54 in U.S. Pat. No. 3,229,779 in such a manner that sector 440 will be rotated through an angular distance that is equal to one-fifth of the angular spacing between adjacently disposed notches for each range weight applied to or removed from beam 24.

As shown in FIG. 18, cam wheel 395 is provided with a single step 610 to provide two differently diametered surfaces 611 and 612. The smaller diametered surface 611 extends through an angular distance that is equal to the angular dial distance of overlap (400 pounds) between successive weight ranges. Whenever shaft 26 has rotated to a position where the weight indicated is at least 2,000 pounds plus any applied range weights, but not greater than 2,400 pounds plus any applied range weights, surface finger 432 will be engageable with surface 611 and not surface 612. For the remaining weight values, finger 432 will engage surface 612 and not surface 611.

Engagement of finger 432 with surface 612 prevents finger 432 from entering one of the notches 606, should one of them be aligned with finger 432. But when surface 611 faces finger 432, the reduced diameter of surface 611 allows finger 432 to travel forwardly by a distance that is sufficient to allow finger 432 to enter and seat in any of the notches 606, should one of the notches 606 be aligned with finger 432.

Thus, surface 612 acts as a stop abutment surface that prevents fingers 432 from entering any aligned one of the notches 606 whenever the rotational position of shaft 26 is such that the indicated weight is outside of the 400 pound overlap between successive weight ranges or, more particularly, less than 2000 plus the weight of any range weights that may be applied to beam 24. Therefore, rotation of cam wheel 394 with shaft 26 permits the entry of finger 432 into an aligned one of the notches 606 only when the indicated weight is in the 400 pound overlap between successive weight ranges or, more particularly, is in the range from 2000 pounds to 2,400 pounds plus any range weights on beam 24.

As shown in FIG. 18, cam sector 441 is formed with four equiangularly spaced apart, radially extending steps 614 of uniform depth. Steps 614 define four differently diametered surfaces 615, 616, 617 and 618. Cam sector 441 is connected to range weight assembly 32 by motion transmitting assembly 608 in such a manner that it will be rotated through an angular distance that is equal to the angular spacing between adjacent steps 614 for every five range weights applied to or removed from beam 24. Thus, for each range weight applied to or removed from beam 24, cam sector 441 will be rotated through an angular distance that is equal to one-fifth of the angular distance between adjacently disposed steps 614. As viewed from FIG. 18, sector 441 is rotated counterclockwise by application of one or more range weights to beam 24 and is rotated clockwise by removal of one or more range weights from beam 24. Assembly 608 may comprise by way of exam-

ple, a pair of motion transmitting cables that are respectively connected to cam sectors 440 and 441.

Upon its forward indexing travel, finger 434 will engage one of the stepped surfaces 615-618 or an outer peripheral surface 619 depending upon the angular position of sector 441. The diameters of surfaces 615, 616, 617 and 618 are respectively smaller than the diameters of surfaces 619, 615, 616 and 617 by magnitudes equal to the uniform, radial depths of steps 614. When no range weights are applied to beam 24, finger 434 will engage surface 619 at a location that is angularly spaced from surface 615 by a distance equal to the uniform angular spacing between adjacent ones of steps 614. Thus for the application of the first four range weights to beam 24, finger 434 will engage surface 619, for the application of the fifth, sixth, seventh and ninth range weights to beam 24, finger 434 will engage surface 615, for the application of the tenth through the fourteenth range weights to beam 24, finger 434 will engage surface 616, and so on.

Engagement of finger 434 with surface 619 results in an output at bar 438 that is equivalent to zero. The linear indexing displacement of bar 438 will be equivalent to the digits 1, 2, 3, and 4 when the finger 434 engages surfaces 615-618 respectively.

As previously described the forward indexing travel of bar 438 rotates lever 484 which, in turn, rotates carrier 81 for setting up the digit to be printed in the ten-thousands order of the multi-digit, weight-representing number.

When only the first four range weights are applied to beam 24, finger 432 and 434 will only be engageable with surfaces 609 and 619 respectively. As a result, lever 484 will be rotatably positioned by bar 438 to cause carrier 81 to be set to print a zero. If the fifth range weight is applied to beam 24, but not the sixth range weight, finger 434 will still engage surface 619 so that its input to the summing differential of pulley 448 and cable 450 will still be equivalent to zero. However, cam sector 440 will now be rotated counterclockwise to a position where the lowermost one of notches 606 (indicated at 606a) will align with finger 432. But whether finger 432 is allowed to enter notch 606a to provide an input equivalent to the digit 1 depends upon the position of cam wheel 395 as previously described.

If the indicated weight is less than 10,000 pounds with the fifth range weight applied, finger 432 will engage surface 612, thereby preventing entry of finger 432 into notch 606a. As a result, the input provided by finger 432 will also be equivalent to zero, and lever 484 will be positioned by bar 438 to set carrier 81 to its zero printing position.

If, on the other hand, the indicated weight is any value from 10,000 pounds to 10,400 pounds, cam wheel 395 will have been rotated sufficiently far so that surface 611 will face finger 432. The increment of movement permitted by the reduced diameter of surface 611 allows finger 432 to enter notch 606a. Now the travel of finger 432 will provide an input equivalent to the digit 1, and this travel when summed with the input provided by finger 434, which will still be zero, will cause bar 438 and lever 484 to travel through distances that rotate carrier 81 to its position for printing the digit 1, and when this is summed with the zero input provided by finger 432 the resulting travel of bar 438 and lever 484 rotates carrier 81 to its position for print-

ing the digit 1. This condition will exist for the application of the seventh, eighth and ninth range weights.

When the tenth range weight is applied to beam 24, finger 434 will still be engageable with surface 615 to provide an input equivalent to the digit 1. Now, however, notch 606b aligns with finger 432, and when the indicated weight is in the overlap range from 20,000 pounds to 20,400 pounds, cam wheel 395 will be positioned to allow finger 432 to enter notch 606b. The travel of finger 432 will therefore provide an input equivalent to the digit 1 (i.e., sufficient to cause carrier 81 to rotate through a distance that is equal to the spacing of the digits on the periphery of the carrier). Therefore, the summation of the inputs provided by fingers 432 and 434 will now be equivalent to the digit 2, and the summed up travels of fingers 432 and 434 will be transmitted by bar 438 and lever 484 to rotate carrier 81 to its position for printing the digit 2. It is clear that operations corresponding to that just described take place for the remaining ranges.

From the foregoing description it will be appreciated that cam wheels 394 and 395, cam sectors 439-441, fingers 409 and 432-434, bars 436 and 438, the summing differential comprising pulley 444 and cable 446 and the summing differential comprising pulley 448 and cable 450 form a simplified mechanism for summing the weight indicated by the angular displacement of shaft 26 and any range weights applied to beam 24. It also will be appreciated that the foregoing mechanism of this invention accommodates the overlap between successive weight ranges. The overlap simplifies operation of the scale since the range weights may be applied or removed over a relatively large overlapping range of weight values (400 pounds in this example). It also will be appreciated that the foregoing advantages are achieved without departing from the convention of utilizing levers 430-434 as the outputs for the read-out mechanism.

According to another feature of this invention, printer 22 optionally includes a ticket hold-down bar 630 (see FIGS. 5, 6 and 29) which is positioned above table 100 for holding the ticket or other record medium in place on table 100. As best shown in FIG. 29, bar 630 is secured to and extends horizontally between a pair of parallel spaced apart support arms 632 and 634. Arms 632 and 634 are pivotally mounted on frame 50 by pins 636 (one shown in FIG. 6). Arms 632 and 634 are interconnected at their rearward ends by a structural member 638 and at their forward ends by bar 630. The assembly of arms 632 and 634, bar 630 and member 638 is indicated at 640 in FIGS. 6 and 29 and is swingable or rockable about a horizontal axis that is parallel to the axis of shaft 90 to raise and lower bar 630.

A flexible motion transmitting cable 642 (see FIGS. 6 and 17) is secured at its opposite ends to member 638 and sheave 573. Thus, when lever 570 is rocked clockwise (as viewed from FIG. 17) to lower lock bar 200 to its carrier-locking position, arms 632 and 634 will be pivoted in a counterclockwise direction (as viewed from FIG. 6) to swing hold-down bar 630 downwardly to its ticket-engaging, clamping position on table 100. Thus, for the interval when carriers 78-87 are locked against rotation by bar 200, the ticket or other record medium on table 100 will be clamped between hold-down bar 630 and table 100. In this manner, hold-down

bar 630 prevents inadvertant displacement of the ticket during printing.

When lever 570 is rocked counterclockwise (as viewed from FIG. 17) to raise lock bar 200 to its elevated, unlocking position, it will also swing arms 632 and 634 clockwise (as viewed from FIG. 6) to swing bar 630 upwardly to unclamp and thereby release the ticket on table 100 and to permit the insertion of another ticket in the printer.

When the printer is at rest after each printing operation, the position of cam 420 is such that fingers 406-409 and 432-434 will be retracted and therefore disengaged from their associated indexing cam wheels and sectors, the position of cam 558 is such that locking assembly 548 will be raised to lock levers 480-484 against rotation, the position of cam 568 is such that hold-down bar 630 will be raised to its unclamping position and lock bar 200 will be raised to its unlocking position where it is disengaged from carriers 77-87, and roller 122 will be at the phantom line position which is designated by the term "Rest" in FIG. 8. FIG. 28A schematically illustrates the rest position of the various components in read-out mechanism 98 and printer 22. Thus, fingers 406-409 and 432-434 are normally in their retracted, camdisengaging positions, levers 480-484 are normally locked by pawls 550-554, hold-down bar 630 will normally be in its raised, unclamping position, and lock bar 200 is normally in its raised, unlocking position where it is disengaged from carriers 77-87.

In operation of the scale and printing apparatus thus far described, a load is placed on platform 23. Before pushbutton switch 462 is selectively closed, a ticket is inserted into printer 22 and thumb wheels 300-305 are rotated to set carriers 82-87 to positions for printing a selected identification number. After the scale stabilizes, the operator momentarily closes switch 462 to selectively energize motor 172. Switch 462 is held closed until cam 468 has been rotated by motor 172 to a position where it allows switch 464 to close. Motor 172 will therefore remain energized through switch 464 after switch 462 is released to its opened position.

Upon energization of motor 172 and consequent rotation of cams 420, 558, and 568, pawls 550-554 will be displaced downwardly to their unlocking positions (see FIG. 28B) where they disengage from levers 480-484. At the same time, roller 122 will begin its advancement in a clockwise direction as viewed from FIG. 8. The release of levers 480-484 enables the return springs 244 to bias carriers 77-87 in counterclockwise directions (as viewed from FIG. 28B) to home positions. The bias of spring 244 will also rotate levers 480-484 clockwise in the manner shown in FIG. 28B. Thus, upon disengagement of pawls 550-554 from levers 480-484, it will be appreciated that the previous measurement indicated and memorized by the positions of levers 480-484 is released. Roller 122 will be at or near the position designated as "Step 1" in FIG. 8 upon full disengagement of pawls 550-554 from levers 480-484.

Upon release of levers 480-484, the rotation cam 420 will advance pawl 488 and fingers 406-409 and 432-434 from their retracted positions. Indexing advancement of fingers 406-409 and 432-434 toward their cam-engaging positions causes counterclockwise rotation of levers 480-484 in the manner previously described. Just before fingers 406-409 and 432-434 en-

gage their associated cams, pawl 488 engages star wheel 536 to lock indicator shaft 26 against rotation.

The indexing travel of fingers 406-409 and 432-434 rotates levers 480-484 counterclockwise as viewed from FIG. 17. As previously explained, the angular distance through which each of the levers 480-484 is rotated is an analog representation of the digit to be printed in its associated order. The circumferential spacing of digits on the printing carriers is correlated with the digit-representing angular displacement of levers 480-484 so that the rotation of levers 480-484 will rotate carriers 78-81 to positions for printing the indicated weight.

Before fingers 406-409 and 432-434 disengage from their associated cam wheels and cam sectors on shaft 26, the contour of cam 558 causes lever 562 to be swung clockwise (as viewed from FIG. 17) to swing locking pawls 550-554 upwardly to their leverlocking positions (see FIG. 28C) where pawls 550-554 engage in the aligning notches 556 to lock levers 480-484 against rotation from their digit-representing positions. At this stage an electrical read-out of the weight of the load is available at circuit 514. Also, at this stage, print roller 122 will be at the phantom line position that is indicated at "Step 2" in FIG. 8.

After levers 480-484 are locked by pawls 550-554, the continued rotation of shaft 422 brings cam 568 around to its position where it causes lock bar 200 to be lowered to its carrierlocking position to lock carriers 78-87 in their printing positions (See FIG. 28D). At the same time, the hold-down bar 630 will be swung downwardly to clamp the ticket on table 100 in the manner previously described. At this stage, print roller 122 will be in the upper leg of its endless path of travel at a position indicated as "Step 3" in FIG. 8. Roller 122 will then pass under carriers 78-87 to first print the weight set up on carriers 78-81 and then to print the identification number set up on carriers 82-87. During this period, fingers 406-409 and 432-434 are being withdrawn to their retracted positions, and they reach their fully retracted positions where shaft 422 completes its revolution.

After roller 122 has passed beyond carrier 78-87 to complete the printing of the weight and the identification on the ticket in the printer, the final segment of rotation of cam 568 causes lock bar 200 to be elevated to its raised, unlocking position (see FIG. 28A) and causes hold-down bar 630 to be raised to its ticket release position. At the end of one revolution of shaft 422, the operative parts of the apparatus have resumed their original rest positions and switch 464 will open under the action of cam 468 to de-energize motion 172.

At the end of each printing operation as described above, it will be observed that levers 480-484 remain locked by pawls 550-554 in their weight-representing positions to thus retain the memory of the previous weight measurement. Normally, this memorization of the previous weight measurement is lost or released as soon as motor 172 is re-energized to initiate another printing operation.

It will be appreciated that the advancement of roller 122, the displacement of lock bar 200 to and from its carrierlocking position, the displacement of hold-down bar 630 to and from its ticket clamping position, the advancement and withdrawal of fingers 406-409 and 432-434, and the displacement of lock assembly 548

from and to its lever-locking position are all correlated or coordinated by the apparatus of this invention to achieve the foregoing sequences of operation.

According to another feature of this invention, levers 480-484 may selectively be locked in their weight-representing positions for as long as desired by depressing a pushbutton 650 (see FIG. 1) that is conveniently mounted in the front wall of housing 40 adjacent to pushbutton switch 462. A motion transmitting cable 652 (see FIGS. 4 and 27) is connected to pushbutton 650 and to a lever 654. Lever 654 is pivotably mounted on frame 412 by a pivot pin 656. The pivot axis of lever 654 is parallel to the axis of shaft 422. A spring 658 is anchored at opposite ends to frame 412 and to lever 654 and biases lever 654 in a clockwise direction as viewed from FIG. 27. The motion resulting from pushing pushbutton 650 is transmitted by cable 652 to rotate lever 654 counterclockwise against the bias of spring 658.

As shown in FIG. 27, lever 654 has an upper notched edge 660. Edge 660 is engageable with a pin 662 upon rotation in a counterclockwise direction. Pin 662 is fixed to one of the arms 545.

The notched edge 660 is inclined in such a manner that upon engagement with pin 662 and upon continued rotation of lever 654 in a counterclockwise direction (as viewed from FIG. 27), lock assembly 548 will be cammed in a clockwise direction (as viewed from FIG. 17) to engage locking pawls 550-554 with levers 480-484 respectively, thus locking levers 480-484 against rotation. If lock assembly 548 is already in locking engagement with levers 480-484 when pushbutton 650 is depressed, lever 654 is swung counterclockwise (as viewed from FIG. 27) to a position where the notched edge 660 engages pin 662. Now, lock assembly 548 will be held in its lever-locking position by engagement of lever 654 with pin 662 for as long as pushbutton 650 is held depressed.

From the foregoing description it will be appreciated that as long as pushbutton 650 is held depressed, locking pawls 550-554 will be held in engagement with levers 480-484 to lock levers 480-484 against rotation. Release of pushbutton 650 enables spring 658 to bias lever 654 in a clockwise direction as viewed from FIG. 27, thereby releasing lock assembly 548 from its locking position and allowing it to be lowered under the bias of spring 566 to its unlocking position where pawls 550-554 are disengaged from levers 480-484.

Referring to FIG. 17, the clockwise motion of lock assembly 548, which results from depressing pushbutton 650, is transmitted by spring 568 to urge lever 564 in clockwise direction to its illustrated position. When lever 564 is in its illustrated position pin 567 will oscillate back and forth in the enlarged aperture 565 without imparting any motion to lever 564 when lever 562 is rocked back and forth by rotation of cam 558. Therefore, energization of motor 172 and consequent rotation of cam 558 will not cause lock assembly 548 to be retracted from its illustrated lever-locking position as long as pushbutton 650 is held depressed. Thus, by holding pushbutton 650 depressed to lock levers 480-484 against rotation from their weight-representing positions, the weight indicated by the locked-in positions of levers 480-484 may repeatedly be printed as many times as desired by either depressing pushbutton 462 or by selectively activating printer 22.

It will be recalled that after the initial printing of a weight, levers 480-484 will be locked by pawls 550-554 in their weight-representing positions when motor 172 is de-energized by the opening of switch 464 at the end of the printing cycle. At this stage the weight is therefore memorized by the locked-in positions of levers 480-484. To repeat the printing of the memorized weight on the same ticket or another ticket, push-buttons 462 and 650 are depressed simultaneously. Alternatively, pushbutton 650 may be depressed first, followed by depression of pushbutton 462. In either case, lock assembly 548 will be locked in its lever-locking position to retain levers 480-484 in their weight-representing position and motor 172 will be energized.

By energizing motor 172, shaft 422 will be rotated through another revolution, and roller 122 will be advanced through another revolution along its endless path. The resulting rotation of cam 420 causes fingers 406-409 and 432-434 to advance from their retracted positions toward their cam wheel and cam sector-engaging positions. The resulting rotation of cam 558 will cause lever 562 to rotate counterclockwise (as viewed from FIG. 17); but now, lever 564 will be held in its illustrated position through the connection provided by spring 568, and spring 566 will not be able to pull lever 564 down due to its lighter bias. Thus, any rocking motion of lever 562 will merely cause pin 567 to oscillate back and forth in aperture 565, and no motion will be imparted to lever 564. Cam 558 is therefore free to rotate and lever 562 is free to rock, but lock assembly 548 will remain in locking engagement with levers 480-484. Accordingly, there will be no disengagement of pawls 550-554 as in the operation that was previously described. The forward indexing travel of fingers 406-409 and 432-434 under the bias of springs 414-417 and 442 will not result in any rotation levers 480-484 because levers 480-484 are locked against rotation by having depressed pushbutton 650.

Before print roller 122 reaches the region where it will cause the digits set upon carriers 78-87 to be printed, the rotation of cam 568 causes lock bar 200 to be displaced to its carrier-locking position and hold-down bar 630 to be displaced to its ticket-clamping position in the manner previously described. In the next stage, roller 122 passes under carriers 78-87 to repeat the printing of the memorized weight and to print the selected identification number. Printing of the memorized weight may be repeated as many times as desired by repeatedly depressing both of the pushbuttons 650 and 462 in the manner just described.

It will be appreciated from the foregoing description that the repeated printing of the memorized weight may be accomplished even though the original load is removed from the scale and even though another load of different weight is placed on the scale.

According to another feature of this invention, cover 54 is constructed in such a manner as to permit an electrical pushbutton selector 700 (see FIG. 30) and the previously described, mechanical thumb wheel selector (thumb wheels 300-305) to be optionally, interchangeably mounted on the printer housing 52.

Referring to FIGS. 30-33, which show selector 700 mounted in printer 22 in place of the thumb wheel selector and carriers 82-87, selector 700 comprises a keyboard 702 having a series of pushbutton switches 704 for selecting the different digits in the identification to be printed by printer 22. Pushbutton switches

704 are connected in a suitable, shift register type electrical calculator circuit 706 (see FIG. 33). Circuit 706 operates or controls a suitable, conventional decoding print-out circuit 708 having a series of unshown solenoids for stepping a series of rotatably mounted printing type carriers 710, 711, 712, 713 and 714 to printing positions for printing the number that is selected by depressing pushbutton switches 704. Circuit 706 may be any suitable, conventional form of a keyboard-operated calculator which usually includes circuit 708 to position printing type carriers such as carriers 710-714. In addition to being connected to circuit 708, the output of circuit 706 may also be connected to a conventional display 716 (FIG. 33) for displaying the selected identification number and to one or more remote option circuits as indicated at 718 in FIG. 33. The read-out provided by circuit 718 may be applied to such data processing equipment as storage or a remote print-out of the selected identification number.

Except for the replacement of the previously described thumb wheel selector and carriers 82-87 with the electrical selector 700 and carriers 710-714, and except for the replacement of some parts on the cover and in the printer for mounting selector 700, the scale and printing apparatus shown in FIGS. 30-32 is the same as that shown in FIGS. 1-29. Accordingly, like reference characters have been applied to designate like parts in the embodiment of FIGS. 30-32.

As best shown in FIG. 32, a keyboard panel 720 is detachably mounted on cover 54 in place of panel 312 and covers opening 313a. Panel 720 is formed with an aperture 721 through the pushbuttons of switches 704 extend for access from the exterior of the printer housing. Keyboard 702 is advantageously in the form of a module having a switch housing 722 that mounts the pushbuttons of switches 704. Keyboard 702 may be of any suitable, conventional construction. Housing 722 is mounted on a support frame 724 inside of cover 54. Frame 724 is detachably mounted on cover 54 in place of frame 310.

Circuit 708 is mounted in a suitable casing 726 (FIGS. 31 and 32). Casing 726 is detachably mounted on frame 50 in housing 52. Carriers 710-714 are rotatably supported by casing 726. Although five printing type carriers are shown for selector 700, it will be appreciated the number of carriers may be varied, depending upon the information to be printed. It also will be appreciated that letters or a combination of letters and numbers may be printed. Circuit 706 may be mounted on a circuit board 728 that, in turn, may be detachably mounted on the inside of cover 54.

As shown in FIG. 31, shafts 730 and 732 are detachably mounted on frame 50 in place of shafts 90 and 199 respectively. Shafts 730 and 732 are shorter than shafts 90 and 199 to make room for casing 726. Shafts 90 and 199, like the other components supported by frame 50, are advantageously detachably mounted on frame 50 to allow them to be replaced by shafts 730 and 732. An additional support plate 734 is mounted on one or more of the support arms 48 to support the ends of shafts 730 and 732 adjacent to casing 726. Because carriers 82-87 are omitted from the embodiment of FIGS. 30-32, a shorter lock bar 200a is advantageously mounted on frame 215 in place of lock bar 200. Lock bar 200a is otherwise the same as lock bar 200.

Since carriers 78-81, springs 244, the assembly of frame 215 and lock bar 200a, springs 218 and 220

cable retainer block 268 are all axially adjustable, they may easily be shifted to the positions shown in FIG. 32 to make room for casing 726.

From the foregoing description it will be appreciated that printer 22 may optionally and interchangeably be equipped with a mechanical selector such as thumb wheels 300-305 or an electrical selector such as selector 700. If it is not desired to print an identification or other information along with the weight of the weighed load, the selector and its associated printing type carriers may optionally be omitted from printer 22 without requiring modification of the printer. When no selector is incorporated into the printer, a blank plate 740 (see FIG. 34) may advantageously be detachably mounted on cover 54 in place of panels 312 and 720 to cover opening 313a. Thus, the following structures may optionally and interchangeably be mounted in printer 22: the thumb wheel selector comprising thumb wheels 300-305, the pushbutton selector 700, and plate 740.

To select an identification number with selector 700, the operator depresses selected pushbutton switches 704 to operate circuit 706. Circuit 706 energizes the unshown solenoids or other corresponding components in circuit 708 to step carriers 710-714 to positions for printing the desired number. When pushbutton 462 is selectively depressed, print roller 122 first traverses carriers 78-81 and then carriers 710-714 to sequentially print out the weight set up on carriers 78-81 and the selected identification number set up on carriers 710-714.

From the foregoing description it will be appreciated that the assembly of pulley or sheave 444 and cable 446 constitutes a tackle and particularly a single-whip tackle. Likewise, the assembly of pulley or sheave 448 and cable 450 is also a singlewhip tackle.

What is claimed and desired to be secured by Letters Patent is:

1. In an apparatus for weighing a load and for printing the weight of the weighed load, a scale mechanism for weighing the load, a printer having a plurality of rotatably mounted carriers, a lock member mounted for displacement between a locking position where it directly engages said carriers to lock said carriers against rotation and an unlocking position where it releases said carriers to allow rotation thereof, a rotatably mounted shaft forming a part of said scale mechanism, means forming a part of said scale mechanism for rotating said shaft through an angular distance that is proportional to the weight of the load being weighed, cam means mounted on said shaft, means operatively connected to said carriers and including elements that are cooperatively engageable with said cam means for rotating said carriers to positions for printing the weight of the weighed load, and selectively operated means for sequentially engaging said elements with said cam means to rotate said carriers to positions for printing the weight of the weighed load and for displacing said lock member to its locking position to lock said carriers in the positions to which said carriers have been rotated to print the weight of the weighed load.

2. The apparatus defined in claim 1 comprising a horizontally extending shaft, said carriers being rotatably mounted on said shaft for rotation about a common horizontal axis, and means supporting said lock member for vertical displacement between its locking and unlocking positions.

3. The apparatus defined in claim 2 wherein each carrier is formed with an opening and a series of spaced apart teeth along an edge of said opening, said lock member extending through said opening in each carrier in substantially parallel relation with said shaft, and said lock member being engageable with adjacently disposed ones of said teeth on each carrier upon displacement to said locking position to prevent rotation of each carrier about said shaft, said lock member being disengaged from said teeth on each carrier upon displacement to said unlocking position.

4. The apparatus defined in claim 3 wherein said means supporting said lock member includes spring means biasing said lock member to said unlocking position.

5. The apparatus defined in claim 3 wherein said means supporting said lock member comprises a horizontally extending rod and means suspending said lock member from said rod and providing for selective displacement of said lock member axially of said rod.

6. The apparatus defined in claim 5 wherein said rod is threaded and wherein said suspending means has at least one part engageable with the threads on said rod to retain said lock member in an axially adjusted position.

7. In an apparatus for weighing a load and for printing the weight of the weighed load, a scale for weighing the load and providing a mechanical output that is indicative of the weight of the weighed load, a selectively activatable printer conditioned by said output for printing the weight of the load, means for selectively retaining said mechanical output for any selected time independently of the application of said load to said scale, and means for selectively and repeatedly activating said printer to print the weight indicated by said output.

8. In an apparatus for weighing a load and for printing the weight of the weighed load, a scale for weighing the load and having a plurality of output members that are displaced in accordance with digital values in different orders of a multi-digit number that is indicative of the weight of the weighed load, a selectively activatable printer, means for applying the displacement of said output members to condition said printer for printing the weight indicated by the displacement of said output members upon activation of said printer, displaceable locking means normally positioned to engage and lock said output members against rotation after each printing of the weight is completed, first selectively operable means for sequentially releasing said locking means from said output members to enable said output members to be displaced by the weight of the applied load to their weight-indicating positions, repositioning said locking means to lock said output members against displacement prior to printing, and activating said printer to print the weight indicated by the displacement of said output members, the improvement comprising second selectively operable means for selectively preventing said first selectively operable means from releasing said lock means from said output members when said first selectively operable means is operated to activate said printer, thereby enabling the weight indicated by the locked positions of said output members to repeatedly be printed by repeated activation of said printer.

9. The apparatus defined in claim 8 wherein said printer comprises a plurality of rotatably mounted printing carriers, said apparatus further including mo-

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tion transmitting means connecting said output mem-
bers to said carrier to effect rotation of said carriers to
positions for printing the weight of the weighed load.

10. The apparatus defined in claim 9 comprising a
further printer that is electrically controlled for print-

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ing a number, and transducer means operatively con-
nected between said further printer and said output
members for operating said further printer.

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