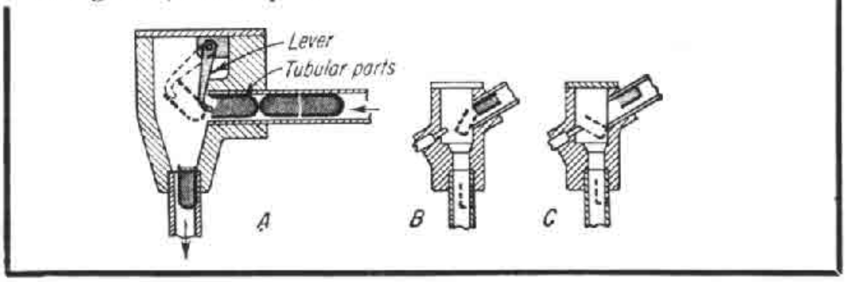
CHAPTER 3
PARTS-HANDLING MECHANISMS

MECHANISMS THAT SORT, FEED, OR WEIGH

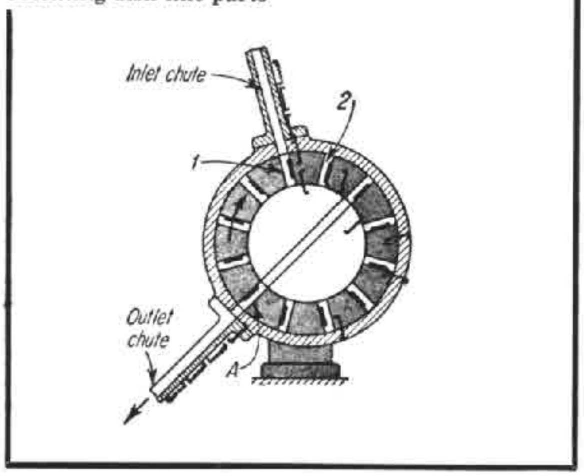
ORIENTING DEVICES

Orienting short, tubular parts



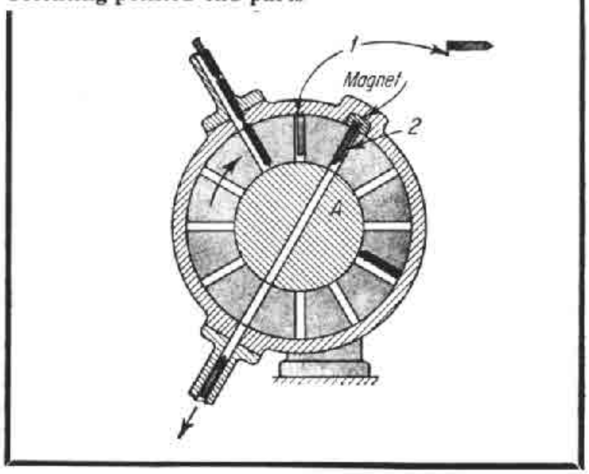
Here's a common problem; Parts arrive in either open-end or closed-end first; you need a device that will orient all the parts so they feed out facing the same way. In Fig. A. when a part comes in open-end first, it is pivoted by the swinging lever so that the open end is up. When it comes in closed-end first, the part brushes away the lever to flip over headfirst. Fig. B and C show a simpler arrangement with pin in place of lever.

Orienting dish-like parts



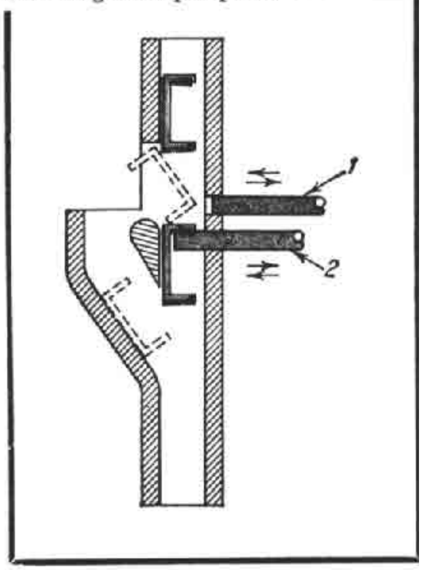
A part with its open-end facing to the right (part 1) falls on a matching projection as the indexing wheel begins to rotate clockwise. The projection retains the part for 230º to point A where it falls away from the projection to slide down the outlet chute, open-end up. An incoming part facing the other way (2) is not retained by the projection, hence it slides *through* the indexing wheel so that it too, passes through the outlet with its open-end up.

Orienting pointed-end parts



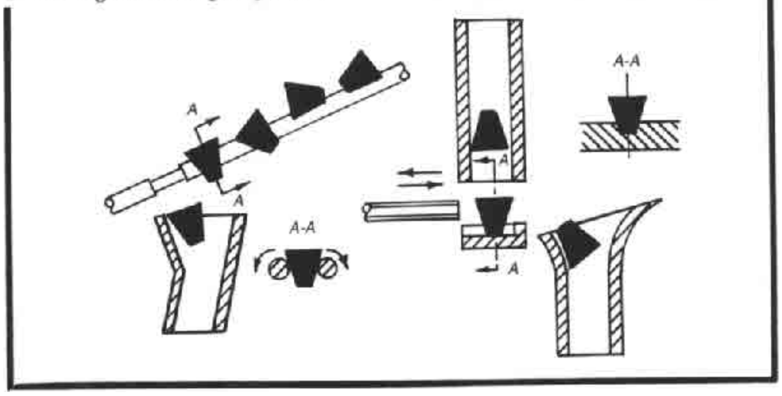
The important point here is that the built-in magnet cannot hold on to a part as it passes by if the part has its pointed end facing the magnet. Such a correctly oriented part (part 1) will fall through the chute as the wheel indexes to a stop. An incorrectly oriented part (part 2) is briefly held by the magnet until the indexing wheel continues on past the magnet position. The wheel and the core with the slot must be made from some nonmagnetic material.

Orienting U-shaped parts



The key to this device is two pins that reciprocate one after another in the horizontal direction. The parts come down the chute with the bottom of the "U" facing either to the right or left. All pieces first strike and rest on pin 2. Pin 1 now moves into the passage way, and if the bottom of the "U" is facing to the right, the pin would kick over the part as shown by the dotted lines. If, on the other hand, the bottom of the "U" had been to the left, the motion of pin 1 would have no effect, and as pin 2 withdrew to the right, the part would be allowed to pass down through the main chute.

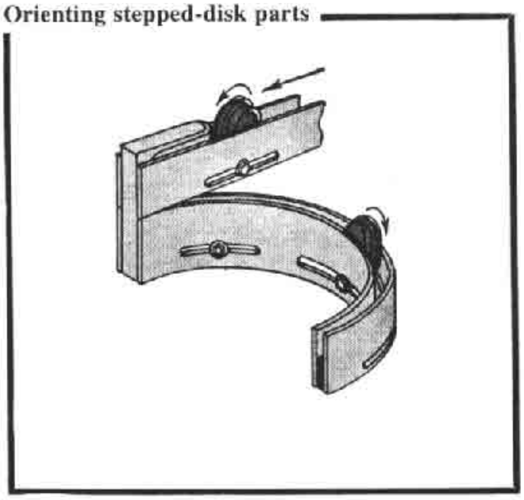
Orienting cone-shaped parts



Regardless of which end of the cone faces forward as the cones slide down the cylindrical rods, the fact that both rods rotate in opposite directions causes the cones to assume the position shown in section *A-A* (above). When the cones reach the thinned-down section of the rods, they fall down into the chute, as illustrated.

In the second method of orienting cone-shaped parts (left), if the part comes down small end first, it will fit into the recess. The reciprocating rod, moving to the right, will then kick the cone over into the exit chute. But if the cone comes down with its large end first, it sits on top of the plate (instead of inside the recess), and the rod simply pushes it into the chute without turning it over.

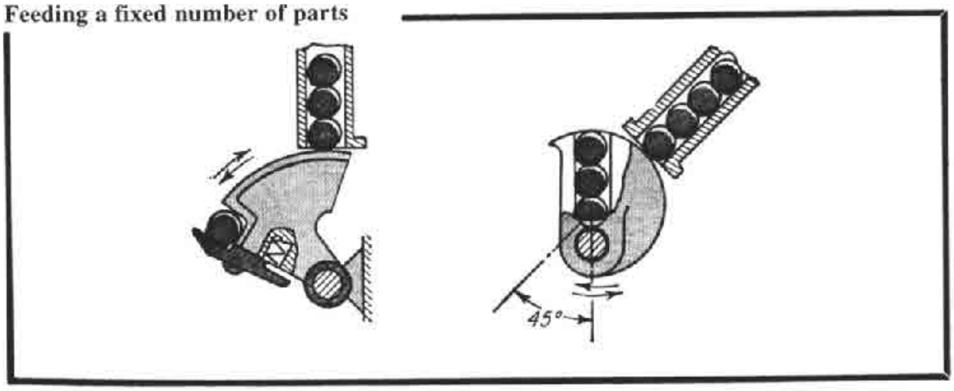
Orienting stepped-disk parts



Parts rolling down the top rail to the left drop to the next rail which has a circular segment. The part, therefore, continue to roll on in the original direction, but their faces have now been rotated 180º. The idea of dropping one level might seem oversimplified, but it avoids the cam-based mechanisms more commonly used for accomplishing this job.

SIMPLE FEEDING DEVICES

Feeding a fixed number of parts

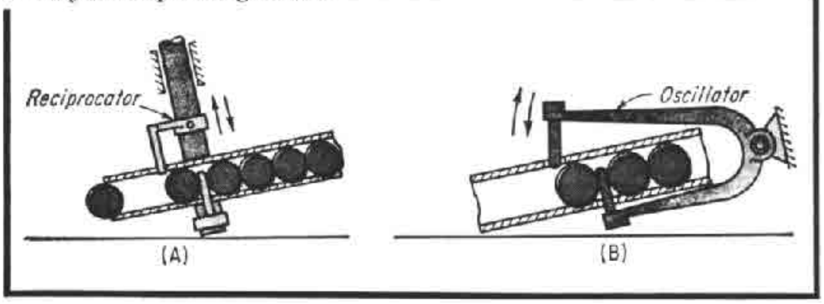


The oscillating sector picks up the desired number of parts, left diagram, and feeds them by pivoting the required number of degrees. The device for oscillating the sector must be able to produce dwells at both ends of the stroke to allow sufficient time for the parts to fall in and out of the sector.

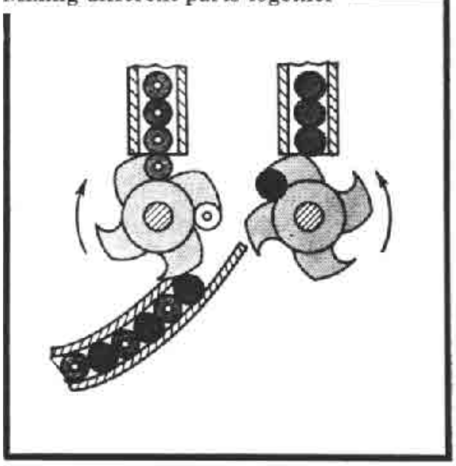
The circular parts feed down the chute by gravity, and they are separated by the reciprocating rod. The parts first roll to station 3 during the downward stroke of the reciprocator, then to station 1 during the upward stroke; hence the time span between parts is almost equivalent to the time it takes for the reciprocator to make one complot oscillation.

The device in Fig. B is similar to the one in Fig. A, except that the reciprocator is replaced by an oscillating member.

One-by-one separating device

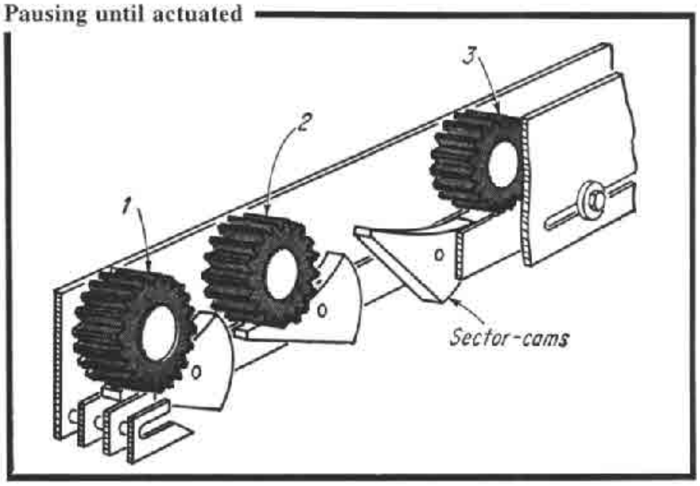


Mixing different parts together



Two counter rotating wheels form a simple device for alternating the feed of two different workpieces.

Pausing until actuated



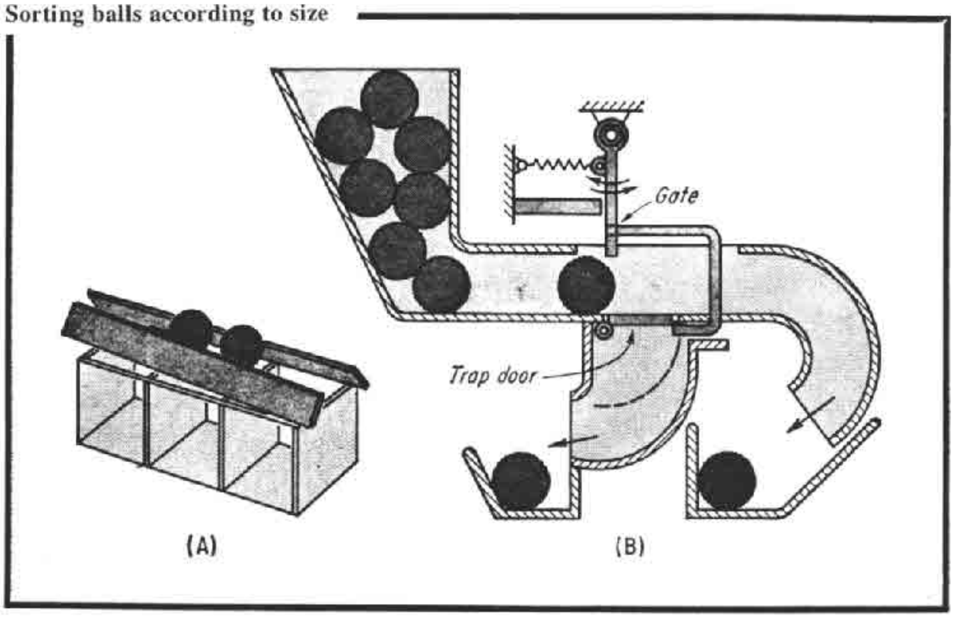
Each gear in this device is held up by a pivotable cam sector until the gear ahead of it moves forward. Thus, gear 3, rolling down the chute, kicks down its sector cam but is held up by the previous cam. When gear 1 is picked off (either manually, or mechanically), its sector cam pivots clockwise because of its own weight. This permits gear 2 to move into place of gear 1—and frees cam 2 to pivot clockwise. Thus, all gears in the row move forward one station.

SORTING DEVICES

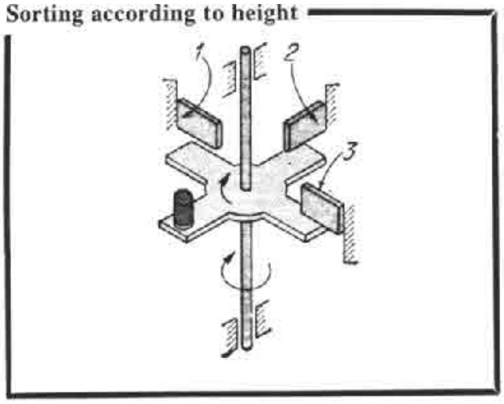
In the simple device (A) the balls run down two inclined and slightly divergent rails. The smallest balls, therefore, will fall into the left chamber, the medium-size ones into the middle-size chamber, and the largest ones into the right chamber.

In the more complicated arrangement (B), the balls come down the hopper and must pass a gate which also acts as a latch for the trapdoor. The proper-size balls pass through without touching (actuating) the gate. Larger balls, however, brush against the gate which releases the catch on the bottom of the trapdoor, and fall through into the special trough for the rejects.

Sorting balls according to size



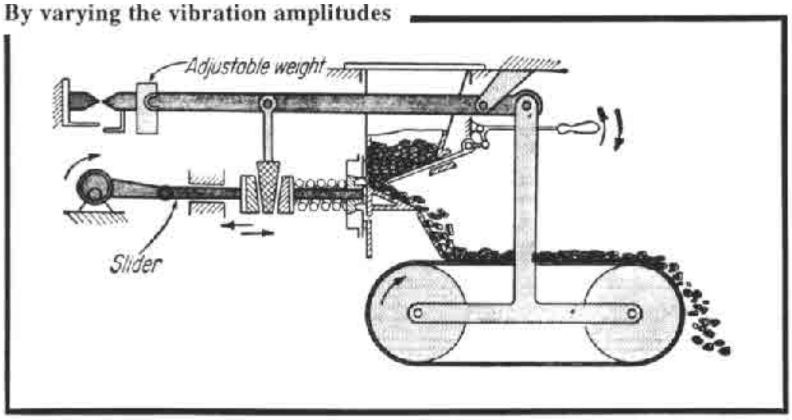
Sorting according to height



Workpieces of varying heights are placed on this slowly rotating cross-platform. Bars 1, 2, and 3 have been set at decreasing heights beginning with the highest bar (bar 1), down to the lowest bar (bar 3). The workpiece is therefore knocked off the platform at either station 1, 2, or 3, depending on its height.

WEIGHT-REGULATING ARRANGEMENTS

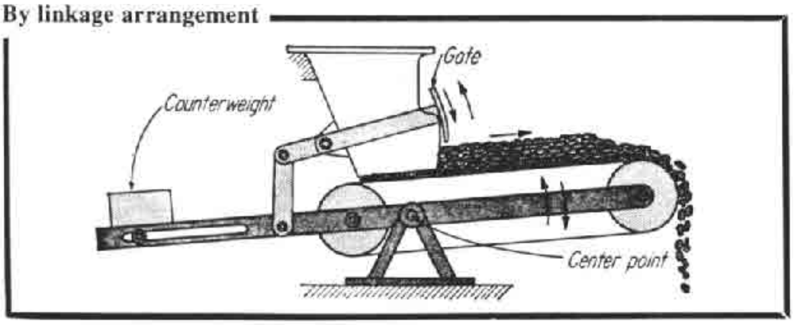
By varying the vibration amplitudes



The material in the hopper is fed to a conveyor by the vibration of the reciprocating slider. The pulsating force of the slider is transmitted through the rubber wedge and on to the actuating rod. The amplitude of this force can be varied by moving the wedge up or down. This is done automatically by making the conveyor pivot around a central point. As the conveyor becomes overloaded, it pivots clockwise to raise the wedge, which reduces the amplitude of the force and slows the feed rate of the material.

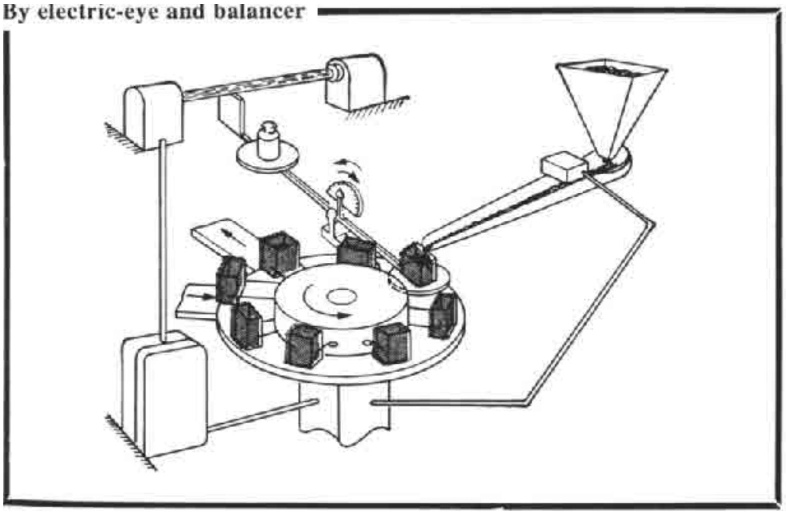
Further adjustments in feed rate can be made by shifting the adjustable weight or by changing the speed of the conveyor belt.

By linkage arrangement



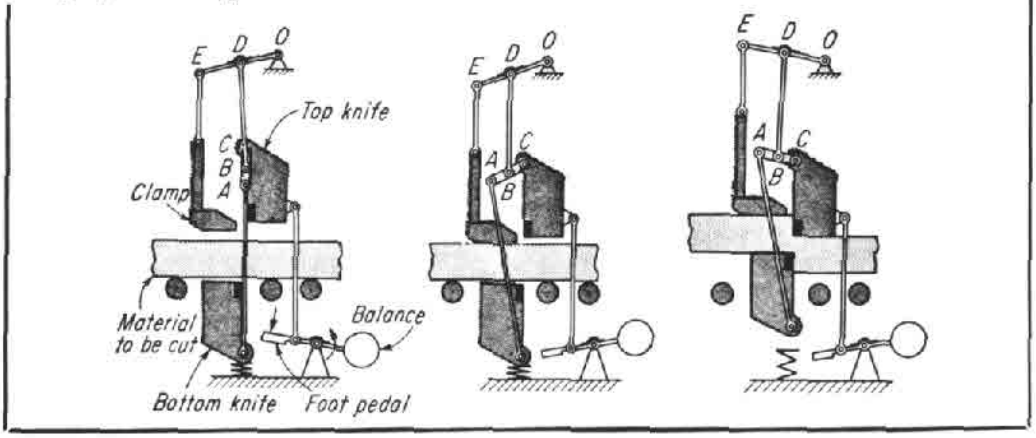
The loose material falls down the hopper and is fed to the right by the conveyor system which can pivot about the center point. The frame of the conveyor system also actuates the hopper gate so that if the amount of material on the belt exceeds the required amount, the conveyor pivots clockwise and closes the gate. The position of the counterweight on a frame determines the feed rate of the system.

By electric-eye and balancer



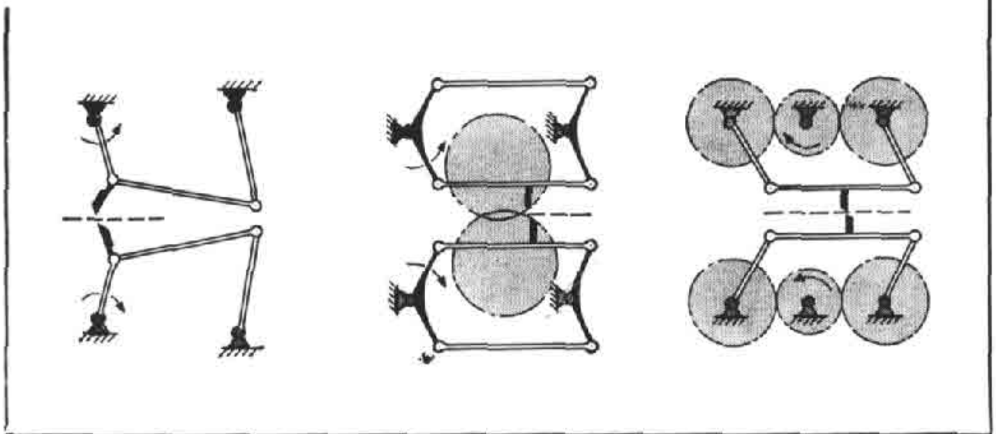
The indexing table automatically stops at the feed station. As the material drops into the container, its weight pivots the screen upward to cut off the light beam to the photocell relay. This in turn shuts the feed gate. The reactuation of the indexing table can be automatic after a time delay or by the cutoff response of the electric eye.

Clamping and cutting device



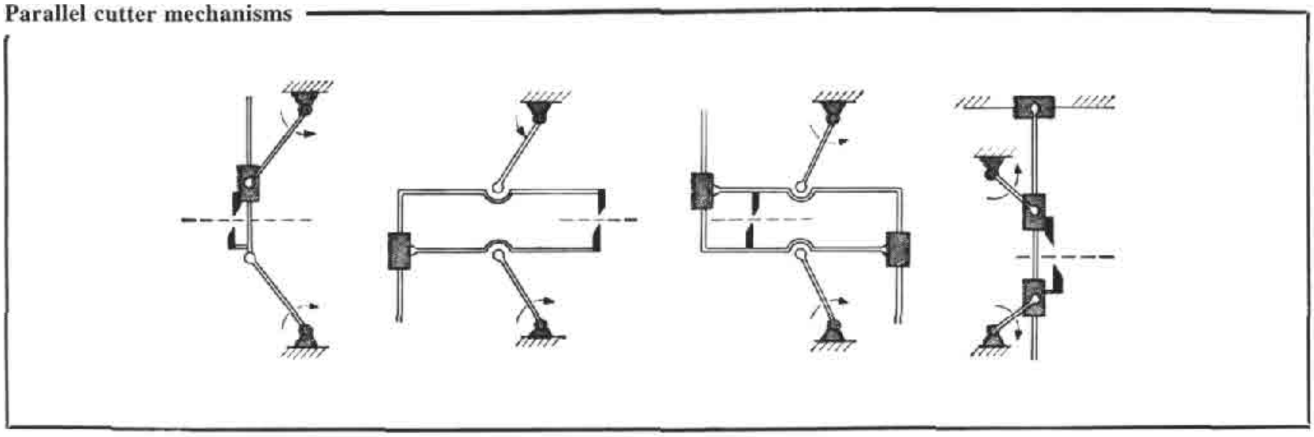
By pressing down on the foot pedal of this mechanism, the top knife and the clamp will be moved downward. However, when the clamp presses on the material, both it and link *EDO* will be unable to move further. Link *AC* will now begin to pivot around point *B*, drawing the lower knife up to begin the cutting action.

Four-bar cutter device



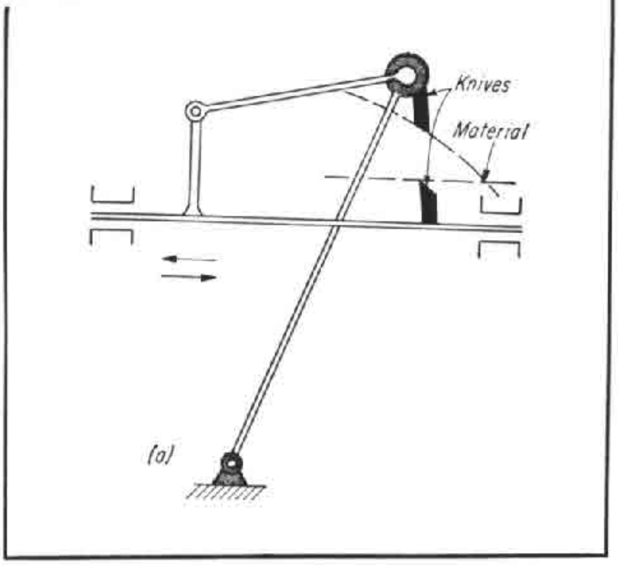
These 3 four-bar cutters provide a stable, strong, cutting action by coupling two sets of links to chain four-bar arrangements.

Parallel cutter mechanisms



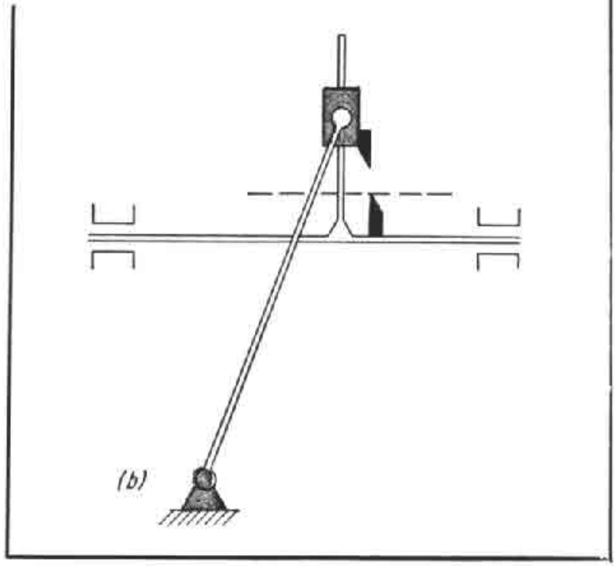
The cutting edges of the knives in the four mechanisms move parallel to each other, and they also remain vertical at all times to cut the material while it is in motion. The two cranks are rotated with constant velocity by a 1 to 1 gear system (not shown), which also feeds the material through the mechanism.

Curved-motion cutter



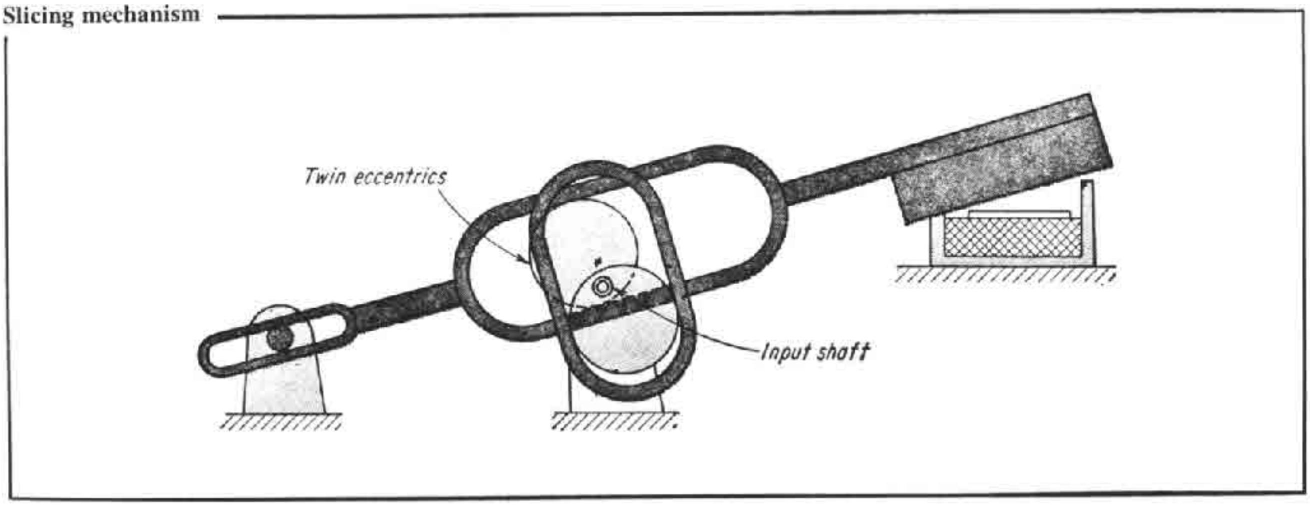
The material is cut while in motion by the reciprocating action of the horizontal bar. As the bar with the bottom knife moves to the right, the top knife will arc downward to perform the cutting operation.

Vertical cutter motion



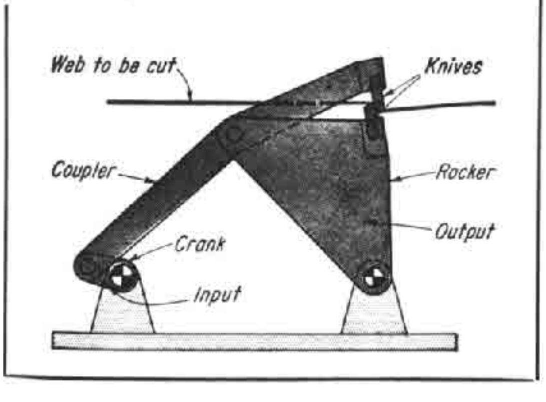
The top knife in this arrangement remains parallel to the bottom knife at all times during cutting to provide a true scissor-like action, but friction in the sliding member can limit the cutting force.

Slicing mechanism



Slicing motion is obtained from the synchronized effort of two eccentric disks. The two looped rings actuated by the disks are welded together. In the position shown, the bottom eccentric disk provides the horizontal cutting movement, and the top disk provides the up-and-down force necessary for the cutting action.

Web-cutting mechanism

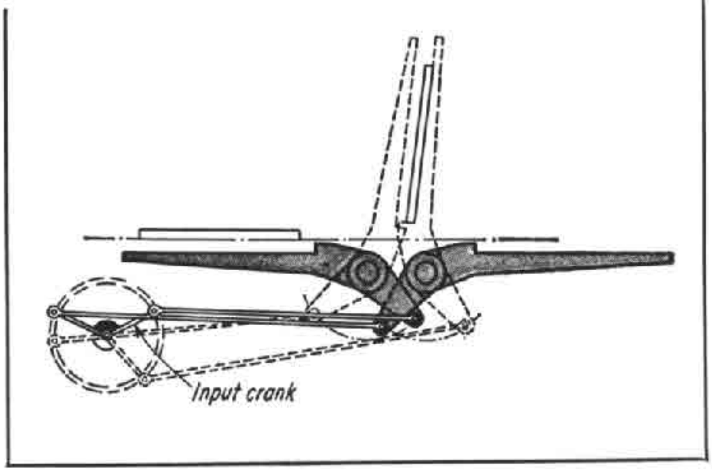


This four-bar linkage with an extended coupler can cut a web on the run at high speeds. The four-bar linkage shown is dimensioned to give the knife a velocity during the cutting operation that is equal to the linear velocity of the web.

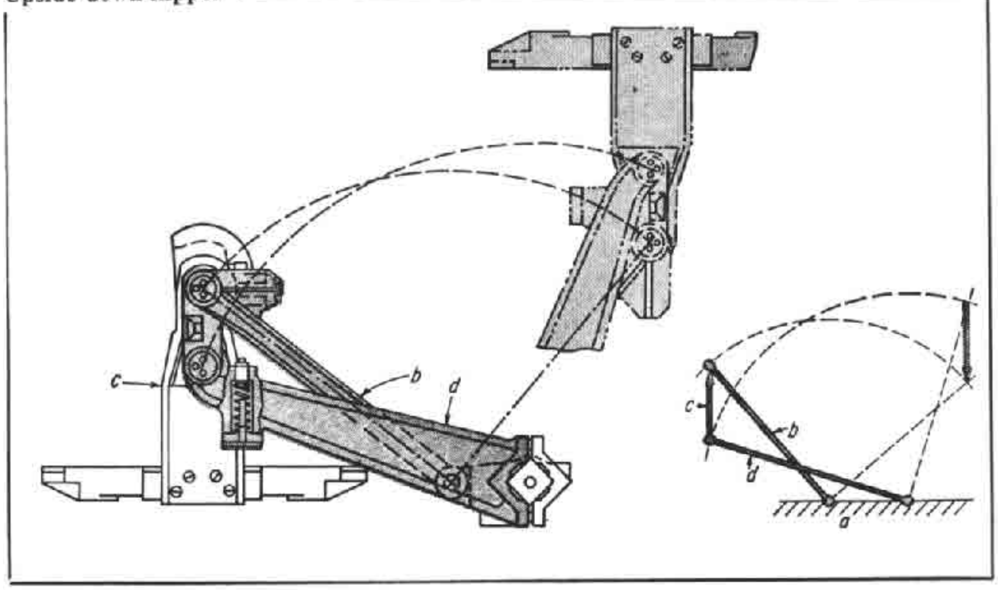
FLIPPING MECHANISMS

This mechanism can turn over a flat piece by driving two four-bar linkages from one double crank. The two flippers are actually extensions of the fourth members of the four-bar linkages. Link proportions are selected so that both flippers rise up at the same time to meet a line slightly off the vertical to transfer the piece from one flipper to the other by the momentum of the piece.

Turnover device



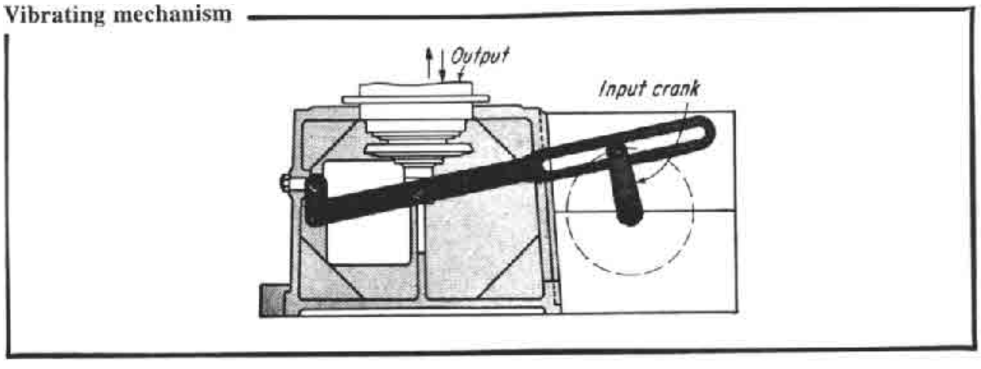
Upside-down flipper



This is a four-bar linkage (links *a*, *b*, *c*, *d*) in which the part to be turned over is coupler *c* of the linkage. For the proportions shown, the 180º rotation of link *c* is accomplished during the 90º rotation of the input link.

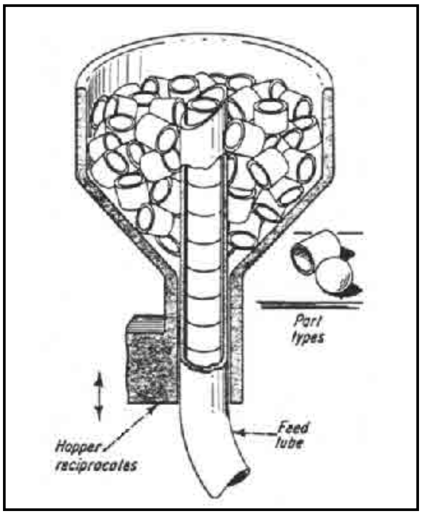
VIBRATING MECHANISM

Vibrating mechanism

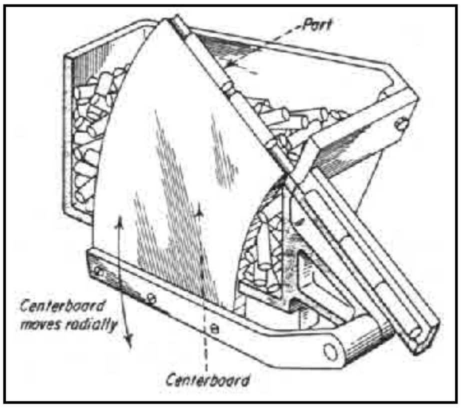


As the input crank rotates, the slotted link, which is fastened to the frame with an intermediate link, oscillates to vibrate the output table up and down.

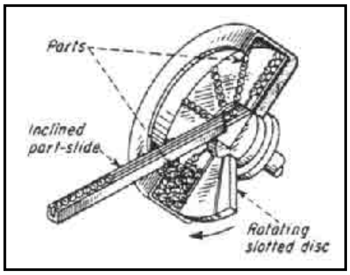
SEVEN BASIC PARTS SELECTORS



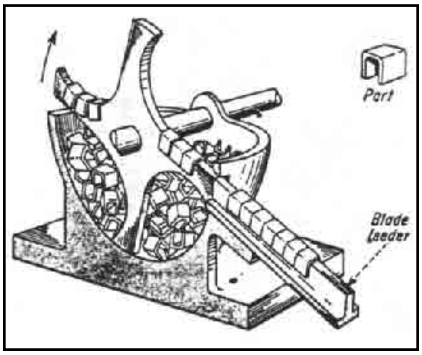
A **reciprocating feed** for spheres or short cyclinders is one of the simplest feed mehanisms. Either the hopper or the tube reciprocates. The hopper must be kept topped-up with parts unless the tube can be adjusted to the parts level.



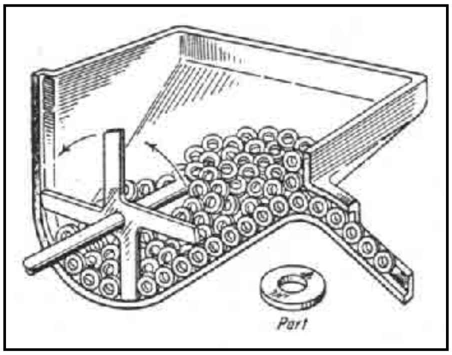
A centerboard selector is similar to reciprocating feed. The centerboard top can be milled to various section shapes to pick up moderately complex parts. I works best, however, with cylinders that are too long to be led with the reciprocating hopper. The feed can be continuos or as required.



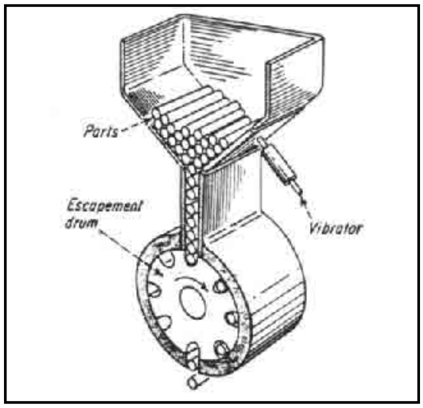
A rotary screw-feed handles screws, headed pings, shouldered shafts, and similar parts in most hopper feeds, random selection of chance-oriented parts calls for additional machinery if the parts must be fed in only one specific position. Here, however, all screws are fed in the same orientation) except for slot position) without separate machinery.



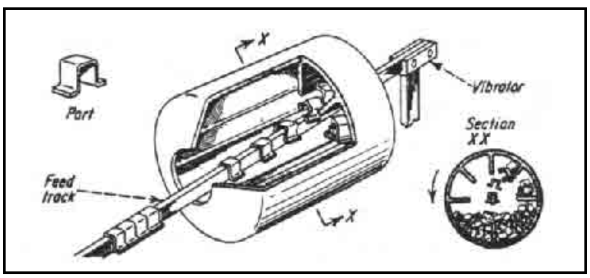
Rotary centerblades catch small U-shaped parts effectively if their legs are not too long. The parts must also be resilient enough to resist permanent set from displacement forces as the blades cut through a pile of parts. The feed is usual continuous.



A paddle wheel is effective for feeding disk-shaped parts if they are stable enough. Thin, weak parts would bend and jam. Avoid these designs, if possible—Especially if automatic assembly methods will be employed.

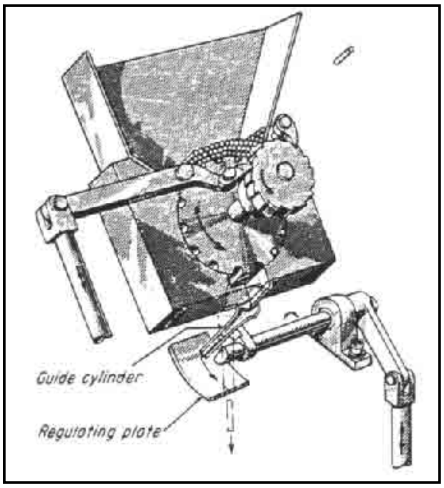


A long-cylinder feeder is a variation of the first two hoppers. If the cylinders have similar ends, the parts can be fed without proposition, thus assisting automatic assembly. A cylinder with differently shaped ends requires extra machinery to orientated the part before it can be assembled.

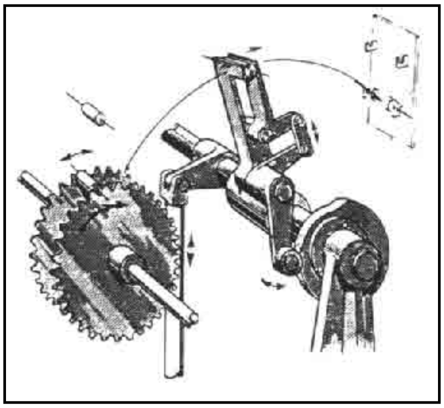


A barrel hopper is useful if parts lend to become entangled. The parts drop free of the rotating-barrel sides. By chance selection, some of them fall onto the vibrating rack and are fed out of the barrel. The parts should be stiff enough to resist excessive bending because the tumbling action can subject them to relatively severe loads. The tumbling can help to remove sharp burrs.

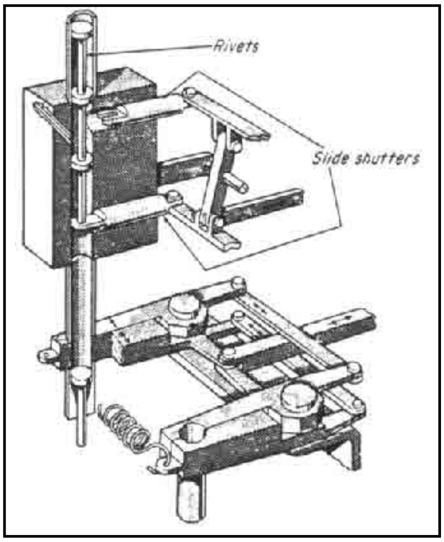
ELEVEN PARTS-HANDLING MECHANISMS



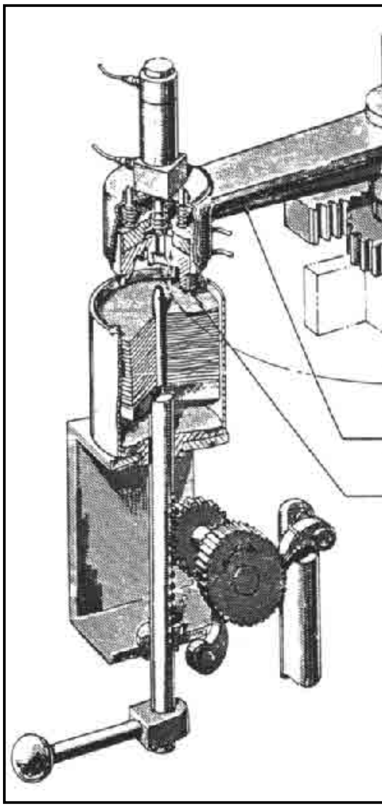
Gravity feed for rods. Single rods of a given length are transferred from the hopper to the lower guide cylinder by means of an intermittently rotating disk with a notched circumference. The guide cylinder, moved by a lever, delivers the rod when the outlet moves free of the regulating plate.



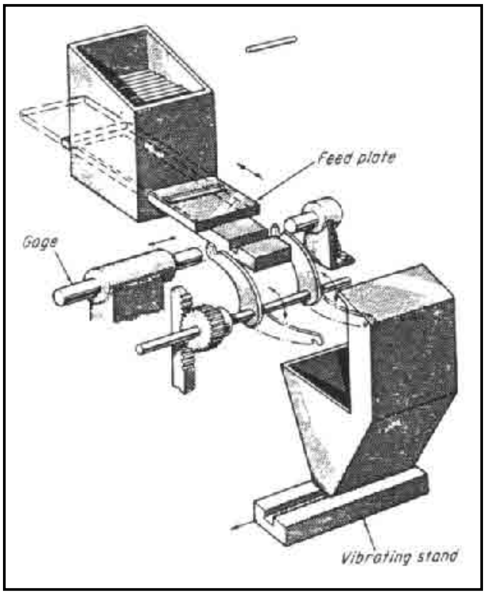
Feeding electronic components. Capacitors, for example, can be delivered by a pair of intermittently rotating gearlike disks with notched circumferences. Then a pick-up arm lifts the capacitor and it is carried to the required position by the action of a cam and follower.



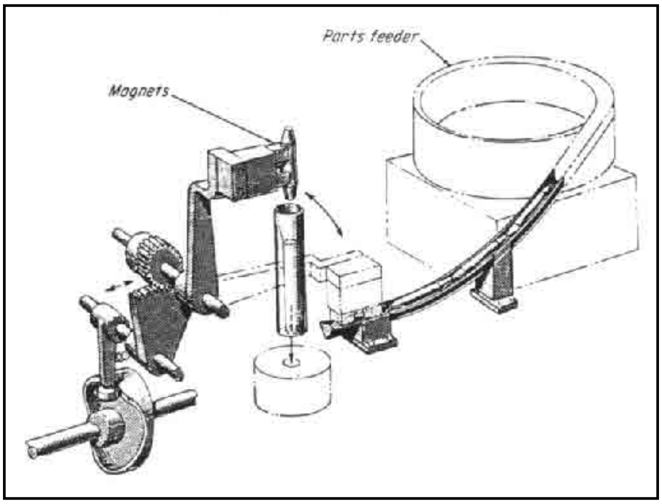
Feeding headed rivets. Headed rivets, correctly oriented, are supplied from a parts-feeder in a given direction. They are dropped, one by one, by the relative movement of a pair of slide shutters. Then the rivet falls through a guide cylinder to a clamp. Clamp pairs drop two rivets into corresponding holes.



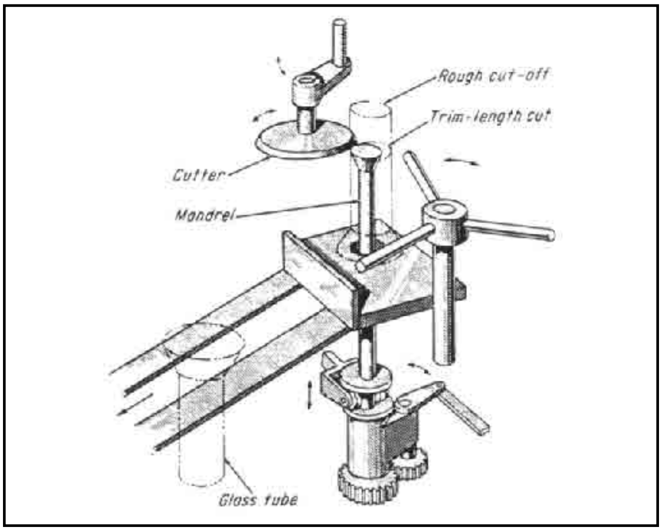
Label feed. Labels are taken out of the hopper by a carrying arm with a vacuum unit to hold the label. The label is then placed into the required position, and the vacuum hold is released.



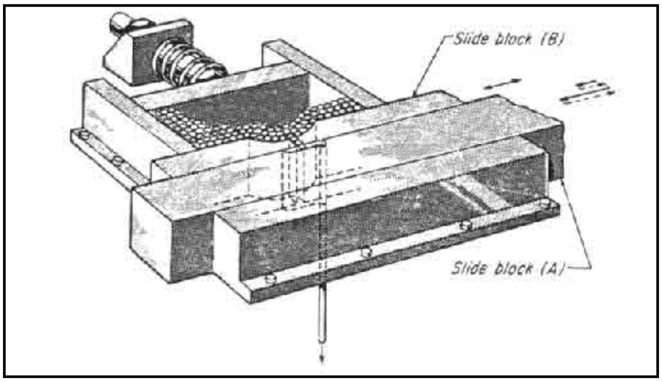
Horizontal feed for fixed-length rods. Single rods of a given length are brought from the hopper to the slot of a fixed plate by a moving plate. After being gauged in the notched portion of the fixed plate, each rod is moved to the chute by means of a lever, and is removed from the chute by a vibrating table.



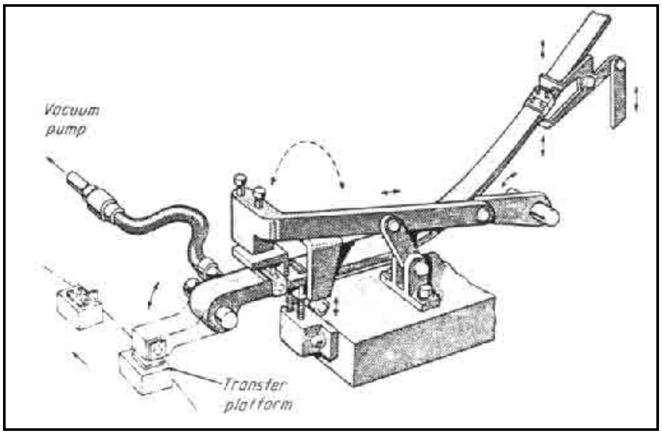
Pin inserter. Pins, supplied from the parts-feeder, are raised to a vertical position by a magnet arm. The pin drops through a guide cylinder when the electromagnet is turned off.



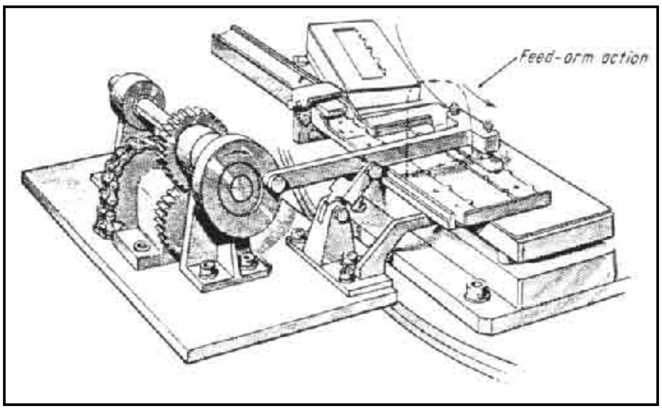
Cutoff and transfer devices for glass tubes. The upper part of a rotating glass tube is held by a chuck (not shown). When the cutter cuts the tube to a given length, the mandrel comes down and a spring member (not shown) drops the tube on the chute.



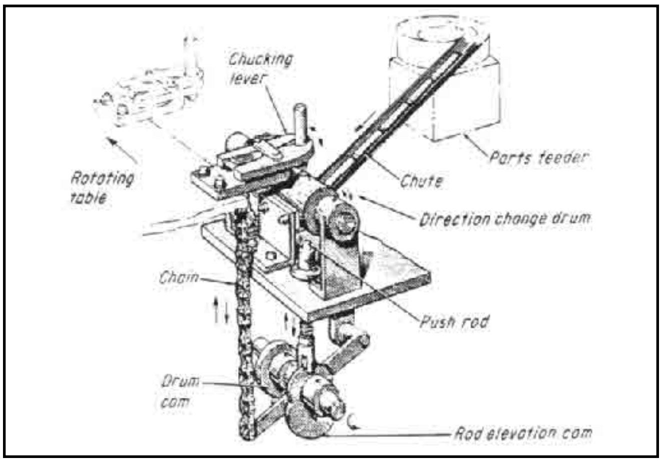
Vertical feed for wires. Wires of fixed length are stacked vertically, as illustrated. They are removed, one by one, as blocks A and B are slid by a cam and lever (not shown) while the wires are pressed into the hopper by a spring.



Feeding special-shaped parts. Parts of such special shapes as shown are removed, one by one, in a given direction, and are then moved individually into the corresponding indents on transfer platforms.



Lateral feed for plain strips. Strips supplied from the parts-feeder are put into the required position, one by one, by an arm that is part of a D-drive linkage.



Vertical feed for rods. Rods supplied from the parts-feeder are fed vertically by a direction drum and a pushing bar. The rod is then drawn away by a chucking lever.

SEVEN AUTOMATIC-FEED MECHANISMS

The design of feed mechanisms for automatic or semiautomatic machines depends largely upon such factors as size, shape, and character of the materials or parts that are to be fed into a machine, and upon the kinds of operation to be performed. Feed mechanisms can be simple conveyors that give positive guidance, or they might include secure holding devices if the parts are subjected to processing operations while being fed through a machine. One of the functions of a feed mechanism is to extract single pieces from a stack or unassorted supply of stock. If the stock is a continuous strip of metal, roll of paper, long bar, or tube, the mechanism must maintain intermittent motion between processing operations. These conditions are illustrated in the accompanying drawings of feed mechanisms.

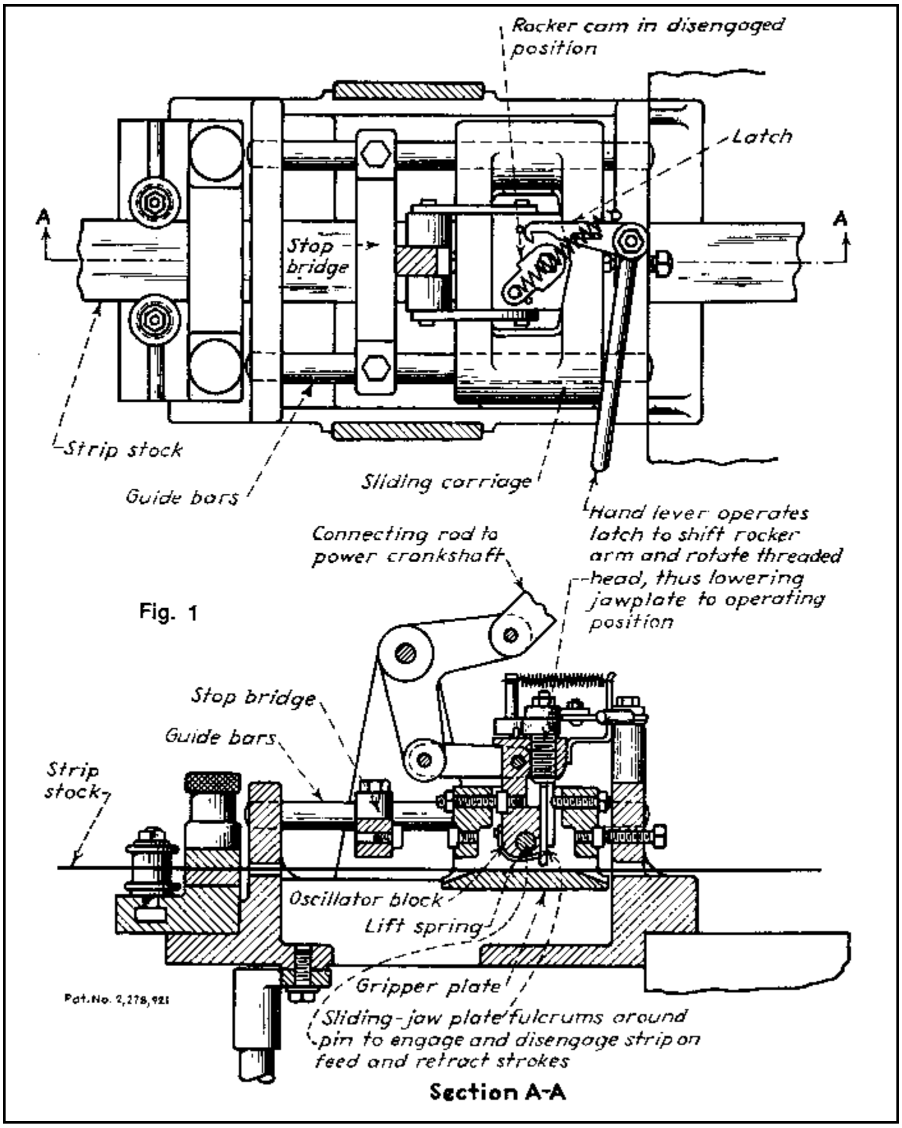
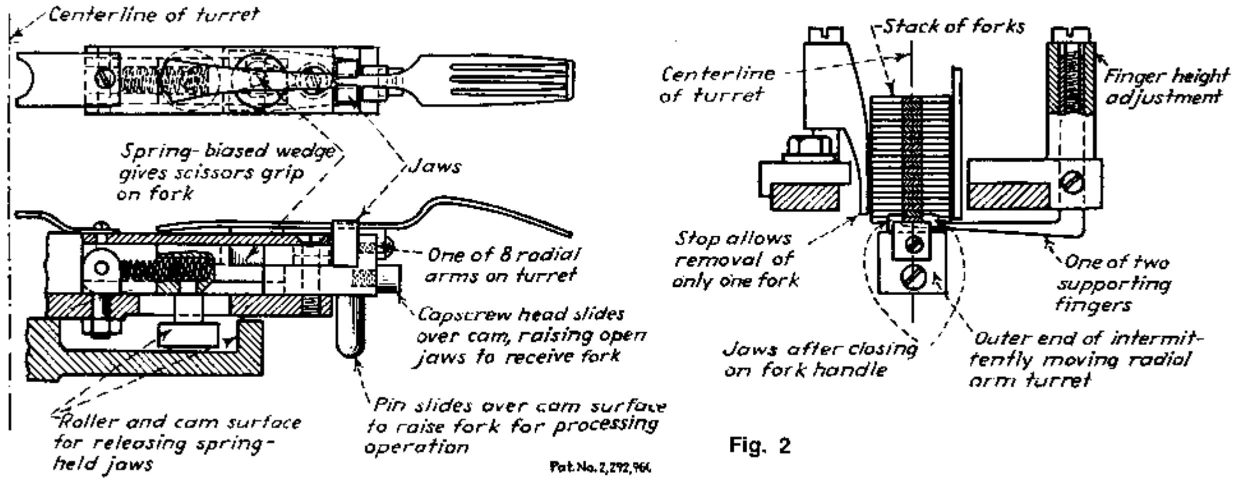
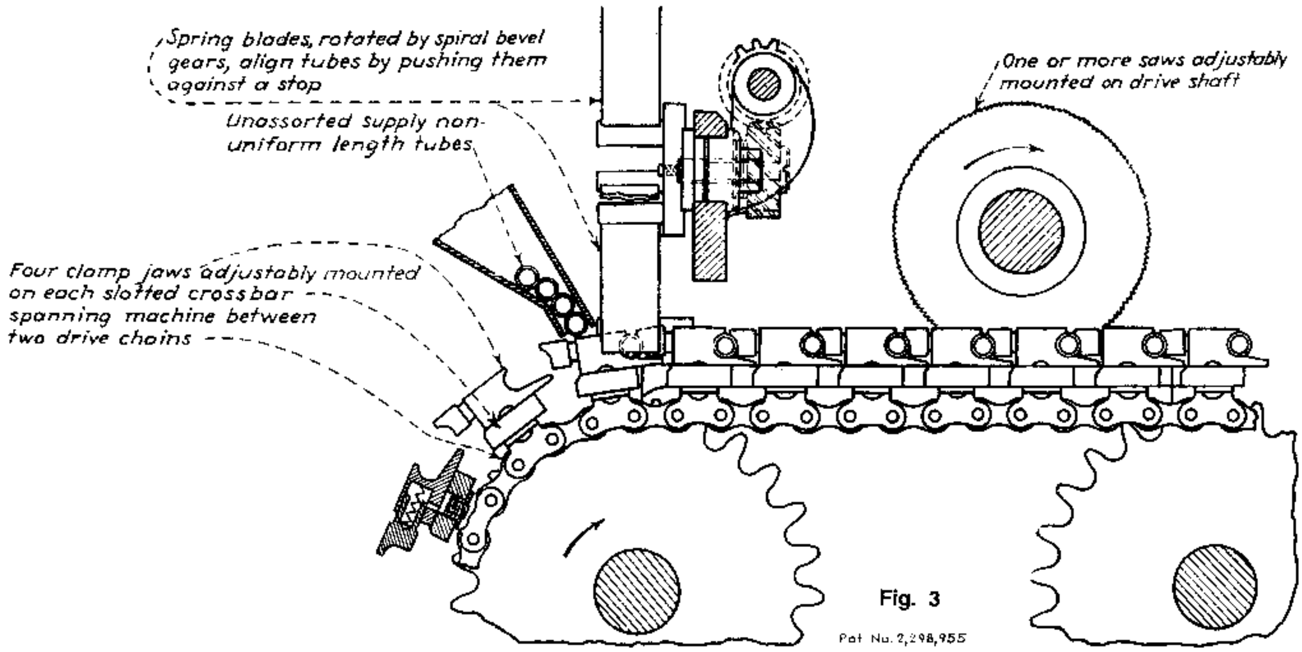


Fig. 1



Centerline of turret
Spring-biased wedge gives scissors grip on fork
Jaws
One of 8 radial arms on turret
Capscrew head slides over cam, raising open jaws to receive fork
Roller and cam surface for releasing spring-held jaws
Pin slides over cam surface to raise fork for processing operation
Pat. No. 2,292,966
Stack of forks
Centerline of turret
Finger height adjustment
Stop allows removal of only one fork
One of two supporting fingers
Jaws after closing on fork handle
Outer end of intermittently moving radial arm turret

Fig. 2



Spring blades, rotated by spiral bevel gears, align tubes by pushing them against a stop
Unassorted supply non-uniform length tubes
One or more saws adjustably mounted on drive shaft
Four clamp jaws adjustably mounted on each slotted crossbar spanning machine between two drive chains
Pat. No. 2,298,955

Fig. 3

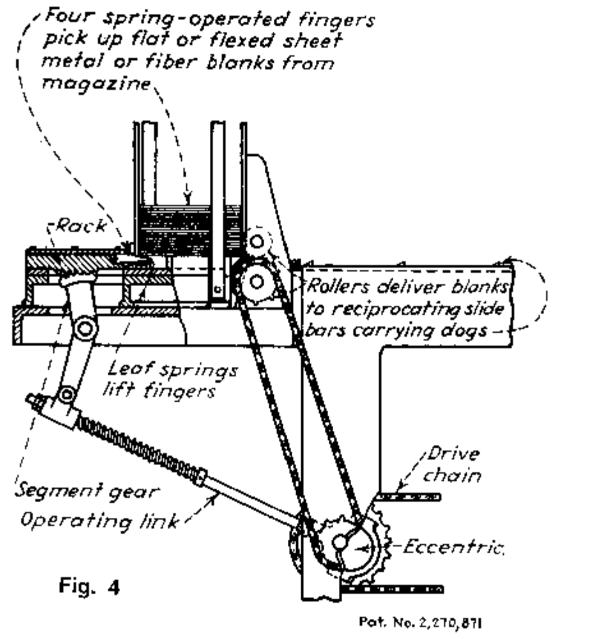
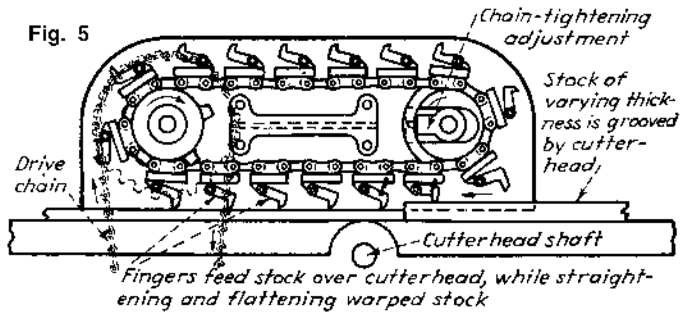


Fig. 4

Fig. 5



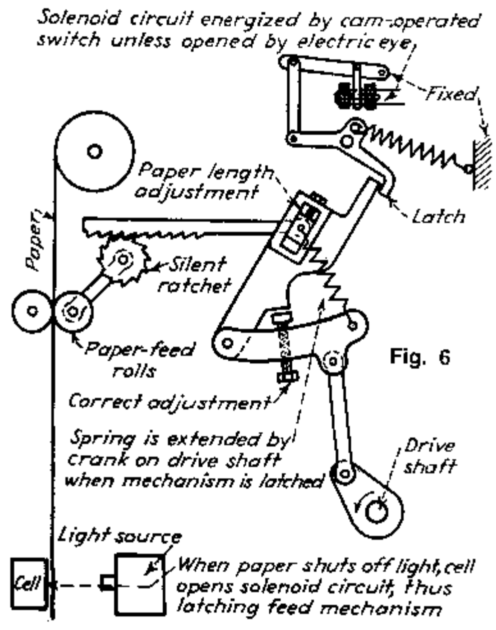


Fig. 6

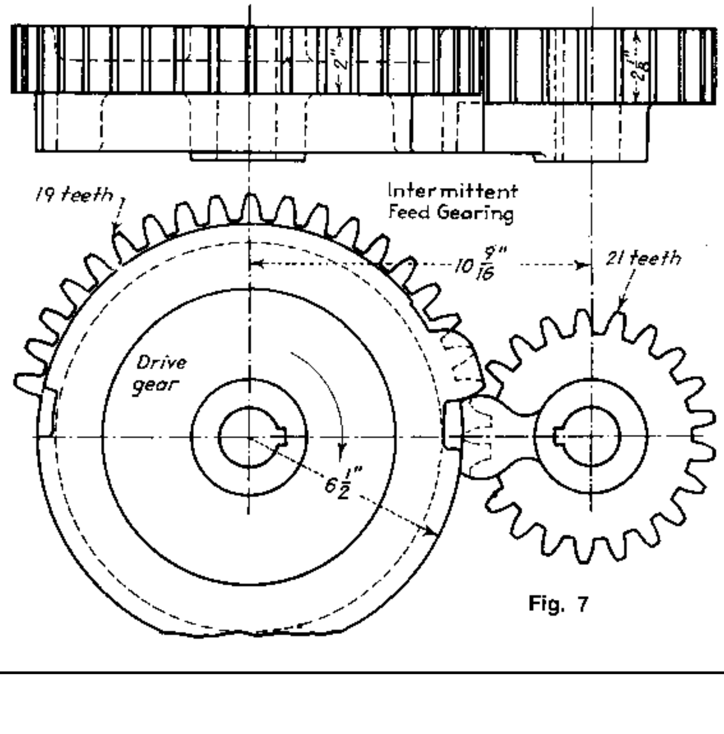


Fig. 7

SEVEN LINKAGES FOR TRANSPORT MECHANISMS

Transport mechanisms generally move material. The motion, although unidirectional, gives an intermittent advancement to the material being conveyed. The essential characteristic of such a motion is that all points in the main moving members follow similar and equal paths. This is necessary so that the members can be subdivided into sections with projecting parts. The purpose of the projections is to push the articles during the forward motion of the material being transported. The transport returns by a different path from the one it follow in its advancement, and the material is left undisturbed until the next cycle begins. During this period of rest, while the transport is returning to its starting position, various operations can be performed sequentially. The selection of the particular transport mechanism best suited to any situation depends, to some degree, on the arrangement that can be obtained for driving the materials and the path desired. A slight amount of overtravel is always required so that the projection on the transport can clear the material when it is going into position for the advancing stroke.

The designs illustrated here have been selected from many sources and are typical of the simplest solutions of such problems. The paths, as indicated in these illustrations, can be varied by changes in the cams, levers, and associated parts. Nevertheless, the customary cut-and-try method might still lead to the best solution.

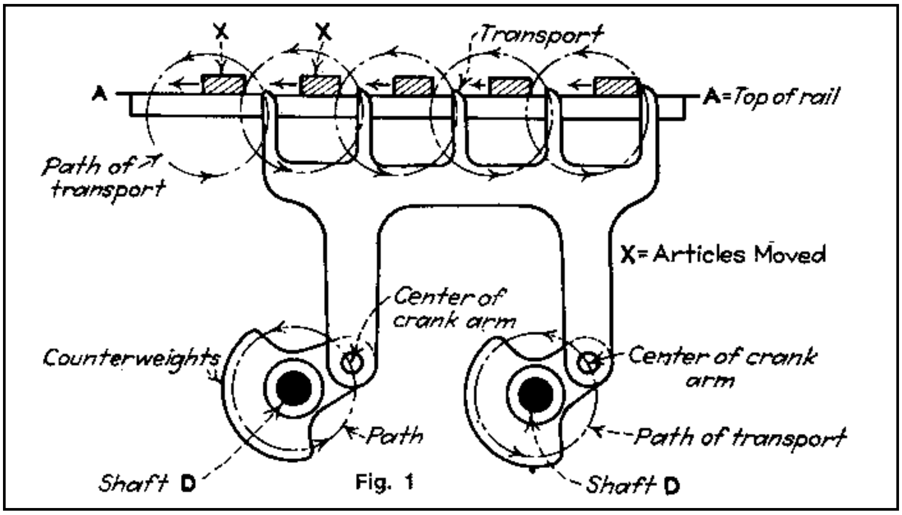


Fig. 1 In this design a rotary action is used. The shafts *D* rotate in unison and also support the main moving member. The shafts are carried in the frame of the machine and can be connected by either a link, a chain and sprocket, or by an intermediate idler gear between two equal gears keyed on the shafts. The rail *A-A* is fixed rigidly on the machine. A pressure or friction plate can hold the material against the top of the rail and prevent any movement during the period of rest.

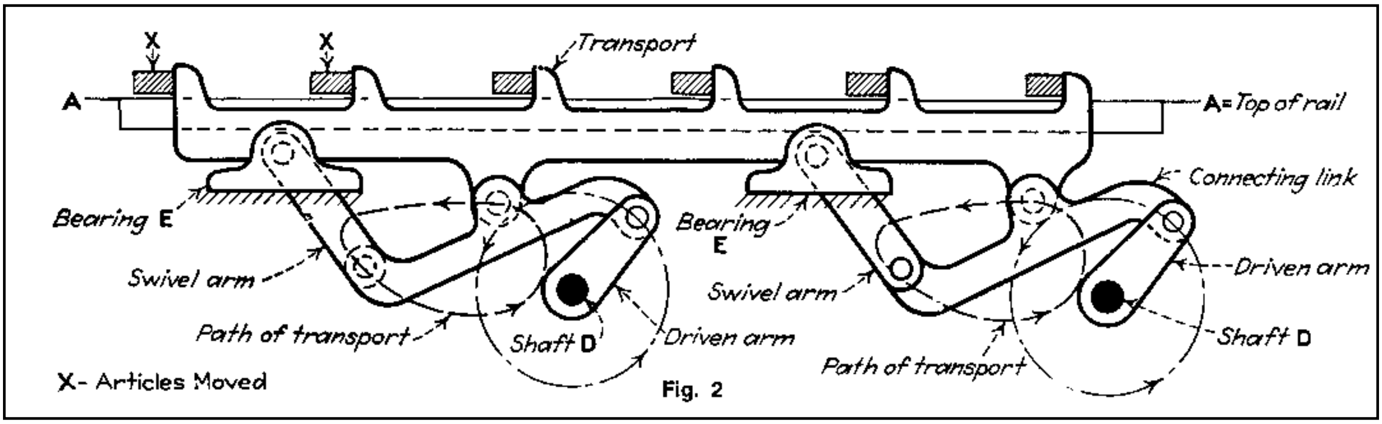


Fig. 2 Here is a simple form of linkage that imparts a somewhat "egg-shaped" motion to the transport. The forward stroke is almost a straight line. The transport is carried on the connecting links. As in the design of Fig. 1, the shafts *D* are driven in unison and are supported in the frame of the machine. Bearings *E* are also supported by the frame of the machine and the rail *A-A* is fixed.

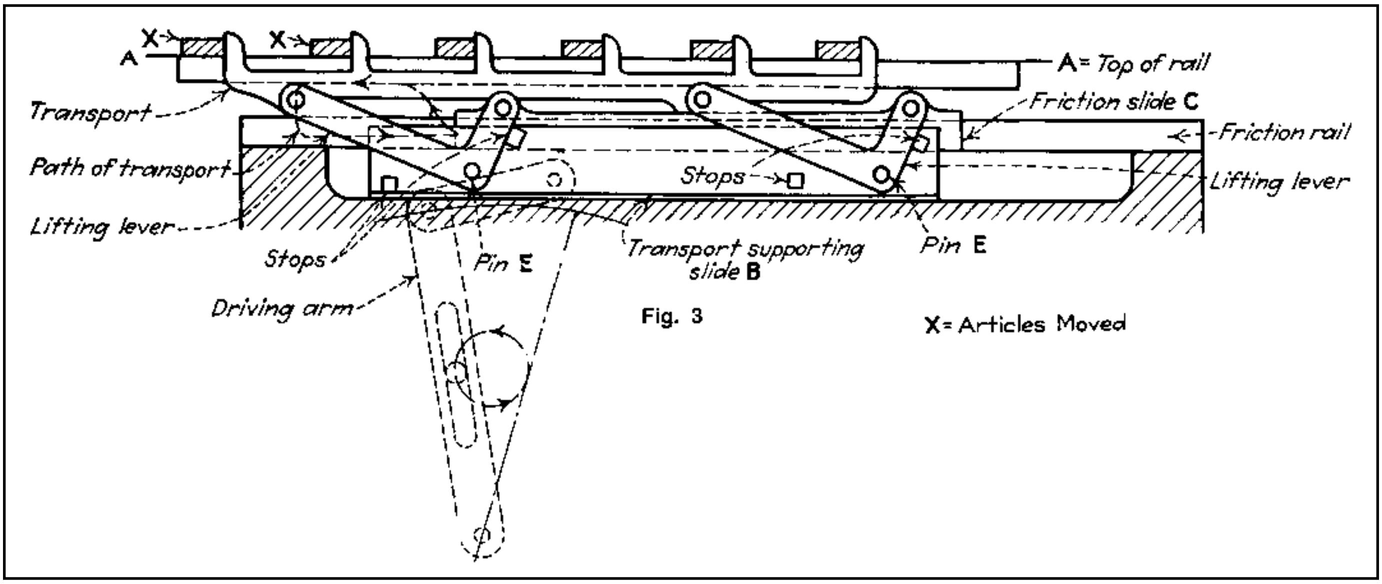


Fig. 3 In another type of action, the forward and return strokes are accomplished by a suitable mechanism, while the raising and lowering is imparted by a friction slide. Thus it can be seen that as the transport supporting slide *B* starts to move to the left, the friction slide *C,* which rests on the friction rail, tends to remain at rest. As a result, the lifting lever starts to turn in a clockwise direction. This motion raises the transport which remains in its raised position against stops until the return stroke starts. At that time the reverse action begins. An adjustment should be provided to compensate for the friction between the slide and its rail. It can readily be seen that this motion imparts a long straight path to the transport.

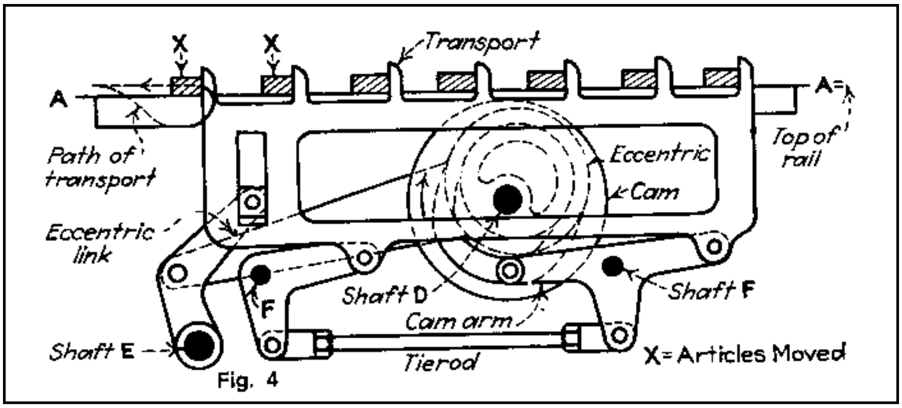


Fig. 4 This drawing illustrates an action in which the forward motion is imparted by an eccentric while the raising and lowering of the transport is accomplished by a cam. The shafts, *F, E,* and *D* are positioned by the frame of the machine. Special bell cranks support the transport and are interconnected by a tierod.

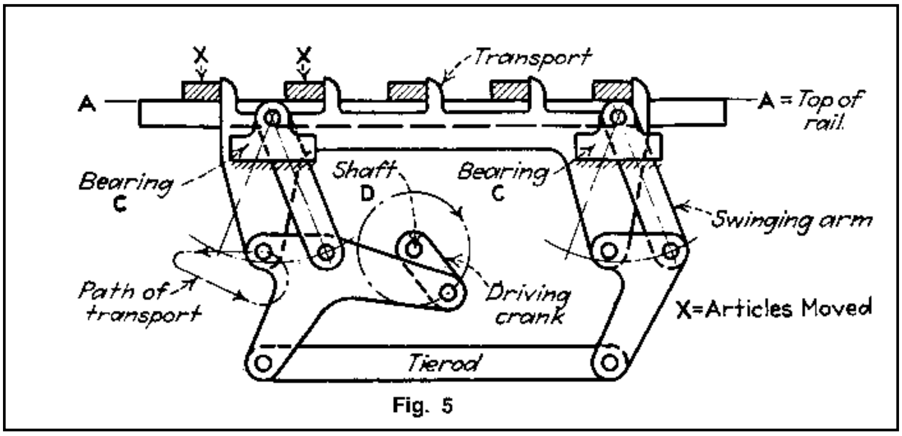


Fig. 5 This is another form of transport mechanism based on a link motion. The bearings *C* are supported by the frame as is the driving shaft *D.*

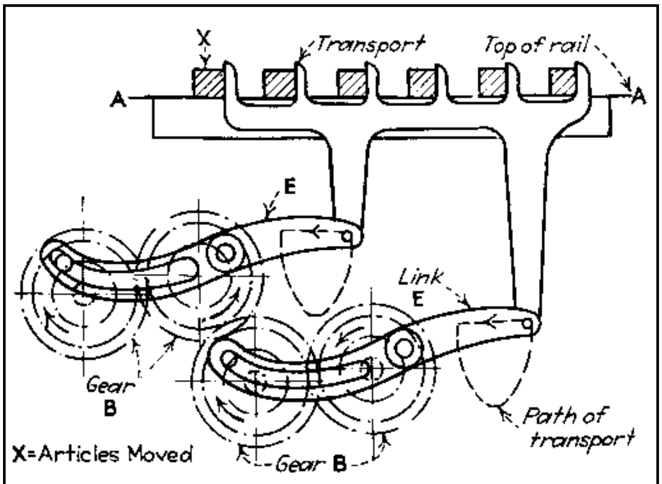


Fig. 6

Fig. 6 An arrangement of interconnected gears with equal diameters that will impart a transport motion to a mechanism. The gear and link mechanism imparts both the forward motion and the raising and lowering motions. The gear shafts are supported in the frame of the machine.

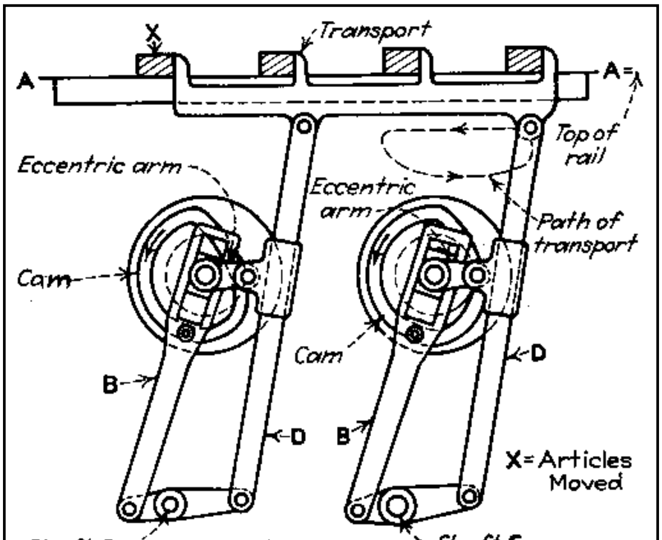
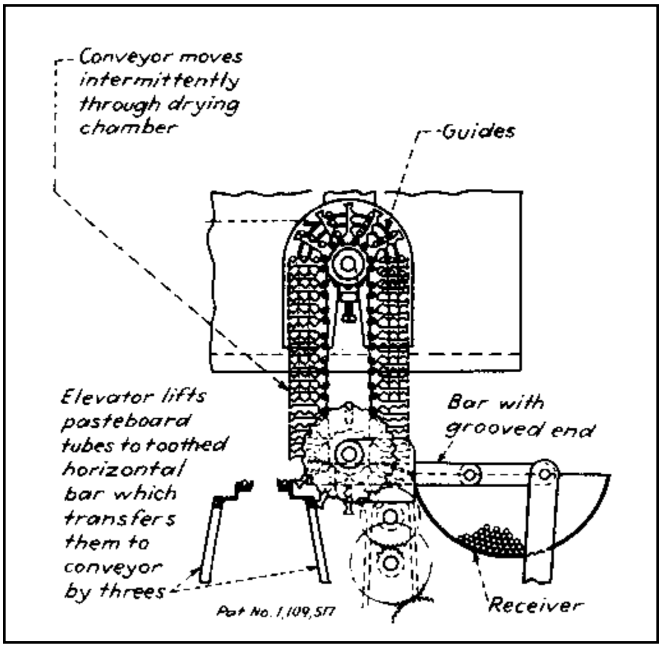


Fig. 7

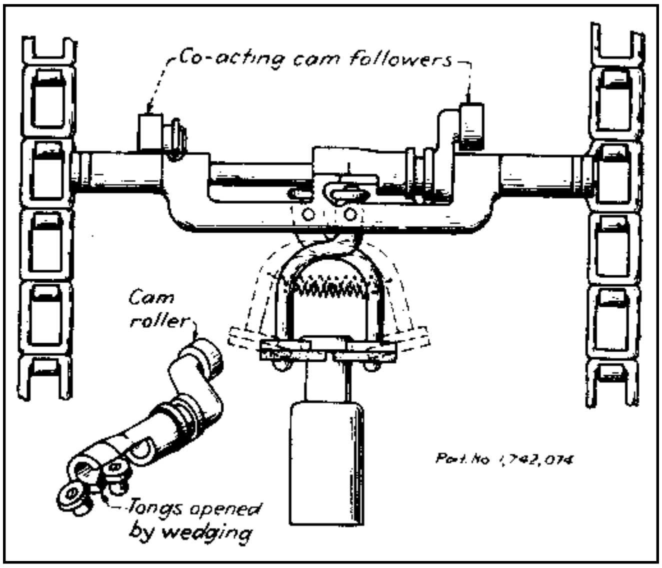
Fig. 7 In this transport mechanism, the forward an return strokes are accomplished by the eccentric arms, while the vertical motion is performed by the cams.

CONVEYOR SYSTEMS FOR PRODUCTION MACHINES

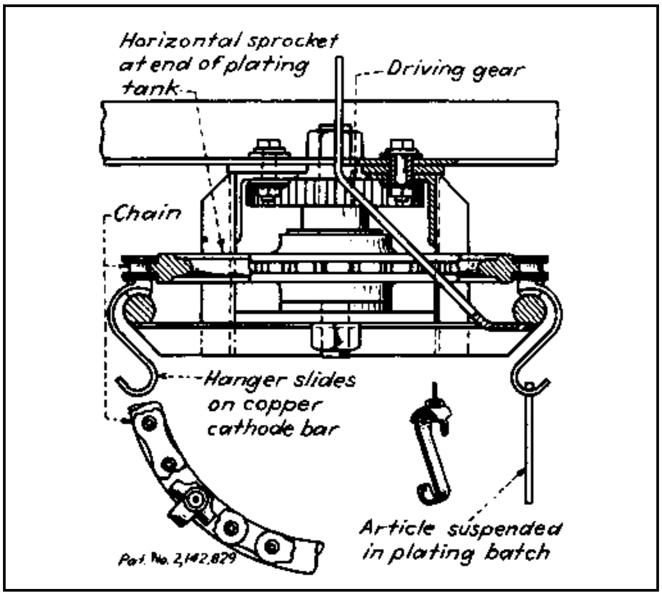
Conveyor systems can be divided into two classes: those that are a part of a machine for processing a product, and those that move products in various stages of fabrication. The movement might be from one worker to another or from one part of a plant to another. Most of the conveyors shown here are components in processing machines. Both continuous and intermittently moving equipment are illustrated.



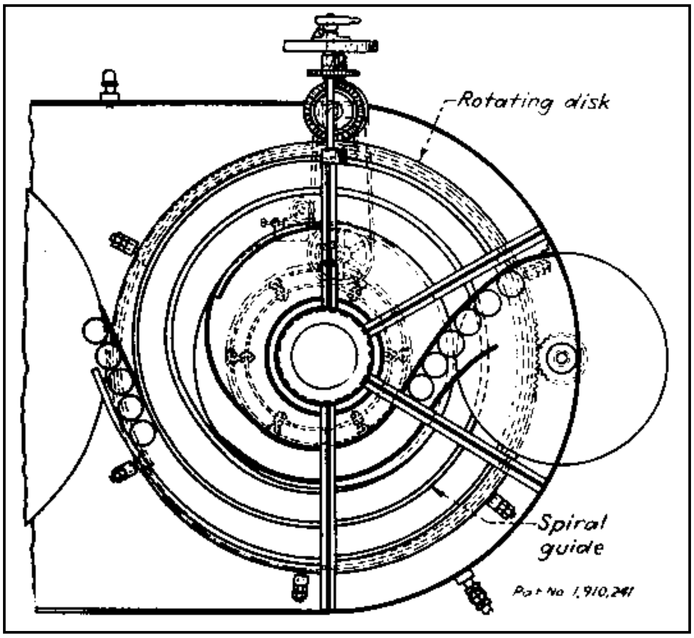
Intermittently moving grooved bar links convey pasteboard tubes through a drying chamber.



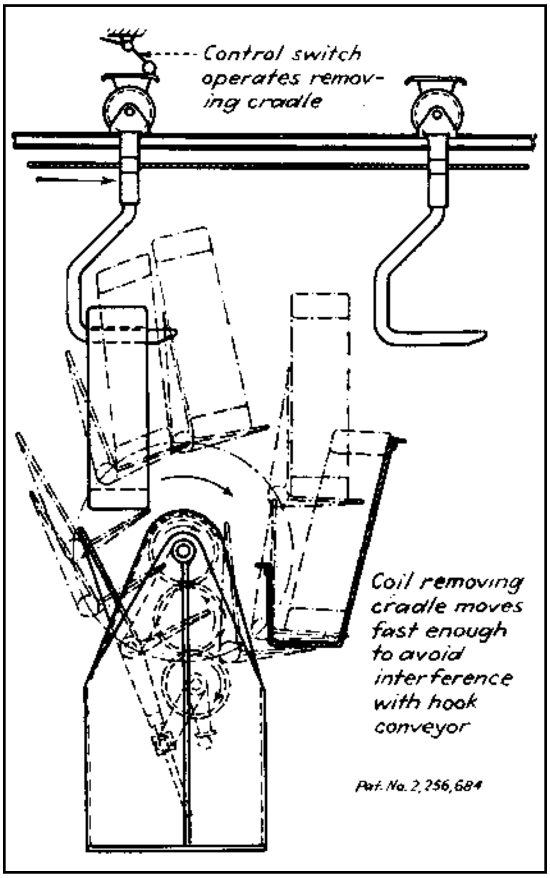
Co-acting cams in the paths of follower rollers open and close tongs over bottlenecks by a wedging action.



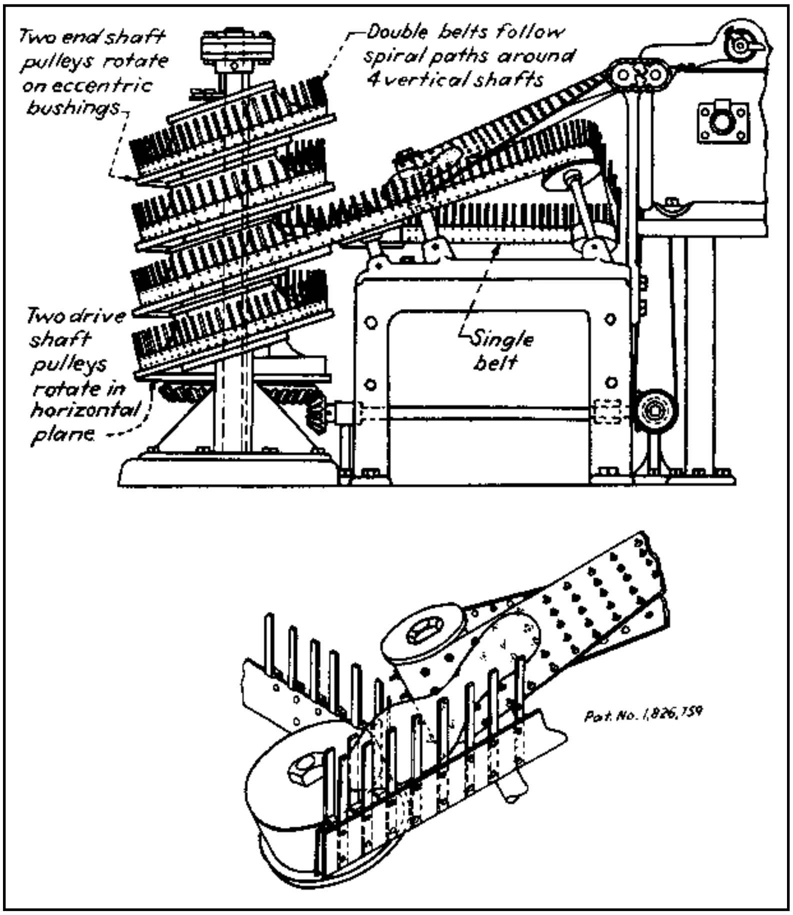
Hooks on a chain-driven conveyor move articles through a plating bath.



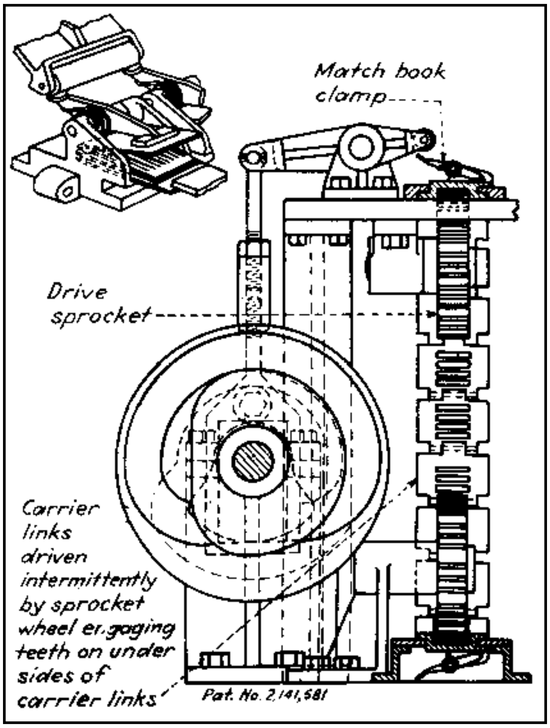
A rotating disk carries food cans in a spiral path between stationary guides for presealing heat treatment.



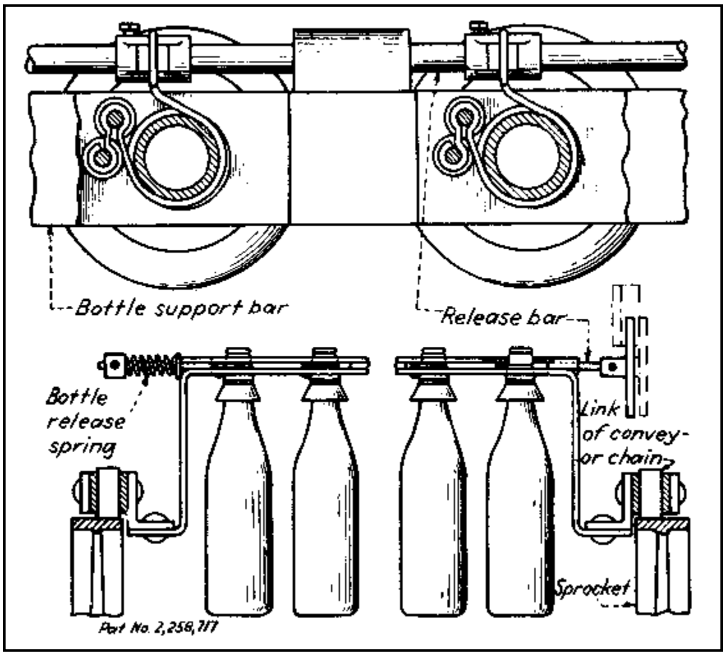
Hooks on a cable-driven conveyor and an automatic cradle for removing coils.



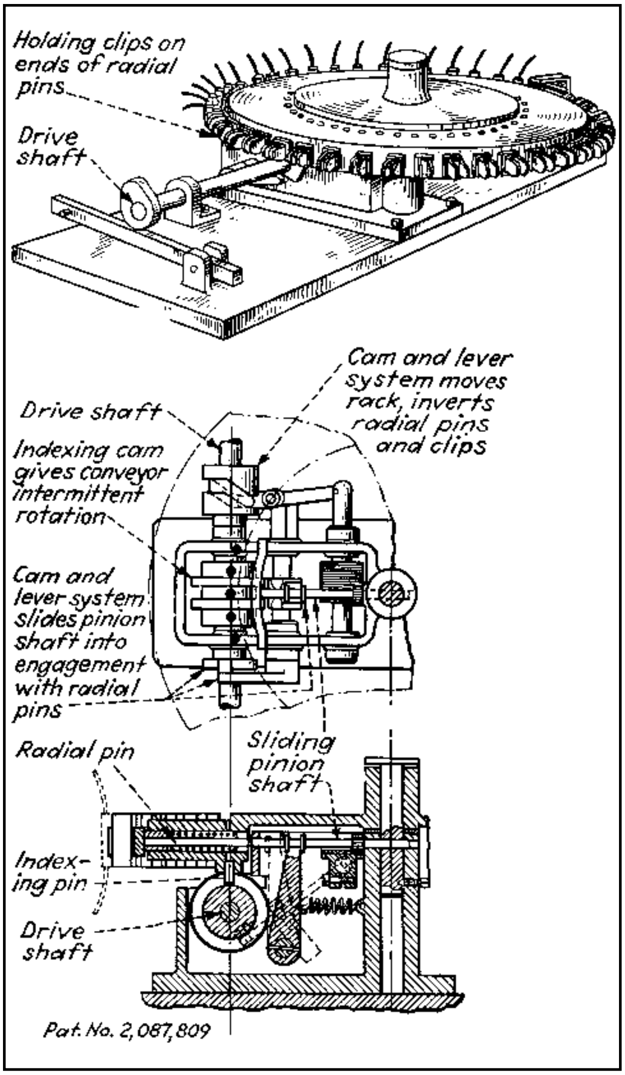
A double belt sandwiches shoe soles during their cycle around a spiral system and then separates to discharge the soles.



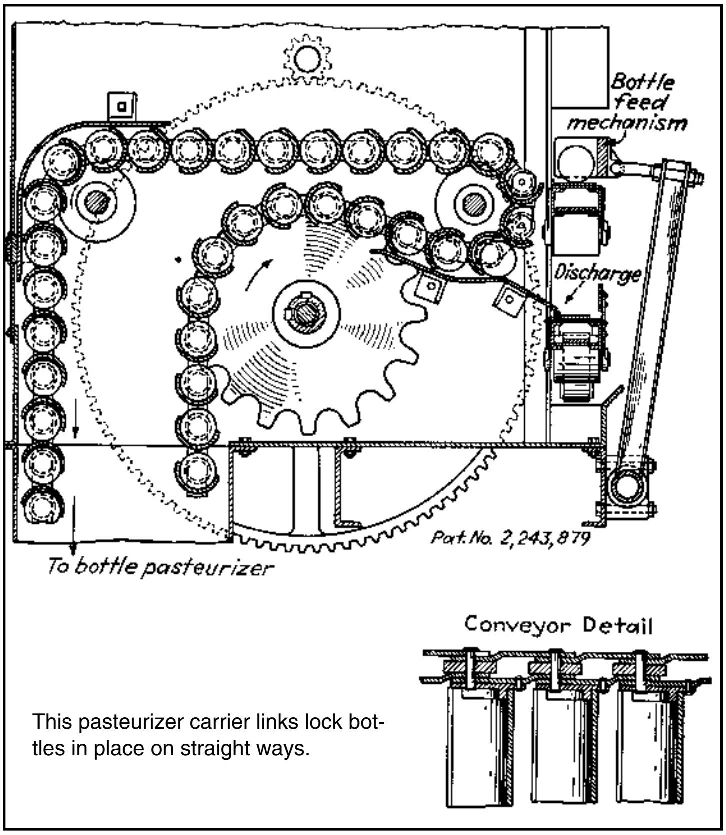
A matchbook carrier links with holding clips that are moved intermittently by sprockets.



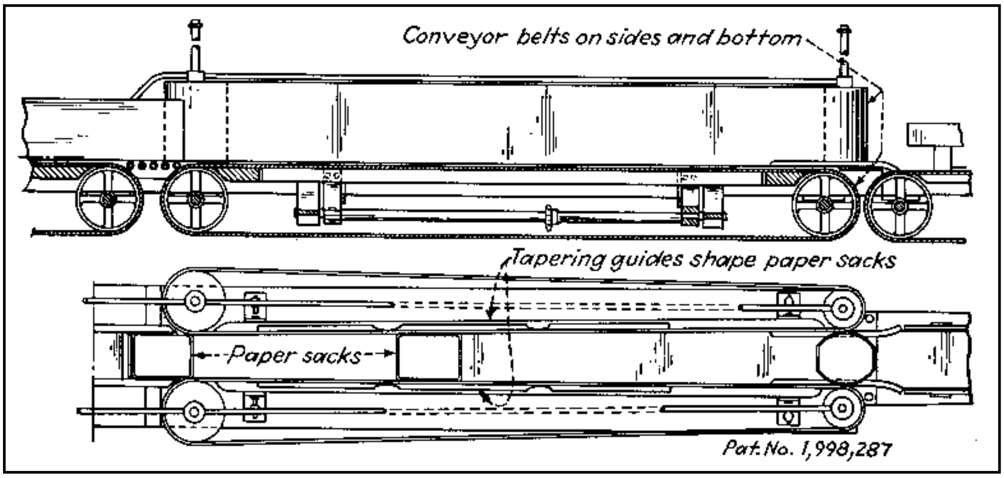
One of several possible kinds of bottle clips with release bars for automatic operation.



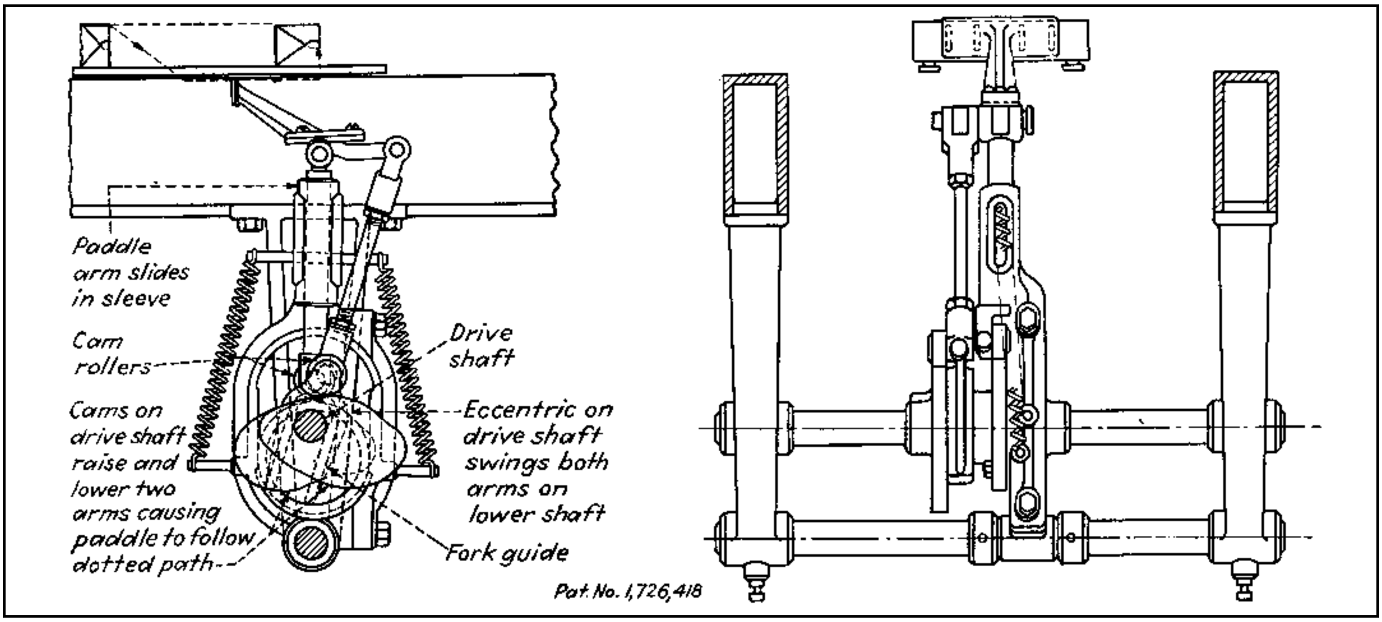
An intermittent rotary conveyor inverts electrical capacitors that are to be sealed at both ends by engaging radial pins which have holding clips attached.



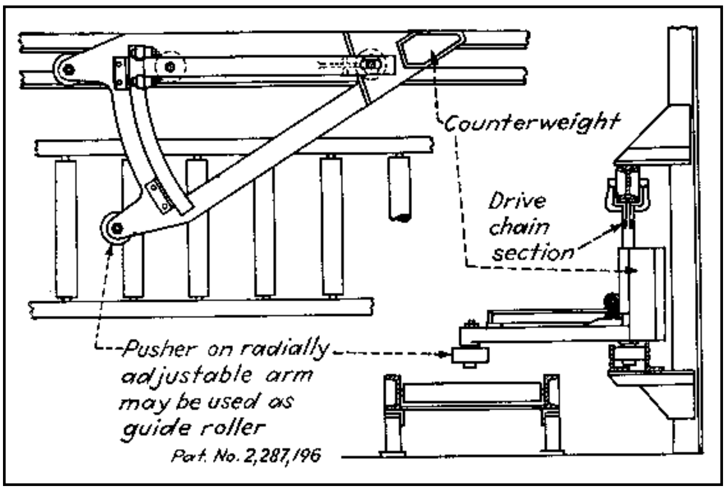
This pasteurizer carrier links lock bottles in place on straight ways.



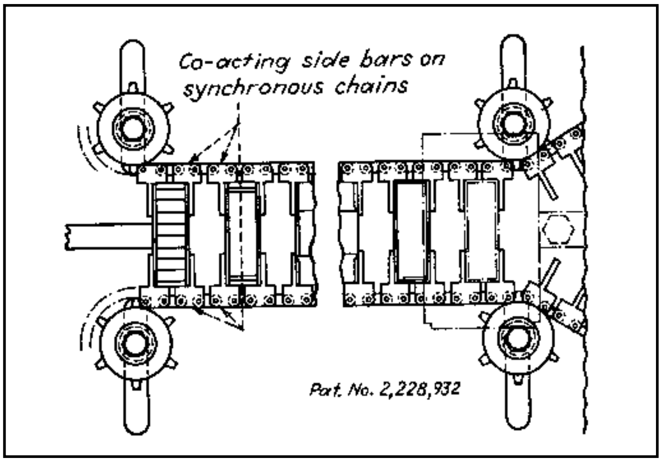
The wedging action of the side belts shapes paper sacks for wrapping an packing.



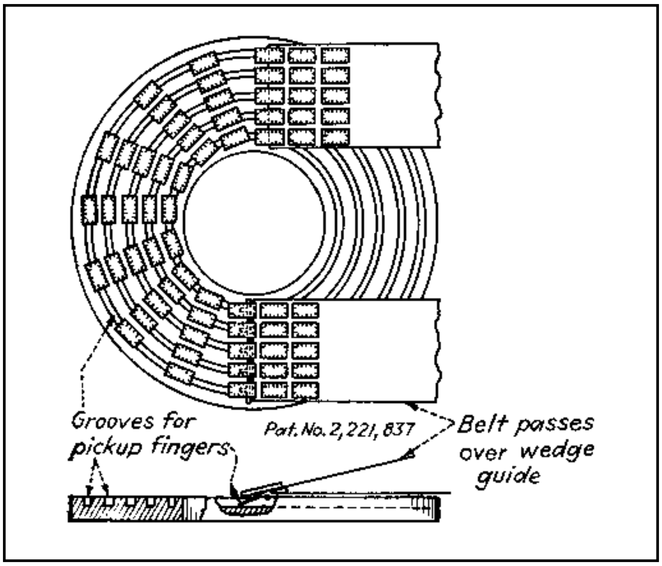
A reciprocating pusher plate is activated by an eccentric disk and two cams on a drive shaft.



A pusher-type conveyor can have a drive on either side.



Synchronous chains with side arms grasp and move packages.



A rotary conveyor transfers articles from one belt conveyor to another without disturbing their relative positions.

TRAVERSING MECHANISMS FOR WINDING MACHINES

The seven mechanisms shown are parts of different yarn- and coil-winding machines. Their fundamentals, however, might be applicable to other machines that require similar changes of motion. Except for the leadscrews found on lathes, these seven represent the operating principles of all well-known, mechanical traversing devices.

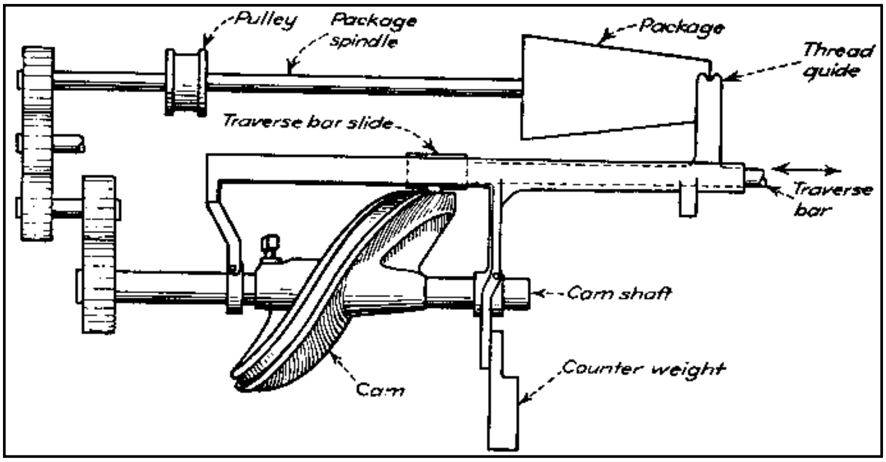


Fig. 1 A package is mounted on a belt-driven shaft on this precision winding mechanism. A camshaft imparts reciprocating motion to a traverse bar with a cam roll that runs in a cam groove. Gears determine the speed ratio between the cam and package. A thread guide is attached to the traverse bar, and a counterweight keeps the thread guide against the package.

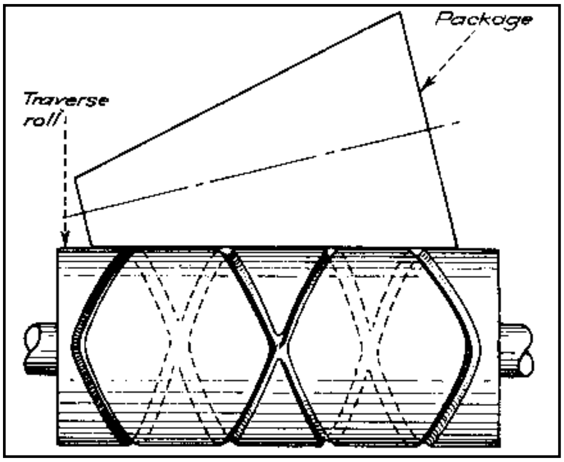
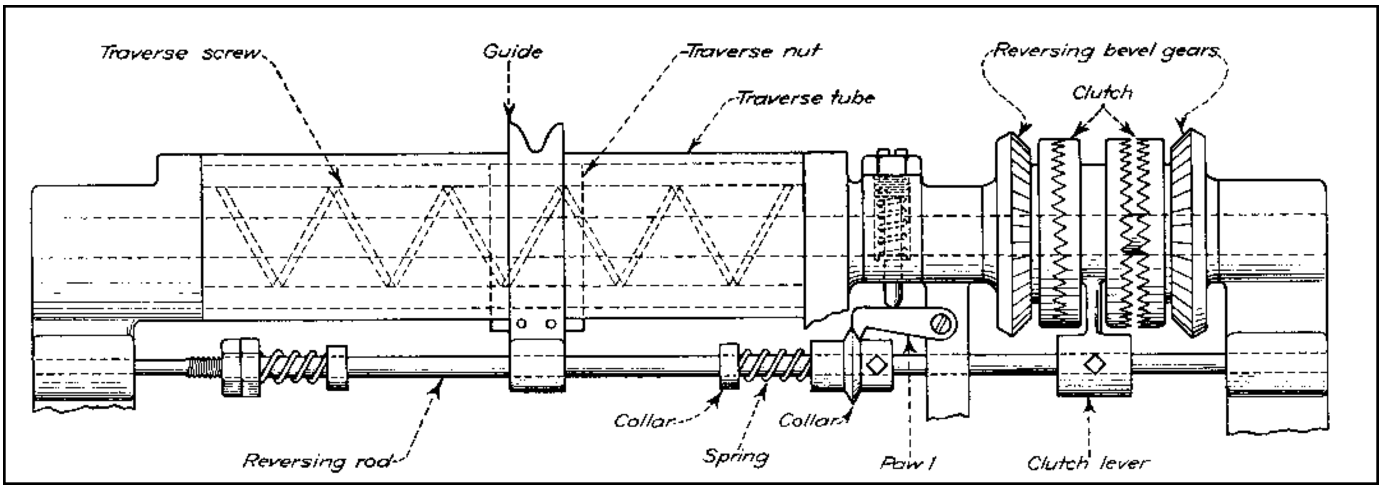


Fig. 2 A package is friction-driven from a traverse roll. Yarn is drawn from the supply source by traverse roll and is transferred to a package from the continuous groove in the roll. Different winds are obtained by varying the grooved path.

Fig. 3 Reversing bevel gears that are driven by a common bevel gear drive the shaft carrying the traverse screw. A traverse nut mates with this screw and is connected to the yarn guide. The guide slides along the reversing rod. When the nut reaches the end of its travel, the thread guide compresses the spring that actuates the pawl and the reversing lever. This action engages the clutch that rotates the traverse screw in the opposite direction. As indicated by the large pitch on the screw, this mechanism is limited to low speeds, but it permits longer lengths of traverse than most of the others shown.



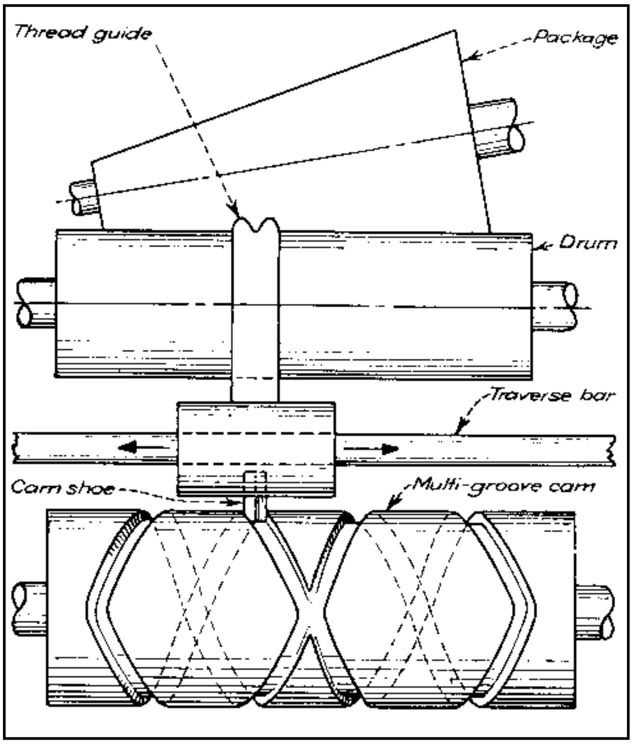


Fig. 4 A drum drives the package by friction. A pointed cam shoe, which pivots in the bottom side of the thread guide assembly, rides in cam grooves and produces a reciprocating motion of the thread guide assembly on the traverse bar. Plastic cams have proved to be satisfactory even with fast traverse speeds. Interchangeable cams permit a wide variety of winding methods.

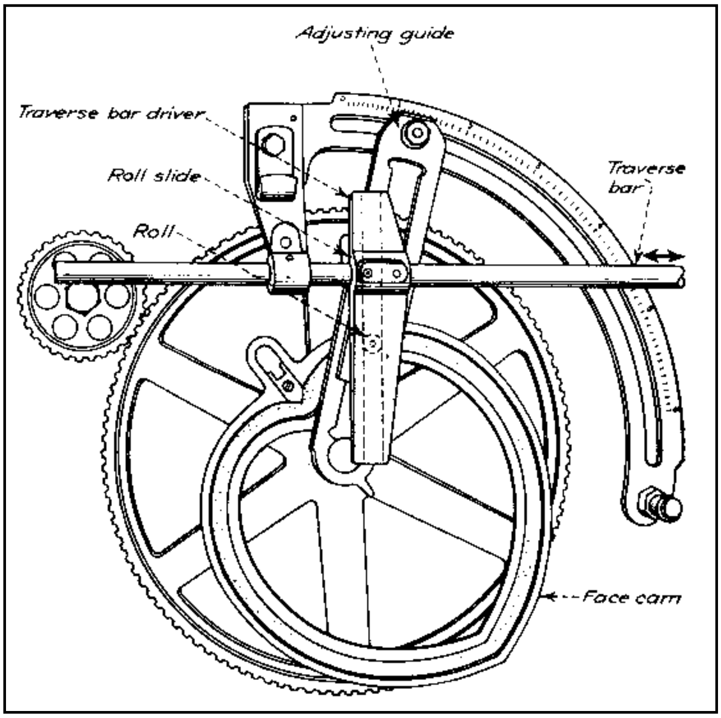


Fig. 5 A roll that rides in a heart-shaped cam groove engages a slot in a traverse bar driver which is attached to the traverse bar. Maximum traverse is obtained when the adjusting guide is perpendicular to the driver. As the angle between the guide and driver is decreased, traverse decreases proportionately. Inertia effects limit this mechanism to slow speeds.

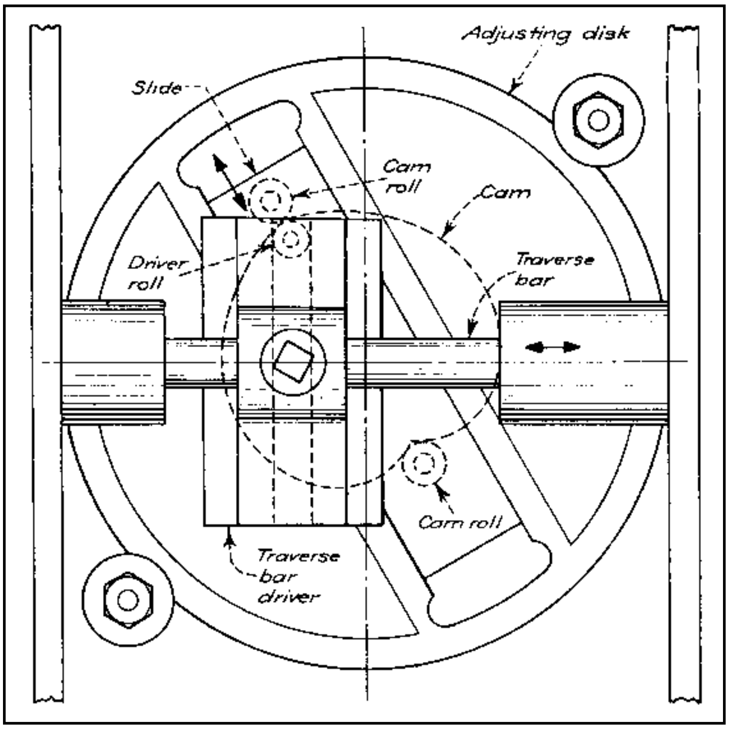


Fig. 6 The two cam rolls that engage this heart-shaped cam are attached to the slide. The slide has a driver roll that engages a slot in the traverse bar driver. Maximum traverse (to the capacity of the cam) occurs when the adjusting disk is set so the slide is parallel to the traverse bar. As the angle between the traverse bar and slide increases, traverse decreases. At 90º traverse is zero.

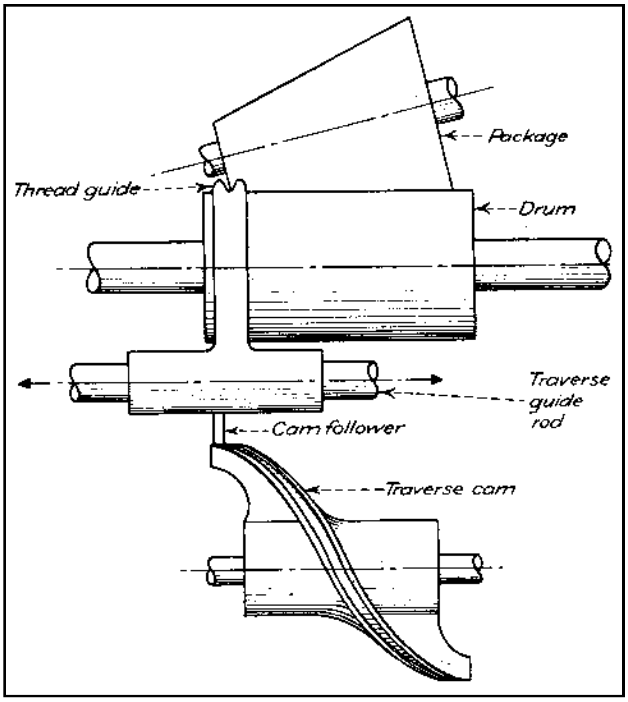
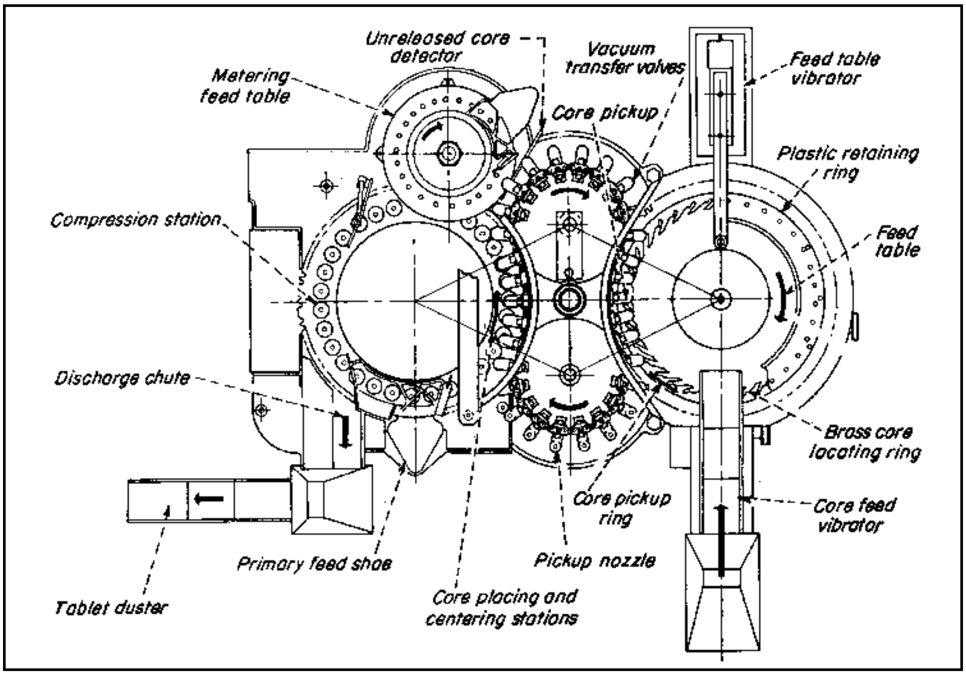


Fig. 7 A traverse cam imparts reciprocating motion to a cam follower that drives thread guides on traverse guide rods. The package is friction driven from the drum. Yarn is drawn from the supply source through a thread guide and transferred to the drum-driven package. The speed of this mechanism is determined by the weight of its reciprocating parts.

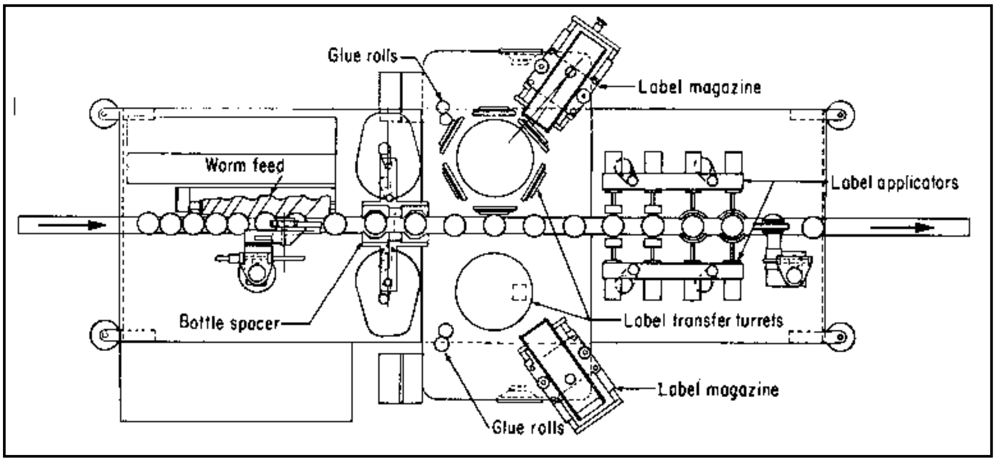
VACUUM PICKUP POSITIONS PILLS

This pickup carries tablet cores to moving dies, places cores accurately in coating granulation, and prevents the formation of tablets without cores.



Cores are hopper fed to a rotating feeder disk through a tablet duster. This disk is vibrated clockwise under a slotted pick-up ring which rotates counter-clockwise. Each slot in the pickup ring holds two cores and lets broken tablets fall through to an area under the feeder table. Cores are picked from ring slots, carried to tablet press dies, and deposited in dies by vacuum nozzles fastened to a chain driven by the press die table. This chain also drives the pickup ring to synchronize the motion of ring slots and pickup nozzles. Coating granulation is fed into the dies ahead of and after the station where a vacuum pickup deposits a core in each die. Compressing rolls are at the left side of the machine. The principal design objective here was to develop a machine to apply dry coatings at speeds that lowered costs below those of liquid coating techniques.

MACHINE APPLIES LABELS FROM STACKS OR ROLLERS



The flow of containers through this labeler is shown by the top-view drawing of the machine. Bottle spacers ensure that containers remain 7½ in. apart on the conveyor. Dual label-transfer turrets allow for the simultaneous application of front and back labels.

This labeling machine can perform either conventional glue-label application or it can heat-seal labels in cut or roll form. The machine labels the front and back of round or odd-shaped containers at speeds of 60 to 160 containers per minute. The containers handled range from 1 in. diameter or thickness to 4¼ in. diameter by 5½ in. wide. Container height can vary from 2 to 14 inches. The unit handles labels ranging from ⅞ to 5½ in. wide and ⅞ to 6½ in. high. The label hopper is designed for labels that are generally rectangular in shape, although it can be modified to handle irregular shapes. Provision has been made in design of the unit, according to the manufacturer, to allow labels to be placed at varying heights on the containers. The unit's cut-and-stacked label capacity is 4,500. An electric eye is provided for cutting labels in web-roll form.

HIGH-SPEED MACHINES FOR ADHESIVE APPLICATIONS

Viscous liquid adhesives are used to glue fabrics and paper, apply paper labels, make cardboard and wooden boxes and shoes, and bind books. Specially designed machines are required if the application of adhesives with different characteristics is to be satisfactorily controlled. The methods and machines shown here have been adapted to the application of adhesives in mass production. They might also work well for the application of liquid finishes such as primers, paint, and lacquer.

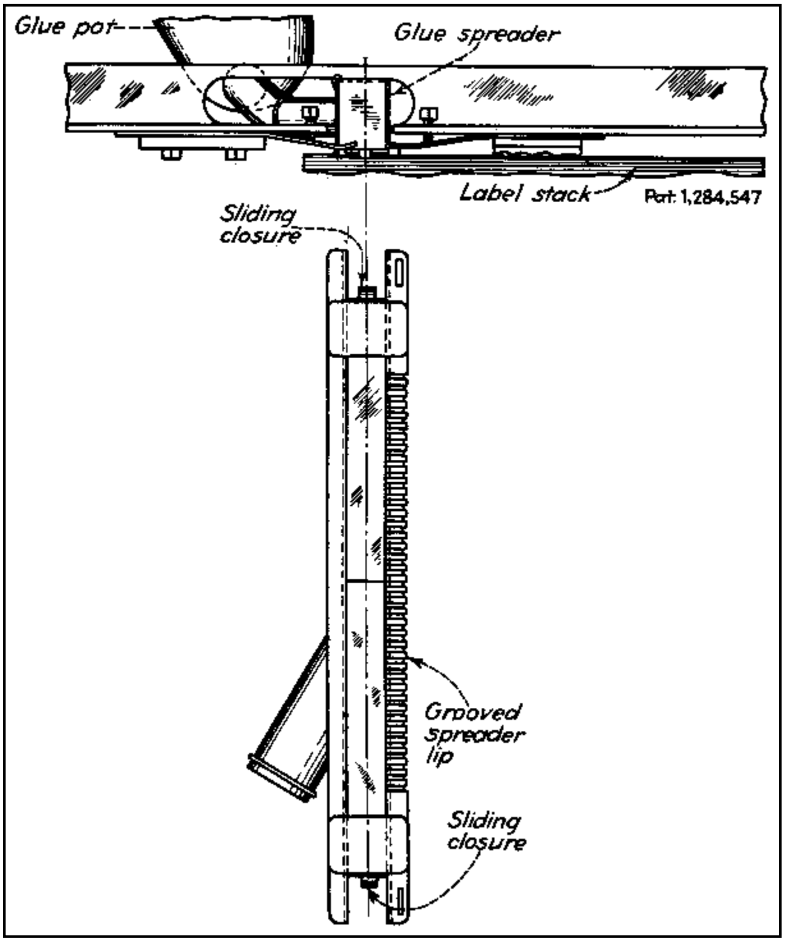


Fig. 1 A gravity spreader has an open bottom and a grooved lip.

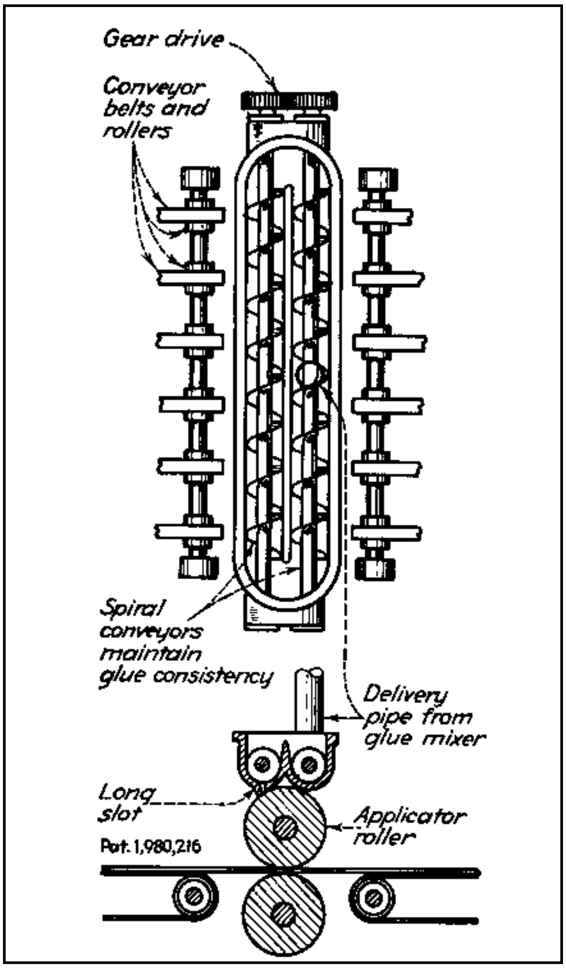


Fig. 2 Spiral conveyors feed the applicator roller by the force or gravity.

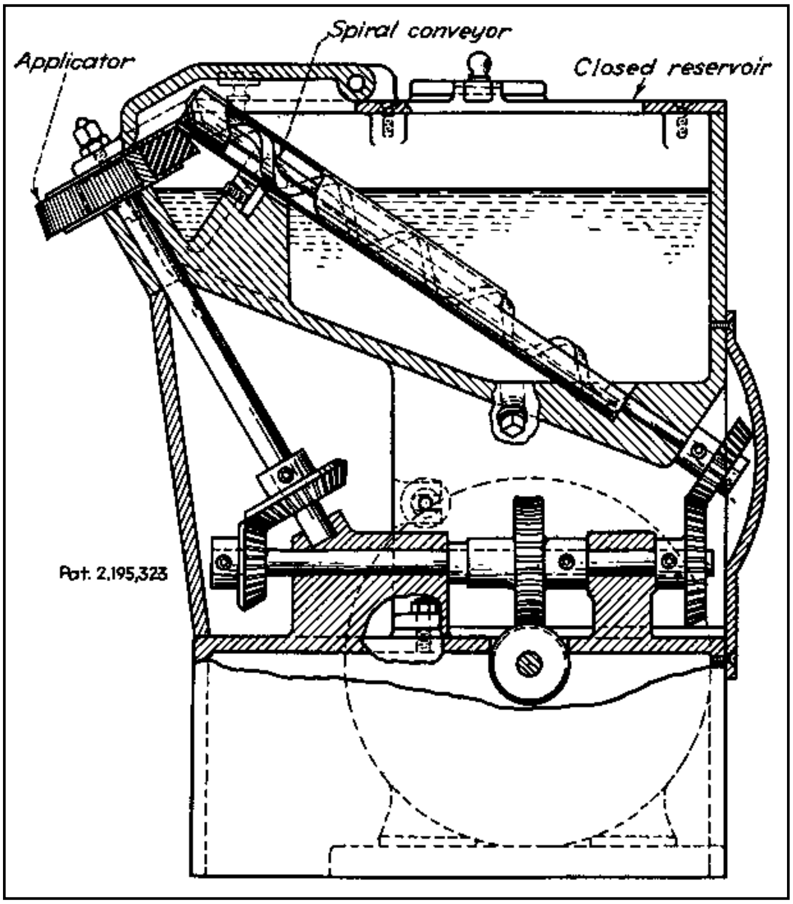


Fig. 3 An applicator wheel is fed by a spiral conveyor.

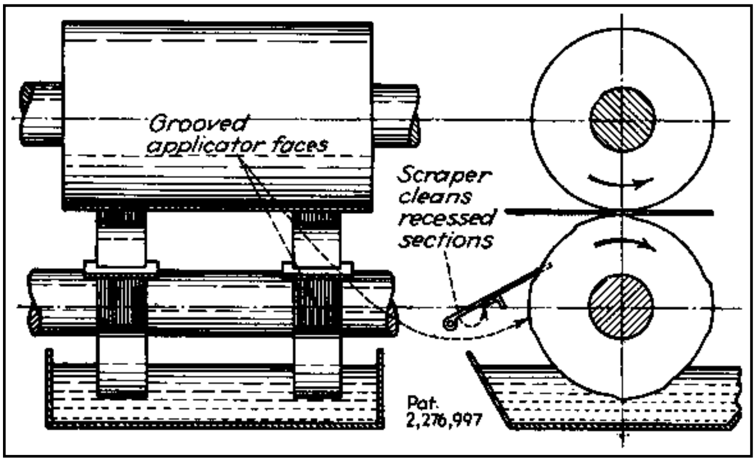


Fig. 4 An adhesive pattern produced by raised faces on the applicator roll.

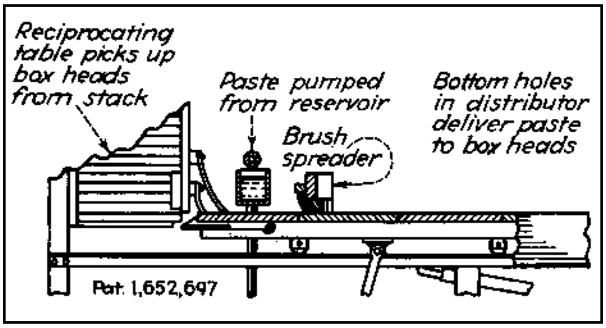


Fig. 5 A gravity spreader with flow from its bottom holes.

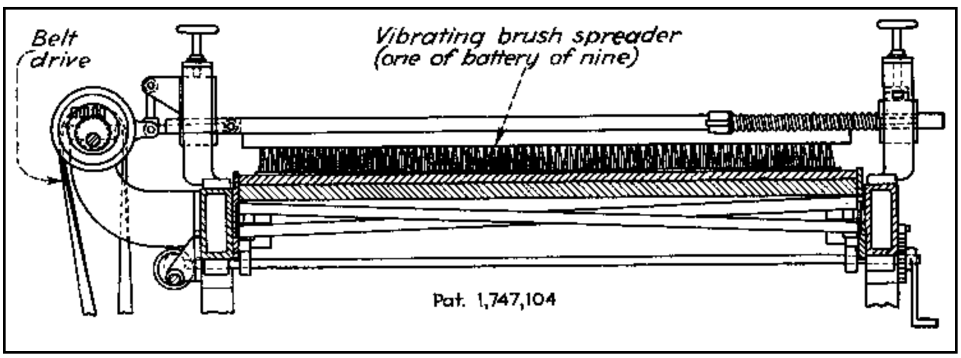
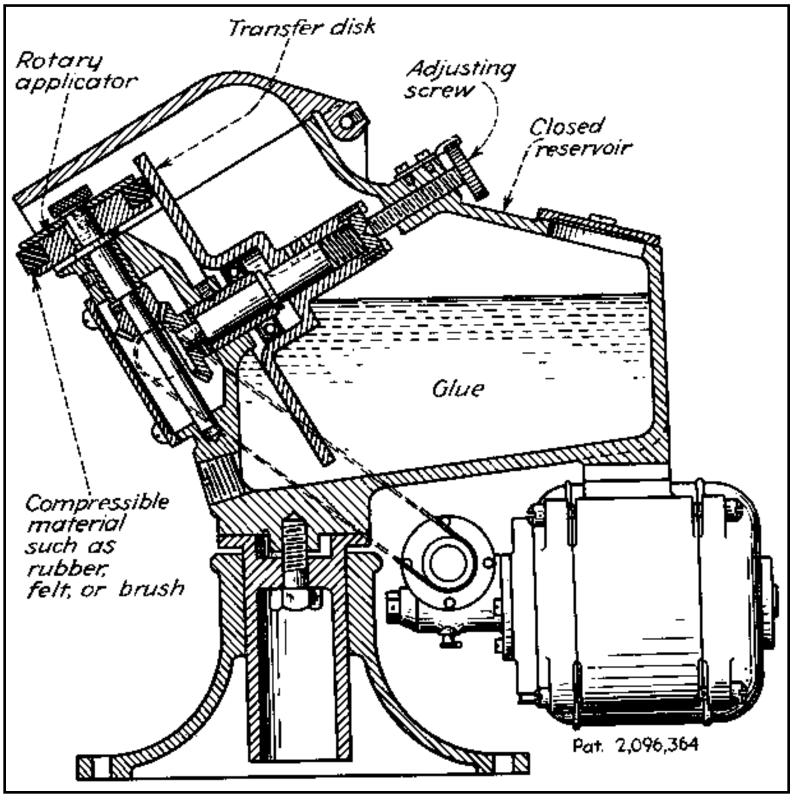


Fig. 6 Vibrating brushes spread the coating after the application by a cylindrical brush.

Fig. 7 This applicator wheel is fed by a transfer disk.



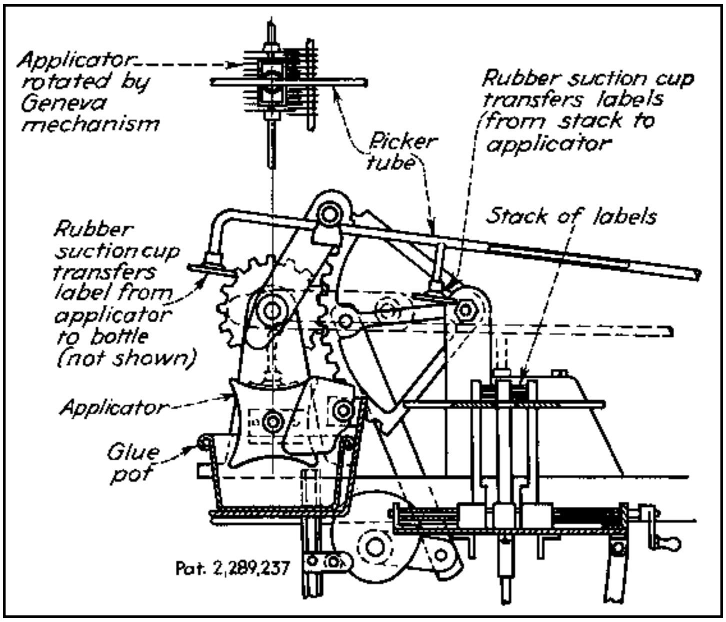
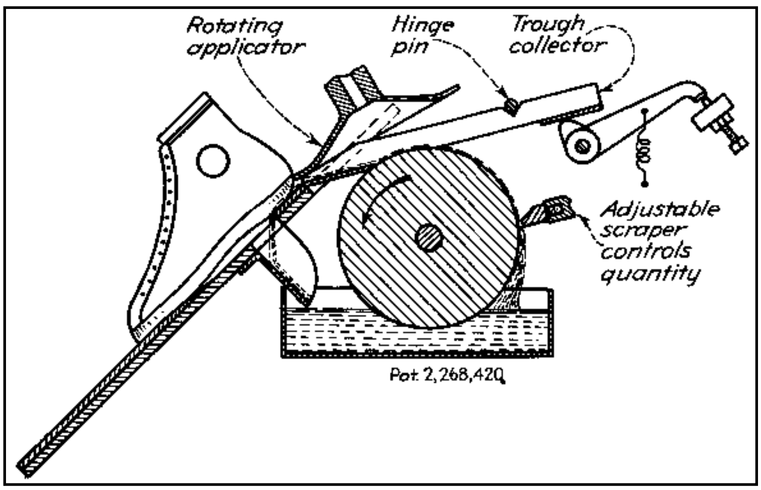


Fig. 8 This applicator surface, consisting of a series of plate edges, is rotated by a Geneva mechanism in the glue pot.

Fig. 9 A rotating applicator disk fed by a trough collector on a transfer drum.



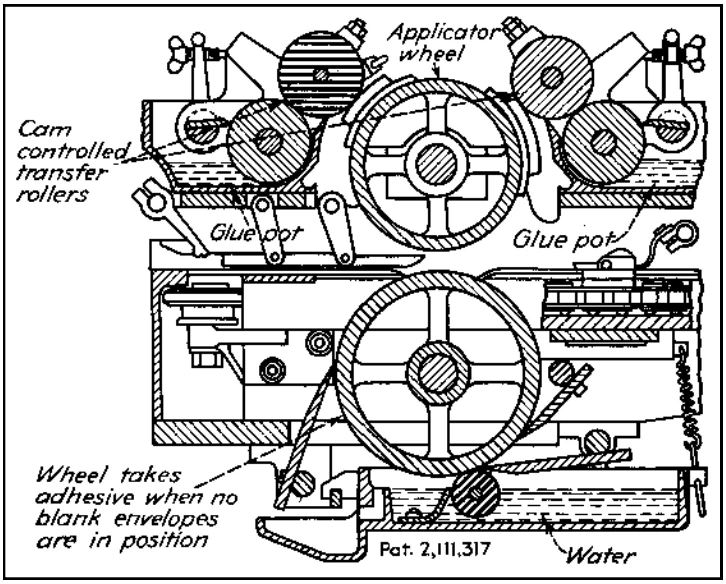


Fig. 10 Cam controlled transfer rollers supply applicator wheel pads with two kinds of adhesive.

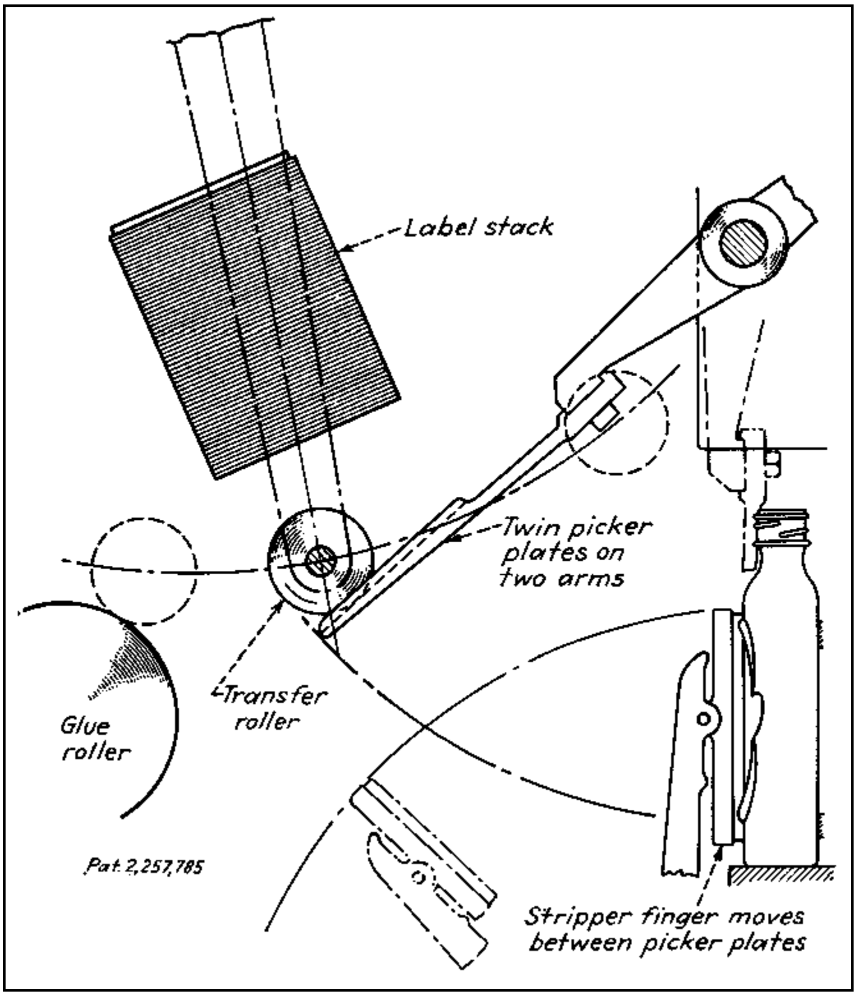


Fig. 11 The bottom label is spread with glue by two abutting glue-coated picker plates, which separate during contact with label stack, then carry the label to the bottle.

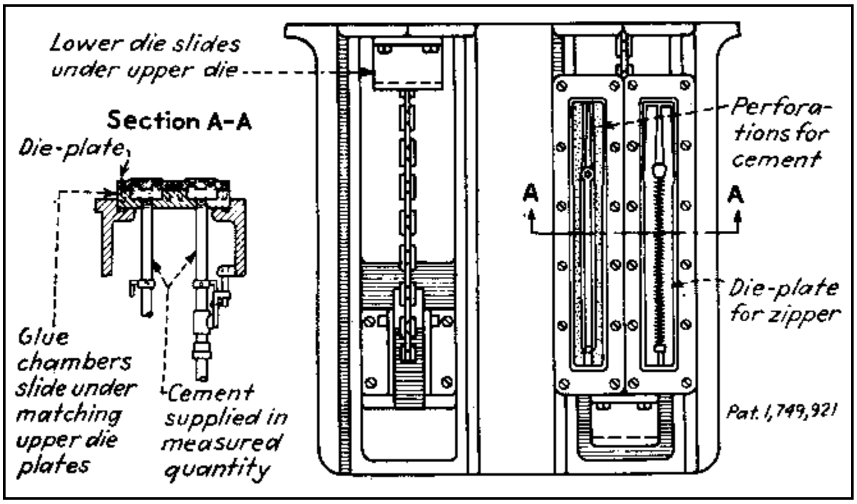


Fig. 12 Measured quantities of cement are forced through perforations in specially designed upper and lower die plates, which are closed hydraulically over zippers. Only the lower die is shown.

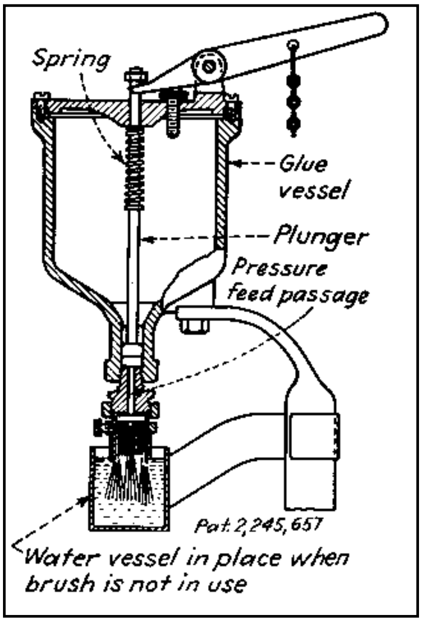


Fig. 13 A brush applicator is fed through passages between bristle tufts by a spring-operated plunger.

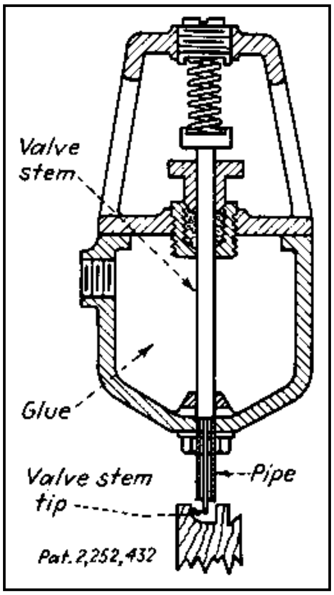


Fig. 14 A shoulder on a valve stem in a glue chamber retains glue until pressure on the tip opens the bottom valve.

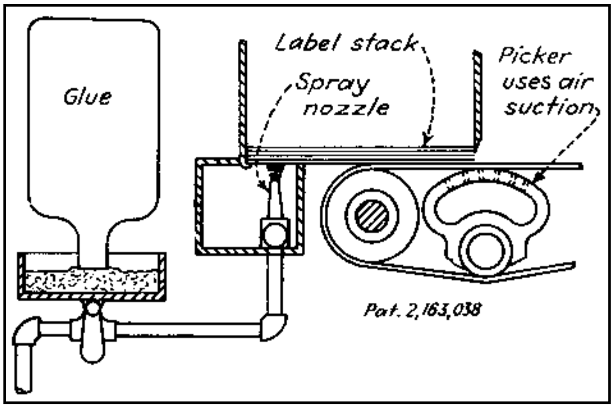


Fig. 15 Glue is applied to envelopes by a spray nozzle.

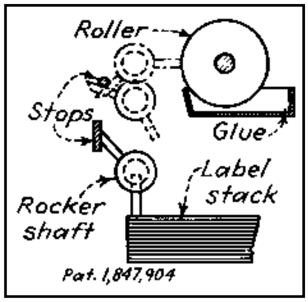
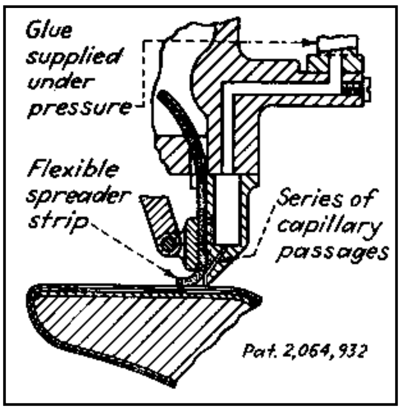


Fig. 16 A rocker shaft on a rack, which is moved vertically by a sector gear, carries glue on a contact bar from the roll to the label stack.

Fig. 17 Glue is extruded through nozzle on work.



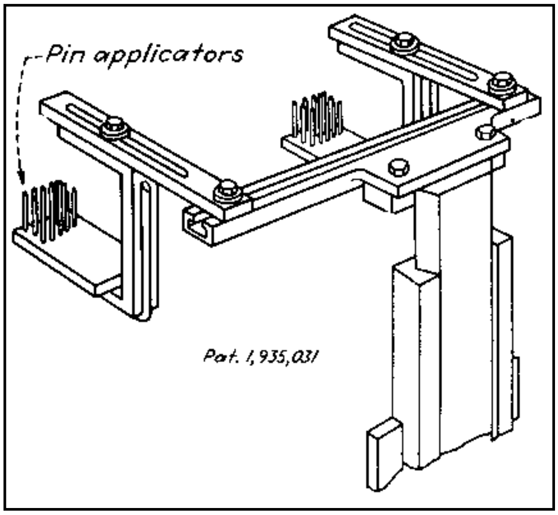


Fig. 18 Pin applicators reciprocate vertically, first immersing themselves in glue, then contacting the undersides of carton flaps in a desired pattern.

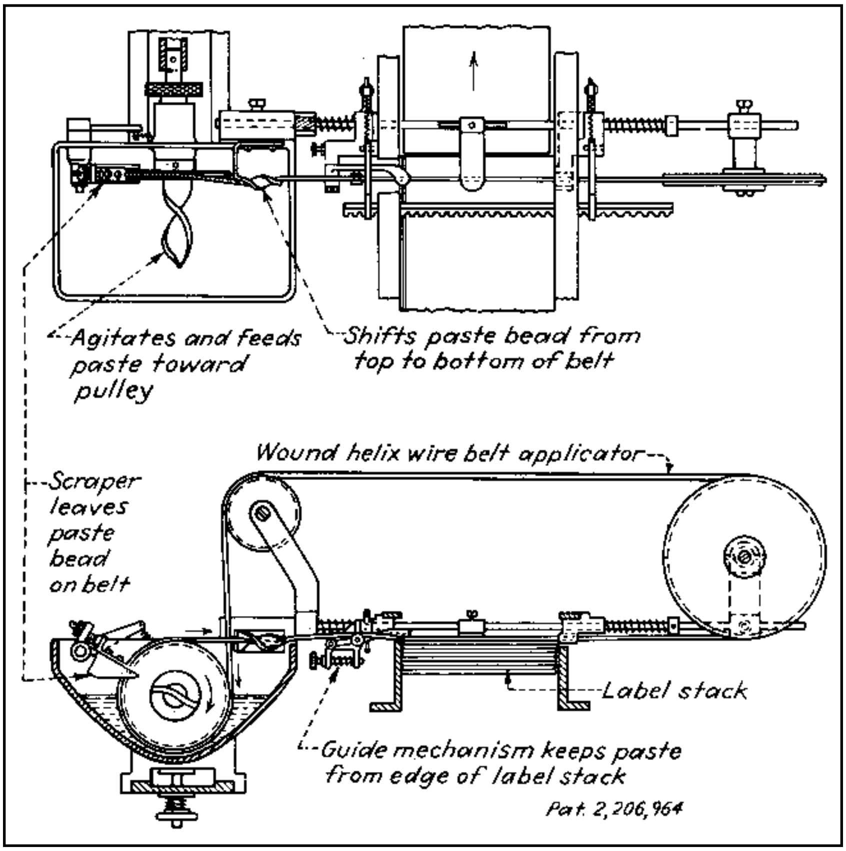


Fig. 19 A paste belt applicator passes around the pulley in a pastepot and slides over the label stack.

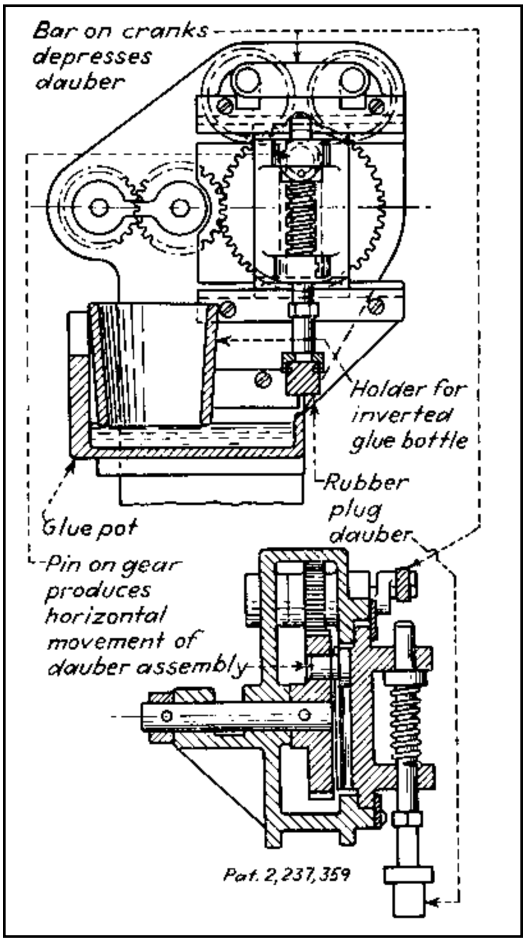


Fig. 20 A dauber assembly is moved horizontally between a glue pot and work by an eccentric pin on a gear. Vertical movements are produced by a crank-operated bar over the dauber shaft.

AUTOMATIC STOPPING MECHANISMS FOR FAULTY MACHINE OPERATION

Automatic stopping mechanisms that prevent machines from damaging themselves or destroying work in process are based on the principles of mechanics, electricity, hydraulics, and pneumatics.

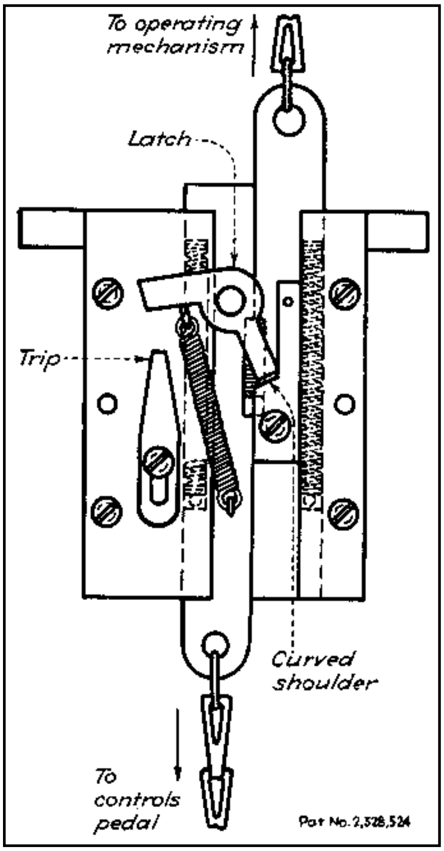


Fig. 1 A repetition of the machine cycle is prevented if a pedal remains depressed. The latch carried by the left slide pushes the right slide downward with a curved shoulder until the latch is disengaged by trip member.

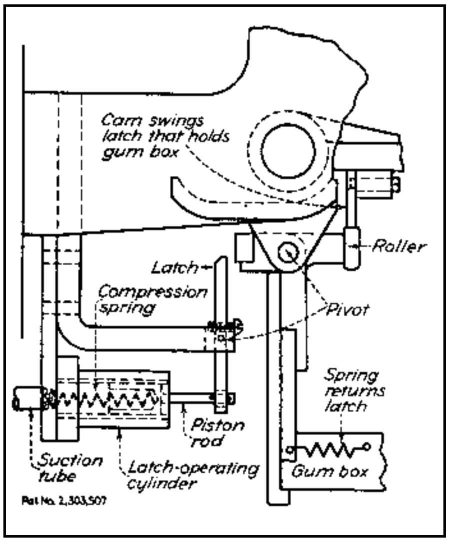


Fig. 2 The gumming of the suction picker and label carrier when the label is not picked up by the suction is prevented by insufficient suction on a latch-operating cylinder, caused by open suction holes on the picker. When a latch-operating cylinder does not operate, the gum box holding latch returns to its holding position after cyclic removal by the cam and roller, thus preventing the gum box and rolls from rocking to make contact with the picker face.

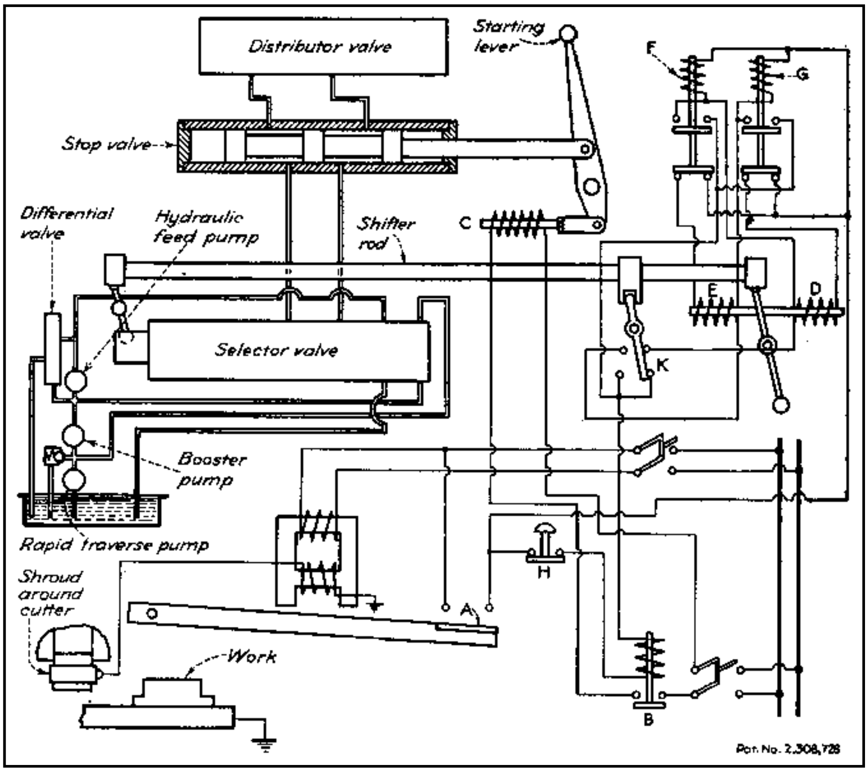


Fig. 3 Damage to the milling cutter, work, or fixtures is prevented by the shroud around the cutter. Upon contact with the work, the shroud closes the electric circuit through the relay, thus closing contact A. This causes contact B to close, thus energizing relay C to operate a stop valve. It also closes a circuit through relay D, thus reversing the selector valve by means of a shifter rod so that bed travel will reverse on starting. Simultaneously, relay F opens the circuit of relay E and closes a holding circuit that was broken by the shifter lever at K. Relay G also closes a holding circuit and opens a circuit through relay D. The starting lever, released by pushbutton H, releases contact A and returns the circuit to normal. If contact is made with the shroud when the bed travel is reversed, interchange the positions of D and E, with F and G in the sequence of operations.

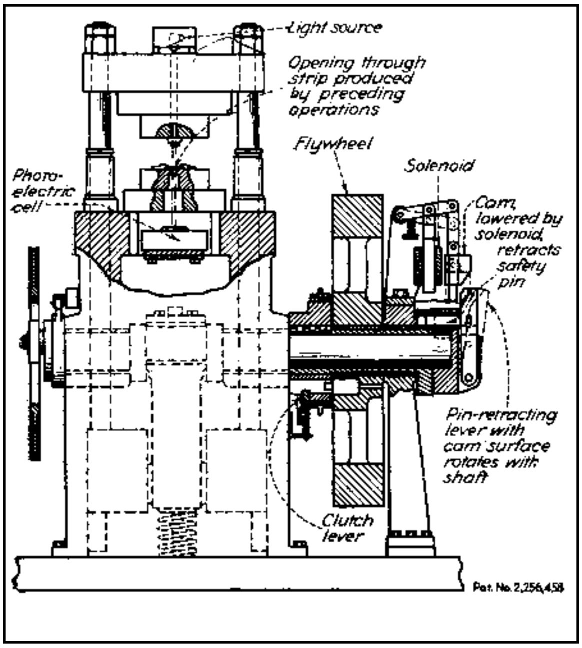


Fig. 4 A high-speed press is stopped when a metal strip advances improperly. A hole punched in the strip fails to match while the opening in the die block to permit a light beam to pass. When the light beam to the photoelectric cell is blocked, the solenoid which withdraws the clutch pin is activated.

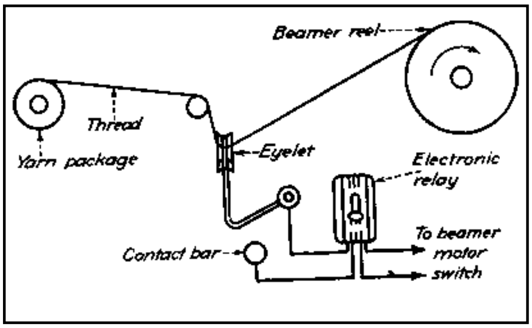


Fig. 5 A broken thread allows the contact bar to drop, thereby closing the electronic relay circuit; this stops the beamer reeling equipment.

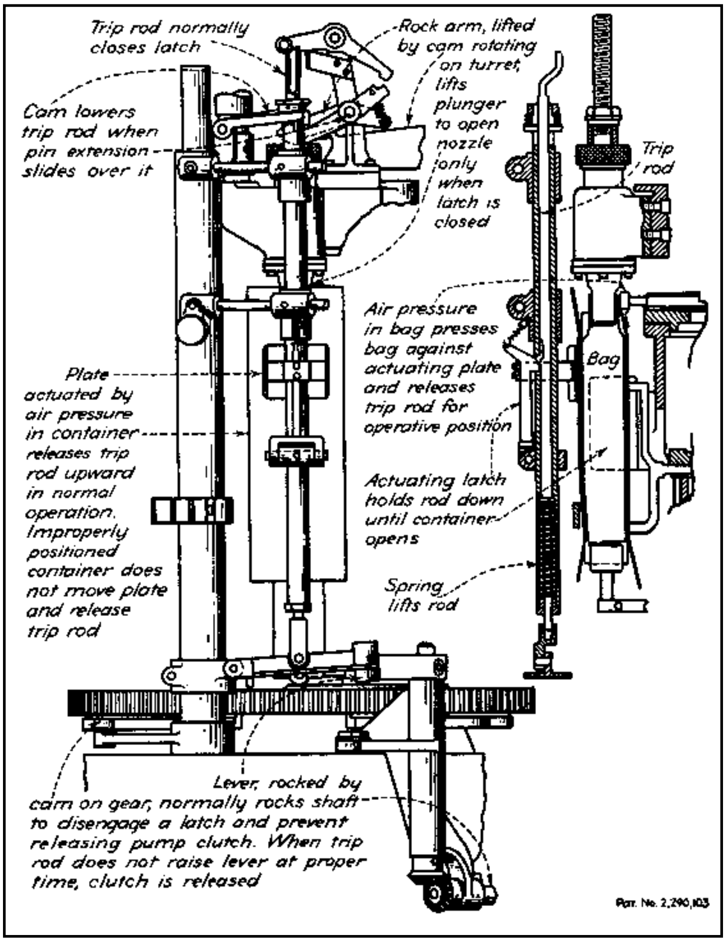


Fig. 6 A nozzle on the packaging machine does not open when the container is improperly positioned.

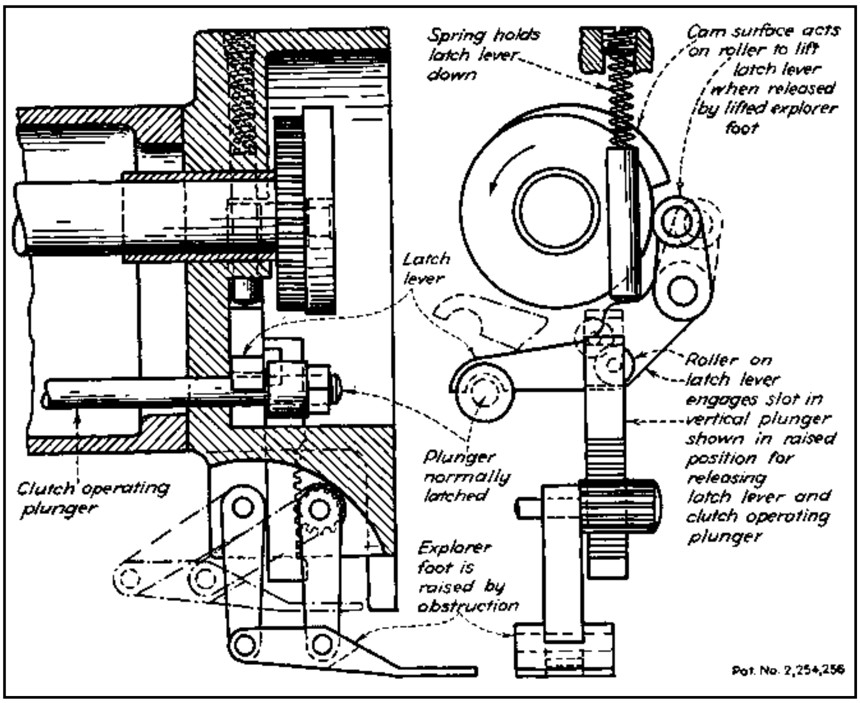


Fig. 7 An obstruction under the explorer foot of a wire-stitching machine raises a vertical plunger which releases a latch lever. A rotary cam then raises a lever that retains the clutch-operating plunger.

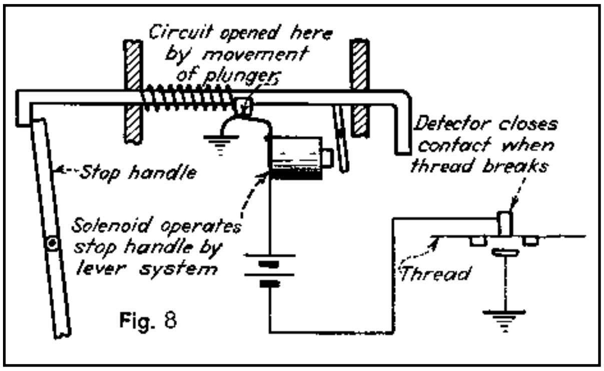


Fig. 8

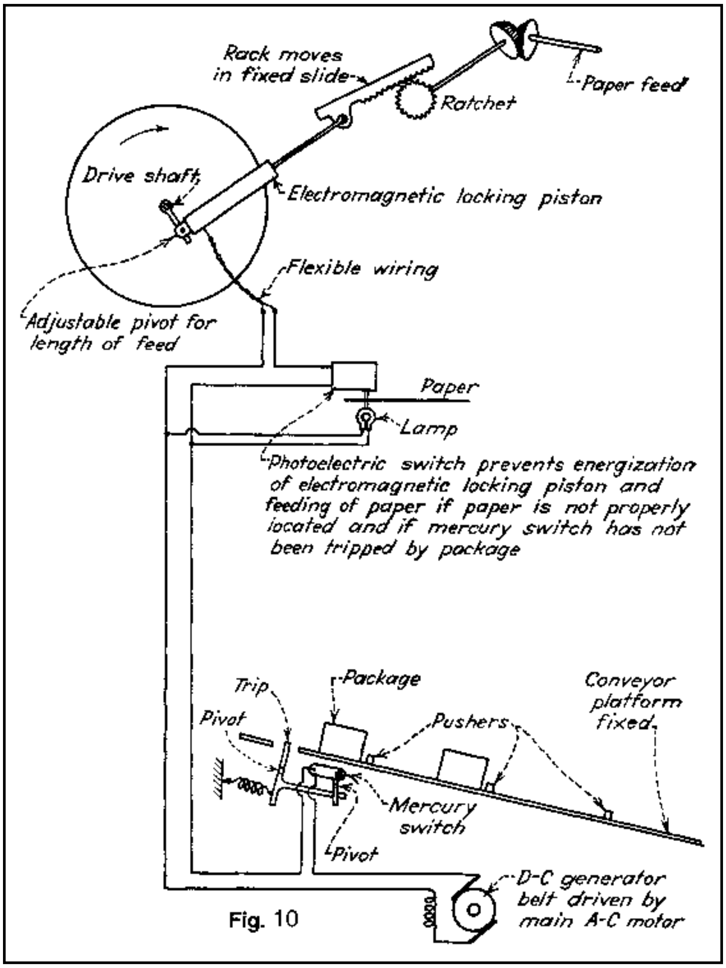


Fig. 10

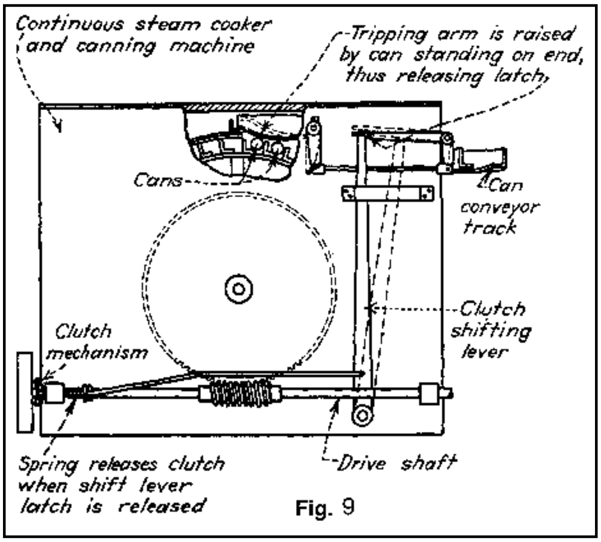


Fig. 9

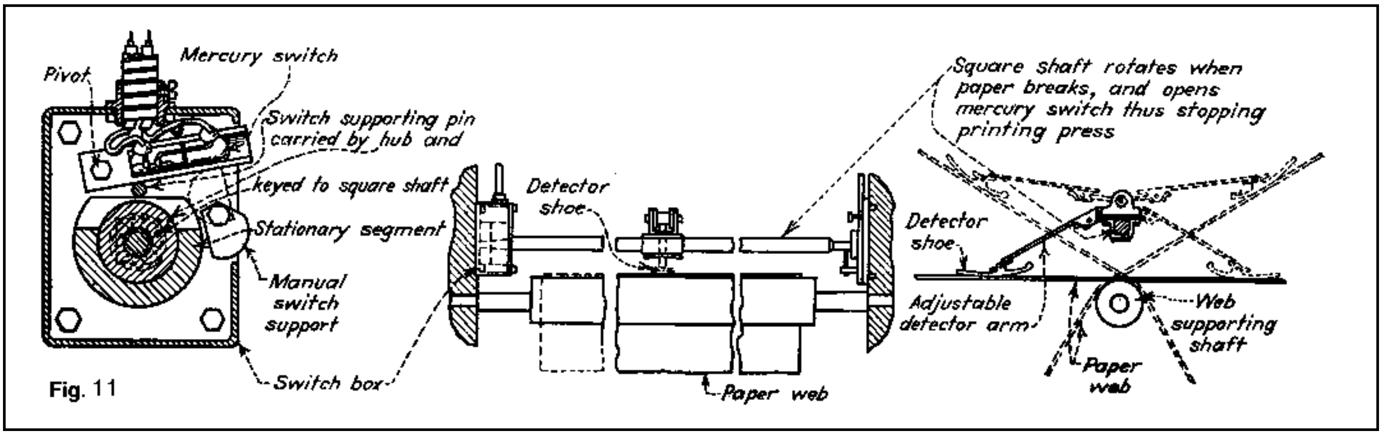


Fig. 11

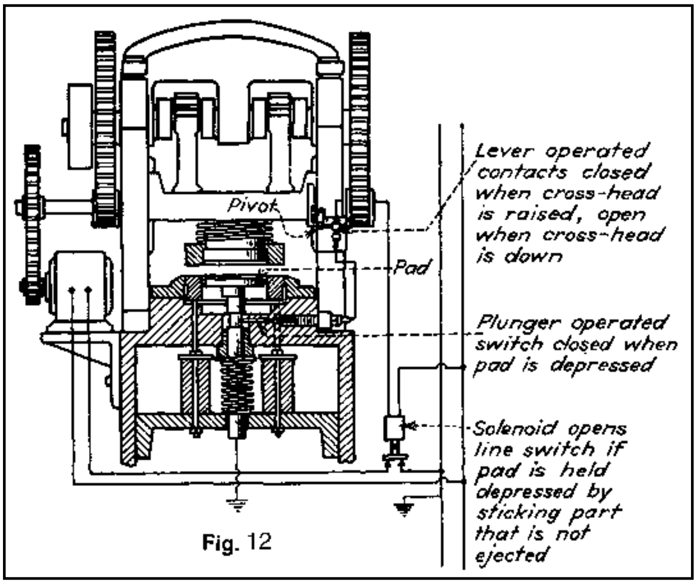


Fig. 12

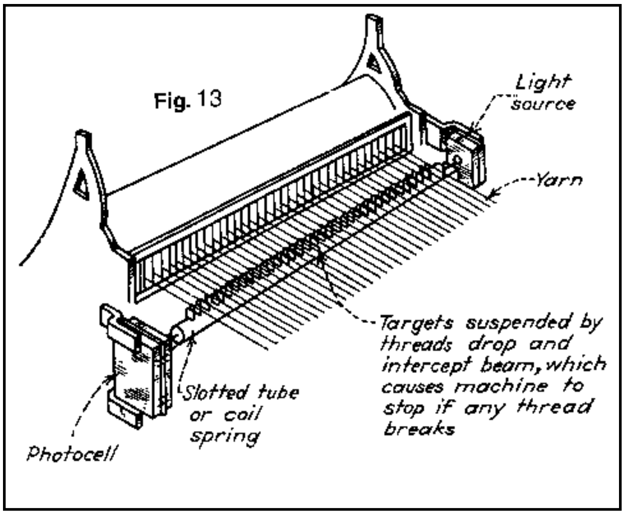


Fig. 13

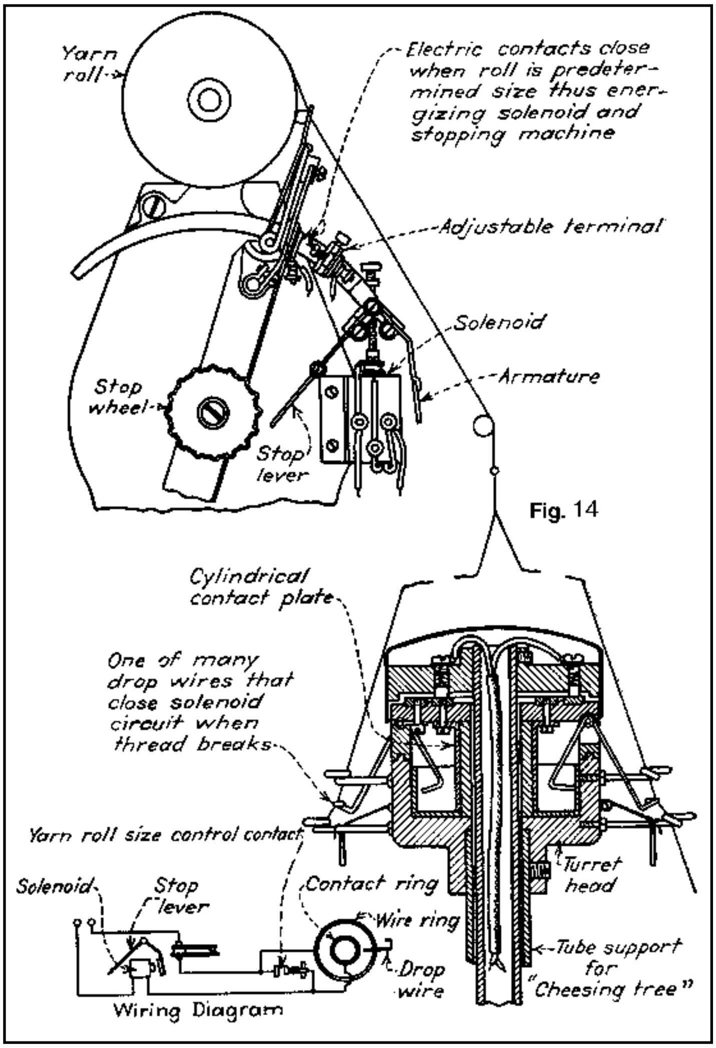


Fig. 14

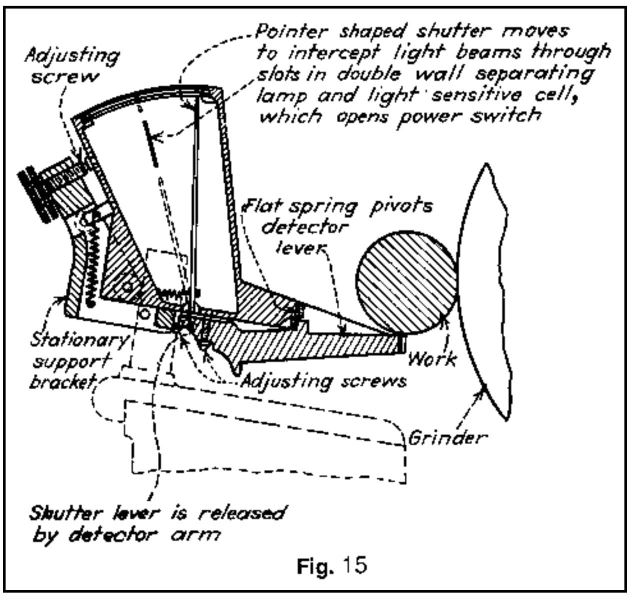


Fig. 15

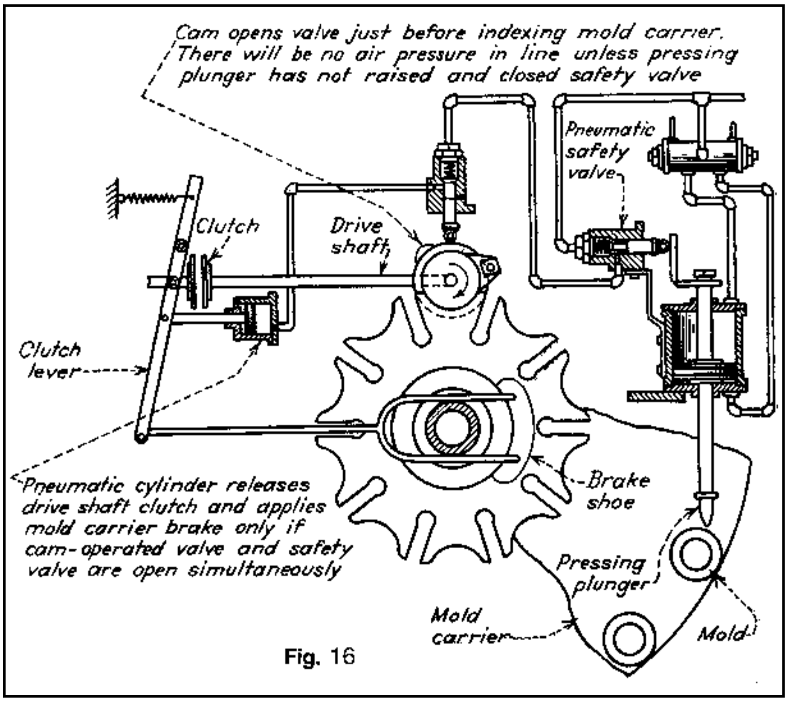


Fig. 16

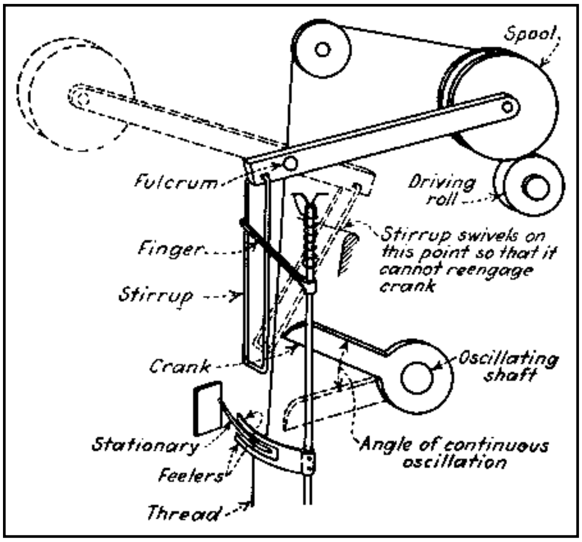


Fig. 17 A mechanism on a spooler. When a thread breaks, the feelers are released and the spiral spring causes the spindle with finger to rotate. The finger throws the stirrup into the path of the oscillating crank, which on its downward stroke throws the spool into the position shown dotted. The stirrup is then thrown out of the path of the oscillating crank.

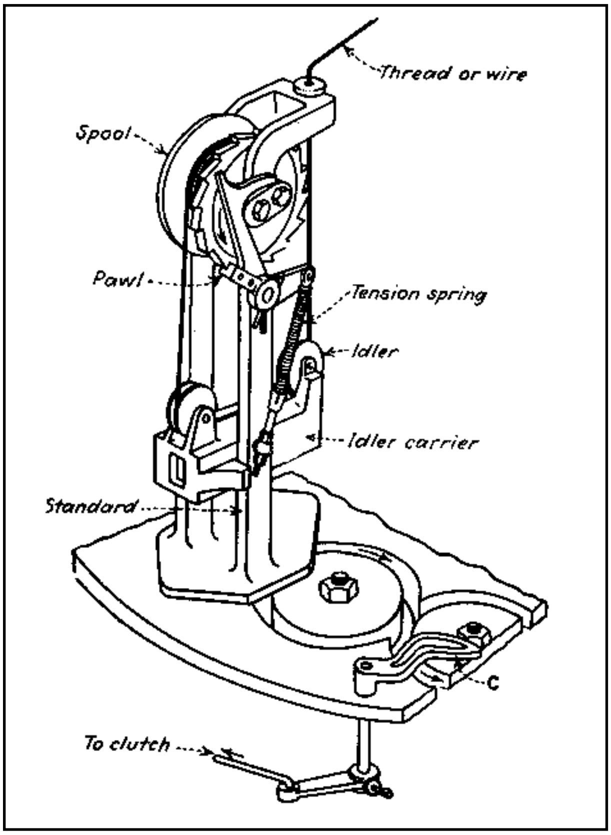


Fig. 18 A mechanism in use on tubular braiding machines. When the machine is braiding, tension on the wire or thread lifts the idler carrier which then releases the pawl from the ratchet on the spool flange and allows the spool to turn and unwind. When the machine stops, the tension on the wire is decreases, allowing the idler carrier to fall so that the pawl can engage the ratchet. If a wire breaks while the machine is running, the unsupported idler carrier falls to the base of the standard, and when the standard arrives at the station in the raceway adjacent to the cam *C,* the lug *L* on the idler carrier strikes the cam *C,* rotating it far enough to disengage a clutch on the driving shaft, thereby stopping the machine.

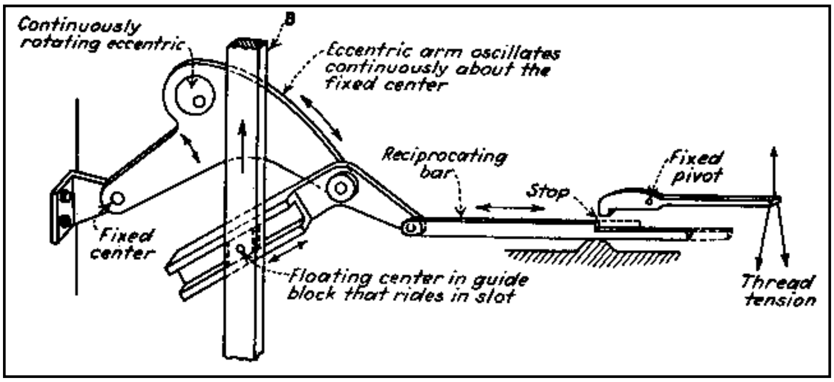


Fig. 19 When thread breaks, the stop drops and intercepts the reciprocating bar. On the next counter-clockwise oscillation of the eccentric arm, the bar *B* is raised. A feature of this design is that it permits the arm *B* to move up or down independently for a limited distance.

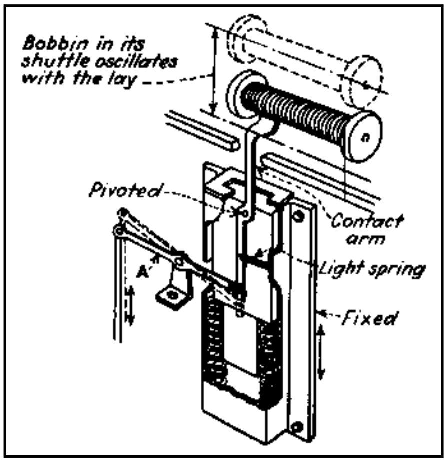


Fig. 20 A diagram of a mechanism that causes a bobbin changer to operate. If the contact arm does not slip on the bobbin, lever *A* will rotate to the position shown. But if contact with the bobbin center slips, when the bobbin is empty, lever *A* will not rotate to the position indicated by the dashed line. This will cause the bobbin changer to operate.

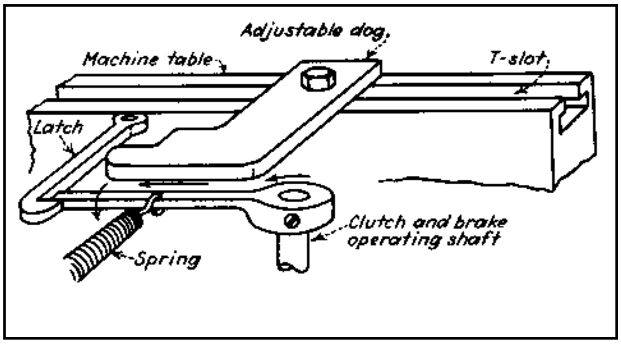


Fig. 21 A simple stop mechanism for limiting the stroke of a reciprocating machine member. Arrows indicate the direction of movements.

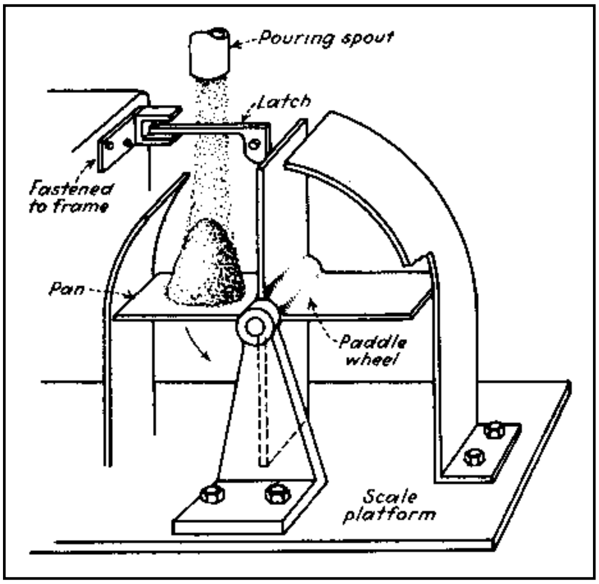


Fig. 22 When the predetermined weight of material has been poured on the pan, the movement of the scale beam pushes the latch out of engagement. This allows the paddle wheel to rotate and dump the load. The scale beam drops, thereby returning the latch to the holding position and stopping the wheel when the next vane hits the latch.

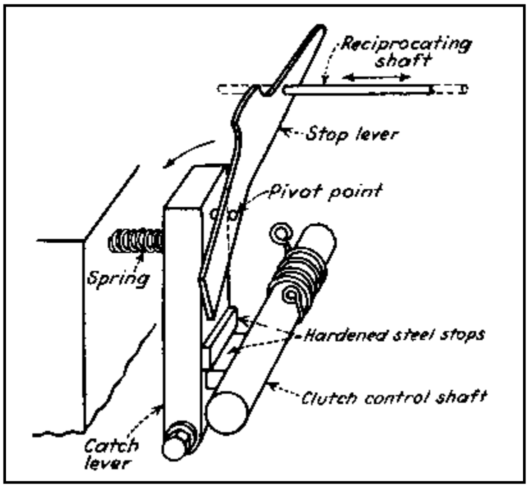


Fig. 23 In this textile machine, any movement that will rotate the stop lever counter-clockwise will move it into the path of the continuously reciprocating shaft. This will cause the catch lever to be pushed counter-clockwise, freeing the hardened steel stop on the clutch control shaft. A spiral spring then impels the clutch control shaft to rotate clockwise. That movement throws out the clutch and applies the brake. The initial movement of the stop lever can be caused by a breaking thread or a moving dog.

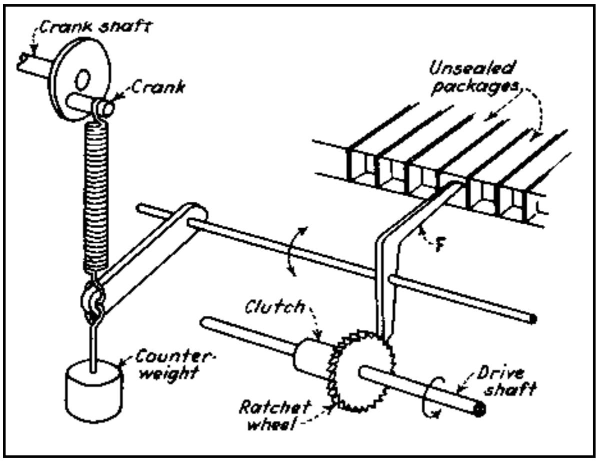


Fig. 24 some package-loading machines have provisions to stop the machine if a package passes the loading station without receiving an insert. Pawl finger *F* has a rocking motion imparted by the crankshaft, timed so that it enters the unsealed packages and is stopped against the contents. If the box is not filled, the finger enters a long distance. The pawl end at the bottom engages and holds a ratchet wheel on the driving clutch which disengages the machine-driving shaft.

ELECTRICAL AUTOMATIC STOPPING MECHANISMS

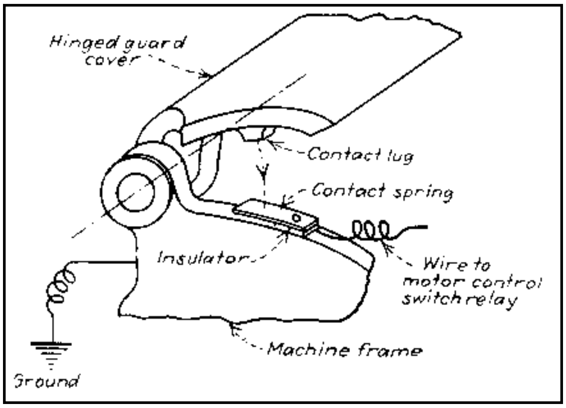


Fig. 1 A safety mechanism on some machines stops the motor when a guard cover is lifted. The circuit is complete only when the cover is down. In that position a contact lug establishes a metal-to-metal connection with the contact spring, completing the relay circuit.

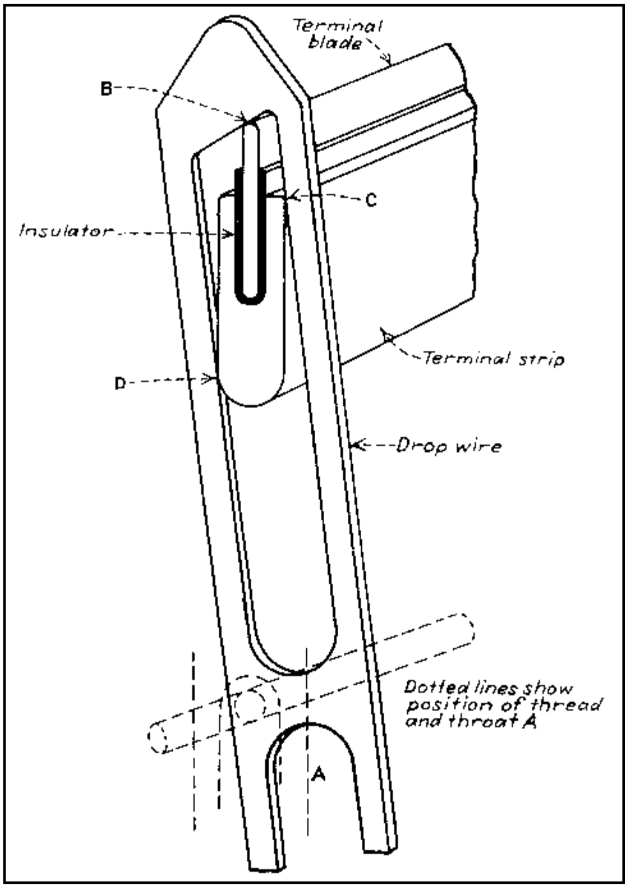


Fig. 2 An electrical three-point wedging "warp stop" is shown after a thread has broken and a drop wire has fallen and tilted to close the circuit. Dotted lines indicate the normal position of the drop wire when it is riding on a thread. When a thread breaks, the drop wire falls and strikes the top of the terminal blade B, the inclined top of the slot. This causes a wedging action that tilts the drop wire against the terminal strip at C and D, reinforcing the circuit-closing action.

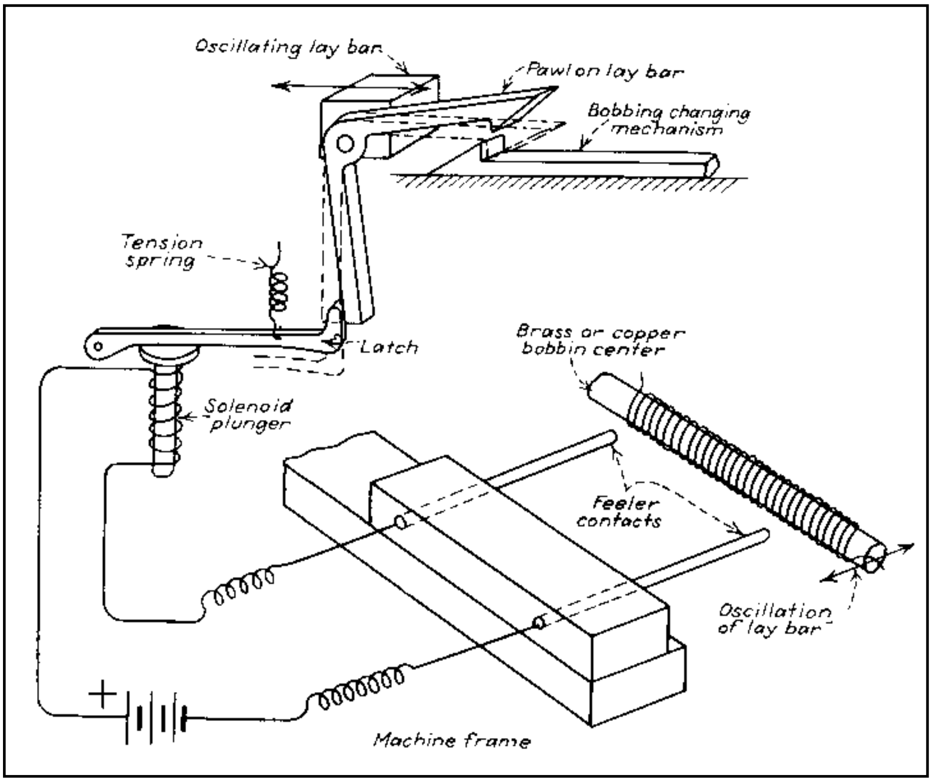


Fig. 3 Bobbin changer. When a bobbin is empty, the feeders contact the metal bobbin center, completing the circuit through a solenoid which pulls a latch. That causes the bobbin-changing mechanism to operator and put a new bobbin in the shuttle. As long as the solenoid remains deenergized, the pawl on the lay bar is raised clear of the hook on the bobbin-changing mechanism.

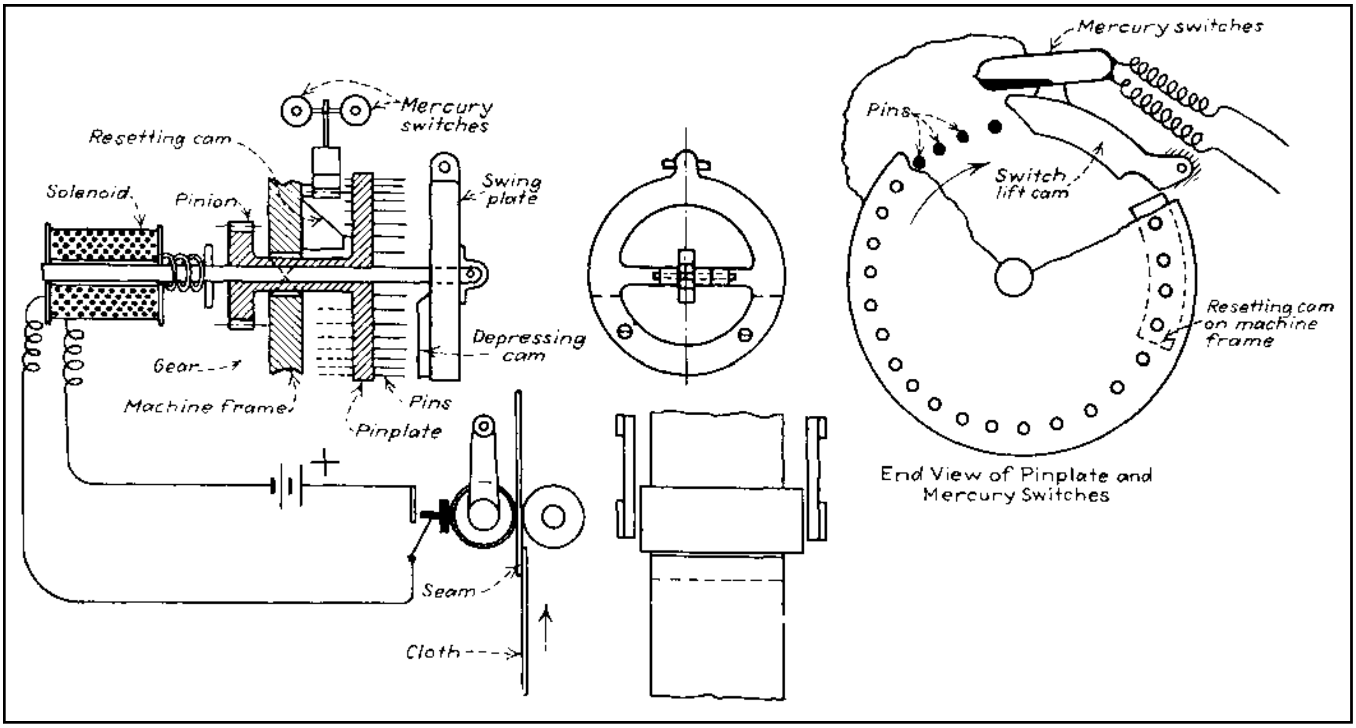


Fig. 4 Control for the automatic shear. When a seam of two thicknesses of cloth passes between the rolls, the swing roller is moved outward and closes a sensitive switch which energizes a solenoid. The solenoid pulls in an armature whose outer end is attached to the hinged ring where a cam plate is also fastened. The cam plate depresses the pins in a rotating plate. As the plate rotates, the depressed pins lift a hinged cam arm on which two mercury switches are mounted. When tilted, the switches complete circuits in two motor controls. A resetting cam for pushing the depressed pins back to their original position is fastened on the machine frame. The two motors are stopped and reversed until the seam has passed through rollers before they are stopped and reversed again.

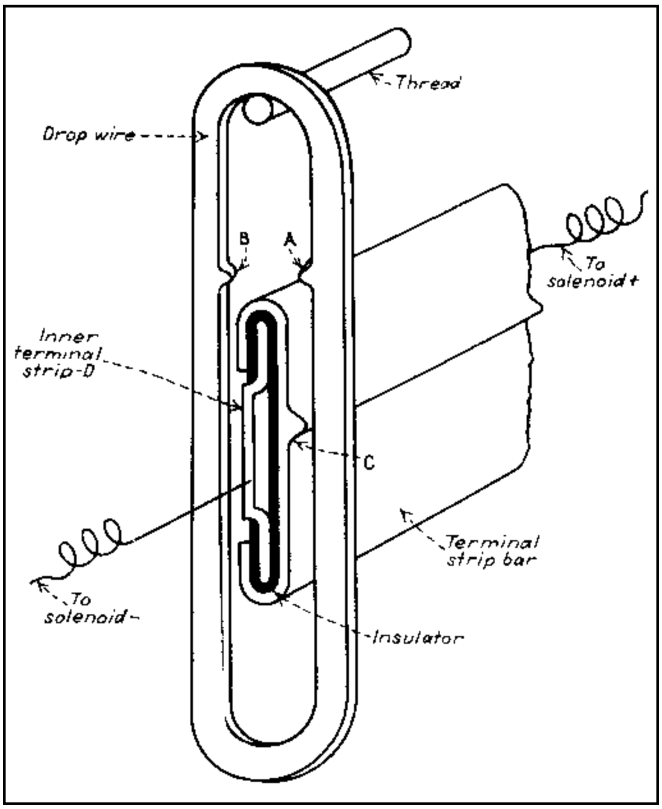


Fig. 5 Electric stop for a loom. When a thread breaks or slackens, the drop wire falls and contact A rides on contact C. The drop wire, supported off-center, swings so that contact B is pulled against the inner terminal strip D, completing the solenoid circuit.

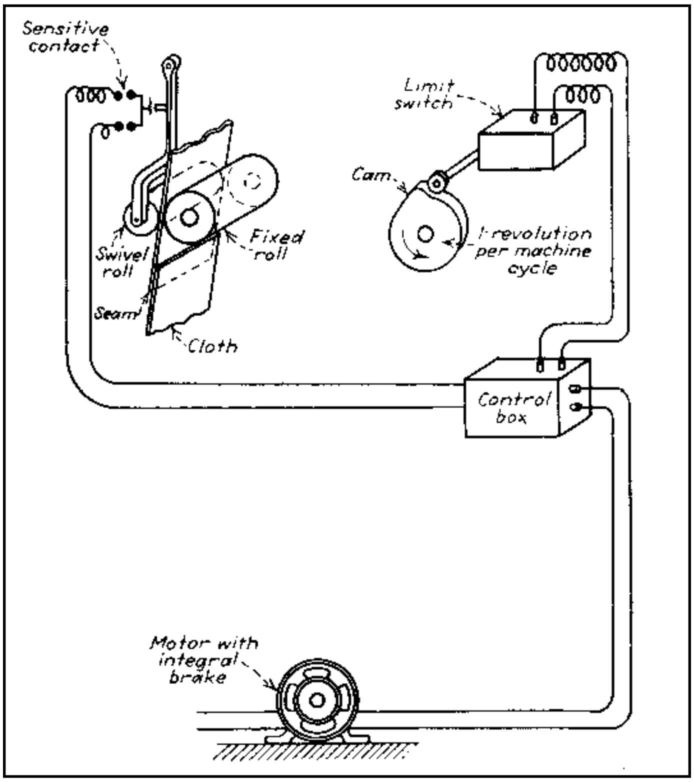
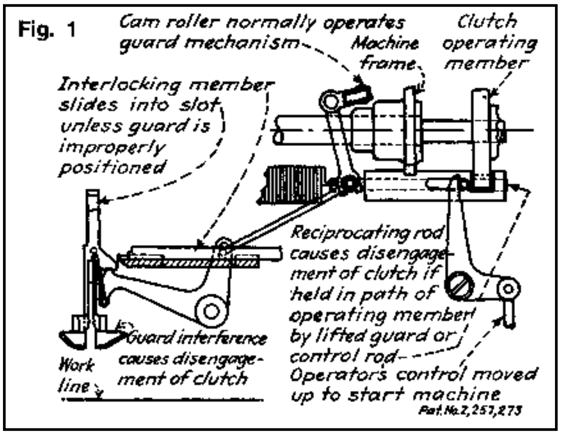


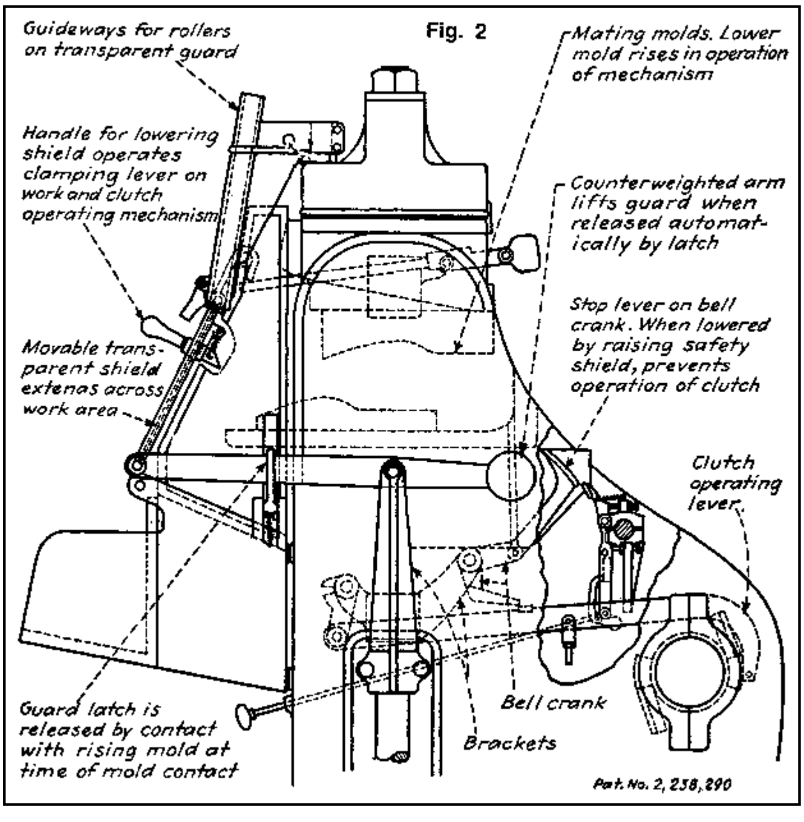
Fig. 6 This automatic stop for a folder or yarder machine always stops the machine in the same position when a seam in the cloth passes between the rolls. A seam passing between the rolls causes the swivel-mounted roll to lift slightly. This motion closes contacts in a sensitive switch that opens a relay in the control box. The next time the cam closes the limit switch, the power of the motor with the integral magnetic brake is shut off. The brake always stops the machine in the same place.

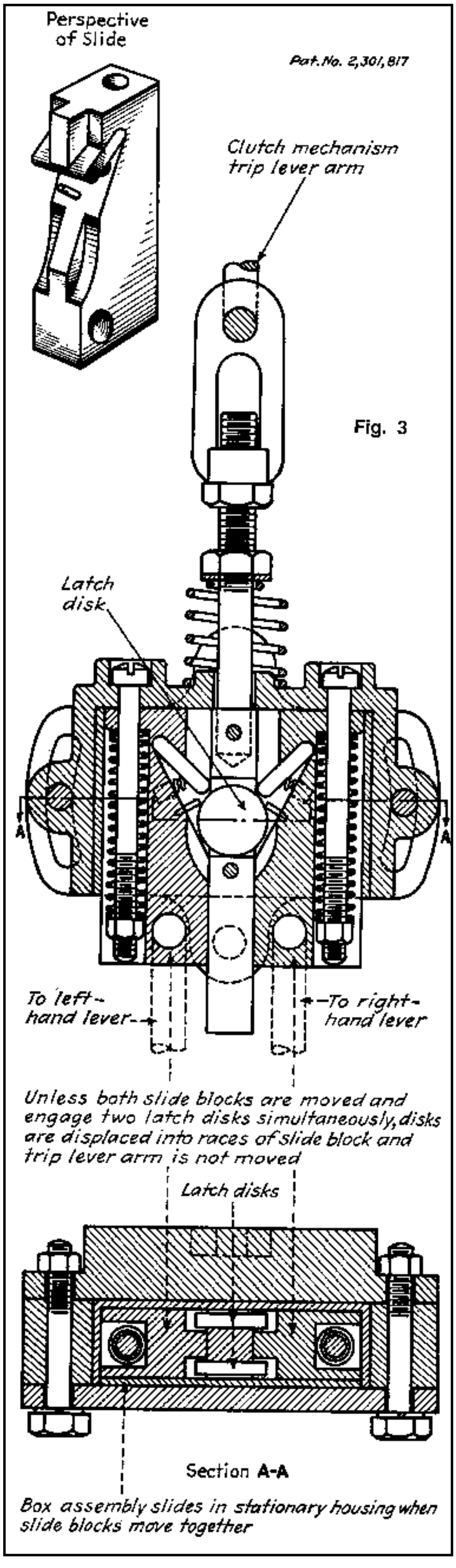
AUTOMATIC SAFETY MECHANISMS FOR OPERATING MACHINES

The best automatic safety mechanisms are those that have been designed specifically for the machine on which they will be installed. When properly designed, automatic safety devices (1) do not reduce the operator's visibility, (2) do not interfere with the operator's performance, (3) do not make physical contact with the operator to prevent injury (e.g., by knocking his hand out of the way), (4) are fail-safe, (5) are sensitive enough to operate instantly, and (6) render the machine inoperative if anyone attempts to tamper with them or remove them.

Safety mechanisms can range from those that keep both of the operator's hands occupied on controls away from the work area to shields that completely enclose the work in progress on the machine and prevent machine operation unless the shield is securely in place. Many modern safety systems are triggered if any person or object breaks a light beam between a photoemitter and photoreceiver.







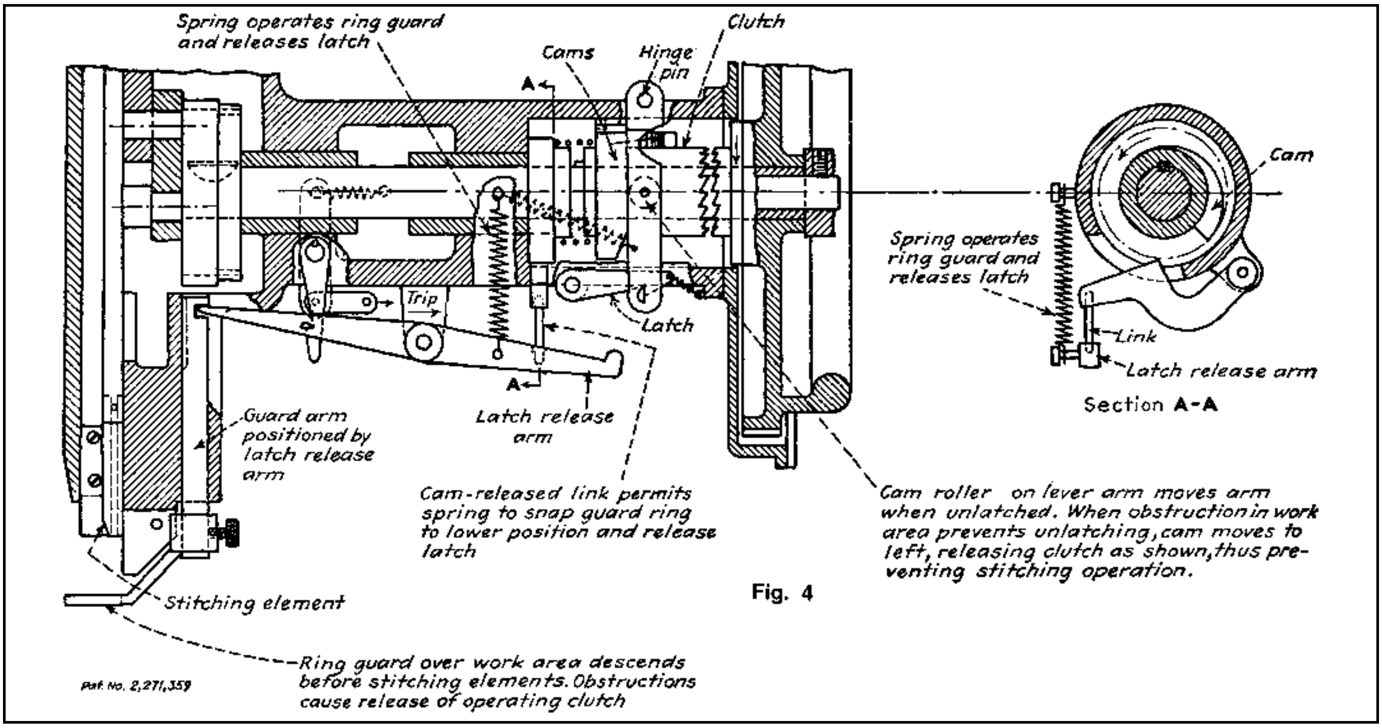


Fig. 4

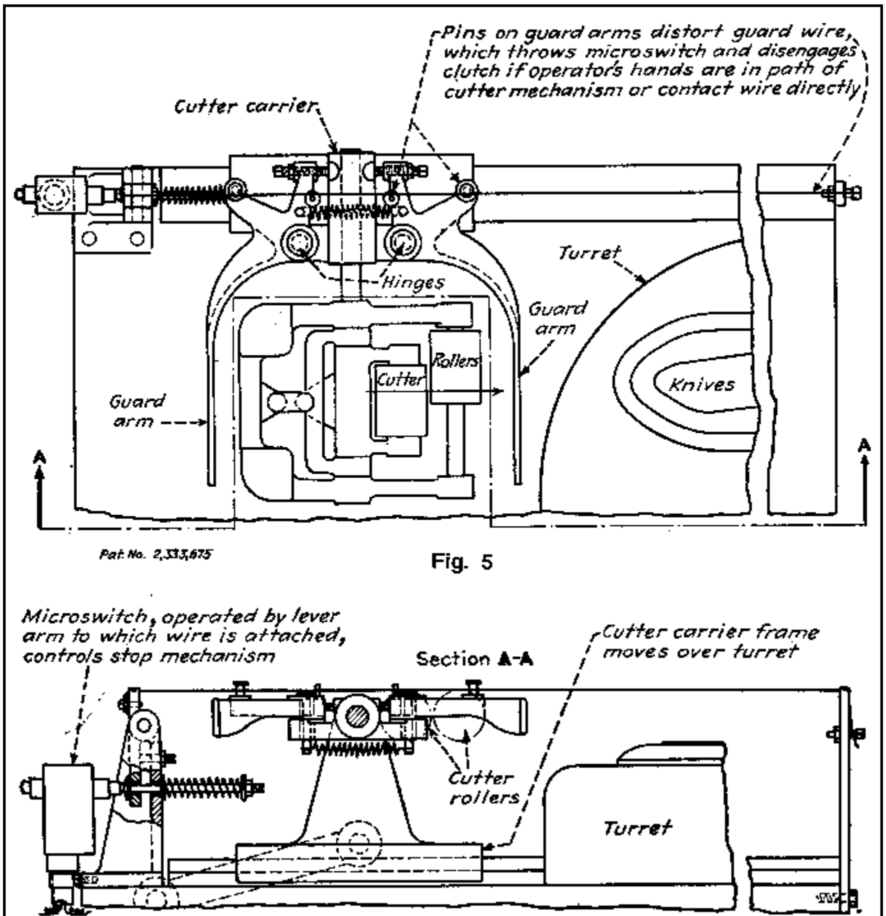


Fig. 5

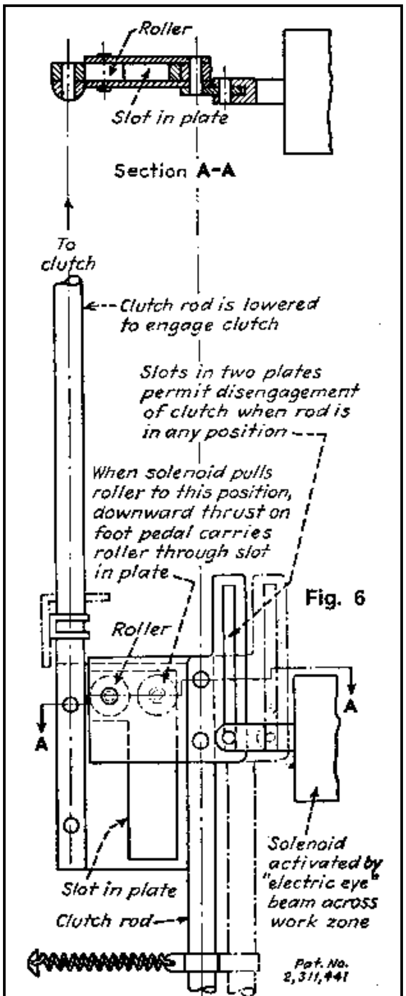


Fig. 6