MOORFEED™

Parts Automation

Parts Feeding and Placement Systems

The industry leader.

Experience

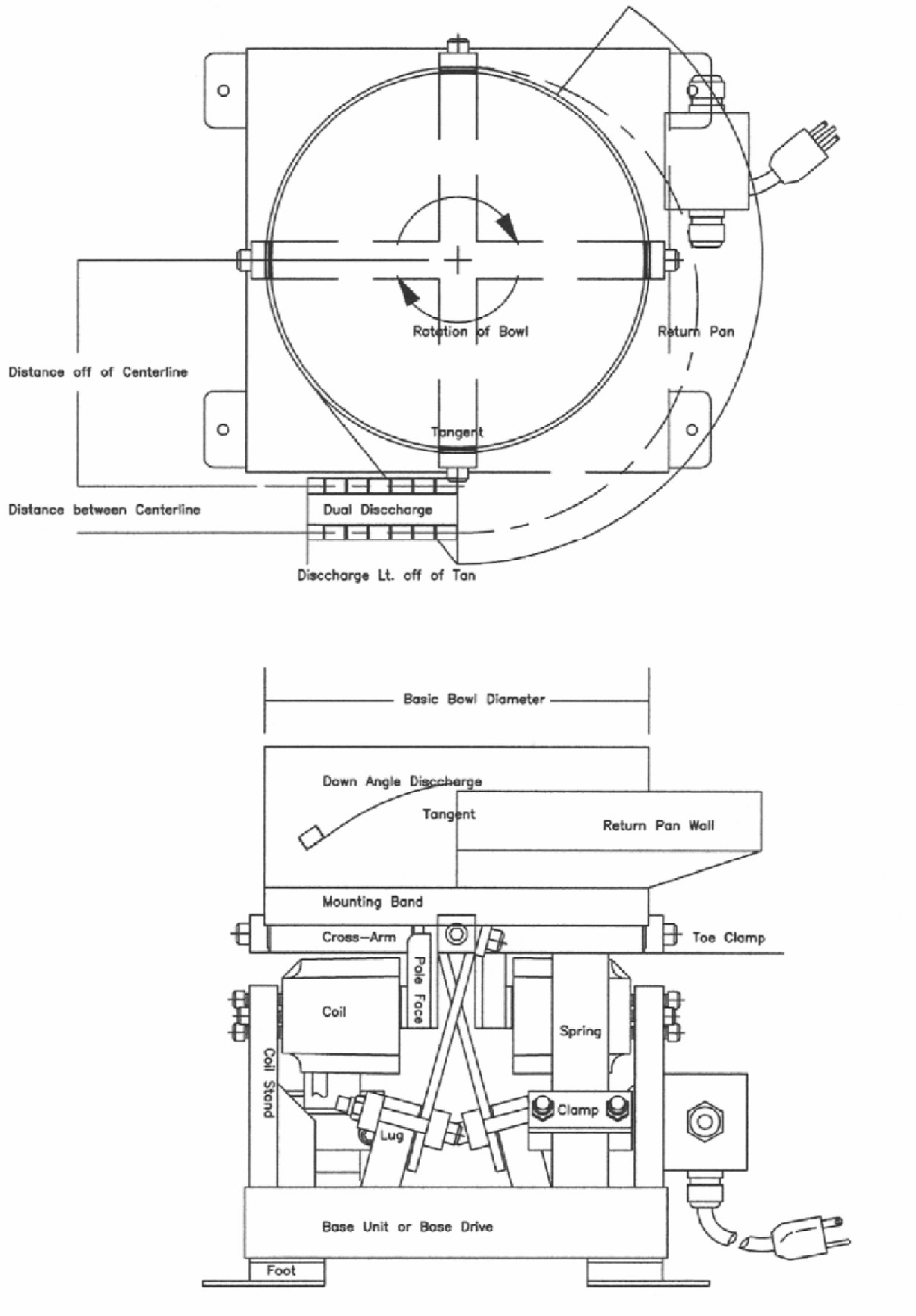
Service

Technology

Innovation

Let us prove it!

FEEDER THEORY



VIBRATORY PART FEEDER

Vibratory bowl feeders are self-contained systems consisting of a bowl feeder that orients the parts and a vibrating drive unit, upon which the bowl feeder is mounted. The drive unit, equipped with a variable- amplitude controller, vibrates the bowl feeder, forcing the parts to move up a circular, inclined track. The track is designed to sort and orient the parts in consistent, repeatable positions, according to certain requirements.

Vibratory bowl feeders can also be manufactured from 304 stainless steel and 316 to meet sanitary requirements in food processing and pharmaceutical.

Vibratory bowl feeders are utilized in the pharmaceutical, automotive, manufacturing, and packaging industries.

Parts feeders are machines that orient parts so that robots or other automated processes can capture and use or package the parts or components. Applications range from packaging pills in the pharmaceutical industry to sparkplug production in the automotive industry. The main difference between parts feeders is their method of directing the feed.

Vibratory bowl feeders are the most common type of parts feeders. The bowl has a helical track which climbs the inside wall of the bowl. Parts are dumped into the bowl that vibrates and Turns. As the parts climb the track they encounter obstacles that orient the parts in a certain way. So that they can be easily used further down the line.

Centrifugal rotary feeders use a bowl that spins and forces parts to the outside of the bowl. At the outside edge of the bowl, the parts are channeled into receivers when the parts are in the right orientation. From the receiver, they go onto a track that moves the parts to the next stage of production. Centrifugal feeders are usually faster and less noisy than vibratory feeders. They also tend to mar parts less than other types of feeders.

Pneumatic feeder's move and position parts by means of a pneumatic piston. The piston functions via hydraulic (liquid) pressure or an air-driven motor to force parts through a tube. These units are ideally suited to convey closures to capping machines, but are also applicable for handling many other small parts including liners, fitments, corks, capsules, etc.

The bowls of parts feeders are commonly available in two configurations, although custom bowl types are manufactured. Cascade bowls, also known as inside track bowls, are primarily used for feeding easily oriented parts like screws and dowels. They are often quieter and less costly than outside- track designs. Outside-track bowls are used when more intricate tooling is required for proper part orientation, for higher feed rates, or for multiple lines of feed. The outside track is pitched downward to improve the separation and orientation of the parts.

Programmable parts feeders are also available. They are more flexible than traditional parts feeders and may be programmed to change the way they isolate or orient parts. Programmable feeders are available in several different configurations ranging from programmable frequency of vibration in a traditional type of feeder, to sensor driven actuators that reorient parts. Robotic parts feeders that use sensors and manipulators to orient parts are also manufactured.

All Vibratory Part Feeders requires a Drive Unit and Controller to Operate.

VIBRATORY PART FEEDER THEORY

Vibrator feeders perform the following operations in handling a part.
ORIENT
SELECT
BACK PRESSURE
ENTER CONFINEMENT
CONFINE

BASIC BOWL

The bowl should be roughly ten to fifteen times in diameter. As the part is long.

Track width should be from one eighth over the width of the part to three times the part width, in the case of long narrow parts.

In case of multiple tracks being fed from one, the track is several times as wide as one part.

In general, a square or oval part should have a track width of one part plus 25%.

The number of turns is a factor of the pitch and band height.

The pitch is to clear from between track and return jams first last and always
.
A track skirt is often used to create an opening situation between tracks.

The heavier the parts the slower it moves up the track.

The average pitch is about one inch in three feet of travel.

Wears is to be considered for designing pitch track and band gage.

In any construction, the overall length of the system is considered in arriving at the correct radial distance from the return.

The band height is determined by the number of turns that will end the track correct location from return and correct height on band.

Addition factors are cost, weight, complexity and auxiliary supply.

OPERATION #1, TO ORIENT

TUBE orienting mechanisms

A half tube lying on chord, or tangent line of the feeder, will impart a rotary motion to the part. This motion will be in the same direction as t bowl rotation when past the tangent point and opposite when ahead of the tangent point. Bottom of part will rotate to the outside behind tangent. Bottom of part will rotate to the inside forward of tangent. (Figure 1)

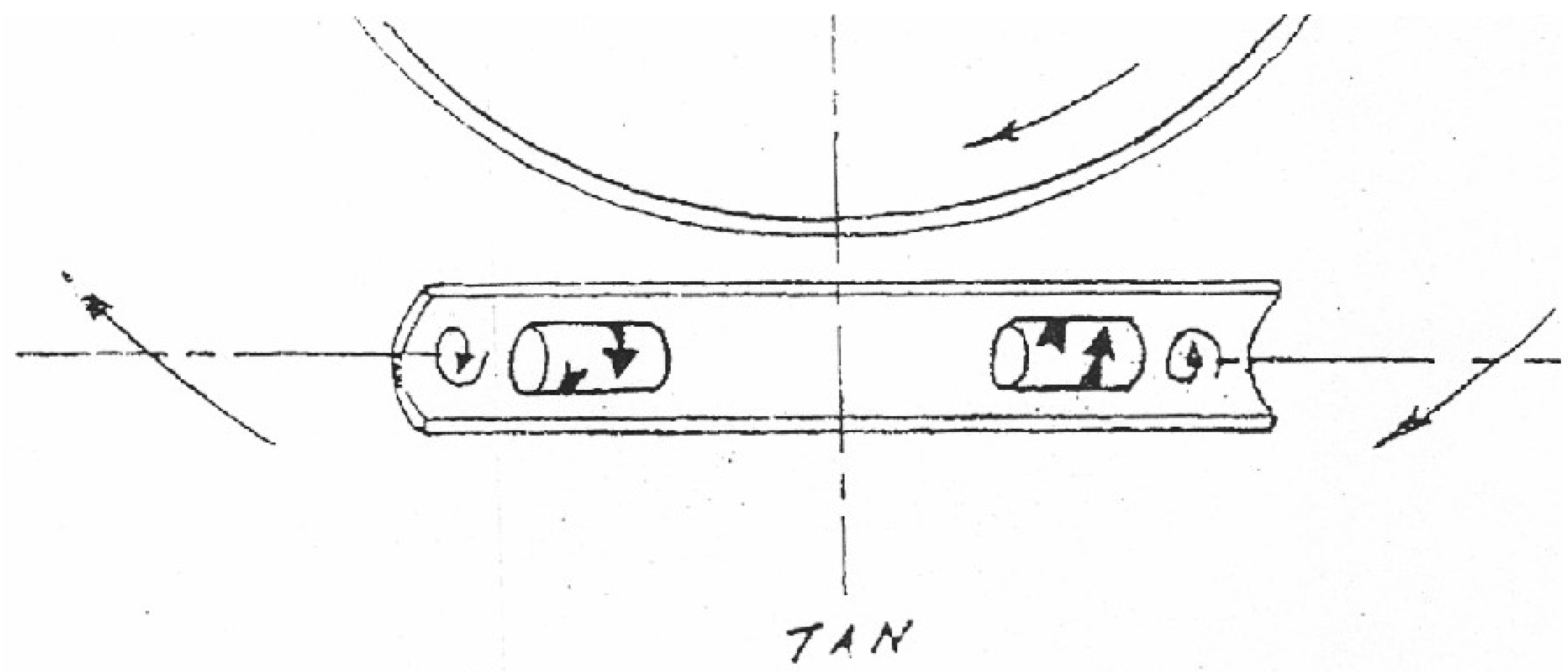


Figure 1

The half tube is used to line parts up end to end or round side down.
The heavy or wide side of a part can be rolled down. The center of gravity will tend to seek the lowest possible position.
Performance is best when parts are free running and on a chord. (Figure 2)

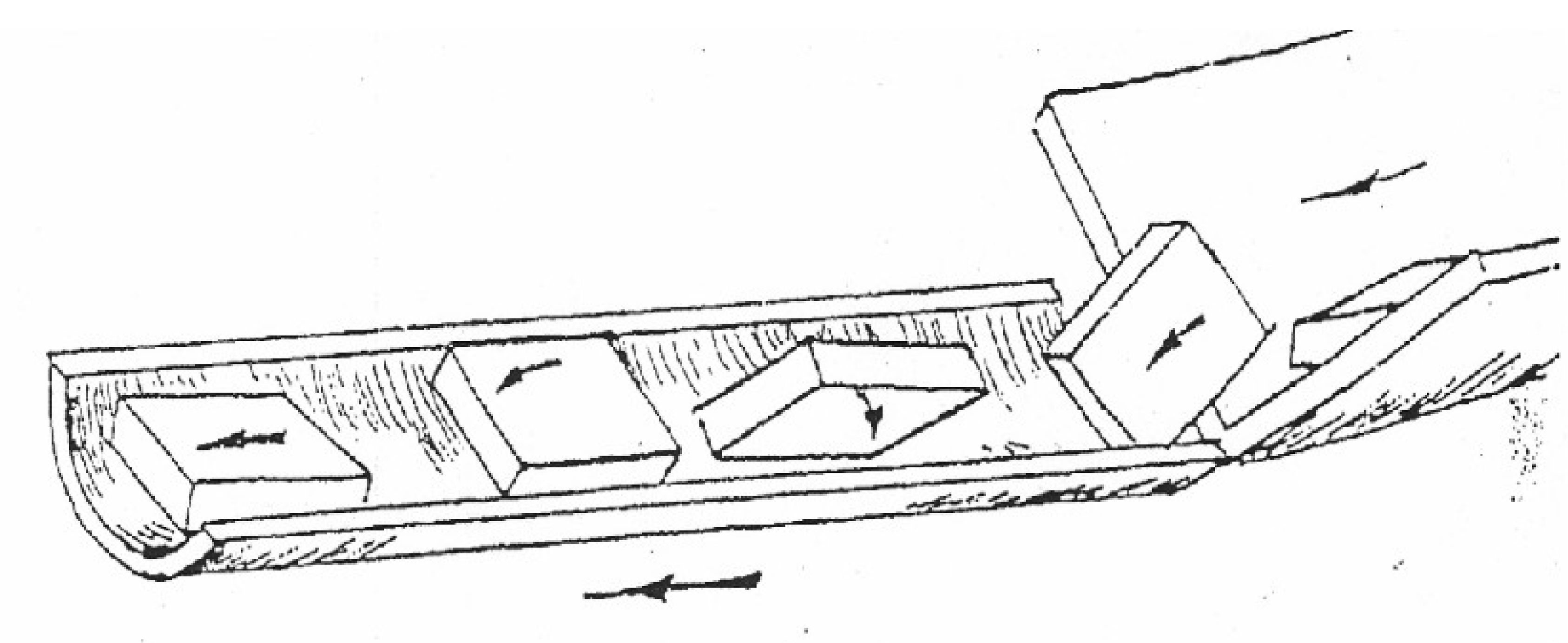


Figure 2

ORIENT

Upside down tube section or the outside diameter of a tube may be used to orient convex shaped parts with the aid of a rail. (Figure 3)

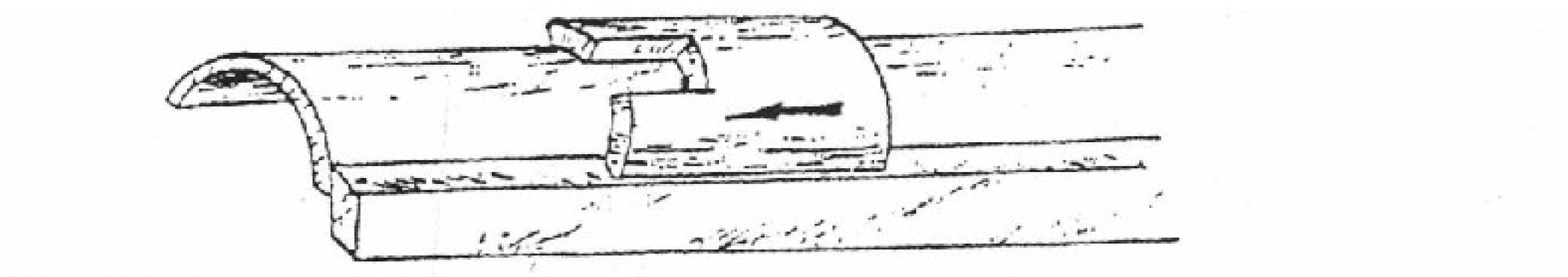


Figure 3

A vertical tube, with or without a center rod, will stack thin disc shaped parts like washers. (Figure 4)

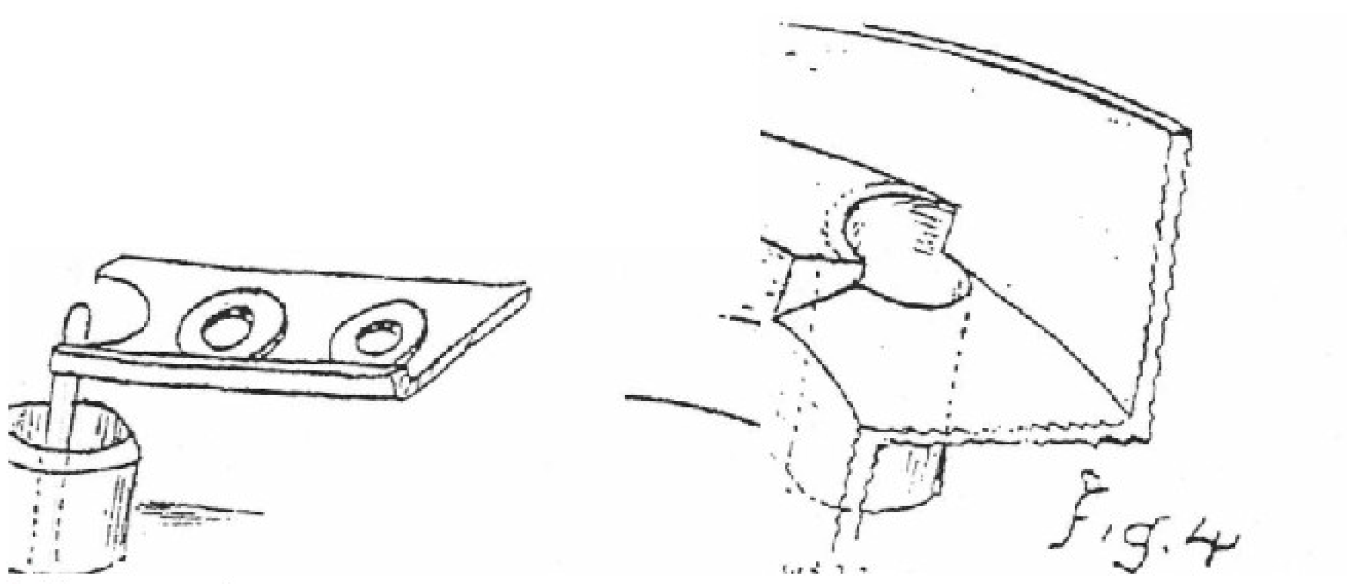


Figure 4

STAND UP ORIENTING MECHANISMS

A vertical step down in the track of proper height will turn a part over 90 degrees in the direction of travel. This can be done with a flat, half tube or V-Track. (Figure 5)

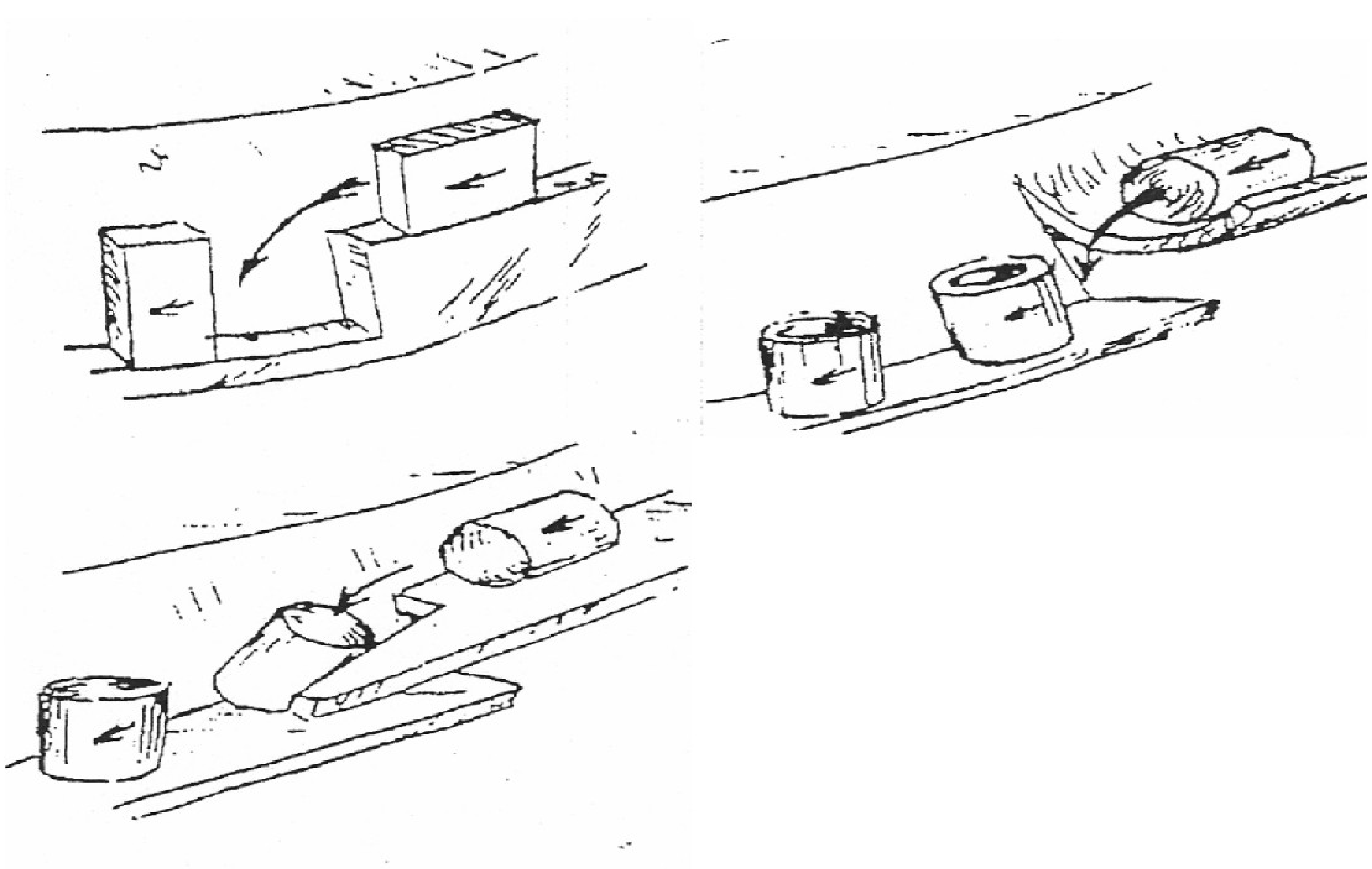


Figure 5

ORIENT

Cylindrical parts should be stood up on the most stable part of the end diameter. This can be done by standing them up on a raised center rail and confining the sides properly. (Figure 6)

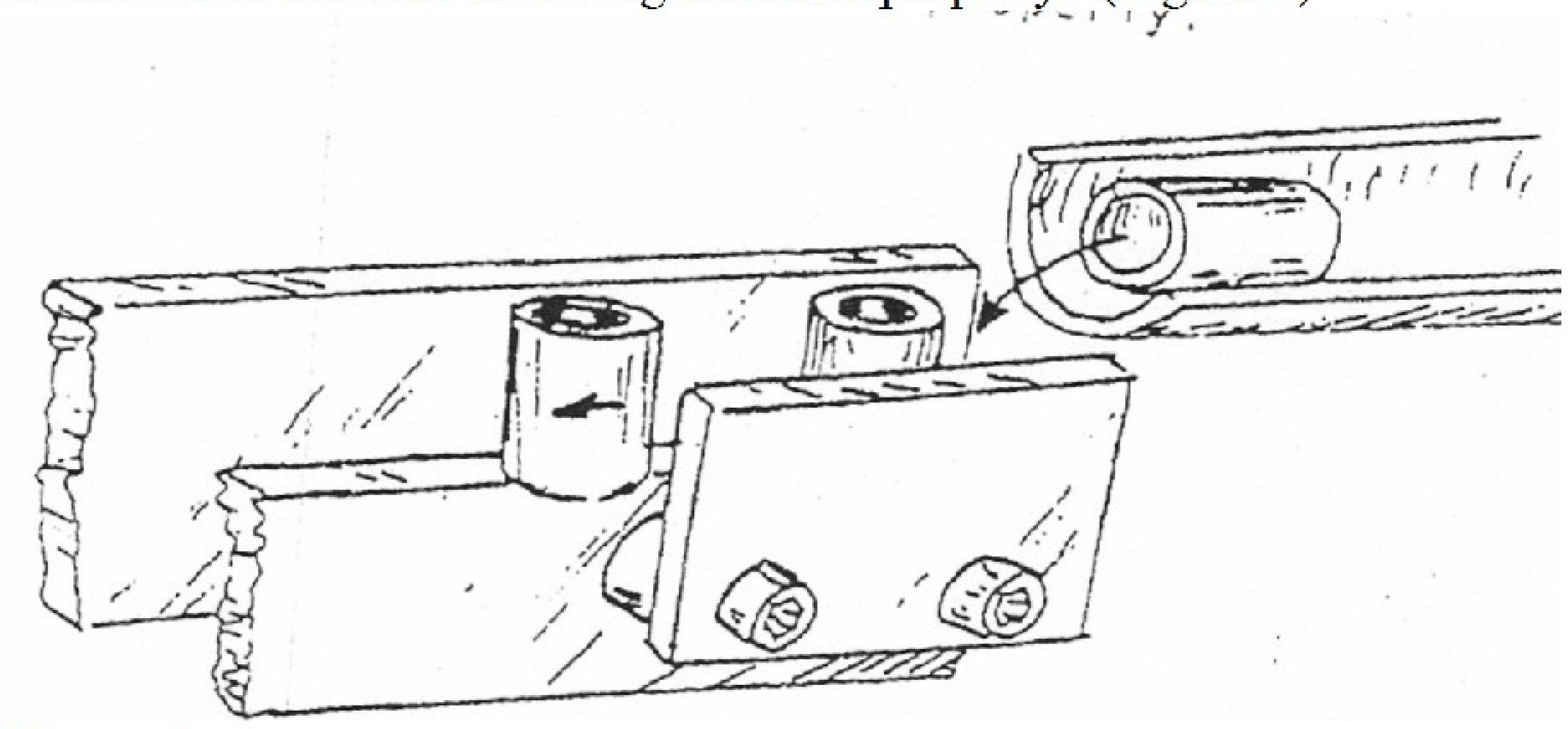


Figure 6

Long parts or parts having a length five times their diameter can be stood up on end at a high rate using a curve and a drop through window onto the lower track. (Figure 7)

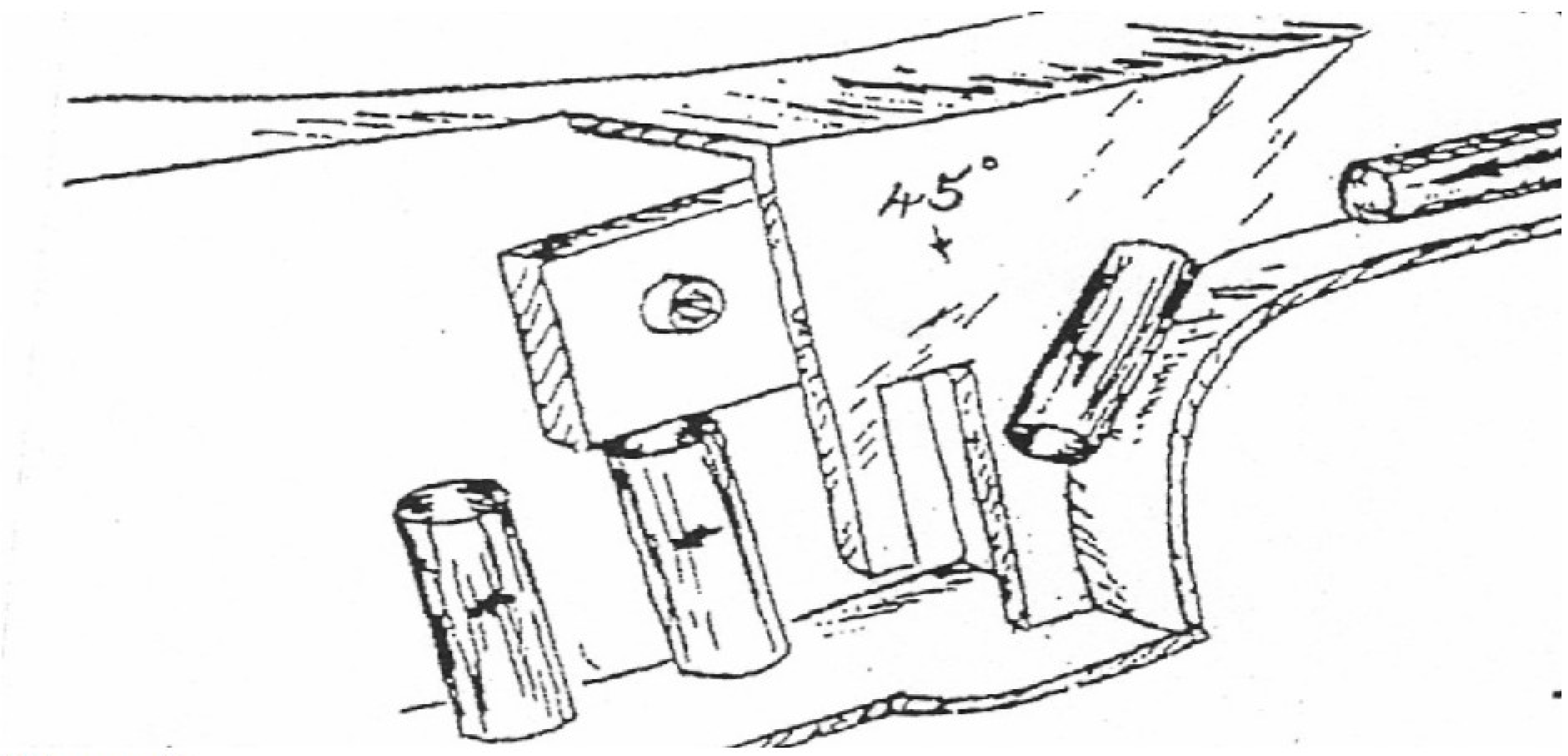


Figure 7

A drop back is used for standing parts up. These methods similar to a vertical drop but are done on approximately 30 degrees and saves vertical height. This is similar to above sketch except the window would be eliminated.

After parts are stood up, a Window can be designed to also give parts a length check. (Figure 8)

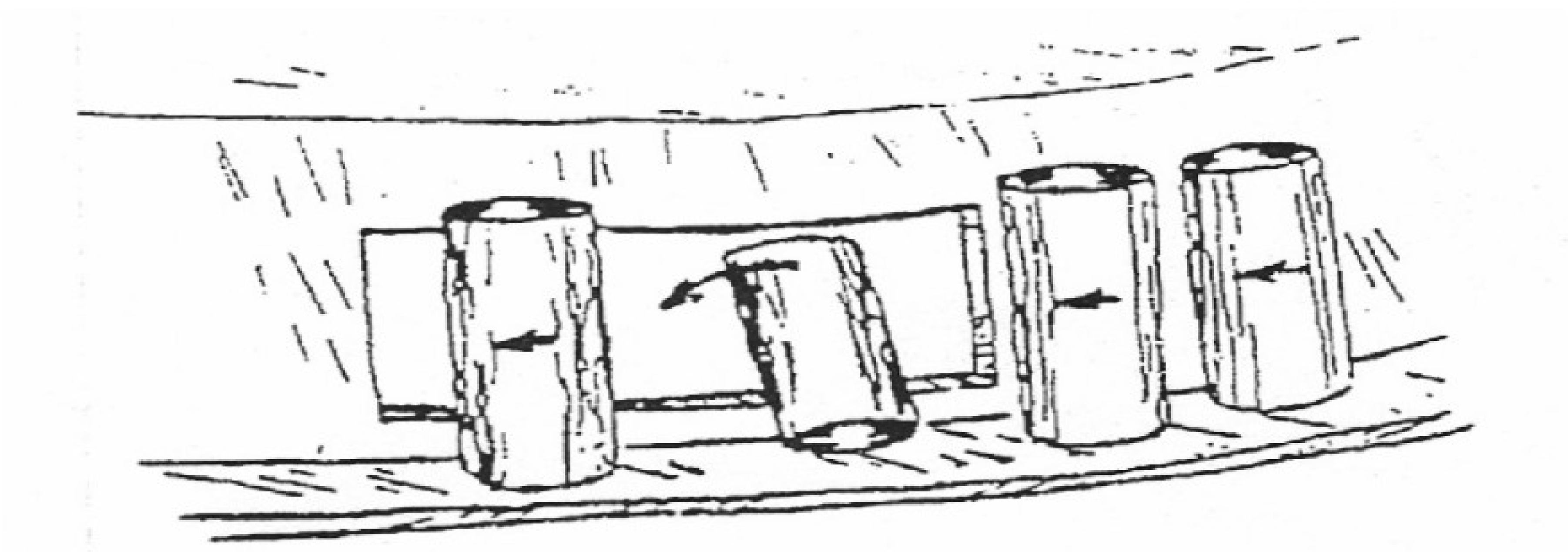


Figure 8

ORIENT

The drop point should be placed on a radius line or tangent point. This position has a maximum forward and a minimum side thrust on the part. (Figure 9)

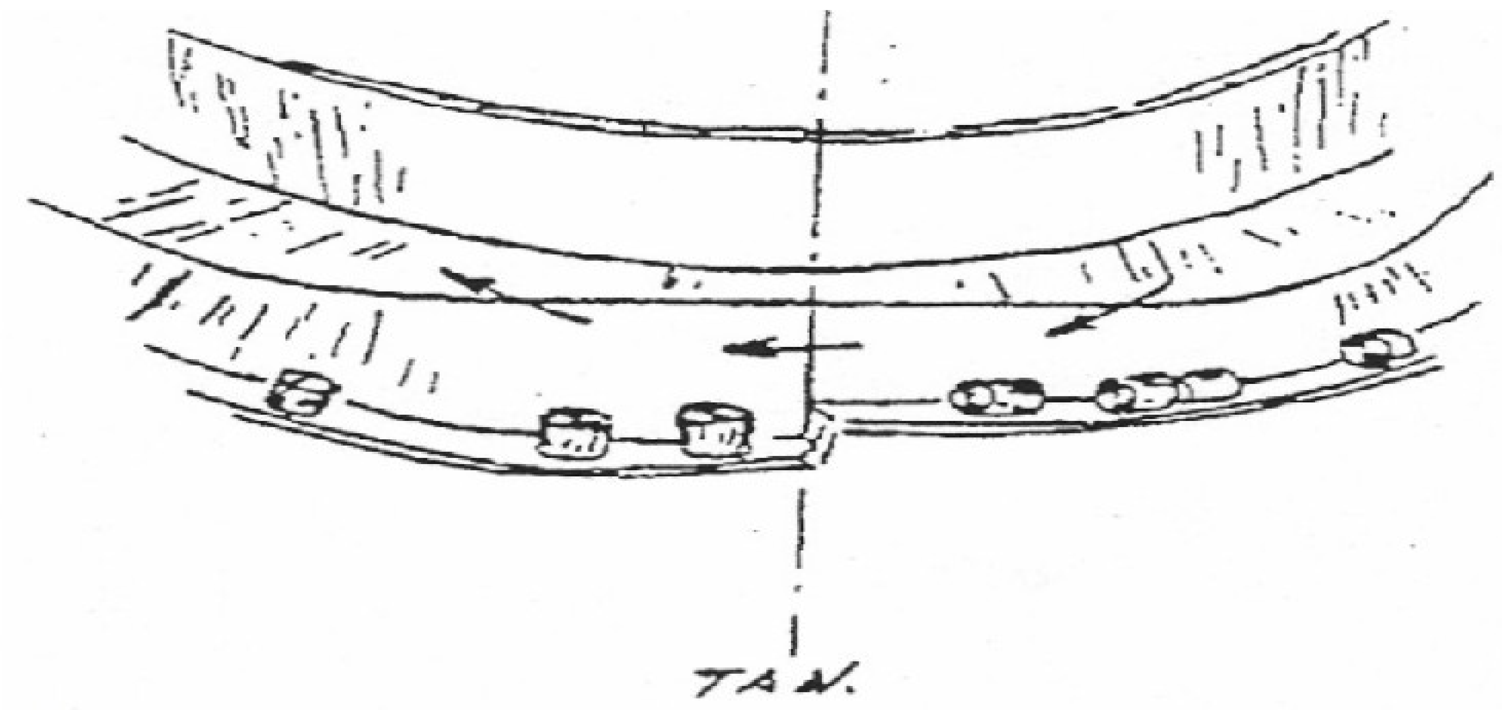


Figure 9

For stability, a controlled rate of climb can be used to regulate the speed of parts entering and leaving the drop point. Parts should be separated or spread out by running on a horizontal track before and after a drop. The speed of a part increases with less rate of climb. (Figure 10)

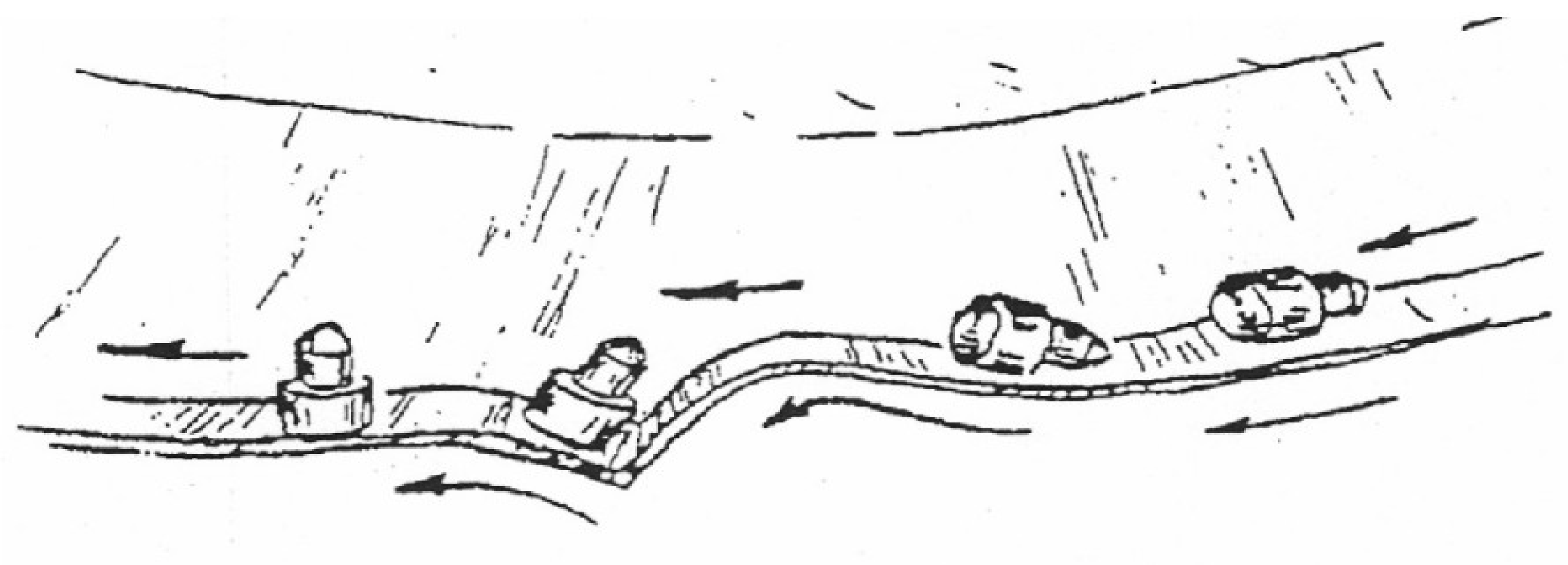


Figure 10

CAM ORIENTING MECHANISMS

A cam placed on the track can turn a part 90 degree in the direction of travel by wedging under a portion of the part and lifting it from the track surface. (Figure 11)

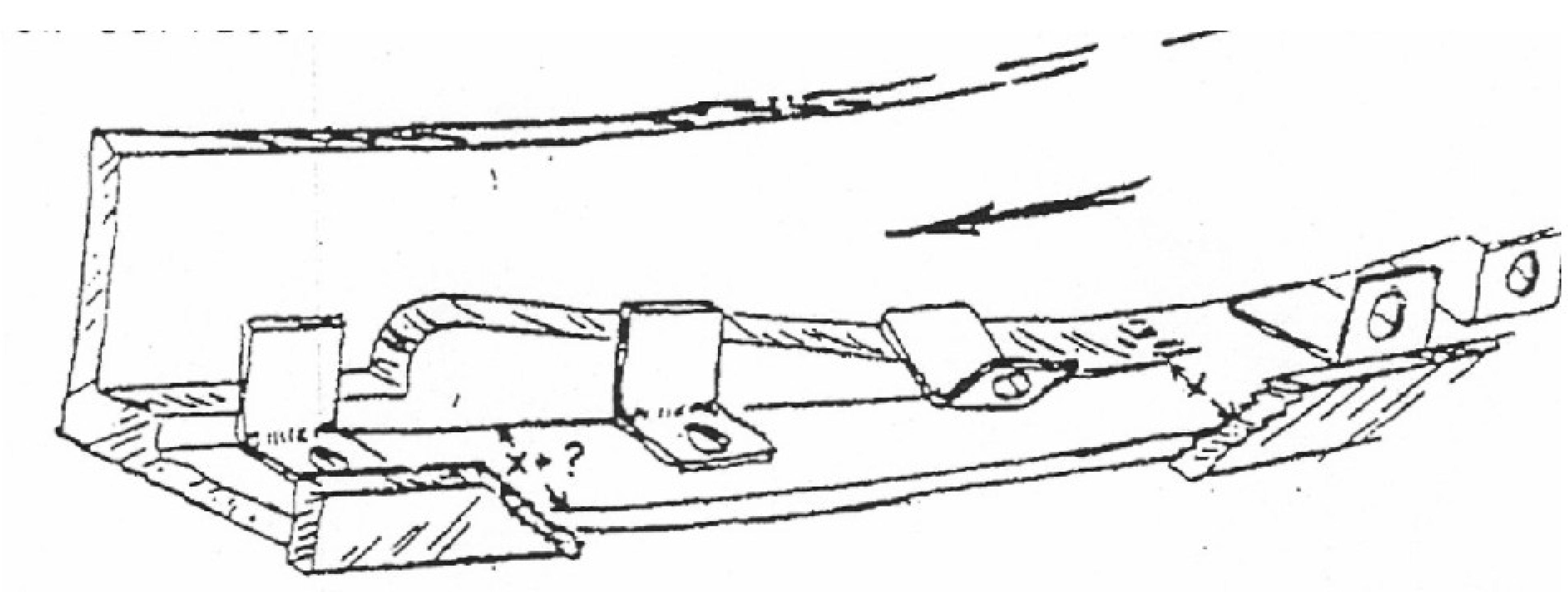


Figure 11

Any cam (including sweeps) must open along the line of travel to eliminate jams. Always and forever OPENING. Consider tool steel for heavy wear line. (See Figure 11)

ORIENT

A cam on the inside of a bowl has a higher pitch angle than the track and causes jams due to the narrow opening angle, and steep rise in the center of gravity. A cam on the outside of a bowl can be built with no rise in center of gravity. (Figure 12)

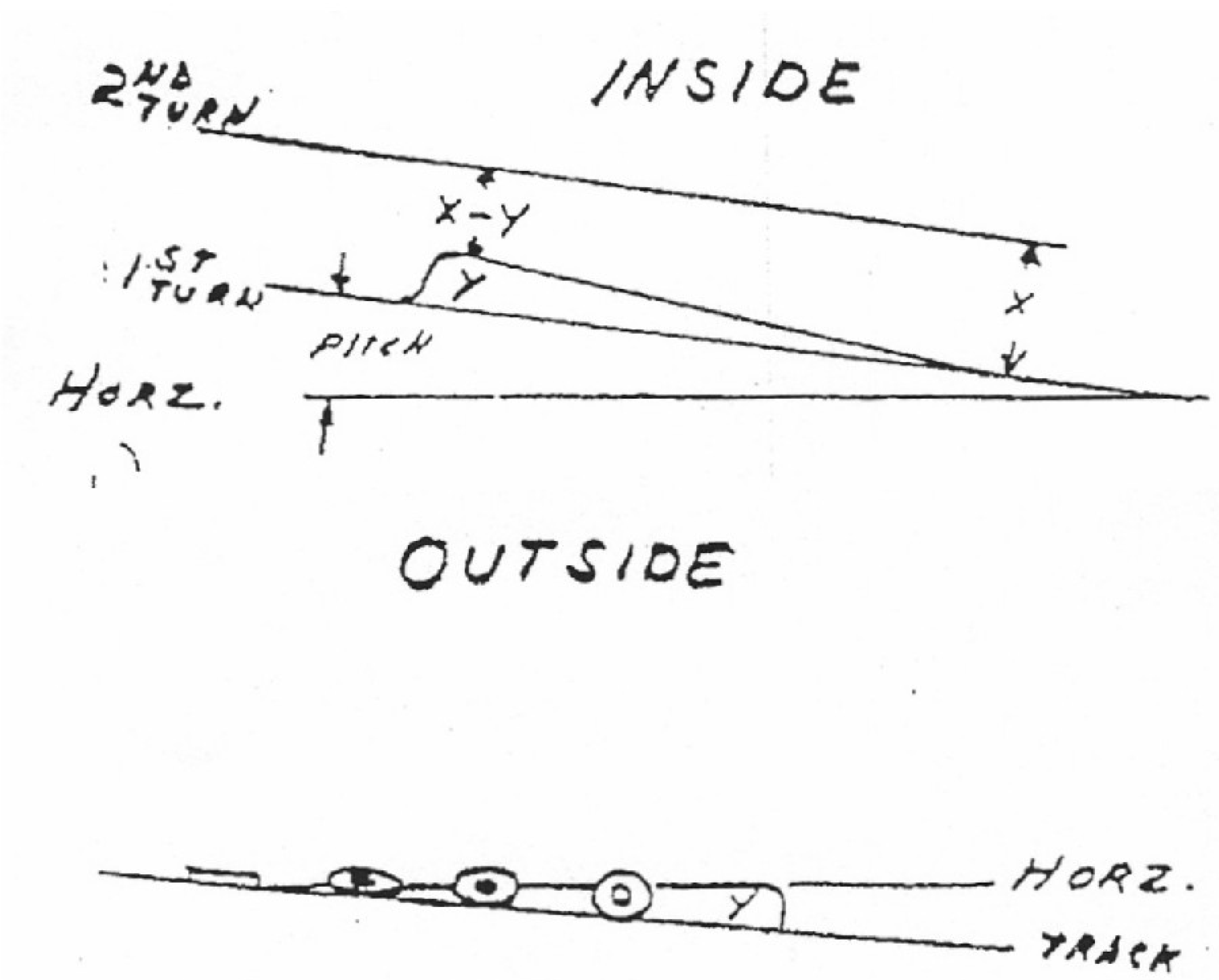


Figure 12

OPERATION #2 TO SELECT

NARROW TRACK SELECTOR

The narrow track can be used with or without a sweep to allow only a single line of parts to pass. (Figure 13)

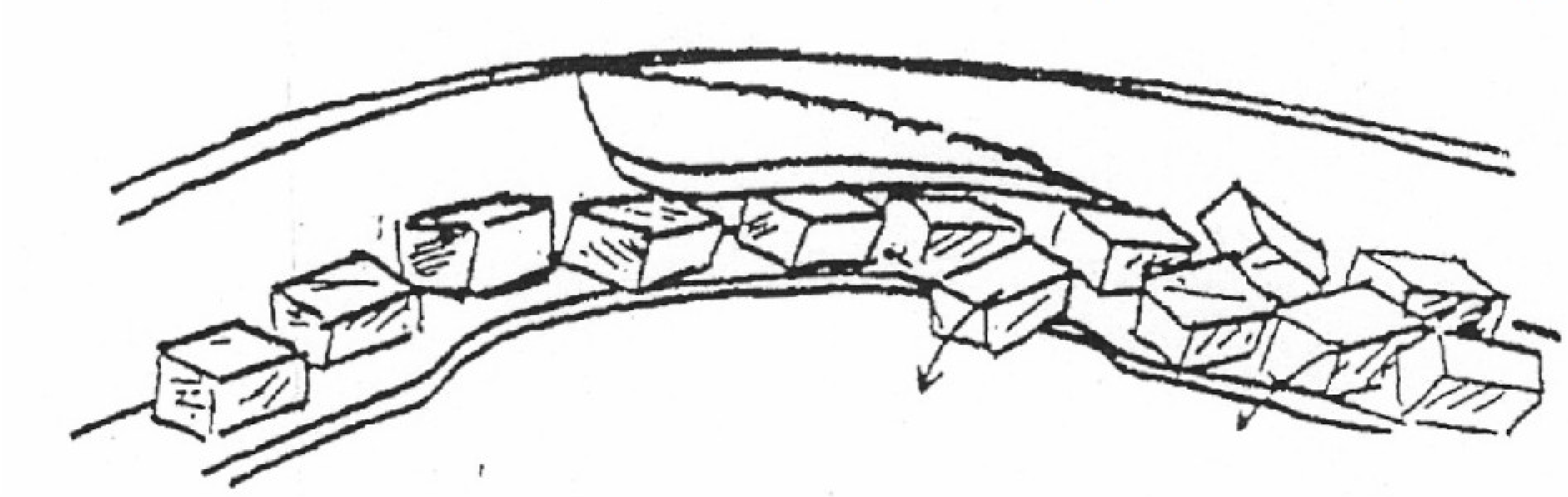


Figure 13

A narrow track section should never be cut too critical or narrow until final development. It is easier to take it off than it is to put it on. (Figure 13)

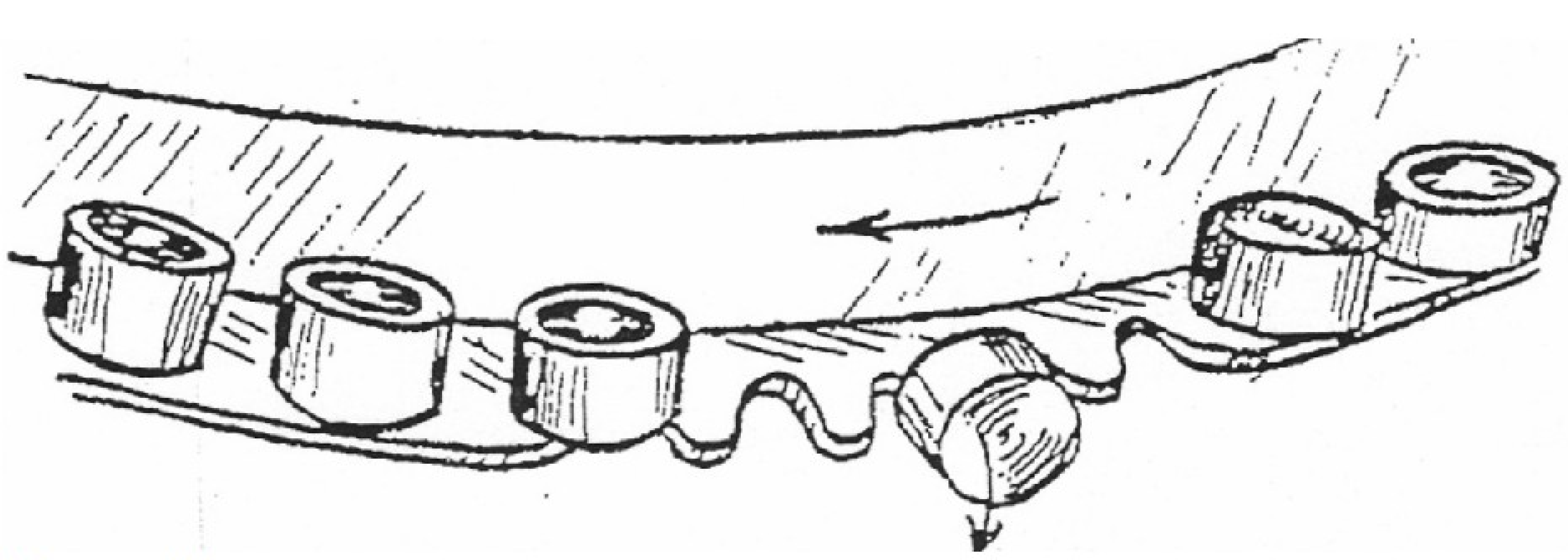


Figure 14

Notches cut in a narrow track in the shape of the part can select out one position. Also called Scallops. (Figure 14)

SELECT

SWEEP SELECTOR

Sweep blades should open and sweep clear of the track. Parts should be swept clear off the track. (Figure 15)

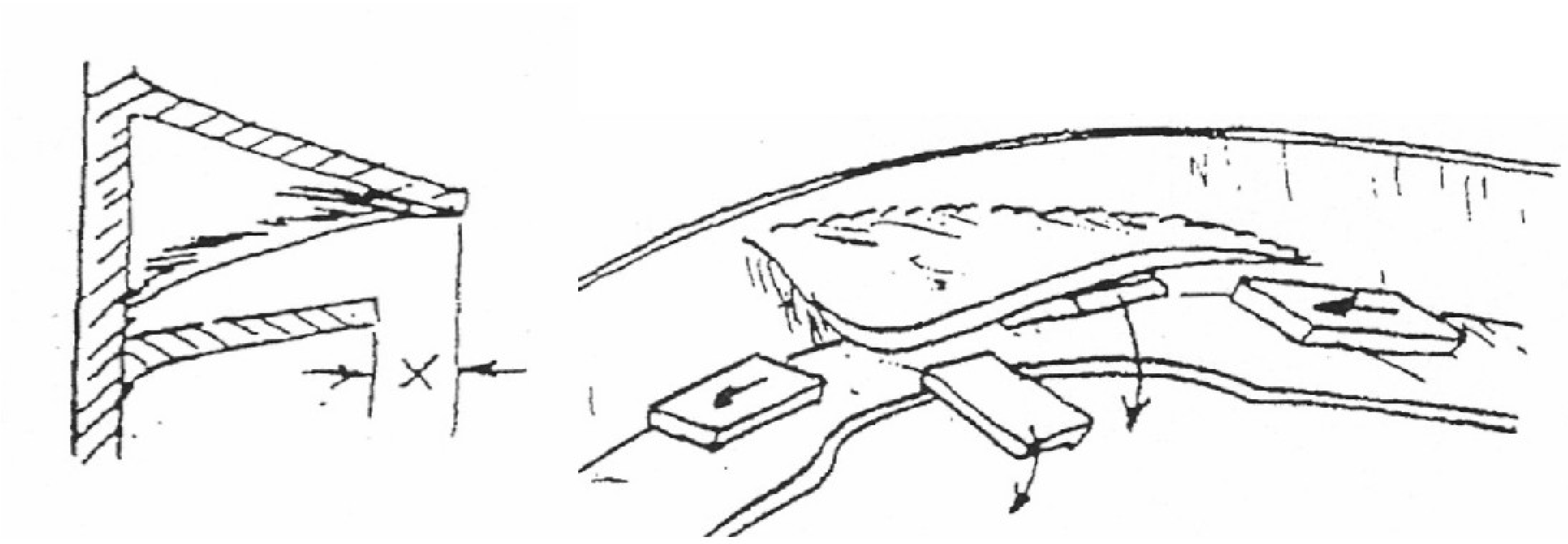


Figure 15

SWEEP SELECTORS

A sweep can be made to profile the part ln the position desired. Parts in a different position will be pushed off the track. (Figure 16)

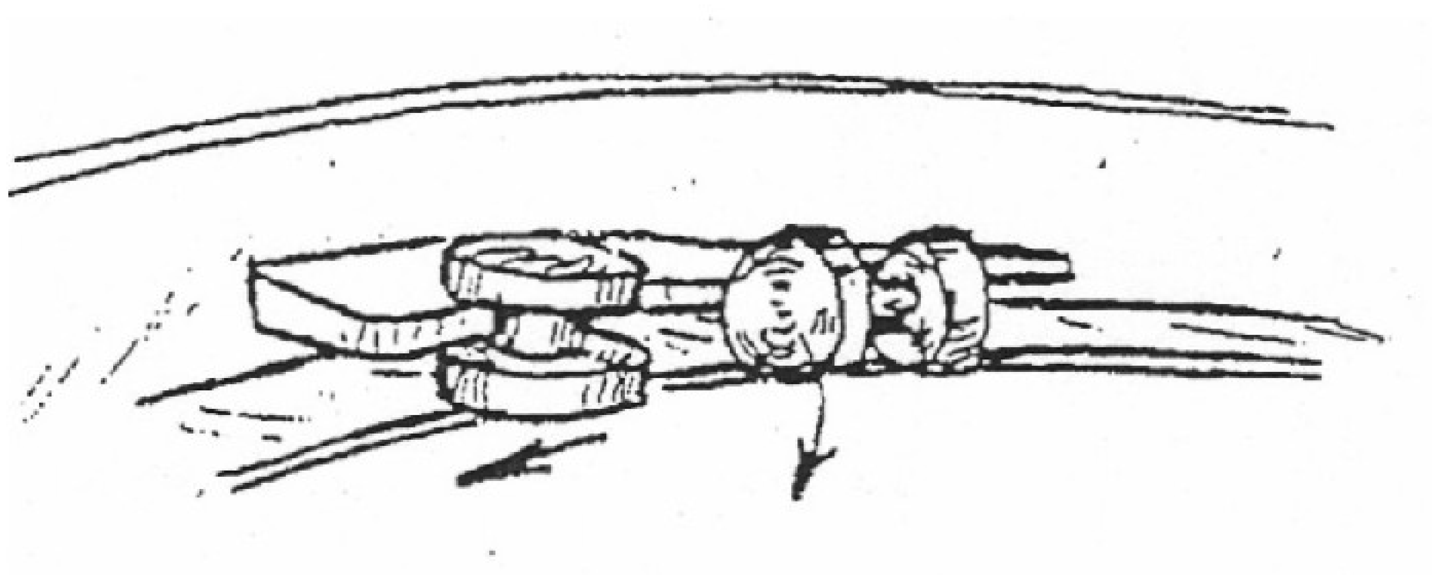


Figure 16

Use vertical sweeps between tracks on a straight wall bowl, to prevent parts from getting on top of the sweep. (Figure 17)

.
Figure 17

INVERTED TRACK SELECTORS

An inverted track is one that has a slope below the horizontal planes with a rail on the edge high enough to carry one or more layers of parts

SELECT

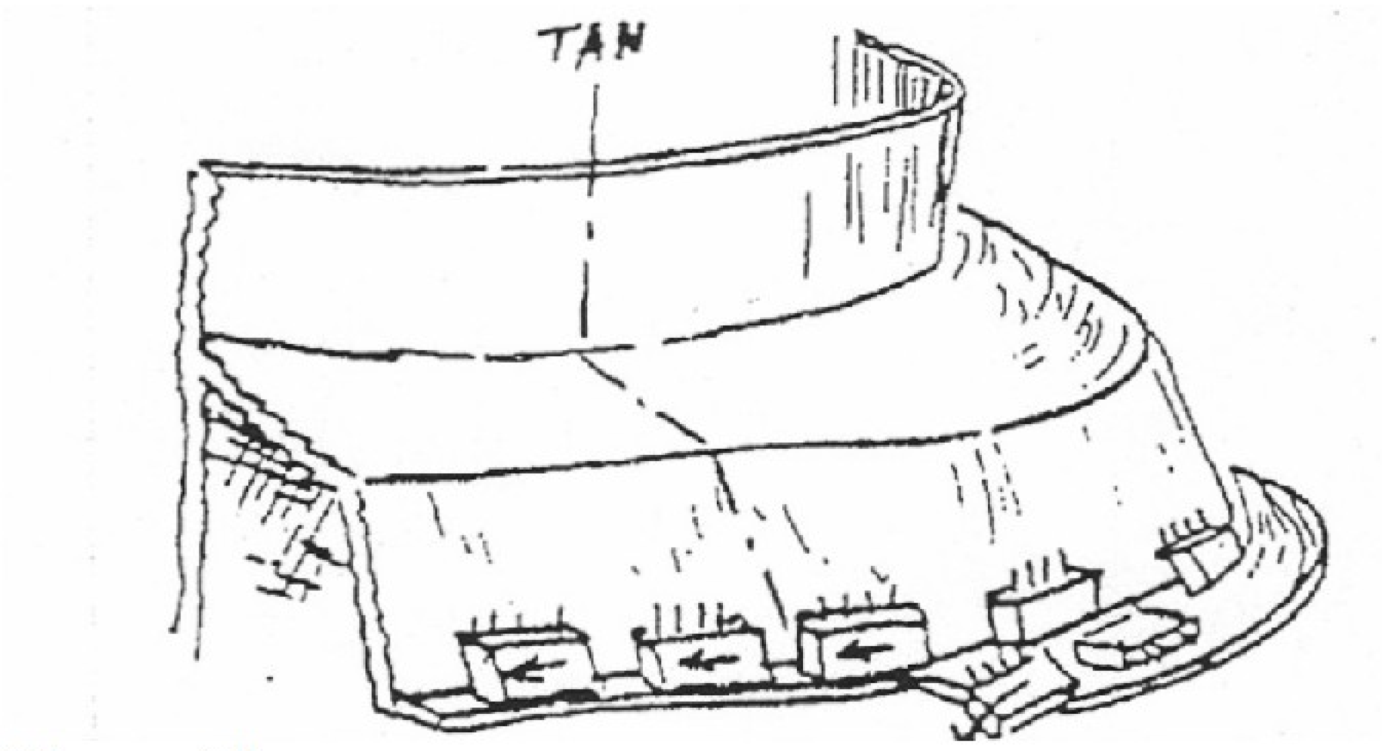


Figure 18

A long thin part on an inverted track may require a chord section to allow the rail to be narrow enough to select, and still support the part properly. (See Figure 18)

Inverted tracks are effective on parts having a large length to thickness ratio, (washers, etc.)

INVERTED TRACK SELECTORS

Sweeps across inverted track rails will cause closing dimensions. (Figure 19)

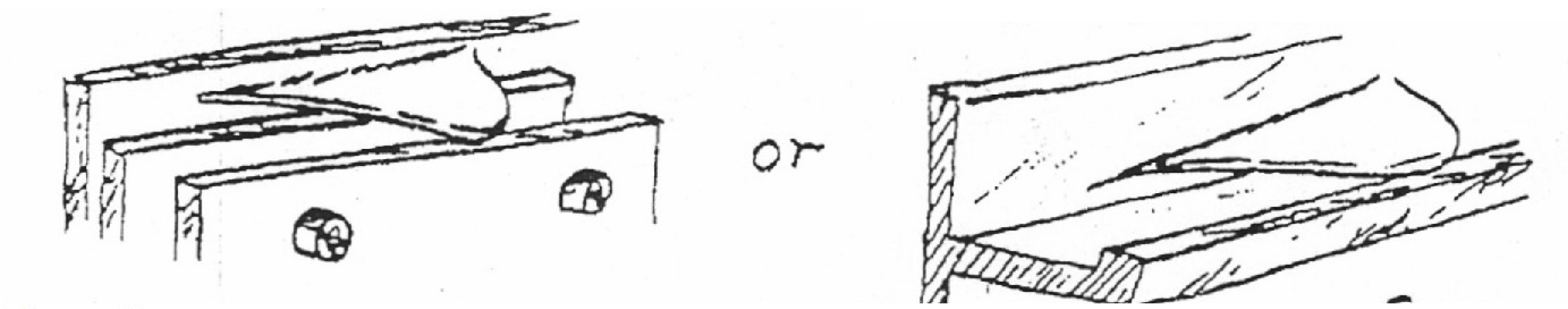


Figure 19

Sweeps and cams should be constructed opening to the rail.

PROFILE SELECTORS

Parts passing over a cut-out in the track which matches the profile of one position will allow this position to drop out, and parts In other position to pass over. Blades above the part are used when required by the profile. (Figure 20)

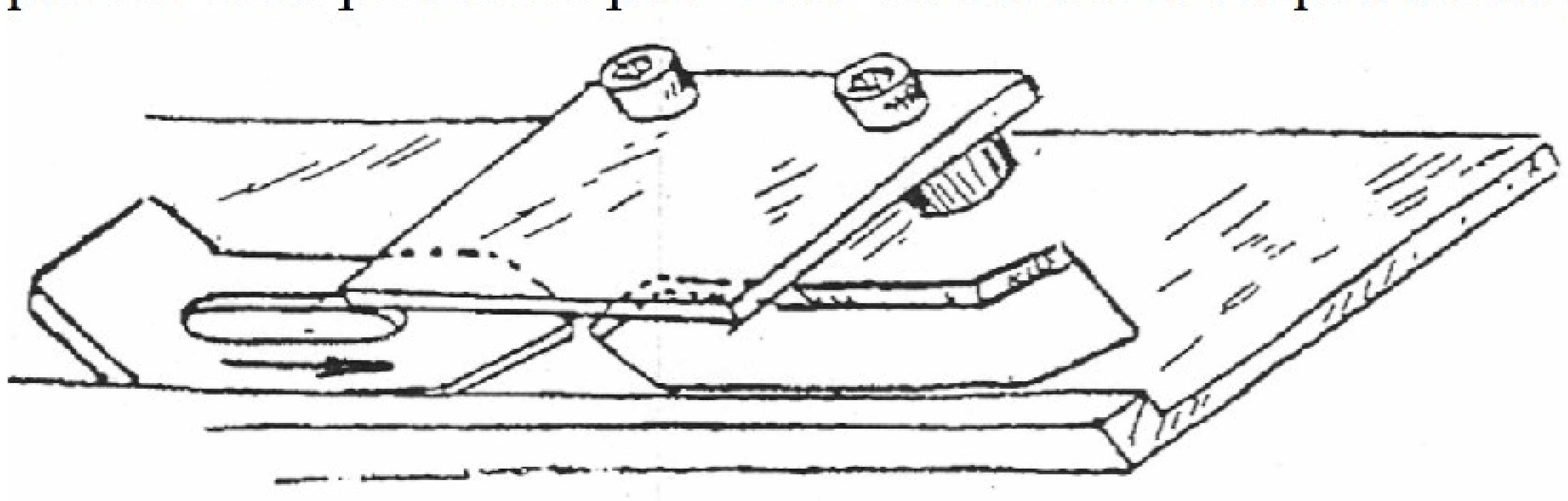


Figure 20

SELECT

PROFILE SELECTORS

Profile selection may be done on either the bottom (track), or side of inverted track sections and V troughs. (Figure 21)

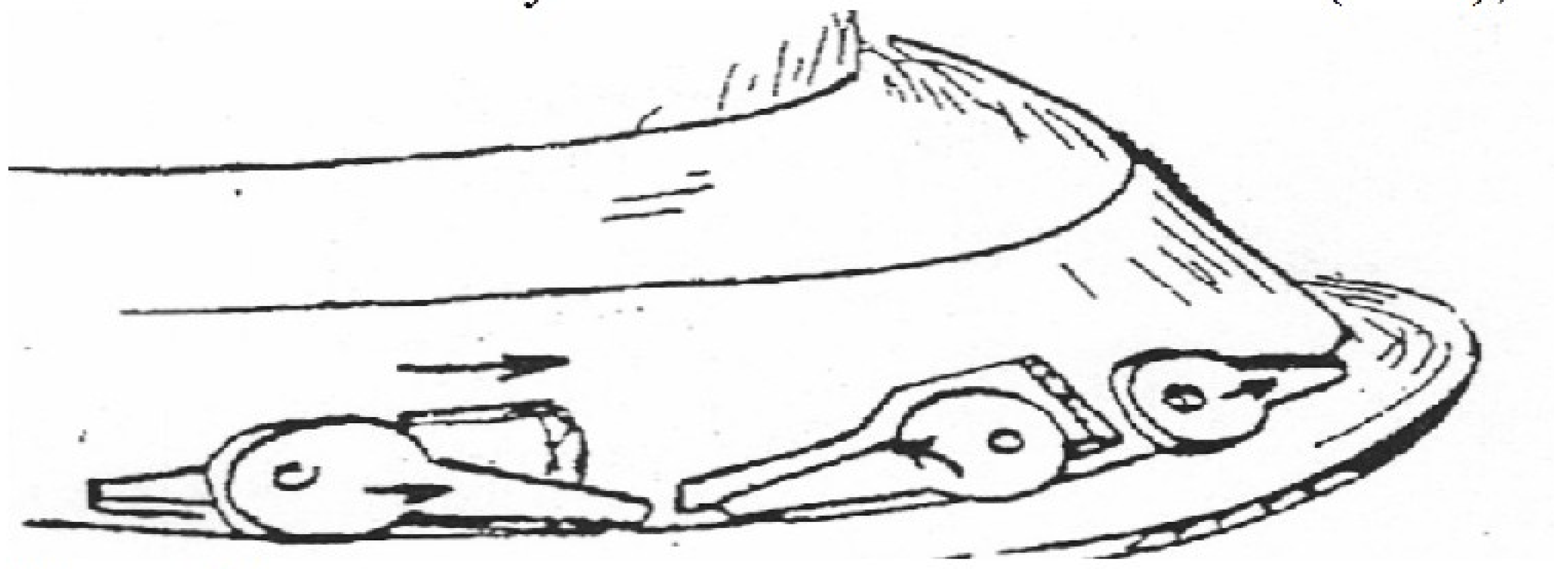


Figure 21

PILL SELECTORS

A part rides or a narrow track and is overbalanced. The part standing up is held from falling by a confinement placed at the proper height and distance from the corner of the track running surface and the wall. (Figure 22)

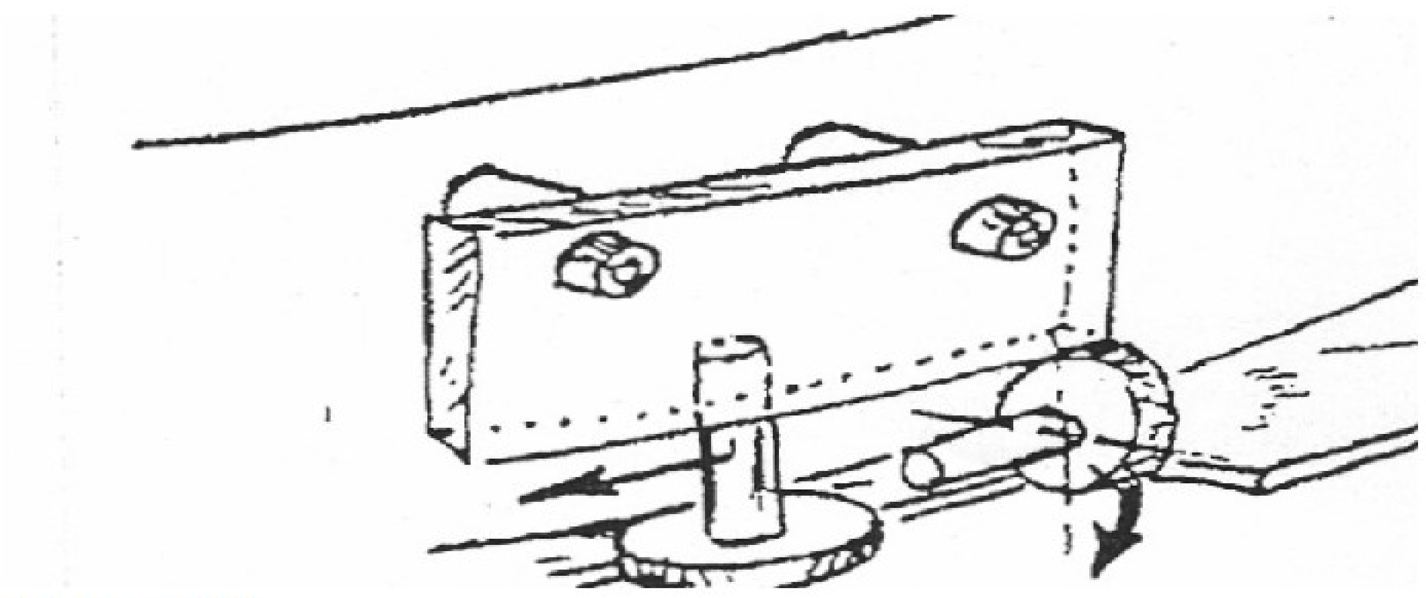


Figure 22

Operation # 3 TO BACK PRESSURE

BUBBLE

A symmetrical bubble is the most commonly used mechanism to eliminate the backpressure and stop excessive numbers of parts from standing on the track. These parts would otherwise introduce high pressure at the entrance to confinement and high wear to track surface. (Figure 23)

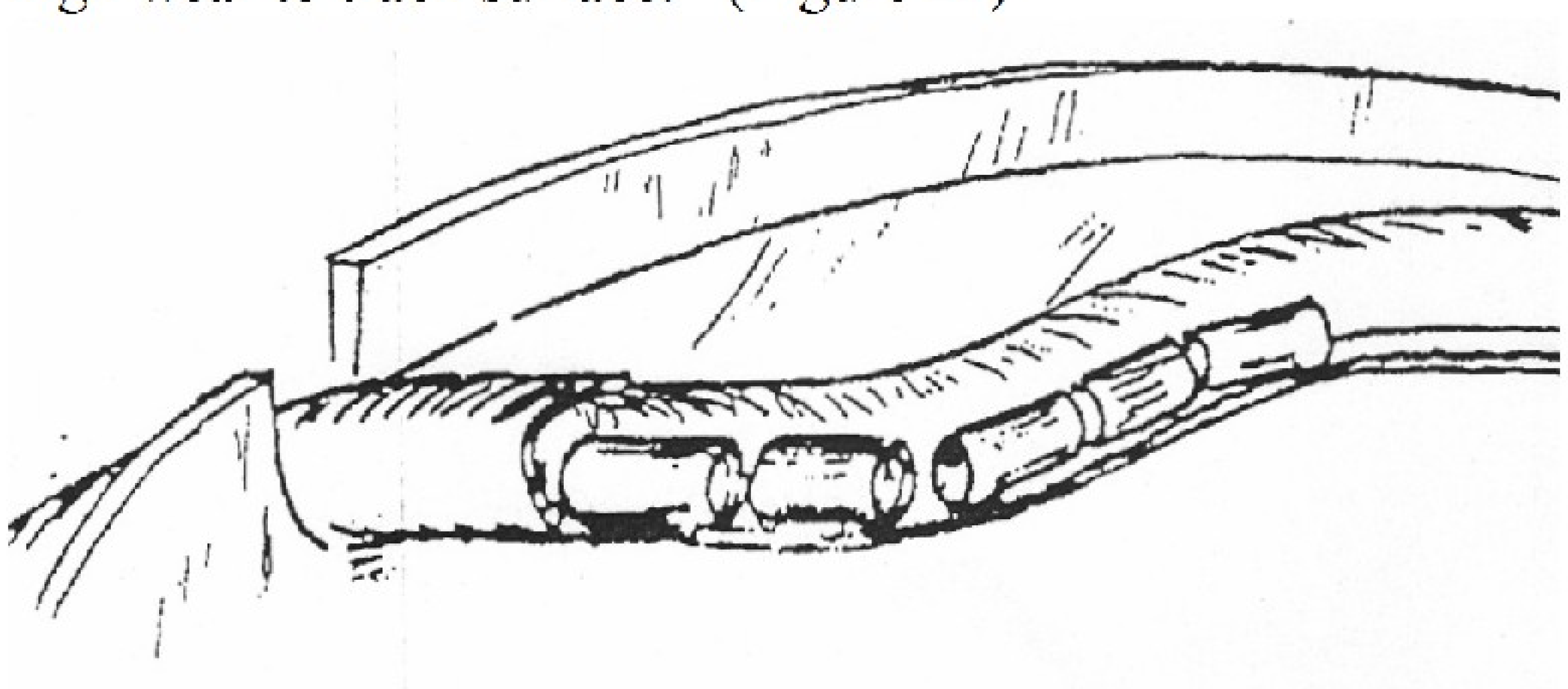


Figure 23

BUBBLE

A vertical drop-down bubble is one where the parts are dropped into a track. If the track is occupied by other parts, the excess spills over the sides, returning to the bowl. (Usually parallel rails). (Figure 24)

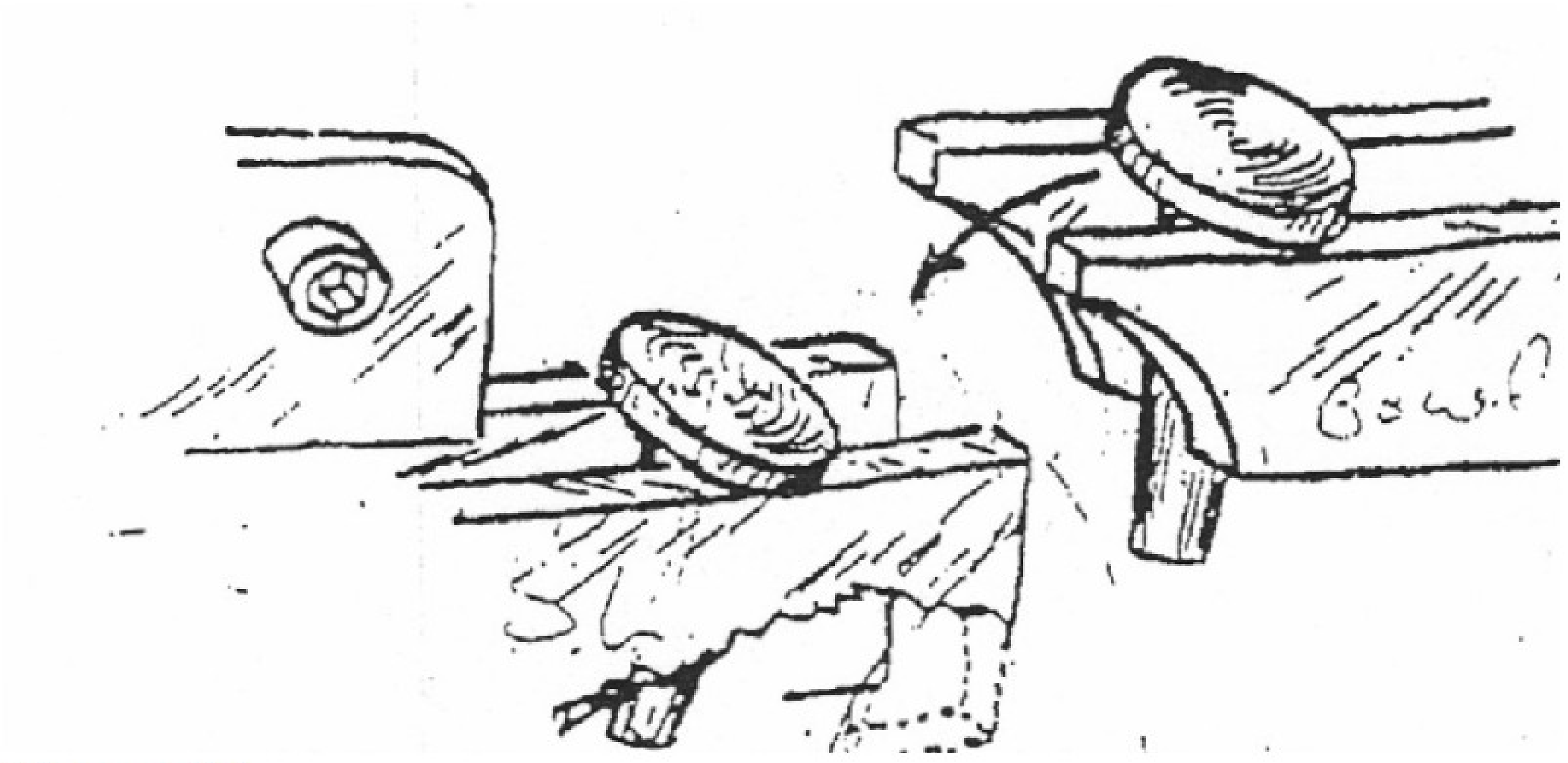


Figure 24

A drop thru bubble is used for verticaltube, or magazine. The less pressure necessary to operate a bubble the better. A bubble must <u>never</u> back up parts into a selector. A full track sensor (Shut-off or Blow-off) must be used with parts which cannot be backpressure. (Telescoping parts, etc.)

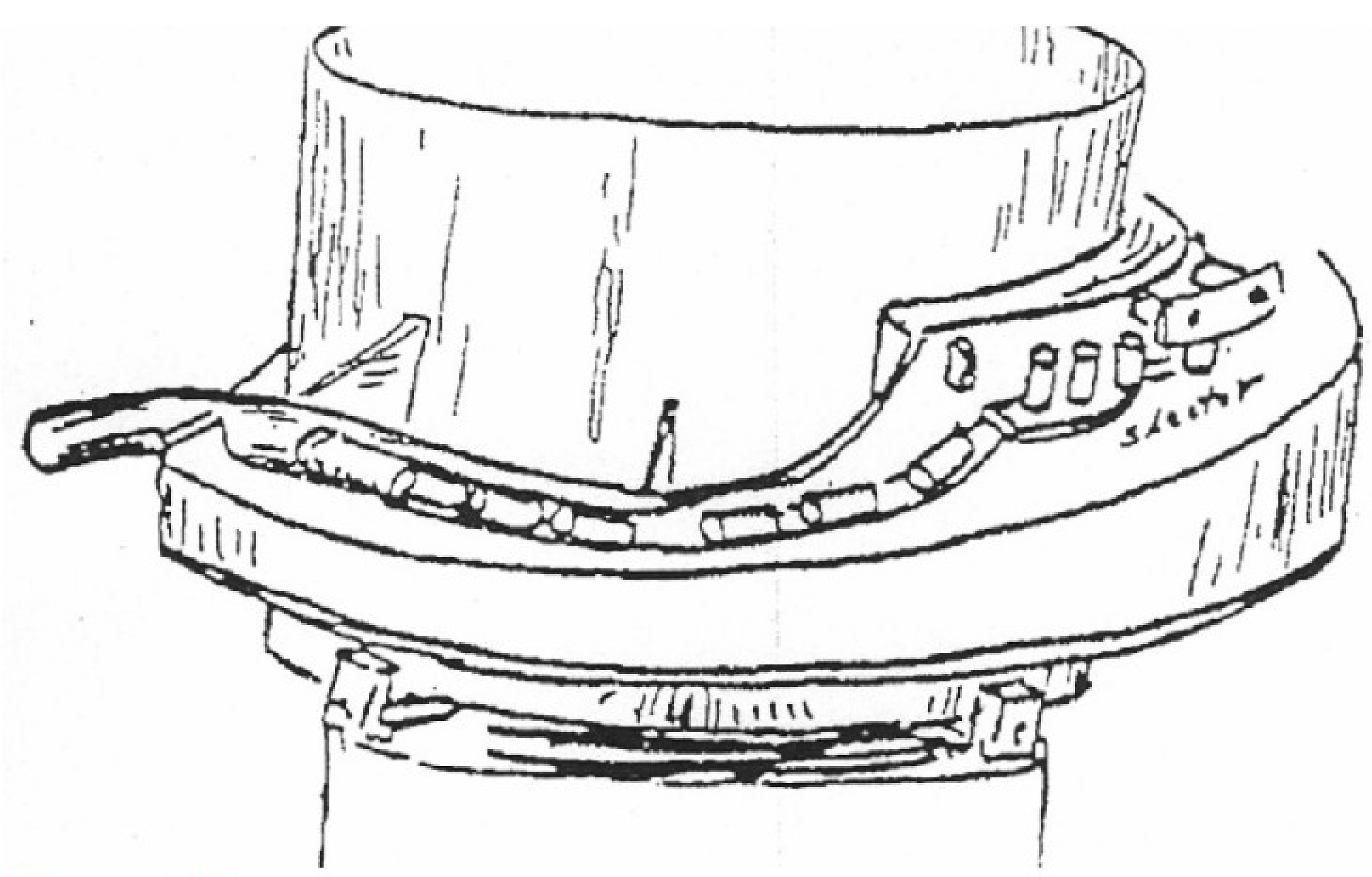


Figure 25

FULL TRACK SENSOR

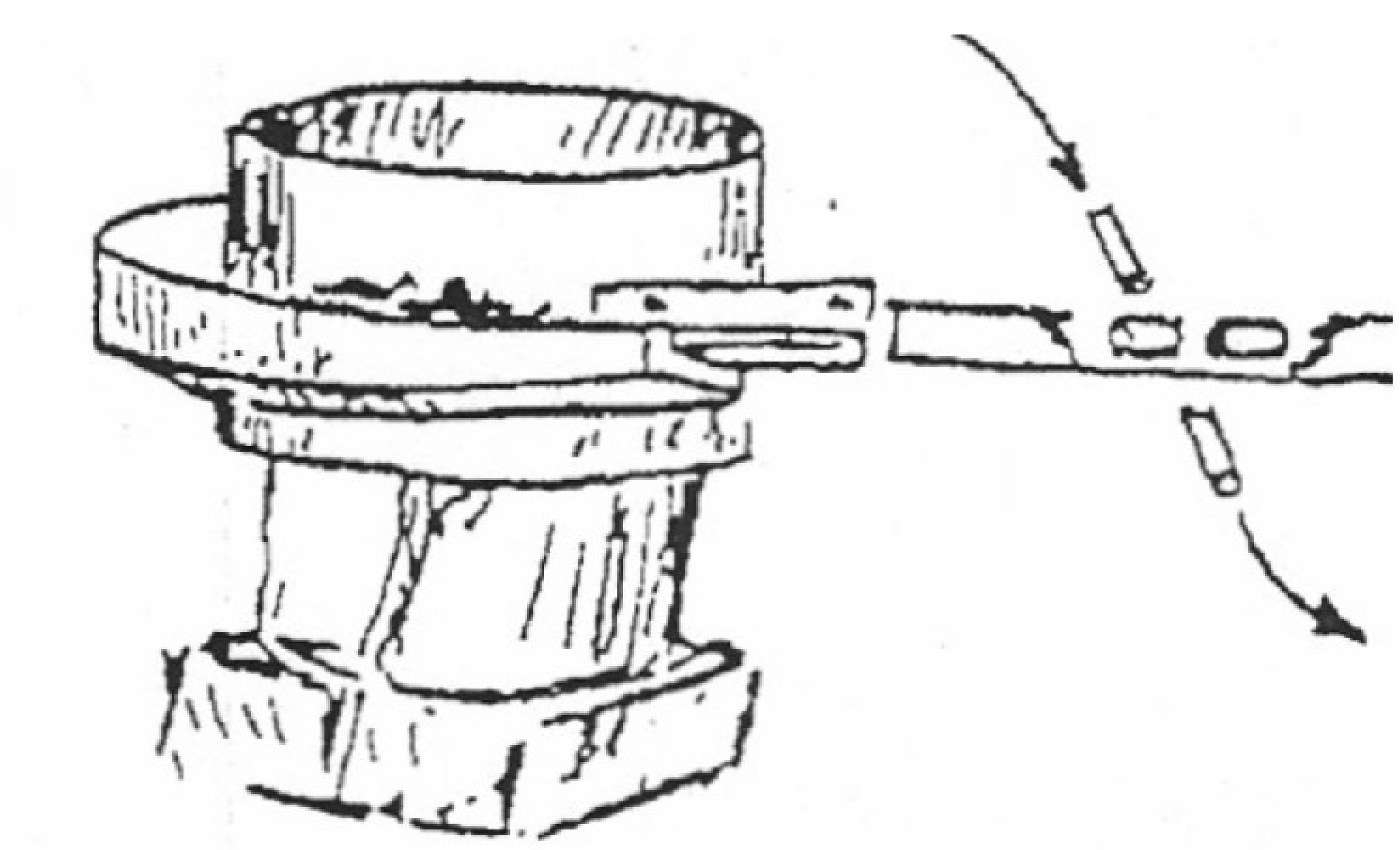


Figure 26

OPERATION #4, ENTRANCE TO CONFINEMENT

BUBBLE

NARROW TRACKS FOR OBLONG PARTS

Since backpressure can cause misalignment of already oriented and selected parts) a selector must be put between the crowns entrance to of the bubble and confinement. (Figure 27)

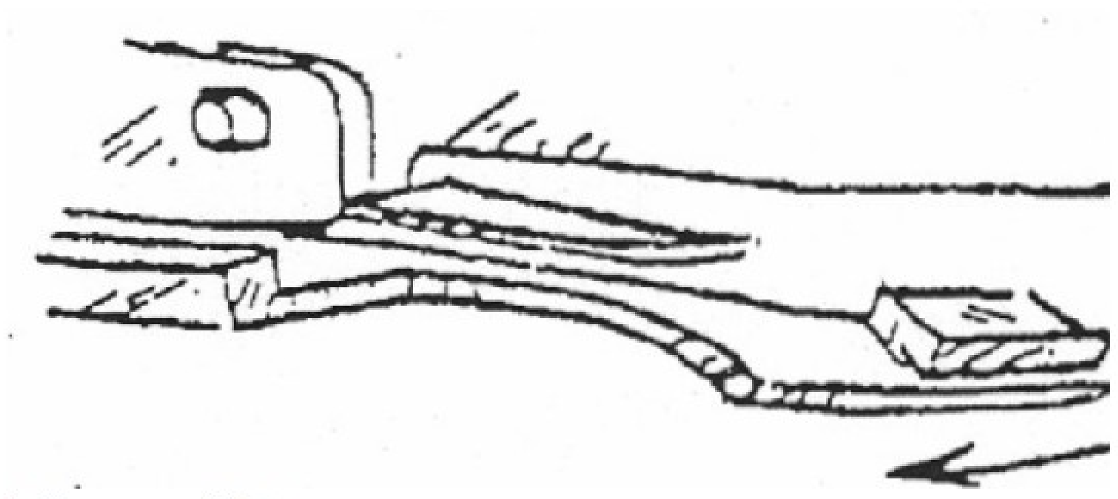


Figure 27

OPEN TUBE FOR ROUND PARTS

Figure 28

PILL BLADE FOR OBLONG PARTS STANDING ON END, ALSO PROFILE BACKUP.

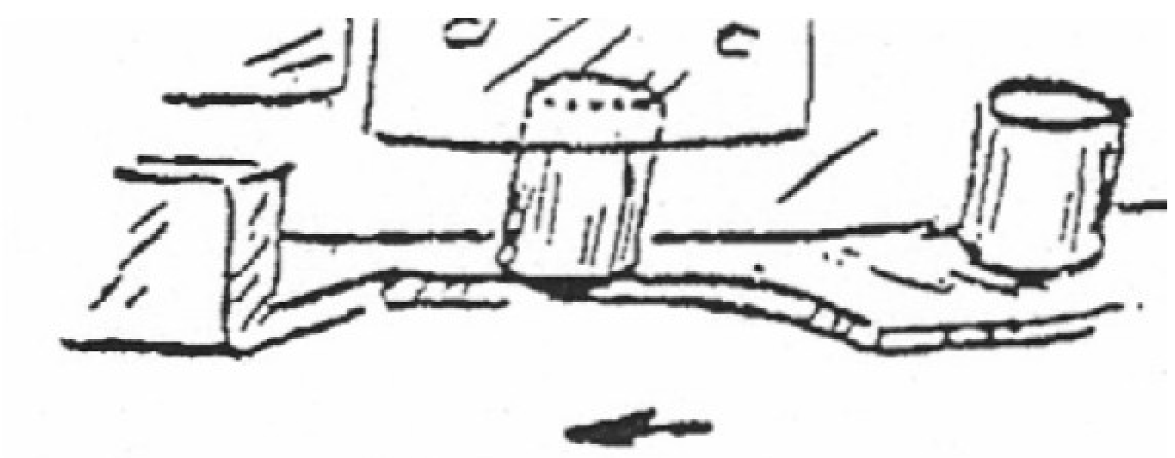


Figure 29

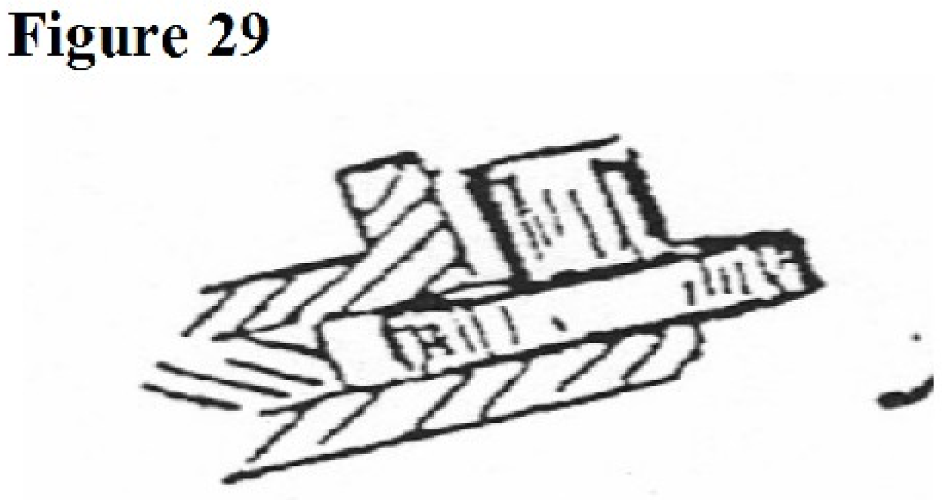


Figure 30

NOTCH FOR OBLONG PARTS LYING SIDEWAYS.

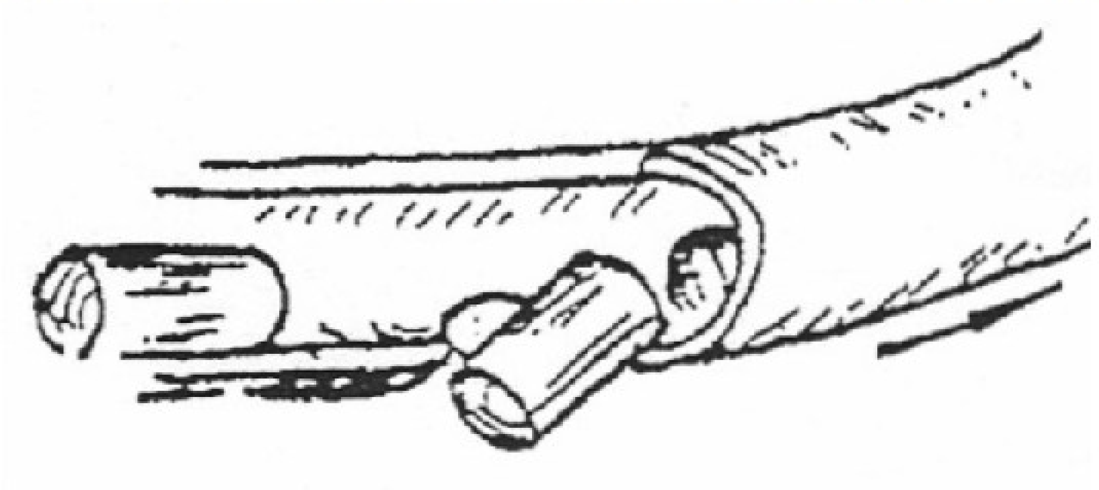


Figure 31

OPERATION #5, CONFINE

The parts are used to decide on proper confinement spacing and must be checked for burrs, flash, bent parts. mfg. process and part handling damage which may cause jams. Estimate manufacturer's ability to hold tolerances on contact points of confinement.

Confinement blades should be bolted on for adjustment and maintenance purposes. The output should be a hardened milled section. Tool steel is used for high wear areas.

Confinements should be as open as possible and yet retain parts in positive control.

AIR

Air is the final consideration for every mechanism in a feeder except confinement.

Air should never be used until all other methods of construction have been exhausted.

A single stream of air over a track will act like a sweep.

A single or double stream air can create a vacuum to help a rare bubble problem.

Air can be used to help keep a selector free flowing. (The use of gravity is better.)

Air can move parts into confinement for difficult problems.

Parts can be turned or oriented with air in some cases.

Air can be used to speed up a profile selector for a higher rate.

Some parts can be selected by a stream of air.

Consider moisture or oil builds up in using air.

DIRT CHUTES

Every feeder design requires consideration maximum removal of dust, chips, scrap parts and other extraneous material which could impair the performance of a feeder.

A parallel track or rails has maximum opening and makes an ideal dirt chute.

A bolt-on blade on a bowl wall cutout can be used to discharge dirt.

Dirt holes drilled at the approach in a bowl or in the wall at the corner of the track will help remove dirt.

TUNING

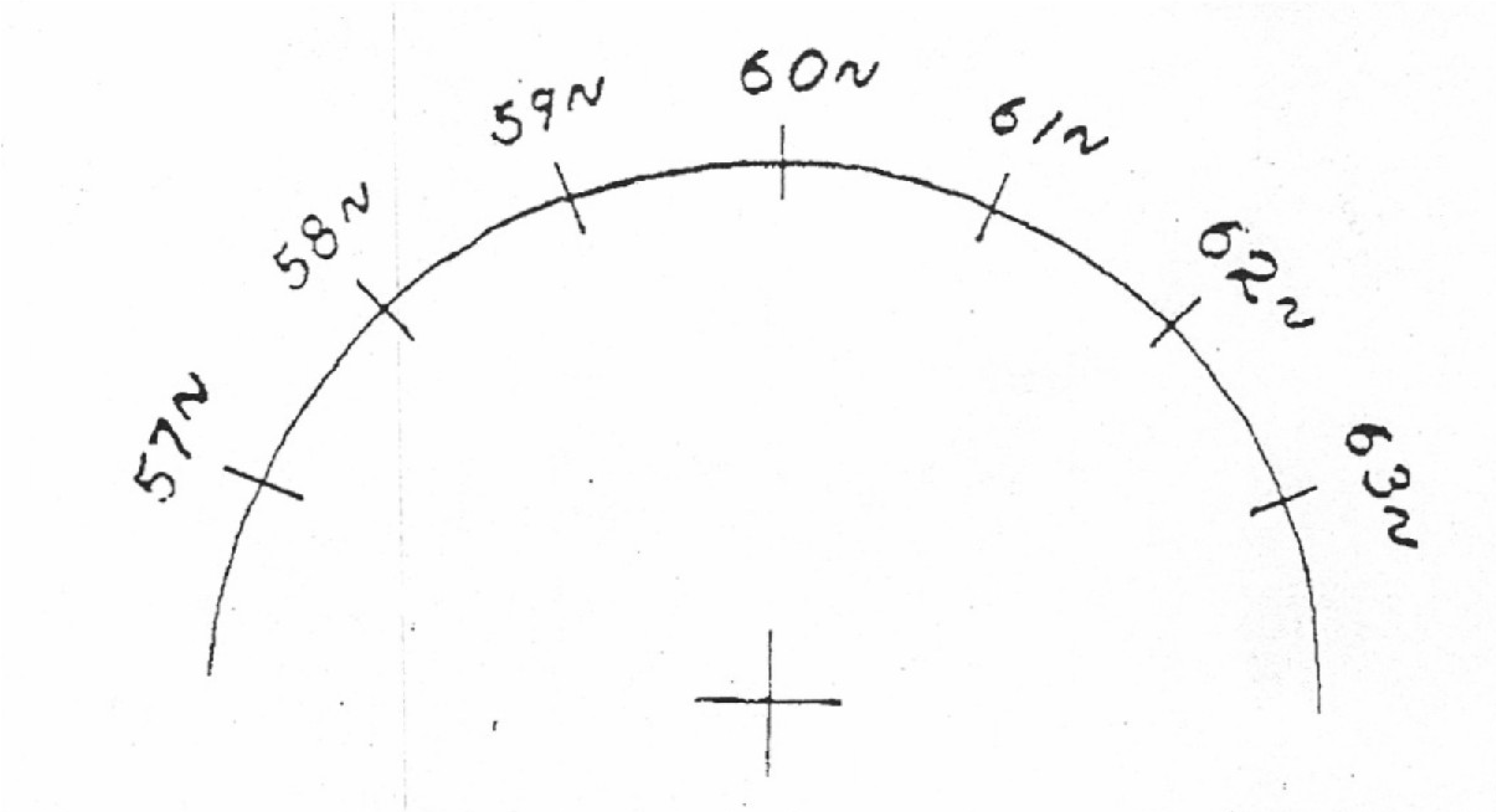


Figure 32

REMOVE SPRINGS　　　　ADD SPRINGS

ADD MASS　　　　REMOVE MASS

Tuning a bowl to proper frequency involves the proper proportions between the mass and the springing.

Adding mass reduces frequency.

Removing mass increases frequency.

Adding springs increases frequency.

Removing springs reduces frequency.

The motion of a feeder bowl is the result of a torque action. Since torque is the products of mass times distance, the amount of mass and, it radial distance are both important functions of frequency.

FREQUENCY CHECK

The natural frequency of the bowl should be as close as possible to the 6Ocy or 12Ocy running frequency of the power coil.

TONE CHECK

At the instant the power is shut off, the bowl will seek its natural frequency. This frequency can be detected as a higher or lower pitch tone than the normal 60c tone.

WEIGHT CHANGE

Removing the base unit covers will change the frequency. A large frequency change, when observed as a reduction in power, would indicate the bowl out of tune. Weight blocks are used to simulate cover weight when tuning.

TUNING

SPRING CHECK

Gradually loosening a spring mounting bolt will produce a simulated spring removal.

HAND CHECK

The bowl frequency can be changed by gripping the bowl with the hands, frequency or tone change to a trained Feeder Man will indicate an over-sprung or under-sprung condition. (Load Sensitive)

PROCEDURES FOR TUNING BASE DRIVES

The following procedure should be used to check the tuning of any 60 or 120 HZ base drive unit:

• **IMPORTANT!** Before tuning unit, make sure there are no cracked or broken springs that all bolts are torque, and the magnet pole faces are set at the proper gap.

With the variable speed controller on and the proper level of parts in the bowl, set the dial at 35% to 40% of the in-put voltage. Some parts movement should be detected at this point. If the feed rate is too slow, increase the controller setting slowly until the desired feed rate is attained. When 80% of the in-put voltage has been used without reaching the desired amplitude or there is excessive or sporadic vibration, check for interference points where something may be contacting the bowl or base drive unit, then follow these tuning techniques to achieve maximum efficiency:

• Loosen a bolt on any one of the spring clamp blocks (preferably a lower bolt), very gradually, until the unit either speeds up or slows down. If the unit speeds up, it is over sprung. If the unit is over sprung, the thinnest spring from two opposing hangers must be removed. When replacing the springs they must be torque as specified in "Base Unit Torque Requirements."

If after this change, there is an under sprung reading (if unit slows down when a bolt is loosened), thinner springs must be added back to the two opposing hangers. **IMPORTANT!** To maintain consistent, even feed motion, the number of springs in opposing spring packs must be equal.

The base unit should be slightly over tuned, but the degree of over tuning must be established. An over tuned condition is a good indication that all bolts are tight and all springs are in good condition.

• Springs tend to work-harden on a base drive unit that has been- in operation for a period of time, causing it to be over tuned. The same procedure as described in (1.) should be used to determine if this condition exists.

• If a unit indicates that it is still under sprung after a spring has been added, check for a spring that may be cracked or broken. This usually happens on the bottom portion of the spring, near the spring clamp hanger. In some cases, the crack cannot be seen because of paint or because it may not be all the way through to the point where it is easily visible it should be removed and inspected closely for hairline cracks.

• Make sure the bolts are long enough to fasten the springs to the spring hangers. For example, if a 5/16" thick spring has been added, there will be 5/16" less of the threads to hold the springs. When tightened, the threads may strip and the unit will give a false tuning reading. The same also applies to the bolts holding the armature or the bowl clamp nuts. The holes for these bolts are blind; therefore if the bolt bottoms out, it will seem to be tight when it actually is not. This situation will cause false readings in the tuning process.

• Another factor that affects tuning is the stretching of the bolts that fasten the springs. We use grade "8" Its, which are especially hardened for durability to prevent this from occurring.

TUNING INSTRUCTIONS AND TABLE REQUIREMENTS

WHAT IS TUNING?

Tuning a vibrating system means adjusting the mechanical vibration to be the same or be in tune with the electrical impulses.

HOW DO YOU DETERMINE IF A UNIT IS TUNED?

If a bowl is not tuned, it feeds slowly or not at all.

HOW DO YOU KNOW IF A BOWL IS TUNED HIGH OR LOW?

Tuned high means the mechanical frequency is higher than the electrical. If a spring clamp screw is loosened gradually and the feed speeds up, then the
bowl is tuned high. If it slows down or stops, it is tuned low.

HOW DO YOU ADJUST THE NATURAL OR MECHANICAL FREQUENCY?

A — By adjusting slip clamps on the 8”, 10”, 12”, 15” Moorfeed bowls; up for higher frequency; down for lower frequency.
B — By reducing the thickness or number of springs for lower tuning on 6”, 1 8”, 21 “,
C — By increasing the thickness or number of springs for higher.

THE AIR GAP IN THE COIL DOES NOT AFFECT TUNING.

However, for best efficiency, the gap should be .030-035.
Half .wave systems are sometimes used on large base units. This gap should be .055-.085.

TABLE REQUIREMENTS

Tables for vibratory units should be constructed of metal heavy enough to withstand the vibrations generated by the drive unit. Any table motion will change the tuning and orienting features on the system.

TUNING

- The tuning of a base drive unit is affected when a weld is either broken or cracked any place in the drive unit or:
- (a) Mounting flange of the bowl
- (b) Track or skirts
- (c) Bottom of the return pan.
- (d) Braces, pan wall, discharge area (as a general rule, these conditions will create a foreign noise and be easily detected)

• Another condition, that occasionally develops and is very difficult to detect, is bolts that hold the rubber feet onto the base drive backing out, causing solid contact between the drive unit and mounting surface. This can cause the tuning to be misread. The way to check for this condition is to remove the unit from the common base plate, and lift it up so that the feet are exposed and tighten the mounting screws.

• It is very important that the clamp nuts holding the bowl to the base drive are tight. When remounting or relocating a bowl on a base drive unit, use a 12" to 15" pipe on 9" to 15" units and one 36" to 48" long for 18" to 36" units. This gives the necessary leverage to tighten the bolts. (For the best results, use a torque wrench). Also, never pull a bowl out, even slightly, from the clamp nuts to line it up with an existing track. Instead, use the jack screws (for leveling and height adjustment) which are built into each LP drive unit as a standard feature. If the bowl is not level, parts may fall off or drift from the track prior to entering a selector causing track jams, mis-oriented parts and a loss of feed rate. A feeder must be level in order to maintain proper feed motion.

• Another problem can result by omitting the thin shim (spring spacer) between the springs when they are changed or added. These spacer shims are very important. If one is omitted, it will result in an adverse affect on tuning. If a shim is not available, one should be made and installed. Don't take the easy way out and try to get by without it. This will only cause more problems later.

• The feed rate will be affected if all bolts that attach the rubber feet to the mounting plate are not securely located. These bolts are to prevent the unit from rotating on the plate. When the drive unit is securely mounted to the plate, optimum feed motion will be transferred to the vibratory bowl.
Also, make sure that the holes are drilled on center and that the rubber feet are not stretched when tightened. This will prevent tuning problems.

• If the gravity or inline track is connected to the vibratory bowl, the feed motion will be adversely affected. The solution is to use an independent track to move the parts from the bowl discharge.

• If a feeder bowl has "dead spots", most often, the problem can be found by looking 180 degrees from the location of these "dead spots". As a general rifle, mass has been added without counter-balancing the bowl, the gap in the coil has been improperly set, there is a broken weld, broken spring, or a loose spring bolt. Any of these conditions may contribute to the problem.

TORQUE INFORMATION

WHAT IS TORQUE?

Torque, by definition, is the result of a force applied to an object through a lever arm, thus tending to rotate the object.
T = F x L
T— Torque
F — Applied Force
L — Lever length measured from the center of rotation to, and at 900 to, the direction of force.

Since both force and length can be expressed in many different units of measurements, so can torque. However, the most common units are: Inch pound (in-lb or lb-in), foot pound (ft-lb or Ib-ft), meter kilogram (mkg) and Newton meter (N.m).

When torque is applied to a threaded fastener, it produces a clamping force that holds the components together. Too much force and the fastener will break. Not enough, and the assembly will not stay together. By controlling the amount of torque, the clamping or holding force is controlled.

WHY IS TORQUE IMPORTANT?

SAFETY: Bolts or nuts which are not tightened enough may vibrate loose, while over tightened ones may break.

ECONOMY: Improperly tightened components may cause damage or accelerated wear. "Blown out" gaskets and broken head bolts are typical examples of such costly errors.

PERFORMANCE: Today's equipment is made of many precision parts which need to be assembled just right to achieve maximum efficiency and performance, improperly tightened head bolts may result in poor compression, over tightened bearings may bind, etc.

GENERAL CONVERSION TABLE FOR TORQUE UNITS

MULTIPLY NUMBER OF To OBTAIN	Inch Ounces	Inch Pounds	Foot Pounds	Centimeter Kilo-grams	Meter Kilo grams	Newton Meters
Inch Ounces	1	16	192	13,89	1389	141.6
Inch Pounds	.0625	1	12	.8680	86.80	8.851
Foot Pounds	.005208	.08333	1	.07233	7.233	.7376
Centimeter Kilograms	.07201	1.152	13.83	1	100	10.20
Meter Kilogram *	.0007201	.01152	.1383	.01	1	.1020
Newton-Meters	.007061	.1130	1.356	.09806	9.806	1

* Meter Kilogram (mkg) is also known as Meter Kilopond (mkp)

GENERAL TORQUE SPECIFICATION CHART FOR

ENGLISH FASTENERS (in Foot Pounds)*

These torque values are approximate and should not be accepted as accurate limits. Indeterminate factors (surface finish, type of plating and lubrication) in specific applications preclude the publication of accurate values for universal use. Manufacturers of various types of equipment usually provide specific tightening instructions which should be followed. **DO NOT USE** the below values for gasket joints or joints of soft materials. DO NOT USE your torque wrench for values greater than its maximum scale reading.

MATERIAL OR GRADE BOLT SIZE	SAE 2 (Mild Steel)	SAE 5	SAE 8	Socket Head Cap Screws	Brass	Stainless A151 Type 303
1/4-20	6	11	12	13	5	5
1/4-28	7	13	15	16	6	7
5/16-18	13	21	25	27	8	9
5/16-24	14	23	30	33	9	10
3/8-16	23	38	50	52	15	17
3/8-24	26	40	60	60	16	18
7/16-14	37	55	85	86	23	25.
7/16-20	41	60	95	95	25	28
1/2-13	57	85	125	130	32	37
1/2-20	64	95	140	145	34	40
9/16-12	80	125	175	180	44	50
9/16-18	91	140	195	210	48	54
5/8-11	111	175	245	255	68	75
5/8-18	128	210	270	290	73	80
GENERAL TORQUE SPECIFICATION CHART FOR						

TUNING

GENERAL TORQUE SPECIFICATION CHART FOR

METRIC FASTENERS (in Newton Meters)*

METRIC FASTENERS (in Newton Meters)*								
MATERIAL CLASS/BOLT DIAMETER		4.6	4.8	5.8	8.8	9.8	10.9	12.9
MM	INCH							
5	.197	3	4	5	7	8	11	12
6	.236	5	6	8	12.5	14	17	20
6.3	.248	5.5	8	9.5	14	16	21	24
8	.315	12	16	20	30	34	44	50
10	.394	23	32	40	60	70	85	100
12	.472	40	56	70	103	120	150	180
14	.551	65	90	110	167	190	240	280
16	.630	100	140	170	270	290	380	440
18	.709	137	177	225	350	—	480	580
20	.787	200	—	330	520		740	860

VIBRATORY BOWL FEEDERS – AFTER INSTALLATION

Since there are no moving parts in a feeder except the springs, what could happen to a feeder?

A problem could occur if the setup is incorrect. The feeder must be on a rigid support so that all the vibrations from the drive unit go to the bowl. A non-rigid support could create secondary vibrations that would affect the feeding. Once properly installed, most feeding systems will still be in running condition when the part that they have been feeding becomes obsolete.

Other problems that could occur that are easy to detect are a burned-out coil, a failed controller, or a broken spring. (A cracked spring is more difficult to detect.) Other faults that are not so obvious might require "re-tuning" the feeder.

What does "re-tuning" a feeder mean?

When a feeder is made it is "tuned" so that it's resonant frequency is close to the frequency of the input current. The moment of inertia of the bowl, the moment of inertia of the drive unit, and the stiffness of the springs determine the resonant frequency. Springs are added or removed to achieve the desired tuning. With 60-Hertz current, the electrons flow through the coils twice for every cycle, thus energizing the coils 120 times per second. (Larger feeders operating at 60 cycles per second use a rectifier to block the flow of electrons in one direction.) Tuning slightly under 120 cycles per second results in a smooth feed; tuning slightly over 120 cycles per second produces a feeder that is less subject to the weight of parts in the bowl.

Over a period of time, a feeder might become "out-of-tune"; that is, the resonant frequency could change. This usually results in a slower feed rate. This could be caused by springs becoming fatigued or becoming work-hardened, the screws holding the springs relaxing or working loose, or the spring clamps and spacers could have a build-up of particles or they could become permeated with oil. All of these effectively change the stiffness of the springs, and thus, the tuning. Re-tuning a feeder consists mostly of adding and/or changing springs and screws. When this is done, it is important that the screws are **TIGHT**. It is also important that the coil gaps be reset properly to avoid damage or burnout of the coils. The gap between the coil and the armature should be even and as close as possible without striking.

TROUBLE SHOOTING VIBRATORY PART FEEDER

1. No vibration (usually an electrical problem)

a. Power supply to control if off
b. Fuse in controller is blown
c. Power cord to feeder is damaged or unplugged
d. Gap between coil and armature is closed
e. Bowl or base is making contact with other equipment
f. Air gap between discharge and track. Possibly cut on angle

2. Vibration (but slow or irregular parts movement)

a. Input voltage to controller is fluctuating
b. Bowl is not down in four locating clamps
c. Feeder bowl is overloaded
d. Lubricant on parts or feeder bowl
e. Toe clamps holding bowl not tight
f. Excess dirt on bowl or parts (clean)
g. Mounting plate or table not sturdy
h. Leveling screws on legs not set firmly
i. Bowl is mounted on a machine which shakes and sets up on interference vibration

NOTE:

The above list, would apply to not only new equipment, but older units as well. Most problems are caused by improper use, or installation, or damage from handling between the factory end user.

ADJUSTABLE GATE: A formed plate riding in parallel vertical track that can be raised or lowered to control the flow of parts from a hopper.

ADJUSTABLE THIN DOWN SECTION: (See below) A section of track that slides in and out to adjust the width of the track in a given area. An adjustable thin down section can be inside or outside of the tooling on the bowl. A short section of interior track that slides in and out. The length depends on the size of the bowl. This can also be external type, usually placed on the bowl just after exit to the outside of the bowl. It is a piece of metal formed to fit 90 degrees to the track, bolted on and adjusted horizontally to limit parts to a single layer on the track.

ADJUSTABLE NARROW DOWN TRACK SECTION: (See above) A short section of track that can be set at various widths. The length depends on the size of the part. This may be either a stainless or tool steel insert that can be adjusted to either orient or limit parts to a single file.

AIR ASSIST: (Air Jet) The use of air to accelerate parts to assure feed rate, Help orient parts or to eject parts that are not oriented properly.

AIR DRIVE: A drive unit that is powered by air using either a reciprocating piston or eccentric rotary device to provide vibration, usually used in explosive environments.

AIR TURBINE: Turbine Vibrators the turbine uses less air than the Ball Vibrator for the purpose of driving a Bowl & Base Unit, Hopper or Inline. Used in explosion proof application.

AIR JET: (Air Assist) A small diameter tube mounted in place which is sometimes used to assist part movement, it is adjusted in the process of development to assist in orientation or final selection with the minimum amount of air pressure. A section of small diameter tubing that could be welded or screwed in fitting to a small block with an air fitting. An air jet is normally welded or bolted to the bowl to assist parts in moving, separating, selecting or orienting parts. A block with small diameter tubing welded in place which is sometimes used to assist in moving or orienting parts. It is adjusted by trial and error using air pressure.

AMPLITUDE CONTROL: A controller uses a transducer mounted on a vibratory bowl or track to feed back the stoke amplitude so a constant amplitude can be maintained. Compensates for voltage and load changed and spring drift.

ANGULAR SKIRT: (See Angle Skirt) A conic section, calculated to fit at the required angle. Attached between the bottom side of the track and the bowl wall to prevent parts from stacking and causing jams between the tracks. A conic section attached inside the bowl to the outer edge of the bottom side of the track and angled to attaché to the bowl wall a short distance above the track below. It is used for the purpose of preventing parts from stacking or wedging and causing jams between the inside tracks. An annular angled waft welded in place between the bowl and under a turn of track used to prevent parts from jamming in between the tracks.

ANGLE SKIRT: (See Angular Skirt) A conic section calculated to fit at the required angle and attached to the bottom side of the track and to the bowl wall. It is used for the purpose of preventing parts from stacking and causing jams between the tracks.

APPROACH: The area inside the feeder bowl where the parts start to climb up the spiral track.

BACK PRESSURE RELIEF DEVICE: A sensor that controls back pressure by cycling the bowl feeder on and off or by controlling a solenoid that blows parts off the track off the bowl just prior to the discharge. The sensor is mounted in the gravity or inline track or conveyor close to the bowl discharge to detect a back up of parts.

BACK PRESSURE RELIEF POINT (BUBBLE): A section of track just prior to entering the discharge, where the track runs around a curve. Part readily feed through this section unless the discharge becomes filled causing the parts to buckle and fall off the track relieving back pressure. The method used for controlling backpressure, inside the bowl parts drop off the tooling just prior to the discharge confinement (also known as parts bubble), Photocell or Proximity controlled; the bowl is turned on and off, based on a sensed part level in auxiliary track.

BACK PRESSURE: The cumulated force of the parts pushing one against the other as they feed in the bowl. Back pressure can cause jams and can carry miss-oriented parts through a selection device. The force the parts exert as they discharge from the feeder bowl. An area of the bowl tooling just prior to the entrance to confinement where the parts will buckle if the discharge is full and recirculate in the bowl. This relieves part pressure which would otherwise cause jamming conditions or mis-oriented parts to
bridge across the bowl tooling. An area of the system just before the parts enter the discharge that causes the parts to fall off the track if the discharge fills with parts. This relieves parts pressure. Eliminating problems that could be caused in the selector area.

BAFFLE: A stainless steel deflector welded to the bowl bottom to guard the return hole thus allowing parts to flow evenly back from the return pan.

BASE DRIVE UNIT: Also called a drive unit. A welded, bolted or cast steel base with steel or fiber glass leaf springs, or rubber bands and blocks, and electromagnetic coil or coils, and cross arm, spider, plat, bar or disk for mounting the bowl or inline track. Base drives can air driven when required. The force used to power the LP Drive Unit is accomplished by using one or more electromagnetic coils which act upon pole face plates to generate vibratory motion. The upper and lower members of the drive unit are constrained by leaf springs causing torsion vibration which is transferred to the top member in the form of feed motion. When the drive unit moves the parts at maximum efficiency with minimum current effort, the unit is said to be tuned to a natural frequency of the power source. The mass and diameter of the feeder bowl is the determining factor in tuning the unit as this mass or diameter is increased, more leaf springs must be added. The rubber feet of the base drive play an important part in allowing the lower member of the drive unit to act as a pendulum to power the bowl and must be of the proper durometer.

BASE PLATE OR MOUNTING PLATE: A thick steel or aluminum plat used for mounting vibratory equipment.

BASIC BOWL: An un-tooled bowl consists of a vertical band and a domed bottom with either an external helical track or an internal helical track. The internal track can also be inverted. Consists of a vertical band of a specific height and diameter, a domed bottom, and an internal helical track of a specific width prior to any tooling. Basic bowls are usually designed and built for a specific part or family of parts. The band, bottom and track assembly prior to any tooling for a specific part. Basic bowls are not off-the-shelf standard items. They are individually designed and can be supplied for many profiles of parts.

BREAKOUT: The area of the feeder where the internal track of the basic bowl stops and the external tooling begins also called a pull out, come out & exit.

BRUSHLON: A “W” Product of vectored bristles that is bonded to the un-tooled tracks and side walls of the bowl. It is available in various thicknesses and Bristol diameter. It helps reduce part damage and noise as well as to increase feed rate in some.

CASCADE BOWL: Recommended only for basic parts orientation, i.e., dowel pins, washers, and parts at random. Cascade Bowls consist of a waterfall style internal track, no hidden areas, with a domed bottom, no return pan, and internal tooling, counter weight may be required.

CENTRIFUGAL FEEDERS: Centrifugal Feeders are used in high-speed applications or in applications that prohibit vibration. A cone shaped disc is rotated inside a bowl. Parts placed inside are moved in a circular direction and centrifugal force moves the parts toward the perimeter of the disc. A variable speed DC motor and controller allow for adjustment of the part feed rate. Feed rates are adjustable from just a few to over 1,000 parts per minute, depending on the part. The Centrifugal bowls is constructed of stainless steel and are supported by a frame and base. Centrifugal feeders are used in a variety of industries such as manufacturing, packaging, assembling, bottle capping, pharmaceutical and medical.

CHORD SECTION: A short straight section of track inserted in the outside of the tooling on the bowl and used to select or orient parts.

CLAMP NUTS: (See Toe Clamps) A machined block at the end of each cross arm of the upper weldment for the purpose of attaching the bowl to the unit. Failure to do so will result in failure or malfunction of the feeder system.

COATING OR LINING: Polyurethane, nylon, Teflon, brushlon, or other materials applied to the bowl surface to reduce wear, reduce noise, or to aid in feeding of the parts. This process may be sprayed on or if in sheets cutout and glued.

COIL CHATTER: A warning sound which indicates that the coil gap is set too close, causing the pole faces to strike. This condition will result in damage to the drive unit if not corrected. A metallic hammering sound that indicates the coil/armature gap is too close and should be reset.

COIL: An electromagnetic coil used to impart energy into a vibratory system.

COIL GAP: The parallel distance between the coil and the pole face measured at rest.

CONFINEMENT: Bolted on tooling used to control parts through a selector, a converter or a Discharge chute. Confinement are sometime harden tool steel. A containing section used to control parts through the discharge chute Confinements are designed in a manner to allow access to the parts by removal of "bolt-on" sections in most cases. The fabrication installed to assure 100% control of the part after a selector ejects improperly positioned parts, and should be always bolted on; not welded.

CONVERTOR (CONVERSION TOOLING): Tooling that turns around or turns over a part to the proper orientation to achieve a higher feed rate or to minimize recirculation of the parts. A properly designed converter repositions or turns around or turns over a part which is not in the proper position. This means a higher feed rate can be achieved. Possibly two or three parts can be converted to the desired position. This also minimizes recirculation of the parts and thus extends the life of the bowl especially on metal or heavy abrasive parts.

CONVEYOR: A powered belt device to move parts, available tooled or un-tooled, fixed or variable speed.

CORD SECTION: A straight section of either stainless or tool steel used to select or orient parts. A short straight section of two parallel pieces of metal sometimes used to select or orient parts.

COUNTER-BALANCE WEIGHT: A piece or pieces of metal attached to the outside wall of the bowl to offset the weight of the external tooling and balance the bowl. The amount of weight and location of the weight is determined by spinning the bowl on a free wheeling shaft and adding weight until the spinning bowl stops in a random pattern indicating that there is no section of the bowl heavier than the rest. A solid steel block of predetermined size and weight that is added to the exterior of the bowl. The location is determined on a counter-balance wheel, in order to offset the weight of the external tooling, etc. (static balance). A piece of metal of predetermined size and weight that is added to the exterior of the bowl. The location is determined on a counter-balance wheel in order to off set the weight of the external tooling, etc.

COUNTER WEIGHT (INLINE): A weight that is mounted at the rear of an inline drive unit to move the center of gravity of the inline drive. The weight balances the drive to give optimum parts movement throughout the entire length of an inline track.

CROSS ARMS: (Also called X-arm, Spider arm) A welded or machined structure consisting of bars that cross in the center that are attached to the drive base via the springs and to the bowl via the toe clamps or tab-mounts. The 4, 6, or 8 arm spider like support structure that holds the bowl in place.

DEAD NEST: A station normally at the end of an output for parts to be located to be picked up by a person, robot or a pick and place device.

DEFLECTOR: A cam blade welded on the inside of the bowl bottom to divert the flow of parts inside the bowl from the return hole thus allowing parts to flow from the return pan. Through the return hole and back up the track. A short strip of metal placed on the inside of the bowl bottom to guard the return hole and to allow parts to flow evenly back up the track from the return part.

DIRT CHUTE: Small holes or a slot is made in the track to remove dirt or foreign material from the bowl. A dirt chute is used to cam the debris out of the bowl. The opening(s) in the track cannot he larger than the smallest dimension of the part being fed. A dirt chute is used to discharge small particles of foreign material from the bowl. The opening cannot be larger than the smallest dimension of the piece part.

DISCHARGE CHUTE: The last tooling section of the bowl that is usually mounted tangent to the center line of the bowl. The discharge chute confines the parts in the attitude and orientation achieved in the bowl. The area of the bowl tooling where the parts exit the bowl in an oriented attitude. (Horizontal or Down Angle) A short section of track that is mounted to the bowl. The discharge chute controls parts in the orientation, achieved in the bowl and in most cases, conveys them to either a horizontal vibratory straight line or gravity track. This is the last section of the bowl. In most cases, it is a straight exit that confines the parts after they are oriented. The section of the bowl that is mounted tangent to the centerline of the bowl. The discharge chute controls parts in the attitude and orientation achieved in the bowl.

DOWN ANGLE DISCHARGE CHUTE: The discharge is angled down to assist movement of parts into a gravity track section. Used to assist movement of parts feeding into a gravity track section.

DRAG-THRU HOPPER: A hopper attached directly to an elevator belt conveyor where a belt with cleats drags through the parts to convey them tip the conveyor to a useable position.

DRIVE UNIT: (Base Drive) The powered base of a feeder bowl, it can be electrical or pneumatic.

DUAL BOTTOM: Also known as false bottom is an extra bowl bottom inserted about ½ an inch above the normal bottom the two most common reasons for this are to raise the return pan higher on the basic bowl, and to allow for filling with a sound damping material.

DUAL LINE BLOW OFF: Each line of feed would be equipped with a high level photo cell sensor to operate the feeder intermittently to control back pressure.

DUAL LINE DISCHARGE: Two lines of parts being fed out of the feeder.

ELECTRICAL ENCLOSURES: See NEMA Enclosures attached.

ELECTRO-POLISH: An extra fine surface finish available through a post construction ground and polish procedure.

ELEVATOR: A belt conveyor with cleats or a bucket conveyor that is used to convey parts from a hopper to a high bowl.

ESCAPEMENT: A mechanical device placed at the end of the feeder discharge, horizontal straight line, or gravity track to isolate the end part. A mechanical device that releases one or more parts on receipt of a signal. A mechanical device usually placed at the end of the feeder discharge. It allows only one part at a time to move into another place such as a dead nest to be picked up by a placing device.

EXTERNAL TOOLING: Tooling built outside of the vertical band that starts where the parts feed over the bowl wall and ends at the discharge. Because external tooling starts at the top of the band, Gravity can be used to assist in separating parts moving into selectors, cams and other tooling to orient and merge parts. Any construction outside of the vertical band which separates, orients, selects, confines, or relieves pressure buildup on oriented parts.

FAN SECTION: Tooling that allows parts to swing and/or hang. A fan section located where headed parts feed over the top of the band allows multiple rows of headed parts to hang. An area with an adjustable gap which allows parts to swing and/or hang.

FDA AUTOCLAVE: The same as ground and polish with extra care taken to assure that no seams or welds can trap contaminates. This specification is *usually* used on 316 type stainless steel.

FEEDER BOWL: A spun cast or welded vessel mounted on a vibratory drive used to contain and feed and orient parts. Early vibratory parts feeders where conical or bowl shaped thus the name bowl. The feeder bowl is the actual orienting and feeding device that orients the part to your machine requirements and is the heart of the system. The feeder bowl is always custom tooled to a specific part configuration. Feeder bowls are almost always round and constructed of stainless steel for long life.

FEED RATE: The required number of parts usually specified in parts per minute (ppm), available from a feeding system. Care should be taken not to over state the requirement.

FEET (OR MOUNTING PADS): Rubber isolation pads that absorb excess vibration that would otherwise be carried into the table or floor.

FLANGE MOUNT: This is a continuation of the band below the bowl bottom to hold ft to the cross arms of the base drive unit. Clamp nuts are used to attach small diameter bowls to the top member. On large diameter bowls, clamp nuts, along with a center bolt, are provided.

FILLED BASIC: A bowl in which the cavities inside of the dual bottom and angle skirt (if used) are filled with sound deadening material.

FINAL SELECTOR: A tooled section designed specifically to segregate only those parts that are in the correct attitude.

FINISH: The appearance of a feeder bowl, i.e. Glass Bead or Polished.

FULL TRACK SENSOR: A means of providing a pressure relief when the parts will not efficiently bubble-off of their own accord. This device can be a proximity, fiber optic, or pneumatic type sensor to signal the feeder to start or stop. Also a sensor can activate an air jet to eject excess parts from the entrance to confinement, in which case the 'bowl would continue to run (the latter is most generally used with multiple track bowls).

FULL WAVE: (120 cycle, non-rectified)Describes a type of vibration control using both positive and negative portions of the electrical sine wave.

FOOT PADS: Plates on the bottom of the stand or table used to adjust height and attach the stand or table in position. Could also be swivel pads or isolation pads.

FREQUENCY CONTROL: A control where the electrical frequency can be changed or regulated.

GLASSBEAD: The matte finish achieved by blasting the bowl surface with a very fine glass bead compound.

GRAVITY TRACKS: Gravity tracks and vertical magazines are methods of conveying parts. This type track must be set on an angle great enough that gravity will convey the parts from the discharge chute of the feed system. A magazine is a track in which oriented parts are stacked. This device is usually preloaded; the feeder maintains a full stack. A machined or fabricated track inclined at a sufficient angle to allow gravity to move parts.

GRIZZLY BARS: A series of slots place in the hopper tray to divert debris from being introduce into the feeder.

GROUND AND POLISH: The same as polish but with a greater attention given to all weld fillets, the welds are to be free of voids and pits.

HALF WAVE: (60 cycles, rectified) Describes a type of vibration control using only one side of the zero axis portions of the electrical sine wave.

HOPPER (OR STORAGE HOPPER): A container used to hold a large quantity of parts in active storage and to trickle those parts into the bowl feeder as required maintaining optimum performance of the parts feeder. A paddle switch or other sensor is mounted to sense the level of parts and is wired to turn on the hopper only when the bowl feeder is running.

HORIZONTAL CAM: An irregularly shaped piece of metal usually placed inside the bowl at different points above the parts to control the parts level on the track. A sweep or cam usually placed inside the bowl, at a fixed or adjustable height above the track, opening slightly in the direction of flow to control the parts level on the track.

INLINE FEEDER: A linear driving device used to convey parts from a feeder bowl, available tooled and un-tooled. A vibratory drive unit designed to produce straight-line motion.

ISOLATION SPRINGS: The lower spring packs that act to absorb vibratory motion and transmit it to the body of the straight line drive unit.

LEGS: The vertical supports under a base plate or mounting plate.

LININGS: Bonded layers of material put onto a bowl or track after tooling, i.e. Brushlon.

LIVE BELT HOPPER: Much like the standard hopper with the exception being that there is no vibratory tray it is replaced with a conveyor with variable speed.

LOST DRIVE: Vibration that is not available to drive the feeding system, usually caused by improper mounting or under sized support structure.

LUG MOUNT: To bolt a bowl directly to the cross-arms without toe clamps, usually used when bowls need to be removed from the drive unit frequently for cleaning or interchangeability.

MOUNTING RING: The area the Bowl feeder that mounts to the Base Drive, on larger bowls it uses an extra support band sometime horizontal taking the place of Toe Clamps.

NATURAL ORIENTATION: The attitude that a part will predictably assume repeatedly without intervention.

NEOPRENE LINING: A layer of neoprene is bonded to the un-tooled tracks and side walls of a bowl; helps reduce noise and part abuse.

ORIENT: To positions parts in a usable attitude.

ORIENTATION: The correct position of the piece part at the discharge chute as required by the assembly or placing operation. The final attitude of the parts as they discharge from a feeding system. Parts positioned in a usable attitude. Positioning of part in the attitude you desire for your operation.

OVERHANG: Tooling that extends beyond an edge. Usually refers to that portion of an inline track that extends beyond the front or back end of the inline drive mounting bar or extends beyond the edge of the mounting plate or table. Sometimes used to refer to bowl tooling that extends beyond the mounting plat or table. Overhang refers to the amount of straight track tooling that extends beyond either end of the inline drive mounting bar.

OVERTUNED: Bowl, Inline or Hopper will need spring removed. Proper tuning is important not only to develop maximum spring energy level, but to keep the coil assembly cool.

PARALLEL BLADE SECTION: An area with a stationary or adjustable gap which orients parts (bolts, screws, etc.) to a hanging attitude.

PADDLE SWITCH: A rotary micro switch with a flat on the shaft and a paddle that is positioned in the howl to rise as the parts flow under it. The radial position of the paddle mounted to the shaft can be adjusted in relation to the flat so that the switch is activated when the paddle drops below the set position.

PICK AND PLACE (P&P): A mechanical mechanism used to grip a part or parts, convey the part or parts some distance and to position the part or parts for further operations.

PLACING DEVICE (HEAD): A mechanism used to position a part or parts for further operations. A mechanical means of placing an escaped part into a nest or onto another piece part.

POLE FACE: The laminated plate that provides a pulling surface for the coil. Sometimes refer as a striker plate.

POLISHED: The fine grain finish achieved by hand rubbing with very fine abrasive products.

PREFEEDER: Also known as a hopper, either a vibratory or belted devise to supply parts to a feeder bowl from bulk on demand.

PRE-ORIENT TOOLING: Tooling to change the attitude of a part to the proper position for final selection. A pre-orient tooling will generate higher feed rate & and minimize recirculation of the parts, thus extending the life of the bowl, especially with regard to metal or abrasive parts.

PRODUCTION RATE: The number of oriented parts per minute or hour needed to maintain production requirements.

QUICK DUMP CHUTE: A section of the bowl or hopper that can he readily opened to remove the parts within. A door or panel in the bowl side wall that allows for faster removal of parts other than through the discharge. A quick-opening "window" that is provided to facilitate changing from one part to another when multiple styles or sizes of parts are being fed from the same bowl.

RATE (OR FEED RATE): The number of oriented parts discharging from the bowl in a fixed period of time. Usually stated as parts per minute or parts per hour. The number of parts discharged per minute or hour, as needed to maintain production requirements. The number of parts per minute. or per hour. which you require to meet your production requirements.

RETURN PAN OPENING: An opening in the lower area of the bowl wall that permits excess parts and parts that are rejected by the tooling to be returned to the center of the bowl.

RETURN PAN: The structure attached to the outer band for the purpose of recirculation parts, to the inside of the bowl, that have been rejected by the orienting and selection devices. A pan or basin, welded to the outside of the bowl below and extending beyond the external tooling, to catch the excess parts falling from the track or parts rejected by the tooling and convey these parts back into the interior of the bowl through the return pan opening. The area outside of the basic bowl into which the parts are allowed to fall from the tooling, the parts are then directed back inside of the bowl through the return hole. An extra pan-like area welded to the outside of the howl which catches excess and rejected parts falling from the track. The pan guides these parts back into the interior of the bowl for recirculation.

RISERS: Machined blocks that are used under the drive unit to raise the discharge up to a specified dimension.

ROTATION: The direction the parts travel inside the bowl. Usually specified as CW (clockwise) or CCW (counter clockwise). The direction a bowl and drive will move the parts, either clockwise or counterclockwise.

RUBBER MOUNT: A vibrating unit that uses rubber feet to isolate the vibration from the table or stand.

RUNNING SURFACE: That portion of the basic bowl, pre-orientor, final selector or discharge chute with which the part makes contact this is a variable dimension, depending upon the particular piece part. That portion of the discharge chute with which the part makes contact.

SCRAP CHUTE: A scrap chute is used to discharge small particles of foreign material from the bowl without interfering with flow of the piece parts.

SELECTOR: Tooling designed to accept parts in the proper orientation or to accept parts in an attitude that can be converted to the proper orientation. An area of the system designed and custom fit to profile only the properly positioned part. Parts entering a selector which are not in the proper position are diverted out of the feed line.

SHUTTLE: A mechanism used to move a part or parts at a right angle to the flow.

SHROUD: An enclosure around a drive unit or an inline driver, usually used for cosmetic purposes, or medical application, available in different grades of stainless steel or aluminum or metal.

SOLID MOUNT: A vibrating unit that mounts directly to the table or stand without using rubber isolators. Often the vibrating drive will be isolated from the mounting plate by leaf springs and have a large and heavy counterweight attached to the vibrating drive.

SOLID STATE CONTROL (OR PHASE SHIFT CONTROL): A control using a triac or diode to convert alternating electrical current to pulsating direct current.

SOUND ENCLOSURE: A box or other enclosure with doors that are sometime lined with a sound damping material, to reduce the effect of the noise created by the feeding system.

SPRINGS: The leaf spring that support the driven member of a vibrating unit such as the cross-arms on a drive unit the mounting bar on an inline or the vibrating tray on a pre-feed hopper

STORAGE HOPPER: A storage hopper is used to hold extra parts for replenishing the supply in the bowl. Hoppers are set to operate automatically by a signal from a level control switch, thus eliminating either a deficiency or an over-supply of parts in the Vibratory Feeder Bowl. The storage hopper is the storage area provided to backlog bulk parts prior to entering the feeder bowl. This hopper eliminates overloading or insufficient loads of parts. Causing the bowl not to function as required. Feed rate from the hopper to a bowl is metered by a level control switch.

STRAIGHT LINE VIBRATORY UNIT: A straight line drive unit is designed to produce linear vibratory motion. It is used to power tracks that convey parts horizontally from the feeder bowl discharge to a dead nest or mechanism. It operates on same principles of Base Drive Unit.

SWEEP OR CAM: A stainless or tool steel insert placed above a track to control the part level or orientation.

TAB MOUNTS: Sections welded to the base hand on the outside of the bowl wall that are bolted to extended cross arms and used to clamp the bowl to the drive and transfer vibration to the bowl. Tab mounts locate the bowl and can be ground to assure a predetermined discharge dimension. Tab mounts are usually used on interchangeable bowls and are set up using a fixture to maintain a precise discharge position.

TOE CLAMPS: Machined blocks at the ends of the cross arms on the base drive unit used to clamp the bowl to the drive and transfer vibration to the bowl. The four up to eight machined blocks at the end of the cross arms of the base drive unit must be tightened to assure maximum transfer of vibration to the bowl. Failure to do so will result in failure or malfunction of the feeder system.

TOOLED BOWL: The basic bowl complete with internal or external tooling custom designed to meet feed rate, part orientation and other specifications as required.

TRACKS - GRAVITY, INLINE OR MAGAZINE: Tooling that confines the parts oriented in the bowl feeder and conveys the parts to a more convenient position for escaping. Shuttling placing, necessary for further processing or assembly. Gravity tracks and vertical magazines are other options for getting parts from one location to another. A gravity track can set on an angle great enough that gravity will take the part to Its proper location. It may be used in conjunction with either the inline or bowl feeder. A magazine is a channel in which oriented parts are stacked. This device is usually preloaded; the feeder maintains a full stack.

TRACK SWITCH: A switch of any type which turns the feeder off whenever the tracking to the machine becomes full. The track switch also helps to eliminate wear, noise and jams within the feeder. Air, photoelectric, proximity and electro-mechanical track switches can be used.

TUNING: Matching the resonance frequency of the two mass system base and bowl, base and inline, hopper and pan feeder the frequency of the power source. The relationship between the number of springs, the thickness of the springs, and the coil gap. Proper tuning is an important factor in achieving maximum spring energy level. When a drive unit is improperly tuned (over or under-sprung) the spring tension does not correspond with the natural frequency of the feeder mass. Either condition prevents the mass from returning to its neutral position before the next magnetic pulse takes over thus restricting the full motion each 112 a second. Normal 60 Hz current produces 120 magnetic cycles per second, and transmits 120 mechanical cycles per second to the bowl. Tuning the unit to a natural frequency of either 60 Hz or 120 Hz, for proper balance between coil assembly energy development and spring tension, is of utmost importance to a smooth and efficient feed system. At this balance point it should be noted that parts will feed at maximum efficiency with minimum current draw. The addition or removal of springs may be necessary to obtain the balance needed. The same principles apply for 60 Hz except one half of the magnetic pulse is cut out, leaving only 60 mechanical movements per second (sometimes referred to as 112 wave or rectified current). The air gap between the coil assembly and armature plate is important. If the air gap needs to be reset, adjust it so the pole faces are as close as possible without striking. This will generate maximum power with minimum amperage draws. If the air gap is too small, the coil will clatter; if too large, the energy will not be used efficiently, causing the coil to overheat.

UNDERTUNED: The Bowl, Inline or Hopper will need additional springs to correct this problem. Proper tuning is important not only to develop maximum spring energy level, but to keep the coil assembly cool.

URETHANE COATING: A multi-coat hard surface urethane that is sprayed onto un-tooled areas of a bowl or track helps reduce noise and part abuse.

VARIABLE TRANSFORMER CONTROL: A large rheostat type control that vanes the voltage applied to the coil.

VIBRATORY BASE UNIT: See base drive unit.

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