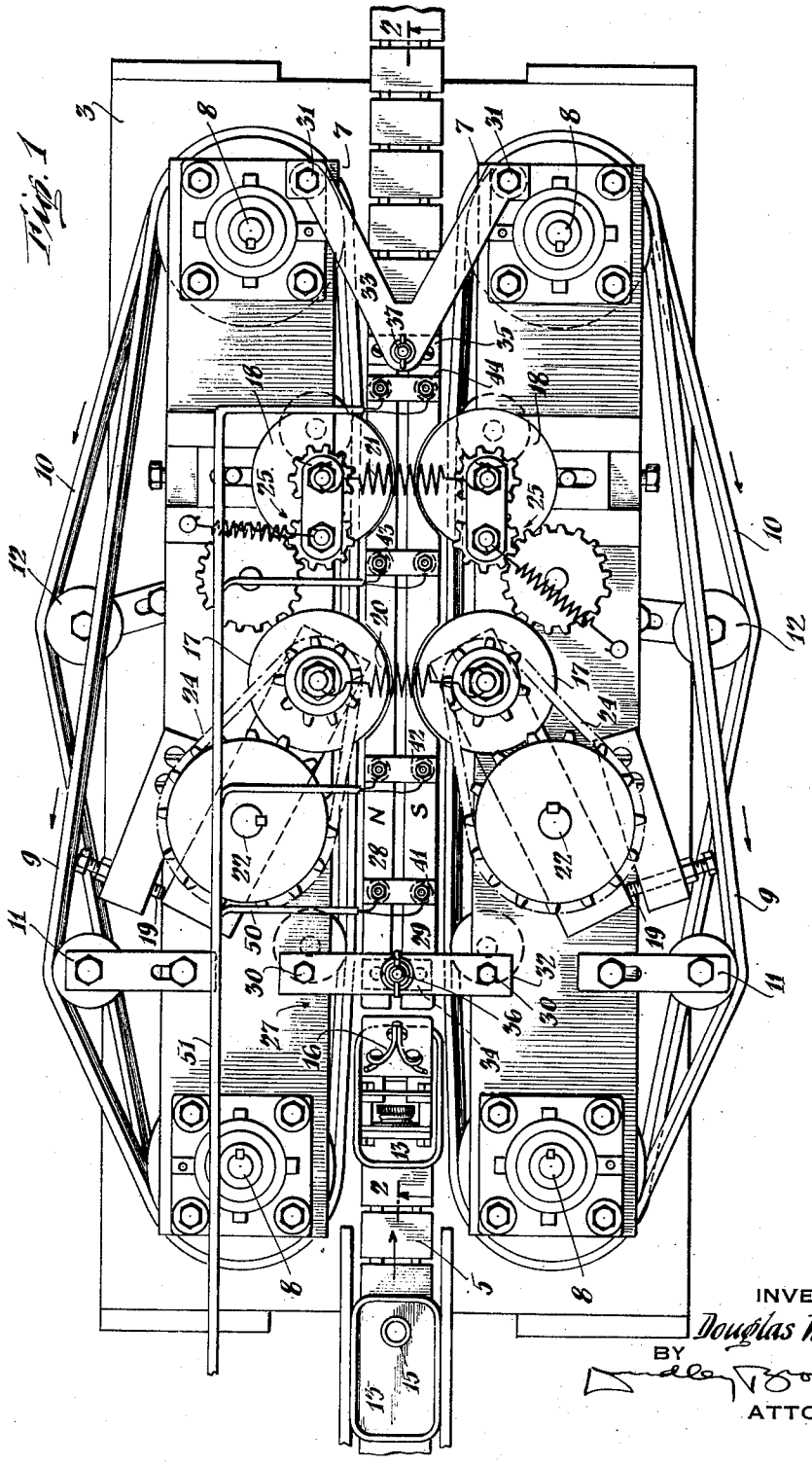
April 20, 1948. D. W. THOMAS 2,440,030

MAGNETIC CAP GUIDE

Filed May 1, 1946 3 Sheets-Sheet 1



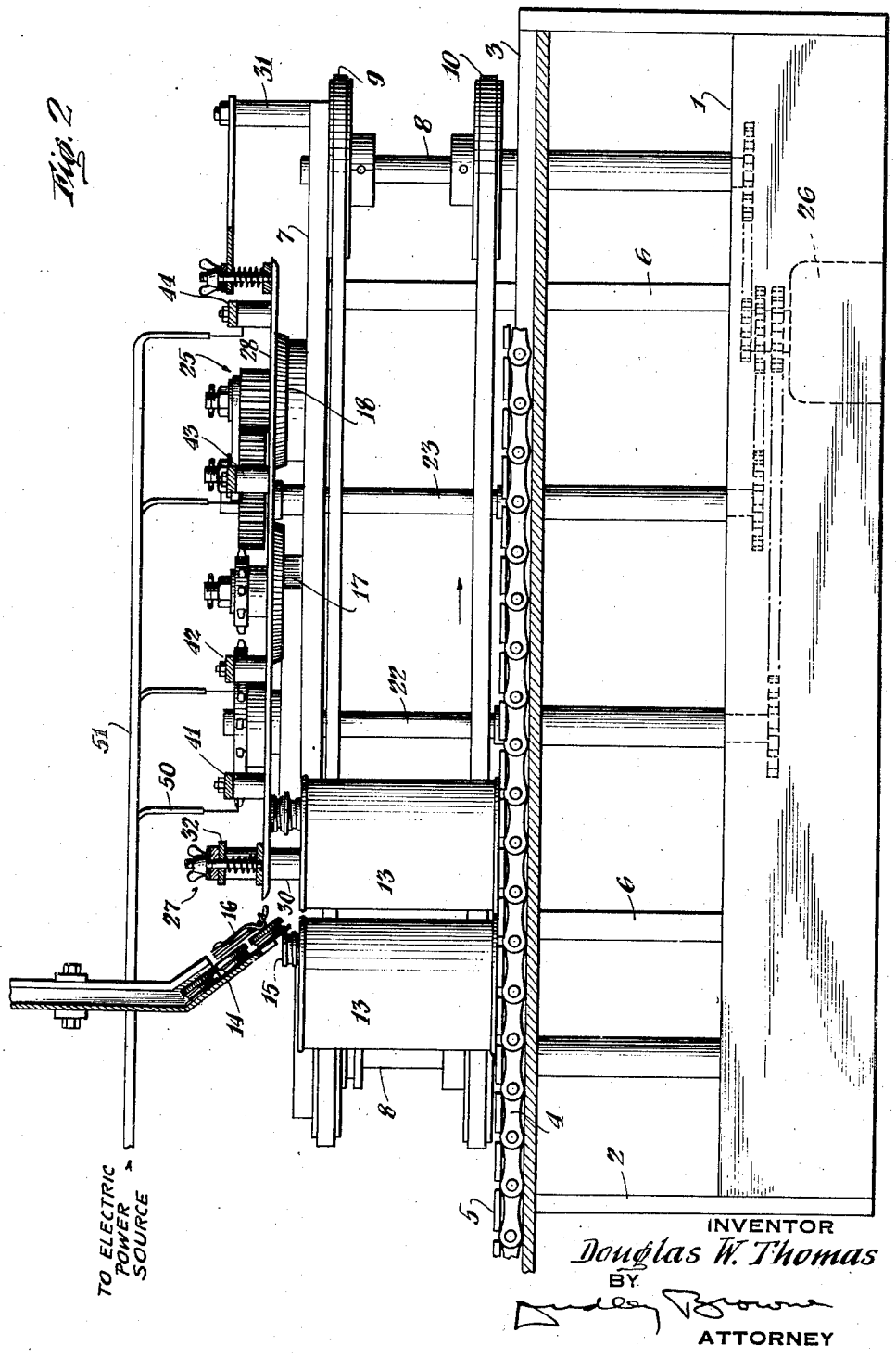
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Fig. 2



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Fig. 3

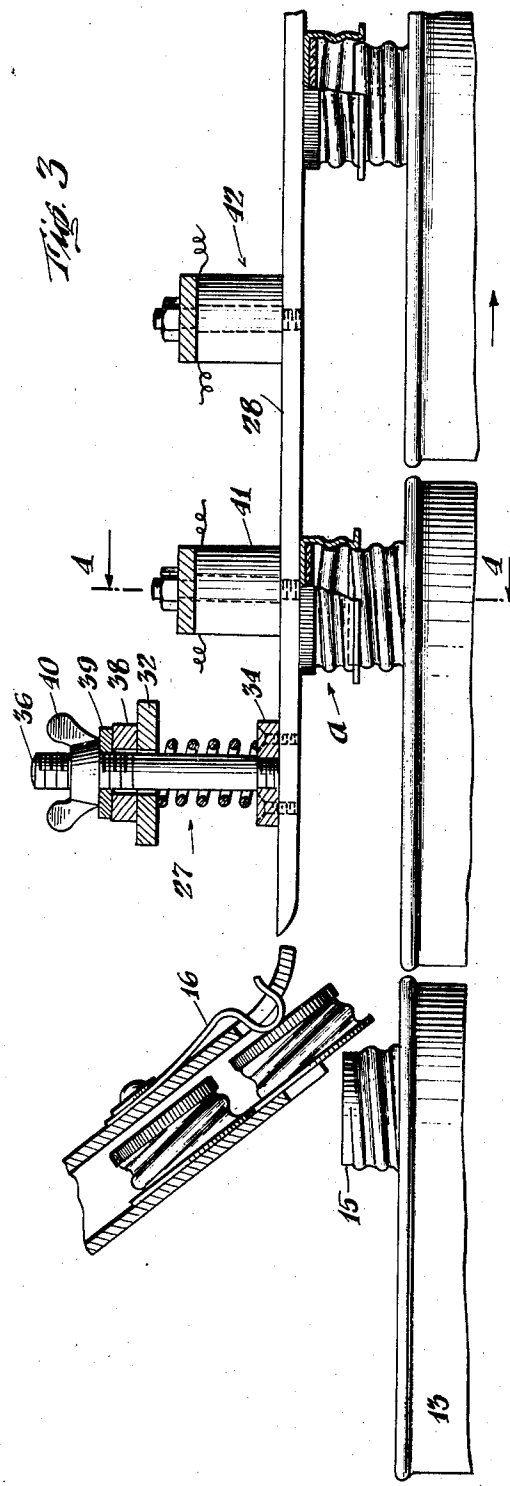


Fig. 4

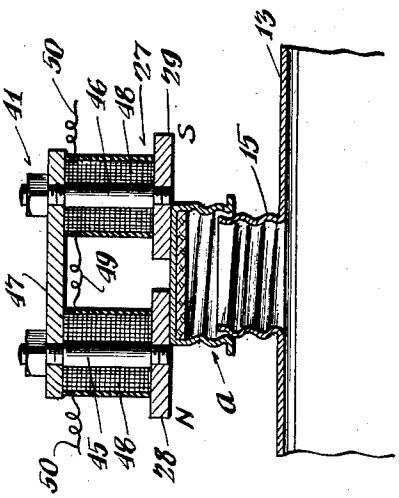
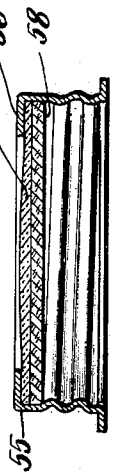


Fig. 5



Fig. 6



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UNITED STATES PATENT OFFICE

2,440,030

MAGNETIC CAP GUIDE

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6 Claims. (Cl. 226—88)

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This invention relates to a magnetic cap guide adapted to form part of a container-capping machine.

Numerous machines have been designed and used commercially for applying screw caps to bottles or other containers having threaded necks. In one type, upright bottles are moved horizontally through the machine while caps are fed to the machine through a vertical or inclined chute. As each bottle passes under the mouth of the cap chute, the forward edge of the bottle neck engages the inside of the forward part of a cap flange and the forward movement of the bottle extracts the cap from the chute and seats it in an approximately horizontal position on the neck. As the bottle and cap pass on through the machine, they encounter rotating means which, by relative rotation of cap and bottle, turn the former home on the latter. In some machines the container is held relatively fixed and the cap is rotated; in others the cap is held fixed and the container rotated; in still others both may be rotated counter to each other.

Various types of mechanical guides have been devised to ensure that the caps remain seated on the container necks as the containers pass from the cap chute to the cap-tightening means. One type of guide is in the form of an inverted rectangular trough, the sides of which are provided on their bottom edges with narrow inwardly extending flanges. These flanges are wide enough to support the caps by contact with the bottom flanges of the caps, but spaced apart sufficiently to permit passage of the container necks, each neck being partially inserted in a cap and moving the cap with it longitudinally of the trough as the container advances through the machine.

In spite of the small clearances involved and the nice adjustment required, such guides in general work satisfactorily provided both container and cap are made to close tolerances and are without imperfections.

In practice, however, it has been found that a substantial percentage of the caps passing through such a machine either may land on the container necks out of the horizontal or become cocked in passing from cap chute to tightening means. Such caps are not spun home by the tightening means; if detected by the inspector they may be tightened by hand; otherwise they result in leaky containers. In either case they represent loss of time, material or customer goodwill.

Accordingly it is an object of my invention to provide a cap guide that will ensure proper seating of caps on containers in a capping machine.

It is another object of my invention to provide a guide of this kind that is simple in construction and requires a minimum of close adjustment in use.

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It is a further object of my invention to provide an efficient magnetic cap guide for use with caps made of or containing ferrous metal or other ferromagnetic material.

Other objects and advantages will be apparent from the following description.

According to my invention I provide a magnetic guide in a capping machine extending above and parallel to the line of travel of the containers from the cap chute to or beyond the cap tightening means. The guide is placed at such a height above the containers that caps, after being removed from the chute by the forward movement of the containers, are attracted to the under side of the magnetic guide and held in sliding contact with it, their sealing surfaces slightly above but their lower flanges surrounding the container necks. The caps are thus kept in perfect horizontal position and alined with the necks of their respective containers while they are advanced by the movement of the latter to the tightening means.

My invention may be used with any type of magnetically attracted cap which requires horizontal positioning and alinement with a container before tightening—e. g., friction caps or clamped-on caps—but it is most useful and advantageous for use with screw caps. In this case, as the caps come in contact with the tightening means they may be rapidly rotated relatively to the container; the pushing contact of the container neck on the inside of the cap causes the threads of neck and cap to engage and the cap is spun home. Since the cap is held horizontal by the magnetic guide as it engages the tightening means, crossing of threads is avoided and the sealing surfaces of cap and container neck meet fairly to form a tight seal. In various forms of machine, the cap may be spun while the container is held, the container may be spun while the cap is held, or cap and container may both be rotated counter to each other. As the cap is brought home on the container neck, it is drawn down from contact with the magnetic guide and further forward movement of the container removes it from the magnetic field of the guide.

My guide may be a permanent magnet or an electromagnet energized by D. C. or A. C. current. I prefer to use an electromagnet since it is not subject to demagnetization by vibration or heat when in use. A permanent magnet, however, may be remagnetized from time to time as becomes necessary. I prefer to make my guide in the form of two parallel iron or steel strips bridged and connected by inverted U-shaped magnets with poles all oriented in the same sense. The parallel strips thus become pole pieces of opposite polarity. In the case of electromagnets the legs of the inverted U's are surrounded by coils of insulated wire wound in the appropriate

directions and connected with a source of electric current. The U's may be connected in series or parallel, depending on the voltage applied and the design of the windings. The field strength at the pole pieces should be regulated to cause the caps to jump into contact with the guide as they leave the chute and to hold them there with a moderate sliding pressure as they are moved towards the tightening means.

My magnetic guide is especially useful with caps stamped, spun or otherwise fabricated of iron, such as ferrous-base tin plate; it can also be used with caps of other paramagnetic material, such for example as nickel, by providing adequate field strength. While it is preferred, it is not essential, that the entire cap be made of paramagnetic material. Plastic caps, for example, with an iron washer between the sealing washer and the cap may be used, or caps consisting of a threaded galvanized flanged iron ring and a glass or plastic cover may be used. It is essential, however, that the cap used contain sufficient material attracted towards the magnetic field of the guide to hold the cap in sliding contact with the under side of the guide. It is also essential that the top of the cap in contact with the magnetic guide be so shaped that the cap when held against the guide is properly positioned to be brought securely home on the container neck by the tightening means.

One embodiment of my invention and certain types of caps with which it may be used are illustrated in the accompanying drawings; the scope of my invention, however, is not to be considered as limited thereby, but is defined in the appended claims.

In the drawings:

Fig. 1 is a plan view of that part of a capping machine embodying my invention;

Fig. 2 is a sectional side view of the part of the machine shown in Fig. 1, the section (except as to the containers) being taken on line 2—2 of Fig. 1;

Fig. 3 is a larger-scale sectional side view of a portion of the machine shown in Fig. 2;

Fig. 4 is a sectional end view taken on line 4—4 of Fig. 3; and

Figs. 5 and 6 are side views partly in section of types of caps which may be used with my invention.

In the drawings, 1 represents a base plate mounted on supports 2 at a suitable height above the floor. Supports 2 extend above plate 1 and carry intermediate plate 3 in a trough in which run chains 4 carrying articulated conveyor belt 5 driven by conventional means not shown. On plate 1 are mounted posts 6 which extend through plate 3 and support a pair of gear-carrying plates 7.

Two pairs of arbors 8 are mounted vertically in suitable bearings on plates 1 and 7; each arbor carries two pulleys over which run 2 pairs of V-belts 9 and 10 and 9' and 10', tensioned by suitable devices 11 and 12. The inner straight-line flights of these belts run horizontally above and on each side of conveyor 5, and act to keep containers 13 in line as they pass through the machine, the upper parts of the containers projecting above and passing between plates 7. Arrows indicate direction of travel of conveyor, of belts and of containers.

A cap chute is fixedly mounted above the machine having a forwardly inclined portion 14, terminating above the line of travel of container necks 15. The bottom of the chute is open but is provided with a cap-retaining spring 16 having just sufficient tension to ensure that the caps do not drop out by gravity but to permit each to be withdrawn from the chute by contact with the neck of an advancing container. For this purpose the chute is mounted at such a height that the lower forward edge of the bottom spring-held cap is below the top of neck 15, as shown in Fig. 3.

The cap-tightening means comprises two pairs of rapidly rotated steel discs 17 and 18. The discs of each pair are mounted on opposite sides of the cap pathway, and each pair acts on each cap to screw it home on the neck over which it is positioned, the second pair of discs acting to give the caps a final tightening. Engagement of discs with caps is ensured by mounting the disc arbors for arcuate or sliding movement with suitable limit stops (e. g., 19) and providing tension springs 20 and 21 to draw the discs of each pair towards each other. The edges of discs 17 and 18 are roughened by shallow fluting to effect frictional rotation of the caps by the discs. Discs 17 and 18 are rotated by vertical spindles 22 and 23 and appropriate chain or gear drive, 24 and 25 respectively.

Power for operating belts 9, 9', 10 and 10' and discs 17 and 18 is supplied by prime mover 26 located under plate 1 and diagrammatically indicated in Fig. 2. Belts 9, 9', 10 and 10' are driven at approximately the same linear velocity as conveyor 5.

The magnetic guide which is the subject of this invention is indicated in general by 27. It consists essentially of two narrow soft iron strips 28 and 29, inverted-U electromagnets connecting the strips and inducing magnetic polarity in them, and supporting means to hold the strip assembly above and parallel to conveyor 5.

The supporting means includes two pairs of posts 30 and 31 mounted on plates 7, and fixedly connected respectively by straight crossbar 32 and V crossbar 33. The pole pieces are connected together by screwed or riveted non-magnetic battens (e. g., of Bakelite) 34 and 35 in the centers of which are mounted threaded non-magnetic studs (e. g., of brass) 36 and 37 passing through holes in crossbars 32 and 33 when the guide is in position. The guide is maintained at the proper height by washers 38, hexagonal nuts 39 and wings nuts 40 cooperating with compression springs 41 on both studs 36 and 37, as shown in detail on stud 36 in Fig. 3. This supporting means maintains the pole strips 28 and 29 at a fixed minimum height above the conveyor but permits a limited amount of elastic displacement upwards to prevent binding and conform to slight operating irregularities.

The pole pieces are provided with four pairs of electro-magnets 41—44. Each (as shown for 41 in Fig. 4) consists of two soft iron core pieces 45 and 46 in close magnetic contact with pole pieces 28 and 29 and with soft iron yoke 47. Coils of insulated wire 48 surround the core pieces, wound in a suitable direction to induce opposite polarity in the pole strips 28 and 29—indicated by N and S. The coils in each U unit are connected by wire 49 and their opposite ends are conected by leads 50 to an electric power source through cable 51. The magnet units 41—44 may be connected in series or in parallel, depending on windings, applied voltage, etc. In any case units 41—44 are so oriented that all cooperate to magnetize each pole piece, 28 or 29 respectively, in the same sense.

The machine illustrated in the drawings is set up for capping rectangular containers having necks located on a center line. It will be obvious to those skilled in the art that alterations in the positioning of the tightening means and of the magnetic guide with respect to conveyor 5 and belts 9, 9', 10 and 10' may be made to accommodate various sizes and shapes of container, e. g. rectangular containers with necks in a corner of the top.

The operation of the machine illustrated is as follows:

Containers placed on conveyor 5 are advanced through the machine and kept alined by movement of the conveyor and of belts 9, 9', 10 and 10'. As each container passes under chute 14 it removes the bottom cap from the chute by pressure of the forward edge of neck 15 on the inside of the forward edge of the cap flange; in chute 14 another cap then drops by gravity into the bottom position, and is retained there by spring 16 until removed by a following container.

As soon as a cap is free of the bottom of the chute and of spring 16, it drops on and partly surrounds the neck of the container which has removed it from the chute, but on further forward motion of the container the cap is brought within the magnetic field of pole pieces 28 and 29 and jumps into contact with them, assuming the position shown at *a* in Fig. 3. It will be seen that the cap is held horizontally and still engages the neck of a container. In this position the cap is moved along by the container to the tightening means. The only substantial work done on the cap at this stage is that necessary to overcome the friction between cap and guide 28 and 29, since the cap is not withdrawn from the pole pieces until it is screwed down by the tightening means.

When the cap engages the latter, viz, the successive pairs of discs 17 and 18, it is rapidly rotated by them in a direction to screw it home on the container; the slight pressure of neck on cap as each container advances causes the male and female threads to engage, and consequently the rotation of the cap brings it smartly home on the neck. Crossing of threads is prevented by the horizontal position of the cap as rotation starts, and this horizontal position, in turn, is assured by the magnetic attraction of the cap to the horizontally disposed pole pieces 28 and 29. Tightening of the cap draws it down and out of contact with the pole pieces. Further advance of the capped container on conveyor 5 expels the container from the machine.

The caps illustrated in Figs. 1–3 are of conventional ferrous-base tin plate. Other types of cap may be used with my invention provided they incorporate a sufficient amount of paramagnetic material to be drawn up to pole pieces 28 and 29 with reasonably obtainable field strength. In Fig. 5 is illustrated a cap having a plastic body, an elastic sealing washer 53, and between the washer and the top of the cap a tinned iron disc 54 which furnishes a path for magnetic flux. Another usable type of cap is shown in Fig. 6. This cap consists of a threaded iron ring 55, preferably galvanized or cadmium plated, provided with a retaining flange 56, which bears on plastic or glass top 57 when on the sealed container to effect sealing through elastic washer 58. Ring 55 here furnishes a path for magnetic flux.

As stated above, my magnetic guide is applicable not only in capping machines which apply screw caps to containers but also in those which apply other types of caps such as friction caps; for example in such a machine a vertical plunger adapted to drive the caps on the container necks might replace spinning discs 17 and 18. In all such machines my magnetic guide functions to maintain the caps in a desired angular relation to the container at the moment of sealing.

I claim:

1. In a container-capping machine, cap-tightening means, conveyor means for moving containers and caps into operative relation with the cap-tightening means, and a magnetic cap guide disposed in spaced parallel relation with the conveyor means ahead of the cap-tightening means.

2. In a container-capping machine, cap-tightening means, conveyor means for moving containers and caps into operative relation with the cap-tightening means, and a magnetic cap guide disposed in parallel relation with the conveyor means ahead of the cap-tightening means, the distance from the conveyor means to the magnetic cap guide being greater than the height of the containers but less than the added heights of container and cap.

3. In a container-capping machine, cap-supplying means, cap-tightening means, conveyor means for moving containers and caps from the cap-supplying to the cap-tightening means, and a magnetic cap guide adapted to maintain caps in desired angular relation to containers during travel to the cap-tightening means.

4. In a container-capping machine, cap-tightening means, conveyor means for moving containers and caps into operative relation with the cap-tightening means, and a magnetic cap guide disposed in spaced parallel relation with the conveyor means ahead of the cap-tightening means, said guide comprising two elongated spaced-apart pole pieces of opposite polarity.

5. In a machine adapted to apply screw caps to containers having threaded necks, cap-supplying means, conveyor means, cap-tightening means, and a magnetic cap guide, the cap-supplying means being adapted to position successive caps on the necks of successive containers passing therebeneath, the conveyor means being adapted to advance containers and associated caps from the cap-supplying means into operative relation with the cap-tightening means, the cap-tightening means comprising two like-rotating discs on arbors resiliently mounted so as to engage the discs with caps passing there-between and screw the discs home on the associated container necks, and the magnetic cap guide comprising two elongated pole pieces of opposite polarity extending horizontally above the conveyor means and so positioned as to maintain mganetically attracted caps in a horizontal position while surrounding the necks of containers and being brought into operative relation with the cap-tightening means.

6. The combination defined in claim 5, in which the pole pieces are connected by a plurality of inverted-U electrically energized magnetic cores so oriented as to induce opposite magnetic polarity in the pole pieces.

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