Dec. 16, 1952 J. J. SHANLEY 2,621,740

APPARATUS FOR CUTTING SAMPLES

Filed Nov. 17, 1949 2 SHEETS—SHEET 1

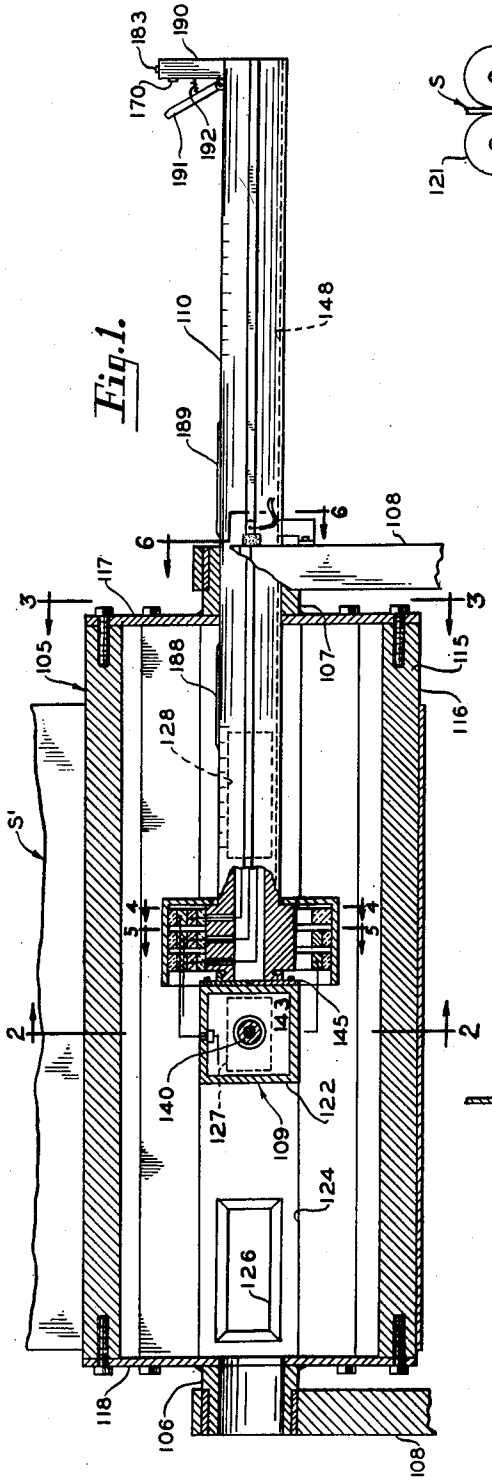


Fig. 1.

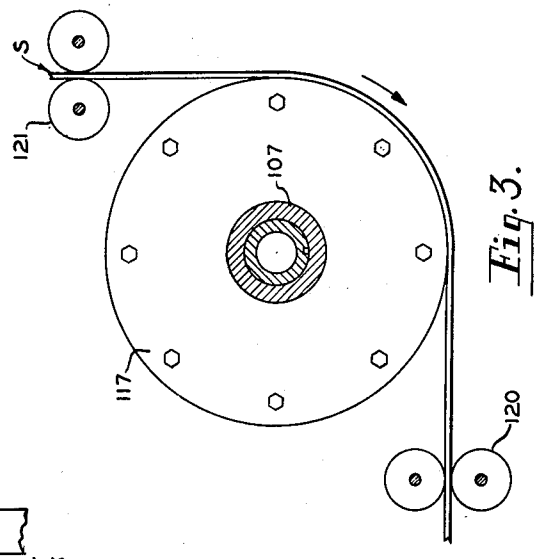


Fig. 3.

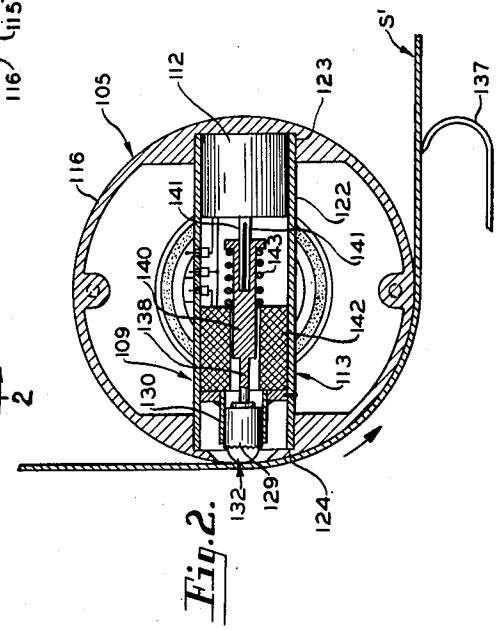


Fig. 2.

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APPARATUS FOR CUTTING SAMPLES

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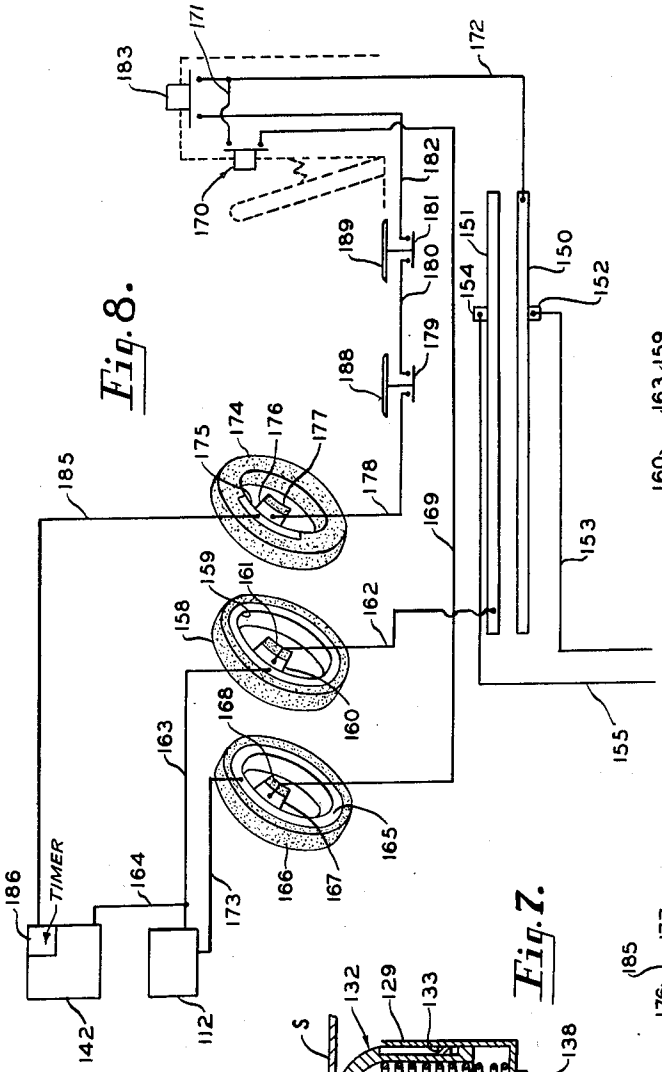


Fig. 8.

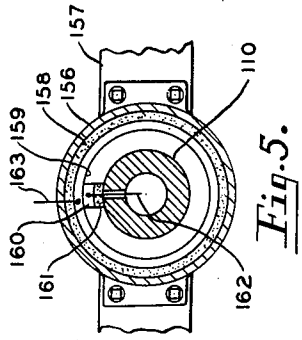


Fig. 5.

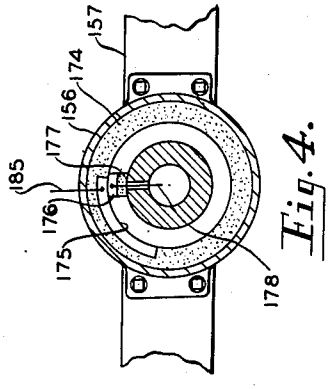


Fig. 4.

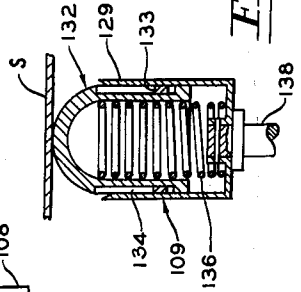


Fig. 7.

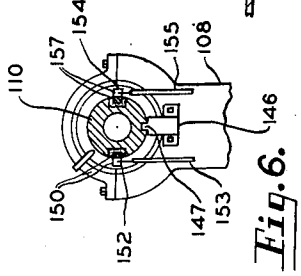


Fig. 6.

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APPARATUS FOR CUTTING SAMPLES

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Application November 17, 1949, Serial No. 127,840

10 Claims. (Cl. 164—99)

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This invention relates to apparatus for taking samples from moving strip.

The present application is related to application Serial No. 72,472, filed January 24, 1949, by Joseph Echols and assigned to the assignee of this application.

In the production of metal strip, it is desirable to take samples of the strip at frequent intervals along the length of the moving strip before it passes to other sections of the mill or is coiled into large coils. Strip is customarily moved along at high speeds, and it is undesirable to stop the strip to enable samples to be taken. Stopping the strip reduces production and the interruption causes changes in the characteristics of the strip so that the strip is not uniform.

Flying sample punches have been proposed for taking samples from moving strip. These sampling devices have been complicated and expensive and have necessarily included very complex control devices, all of which have made the cost excessive.

Accordingly, it is an object of the present invention to provide novel apparatus for taking samples from rapidly moving strip that is economical to build and use and that will operate in a highly satisfactory manner.

Another object of the present invention is to provide an improved apparatus for taking as many samples as desirable along the length of moving strip and for taking these samples from the central portion or either edge portion of the strip as desired.

Another object of the present invention is to provide apparatus for cutting samples from moving strip without cutting a greater number of samples than desired so as to avoid jamming of the apparatus and damaging the strip.

Another object of the present invention is to provide an improved control circuit for an apparatus for cutting samples from moving strip.

In accordance with a preferred embodiment of my invention, the strip passes through an arc in contact with a rotating cylindrical surface. Means are provided within the cylindrical surface for severing a sample from the strip, and the apparatus includes control means operable to cause the severing means to remove a sample from the moving strip as is desired. The samples can be removed from the central or either edge portion of the strip, and suitable safety control means is preferably provided to prevent inadvertent operation of the severing means, except when in position to sever a sample. The present apparatus is relatively economical to construct and operate.

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These and other objects and advantages will become more apparent from the following description, taken with the accompanying drawings, in which:

Figure 1 is a transverse sectional view of apparatus embodying the principles of the present invention;

Figure 2 is a sectional view taken along line 2—2 of Figure 1;

Figure 3 is an end view partially in section and taken along line 3—3 of Figure 1;

Figures 4 and 5 are fragmentary sectional views taken along lines 4—4 and 5—5, respectively, of Figure 1;

Figure 6 is a fragmentary sectional view taken along lines 6—6 of Figure 1;

Figure 7 is an enlarged fragmentary sectional view of the cutter head shown in Figure 2; and,

Figure 8 is an expanded diagrammatic view showing the electrical circuit for the apparatus of Figure 1.

Referring to the drawings, the sample cutting apparatus includes a drum or housing 105 rotatably mounted on trunnions 106 and 107 in supports 108. A sample cutting means 109 is mounted in housing 105 and is connected to a non-rotating shaft 110 extending through hollow trunnion 107 to the exterior of the apparatus. The shaft 110 is longitudinally movable through trunnion 107 for moving the cutting means 109 longitudinally of the housing 105 to position the cutting means for cutting a sample from the central portion or either edge portion of the strip S rapidly moving through an arc extending part way around the periphery of the housing 105. A motor 112 is mounted inside of housing 105 to drive the cutting means. Solenoid means 113 is arranged inside of the housing for moving the cutting means outwardly into a strip cutting position. The control circuit, shown diagrammatically in Figure 8, includes means to prevent the cutter means from cutting a sample except when facing outwardly toward the strip and includes means for preventing the cutting means from being moved outwardly to the cutting position except when in the correct position transversely of the strip or longitudinally of the housing 105.

The housing 105 includes a cylinder 115 having an outer cylindrical surface 116. A circular plate 117 is connected to one end of cylinder 115 and carries the trunnion 107 and a cylindrical plate 118 is fastened to the other end of cylinder 115

and carries the trunnion 106. Thus, the housing 105 is rotatable about the axes of trunnions 106 and 107, and these axes coincide with the longitudinal axis of the cylindrical surface 116.

Any suitable type apparatus may be used for supporting and propelling the strip, and this apparatus may be of the type used in steel mills and other plants for supporting and propelling strip along a predetermined path. Guide rolls 120 and 121 guide the strip about the housing so that the strip is in contact with the cylindrical surface 116 through an arc of about 90°, and the axis of this arcuate path of the strip coincides with the longitudinal axis of the housing.

The cutting means 109 is mounted in a square, box-shaped supporting member 122. One end of member 122 is slidably mounted in way 123 formed on the inside of cylinder 115. The opposite end of member 122 is slidably mounted in way 124, also formed in cylinder 115. The supporting member 122 and the cutting means 109 are slidable along ways 124 and 123 for moving the cutting means transversely of the strip and longitudinally of the cylindrical surface 116 for positioning the cutting means to cut a sample from the central portion or from either edge portion of the strip S. Spaced apart openings 126, 127 and 128 are provided in the cylindrical surface 116, and these openings extend through a wall of cylinder 115. The opening 126 is in alignment with one edge portion of the strip while the opening 128 is in alignment with the other edge portion of the strip, and opening 127 is in alignment with the central portion of the strip. The openings are transversely aligned and are arranged so that when the cutting means 109 is moved transversely of the strip and along the longitudinal axis of the housing 105, the cutting means will move into alignment with these openings so that the cutting means can be positioned at either one of the openings to cut a sample from the desired portion of the strip. As shown, three separate openings are provided. These openings may be continuous. Preferably, if the openings are continuous, the continuous opening extends around and across the cylindrical surface 116 so that the surface 116 will form a better support for the strip. Especially if the opening is maintained relatively narrow, a continuous opening may be formed in the cylindrical surface 116 extending in a direction normal to the direction of strip travel.

The cutting means includes an annular cutter 129 rotatably mounted in a sleeve 130 which is, in turn, mounted in member 122. The cutter is rotatable about its axis which axis extends in a direction normal to the axis of rotation of the housing 105, and if the axis of rotation of the cutter is extended, it intersects the axis of the housing. Within the cutter 129, there is slidably mounted a sample ejector 132 which is retained within the cutter by an annular ring 133 which is connected to the cutter and fits into a relatively wide slot 134 formed at ejector 132. The ejector 132 is urged outwardly against the strip by a compressed spring 136, and the ejector 132 has resilient inward and outward movement along the axis of rotation of the cutter 129. When the cutter 129 cuts a sample, as will be more fully hereinafter described, the ejector 132 pushes the sample outwardly, and if the sample tends to remain connected at some point to the strip, the ejector will bend or tilt the sample outwardly so that it will be caught and removed by the hook-shaped member 137 disposed along the path of the strip as shown in Figure 2.

Shaft 138 is connected to the cutter 129 and has an enlarged portion 140 adapted to slidably fit over a splined shaft 141 of motor 112. The shaft 138 and the cutter 129 are slidable relative to the motor shaft 141 along the axis of rotation of the cutter. The solenoid coil 142 is mounted within member 122 and extends about the shaft 139. The enlarged portion 140 of the shaft also forms a core for the solenoid coil 142. A compressed spring 143 normally urges shaft 139 toward the motor 112 so as to urge the cutter 129 to a non-cutting position within the cylindrical surface 116 of housing 105. When the solenoid coil 142 of the solenoid means 113 is energized, the enlarged shaft portion 140 is moved in a direction away from motor 112 against the pressure of spring 143 to move the cutter 129 outwardly along the axis of rotation of the cutter and through the opening in the cylindrical surface 116 against the strip to the sample cutting position.

The shaft 110 extends from within the housing 105 through hollow trunnion 107 to a position outside of the housing. The inner end of shaft 110 is rotatably mounted in a bearing 145 connected to member 122. As shown more clearly in Figure 6, a bracket 146 is mounted on one of the supporting posts 108 and has formed thereon a tongue or key 147 which fits in an elongated slot 148 formed in the bottom of the shaft 110 to prevent the shaft from rotating. The shaft 110 is longitudinally slidable through the trunnion 107 to move the member 122 and the cutter 129 back and forth longitudinally of the housing 105 to position the cutter in alignment with anyone of the openings 126, 127 or 128. Rotationwise the shaft 110 is stationary and does not rotate with housing 105.

The present apparatus includes a control circuit which is so arranged as to prevent operation of the cutting means except when the cutter 129 is in the correct position for cutting a sample from the strip S. Referring more particularly to Figures 4, 5, 6 and 8, conductive metal strips 150 and 151 are mounted on opposite sides and are electrically insulated from the shaft 110. The bar 150 is in electrical contact with a fixed member 152 which is connected through wire 153 to one side of a source of electric current. The elongated bar 150 is in sliding contact with member 152 so that the bar 150 is connected to the source of electric current at all times when the shaft 110 is moved longitudinally of the cylindrical housing 105. The bar 151 is in sliding electrical contact with contact member 154 which is connected through wire 155 to the opposite side of the source of electric current. In a cover 156 on cross arm 157 in the housing 105, there is mounted a non-conductive annular ring 158. A conductive ring 159 is mounted inside of ring 158. Rings 158 and 159 rotate with housing 105. A relatively short, arcuate conductive contact member 160 is mounted on shaft 110 and insulated therefrom by a non-conductive member 161. The internal surface of member 159 is continuously in sliding contact with the external surface of member 160 so that these members are always electrically connected together. The contact member is connected through wire 162 and bar 151 to the source of electric current. Wire 163 connects motor 112 to the annular conductive member 159 and wire 164 connects the solenoid 142 to wire 163 so that the solenoid 142 and the

motor 112 are at all times connected to one side of the source of electric current.

An annular conductive member 165 is mounted within cover 156 and insulated therefrom by a non-conductive member 166. A relatively short, arcuate conductive member 167 is mounted on shaft 110 and insulated therefrom by non-conductive member 168. Members 165 and 167 are continuously in electrical contact with each other. The conductive member 167 is connected through a wire 169, normally open switch 170 and wires 171 and 172 to the bar 150 which is connected to a source of electric current. The conductive member 165 is connected through wire 173 to the motor 112 so that when switch 170 is closed the circuit to motor 112 is completed and the motor is energized to rotate the cutter 129.

A third annular non-conductive member 174 is mounted in cover 156 and includes an arcuate, conductive metal insert 175. A conductive contact member 176 is mounted on shaft 110 and insulated therefrom by non-conductive member 177. The conductive members 175 and 176 are arcuate segments which are in electrical contact with each other when the cutter 129 is in the same quadrant as the strip S. The conductive member 176 is connected through wire 178, normally closed switch 179, wire 180, normally closed switch 181 and wire 182 to switch 183. The normally open switch 183 is connected to wire 172 and the source of electric current. The conductive member 175 is connected through wire 185 to a timer 186 which is in turn electrically connected to the solenoid 142. The timer 186 is of the type which disconnects solenoid 142 from wire 185 a predetermined period after the solenoid 142 and timer 186 are energized to prevent inadvertent energization of the solenoid. The timer 186 automatically breaks the circuit between solenoid 142 and wire 185 a predetermined period after a sample is cut to prevent inadvertently re-energizing solenoid 142 upon the next rotation of contact 175.

The control circuit includes means for preventing accidental movement of the cutter 129 outwardly toward the cutting position when the cutter is not in alignment with one of the openings 126, 127 or 128. Each switch 179 and 181 includes a movable, elongated switch button 188 and 189, respectively. The switch buttons 188 and 189 are mounted in shaft 110 in such a position that when shaft 110 is moved longitudinally to move the cutter into alignment with any one of the openings, one of the buttons 188 or 189 is depressed to open the corresponding switch when the cutter is not in alignment with an opening. As shown in Figures 1 and 8, the cutter is in alignment with opening 127, buttons 188 and 189 are in the raised position, and switches 179 and 181 are closed. If shaft 110 and cutting means 109 are moved to the right, button 188 is depressed by trunnion 107. When button 188 is depressed, switch 179 is open, and the circuit to solenoid 142 is broken so that if switch 170 is closed solenoid 142 is not energized. Upon further movement of shaft 110 to the right, the cutting means moves into alignment with opening 128 and button 188 moves outside of trunnion 107 so that button 188 is no longer depressed and switch 179 is closed. Similarly, if shaft 110 is moved to the left from the position shown to move the cutter into alignment with opening 126, button 189 is depressed and switch 181 is opened when the cutter is between openings 127 and 126.

An upright handle 190 is mounted on the outer end of shaft 110, and handle 190 carries switches 170 and 183, Figure 1. An arm 191 is pivotally mounted on shaft 110 adjacent handle 190 and is normally held away from handle 190 and switch 170 by a spring 192. When the operator wishes to cut a sample, the operator grasps handle 190 and arm 191 in his hand. The operator's grip will move arm 191 against handle 190 and switch 170 to close the switch. The closing of switch 170 closes the circuit to motor 112 which then rotates cutter 129. If the operator wants to cut a sample from the strip S', he closes switch 183 with his thumb and when contacts 159 and 160 are in engagement or contact with each other, the rotating cutter is moved outwardly through opening 127 to cut the sample. If it is desired to cut a sample from either edge portion, the operator, while gripping handle 190 and handle 192, moves shaft 110 either inwardly or outwardly to move the rotating cutter into alignment with either opening 126 or 128. While the cutter is between the openings, one of the switch buttons 188 or 189 is depressed, and, if the operator closes switch 183 with his thumb, the solenoid is not energized, and the cutter is not moved outwardly. When the cutter is in alignment, either with opening 126 or 128, both switches 179 and 181 are closed, and the operator can energize solenoid 142 to cut a sample by closing switch 183 when desirable. If the operator inadvertently holds switch 183 closed through more than one rotation of housing 105, timer 186 will prevent the cutting of more than one sample. After a predetermined period, which is long enough to permit the operator to release switch 183, timer 186 automatically closes and reconnects solenoid 142 to wire 185 so that another sample can be cut.

In the present apparatus, the cutter is movable longitudinally of the housing or drum and transversely of the strip. Thus, a sample can be readily removed from the desired portion of the strip to determine the physical and chemical characteristics of the strip. For example, when producing non-coated strip, it is necessary to determine frequently the hardness and other characteristics and when producing coated strip such as tinplate, it is necessary to determine the thickness and at times other characteristics of the coating portion of the strip.

I claim:

1. In apparatus for cutting samples from strip moving through an arcuate path, a housing having an elongated external cylindrical surface for engaging a surface of the strip as it moves through such an arcuate path, means supporting the housing for rotation about the longitudinal axis of the cylindrical surface, a sample cutter, supporting means in the housing supporting the cutter for rotation about an axis normal to said longitudinal axis, motor means carried by the cutter supporting means for rotating the cutter, the motor means including a rotatable shaft means aligned with and rotatable about the extended axis of cutter rotation, cutter shaft means connected to the cutter and connected to and slidable along the motor shaft means so that the cutter is connected to the motor shaft means when moved along the extended axis of cutter rotation, and means carried by the cutter supporting means for moving the cutter from an inoperative position within the cylindrical surface outwardly along the extended axis of cutter rotation to a strip cutting position adjacent the cylindrical surface for cutting a sample from the strip.

2. In apparatus for cutting samples from strip moving through an arcuate path, a housing having an elongated external cylindrical surface for engaging a surface of the strip as it moves through such an arcuate path, means supporting the housing for rotation about the longitudinal axis of the cylindrical surface, a sample cutter, supporting means in the housing supporting the cutter for rotation about an axis normal to said longitudinal axis, motor means carried by the cutter supporting means for rotating the cutter, the motor means including a motor shaft means aligned with and rotatable about the extended axis of cutter rotation, cutter shaft means connected to the cutter and to the motor shaft means, the cutter shaft means being slidable along the motor shaft means while maintaining connection therewith, a solenoid field means through which the cutter shaft means extends, means normally maintaining the cutter in an inoperative position within the cylindrical surface, solenoid core means connected to the cutter shaft means so that energization of the solenoid field means moves the solenoid core means and the cutter from the inoperative position outwardly along the extended axis of cutter rotation to a strip cutting position adjacent the cylindrical surface for cutting a sample from the strip.

3. In apparatus for cutting samples from strip moving through an arcuate path, a housing having an elongated external cylindrical surface for engaging a surface of the strip as it moves through such an arcuate path, means supporting the housing for rotation about the longitudinal axis of the cylindrical surface, a sample cutter, supporting means in the housing supporting the cutter for rotation about an axis normal to said longitudinal axis, ways in the housing extending transversely of the strip, the cutter supporting means being mounted in said ways for movement therealong, and motor means carried by the cutter supporting means for rotating the cutter.

4. In apparatus for cutting samples from strip moving through an arcuate path, a housing having an elongated external cylindrical surface for engaging a surface of the strip as it moves through such an arcuate path, a sample cutter, supporting means in the housing supporting the cutter for rotation about an axis normal to said longitudinal axis, motor means carried by the cutter supporting means for rotating the cutter, means carried by the cutter supporting means for moving the cutter from an inoperative position within the cylindrical surface outwardly along the extended axis of cutter rotation to a strip cutting position adjacent the cylindrical surface for cutting a sample from the strip, and ways in the housing extending transversely of the strip, the cutter supporting means being mounted in said ways for movement therealong.

5. In apparatus for cutting samples from strip moving through an arcuate path, a housing having an elongated external cylindrical surface for engaging a surface of the strip as it moves through such an arcuate path, trunnions at opposite ends of the housing, bearing means engaging the trunnions and supporting the trunnions and housing for rotation about the longitudinal axis of the cylindrical surface, one of the trunnions being hollow, a sample cutter including cutter actuating means, supporting means in the housing supporting the cutter for rotation about an axis normal to said longitudinal axis, ways in the housing extending transversely of the strip, the cutter supporting means being mounted in said ways for movement therealong, and shaft means connected to the cutter supporting means including a portion extending through the hollow trunnion to a point outside of the housing, said portion being slidably mounted in said hollow trunnion for longitudinal movement therein.

6. In apparatus for cutting samples from strip moving through an arcuate path, a housing having an elongated external cylindrical surface for engaging a surface of the strip as it moves through such an arcuate path, trunnions at opposite ends of the housing, bearing means engaging the trunnions and supporting the trunnions and housing for rotation about the longitudinal axis of the cylindrical surface, one of the trunnions being hollow, a sample cutter including cutter actuating means, supporting means in the housing supporting the cutter for rotation about an axis normal to said longitudinal axis, ways in the housing extending transversely of the strip, the cutter supporting means being mounted in said ways for movement therealong, shaft means connected to the cutter supporting means including a portion extending through the hollow trunnion to a point outside of the housing, said portion being slidably mounted in said hollow trunnion for longitudinal movement therein, and holding means preventing the rotation of the shaft means with the housing and cutter supporting means.

7. In apparatus for cutting samples from strip moving through an arcuate path, a housing having an elongated external cylindrical surface for engaging a surface of the strip as it moves through such an arcuate path, trunnions at opposite ends of the housing, bearing means engaging the trunnions and supporting the trunnions and housing for rotation about the longitudinal axis of the cylindrical surface, one of the trunnions being hollow, a sample cutter including cutter actuating means, a plurality of cutter openings in the cylindrical surface, supporting means in the housing supporting the cutter for rotation about an axis normal to said longitudinal axis, shaft means connected to the cutter supporting means including a portion extending through the hollow trunnion to a point outside of the housing, said portion being slidably mounted in said hollow trunnion for longitudinal movement therein, switch means mounted on said shaft means and movable therewith along a predetermined path, and fixedly mounted switch actuating means in position along the path of switch movement to actuate the switch means only when the cutter is in alignment with a cutter opening.

8. In apparatus for cutting samples from strip moving through an arcuate path, a housing having an elongated external cylindrical surface for engaging a surface of the strip as it moves through such an arcuate path, trunnions at opposite ends of the housing, bearing means engaging the trunnions and supporting the trunnions and housing for rotation about the longitudinal axis of the cylindrical surface, one of the trunnions being hollow, a sample cutter, a plurality of cutter openings in the cylindrical surface, supporting means in the housing supporting the cutter for rotation about an axis normal to said longitudinal axis, means carried by the cutter supporting means for moving the cutter from an inoperative position within the cylindrical surface outwardly along the extended axis of cutter rotation to a strip cutting position

adjacent the cylindrical surface for cutting a sample from the strip, shaft means connected to the cutter supporting means including a portion extending through the hollow trunnion to a point outside of the housing, said portion being slidably mounted in said hollow trunnion for longitudinal movement therein, switch means mounted on said shaft means and movable therewith along a predetermined path, and fixedly mounted switch actuating means in position along the path of switch movement to actuate the switch means only when the cutter is in alignment with a cutter opening.

9. In apparatus for cutting samples from strip moving through an arcuate path, a housing having an elongated external cylindrical surface for engaging a surface of the strip as it moves through such an arcuate path, trunnions at opposite ends of the housing, bearing means engaging the trunnions and supporting the trunnions and housing for rotation about the longitudinal axis of the cylindrical surface, one of the trunnions being hollow, a sample cutter, supporting means in the housing supporting the cutter for rotation about an axis normal to said longitudinal axis, means carried by the cutter supporting means for moving the cutter from an inoperative position within the cylindrical surface outwardly along the ended axis of cutter rotation to a strip cutting position adjacent the cylindrical surface for cutting a sample from the strip, ways in the housing extending transversely of the strip, the cutter supporting means being mounted in said ways for movement therealong, shaft means connected to the cutter supporting means including a portion extending through the hollow trunnion to a point outside of the housing, said portion being slidably mounted in said hollow trunnion for longitudinal movement therein, holding means preventing the rotation of the shaft means with the housing and cutter supporting means, a plurality of cutter openings in the cylindrical surface, switch means mounted on said shaft means and movable therewith along a predetermined path, and fixedly mounted switch actuating means in position along the path of switch movement to actuate the switch means only when the cutter is in alignment with a cutter opening.

10. In apparatus for cutting samples from strip moving through an arcuate path, a housing having an elongated external cylindrical surface for engaging a surface of the strip as it moves through such an arcuate path, trunnions at opposite ends of the housing, bearing means engaging the trunnions and supporting the trunnions and housing for rotation about the longitudinal axis of the cylindrical surface, one of the trunnions being hollow, a sample cutter, supporting means in the housing supporting the cutter for rotation about an axis normal to said longitudinal axis, motor means carried by the cutter supporting means for rotating the cutter, means carried by the cutter supporting means for moving the cutter from an inoperative position within the cylindrical surface outwardly along the extended axis of cutter rotation to a strip cutting position adjacent the cylindrical surface for cutting a sample from the strip, ways in the housing extending transversely of the strip, the cutter supporting means being mounted in said ways for movement therealong, shaft means connected to the cutter supporting means including a portion extending through the hollow trunnion to a point outside of the housing, said portion being slidably mounted in said hollow trunnion for longitudinal movement therein, holding means preventing the rotation of the shaft means with the housing and cutter supporting means, a plurality of cutter openings in the cylindrical surface, switch means mounted on said shaft means and movable therewith along a predetermined path, and fixedly mounted switch actuating means in position along the path of switch movement to actuate the switch means only when the cutter is in alignment with a cutter opening.

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No references cited.