Dec. 16, 1952 J. ECHOLS 2,621,739

SAMPLE CUTTING APPARATUS

Filed Jan. 24, 1949 2 SHEETS—SHEET 1

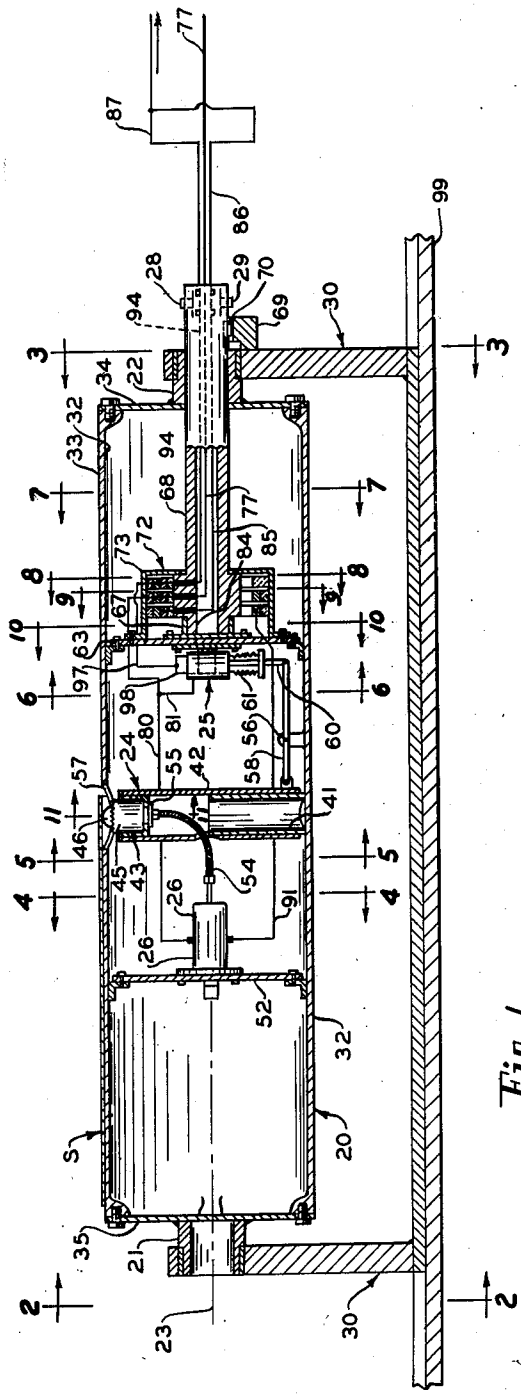


Fig. 1

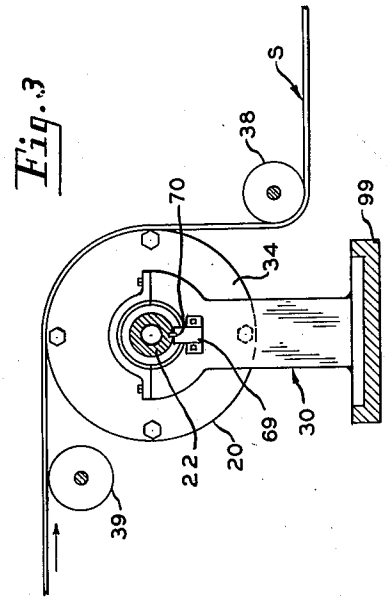


Fig. 3

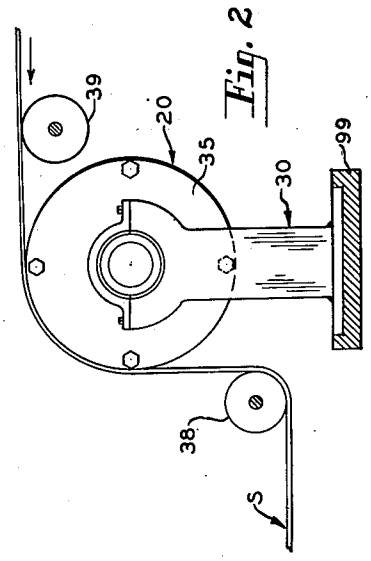


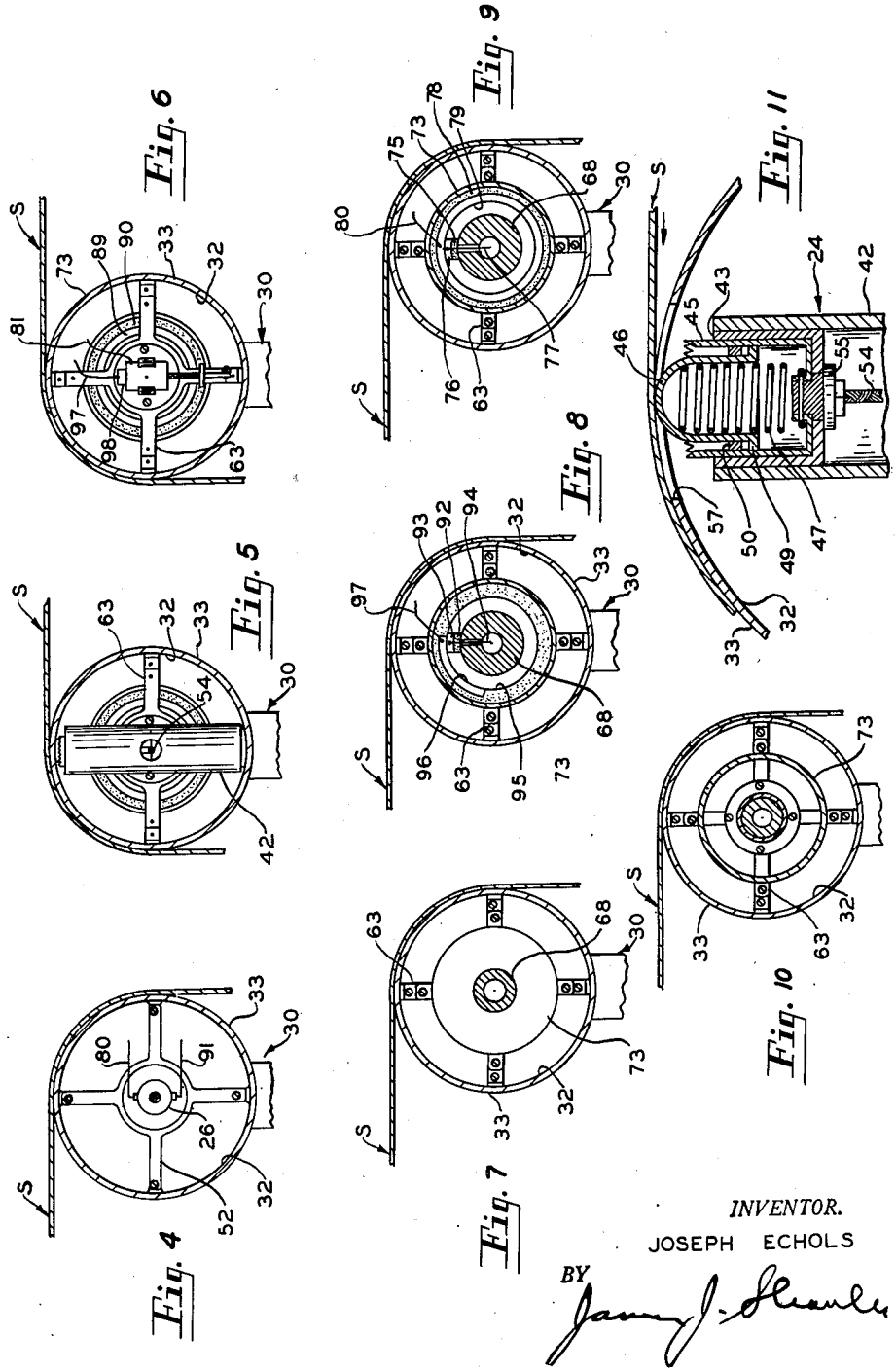
Fig. 2

INVENTOR.
JOSEPH ECHOLS
BY
James J. Shanley

Dec. 16, 1952 J. ECHOLS 2,621,739

SAMPLE CUTTING APPARATUS

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INVENTOR.
JOSEPH ECHOLS
BY

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SAMPLE CUTTING APPARATUS

Joseph Echols, Steubenville, Ohio, assignor to National Steel Corporation, a corporation of Delaware

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16 Claims. (Cl. 164—99)

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

Application Serial No. 127,840, filed November 17, 1949, by James J. Shanley and assigned to the assignee of this application, is related to the present 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 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.

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.

Referring to the drawings, Figure 1 is a transverse sectional view through apparatus embodying the principles of the present invention;

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Figure 2 is an end view, partially in section, of the apparatus of Figure 1 and taken as shown by line 2—2;

Figure 3 is a sectional view taken along line 3—3 of Figure 1;

Figures 4 to 10, inclusive, are each fragmentary sectional views taken along the lines of like number on Figure 1;

Figure 11 is an enlarged fragmentary sectional view taken along line 11—11 of Figure 1.

Referring more particularly to Figures 1 to 11, inclusive, the apparatus for taking samples from moving strip such as the strip S includes a housing or drum 20 rotatably mounted on trunnions 21 and 22 for rotation about a longitudinal axis 23. Sample cutting means 24 is mounted within the housing 20 and is movable from a non-cutting position within the housing outwardly into a cutting position by power-actuated means 25. A motor 26 is supported within housing 20 for rotating the cutting means and the motor 26 and the means 25 are actuated through a control circuit including manually operable switches 28 and 29 for actuating the cutting means 24 to cut a sample from the strip. The housing 20 is supported by a suitable framework 30 which is movable transversely of the direction of strip travel so that the cutting means 24 can be moved transversely of the strip to position the cutting means to cut a sample from the central portion of the strip or from either edge portion of the strip as may be desired.

The housing or drum 20 includes a cylindrical portion 32 having an external cylindrical surface 33. A plate 34 is fastened to one end of the cylinder 32 and carries the hollow trunnion 22 rotatably mounted in the supporting framework 30. A plate 35 is fastened to the opposite end of the cylinder 32 and carries the trunnion 21 which also is rotatably mounted in suitable bearings in the supporting framework 30. The continuously moving strip S is supported and moved along its path of travel at a relatively high speed by means of power-driven roll means of the type customarily used in steel plants and other plants for supporting and propelling strip along a path. Rolls at 38 and 39, which may be driven, are provided for guiding the strip part way around the surface 33. As shown, the strip S extends about surface 33 through an angle of about 90°, but the angle may be greater or less. The strip S is under tension, and it rotates the housing 20 so that the peripheral speed of housing 20 is equal to the speed of the strip S. The housing 20 rotates about axis 23 which is the longitudinal axis

of trunnions 21 and 22 and the longitudinal axis of the cylindrical surface 33.

Within housing 20 and within cylindrical surface 33 there is mounted the sample cutting means 24. A post 41 is connected to cylinder 32 and has mounted thereon a sleeve 42. The sleeve 42 is slidably mounted on post 41 for movement along a line normal to axis 23. In the opposite end of sleeve 42, there is mounted a cup 43 in which there is rotatably mounted a cutter 45. In the cutter 45, Figure 11, there is mounted a sample ejector or pusher 46 which is urged outwardly by a compressed spring 47. An outwardly projecting shoulder 49 is provided on ejector 46 which cooperates with an annular ring 50 in cutter 45 to retain ejector 46 in the cutter. The ejector 46 has limited inward and outward movement so that after the cutter 45 has cut a sample the ejector 46 can and will push the sample outwardly from the strip.

A member 52 is mounted in cylinder 32 and carries the electric motor 26 which is connected through a flexible shaft 54 to a short bearing shaft 55 which extends through an opening in the base of cup 43 and is connected to the cutter 45. When motor 26 is energized, the annular cutter 45 is rotated about its axis which is normal to the axis 23, and the extended axis of rotation of cutter 45 intersects the axis 23 and coincides with a diameter of the cylindrical surface 33.

A cutter opening 57 is provided in the periphery of the cylinder 32 and in alignment with cutter 45. The cutting means 24 is movable from a non-cutting position inside of surface 33 outwardly through opening 57 for cutting a sample from the strip S. The sleeve 42 is connected to one end of a lever 58 which is pivotally supported at 59. The other end of lever 58 is connected to the end of a plunger 60 of the solenoid 25. Springs 61 urge plunger 60 upwardly and sleeve 42 downwardly, as shown in Figure 1, so that the cutting means is held normally in the non-cutting position inside of surface 33. When solenoid 25 is energized, the plunger 60 is moved outwardly and downwardly against the springs 61 to raise sleeve 42 and move the cutter 45 outwardly through opening 57 and against the strip S to the sample cutting position. The longitudinal axis of sleeve 42 coincides with the axis of rotation of cutter 45 so that cutter is movable back and forth along the axis of rotation of the cutter and along a diameter of the surface 33 in a path normal to axis 23. The solenoid 25 is fastened to a member 63 mounted in cylinder 32. The solenoid 25, cutting means 24 and motor 26 are all movable with cylinder 32 about axis 23. The cutter 45 revolves about axis 23 and motor 26 and solenoid 25 may be mounted so as to revolve about axis 23 instead of being mounted for rotating on axis 23, as shown.

As shown more clearly in Figures 2 and 3, the strip S moves through a predetermined arcuate path about axis 23 and extends part way about the cylindrical surface 33 through an angle of about 90°. The apparatus includes control means for preventing the cutting means from being moved outwardly to the cutting position except when the cutter 45 is facing outwardly toward the strip S or except when the cutter is in or almost in the same quadrant as the strip. On plate 63, there is mounted a bearing 67 in which is rotatably mounted one end of a shaft or arm 68 which extends through hollow trunnion 22. On the frame 30, there is a bracket 69 which holds key 70 which engages shaft 68 to prevent shaft 68 rotating with cylinder 32. The shaft 68 is stationary and carries electrical control means at 72 within a cover 73 mounted on member 63.

Referring to Figures 1 to 11 and more particularly to Figure 9 on shaft 68, there is mounted a non-conductive segment 75 which supports an arcuate conductive member or switch contact member 76 connected through wire 77 to one side of a source of electric current. In cover 73, there is mounted an annular non-conductive ring 78 supporting an annular conductive ring or contact member 79. The internal surface of ring 79 has the same radius of curvature as and is in electrical contact with the external surface of member 76. Ring 78 is connected through wire 80 to one side of cutter motor 26 and is connected through wire 80 and wire 81 to the solenoid 25. Thus, both the motor and solenoid 25 are normally connected through electrical contacts 79 and 76 to wire 77 and one side of a source of electric current.

Referring more particularly to Figures 1 and 6, an electrical contact 84 is mounted on and insulated from shaft 68 substantially the same as contact 76. Contact 84 is connected through wire 85 to normally open switch 29 which is connected through wire 86 and wire 87 to the other side of the source of electric current. An annular conductive ring contact 89 is mounted in cover 73 and is insulated therefrom by a non-conductive insulating ring 90. The ring 89 has internal surface that is always in electrical contact with contact 84 so that the ring 89 is electrically connected to the source of electric current when switch 29 is closed. Contact ring 89 is connected through wire 91 to the opposite side of motor 26. Thus, when switch 29 is closed, motor 26 is energized and cutter 45 is rotated.

Referring more particularly to Figures 1 and 8, the shaft 68 carries a non-conductive member 92 which insulates and supports on the shaft 68 an electrical contact 93. Contact member 93 is connected through wire 94, normally open switch 28 and wire 87 to the source of electric current. The cover or housing 73 carries an annular, non-conductive ring 95 which supports an arcuate contact segment 96 having an internal surface with the same radius of curvature as the external surface of contact 93. The contact 93 is stationary and the contact 96 moves past and is in electrical engagement with contact 93 only when cutter 45 is facing outwardly toward the strips. Contact 96 is connected through wire 97 to a timer 98 which is normally electrically connected to the solenoid 25. The timer 98 may be of any suitable type and is normally closed but automatically opens a predetermined period after being energized to de-energize solenoid 25 when switch 28 is held closed so that the closing of switch 28 will cause only one sample to be taken.

Normally, when it is desired to cut a sample from the strip S, the operator will simultaneously close switches 28 and 29. The closing of switch 29 energizes motor 26 to rotate the cutter 45 about its axis. The closing of switch 28 connects the electrical contact 93 to wire 87 and when the contacts 92 and 96 are in engagement, the timer 98 and solenoid 25 are energized. Upon energization, the solenoid 25 raises sleeve 22 and cutting means 24 to move the cutter 45 through the opening 57 and against the strip S. The rotating cutter 45 cuts a disc sample from the strip, and, as the cutter cuts through the strip, the ejector

46 pushes the sample outwardly. With this arrangement of electrical contacts 93 and 96, the cutter is only moved outwardly when it is facing toward the strip and is positioned relative to the strip for properly cutting a sample. The total angular length of contacts 93 and 96 is equal in degrees to the angle through which the strip extends about and in engagement with the cylindrical surface 33. As shown, contacts 93 and 96 engage each other through slightly more than 90° of each rotation of the cylinder 32. These electrical contacts may be of the same length, or contact 93 may be relatively long, and contact 96 may be relatively short, as long as the contacts only engage each other while the strip is in contact with or very close to the cylindrical surface 33.

Closing switch 28 also energizes timer 98. Timer 98 automatically disconnects the solenoid 25 from wire 97 and switch 28 after one sample has been cut and holds the circuit open for a predetermined period to prevent the operator accidentally cutting a series of samples upon inadvertently holding the switch 28 closed for a longer period than is required to cut one sample. The strip S often will be moving at such a high speed that it would be very difficult for an operator to release switch 28 fast enough to prevent cutting more than one sample if timer 98 were not interposed in the electrical control circuit to hold the circuit open long enough to permit the operator to release the switch.

As shown and described, the cylinder 32 presents a continuous cylindrical surface 33 except for the opening 57. The cylindrical surface 33 need not be continuous as long as it has sufficient continuity to present a sufficient amount of surface to cause the strip to move through an arc. It is contemplated that the cylinder 32 could be formed of longitudinally spaced apart circular ribs connected by bracing members or may be formed in any suitable manner to provide an external cylindrical surface of sufficient magnitude to confine the strip to arcuate movement.

At times, it will be desirable to cut samples from the central portion while at other times it will be desirable to cut samples from one or the other edge portions of the strip. The frame 30 is slidably mounted in a base member 99 for movement transversely of the direction of strip travel, and the cutter 45 is laterally movable across the strip to the desired position for cutting a sample from the central portion or either edge portion.

In operation, the cutting means 24 is moved transversely of the direction of the path of the strip to align the cutting means with the central portion or with either edge portion, depending upon where it is desired to cut the sample. With the cutting means 24 properly positioned, the operator may close switch 29 and then close switch 28 or simultaneously close the switches to cut a sample. The closing of switch 29 energizes motor 26 and rotates the cutter 45 about its axis. The closing of switch 28 energizes solenoid 25 and timer 98 when the contacts 93 and 96 are in engagement. If, at the time switch 28 is closed, the cutter 45 is facing away from that portion of the strip S which extends in an arc about the cylindrical surface 33, then contacts 93 and 96 are not in electrical engagement with each other, and the solenoid and timer are not energized. As soon as housing 20 has rotated sufficiently to bring contact 96 into engagement with contact 93, which occurs when the cutter 45 is facing towards the strip, the solenoid 25 and timer 98 are energized. When the solenoid 25 is energized, sleeve 42 is raised and the rotating cutter 45 is moved outwardly along its axis of rotation against the strip, and the cutter cuts a disc-shaped sample from the strip as it rotates with the housing at the same peripheral speed as the strip. As the cutter 45 cuts through the strip, the ejector 46 pushes the sample outwardly. As the cutter 45 moves to the horizontal position, contact 96 moves past contact 93 to de-energize solenoid 25, and the springs 61 turn the cutting means to the non-cutting position with the cylindrical surface 33. Before the housing 20 can rotate through another revolution, the timer 98 automatically disconnects wire 97 from solenoid 25 so that if the operator holds the switch 28 in closed position the solenoid 25 can not be again energized or inadvertently cut additional samples. After a predetermined period, timer 98 automatically reconnects wire 97 to solenoid 25 so that when switch 28 is again depressed solenoid 25 will be energized to cut another sample. The use of timer 98 or other suitable means to automatically disconnect solenoid 25 and render switch 28 inoperative is very desirable. The drum 20 rotates so rapidly that it is difficult, if not impossible, for the operator to press switch 28 and release it after the sample has been cut and before the cutter has rotated into position to cut another sample. The operator can cut as many samples as desired by pressing and releasing switch 28 the same number of times.

In the apparatus of Figures 1 to 11, the cutting means is movable transversely of the strip for selectively cutting a sample from the central portion of the strip or from either edge portion of the strip. In one embodiment, the cutter and housing are both movable transversely of the strip, while in the other embodiment the cutter is movable longitudinally of the housing, but, in both embodiments, there is means supporting the cutter for movement 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 a predetermined arcuate path, a housing having an external cylindrical surface for engaging a surface of the strip as it moves through such an arcuate path, said housing being rotatable about the longitudinal axis of said cylindrical surface, a rotatable sample cutter carried by the housing and movable with the housing about the axis of the cylindrical surface, the sample cutter being supported in the housing for rotation about a second axis normal to the axis of rotation of the housing and power actuated means mounted in the housing for rotating the cutter about the second axis for cutting a sample from the strip as it moves through said path.

2. In apparatus for cutting samples from strip moving through a predetermined arcuate path, a housing having an external cylindrical surface for engaging a surface of the strip as it moves through such an arcuate path, said housing being rotatable about the longitudinal axis of said cylindrical surface, a sample cutter carried by the

housing facing outwardly toward the cylindrical surface for movement with the housing about the axis of the cylindrical surface, means in the housing supporting the sample cutter for movement from an inoperative position within the cylindrical surface outwardly to a cutting position adjacent the cylindrical surface and power-actuated means connected to the sample cutter carried by and rotatable with the housing for moving the cutter from the inoperative position within the cylindrical surface outwardly to the cutting position adjacent the cylindrical surface for cutting a sample from the strip as it moves through said path.

3. In apparatus for cutting samples from strip moving through a predetermined arcuate path, a housing having an external cylindrical surface for engaging a surface of the strip as it moves through such an arcuate path, said housing being rotatable about the longitudinal axis of said cylindrical surface, a sample cutter carried by the housing facing outwardly toward the cylindrical surface for movement with the housing about the axis of the cylindrical surface, means in the housing supporting the sample cutter for movement from a non-cutting position within the cylindrical surface outwardly to a cutting position adjacent the cylindrical surface, and solenoid operated means carried by the housing and connected to the sample cutter for moving the cutter only upon energization from the non-cutting position within the cylindrical surface outwardly to the cutting position adjacent the cylindrical surface for cutting a sample from the moving strip.

4. In apparatus for cutting samples from strip moving through a predetermined arcuate path, a housing having an external cylindrical surface for engaging a surface of the strip as it moves through such an arcuate path, said housing being rotatable about the longitudinal axis of said cylindrical surface, and an annular sample cutter carried by the housing facing outwardly toward the cylindrical surface for movement with the housing about the axis of the cylindrical surface, means in the housing for rotating the cutter about an axis normal to the axis of rotation of the housing, and means for moving the cutter from an inoperative position within the cylindrical surface outwardly along the extended axis of rotation of the cutter to a strip cutting position adjacent the cylindrical surface for cutting a sample from the strip.

5. In apparatus for cutting samples from strip moving through a predetermined arcuate path, a housing having an external cylindrical surface for engaging a surface of the strip as it moves through such an arcuate path, said housing being rotatable about the longitudinal axis of said cylindrical surface, an annular sample cutter carried by the housing facing outwardly toward the cylindrical surface for movement with the housing about the axis of the cylindrical surface, means in the housing for rotating the cutter about an axis normal to the axis of rotation of the housing, and solenoid means operable only upon energization to move the cutter from a non-cutting position within the cylindrical surface outwardly along the extended cutter axis to a cutting position adjacent the cylindrical surface for cutting a sample from the moving strip.

6. In apparatus for cutting samples from strip moving through a predetermined arcuate path, a housing having an external cylindrical surface for engaging a surface of the strip as it moves through such an arcuate path, said housing being rotatable about the longitudinal axis of said cylindrical surface, and an annular sample cutter carried by the housing facing outwardly toward the cylindrical surface for movement with the housing about the axis of the cylindrical surface, an electric motor in the housing for rotating the cutter about an axis normal to the axis of rotation of the housing, and solenoid means operable only upon energization to move the cutter from a non-cutting position within the cylindrical surface upwardly along the cutter axis to a cutting position adjacent the cylindrical surface for cutting a sample from the moving strip.

7. In apparatus for cutting samples from strip moving through a predetermined arcuate path, a housing having an external cylindrical surface for engaging a surface of the strip as it moves through such an arcuate path, said housing being rotatable about the longitudinal axis of said cylindrical surface, means in the housing for cutting a sample from the strip, solenoid means operable only upon energization to move the sample cutting means from a non-cutting position within the cylindrical surface outwardly to a cutting position adjacent the cylindrical surface for cutting a sample from the moving strip, and an electrical control circuit for controlling energization of the solenoid means, said control circuit including a first non-rotatable electrical contact member and a second contact member rotatable with said housing and movable past and in electrical engagement with said first contact only during that portion of each rotation of the rotatable contact and the housing when the cutter is facing outwardly toward the strip, one contact being connected to a source of electric current and the other contact being connected to the solenoid means to close the circuit to the solenoid means only when the contacts are in engagement with each other.

8. In apparatus for cutting samples from strip moving through a predetermined arcuate path, a housing having an external cylindrical surface for engaging a surface of the strip as it moves through such arcuate path, said housing being rotatable about the longitudinal axis of said cylindrical surface, an annular sample cutter carried by the housing facing outwardly toward the cylindrical surface for movement with the housing about the axis of the cylindrical surface, solenoid operated means operable only upon energization to move the annular cutter from a non-cutting position within the cylindrical surface outwardly along the cutter axis to a cutting position adjacent the cylindrical surface for cutting a sample from the moving strip, and an electrical control circuit for controlling energization of the solenoid operated means, said control circuit including a first non-rotatable electrical contact and a second contact rotatable with said housing and movable past and in electrical engagement with said first contact only during that portion of each rotation of the rotatable contact and the housing when the cutter is facing outwardly toward the strip, one contact being connected to a source of electric current and the other contact being connected to solenoid means to close the circuit to the solenoid only when the contacts are in engagement with each other.

9. In apparatus for cutting samples from strip moving through a predetermined arcuate path, a housing having an external cylindrical surface for engaging a surface of the strip as it moves

through such arcuate path extending part way around the cylindrical surface through a predetermined angle, said housing being rotatable about the longitudinal axis of said cylindrical surface, an annular sample cutter carried by the housing facing outwardly toward the cylindrical surface for movement with the housing about the axis of the cylindrical surface, power-actuated means in the housing for rotating the cutter about an axis normal to the axis of rotation of the housing, solenoid means operable only upon energization to move the cutter from a non-cutting position within the cylindrical surface outwardly along said last mentioned axis to a cutting position adjacent the cylindrical surface for cutting a sample from the moving strip, and an electrical control circuit for controlling energization of the solenoid operated means, said control circuit including a first non-rotatable electrical contact and a second contact rotatable with said housing and movable past and in electrical engagement with said first contact only during that portion of each rotation of the rotatable contact and the housing when the cutter is facing outwardly toward the strip, one contact being connected to a source of electric current and the other contact being connected to solenoid means to close the circuit to the solenoid only when the contacts are in engagement with each other.

10. In apparatus for cutting samples from strip moving through a predetermined arcuate path, a housing having an external cylindrical surface, said housing being rotatable about the longitudinal axis of said cylindrical surface, guide means for maintaining a surface of the moving strip in contact with the cylindrical surface as the strip moves through such arcuate path extending part way around said cylindrical surface through a predetermined angle, an annular sample cutter carried by the housing facing outwardly toward the cylindrical surface for movement with the housing about the axis of the cylindrical surface, an electrical motor in the housing for rotating the cutter, a cutter opening in the cylindrical surface in alignment with the outwardly facing cutter, solenoid means operable only upon energization to move the cutter from a non-cutting position within the cylindrical surface outwardly along the last mentioned axis and through said opening to a cutting position adjacent the cylindrical surface for cutting a sample from the moving strip, and an electrical control circuit for controlling energization of the solenoid operated means, said control circuit including a first non-rotatable electrical contact and a second contact rotatable with said housing and movable past and in electrical engagement with said first contact only during that portion of each rotation of the rotatable contact when the cutter is facing outwardly toward the strip, one contact being connected to a source of electric current and the other contact being connected to solenoid means to close the circuit to the solenoid only when the contacts are in engagement with each other.

11. In apparatus for cutting samples from strip moving through a predetermined arcuate path, the combination comprising, a housing having an external cylindrical surface for engaging a surface of the strip as it moves through such arcuate path, said housing being rotatable about the longitudinal axis of said cylindrical surface, a sample cutter carried by the housing facing outwardly toward the cylindrical surface for movement with the housing about the axis of the cylindrical surface, means in the housing for rotating the cutter about an axis normal to the axis of rotation of the housing, solenoid means operable only upon energization to move the cutter from a non-cutting position within the cylindrical surface outwardly along the cutter axis to a cutting position adjacent the cylindrical surface for cutting a sample from the moving strip, an electrical control circuit for controlling energization of the solenoid means, said control circuit including normally open switch means manually operable to a closed position, and timer means interposed in the control circuit and operable a predetermined period after energization of the solenoid means to open the control circuit to prevent re-energization of the solenoid means for a predetermined period.

12. In apparatus for cutting samples from strip moving through a predetermined arcuate path, the combination comprising, a housing having an external cylindrical surface for engaging a surface of the strip as it moves through such arcuate path, said housing being rotatable about the longitudinal axis of said cylindrical surface, a sample cutter carried by the housing facing outwardly toward the cylindrical surface for movement with the housing about the axis of the cylindrical surface, means in the housing for rotating the cutter about an axis normal to the axis of rotation of the housing, solenoid means operable only upon energization to move the cutter from a non-cutting position within the cylindrical surface outwardly along the cutter axis to a cutting position adjacent the cylindrical surface for cutting a sample from the moving strip, an electrical control circuit for connecting the solenoid means to a source of electroplating current and for controlling energization of the solenoid means, said control circuit including a first non-rotatable electrical contact and a second contact rotatable with said housing and movable past and in electrical engagement with said first contact only during that portion of each rotation of the rotatable contact when the cutter is facing outwardly toward the strip, one contact being connected to a source of electric current and the other contact being connected to the solenoid means to close the circuit to the solenoid means only when the contacts are in electrical engagement with each other, normally open switch means interposed in the control circuit, said switch means being operable to a closed position to effect energization of the solenoid means when said contacts are in electrical engagement with each other, and timer means interposed in the control circuit and operable a predetermined period after energization of the solenoid means to open the control circuit and prevent re-energization of the solenoid means for a predetermined period whereby the switch means may be released and the cutting of more than one sample at a time is prevented.

13. In apparatus for cutting samples from strip moving through a predetermined arcuate path, the combination comprising, a housing having an external cylindrical surface for engaging a surface of the strip as it moves through such arcuate path extending part way around the cylindrical surface through a predetermined angle, said housing being rotatable about the longitudinal axis of said cylindrical surface, an annular sample cutter carried by the housing facing outwardly toward the cylindrical surface

and movable with the housing about the axis of the cylindrical surface, an electrical motor in the housing for rotating the cutter, and means supporting the cutter for movement transversely of the strip surface and the direction of strip travel into position for cutting a sample from the center portion of the strip and into position for cutting a sample from either edge portion of the strip.

14. In apparatus for cutting samples from strip moving through a predetermined arcuate path, the combination comprising, a housing having an external cylindrical surface for engaging a surface of the strip as it moves through such arcuate path extending part way around the cylindrical surface through a predetermined angle, said housing being rotatable about the longitudinal axis of said cylindrical surface, an annular rotatable sample cutter carried by the housing facing outwardly toward the cylindrical surface and movable with the housing about the axis of the cylindrical surface, an electrical motor in the housing for rotating the sample cutter, flexible means within the housing connecting the motor and the cutter, and means for moving the cutter from an inoperative position within the cylindrical surface outwardly to a cutting position adjacent the cylindrical surface.

15. In apparatus for cutting samples from strip moving through a predetermined arcuate path, the combination comprising, a housing having an external cylindrical surface for engaging a surface of the strip as it moves through such arcuate path, said housing being rotatable about the longitudinal axis of said cylindrical surface, an annular sample cutter carried by the housing facing outwardly toward the cylindrical surface for movement with the housing about the axis of the cylindrical surface, solenoid means carried by the housing, means in the housing supporting the sample cutter for movement from a non-cutting position within the cylindrical surface of the housing outwardly to a cutting position adjacent the cylindrical surface, and link means connecting the solenoid means and the sample cutter, said solenoid means being operable upon energization to move the cutter from the non-cutting position within the cylindrical surface outwardly to the cutting position adjacent the cylindrical surface for cutting a sample from the moving strip.

16. In apparatus for cutting samples from strip moving through a predetermined arcuate path, the combination comprising, a housing having an external cylindrical surface for engaging a surface of the strip as it moves through such arcuate path, said housing being rotatable about the longitudinal axis of said cylindrical surface, guide means for maintaining a surface of the moving strip in contact with the cylindrical surface as the strip moves through such arcuate path extending part way around the cylindrical surface through a predetermined angle, an annular sample cutter carried by the housing facing outwardly toward the cylindrical surface for movement with the housing about the axis of the cylindrical surface, an electrical motor in the housing for rotating the cutter, a cutter opening in the cylindrical surface in alignment with the cutter, solenoid means in the housing, connected to the cutter, said solenoid means being operable only upon energization to move the cutter from a non-cutting position within the cylindrical surface outwardly along the axis of rotation of the cutter and through the cutter opening for cutting a sample from the moving strip, an electrical control circuit for controlling energization of the solenoid operated means, said control circuit including a first non-rotatable electrical contact and a second contact rotatable with said housing and movable past and in electrical engagement with said first contact through an arc substantially coincidental with said arcuate path of the strip part way around the cylindrical surface so that said second contact is in electrical engagement with said first contact only during that portion of each rotation of the cylindrical housing when the cutter is facing outwardly toward the strip, one contact being connected to a source of electric current and the other contact being connected to the solenoid means to effect energization of the solenoid means only when the contacts are in engagement with each other, normally open switch means manually operable to a closed position interposed in the control circuit between the solenoid means and the source of electric current, and timer means interposed in the control circuit between the solenoid means and the source of electric current, said timer means being operable a predetermined period after energization of the solenoid means to open the control circuit and prevent re-energization of the solenoid means for a predetermined period.

JOSEPH ECHOLS.

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