Nov. 28, 1933. J. F. GEARY ET AL 1,937,473

AUTOMATIC SAMPLER AND TRANSFERRING DEVICE

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FIG. 2.

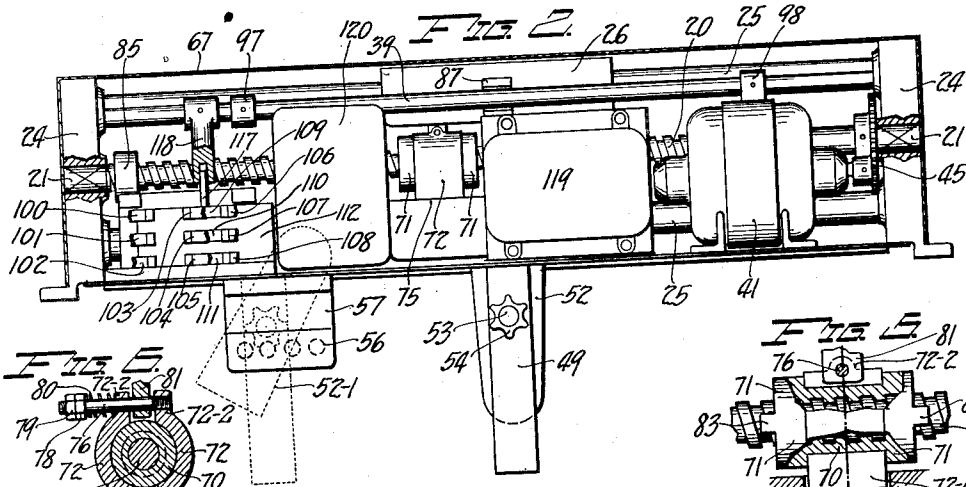


FIG. 5.

FIG. 5.

FIG. 1.

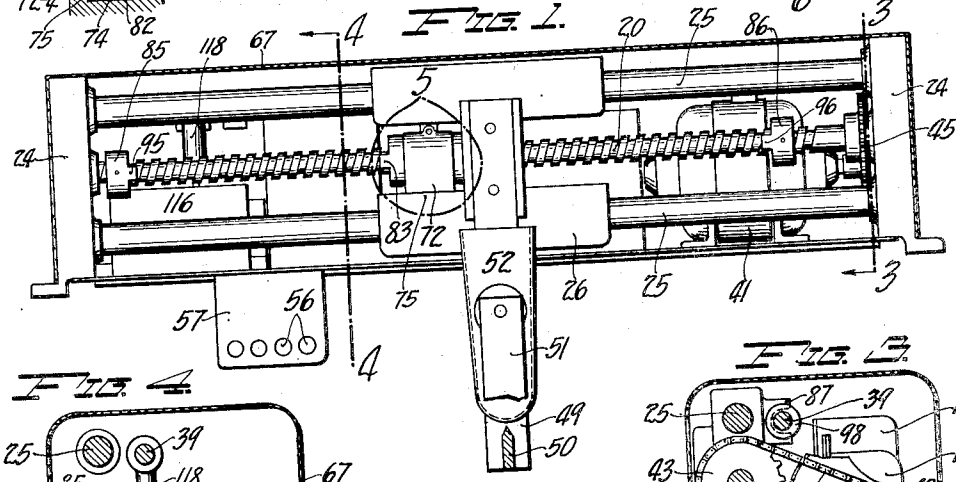


FIG. 4.

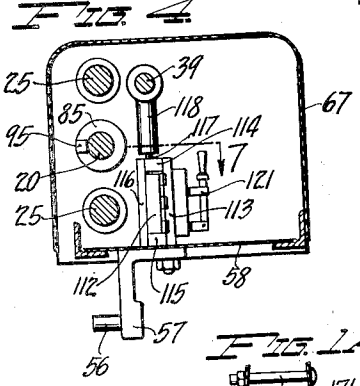


FIG. 3.

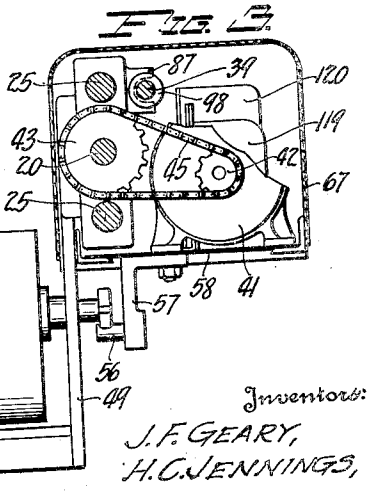
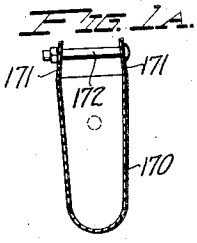


FIG. 1A.



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FIG. 7.

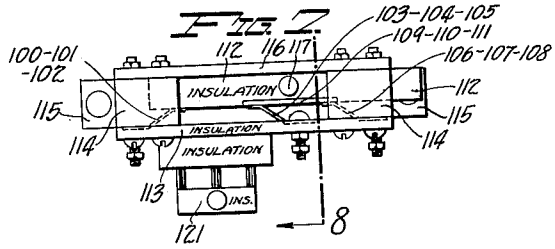


FIG. 10.

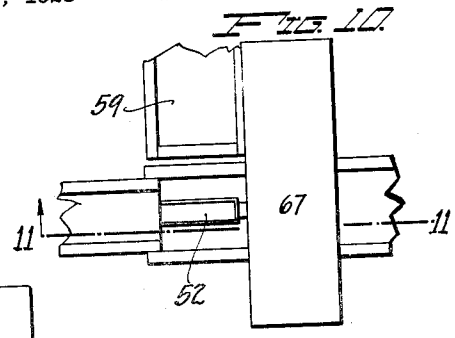


FIG. 8.

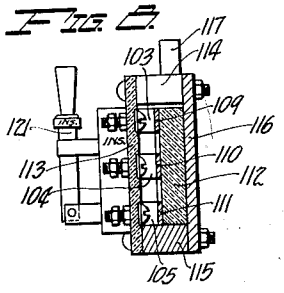


FIG. 14.

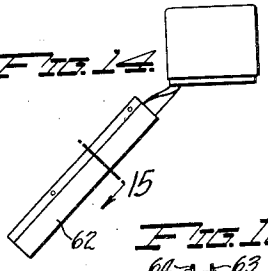
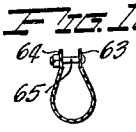


FIG. 15.



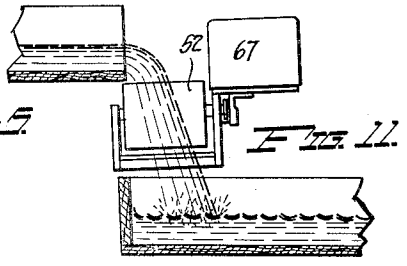


FIG. 11.

FIG. 9.

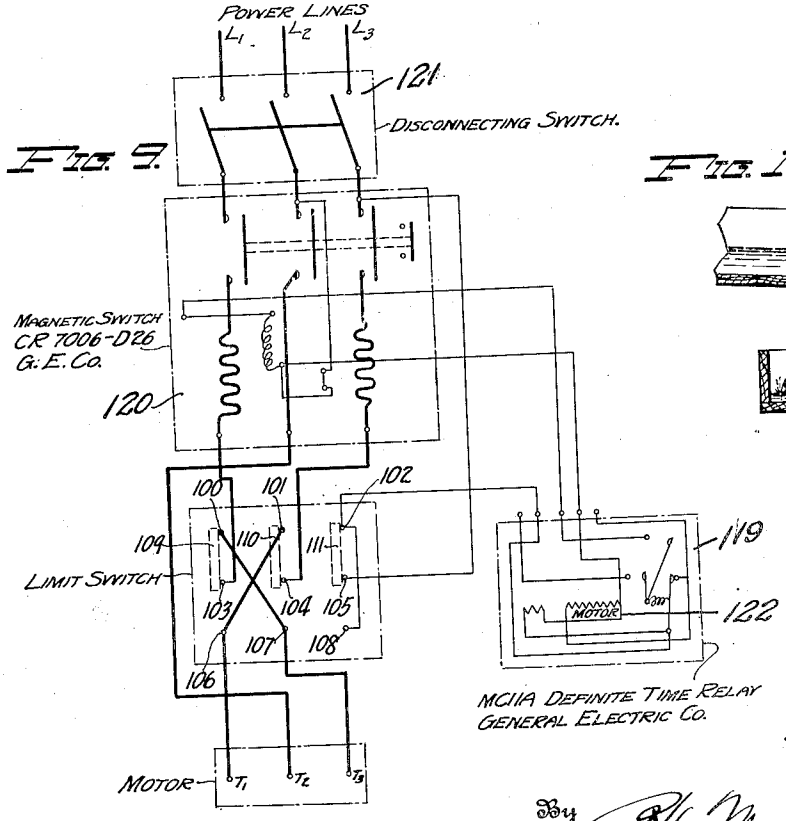


FIG. 12.

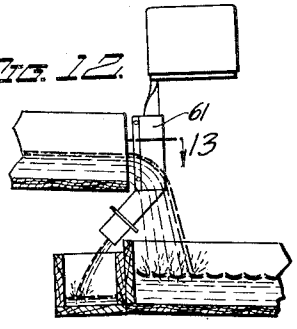
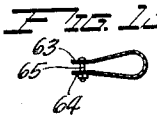


FIG. 13.



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UNITED STATES PATENT OFFICE

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AUTOMATIC SAMPLER AND TRANSFERRING DEVICE

James F. Geary and Harry C. Jennings, Salt Lake City, Utah

Application October 17, 1928. Serial No. 313,074

7 Claims. (Cl. 73—21)

This invention relates to an automatic sampler and transferring device, and its principal objects are:

First. To be fully automatic in its action.

Second. To produce accurate and reliable results.

Third. To be simple and not liable to get out of order when in the hands of unskilled users.

Fourth. To be economical in manufacturing and installation costs.

Fifth. To be adjustable as to the amount of material taken as a sample; adjustable as to the duration of the time intervals between taking periods; and adjustable as to the length of the travel or stroke of the material transferred.

The present application for patent is a combination, and continuation in part, of our applications for U. S. patents, Serial No. 211,705, filed August 9, 1927 and Serial No. 239,560, filed December 12, 1927.

In sampling calculations, the material to be sampled is considered to be a stream or ribbon of uniform cross-section moving at a uniform rate of speed, and the theoretically correct sample consists of slices cut from this stream or ribbon at regular intervals. Each slice consists of an equal amount of material from all parts of the stream, so that the sides of the slice must be parallel to each other, although it is not necessary that the sides be perpendicular to the axis of the stream.

The material to be sampled may be dry, such as crushed ore, coal, cement, etc., flowing in steeply inclined or vertical chutes, or off the end of a belt conveyor, or the material may be in the form of a liquid or semi-liquid, such as ore pulp, flowing in launders.

The sample must be accurately representative of the whole mass of material passing through the plant.

In order to obtain an accurate sample, the cutter, in every instance, must move across the stream (*a*) at regular time intervals; (*b*) in straight lines, not swing in an arc; (*c*) at a uniform rate of speed.

In attaining the objects previously outlined, we provide a properly guided crosshead or carriage. The carriage is propelled along its guide preferably by means of a rotatably mounted screw which engages a threaded sleeve nut rotatably mounted in connection with the carriage. The said screw extends longitudinally of, and substantially parallel with, the guide. The screw may be driven by a small electric motor connected thereto by any well known means, such as a sprocket chain. The motor is reversible and thus the screw may be rotated in either direction. The sleeve nut acts in the capacity of a traction member.

A reversing limit switch, actuated by the carriage when it has reached the end of its travel or stroke in either direction, serves to shut off the current to the motor, and immediately thereafter is moved to reverse the electric circuit. Upon the expiration of a predetermined interval of time, a timing switch causes the reversed circuit to be energized, thereby starting the motor in the reverse direction. When the carriage has reached the opposite end of its stroke, the limit switch is again reversed, bringing it to its first position. This action, alternating the direction of travel of the carriage at the end of each stroke, continues indefinitely.

On the carriage is mounted a sample cutter of any desired kind, such as a spout or a bucket.

In order to prevent the carriage from overtraveling the desired limit point in either direction, a stopping and braking mechanism is employed, whch serves to overcome the momentum of the motor, and to positively stop the rotation of the same when the said limit point is reached by the carriage. This mechanism is operative directly upon the aforesaid sleeve nut, or briefly nut, to lock it upon the screw at the end of every stroke, thereby bringing the carriage to an abrupt stop. The nut is rotatably mounted in relation to the carriage, and moves with it, but normally is prevented from having any rotative motion. This is accomplished by means of an adjustably tensioned brake encircling the nut and having its bearing thereon. The tension is sufficient to normally prevent the nut from turning with the screw, but when the nut is engaged by a stop collar, one collar being adjustably fixed on the screw on each side of the carriage, the nut is locked upon the screw and rotates momentarily within the brake band. The tension upon this band brings the nut with its locked screw, and consequently the motor also, to a prompt though gradual stop.

This sampler is designed for use in connection with the treatment of ores, in the washing of coal, the making of cement, and so on, where it is necessary to secure at regular intervals a sample of the material in process of manufacture in order to effect the proper control of the manufacturing or other operations.

The features of the invention for which the protection of Letters Patent is desired, are col-

lectively grouped in the claims concluding this specification.

In the drawings, which illustrate merely one embodiment of our invention,

Fig. 1 represents the front elevation, the casing and a minor part being in section and the front of the casing omitted; Fig. 1A, a modified detail;

Fig. 2, the rear elevation, reflected from a mirror plane, the back of the casing being omitted;

Fig. 3, a section on line 3—3, Fig. 1, the parts in the background being in elevation;

Fig. 4, a section taken on line 4—4, Fig. 1;

Fig. 5, an enlargement of the portion included substantially within the broken line 5 in Fig. 1, said enlargement being partly sectionalized in the vertical center plane;

Fig. 6, a section taken on line 6, Fig. 5;

Fig. 7, a fragmentary plan viewed from line 7, Fig. 4, and drawn to an enlarged scale;

Fig. 8, a section taken on line 8, Fig. 7;

Fig. 9, an electrical wiring diagram;

Fig. 10, a plan, somewhat in diagram and indicating one way of using the present sampler in connection with a system of sampling launders;

Fig. 11, a section taken on line 11—11, Fig. 10;

Fig. 12, a vertical section taken through a different system of sampling launders, the sampler equipped with a spout instead of bucket, being shown in end elevation;

Fig. 13, an enlargement of the section taken on line 13, Fig. 12;

Fig. 14, an end elevation of the sampler having a spout of modified form; and

Fig. 15, a section taken on line 15, Fig. 14.

Referring to the drawings, the propelling element, preferably a screw in the form of a threaded shaft, is indicated at 20, and the bearings in which the propelling screw rotates, at 21, these latter being conveniently formed in the end frames 24. The end frames are rigidly connected to each other by rods 25, which may serve as guides for the slidable crosshead or carriage 26. The electric motor 41 carries the rigidly mounted sprocket pinion 42, which is connected with the sprocket wheel 43, rigidly mounted on the screw 20, by means of the chain 45.

In order to impart motion to the carriage, the screw 20 has threaded upon it the sleeve nut 70, this nut having formed at opposite ends thereof, the integral flanges 71 and teeth 83 and 84, respectively. Between these flanges is mounted the brake, consisting of shoes 72. The shoes have the lugs 72—3 and 72—4 extending down loosely into the pocket 74, defined within the structure 75, which latter may be integral with the carriage 26. The upper parts of the brake shoes 72 are connected to each other by means of the bolt 76 having one end thereof fastened in the lug 72—1 and passing freely through a hole in the lug 72—2. At its other end the bolt carries the adjusting nut 78 and the lock nut 79.

By means of the nuts 78 and 79, the spring 80, strung on the bolt 76 and arranged to react between the lug 72—2 and the nuts 78, may be adjustably tensioned. When the proper tension is placed upon the spring, the nut 70 will normally be held stationary in the brake, but at other times may be caused to have a restricted rotation in the brake. The bolt 76 also passes loosely through the lug 81, forming preferably an integral part of the carriage 26.

Lugs 72—3 and 72—4 are spaced apart from each other to accommodate a felt oiler 82, which latter may contact the outside surface of the sleeve nut 70 and at the same time dip down into a bath of oil contained in the pocket 74, thus providing lubrication for the sleeve nut bearing. Since the lugs 72—3 and 72—4 are loosely disposed in the pocket 74, they form a connection between the sleeve nut and the carriage, which is not absolutely rigid.

Spaced apart along the screw 20 are the adjustable stop collars 85 and 86, which respectively carry the inwardly projecting rigid teeth 95 and 96 positioned to engage the sleeve teeth 83 and 84, respectively, at the proper times. The collars 85 and 86 are adjustable along the length of the screw 20 by any usual means, such as set screws and may be set to vary the stroke of the carriage as desired. The shiftable rod 39 carries the adjustable collars 97 and 98, which likewise may be provided with set screws, and thus may be set as required to correspond to the positions of the collars 85 and 86, respectively.

The limit switch in effect is similar to an ordinary three-point-double-throw switch and is effective to open and close the power motor circuit. It comprises a slide 112 and a slab 113, both made of insulating material, such as fiber. The slide works between the blocks 114 and the base member 115, these forming spacers between the slab 113 and a back plate 116. On the slab are mounted electric spring contacts 100 to 108, while the slide carries the electrically conductive strips 109 to 111, positioned so as to coact with the said contacts.

With the slide in the position shown in Fig. 7, current may pass from the contacts 103—104—105 through contacts 106—107—108, respectively, or vice versa. When the slide is moved sufficiently far towards the left, current may pass from the contacts 103—104—105 through contacts 100—101—102, respectively, or vice versa, thus making possible, as is well known, a reversal in the direction of flow of the electric current in the power motor circuit, and hence a corresponding reversal in the direction of rotation of the motor.

The slide 112 is actuated by means of the shiftable rod 39, the connection between the two being effected by a pin 117 projecting rigidly from the slide, this pin being secured in a dog 118 rigidly mounted on the shiftable rod.

To follow the operation of this sampler, let it be supposed that the carriage is moving to the left, it being assumed that the adjustable tension upon the brake shoes 72 is sufficient to cause these to grip the sleeve 70 with a force greater than the frictional resistance of the carriage 26 along its guides 25. As a consequence, the sleeve nut is prevented from rotating with the screw, and is therefore carried along by the screw, accompanied by the carriage 26. As soon however, as the extremity of the tooth 83 strikes against the tooth of the fixed collar 85, the sleeve nut can go no farther. This results in the sleeve nut turning with the screw, which overcomes the frictional resistance between the tension shoes 72 and the circumferential surface of the sleeve nut, causing a drag on the motor and bringing the latter to an easy stop. Meanwhile, the forked lug 87, projecting rigidly from the carriage and extending over the shiftable rod 39, will have contacted the set collar 97, and by moving the shiftable rod will have caused the dog 118 to move the slide 112 of the limit switch towards the left into the reversing position. Just before this engagement, the timing switch 119 will have opened the motor

circuit, making it necessary for the brake shoes 72 to overcome only the momentum of the rotating parts of the motor.

As soon as the timing switch again closes the motor circuit, the carriage will commence moving towards the right, and when it reaches the end of its stroke in this direction, the tooth 84 will engage the tooth 96, thereby causing a corresponding repetition of the movements described for the other end of the stroke.

The shifting collars 97 and 98 should be set at substantially a constant distance from stop collars 85 and 86 respectively, when the latter are adjusted to any desired position along the screw 20. The operation of this device is entirely automatic and the cycles of motion are repeated indefinitely so long as current is supplied to the electric circuit.

The control equipment necessary to accomplish the movement of the carriage as just described, consists primarily of an electrical timing relay actuated by a very small (about the size of a walnut) constant speed motor and may be of well known manufacture. For example, in the present instance, the wiring diagram shown in Fig. 9, covers the use of the General Electric Co.'s Definite Time Relay MC11A, indicated at 119 and illustrated and fully described in instruction sheet #GEH—26, which is necessarily accompanied by a magnetic switch such as CR 7006—D26, indicated at 120, and illustrated and fully described in instruction sheet GEJ—137A. Both these instruction sheets are available at any office of the General Electric Company to anyone who may request them.

Any ordinary switch, such as a single-throw-three-point, indicated at 121, may be used to disconnect the apparatus from the power lines.

The detailed actions of the electrical equipment may be briefly summarized as follows:

When the limit switch functions, it reverses the power motor leads 100 and 101, and as the switch blades 109—110—111 move from one position to the other, there is a slight time interval between breaking, for instance, contacts 100, 101 and 102 and making contacts 106, 107 and 108. During this time interval, the magnetic switch 120 opens, thereby disconnecting the power motor 41 from the power lines. The very small constant-speed control motor 122, Fig. 9, runs in its own circuit continually, this circuit being interconnected with the power circuit, and as soon as the predetermined time interval has elapsed, the timing switch 119 is brought into operation by the control motor, which causes the magnetic switch to close, thereby again starting the motor 41, this time, of course, in the reverse direction. When the carriage reaches the opposite end of its stroke, the limit switch is shifted back to its first position, and in the slight time interval of moving from 106, 107 and 108 to 100, 101 and 102, the magnetic switch again opens, which again disconnects motor 41 from the power lines.

In Figs. 1 to 3, a depending arm 49 is shown rigidly attached to the carriage 26, and carrying at its lower end the crossbar 50, on the other end of which is rigidly mounted the standard 51. Pivotally supported in the standard 51 and the arm 49, is the tilting bucket 52, and fast on the bucket pivot 53 is the toothed wheel 54 arranged to engage and mesh with the pins 56 which are rigidly fastened in the bracket 57, this latter in turn, being fastened to the bottom 58 of the housing structure. It will be clear that when the bucket reaches the left extreme of the carriage-travel, that the bucket will be almost or entirely inverted, indicated by dotted lines 52—1, Fig. 2, thereby discharging its contents into a suitable receptacle, such as launder 59, Fig. 10.

Normally, as when receiving a sample, the bucket is substantially in the upright position, as indicated in Fig. 1. The crossbar 50 is beveled along its upper edge so that any part of the sampled material that might otherwise lodge upon it, shall be discharged. The bucket cutter just described, is usually used for ore and the like, crushed to about the size of a nut, this material being accompanied by wet fines. The wet cutter 61, Fig. 12, is intended usually for liquids, such as ore pulps, chemicals, etc.; the dry cutter 62, Fig. 14, for cement, carbide, etc.

The cutters are preferably made of sheet metal bent into substantially the forms shown. Cutters 61 and 62 may be made adjustable by varying the space between the lips 63 and 64, Figs. 13 and 15, respectively. This may be accomplished by forming the sheet metal so lips 63 and 64 shall stand apart a greater distance than the maximum space required, and then reducing the space by screwing up the nuts on bolts 65, these counteracting the natural resiliency of the sheet metal.

It is to be remembered that the length of the stroke of the cutter across any stream to be sampled, may be varied as desired by properly adjusting the position of the stop collars 85 and 86 along the screw 20, as previously mentioned herein.

If desired, the bucket-type sample cutter instead of being made as shown at 52, may have the body 170, Fig. 1A, with the upwardly extending flexible lips 171, so that the space between these lips may be adjustably contracted by means of one or more bolts 172.

It will be noted that the entire driving mechanism may be enclosed in a weather-proof, dust-proof housing or casing 67, preferably made of metal. Only the sample cutter need be exposed.

Recapitulating the operating phase of this sampler, an instance of the motion characteristics of the motor follows:—(*a*) Motor starts in the clockwise direction automatically, by timing relay. (*b*) Motor runs about five seconds, during which time it drives the cutter across the stream to be sampled, a distance of perhaps two feet. (*c*) At the end of the stroke the carriage causes the limit switch to be tripped, and after a short time interval, to be reversed. (*d*) Motor is fully stopped due to the resistance of the spring brake. (*e*) Motor remains at rest a certain period of time, which period should be capable of being varied from about one minute to about fifteen minutes, this variation being obtained by properly adjusting the timing relay. After this period of rest, the motor is automatically started in the reverse or counter clockwise direction, due to the action of the timing relay, and continues to run about five seconds, during which time it drives the cutter back across the stream to its original position, this time tripping the limit switch in the opposite direction, again causing the current to be shut off from the motor, and reversing the limit switch. Here the motor rests again for the desired period, then starts again in the clockwise direction, repeating the cycle just described indefinitely.

By means of this invention, a plurality of samplers in different parts of a plant can be operated simultaneously by one timing relay and magnetic switch serving as a remote control, and placed, for instance, in the superintendent's of-

fice of a plant. Such an arrangement involves only well known details of electric wiring with which every skilled electrician is conversant, and therefore need not be shown, nor further described herein.

While a specific embodiment of this invention is herein shown and described, it is to be clearly understood that all the detailed parts thereof, may or may not be shown in the preferred forms, and further, that the preferred forms may be varied from time to time as the development of this invention and the arts to which it appertains, advance. Therefore the essential and characteristic features of this invention will be readily discernible from the claims in which its spirit is generalized.

Having fully described our invention what we claim is:

1. An automatic sampler, including in combination, guides, a sampling device with a carriage mounted on said guides, a propelling screw spaced apart from and extending substantially parallel to said guides, engaging means between said carriage and said screw, means for imparting rotative motion to said screw, a limit switch effective to cause change in the direction of rotation of said motion imparting means, means for actuating said limit switch at the end of each travel stroke of said carriage, and electric timing relay means adapted to cause the energizing of the motive means after the operation of said limit switch, at predetermined intervals.

2. An automatic sampler including in combination guides, a sampling device with a carriage reciprocatively mounted on said guides, a propelling member substantially paralleling said guides and effective to move said carriage, a braking mechanism effective to engage said propelling member at the end of a travel stroke of said carriage, a reversible motor connected to said propelling member, a limit switch in circuit with said motor, means whereby said limit switch is actuated by said carriage, and a timing switch in circuit with said limit switch and with said motor.

3. A sampler, including in combination, a rotatable propelling screw, a traveling nut engaging said screw, stop members fixed on said screw to intermittently contact said nut, a brake means engaging said nut, a sampling device receiving motion through said nut, an electric motor for rotating said screw, means for reversing said motor after every contact between said nut and a stop member, and an electric definite time relay in circuit with said electric motor and with said reversing means for the purpose of energizing and directionally reversing said motor in accurately determined time periods spaced apart from and alternating with one another.

4. A sampler, including in combination, a rotatable propelling member, a sampling device having a traction member movable along said propelling member, motive means for said propelling member, a limit switch means adapted to control said motive means, shifting mechanism adapted to operate the limit switch means, stops for said traction member, and an engaging member accompanying said traction member, said engaging member being adapted to engage and operate said shifting mechanism when the said traction member has reached definite positions relative to said stops.

5. A sampler, including in combination, a rotatable shaft, a sampling device having a traction element engaged by said shaft, electric motive means connected to said shaft, a limit element operative to open the electric motive means circuit, engaging means between said limit element and said traction element, and electric time relay operative to cause the closing of the electric motive means circuit.

6. In an automatic sampler, a sample cutter having lips spaced apart from each other, means for adjustably varying the space between said lips, means for mounting said cutter for reciprocative motion, means for imparting motion to said cutter, an electric limit switch in circuit with the motion-imparting means and which is operative to stop the motion of said motion-imparting means, and an electric timing switch in circuit with the motion-imparting means, said electric timing switch being operative to energize said motion-imparting means.

7. A sampler, including in combination, a rotatable propelling screw, electric motive means connected thereto, a sampling device having a traction nut engaging said screw, a brake means in which said nut is rotatable but normally held against rotation, stop members effective to engage said nut thereby causing the nut to rotate with said screw, a limit switch for controlling said electric motive means, shifting mechanism for said limit switch, an electric definite timing relay, a magnetic switch operatively connected to the timing relay, the said timing relay and magnetic switch being in circuit with said electric motive means and said limit switch, and means whereby said shifting mechanism is actuated when said traction nut has reached certain predetermined positions relatively to said stop members.

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