Patented Oct. 4, 1938

2,132,311

UNITED STATES PATENT OFFICE

2,132,311

APPARATUS FOR SURFACE TREATING METAL ARTICLES

Verne Elwood Minich, Mishawaka, Ind., assignor to The American Foundry Equipment Company, Mishawaka, Ind., a corporation of Delaware

Application July 10, 1935, Serial No. 30,600

12 Claims. (Cl. 51—9)

This invention relates to apparatus for surface treating metal articles.

The invention relates particularly to apparatus for cleaning, hardening, roughening or otherwise treating the surface of metal sheets, billets and other metal articles by the abrasive effect of a stream of abrasive particles projected against such surfaces at relatively high velocities.

In the abrasive-treating of the surfaces of metal articles, I propose to employ one or more rotary abrasive-throwing wheels, so mounted that the wheels may be easily manipulated so that the thrown abrasive will most effectively and advantageously attack the work. The apparatus herein described can be economically and effectively used in various treating operations, such as cleaning, hardening and roughening metallic sheets, billets and other hard objects.

Where a rotary wheel is employed, it is desirable that the wheel and associated apparatus for handling the articles to be treated be so designed as to be compact and rugged, and permit the obtaining of the maximum utilization of the wheel or wheels, and at the same time permit considerable flexibility in the operation thereof, so that articles of various sizes may be treated in a single installation.

In apparatus of the class to which this invention relates, it is especially desirable that the abrasive-throwing wheels be disposed along the path of travel of the articles along a production line so that all of the surfaces of the articles may be treated in the course of a single trip through the apparatus, thus permitting maximum speed of operation and maximum efficiency of the apparatus.

Another desideratum of this class of apparatus is that the apparatus should be adaptable to operate with maximum efficiency upon sheets, billets or the like of various sizes, with simple adjustment, whereby a minimum amount of apparatus may be employed in a mill producing a large variety of sizes of articles.

The present invention concerns apparatus comprising a conveyor for transporting articles such as sheets and billets along a predetermined path, and a plurality of abrasive-throwing wheels mounted adjacent the conveying means in positions to project the abrasive against all surfaces of the sheets or billets.

Another feature of the invention is the provision of suitable mounting means for the wheels, whereby they may be adjustably positioned to change the positions of the abrasive streams relative to the respective surfaces of the articles to be treated, thus permitting maximum utilization of the abrasive streams projected by the wheels.

Another feature of the invention is the provision, in one embodiment of the invention, of an arrangement of a plurality of wheels so arranged that a minimum number of wheels are adapted to treat a plurality of sheets or billets.

Various other features and advantages of the invention will be apparent from the following particular description and from an inspection of the accompanying drawings, wherein:

Fig. 1 is a top plan view of an apparatus constructed according to the invention;

Fig. 2 is a side elevational view of the apparatus in Fig. 1;

Fig. 3 is an enlarged vertical cross-section, taken along the line 3—3 of Fig. 2;

Fig. 4 is a vertical section taken along line 4—4 of Fig. 3;

Fig. 5 is a top plan view of a portion of the apparatus shown in Fig. 4;

Fig. 6 is a horizontal cross-sectional view taken along the line 6—6 of Fig. 4;

Fig. 7 is an enlarged vertical cross-sectional view of the abrasive throwing wheel, this view being taken along the line 7—7 of Fig. 3;

Fig. 8 is a diagrammatic view of the apparatus, illustrating the manner in which the wheels may be arranged when relatively wide sheets are to be cleaned;

Fig. 9 is a diagrammatic side elevational view of the apparatus shown in Fig. 8;

Fig. 10 is a diagrammatic vertical cross-sectional view of an apparatus showing an arrangement of wheels for simultaneously treating the face and the edges of a sheet or plate; and

Fig. 11 is a fragmentary view, partially in cross-section, of another device for cleaning the edges of sheets or billets.

In the drawings accompanying and forming part of this specification, certain specific disclosure of the invention is made for purposes of explanation, but it will be understood that the details may be modified in various respects without departure from the broad aspect of the invention.

The apparatus illustrated in Figs. 1 to 6, inclusive, shows a conveyor C adapted to transport horizontally a pair of sheets or billets S_1 and S_2 past two spaced abrasive wheel assemblies W, each consisting of three wheels 50, 150 and 250 (Fig. 4), adapted to project streams of abrasive against both sides of both of the spaced sheets and past a plurality of spaced edge-treating mechanisms V, each having a wheel 350 adapted

to project a stream of abrasive against the edges of the sheets.

Referring to Figs. 1 and 2, the conveyor C comprises a side frame 1 having supporting legs 3 and 4, and a somewhat similar parallel side frame 2 having supporting legs 5 and 6. Journalled in spaced bearings 7 and 17, supported by the side frames 1 and 2, are upper and lower sets of supporting rolls 8 and 18, which constitute upper and lower conveyors for supporting sheets (indicated at S_1 and S_2).

The driving arrangement comprises upper and lower pinch rolls 9 and 10, supported in bearings 11 and 12 supported by the end portions of the side frames 1 and 2. The upper and lower stationary pinch rolls 9 and 10 cooperate with movable pinch rolls 13 and 14, rotatably mounted in bearing blocks 15 and 16, slidable in the side frames and urged apart by a spring 19 to move the rolls 13 and 14 toward their respective cooperating upper and lower stationary rolls 9 and 10 to constitute means for advancing the sheets S_1 and S_2. The upper and lower stationary rolls 9 and 10 are rotated by a suitable driving means (not shown).

The wheel assembly W is carried on a vertical standard 20 secured in a suitable base 21 (see Figs. 3–7). Supported on the standard 20, at a point between the levels of the upper and lower sets of rolls 8 and 18, is a sleeve 22 having a securing pin 23 extending therethrough and engaging the standard 20 to fixedly retain the sleeve in adjusted position. Formed integral with the sleeve 22 is a horizontally extending bracket 24 having dove-tailed grooves 25 formed in its top surface, and receiving a table 26 having corresponding dove-tailed arcuate edges. Supported on the table 26 is a motor 30 having a shaft 31 which carries a pulley 32 driving a multiple belt 33 trained over a pulley 34 carried on a shaft 35. The shaft 35 is journalled in bearings 36 and 37 formed integral with the brackets 38 and 39 supported on the upper surface of the table 26. Mounted on the shaft 35 is an abrasive-throwing wheel 50 which will be described more in detail hereinafter.

An adjusting arrangement 40, for positioning the table 26 on the supporting bracket 24, comprises an arcuate rack 41 formed on the lower surface of the table 26, with which meshes a pinion 42 carried on a shaft 43, which is journalled in bearings 44 and 45 formed integral with the bracket 24.

A hand wheel 46 is secured to the end of the shaft 45 for rotating the same to rotate the pinion 42, and thus slide the table 26 angularly about the bracket 24, in a manner which will be apparent, to thus swing the wheel 50 angularly about a vertical pivot passing centrally of the wheel.

The wheel 50 (Figs. 3 and 7) comprises a hub portion 51 supporting spaced, parallel, side plates 52 and 53 of disc form, secured in spaced relation by spacing studs 54, and having secured therebetween a plurality of radially-extending abrasive projecting blades 55, which extend from the periphery of the plates 52 and 53 to a point inwardly short of the axis of the plates 52 and 53 to define a central space. Also secured to the hub 51 is an impeller 56 having a plurality of radially-extending impelling vanes 57 terminating short of the inner ends of the blades 55.

Interposed between the outer ends of the impelling vanes 57 and the inner ends of the blades 55, is a relatively stationary cylindrical control cage 58, which may comprise an outer cylindrical member 59 and an inner cylindrical member 60, which control cage 58 is mounted by suitable means (not shown), and does not rotate with the several members carried by the hub 51. The outer cylinder 59 is provided with substantially diametrically opposite abrasive discharge openings 61 and 62 in the tubular side wall thereof, each extending a substantial distance circumferentially, and the inner cylinder 60 is provided with diametrically opposite abrasive discharge openings 63 and 64 adapted to register with the openings 61 and 62, but which do not extend as great a distance circumferentially as the openings 61 and 62.

The cylinders 59 and 60 are provided with individual supporting members 65 and 66, whereby the cylinders may be rotated relatively to one another to close either one or the other, or both, of the outlets defined by the openings 61 and 63 and openings 64 and 65, respectively.

A suitable feed pipe 67 is mounted adjacent the control cage 58, and is adapted to supply abrasive to the interior of the control cage 58, wherein the abrasive is engaged by the blades 57 of the impeller 56, and thrown out through the openings 61 and 63, and also through the openings 62 and 64, when the cylinders 59 are in the position of adjustment shown in Figs. 3 and 7.

It will now be seen that, when the motor 30 is energized, the shaft 35 will be rotated and will rotate the assembly constituted by the hub 51, the side plates 52 and 53 and the blades 55 and the impeller 56. If abrasive is fed through the inlet pipe 67, the impeller vanes 57 will throw the abrasive out through the upper and lower outlets, above-described, to provide upper and lower streams of abrasive (indicated respectively by *a* and *b* in Fig. 7), impinging against the sheets S_1 and S_2, respectively.

If the outer cylinder as shown in Figure 3 is rotated in a clockwise direction relative to the inner cylinder through an angle of approximately 45°, the upper outlet will be closed and the lower outlet will remain open, thereby preventing the abrasive from being thrown outwardly, and only the stream *b* will be projected. On the other hand, if the outer cylinder is rotated in a counterclockwise direction 45° from the position shown in Fig. 3, the lower outlet will be closed and the upper outlet will remain open, thereby discontinuing the lower stream of abrasive *b*, and permitting the upper stream to continue. If the outer cylinder is moved approximately 75° in either direction relative to the inner cylinder, both streams will be closed off and no abrasive will be projected by the wheel.

The upper wheel 50 is also supported for pivotal adjustment relative to a vertical axis through the wheel. Mounted on the standard 20, above the sleeve 22, is a sleeve 70 which may be locked into any desired position of adjustment by a pin 71 extending through the sleeve 70 and into a suitable opening in the standard 20. The sleeve 70 is formed integral with a horizontal arm 72, at the free end of which is formed a bearing 73 and a rotatable stub shaft 74, on the lower end of which is carried a sleeve 75. Formed integral with the sleeve 75 is a horizontally-extending bracket 76 having an offset arcuate arm 77, the free end of which is slidable on a supporting bracket 78 formed integral with the sleeve 70. A supporting plate 79 is secured to the bracket 76 and the arm 77, and carries a motor 80 driving a shaft 81, on which is carried

a pulley 82, which in turn drives a multiple belt 83, trained over a second pulley 84 carried on a horizontal shaft 85. The shaft 85 is journalled in bearings 86 and 87 supported from triangular brackets 88 and 89, depending from the bracket 76 and the supporting plate 79, respectively.

Carried on the outer end of the shaft 85 is a wheel 150, which may be similar to the wheel 50, previously described, or the wheel may be similar to the wheel 210a illustrated in Figure 10 hereafter described. The wheel 150 is adapted to project the stream of abrasive c downwardly against the surface of the sheet S_1 when the motor 80 is energized. Where a wheel having a double-cylinder control cage, such as that disclosed in Fig. 7, is employed, the control cage will be adjusted so that the upper outlet will be closed; and, if desired, a wheel having a single-cylinder control cage may be substituted.

Attached to the arcuate arm 77 is an arcuate rack 90, which meshes with a pinion 91 carried on a stub shaft 92 journalled in a bearing 93, which is formed integral with the sleeve 70. The hand wheel 94, fixed on the shaft 92, permits rotation of the pinion 91 to effect angular movement of the rack 90 and to slide the arcuate arm 77 along on the supporting bracket 78. This movement of the arm 77 effects corresponding angular movement of the bracket 76, and the wheel 150 is moved angularly about a pivot passing vertically about the center of the wheel.

The lower wheel 250 may be supported in a manner similar to either of the wheels 50 or 150, but for the purpose of illustration a third type of supporting arrangement is disclosed.

Supported on the standard 20 below the level of the bottom sheet S_2, is a sleeve 100 adjustably secured in fixed position by a pin 101, which sleeve 100 has a table 102 formed integral therewith. At the outer end of the table 102, is a bearing 103 in which is journalled a rotatable stub shaft 104 carrying a collar portion 105 formed integral with a table 106. The table 106 has a depending flange 107 adapted to engage the arcuate edge of the table 102 for guiding the table 106 for pivotal movement on the table 102.

Supported on the table 102 is a plate 108 on which is mounted a motor 110 driving a shaft 111 which carries a pulley 112, which in turn carries a multiple belt 113 trained over a second pulley 114 carried on a horizontal shaft 115. The horizontal shaft 115 is rotatably mounted on bearings 116 and 117 supported on triangular brackets 118 and 119, respectively, and carries a wheel 250 which is similar to the wheel 50 described in detail in the foregoing specification.

Where a wheel having a double-cylinder control cage is employed, the upper opening only will be opened, whereby a stream of abrasive d is projected only in an upward direction against the lower surface of the sheet S_2 carried by the rolls 18.

Formed on the lower surface of the table 106 is an arcuate rack 125, with which meshes a pinion 126 carried on a pin 127 journalled in a suitable bearing (not shown) in the table 102. A suitable crank 130 is connected to the shaft 127 for rotating the pinion to move the table 106 angularly about the pivot provided by the stub shaft 104.

From the foregoing it will be seen that each of the three wheels 50, 150 and 250 may be angularly adjusted about a pivot passing vertically through the center of the wheel, and thus each of the wheels may be moved to any one of a number of positions between the positions indicated in full lines and in broken lines, respectively, in Fig. 5.

When the wheel is in a position such that its axis of rotation lies in a direction extending parallel to the direction of movement of a sheet on the conveyor, the impingement pattern of the stream of abrasive projected against a sheet on the conveyor has a maximum dimension transversely of the sheet. When the wheel is moved to other positions of adjustment, wherein the axis of rotation of the wheel extends at an angle to the direction of travel of the sheet, the transverse limits of the impingement pattern, relative to the sheet on the conveyor, are considerably closer together than when the wheel is in the other position of adjustment. Thus the transverse limits of the impingement pattern may be varied to coincide with the side margin sheets of widths varying from a width substantially equal to that of the sheet shown in full lines in Fig. 5, to that of a sheet having a width equal to that indicated in broken lines.

For the purposes of illustration, the shape and dimensions of the impingement pattern have been assumed to be substantially that of the area of an axial cross-section of the wheel, but it will be understood that the shape and dimensions of the pattern varies with the peripheral length of the discharge outlet in the control cage 58, and that this pattern need not necessarily coincide with the cross-sectional area of the wheel.

It further will be noted that the three wheels 50, 150 and 250 are disposed in vertical alignment substantially in a plane passing intermediate two sets of rolls 8 and 18, and thus the wheels 50 and 250 project their respective streams of abrasive a and d against the upper and lower sheets S_1 and S_2 respectively through the space between the rolls 8 and 18, and none of the abrasive is projected against the rolls. Also, because of this positioning of the wheels, if the wheels 50 and 150 should, for any reason, be operated during the time when no sheets are disposed on the rolls, the abrasive streams projected downwardly from these wheels would not impinge upon these rolls. Because of this arrangement of the wheels, there is little or no tendency for the rolls to be worn away by the abrasive streams.

The arrangement of the wheels in vertical alignment ensures that an equal force, due to the abrasive, is applied simultaneously to the upper and lower faces of the sheets. Hence, there is no tendency for the sheets to buckle due to the force applied thereto by the stream of abrasive.

The sleeves 22, 70 and 100, which support the wheels 50, 150 and 250 on the standard 20, are constructed to be both slidable and rotatable on the standard when their respective locking pins 23, 71 and 101 are withdrawn. Thus, the wheels may be individually swung out of operative position for the purpose of adjustment or repair. Furthermore, if desired, the height of any individual wheels relative to the conveyor may be adjusted by suitable adjustment of the respective sleeve on the standard. For the purpose of adjustment of the wheels, relative to the standard, suitable openings 20a as shown more particularly in Figs. 5 and 6 may be provided in the standard. Furthermore, other types of securing means for locking the sleeves in the desired positions on the standard may be provided, as will be understood by those skilled in the art.

As set forth above, any desired number of wheel

assemblies may be provided as are found necessary to suitably clean the sheets passing through the apparatus, and within the present embodiment two such assemblies, W_1 and W_2, are shown, both of which preferably are identical in construction.

The edge-treating wheel assembly V comprises a bracket 151 secured on the side frame 1 and supporting a horizontally-disposed wheel 350 and a driving motor 152 suitably connected to the wheel 350; a feed conduit 153 is supported adjacent the wheel 350 for supplying abrasive thereto.

A wheel assembly 350 is provided adjacent each side of both upper and lower rolls 8 and 18 in position to project a stream of abrasive horizontally against the edges of the sheets S_1 and S_2 supported by the conveyor C to thereby treat the edges of these sheets as the sheets are moved past the level of the wheels. A sufficient number of wheel assemblies is provided adjacent each edge of the sheets so that the surface of the edge is subjected to the impinging action of a stream of abrasive for a sufficient period to thoroughly treat it.

A suitable housing or housings (not shown) may be provided for inclosing the wheel assemblies. Preferably an individual housing is provided for each assembly with suitable arrangement being made for permitting the passage therethrough of the sheets and for collecting the spent abrasive.

Also, a suitable arrangement may be provided for supplying abrasive to the several feed conduits, which may take the form of a flexible conduit or adjustably mounted, rigid conduit.

It is also within the contemplation of the invention to provide for treating bars and other shapes of elongated metal articles in addition to sheets. Such articles may be treated by the apparatus disclosed with suitable modifications in the conveyor rolls and the pinch rolls, so that the articles will be securely positioned in the proper position to receive the stream of abrasive.

Where it is desired to treat sheets of such widths that it is impractical to employ a wheel having an impingement pattern long enough to extend laterally the entire width of the sheet, another arrangement of wheels may be made so that the sheet may be treated in a single trip through the apparatus. Such an arrangement is shown diagrammatically in Figs. 8 and 9, wherein a plurality of spaced rolls 200 are arranged to support a sheet S_3 having a width several times the width of the impingement pattern of an abrasive-throwing wheel. Disposed above the rolls 200 are three abrasive-throwing wheels 201, 202 and 203 which are arranged in echelon, being staggered longitudinally and transversely of the sheet S_3 supported on the conveyor.

The wheels 201, 202 and 203 are disposed angularly with respect to the sheet S_3 in such a manner that the abrasive stream projected by each wheel impinges against one-third of the surface of the sheet, the two outer wheels 201 and 203 each thus treating the marginal outer third of the sheet, and the central wheel 202 treating the center third of the sheet.

Preferably a second set of wheels (not shown) is provided below the sheet and disposed similarly to the wheels 201, 202 and 203 (shown), for the purpose of treating the lower surface of the sheet simultaneously with the treatment of the upper surface, thus providing for a complete treatment of the sheet in a single trip through the apparatus.

In Fig. 10 is shown an arrangement by which one surface and the edges of a sheet may be treated simultaneously by the use of two wheels. The wheels 210*a* and 210*b* each consists of a pair of side plates 211 carrying radially-extending blades 212 and a rotatable impeller 213, having impeller vanes 214 and a stationary control cage 215 disposed between the ends of the vanes 214 of the impeller, and the blades 212. The control cage 215 has a discharge opening 216 in the tubular side wall thereof through which abrasive is projected from the impeller 213 into the path of the blades 212. A suitable arrangement (not shown) is provided for rotating the side plates 211 which carry the blades 212 and also the impeller 213.

The wheel 210*a* is disposed above the sheet S_4, which rests upon a suitable conveyor 219 and slightly to one side of the sheet in a position to project a stream of abrasive *p* against the left-hand half of the upper surface of the sheet S_4 and also the left-hand edge thereof.

The wheel 210*b*, which is similar in all respects to the wheel 210*a*, is disposed in a corresponding but reversed position above and slightly to the right of the sheet, and is positioned and adjusted to project a stream of abrasive *q* angularly against the right-hand half of the sheet S_4, and against the right-hand side edge thereof. Thus it will be seen that the abrasive streams *p* and *q* treat the surface of the sheet S_4, and likewise treat the side edges at the same time.

If desired, one or more wheels may be disposed in such position as to treat the lower surface of the sheet S_4 in a manner which will be apparent from the foregoing.

Still another arrangement is shown in Fig. 11 for treating the edges of sheets which is particularly adapted to removing mill scale and similar foreign matter from the surface of the edges in a simple and inexpensive manner.

This arrangement comprises a circular knurling wheel 251 having the usual sharpened teeth 251*a*. The wheel 251 is supported by a bracket 252 mounted adjacent the sheet to be treated, which standard has a pair of arms 253 in which is slidably mounted a rod 254 carrying a clevis member 255 in which the wheel 251 is rotatably mounted. The rod 254 is urged toward the edge of the sheet S_5 to be treated by a spring 256, bearing against a collar 257 formed on the rod. Thus the wheel is resiliently urged into engagement with the edge of the sheet S_5, and as the sheet passes along on the conveyor the knurling wheel bites into the mill scale and other foreign matter on the edge of the sheet, and loosens the same, causing it to fall from the sheet, thus leaving the edge of the sheet clean and in suitable condition for treatment.

A circular knurling wheel 251 may be substituted for the horizontally-arranged wheels 350 of the apparatus shown in Fig. 1. In this embodiment the bracket 252 may be supported in a suitable manner from the standard 151.

Thus it will be seen that the invention provides a simple and compact arrangement for cleaning all of the surfaces of a plurality of sheets or billets simultaneously, in such a manner that the operation may be completed in a relatively short period, and in the course of a single trip of the sheets or billets through the apparatus. By reason of the arrangement of the conveyor for transporting the plurality of sheets simultaneously in spaced arrangement, and the disposition of a single wheel between two adjacent sheets which

wheel may be operated to project two streams of abrasive in opposite directions, it is possible to treat the sheets with a lesser number of wheels than would be required if the arrangement provided for treating only one sheet at a time. Because of the novel arrangement of conveyors and wheels, the apparatus may be made compact without crowding any of the elements thereof.

The provision of an adjustable support for each wheel, whereby the wheel may be rotated about the vertical axis passing through the wheel, and may at the same time be adjusted vertically relative to the sheet to be treated, permits the maximum utilization of the stream of abrasive. As explained in the foregoing, the adjustable mounting permits the abrasive stream to be swung in any direction about a vertical pivot so that the end of the impingement pattern may be made to coincide with the margin of the sheet which is being treated. This adjustable arrangement also permits the treating of sheets of various widths in a single apparatus without requiring any changes in the elements of the apparatus other than a change in the adjustment of the positions of the wheels.

Inasmuch as the driving mechanism and the wheel are constructed as a unit, and adapted to be moved as a unit, the arrangement is both compact and sturdy, and no unusual difficulties in transmitting power from the motor to the wheel are encountered. Since the motor which drives the wheel may be energized by electricity through flexible conductors, no serious difficulties are encountered in supplying electric energy to the motors.

The provision of means for treating the edges, during the passage of the sheets through the apparatus, and as a part of the same operation with the treating of the side faces of the sheet or billet, permits the entire treating operation to be carried out in a single operation. Thus, only a minimum amount of handling of the sheets is required.

The arrangement of rolls in the roll conveyor is such that no appreciable wear of the rolls results from the abrasive being thrown thereagainst. As pointed out previously, the rolls are disposed in spaced relation, and the wheels are so disposed that the abrasive projected therefrom passes between the rolls and does not strike the rolls to any appreciable extent. Furthermore, since the sheets are urged along on the pinch rolls, which may be disposed at a considerable distance from the wheels, and since no driving mechanism, such as gearing and the like, is disposed adjacent any of the wheels, undue wear of the driving mechanism due to the presence of abrasive particles is minimized. The arrangement of the wheel assemblies is such that they may be individually shielded from the remainder of the apparatus, or all may be shielded in a single housing from the remainder of the apparatus.

While certain novel features of the invention have been disclosed and are pointed out in the annexed claims, it will be understood that various omissions, substitutions and changes may be made by those skilled in the art without departing from the spirit of the invention.

This application is a continuation in part of my co-pending application Serial No. 727,665, filed May 26, 1934, which issued into Patent No. 2,077,637 on April 20, 1937, and particularly the subject matter shown in Figures 7 and 8 of the drawings of said co-pending application.

What is claimed is:

1. Apparatus for cleaning and removing scale and extraneous material from metallic objects including, a pair of conveyors arranged in generally parallel relationship and adapted to transport the metallic objects to be cleaned, a centrifugal abrasive throwing wheel positioned between said conveyors, said wheel having control means operative to direct an abrasive stream simultaneously against the objects supported on each of said conveyors, and abrasive throwing wheels positioned exterior to said conveyors, each of said wheels having means for directing a single stream of abrasive against the objects supported thereon.

2. Apparatus for treating sheets comprising a rotatably mounted abrasive-throwing wheel for projecting abrasive at high velocities, means associated with said wheel for controlling the abrasive discharge from said wheel selectively to project abrasive in streams in either or both of two opposite directions, and means for transporting sheets to be cleaned past and through either or both of said streams.

3. Apparatus for cleaning and removing scale and other extraneous materials from metallic objects including, a conveyor for transporting said objects along a linear path, an abrasive throwing wheel operative to direct a stream of abrasive against the objects supported on said conveyor, a drive shaft for said wheel, power means for rotating said shaft, and means for shifting the position of said wheel with respect to said conveyor including a supporting standard, a bracket pivotally mounted on said standard, a second bracket supporting said wheel, shaft and power means, said second bracket being pivotally mounted on said first-named bracket, said brackets together providing a swingable jackknife support for said wheel.

4. Apparatus for cleaning and removing scale and other extraneous materials from metallic objects including, a conveyor for transporting said objects along a linear path, an abrasive throwing wheel operative to direct a stream of abrasive against the objects supported on said conveyor, and means for shifting the position of said wheel with respect to the objects supported on said conveyor including, a fixed supporting standard positioned to one side of said conveyor, a bracket pivotally mounted on said standard swingable over said conveyor through a predetermined arc, and means for pivotally mounting said wheel on said swingable bracket whereby said wheel can be swung through a predetermined arc about said supporting standard and assume various positions with respect to the objects supported on said conveyor.

5. An abrasive-throwing wheel including a rotor adapted to be rotated at high peripheral speed, a plurality of throwing blades mounted on said rotor and extending from a central space of the rotor toward the periphery thereof, an impeller fixed to rotate with said rotor, and a control cage surrounding said impeller and extending into said central space, said control cage including a plurality of concentric cylindrical members each having a plurality of openings in the side walls thereof, and means mounting said cylindrical members for relative angular movement to bring said openings into and out of registration.

6. An abrasive-throwing wheel including a rotor adapted to be rotated at high peripheral speed, a plurality of throwing blades mounted on said rotor, an impeller fixed to rotate with said

rotor, and a control cage disposed between said impeller and said blades including a pair of telescoped tubular members each having a plurality of openings in the side wall thereof, and means mounting said tubular members for relative movement whereby one or more openings of one of said tubular members may be selectively placed into registration with corresponding openings in the other of said tubular members.

7. An abrasive-throwing wheel including a rotor adapted to be rotated at high peripheral speed, an impeller centrally mounted on said rotor, a series of throwing blades mounted on said rotor and extending from adjacent said impeller toward the periphery of the rotor, a pair of telescoped tubular members surrounding said impeller and each having a plurality of openings in its side wall adapted to register with openings in the other tubular member, and means for angularly moving said tubular members to bring one or more pairs of said corresponding openings selectively into registration to cause said wheel to project a corresponding number of streams of abrasive.

8. Apparatus for treating metal surfaces comprising a conveyor for advancing metal material, and a second conveyor for advancing metal material, said conveyors being disposed substantially parallel, and a centrifugal abrasive throwing device mounted between said conveyors for rotation in a plane substantially perpendicular to the surfaces of the material on said conveyors, said device being effective to treat the material on both conveyors simultaneously.

9. A blasting machine adapted to throw two oppositely directed streams of abrasive to clean hard metallic surfaces positioned at opposite sides of said wheel, including a rotor having rotatably mounted radially arranged throwing blades extending inwardly short of the axis of rotation of said rotor to provide a central abrasive receiving space, a tubular control member positioned within said central space, said control member having a plurality of discharge outlets of limited peripheral length positioned substantially diametrically opposite one another, and impeller means for forcing the abrasive through said discharge outlets and into the path of rotation of said blades.

10. Apparatus for cleaning metal sheets, or plates comprising a frame, a conveyor for moving metal material therealong, abrasive throwing wheels mounted on the frame for rotation and each adapted to project a plurality of streams in opposite directions, said wheels being spaced apart across the width of the conveyor and along the path of material moving therealong, and a second conveyor on the opposite side of the wheels from the first-mentioned conveyor, said second conveyor being adapted to support the material in position to be cleaned by said wheels while being moved.

11. An abrasive throwing wheel including rotatably mounted, radially arranged throwing blades terminating inwardly short of their axis of rotation to provide a central space, a control member disposed in said central space and having a plurality of outlet openings therein, means for urging abrasive through said outlet openings and depositing it in the path of said blades, and control means for closing at least one of said outlet openings.

12. Apparatus for blast cleaning metal objects including, a conveyor for transporting said objects along a linear path, an abrasive throwing wheel operative to direct a stream of abrasive against the objects supported on said conveyor, means for shifting the position of said wheel with respect to the objects supported on said conveyor including, a fixed supporting standard positioned to one side of said conveyor, a bracket pivotally mounted on said standard swingable over said conveyor through a predetermined arc, means for retaining said bracket in fixed position, means for pivotally mounting said wheel on said swingable bracket whereby said wheel may assume various positions of adjustment with respect to said bracket and the objects supported on said conveyor, and means for setting said pivotally mounted wheel supporting means in the desired selected position with respect to said bracket.

VERNE ELWOOD MINICH.

Oct. 4, 1938. V. E. MINICH 2,132,311

APPARATUS FOR SURFACE TREATING METAL ARTICLES

Filed July 10, 1935 5 Sheets-Sheet 1

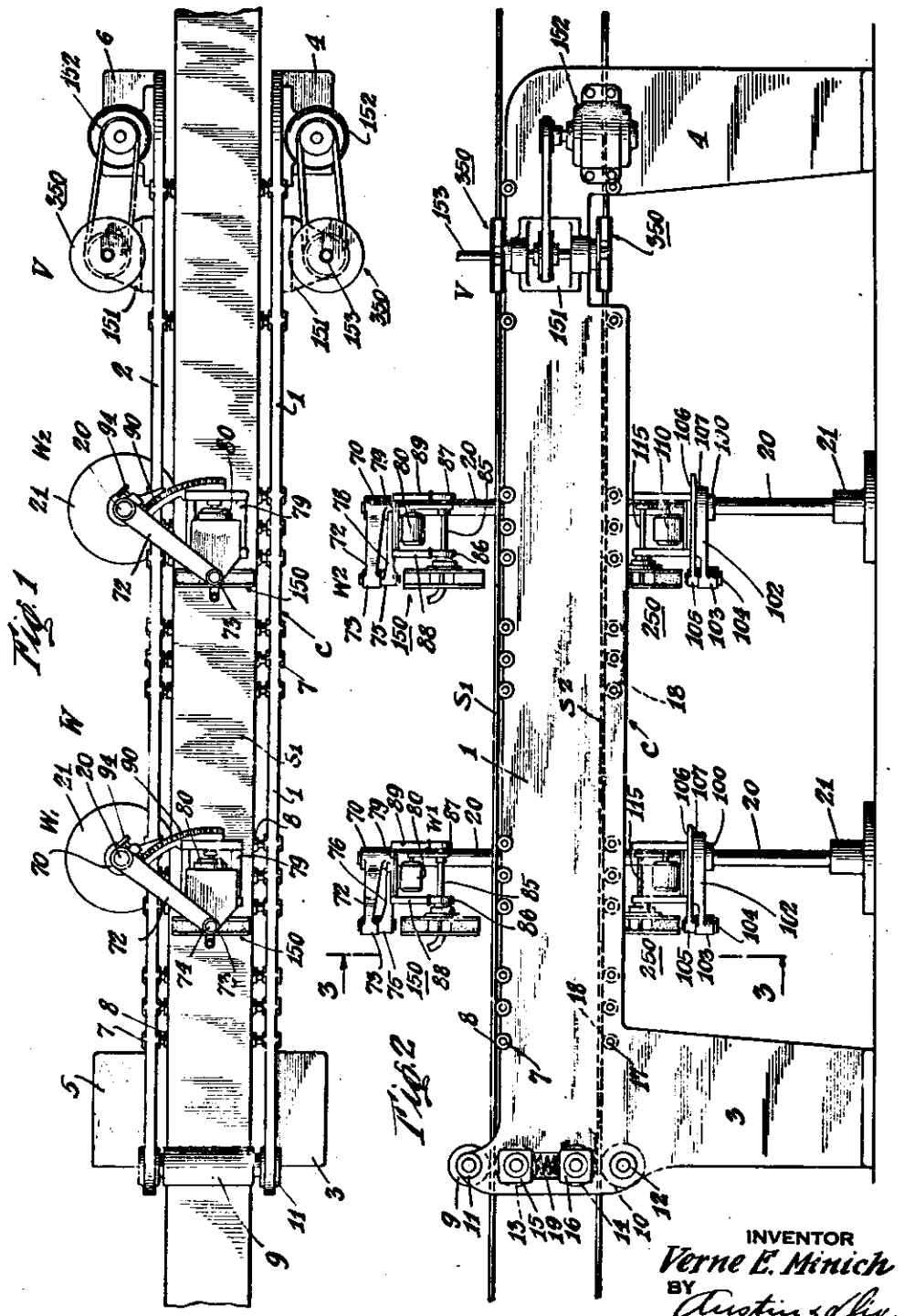


Fig. 1

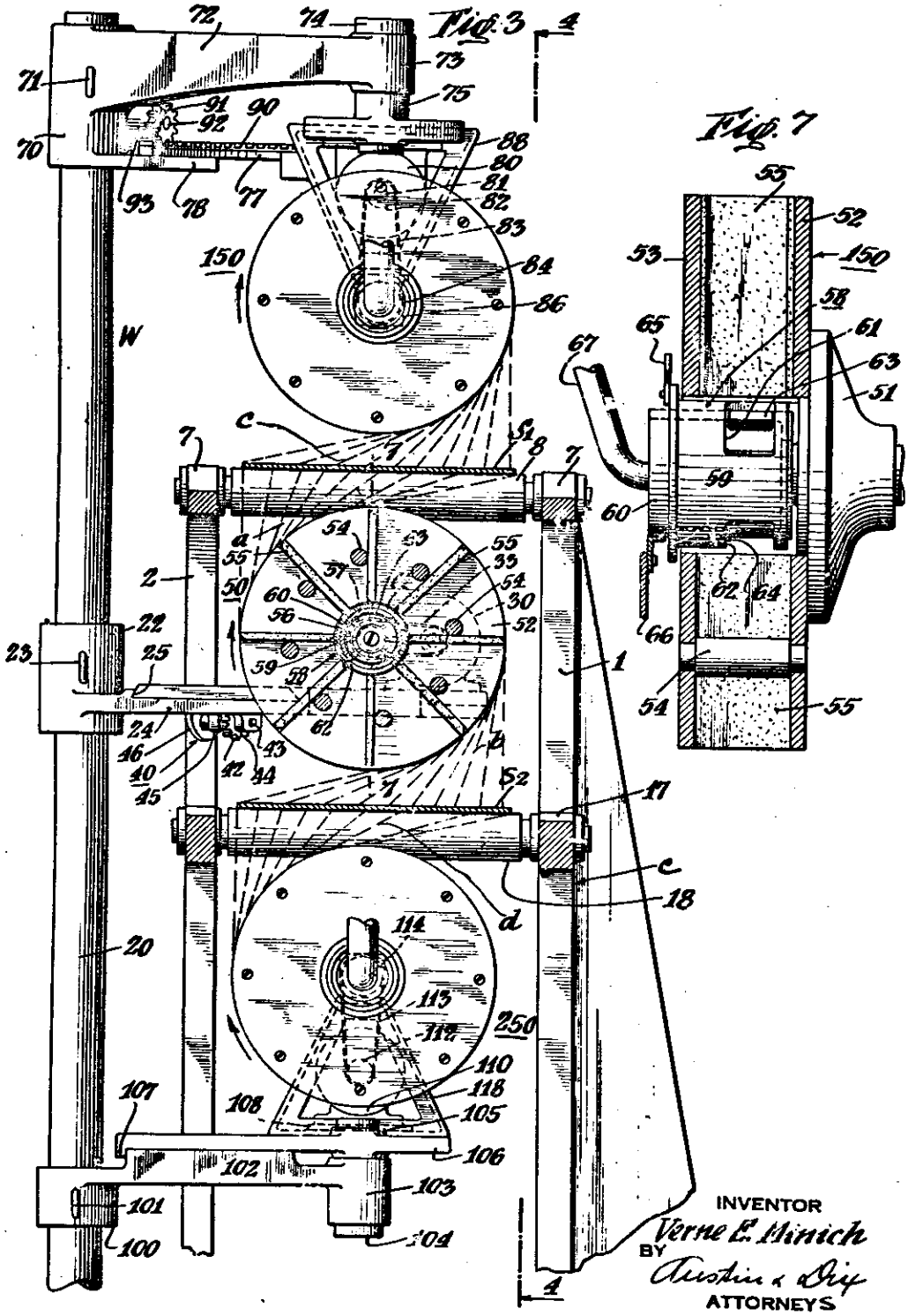
Fig. 2

INVENTOR
Verne E. Minich
BY
Austin & Lilly
ATTORNEYS

Oct. 4, 1938. V. E. MINICH 2,132,311

APPARATUS FOR SURFACE TREATING METAL ARTICLES

Filed July 10, 1935 5 Sheets-Sheet 2

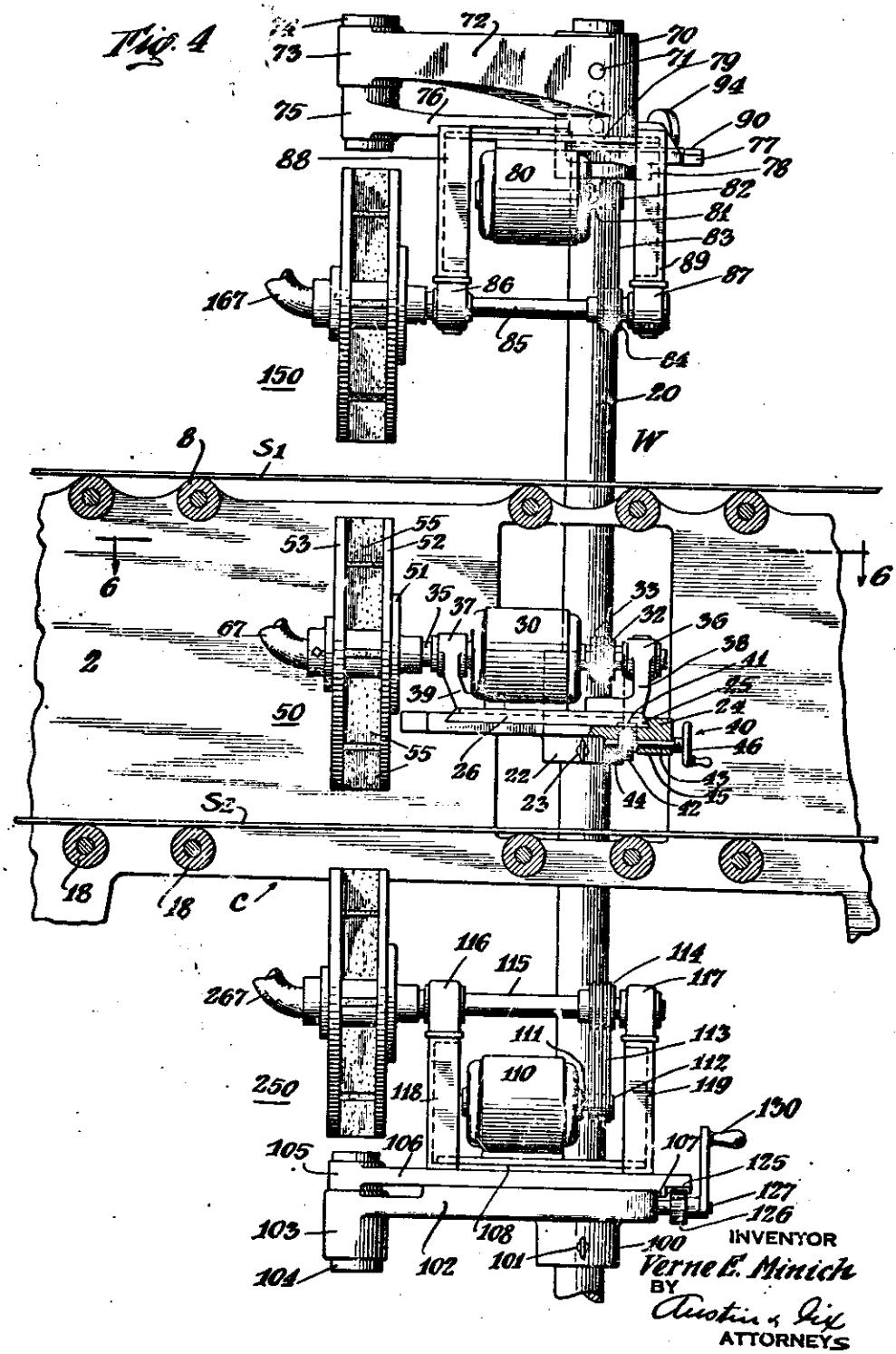


Oct. 4, 1938. V. E. MINICH 2,132,311

APPARATUS FOR SURFACE TREATING METAL ARTICLES

Filed July 10, 1935 5 Sheets-Sheet 3

Fig. 4



INVENTOR
Verne E. Minich
BY
Austin & Dix
ATTORNEYS

Oct. 4, 1938. V. E. MINICH 2,132,311

APPARATUS FOR SURFACE TREATING METAL ARTICLES

Filed July 10, 1935 5 Sheets-Sheet 4

Fig. 5

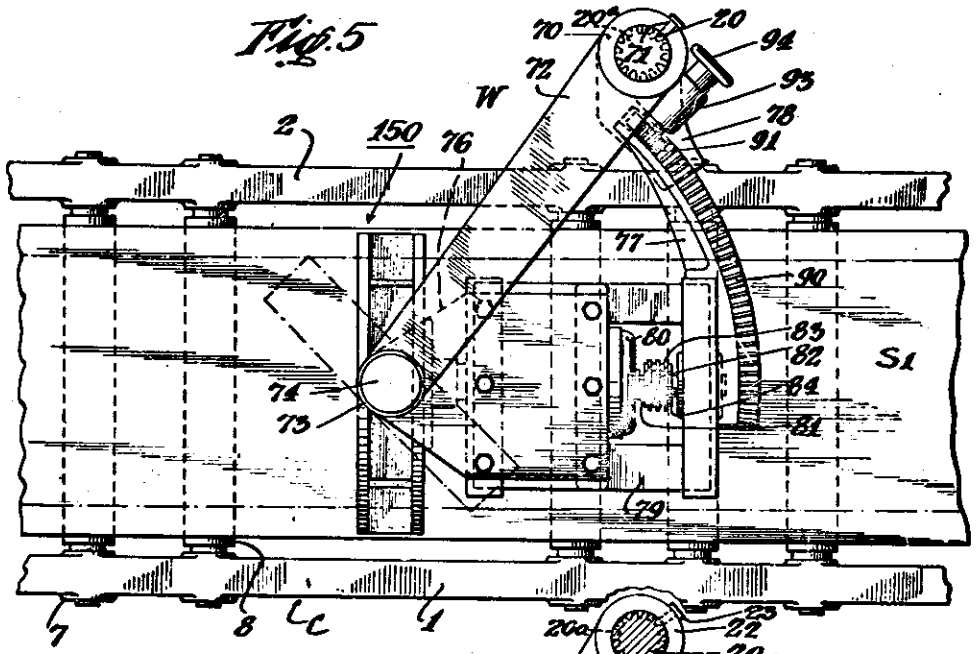
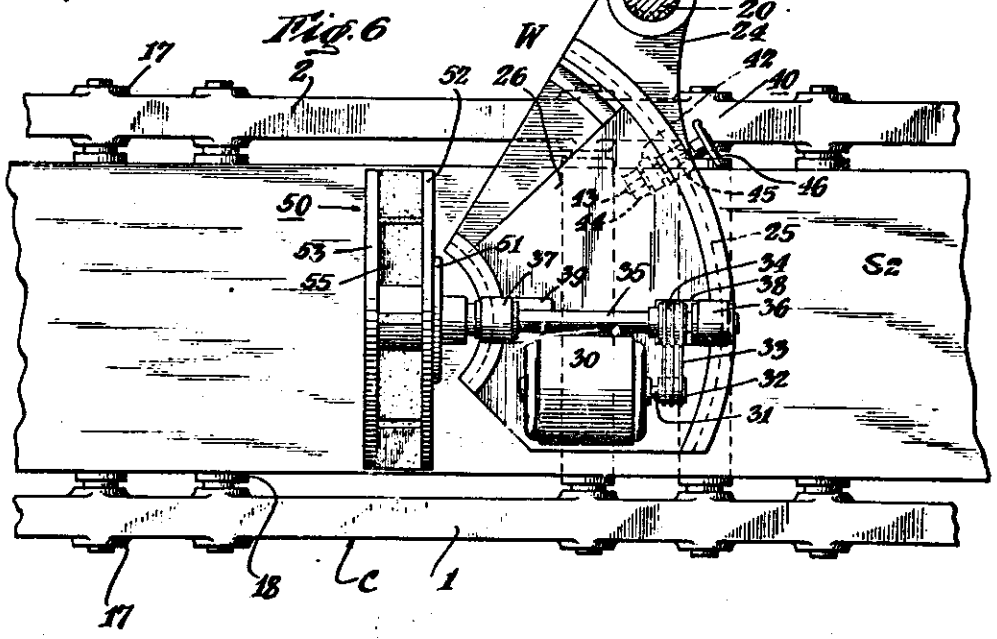


Fig. 6



INVENTOR
Verne E. Minich
BY
Austin & Ely
ATTORNEYS

Oct. 4, 1938. V. E. MINICH 2,132,311

APPARATUS FOR SURFACE TREATING METAL ARTICLES

Filed July 10, 1935 5 Sheets-Sheet 5

Fig. 8

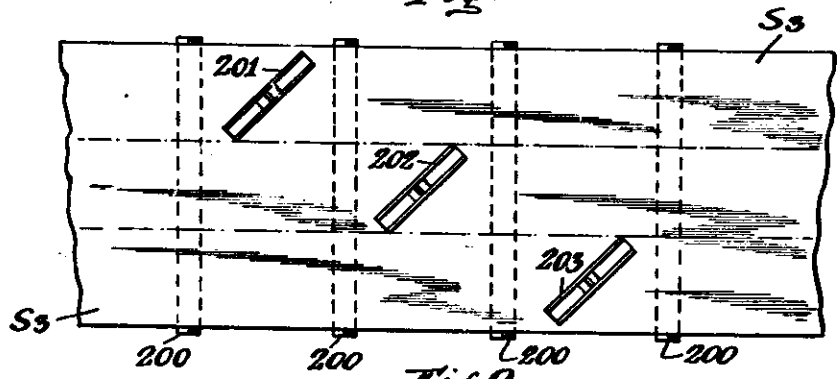


Fig. 9

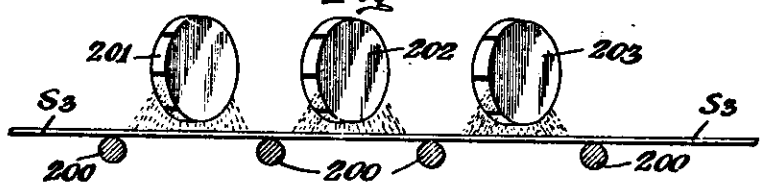


Fig. 10

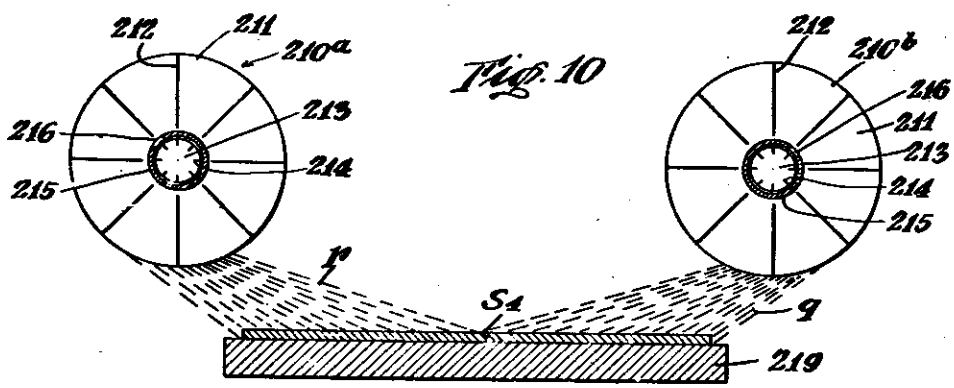
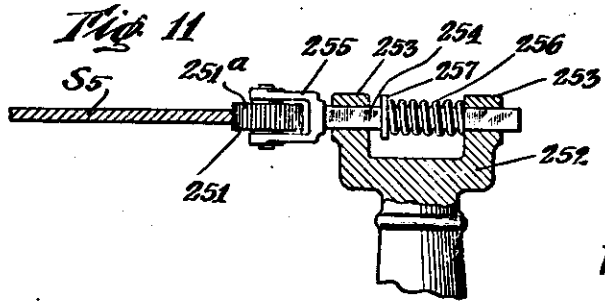


Fig. 11



INVENTOR
Verne E. Minich
BY
Austin & Rief
ATTORNEYS