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APPARATUS FOR TREATING METAL ARTICLES

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21 Claims. (Cl. 51—9)

This invention relates to apparatus for treating metal articles.

In cleaning, polishing, hardening, or otherwise treating the surfaces of metallic objects, the objects treated should be manipulated in such manner that all or predetermined portions of the surfaces of the articles are uniformly exposed to treatment, and preferably the length of time of such exposure should be positively controlled.

Where the articles to be treated are relatively small and rugged and are suitably shaped, they can be conveniently presented for treatment in various types of tumbling apparatus now in use. However, where the articles are large and heavy, or irregular in shape, or fragile and breakable, tumbling is not suitable. Further, where the articles have cavities or projections, it is necessary to present these cavities or projections to the abrasive stream in such a manner that all areas will be uniformly treated. To attain maximum efficiency and economy the apparatus should be so designed that the process can be carried out continuously without shutting down the apparatus, as is necessary in batch operations.

According to the present invention, each article to be treated is supported on a carriage, and the carriage is urged along a predetermined path to carry the article through the treating stream. The article is rotated or turned on the carriage simultaneously with its movement through the stream, thereby uniformly exposing the various surfaces of the article to the effect of the stream.

The apparatus for carrying out the process includes one or more abrasive projectors, preferably of the centrifugal throwing wheel type having means associated therewith for controlling the direction of flight of the treating particles. The article-supporting carriages move through the stream on a suitable track. Means are provided for advancing the carriage or carriages at the proper rate of speed. The driving means may include a flexible endless member supported for traveling movement and having driving engagement with the carriage or carriages. Each carriage may be provided with spaced pairs of rotatably mounted supporting elements adapted to engage the article. A driving member may be disposed adjacent the path of movement of the carriage in a position to engage and rotate the supporting elements, thereby to turn the article on the carriage, while the latter is advanced through the stream of treating material.

The apparatus herein described is suitable for treating numerous types of articles, such as irregular, heavy or fragile castings, forgings and other machine and structural members. For example, the apparatus is well adapted for handling and treating crank shafts and similar irregularly shaped articles. The articles are positively advanced through the treating stream under controlled speed and are rotated in the stream under controlled speed and thus may be exposed for treatment for any desired period. The apparatus may be operated continuously and substantially automatically and requires little or no attention on the part of the operator. If desired, suitable automatic apparatus may be provided for delivering the articles to the apparatus and conveying the treated articles therefrom.

An object of this invention is to provide an improved apparatus for cleaning, polishing, hardening or otherwise treating metallic objects.

Another object of this invention is to provide an improved apparatus for cleaning and treating metallic articles which are large and heavy, or irregular in shape, or fragile and breakable, or articles of such a character that their surfaces cannot be effectively exposed for treatment by tumbling action.

Another object of this invention is to provide an improved apparatus for simultaneously advancing and rotating articles to be cleaned through an abrasive stream so as to uniformly expose the surfaces thereof to abrasive treatment.

Another object of this invention is to provide an improved apparatus for continuously treating metal articles which is relatively simple in construction, requires little or no attention on the part of the operator, which is strong and durable, and is admirably adapted for continuous production operations.

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

Although the novel features which are believed to be characteristic of this invention will be particularly pointed out in the claims appended hereto, the invention itself, as to its objects and advantages, and the manner in which it may be carried out, may be better understood by referring to the following description taken in connection with the accompanying drawings forming a part thereof, in which:

Fig. 1 is a somewhat diagrammatic side elevational view of one form of apparatus suitable

for carrying out the invention, certain parts of the structure being broken away to expose the interior;

Fig. 2 is a top plan view of the apparatus shown in Fig. 1;

Fig. 3 is an enlarged fragmentary cross-sectional view of the apparatus, taken along line 3—3 of Fig. 2;

Fig. 4 is an enlarged fragmentary cross-sectional view of the apparatus, taken along line 4—4 of Fig. 2;

Fig. 5 is an enlarged transverse cross-sectional view of the apparatus, taken along line 5—5 of Fig. 1;

Fig. 6 is an enlarged top plan view of one of the article-supporting carriages together with a portion of the associated driving element;

Fig. 7 is a side elevational view of the carriage shown in Fig. 6, and

Fig. 8 is a somewhat diagrammatic sectional detail of the centrifugal abrasive projector.

In the following description and in the claims, various details will be identified by specific names for convenience, but they are intended to be as generic in their application as the art will permit. Like reference characters denote like parts in the several figures of the drawings.

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.

There is shown in Figs. 1 to 5 inclusive, by way of illustration, apparatus constructed in accordance with the invention. The apparatus includes a housing 1 having a treating chamber 2, a loading chamber 3 having a loading opening 4, and an unloading chamber 5 having an unloading opening 6. Extending throughout the chamber is a conveyor 7 adapted to carry the articles to be treated from the loading chamber 3 through the treating chamber 2 to the unloading chamber 5, which conveyor is more fully described hereinafter.

One or more abrasive projectors may be suitably mounted on the top wall of the housing 1 for projecting a corresponding number of streams of treating material into the chamber. In the present example two such projectors A and B are shown, which project the abrasive streams designated *a* and *b*, respectively. Although the projectors A and B may take various forms, preferably they are of the centrifugal throwing wheel type having means associated therewith for controlling the direction of flight of the thrown treating material.

The wheel 10 includes a plurality of throwing blades 14 which extend in a generally radial direction from adjacent the periphery of the wheel to points inwardly short of the center to provide a central space 15. Disposed in the space 15 is an impeller 16 having a plurality of radially directed vanes 17. Surrounding and spaced from the impeller 16 is a relatively stationary independently mounted control member 18 having a discharge outlet 19.

The blades 14 may be supported by one or more side wall members 12 and 13 which are mounted on a shaft 20 rotatable in a bearing 21. The impeller 16 preferably rotates with the blades and may be connected to the drive shaft 20. A motor 22 mounted on a base 23 is connected to the shaft 20 through a suitable drive 24 for rotating the wheel or projector.

The wheel 10 extends through an opening 25 in the top wall of the housing 1 and is supported on a mounting plate 26 adapted to close the opening 25 in the housing 1. A casing 27 may be provided to enclose the wheel 10 projecting above the plate 26. The mounting plate 26, carrying the projector and the driving motor 22, may be adjustable angularly on the housing 1 for the purpose of adjusting the position of the projector 10 and projected abrasive stream relative to the conveyor 7. The projector B may be constructed and mounted similarly to projector A, but preferably rotates in the opposite direction for a purpose which will hereinafter appear.

Each wheel may be supplied with treating material from a hopper 30 through a conduit 31 extending to feed-pipe 32 which conducts the material to the impeller 17.

The treating material, sometimes referred to as "abrasive", may comprise granular material, such as cracked steel grit, steel shot, sharp quartz sand, or other cleaning, abrading, polishing or hardening material. The material selected will, of course, depend upon the surface effect desired. It will therefore be understood that where the term "treating material" or "abrasive" is used it includes within its range all materials useful for cleaning, polishing, hardening or otherwise modifying the surface of metallic objects.

When the wheel 10 is rotated and supplied with abrasive, the impeller 16 throws the abrasive through the control cage opening 19 and into the path of the rotating throwing blades 14. The abrasive is carried along the leading faces of the blades 14 and is projected therefrom adjacent the periphery of the wheel at the desired treating velocity. The abrasive spreads out from the wheel in a fan-shaped stream *a* which produces an impingement pattern in the shape of an elongated strip. The direction of flight of the treating material is controlled by the clock dial position of the outlet 19 of the control member 18.

It will be noted that each abrasive stream *a* and *b* extends throughout a considerable range of angularity which may approach 90°. Preferably, the streams are directed in reversed directions so that the range of angularity of the combined streams approaches 180°.

The abrasive which is thrown by the projectors A and B against the work finally falls onto the floor 34 and is transported to a collecting trough 35. A screw conveyor 36 is disposed in the trough 35 and is driven by a suitable source of power (not shown) to convey the projected abrasive to an elevator 37. The elevator may include an endless flexible belt 38 trained over drums 39 and 40 and carrying buckets 41. A motor 42 connected by a drive 43 is provided for actuating the belt 38 and causes the buckets 41 to elevate the abrasive from the trough 35 to a conduit 45 from which the abrasive flows by gravity to the hopper 30.

Referring now to Figs. 6 and 7, there is shown one form of carriage 50 constituting a component part of the conveyor 7. The carriage 50 supports the articles to be treated and conveys them through the streams of abrasive *a* and *b*. Preferably, a plurality of carriages 50 are provided which pass through the abrasive streams in close succession.

Each carriage 50 may include end rails 51 and 53 and side rails 52, secured together to form a generally rectangular frame. Suitable bracing rails 54 may be connected to the end rails 51

and 53. Extending transversely across one end of the frame is a cross-rail 55 adapted to rotatably carry a pair of supporting heads or rollers 56, each head rotating on a stud 57 secured in cross-rail 55. The supporting heads 56 preferably may be circular or oval-shaped and are so mounted that the peripheries of the supporting heads cooperate to turn the articles supported thereon when rotated.

Extending transversely across the other end of the carriage 50 is a cross-rail 59 mounting a second pair of supporting heads or rollers 60 also providing a supporting periphery, which preferably is in alignment with the supporting peripheries provided by the heads 56. The cross-rails 59 may be secured to a pair of brackets 61 slidably supported on the side rails 52 and adapted to be adjustably secured by bolts 62 or other members extending through openings 63 and 64 in the brackets 61 and side rails 52, respectively. It will thus be noted that the supporting heads 60 may be spaced from the supporting heads 56 any desired distance to best accommodate the articles to be treated.

The front end of the carriage 50 is connected to and supported by a pair of spaced parallel driving chains 70, each of which includes links 73 and 74, secured together by pins 68 carrying rollers 75. A shaft 71 is secured to the carriage 50 and extends laterally therefrom to engage the chains 70. Each end of the shaft 71 has a reduced portion 72 extending through links 73 and 74 and rollers 75. Secured to and extending across the front end of the carriage 50 is a rearwardly directed plough or scooper 67, the function of which will hereinafter appear.

The rear end of the carriage 50 is supported on wheels 65 rotatably mounted on stud shafts 66, suitably secured to the rear ends of the side rails 52.

Each driving chain 70 may be trained over a pair of driving sprockets 76 located in the loading chamber 3 and unloading chamber 5, respectively, and rotatably carried on shafts 77 journalled in bearings 78. The driving sprockets 76 in the unloading chamber 5 may be driven by a motor 79 connected by a drive 80 and a speed reducer 81 to a shaft 82. A drive 83 and sprocket 84 may operatively connect the shaft 77 to the shaft 82.

Each chain 70 is supported by and adapted to ride along an upper chain track 86 supported on brackets 87 extending from the wall of the housing 1 and a lower chain track 88 supported on brackets 89.

The wheels 65 of the several carriages 50 are supported and guided by upper carriage tracks 90, 90 mounted on the brackets 87, 87, between and below the chain tracks 86. The wheels 65 are preferably of such diameter that each carriage is substantially horizontal when supported on the chains 70 and the carriage tracks 90, 90.

The left-hand ends 91 of the tracks 90, 90 (as viewed in Fig. 3) are curved downwardly and are supported by brackets 92, 92. Return tracks 93, 93 are mounted on brackets 94, 94, adjacent the track ends 91, 91, and lower carriage tracks 95, 95 mounted on brackets 89, 89 extend from the return tracks 93, 93 toward the other end of the housing 1. Each lower carriage track 95 has an inclined portion 96 which extends to a spur 97 supported on a bracket 98 approximately at the height of the upper carriage track 90.

Adjacent each spur 97 is a switch 99, swingable about a pivot 100 carried on brackets 101, and adjacent the end of each upper track 86 is a second switch 103, swingable about a pivot 104 carried in brackets 105. The switches 99 and 103 are swingable upwardly in opposite directions. A bridge 102 mounted on brackets 105 may extend between each set of switches 99 and 103.

Disposed adjacent and extending along the path of movement of the carriages 50 on each side thereof is a driving roll 110 carried on a shaft 111 extending through openings 112 in the housing 1 and journalled in bearings 113. A motor 115 may be connected through a speed reducer 116 and drives 117 to the shafts 111 for rotating the driving rolls 110.

The operation of the apparatus is as follows: The wheels 10 and 11 are energized by their driving motors 22, 22 and abrasive is supplied to the wheels from the hopper 30. The wheels 10 and 11 throw fan-shaped streams of abrasive *a* and *b* into the treating chamber 2.

The motor 79 is energized and actuates the driving sprockets 76 in the unloading chamber to cause each of the chains 70 to travel around an endless path determined by the sprockets 76 and the upper and lower chain tracks 86 and 88; the rollers 75 of the chains 70 ride along on the tracks 86 and 88.

Although the apparatus is suitable for treating various articles, there is shown for the purpose of illustration a plurality of crank shafts *c* of the type commonly used in automotive engines. A crank shaft *c* is deposited upon one of the carriages 50 when the latter is approximately in the position *d* (as shown in Fig. 4). The crank shaft *c* is placed on the carriage 50 with the ends thereof seated upon the divergent peripheral portions of the paired supporting heads 56 and 60.

As the chain 70 is advanced the carriage 50 moves into the treating chamber 2 toward the position *e* and enters the abrasive stream *a*. The treating particles strike the crank shaft *c* at angles which vary continuously as the crank shaft passes through the stream thus impinging against all of the vertical surfaces as well as the horizontal surfaces. During movement of the carriage 50 through the treating chamber 2, the supporting heads 56 and 60 bear against the corresponding driving rolls 110, 110, which causes the supporting heads 56 and 60 to rotate about their axes. This causes the crank shaft *c* to rotate about its axis and thus expose all of the surface portions to the stream. In the course of its travel through the streams *a* and *b* all surfaces are fully and uniformly treated.

When the carriage 50 reaches a position, such as the position *f*, the crank shaft *c* may be removed and the front end of the carriage 50 is carried around a loop defined by the chains 70 passing around the sprockets 76 at the unloading end of the apparatus. The rear end of the carriage, however, is guided downwardly by the track ends 91 and caused to reverse its direction by the return reversing tracks 93. The carriage 50 is then moved in the return direction along the lower tracks 88, 88 and 95, 95, with its rear end preceding the forward end.

When the carriage 50 approaches the loading end of the apparatus the wheels 65 ride up the inclined tracks 96 and onto the spurs 97, the wheels 65 lifting the switches 99, 99. The forward end of the carriage is carried around the sprockets 76, and as the forward end of the carriage 50 begins to move to the left the rear end rides over the lowered switches 99, 99.

As the forward end of the carriage 50 is raised,

it raises the switches 103, 103 and passes up through the switches and is moved forwardly and onto the upper chain tracks 86, 86, the wheels 65 riding over the bridges 102, 102 and over the closed switches 103, 103. The carriage 50 is then again in the position *d* ready to receive another crank shaft *c*.

During the movement of each carriage 50 along the lower tracks 88, 88 and 95, 95, the scraper 67 carries the spent abrasive along the floor 34 and causes it to drop into the trough 35 from whence it is returned to the hopper 30, as above described.

Various modifications may be made in the structure to adapt it for various uses. Any suitable number of carriages may be employed and the supporting heads may be replaced by other types of supporting elements, depending upon the articles which are to be treated.

Where the articles to be treated are narrower than the impingement pattern of the streams *a* and *b*, the positions of the wheels 10 and 11 may be adjusted so that their impingement patterns extend in the direction of movement of the articles through the apparatus, thus effecting a maximum speed of operation. Where the articles are relatively wide, the wheels are adjusted angularly on the housing so that their impingement patterns extend over a greater distance laterally with respect to the path of movement of the articles, thus insuring that all portions of the articles pass through the streams.

From the foregoing it will be seen that the present invention provides apparatus for effectively treating large and heavy, or awkwardly shaped, brittle or fragile castings, forgings, and other metal articles. The supporting heads provide an especially suitable arrangement for rotating the articles such as crank shafts and the like during treatment. The carriages are positively driven and guided and the articles may be rotated at any desired speed to most effectively expose the desired surface areas to abrasive treatment.

It will be noted that during the entire cycle of movement of each carriage, the carriage is not inverted but is maintained in upright position. Thus it is possible, if desired, to allow the article to remain on the carriage and pass it through the stream a plurality of times without removing it from the carriage.

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.

What is claimed is:

1. In an abrading machine, a centrifugal abrasive propelling mechanism operative to project a fan-shaped stream of abrasive particles having an elongated impingement pattern, a pair of spaced endless supporting belts, drive mechanism for advancing the upper flight of said supporting belts in the general direction of the longitudinal axis of said impingement pattern, a frame extending between and connected to said supporting belts, a pair of rollers mounted on said frame having their peripheries positioned in adjacent relationship to provide opposed and divergent supporting surfaces for the workpiece, and driven means operative to rotate said supporting rollers to rotate the workpiece during its linear advance through said stream.

2. Apparatus for blast cleaning metallic articles including in combination, an abrasive throwing wheel operative to project a controlled stream of abrasive at blasting velocities so as to define an elongated impingement pattern, a movable support, a continuous flexible member for advancing said movable support in the general direction of the longitudinal axis of said impingement pattern, spaced rotatable elements mounted on said support for supporting the articles to be cleaned, and driven means positioned outside the path of said abrasive stream and mounted independently of said movable support but adapted to attachably and detachably engage said rotatable elements to rotate said elements and the articles supported thereon during passage of the articles through said stream.

3. Apparatus for blast cleaning and treating metal articles including, a track comprising spaced track members, a centrifugal abrasive propelling mechanism operative to project a fan-shaped stream of abrasive particles between said track members, an article-supporting carriage spanning said track members and movable along said track, a driven member attached to said carriage for advancing said carriage along said track, rotatable means mounted on said carriage on which the article is adapted to rest, and a driven element mounted independently of said carriage and normally beyond the reach of said abrasive stream, said rotatable article-supporting means being movable into operative engagement with said driven element prior to movement of the carriage-supported article into the abrasive blast whereby to rotate the article in said stream as the carriage is linearly advanced through said stream, said article rotatable means moving out of engagement with said driven element when the article has completed its passage through the abrasive stream.

4. Apparatus for blast cleaning and treating metal articles including, a centrifugal abrasive propelling mechanism operative to project a stream of abrasive particles, spaced conveyors for moving articles to be treated through said stream, a support extending between and connected to said spaced conveyors, spaced supporting rollers rotatably mounted on said support, said rollers having their peripheries positioned to constitute opposed and divergent supporting surfaces for said articles, and a member driven independently of said conveyors adapted to frictionally engage the periphery of one or more of said rollers and rotate the article supported on said rollers during its linear travel through said stream.

5. Apparatus for treating metal articles including, means for projecting a stream of abrasive particles, an article-supporting carriage, a pair of spaced endless driving means supporting one end of the carriage, a pair of spaced tracks supporting the opposite end of the carriage, and means for actuating said endless driving means to advance the article supported on said carriage through said stream.

6. Apparatus for treating metal articles including, means for projecting a stream of abrasive material, a pair of spaced endless conveyors for moving articles to be treated through said stream, a member extending between and connected to said spaced conveyors, spaced supporting rollers rotatably mounted on said member, said rollers having their peripheries adjacent and adapted to constitute opposed and divergent supporting surfaces for said articles, and driven means mounted independently of said conveyors

and positioned outside the path of said abrasive stream for rotating said rollers.

7. Apparatus for blast cleaning metallic articles including in combination, a centrifugal projector operative to throw a directed stream of abrasive at blasting velocities, an article-supporting carriage, spaced tracks for supporting said carriage for linear movement therealong, means for advancing said article-supporting carriage through said stream, means for supplying abrasive particles to said projector, a hopper for receiving abrasive, and a scraper associated with said carriage for transporting the abrasive thrown by said projector to said hopper.

8. Apparatus for treating metal articles, including means for projecting a stream of abrasive material, a series of carriages adapted to support articles to be treated, an endless driving element, means permanently connecting said carriages to said driving element, means for supporting said carriages for linear movement, and means for guiding said carriages through said stream, said last means including a forward track, a return track, a reversing track and a switch connecting said forward and return tracks to provide a continuous, endless guiding means for said carriages.

9. Apparatus for treating metal articles, including centrifugal means for projecting a stream of abrasive material, means including a carriage having a rotatable element for supporting an article to be treated, means for advancing said carriage to carry said article through said stream, a rotatable member extending along the path of said rotatable element and engageable therewith for driving said rotatable element during at least a portion of its travel, and means for moving said carriage in a reverse direction out of the effective range of said stream.

10. Apparatus for treating metal articles including centrifugal means for projecting a fan-shaped stream of abrasive material having an elongated impingement pattern, means including a plurality of freely rotatable supporting rollers for supporting an article to be treated, means for advancing said supporting rollers in a continuous, endless path to carry said article through said stream, an elongated driving roll extending along the path of said rollers, and means mounting said driving roll for driving engagement with at least one of said supporting rollers for rotating it during at least a portion of the travel thereof through said stream.

11. In an abrading machine, centrifugal abrasive propelling mechanism operative to project a fan-shaped stream of abrasive particles having an elongated impingement pattern, a pair of spaced endless supporting members between which said fan-shaped stream is projected, means for advancing the upper flight of said supporting members in the general direction of the longitudinal axis of said impingement pattern, a frame member extending between and connected to said supporting members, a workpiece-supporting means rotatably mounted on said frame member, and driven means positioned to one side of said workpiece-supporting means operative to rotate said workpiece-supporting means and the workpiece supported thereon during the passage of said workpiece through said abrasive stream.

12. In an abrading machine, a centrifugal abrasive propelling mechanism for projecting a stream of abrasive particles, rotatable supports, a pair of spaced flexible supporting members trained over said rotatable supports, driving mechanism for advancing said flexible members, a frame extending between and connected to said flexible members, article-supporting means rotatably mounted on said frame, and drive means independent of said frame for rotating said article-supporting means to rotate the article during its linear advance through said stream.

13. In an abrading machine, a pair of spaced flexible supporting chains, a pair of rotatably mounted sprockets supporting each of said chains, a centrifugal abrasive propelling mechanism positioned to project a stream of abrasive particles between said spaced chains, drive means for advancing a flight of said chains linearly and in unison, a frame extending between and connected to said spaced chains, a pair of workpiece-supporting rollers rotatably mounted on said frame, an elongated drive roll having its elongated axis extending in the general direction of advance of said drive chains adapted to frictionally engage with one of said supporting rollers, and drive means for rotating said drive roll to rotate the workpiece during its linear advance through said stream.

14. In an abrading machine, a centrifugal abrasive projecting mechanism operative to project a fan-shaped stream of abrasive particles having a generally elongated impingement pattern, a workpiece-supporting carriage, spaced generally parallel extending elements supporting said carriage, means for advancing said carriage through said stream in the general direction of the longitudinal axis of said impingement pattern, paired sets of workpiece-supporting rollers rotatably mounted on said carriage, a pair of spaced drive rolls between which said fan-shaped stream is projected, means for rotating said drive rolls, said workpiece-supporting rollers being positioned to be moved into operative engagement with said drive rolls whereby to rotate said supporting rollers and the workpiece supported thereon as the workpiece is linearly advanced through said abrasive stream.

15. In an abrading machine, a centrifugal abrasive propelling mechanism operative to project a stream of abrasive particles, a pair of spaced upper trackway members between which the abrasive stream from said propelling mechanism is projected, a pair of spaced lower trackway members, a pair of spaced spur trackway members extending to said lower trackway members, a spur switch connecting said upper trackway members to said spur trackway members, and a workpiece-supporting carriage supported by and movable over said trackway members.

16. In an abrading machine, an upper trackway and a lower trackway, a spur trackway and a trackway switch connecting said upper and lower trackways, a workpiece-supporting carriage movable over said trackways, driven means connected to said carriage operative to advance said carriage over said lower trackway, spur trackway, trackway switch and upper trackway, and a centrifugal abrasive propelling mechanism operative to project a stream of abrasive particles against the workpiece supported on said carriage as said carriage is advanced over one of said trackways.

17. In an abrading machine, a pair of spaced trackways, a spur trackway and a trackway switch connecting said spaced trackways, a workpiece-supporting carriage movable over said trackways, means associated with said carriage operative to advance said carriage from one of

said spaced trackways to the other of said spaced trackways through the medium of said spur trackway and trackway switch, and a centrifugal abrasive propelling mechanism positioned adjacent one of said spaced trackways operative to project a stream of abrasive particles against a workpiece supported on said carriage as said carriage is advanced over said adjacent trackway.

18. In an abrading machine, a circuitous trackway, a workpiece-supporting carriage movable over said trackway, a continuous flexible driven element operably connected to said carriage, means for driving said flexible element to advance said carriage along said circuitous trackway, centrifugal abrasive propelling mechanism operative to project a downwardly directed fan-shaped stream of abrasive particles positioned adjacent a section of said trackway, and driven means operating independently of said element-driving means for rotating the workpiece supported on said carriage while passing through the abrasive stream when the carriage moves through the trackway section adjacent said abrasive propelling mechanism.

19. In an abrading machine, upper and lower trackways, a carriage including rollers movable over said trackways, and a frame supported by said rollers, trackway elements adjacent the ends of said upper and lower trackways for guiding said carriage rollers from one trackway to the other, a centrifugal abrasive propelling mechanism operative to project a fan-shaped stream of abrasive particles positioned adjacent a section of one of said trackways, means for advancing said carriage over said trackways and trackway elements, a workpiece supporting means rotatably mounted on said carriage, and driven means adjacent said abrasive propelling mechanism for rotating said workpiece-supporting means and the workpiece while the workpiece is advanced on said supporting carriage through said stream.

20. In an abrading machine, a continuous circuitous trackway comprising a pair of spaced generally parallel extending tracks, an endless drive member, a workpiece-supporting carriage having rollers movable over said trackway, means connecting said carriage to said endless drive member, means for driving said endless member to advance said workpiece-supporting carriage over said circuitous trackway, and a centrifugal abrasive projecting mechanism operative to project a stream of abrasive particles, said mechanism being positioned adjacent a section of said trackway to project the abrasive stream against the workpiece supported on said carriage and between said tracks while said carriage is advanced along said section of the trackway.

21. In an abrading machine, a continuous circuitous trackway including spaced guide means, an endless relatively flexible member extending along each of said guide means, a workpiece-supporting carriage including a carriage frame, and rollers rotatably mounted on said carriage frame and movable along said guide means, means connecting said carriage to said spaced flexible members, means for driving said flexible members in unison to advance said workpiece-supporting carriage over said circuitous trackway, and a centrifugal abrasive propelling mechanism, said mechanism being positioned adjacent said circuitous trackway to project an abrasive stream against the workpiece supported on said carriage while said carriage is advanced along said circuitous trackway.

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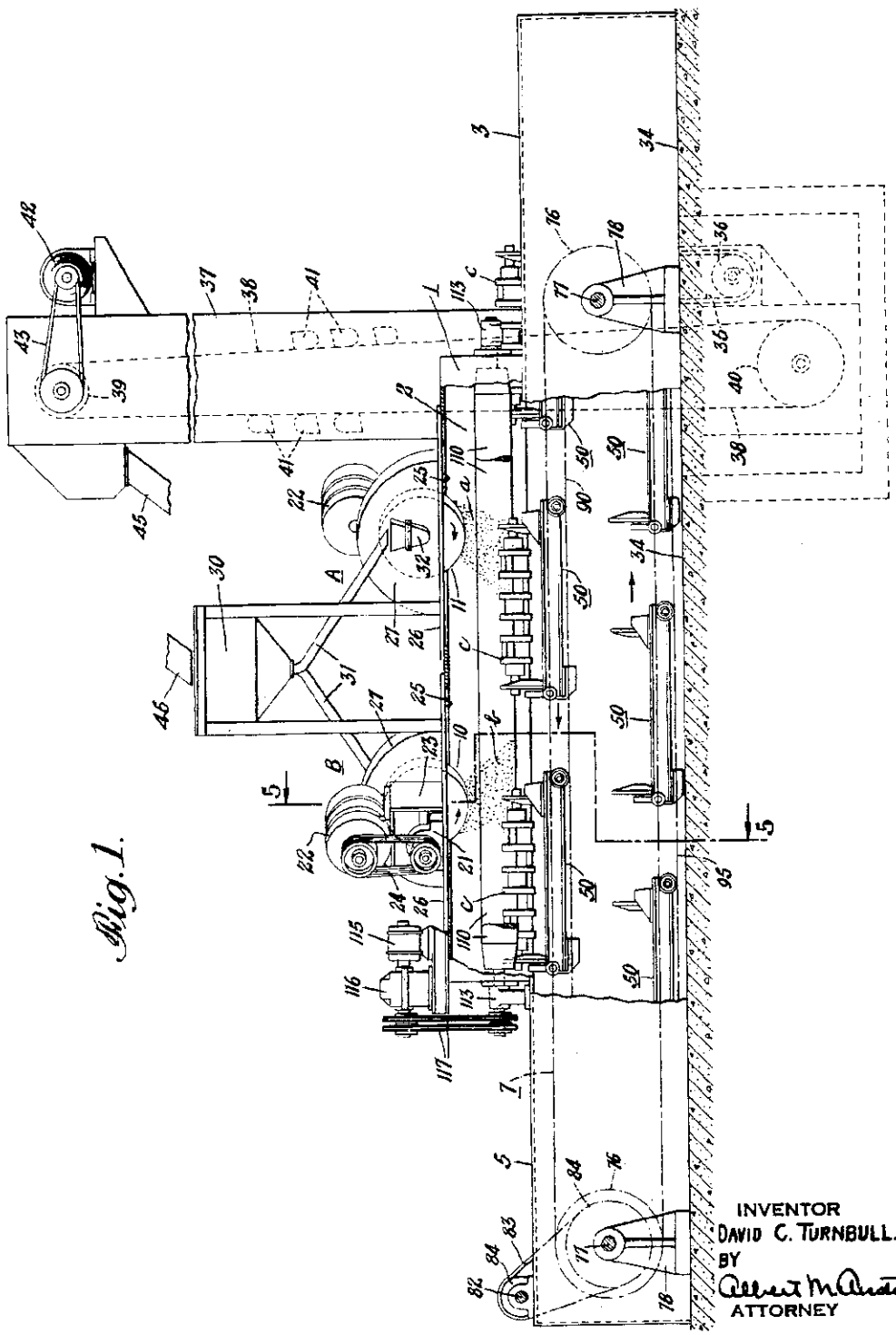

Fig. 1.

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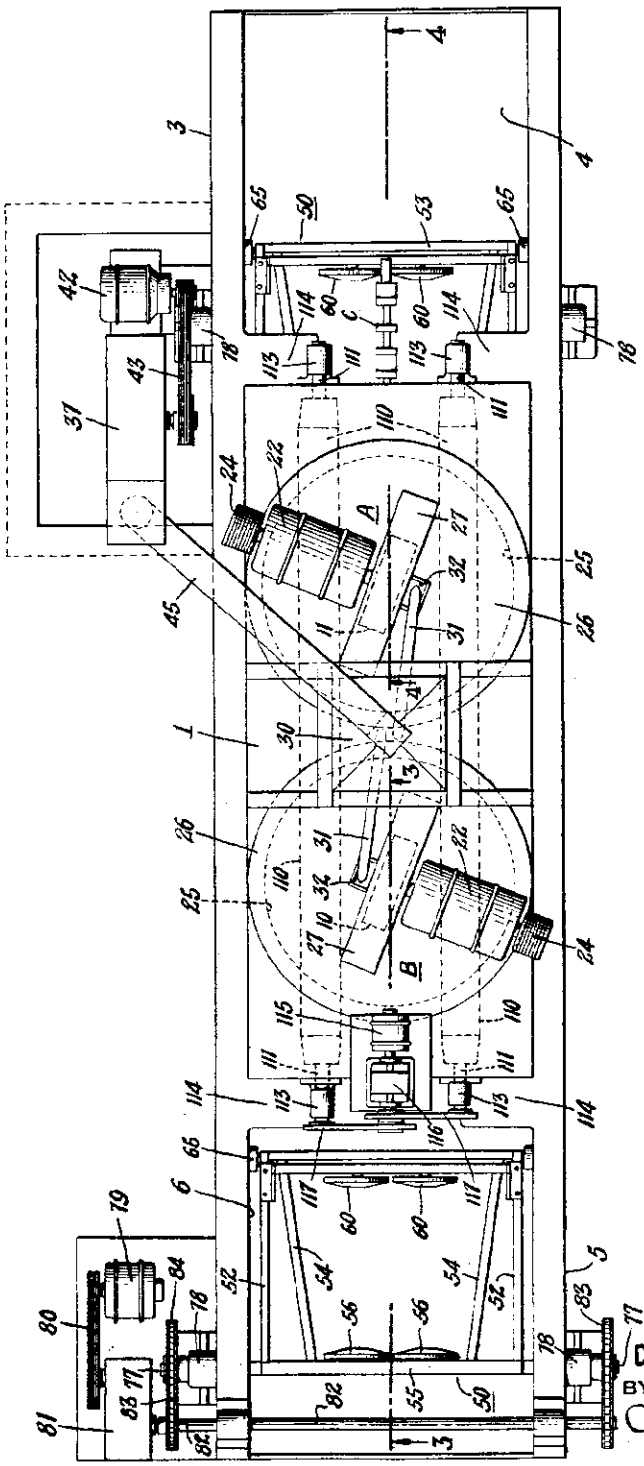

Fig. 2.

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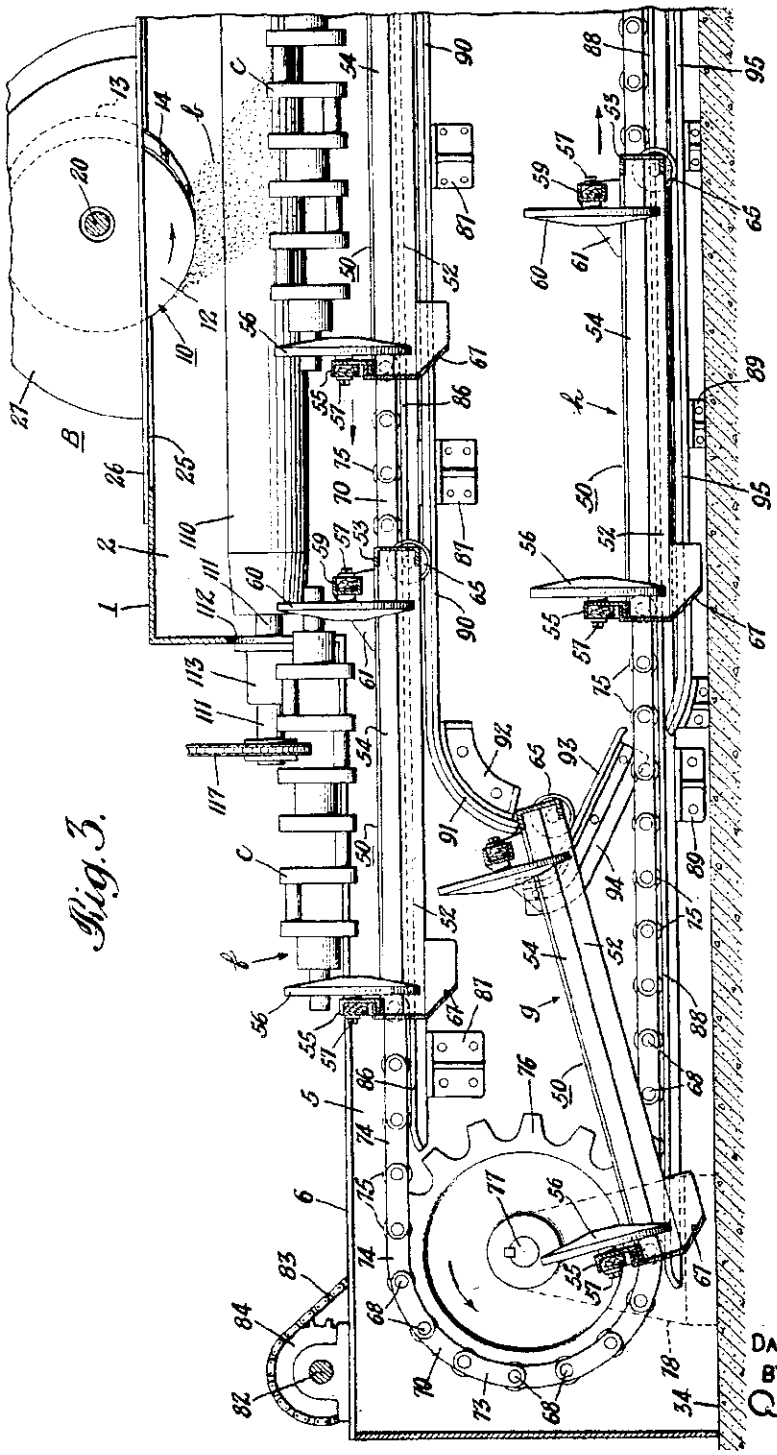

Fig. 3.

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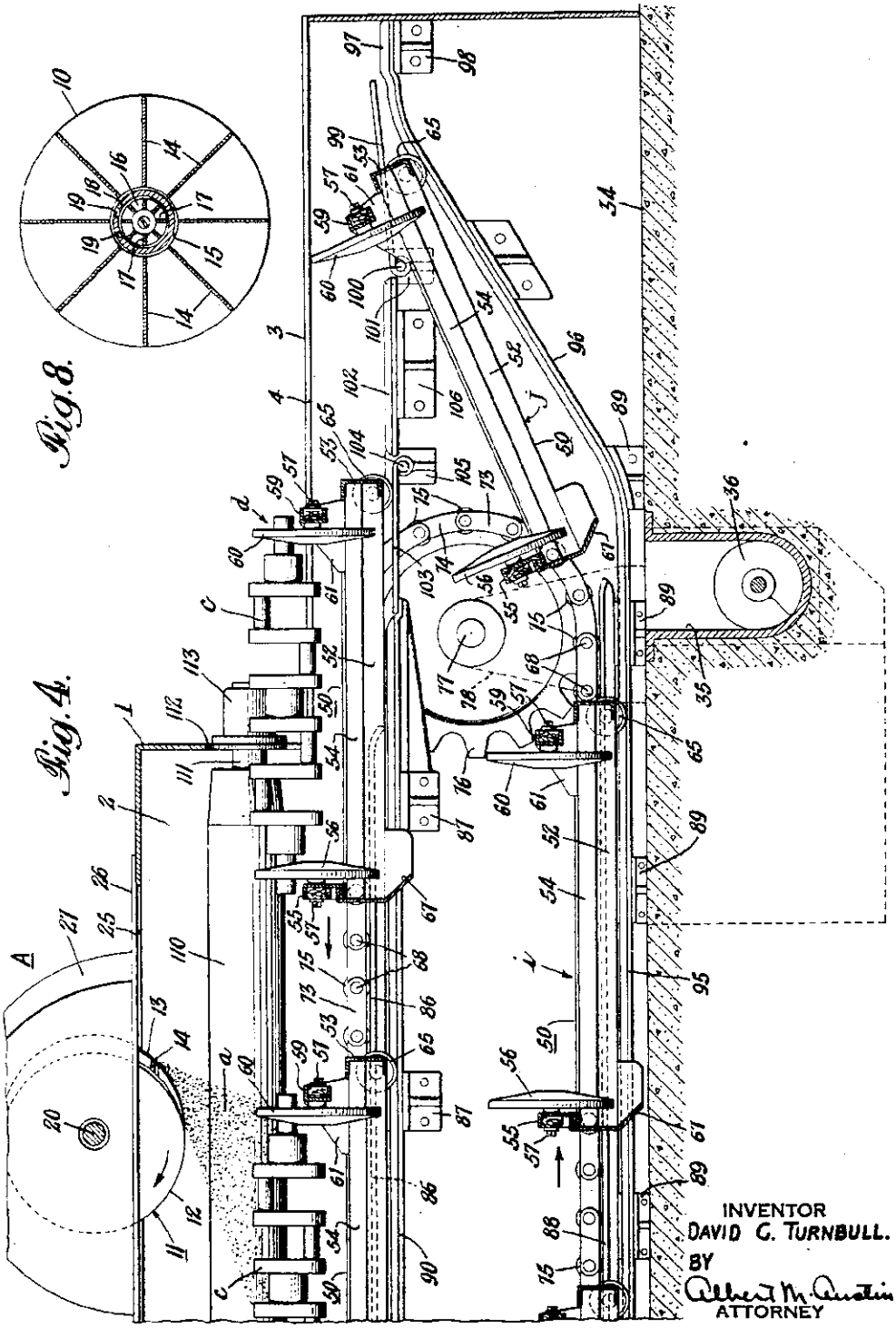

Fig. 8.

Fig. 4.

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Fig. 5.

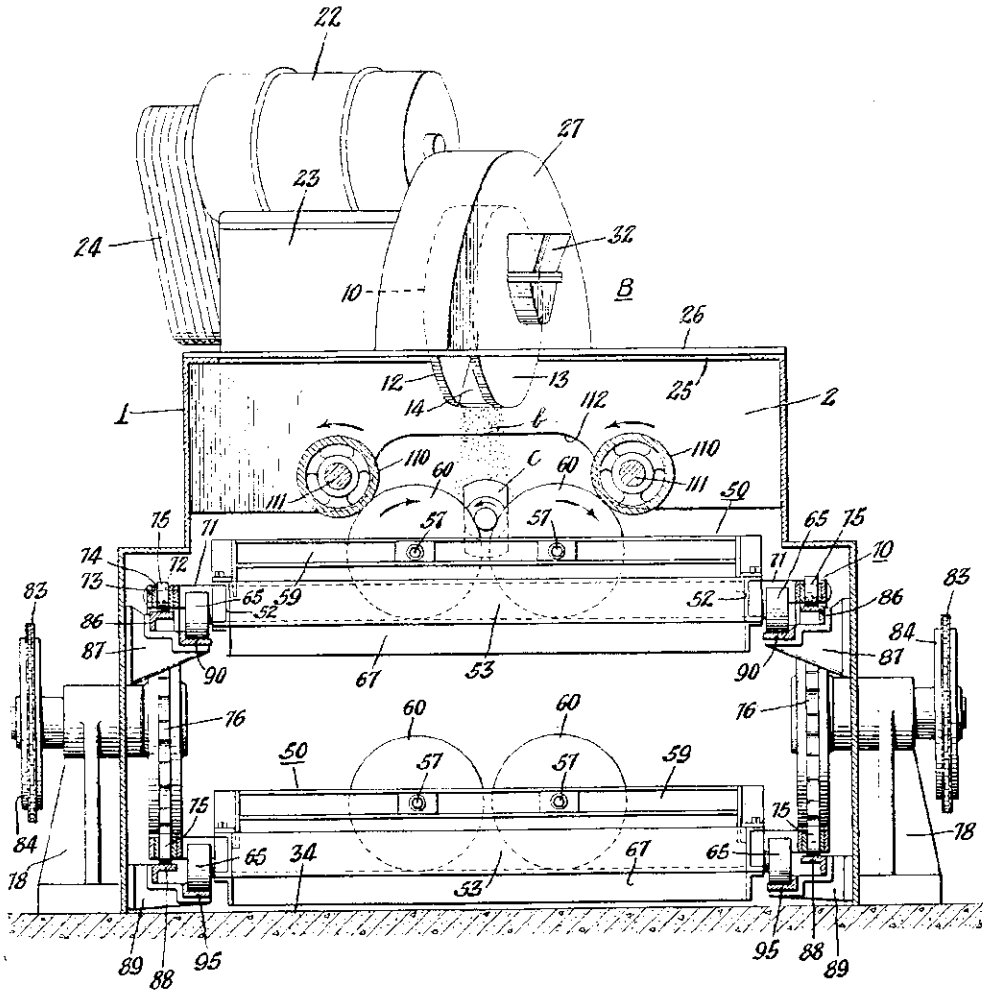

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Fig. 6.

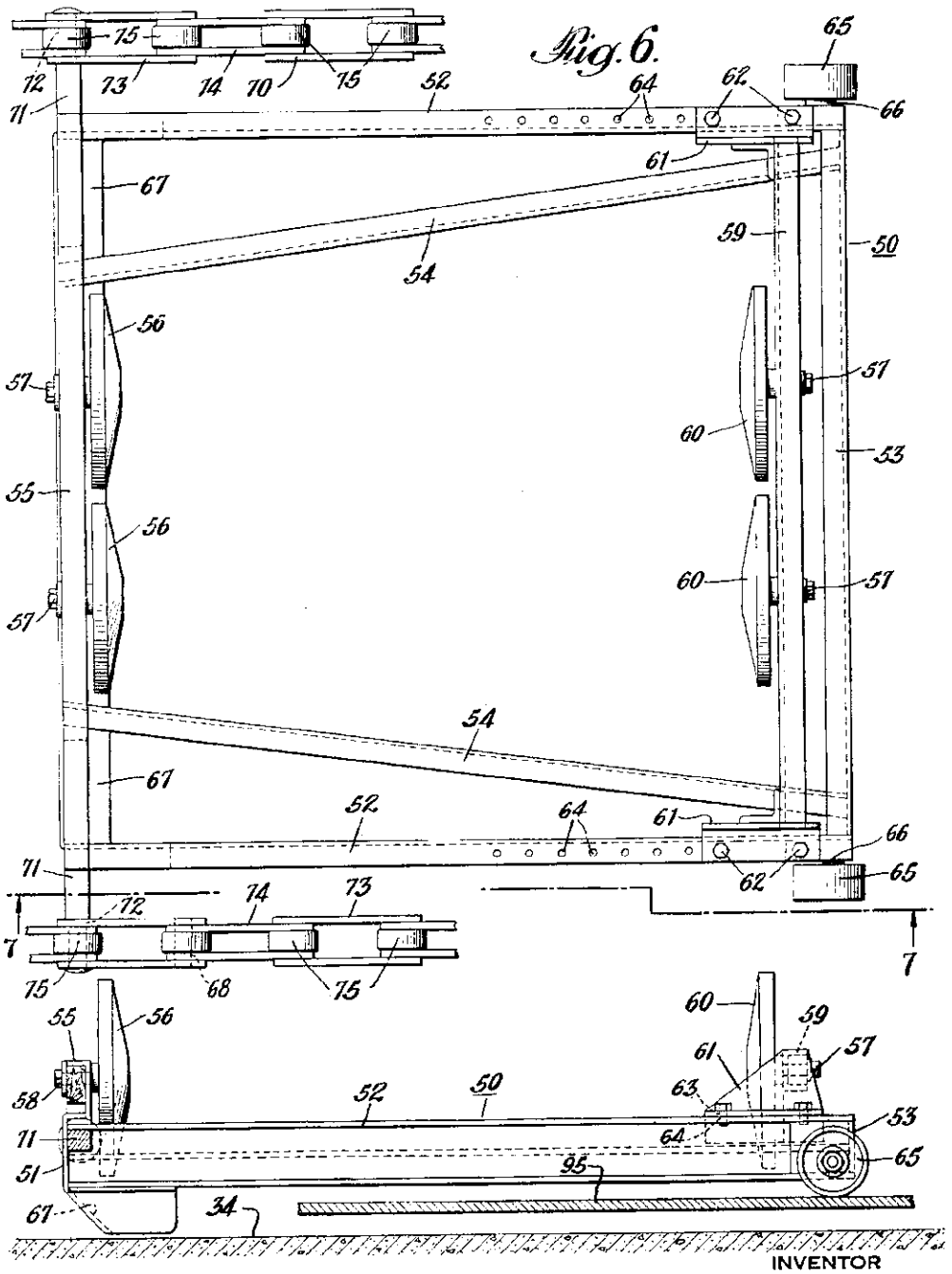

Fig. 7.

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