No. 637,526. Patented Nov. 21, 1899.

J. W. RENO.

INCLINED ELEVATOR.

(Application filed June 22, 1899.)

(No Model.) 5 Sheets—Sheet 1.

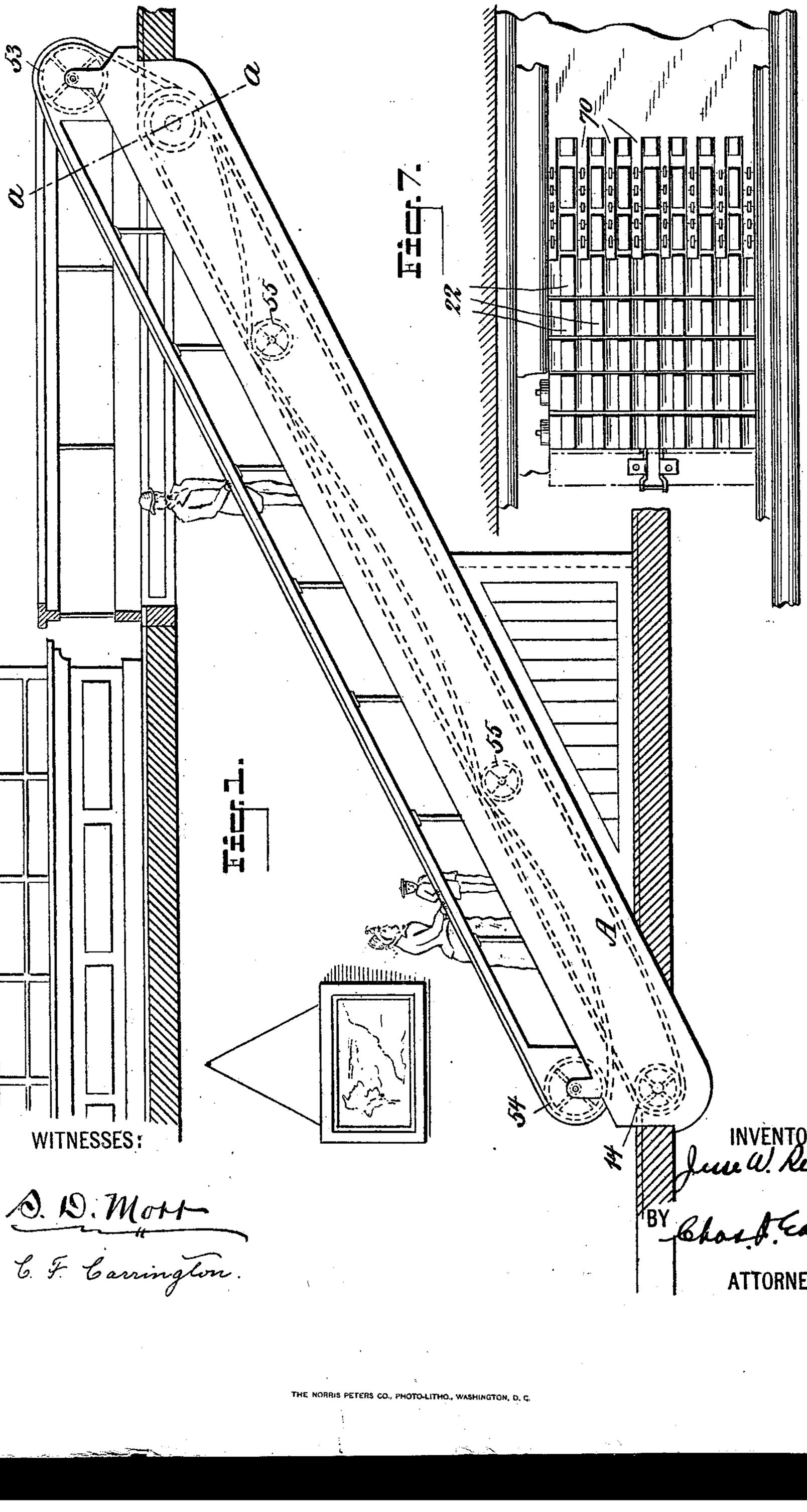

Fig. 1.

Fig. 7.

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(No Model.)

5 Sheets—Sheet 2.

Fig. 1.

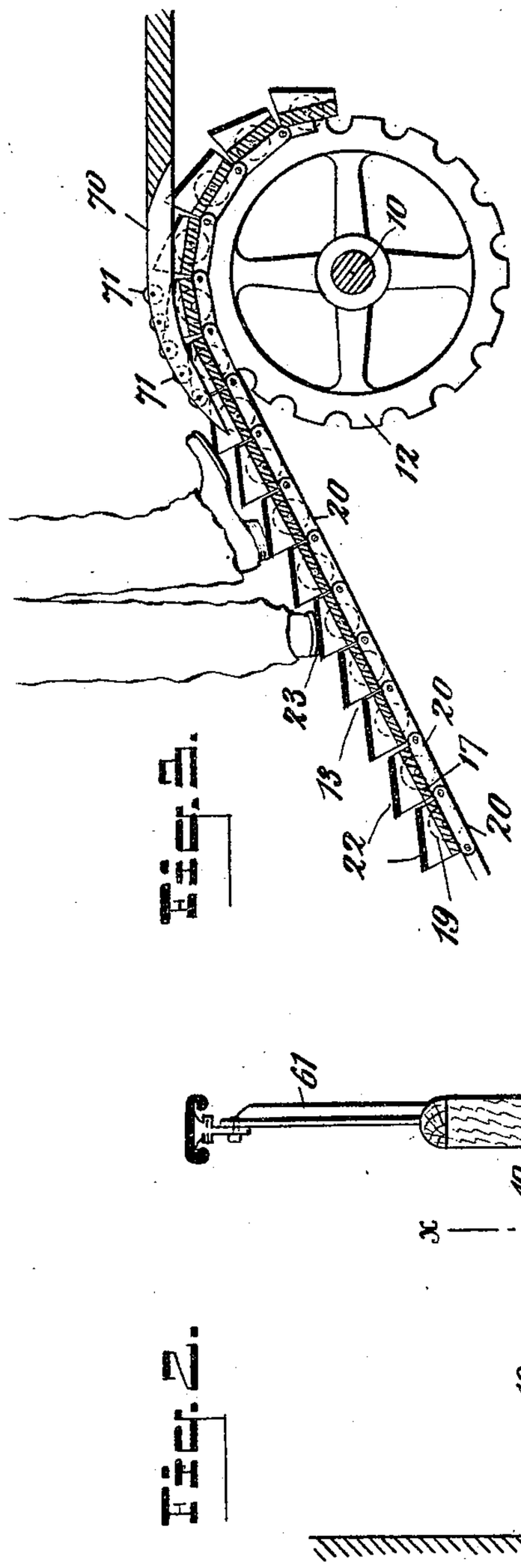


Fig. 4.

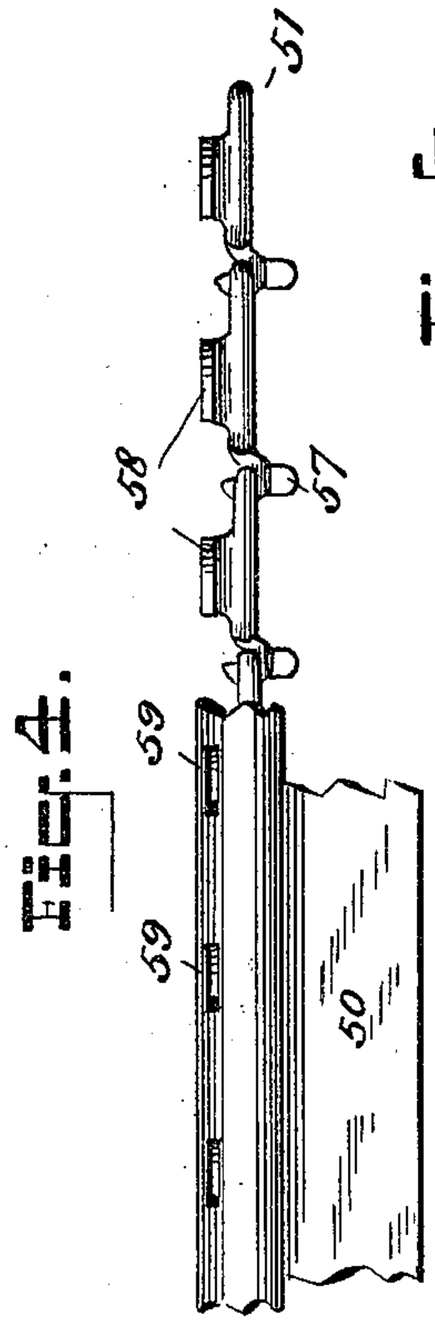


Fig. 3.

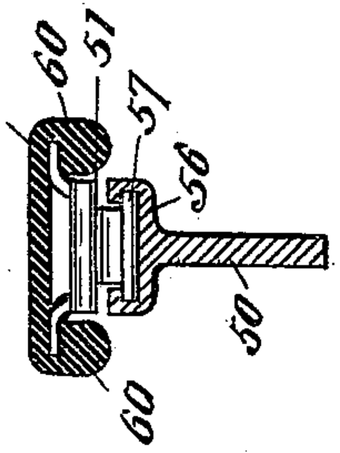


Fig. 5.

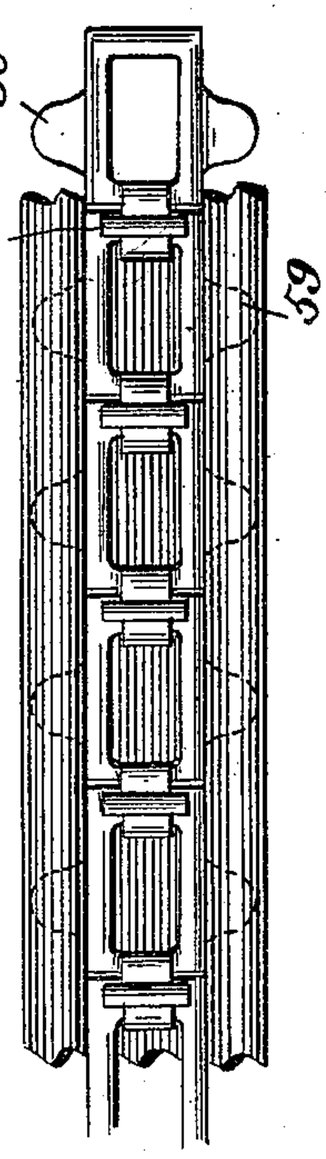
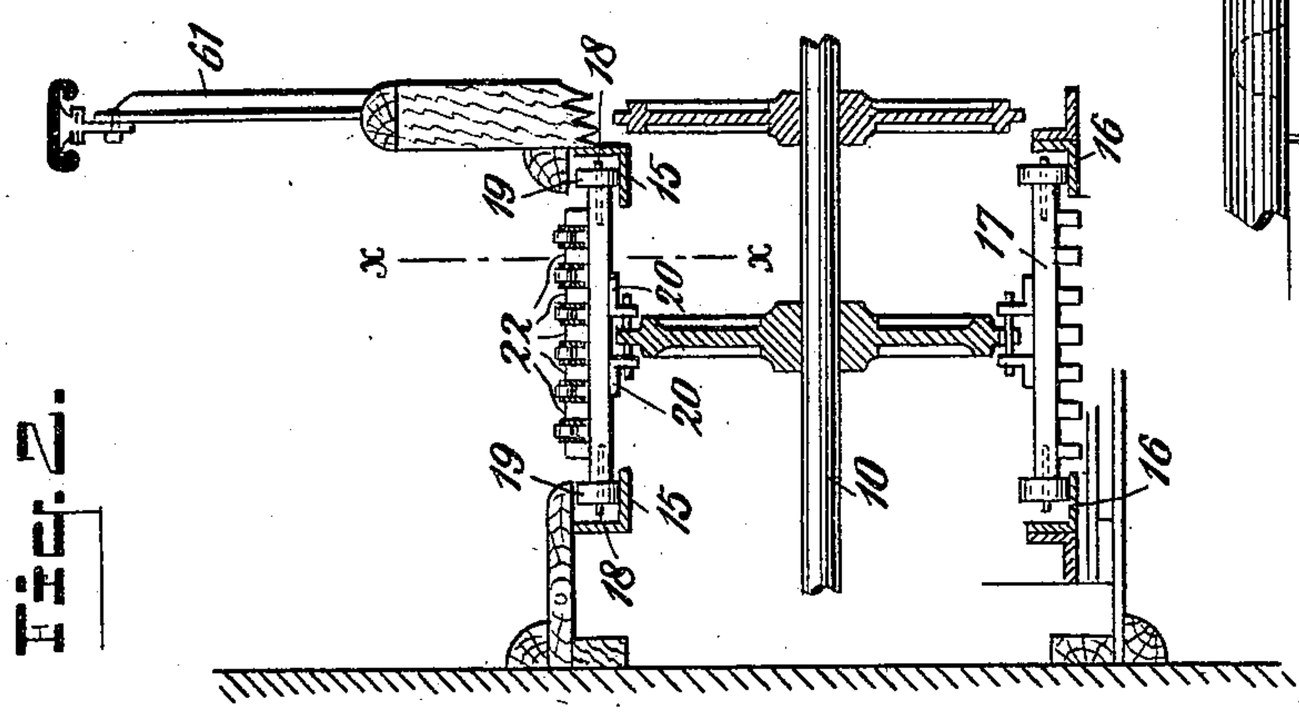


Fig. 2.



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(Application filed June 22, 1899.)

(No Model.) 5 Sheets—Sheet 3.

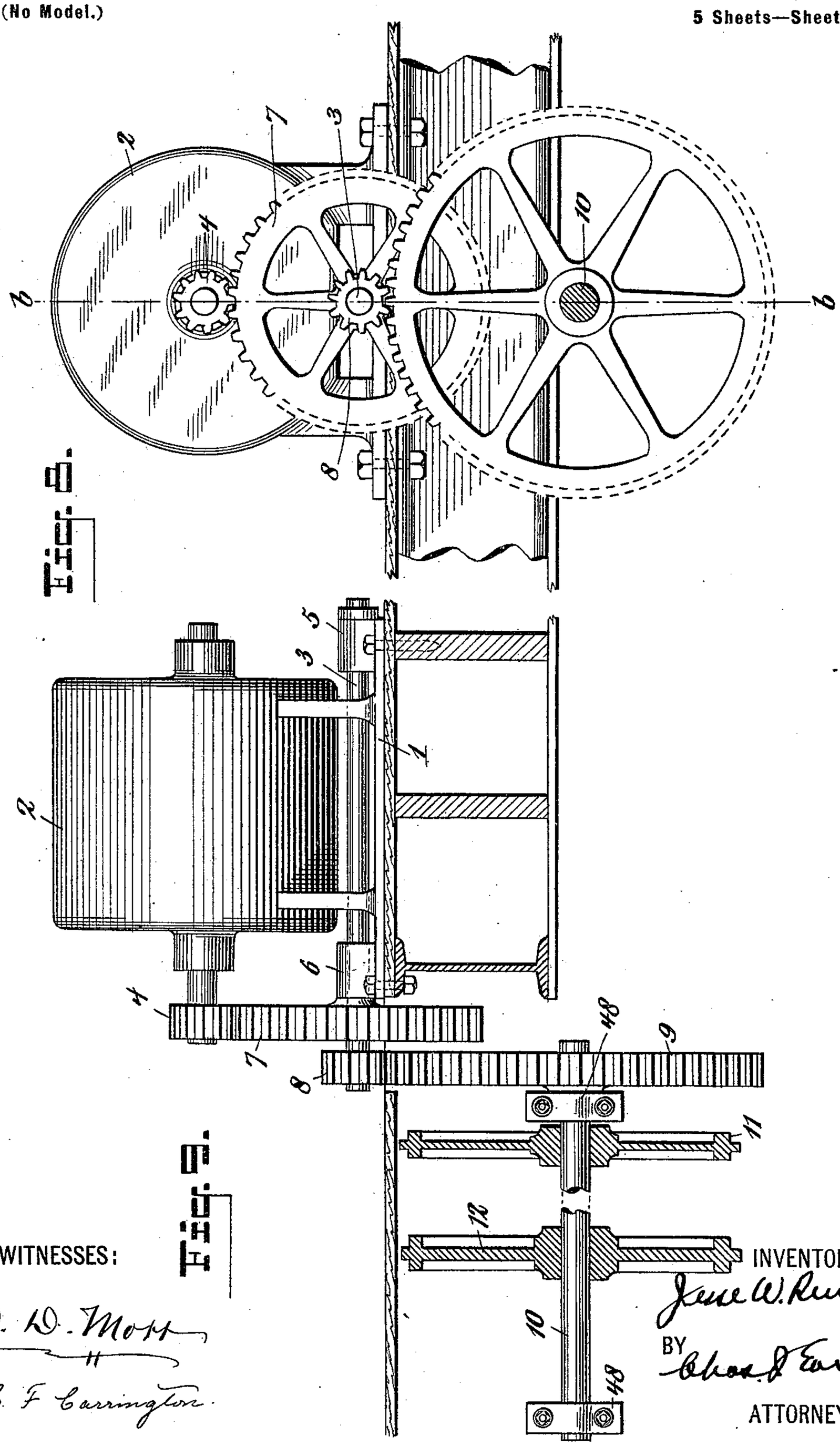

FIG. 5.

FIG. 6.

FIG. 7.

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(Application filed June 22, 1899.)

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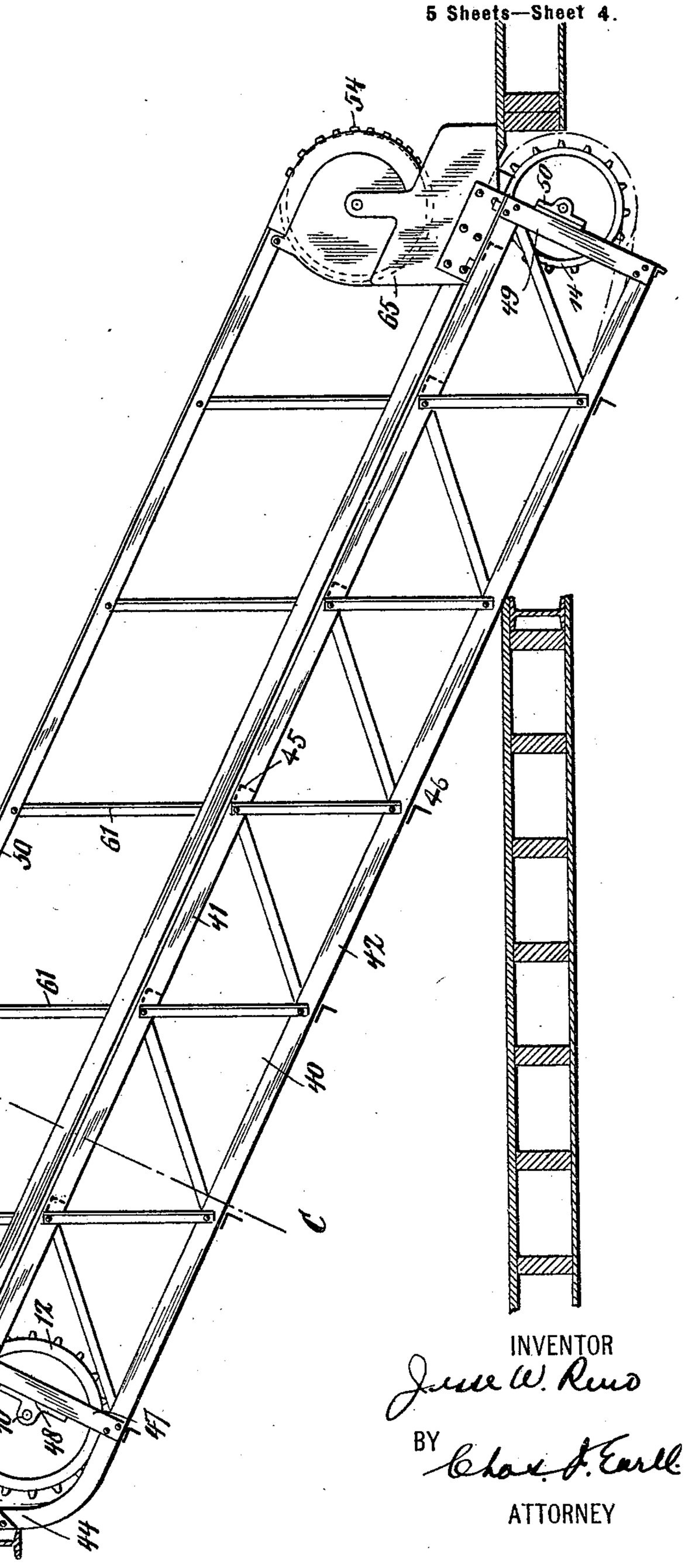

Fig. 10.

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(Application filed June 22, 1899.)

(No Model.)

5 Sheets—Sheet 5.

Fig. 12,

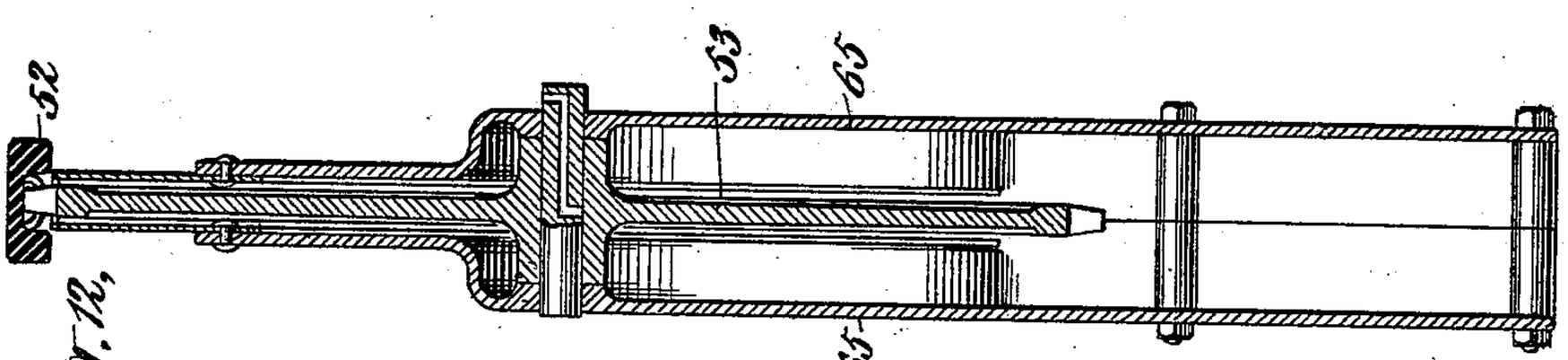
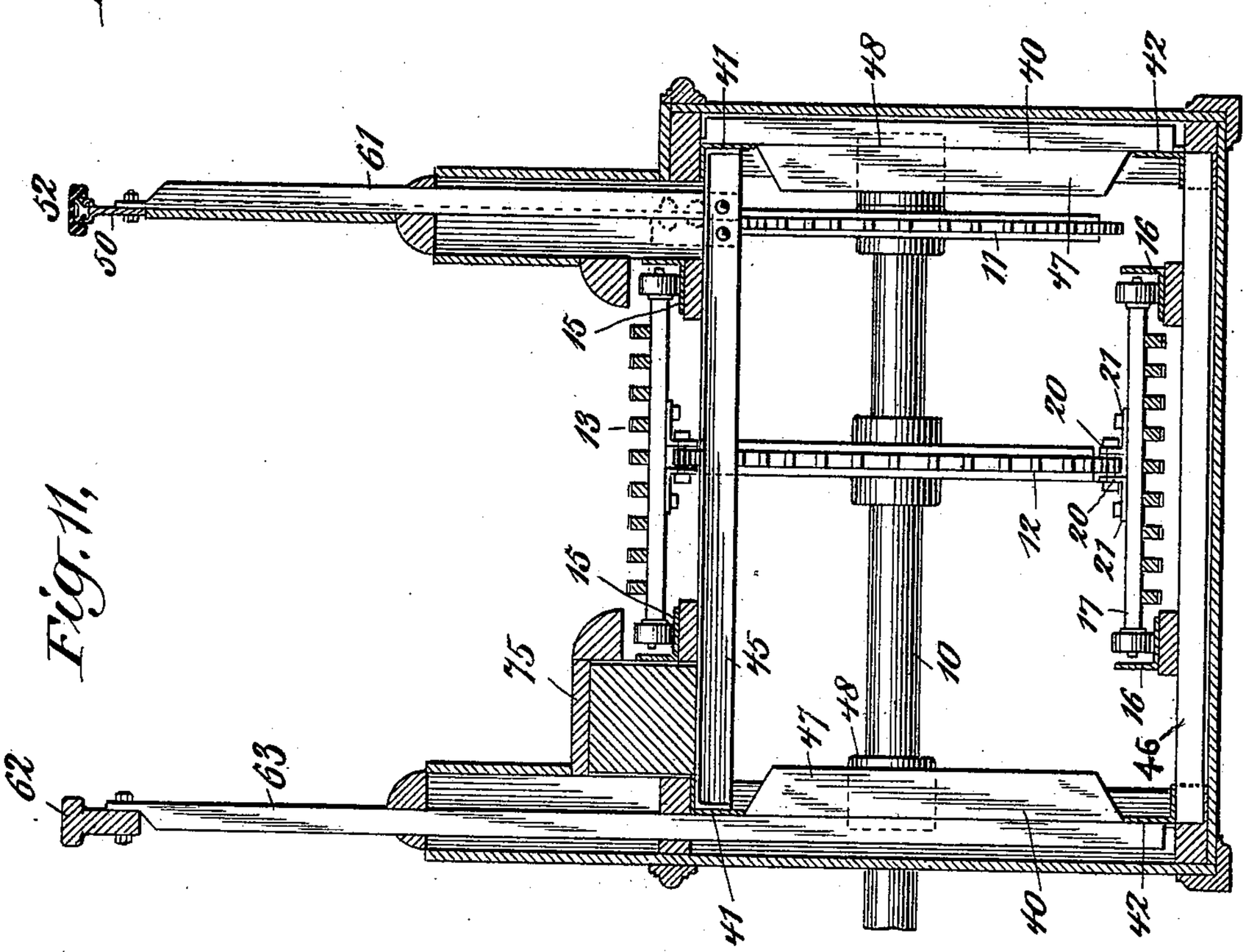


Fig. 11,



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UNITED STATES PATENT OFFICE.

JESSE WILFORD RENO, OF NEW YORK, N. Y.

INCLINED ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 637,526, dated November 21, 1899.

Application filed June 22, 1899. Serial No. 721,463. (No model.)

To all whom it may concern:

Be it known that I, JESSE WILFORD RENO, a citizen of the United States of America, and a resident of the city, county, and State of New York, have invented certain new and useful Improvements in Inclined Elevators, of which the following is a specification.

My invention relates to inclined passenger-elevators by means of which passengers are carried on a continuously-moving tread-surface or belt adapted to travel along an inclined track from one level to another, as from one floor in a building to another above or below it, the object being to provide an elevator of this character that shall be reliable and effective in its construction and operation, and one especially adapted for the safety and convenience of passengers, and at the same time one that can be more economically manufactured and installed than those heretofore in use, and one that is particularly adapted for use where the space is limited.

My invention consists in the novel construction and arrangement of parts whereby the driving mechanism is located upon the upper of the two floors connected by the elevator, easily accessible and in a relatively small space, and whereby a supporting structure is constructed of two latticed trusses having their upper and lower chords connected by transverse members which support track-rails for the upper or operative portion of the tread-surface or belt and the lower or return portion of the same, respectively, and in providing sprocket-wheels at the upper and lower ends and about midway between said trusses, the upper or driving sprocket-wheel being of substantially the same diameter as the distance between the upper and lower track-rails and the lower sprocket-wheel being made of a somewhat less diameter than the distance between the upper and lower track-rails, whereby the tread-surface is supported on the upper track-rails during all of its travel between the upper and lower sprocket-wheels, but is supported on its return on the lower track-rails during only a part of its travel and is permitted to hang freely for a short space between the lower sprocket-wheel and the point where it becomes tangent to and is supported by the lower track-rails, and thus automatically compensate for slack.

My invention consists, further, in providing a movable hand-rail to operate in unison with the movable tread-surface and in the arrangement of the tread-surface, the movable hand-rail, and a stationary hand-rail whereby the movable hand-rail is located more accessible than the stationary hand-rail to the passengers as they stand upon the tread-surface, thereby diminishing the likelihood of the passengers grasping the stationary hand-rail by mistake.

My invention consists, further, in a novel construction of the movable hand-rail, the tread-surface, the upper landing, and in other novel features to be hereinafter described.

In the drawings accompanying and forming part of this specification, Figure 1 is a side elevation of my invention as it is ordinarily installed to connect two floors of a building. Fig. 2 is a transverse section on line *a a* of Fig. 1, showing the general arrangement where the elevator is located adjacent to a wall. Fig. 3 is a partial longitudinal section on line *x x* of Fig. 2. Fig. 4 is a detail view of the movable hand-rail, showing part of the elastic covering removed to expose the links of the hand-rail chain. Fig. 5 is a bottom view of the same. Fig. 6 is a cross-sectional view of the movable hand-rail and a portion of the stationary guide therefor. Fig. 7 is a plan view of the upper landing. Fig. 8 is an end view of the driving mechanism. Fig. 9 is a side view and partial section on the line *b b* of Fig. 8. Fig. 10 is a side view showing the supporting structure. Fig. 11 is an intermediate section on line *c c* of Fig. 10, showing a stationary hand-rail which is used when the elevator is not located adjacent to a wall or where two elevators, one ascending and the other descending, are located adjacent to each other. The stationary hand-rail in this case is located between the two elevators. Fig. 12 shows a cross-section through one of the terminal hand-rail sprocket-wheels on line *d d* of Fig. 10.

Similar characters of reference designate like parts in all of the figures.

The apparatus as a whole may be conveniently divided into the following heads: the

supporting structure, the driving mechanism, the tread mechanism or the moving platform on which the passengers stand, the hand-rail mechanism, and the landings, all these several mechanisms coacting to produce a single result.

The supporting structure consists of two trusses 40 40, formed of an upper chord 41 and lower chord 42, the upper ends of said chords being joined together, so as to form a horizontal portion 43 on the upper chord and the vertical portion 44 on the lower chord, thereby making a convenient means of attachment to the upper floor. The two trusses are connected by transverse members 45 on the upper chord for supporting the upper track, and 46 on the lower chord for supporting the lower track. Secured to the struts 47 are the bearings 48 48 for the driving-shaft 10, and secured to the lower struts 49 are the bearings 50 50 for the lower sprocket-wheel shaft.

Secured to the transverse members 45 and 46 are the upper track-rails 15 15 and the lower track-rails 16 16. Secured to the upper transverse members 45 are the vertical posts 61 for supporting the hand-rail guide 50. The stationary hand-rail 62 when used is preferably supported by the vertical posts 63, which may be made of a continuation of the vertical lattice-bars of one of the trusses. Secured at the upper and lower ends of the truss, on the moving-hand-rail side, are the hand-rail-sprocket-wheel cases 65 65. Each case is preferably made in two parts adapted to be bolted together and inclose the hand-rail sprocket-wheel. The case is so formed that the upper portion, and especially that portion above the center of the sprocket-wheel which is in close proximity to the movable hand-rail, is made narrow relative to the hand-rail, so that a passenger's hand may not come in contact therewith, while the lower portion is made broad enough for the hand-rail to pass on the inside, as is clearly illustrated in Fig. 12. At one side of the movable platform or tread-surface 13 is arranged the stationary surface 75 between the elevating-surface and the stationary hand-rail or wall, and this stationary surface and the stationary hand-rail or wall are preferably arranged to lie on the left-hand side of the tread-surface as one stands looking in the direction in which the platform is moving. The purpose of this arrangement is to make it more convenient and natural for passengers to grasp the movable hand-rail than it is for them to grasp the stationary one, as confusion might arise if while the passenger is standing on the tread-surface he should grasp the stationary hand-rail.

Connecting the upper and lower hand-rail-sprocket cases is the hand-rail guide 50, which has intermediate supports 61 secured to the transverse members 45.

The driving mechanism consists of the base-plate 1, mounted on which is the motor 2. Mounted on the motor-shaft is the pinion 4, which is preferably made of rawhide to reduce the noise. Mounted on the base-plate 1 in the bearings 5 and 6, directly underneath the motor-shaft, is the intermediate shaft 3, which projects beyond the bearing 6 and bears the gear 7 and pinion 8, these gears being overhung, so that they may project below the base-plate and below the floor-surface. The base-plate 1 is arranged to rest upon the floor, to which it is securely bolted. The pinion 8 engages the gear 9 on the driving-shaft 10 of the tread mechanism. By this arrangement I am able to use a standard motor of the ordinary construction, and while it is necessary to reduce the speed in the ratio of one to thirty-five the driving mechanism occupies a relatively small space and is easily accessible for inspection and repair.

The tread-surface consists of a series of transverse slats secured to the links of a chain and forms an endless belt 13, which is driven by the sprocket-wheel 12, located at the upper end of the structure, and passes over an idler 14, located at the lower end, and it is supported between the sprocket-wheels 12 and 14 by the upper track-rails 15 15 and the lower track-rails 16 16. The chain to which the slats are secured is made of links 20, provided with lugs 21, which are bolted to the slats 17. The slats are made preferably of hard wood and are provided with tread-pieces 22 of trapezoidal shape, secured to the slats by means of screws. These tread-pieces are also preferably made of hard wood, and the grain of the wood is made to run transversely of the slats 17, thereby strengthening the latter. The tread-pieces are secured to the slats so as to leave an opening between them which will register with the grating of the landings, as will be hereinafter explained. The tread-pieces are also provided on their upper surfaces with rubber strips to prevent slipping and are arranged at such an angle as will bring them substantially horizontal when in operation. This arrangement of the treads gives the surface of the belt a serrated form, composed of alternating horizontal and vertical portions. The horizontal portions are made wide enough only for the passenger's foot when the latter stands in a position parallel to the slats. I have found in practice that the most natural and convenient position for passengers is to stand with one foot essentially parallel with the slats and the other at right angles thereto, approximately. At the same time by using treads of this form and relative size I am able to dispense with cumbersome and impracticable apparatus, which would be necessary to keep the steps horizontal if ordinary steps were employed.

The character and operation of my tread-surface is essentially different from the usual stairs or steps. An irregular or notched surface is produced, upon which the passenger may step at any point, and then after having stepped upon this surface he may arrange himself in the most comfortable position, as shown in Fig. 3.

Were steps of the ordinary size used, the passenger would be compelled to select some particular step as it came along, but he could not, as in my device, step upon the moving belt at any point without paying particular attention to the steps. For this reason I am enabled to use a much higher speed and greatly increase the capacity of the elevator.

In the ends of the slats are inserted the shafts 18 18, mounted on which are the rollers 19, which engage the track-rails.

The lower sprocket-wheel 14 is made of smaller diameter than the upper sprocket-wheel 12, thereby causing the moving platform to leave the lower track-rails at some distance above the lower sprocket-wheel and to hang in a curve, thus permitting the slack or lost motion due to wear to be automatically taken up.

The hand-rail mechanism consists of the guide 50 and chain 51 and elastic covering 52, together with the sprocket-wheel 11 on the driving-shaft 10, the upper idler 53, the lower idler 54, and the intermediate idlers 55 55, which support the movable hand-rail on its return. The guide 50 is preferably made of T-iron, with the groove 56 formed therein, adapted to receive the lugs 57 of the chain. The chain 51 is made in the ordinary form of a link-belt chain, except that it is provided with the lugs 57, adapted to engage the groove 56, and lugs 58, which are adapted to engage the recesses 59, formed in the elastic covering 52. The elastic covering 52 is provided with depending side portions 60 60, which effectually cover the links of the chain and prevent the hand from coming in contact therewith. This elastic covering in practice is molded of rubber in one long continuous piece. It will be seen that by this construction of the elastic covering it is well adapted to make the curves around the sprocket-wheels and that its neutral surface lies very close to the pitch-line of the chain, thereby necessitating a very slight elongation or stretch as it passes around the sprocket-wheel. It is also to be noted that the elastic covering is readily secured to the chain without the use of rivets or bolts of any description, which latter I have found in practice to be not only expensive but troublesome.

The upper landing is formed of a comb-like grating consisting of prongs or bars 70, which extend into the recesses or grooves formed by the tread-pieces. These bars are tapered at their ends, so as to come below the lowest point of the tread-pieces, and they are provided with rollers 71 for the purpose of reducing the friction of a passenger's foot as it enters upon the platform, the tops of the tread-pieces being made of rubber or similar material, and the foot of the passenger slides easily upon the platform until it is securely landed.

Having thus described my invention, what I claim is—

1. In an inclined elevator, the combination with inclined track-rails and a supporting structure therefor, of a series of movable treads supported by said rails, a movable hand-rail on one side of said treads adjacent thereto, and an inclined stationary surface on the opposite side thereof parallel to said rails and adjacent to said movable treads.

2. In an inclined elevator, the combination with inclined track-rails and a supporting structure therefor, of a series of movable treads supported by said rails, a movable hand-rail on one side of said movable treads, and a stationary hand-rail on the opposite side, said movable hand-rail located adjacent to said movable treads, and said stationary hand-rail located relatively remote therefrom.

3. In an inclined elevator, the combination with inclined track-rails and a supporting structure therefor, of a series of movable treads supported by said rails, a movable hand-rail on one side of said treads adjacent thereto, a stationary hand-rail on the opposite side, and a stationary incline between said stationary hand-rail and said movable treads.

4. In an inclined elevator, the combination with two latticed trusses and an upper set of transverse members secured to the upper chords, and a lower set of transverse members secured to the lower chords of said trusses, of longitudinal track-rails supported upon said upper and said lower transverse members, a shaft journaled near the upper ends of said latticed trusses, a sprocket-wheel mounted on said shaft intermediate of said trusses, of a diameter substantially equal to the distance between said upper and said lower track-rails, a sprocket-wheel located at the lower end of said trusses of less diameter than the distance between the said upper and said lower track-rails, and a series of treads secured to an endless chain passing around said sprocket-wheels and supported on said upper track-rails for the entire distance between said sprocket-wheels, and on the lower track-rails for a portion of the distance.

5. In an inclined elevator, the combination with a series of treads joined together in the form of an endless belt and an inclined supporting structure therefor adapted to connect an upper and a lower floor, of a driving sprocket-wheel mounted on a shaft at the upper end of said supporting structure, a gear on the end of said shaft, a base-plate secured to the upper floor provided with bearings, an intermediate shaft journaled in said bearings having an overhung portion, a pinion on the overhung portion of said intermediate shaft meshing with the gear on the shaft on which said sprocket-wheel is mounted, an intermediate gear on said intermediate shaft between said pinion and said base-plate, and a motor-shaft mounted on said base-plate above said intermediate shaft having a pinion engaging said intermediate gear.

6. In an inclined elevator, the combination

with a series of treads joined together in the form of an endless belt, of a shaft 10 carrying the sprocket-wheels 11 and 12 and the gear 9, the shaft 3 journaled in the bearings 5 and 6 on the base-plate 1, the pinion 8 and gear 7 mounted on shaft 3, and the motor 2 having the driving-pinion 4 to engage the gear 7, all arranged substantially as and for the purpose set forth.

7. In an inclined elevator, the combination with a series of treads linked together in the form of an endless belt, having longitudinal grooves formed in the tread-surface, a landing for said elevator provided with bars which register with said grooves, and friction-rollers mounted in said bars.

8. In an inclined elevator the combination with inclined track-rails and a supporting structure therefor, of a series of treads rigidly secured to the links of an endless chain at a fixed angle, substantially equal to the angle of inclination of the track-rails, and rollers engaging said track-rails mounted on the ends of said treads.

9. In an inclined elevator, an elevator-belt consisting of a series of transverse slats, an endless chain having its links rigidly secured to said slats midway of their length, shafts or studs secured to the ends of said slats, rollers mounted on said shafts or studs and trapezoidal strips secured to said slats so as to leave grooves longitudinally of the belt and so as to thereby form a serrated surface.

10. An element of an elevator-belt for inclined elevators consisting of a link secured to a wooden slat, wooden tread-pieces of trapezoidal form secured to said wooden slats, the grain of said wooden treads substantially at right angles to the grain and longitudinal axis of said slats.

11. In an inclined elevator an elevator-belt consisting of a series of links, a transverse slat rigidly secured to each link, trapezoidal strips of a length slightly greater than the width of an adult human foot secured to said slats so as to leave grooves longitudinally of the belt.

12. In a movable hand-rail for inclined elevators, the combination with an endless chain composed of links hinged together, with an elastic covering therefor.

13. In a movable hand-rail for inclined elevators, the combination with an elastic cover, of an endless chain secured to said cover, a stationary guide for said chain, and means for preventing said hand-rail from being separated from said chain.

14. In a movable hand-rail for inclined elevators, the combination with an elastic cover, of an endless chain secured to said elastic cover, the links of said chain being provided with lugs 57, and a stationary guide provided with a groove to receive said lugs.

15. In a movable hand-rail for inclined elevators, the combination with an endless chain, having the lugs 58 formed on the links of said chain, with an elastic covering, having recesses 59 adapted to engage said lugs.

16. In a movable hand-rail for inclined elevators, the combination with the elastic cover having recesses formed therein, of an endless chain having two sets of lugs formed on the links thereof, one set of lugs adapted to engage the recesses in said elastic covering, and the other set adapted to engage a groove in the stationary guide.

17. An elevator-belt for inclined elevators consisting of a series of elements linked together in the form of an endless belt, each element having a substantially horizontal tread portion of such width that the adult human foot may span a plurality of treads when placed transversely of said treads, and wide enough to support the foot when placed longitudinally.

18. An elevator-belt for inclined elevators consisting of a series of elements linked together in the form of an endless belt, each element having a substantially horizontal tread portion of a width from one-half to one-third the length of an adult human foot.

Signed by me at New York, county and State of New York, this 19th day of June, 1899.

JESSE WILFORD RENO.

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JNO. S. PARKER.