No. 765,648. PATENTED JULY 19, 1904.

E. BALTZLEY & D. M. & T. R. QUAY.

TRAVELING STAIRWAY.

APPLICATION FILED MAR. 25, 1904.

NO MODEL. 2 SHEETS—SHEET 1.

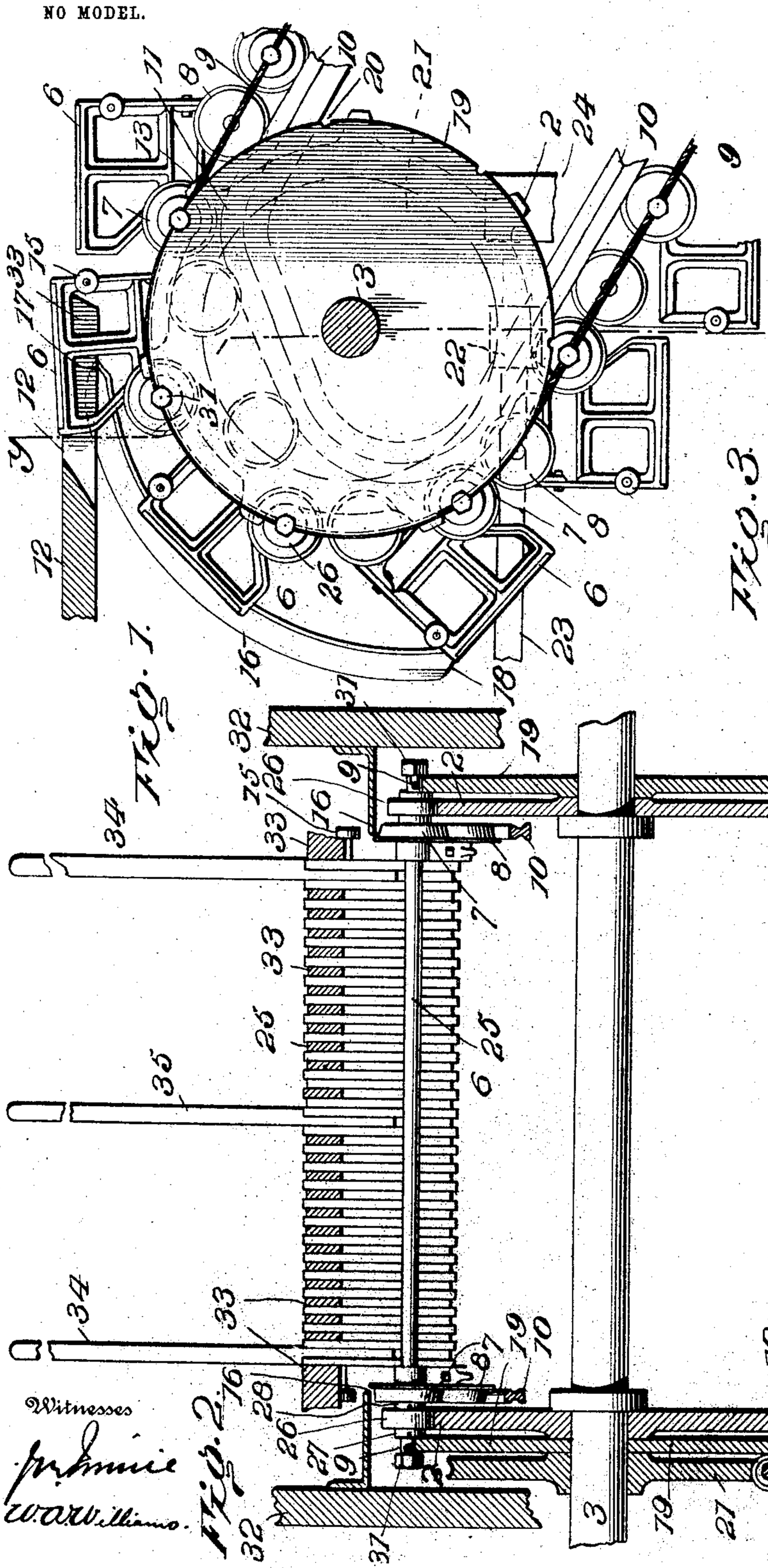

Fig. 1.

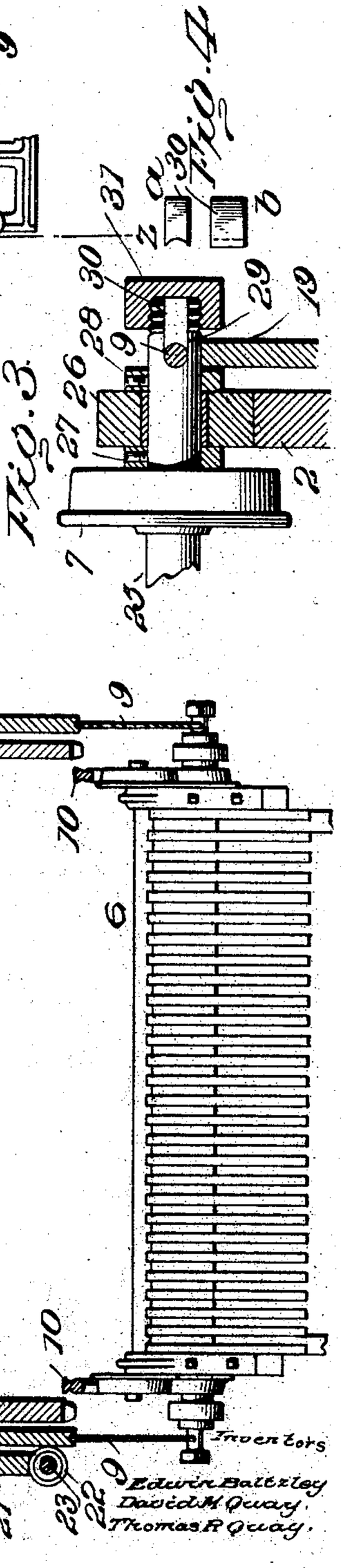

Fig. 3.

Fig. 4.

Fig. 2.

Witnesses
J. Dennie
W. A. Williams.

Inventors
Edwin Baltzley
David M. Quay.
Thomas R. Quay.

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NO MODEL. 2 SHEETS—SHEET 2.

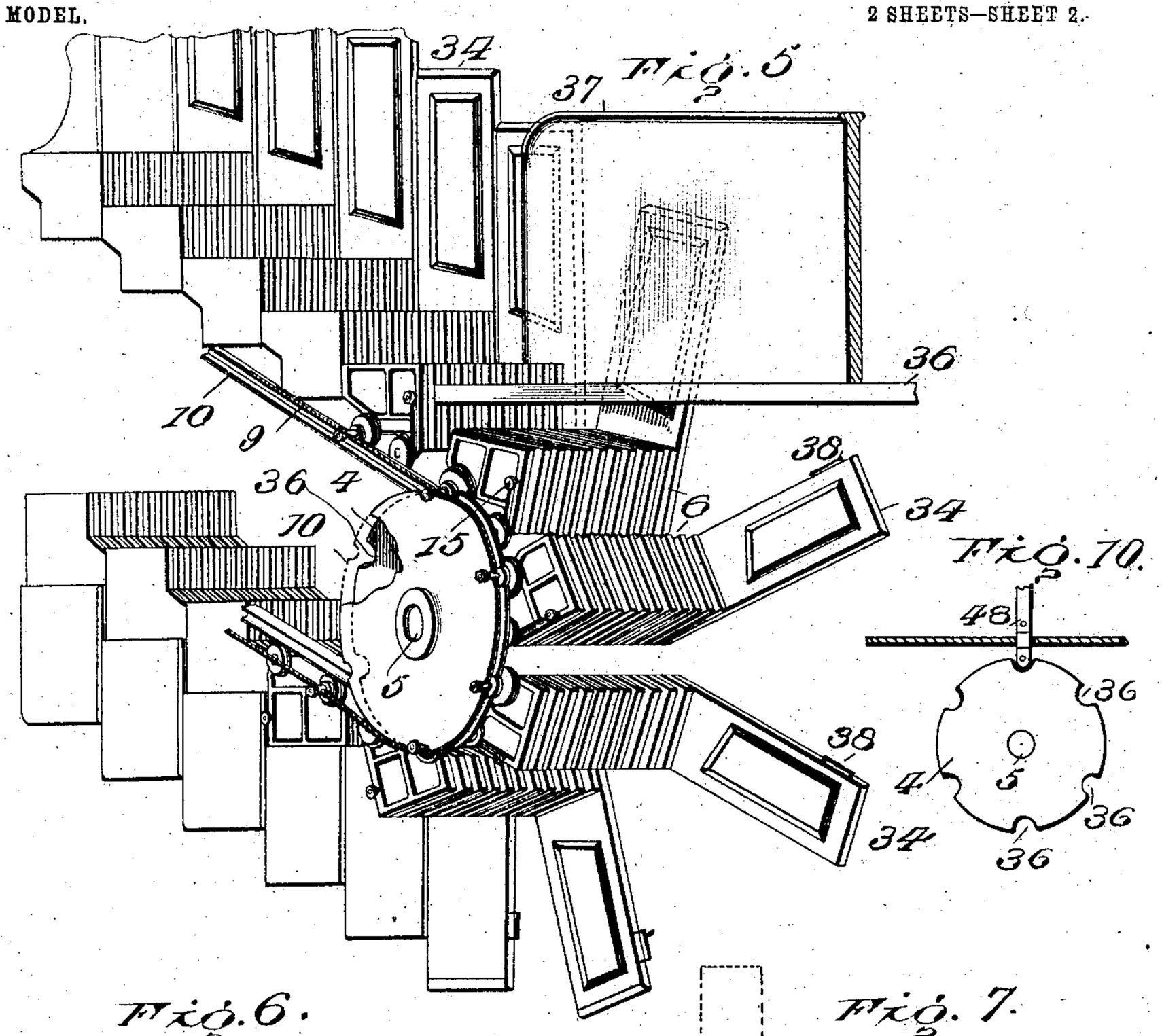


Fig. 5

Fig. 10.

Fig. 6.

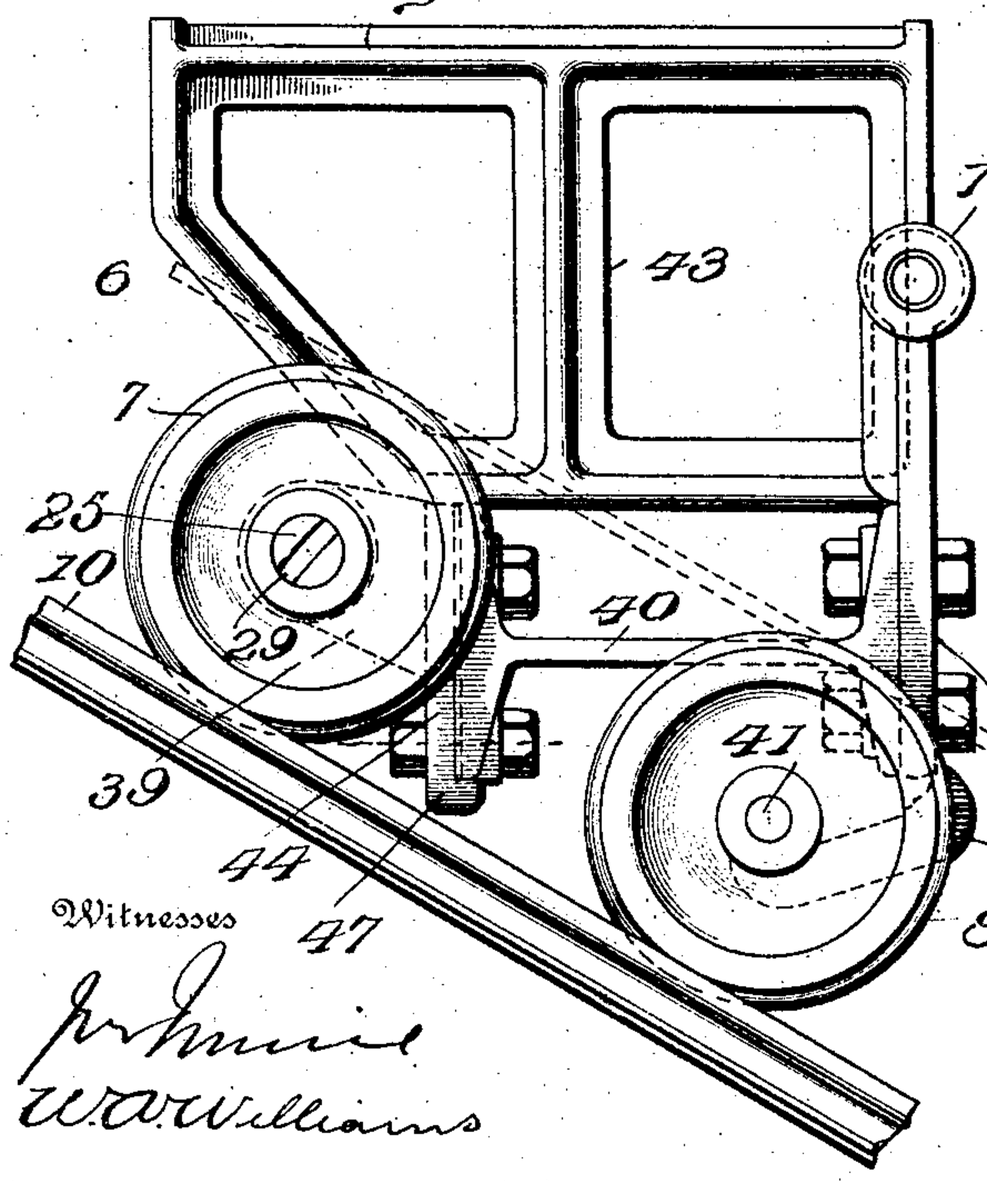


Fig. 7.

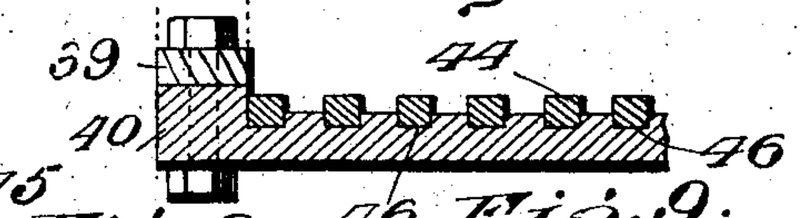
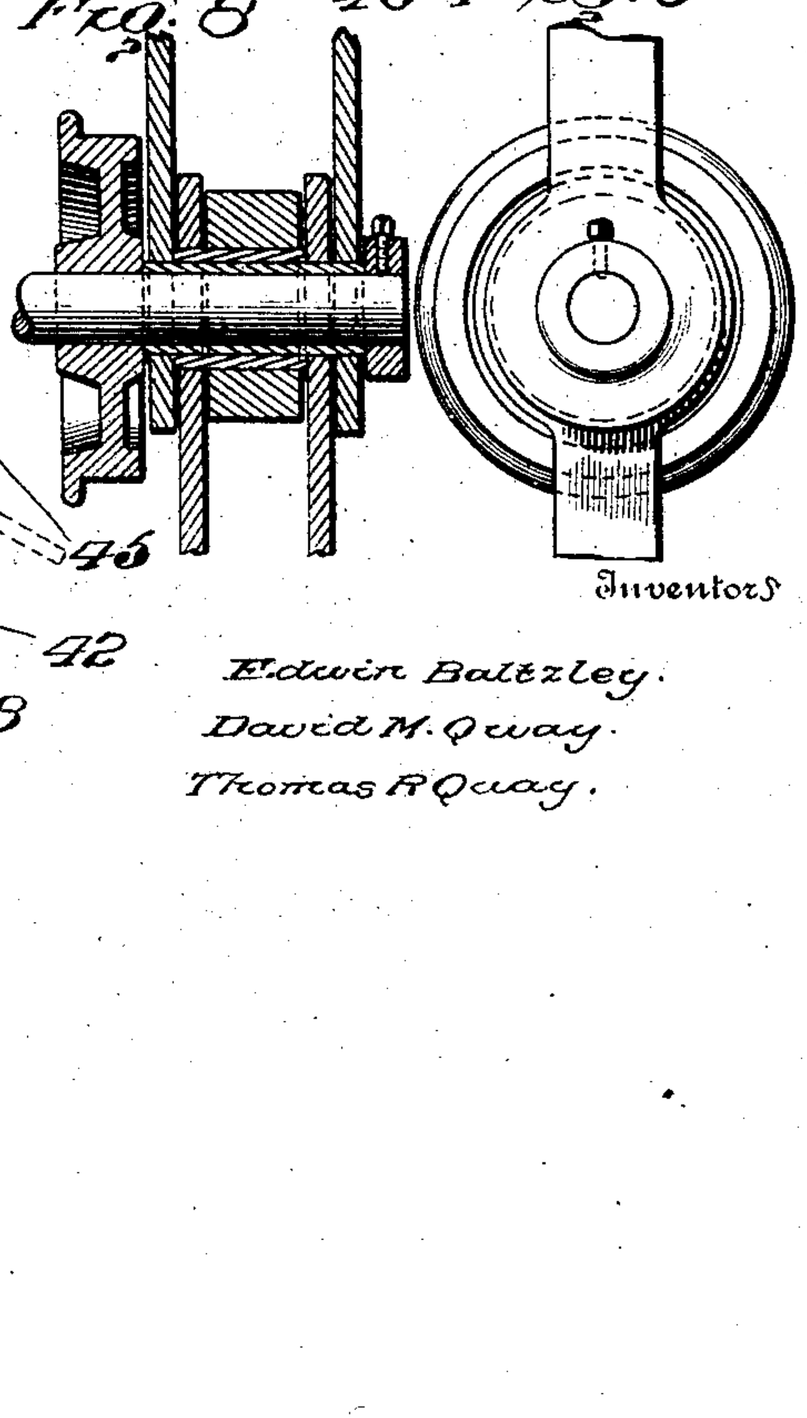


Fig. 8

Fig. 9.



Witnesses

J. Johnson

W. A. Williams

Inventors

Edwin Baltzley.

David M. Quay.

Thomas R. Quay.

No. 765,648. Patented July 19, 1904.

UNITED STATES PATENT OFFICE.

EDWIN BALTZLEY, OF GLEN ECHO, MARYLAND, AND DAVID M. QUAY AND THOMAS R. QUAY, OF NEW YORK, N. Y., ASSIGNORS TO THE TRAVELING STAIRWAY COMPANY, A CORPORATION OF NEW YORK.

TRAVELING STAIRWAY.

SPECIFICATION forming part of Letters Patent No. 765,648, dated July 19, 1904.

Application filed March 25, 1904. Serial No. 199,967. (No model.)

To all whom it may concern:

Be it known that we, EDWIN BALTZLEY, residing at Glen Echo, county of Montgomery, State of Maryland, and DAVID M. QUAY and THOMAS R. QUAY, residing at New York, county of New York, and State of New York, all citizens of the United States, have invented certain new and useful Improvements in Traveling Stairways, of which the following is a specification.

We designate our invention as a "stairvator," it being a revolving or traveling stairway designed to move passengers from one elevation to another with speed, comfort, and safety and belongs to the class and is an improvement upon the inventions by Edwin Baltzley, for which Letters Patent were granted to him, No. 739,141, September 15, 1903; No. 739,574, September 22, 1903; No. 739,575, September 22, 1903; No. 744,457, November 17, 1903.

It consists of a single cam-track and guide therewith for controlling the evolutions of the steps.

It also consists of a step-shaft engagement with the sprocket-wheel.

It also consists of a step-shaft and roller-bearing engagement with the sprocket-wheel.

It also consists of a driven-cable combination with an endless flight of steps.

It also consists of an endless flight of steps linked together by a cable.

It also consists of two or more cables in combination with an endless flight of steps.

It also consists of attaching a cable to each of the outside ends of the journal of the traveling step.

It also consists of locating the wheels, roller-bearings, and cable outside the vertical plane of the steps.

It also consists of the means for preserving the cable circular in bending around the sprocket-wheel.

It also consists of the novel construction of the steps.

It also consists of other new and novel features, which will be fully hereinafter described and claimed.

For a full description of the invention and the merits thereof and also to acquire a knowledge of the details of construction of the means for effecting the results reference is to be had to the following description and drawings hereto attached.

While the essential and characteristic features of the invention are susceptible of other modifications, still the preferred embodiments are illustrated in the drawings, in which—

Figure 1 is a side elevation of the upper end of the invention, showing the cam-track, the sprocket-wheel, which is in dotted lines, the cable-drum, the cable attached to the ends of the step-shafts, the steps, and the guide-rail at the top landing. Fig. 2 is a cross-section of Fig. 1 along the line *y z*, showing the shaft with the sprocket-wheel, cable-drum, and worm-gear mounted thereon, and the steps, landing, cam-track, step-shaft, roller-bearings, cable, guard-rail, and a section of the side framing in proper relation thereto. Fig. 3 is an enlarged transverse section of the end of a step-shaft, showing a wheel, a roller-bearing, and the cable gripped in place by the cap-nut. Fig. 4 is the grip-plug, *a* being a side view, and *b* the top plan view, of it. Fig. 5 is a perspective view of the lower end of the stairway. Fig. 6 is a side elevation of a step mounted on its wheels and track and showing the I-beam and brackets to which it is attached. Fig. 7 shows one of the slotted faces of an I-beam with the legs of the step-segments therein. Fig. 8 is a modification of Fig. 3. Fig. 9 is an end view of Fig. 8, showing the link to be used instead of a cable. Fig. 10 is a modification showing a different plan for employing the cable in which the socket sprocket-wheel is used as the driving-wheel, and the grip which attaches the steps to the cable is extended below the cable, forming a sprocket or tooth to engage with the sockets of the wheel.

Corresponding and like parts are referred to in the following description and indicated in all the views by the same reference characters.

Light weight, cheapness of construction, minimized friction and wear, durability, accessibility of all parts for adjustment and re-

pair, combined with safety, are the essentials secured in the construction herein shown and claimed.

In Fig. 1, 2 is the upper sprocket-wheel on the journal 3. Each of the steps 6 has a forward wheel 7 and the rear wheel 8, all linked together by the cable 9. The cam-track 10 diverges from its ascending portion at 11, and by its forward and downward descent controls and determines the evolutions of the step in passing through and unloading the passenger onto the landing 12. The sprocket 13 of the sprocket-wheel 2 engages the forward wheel 7 of the step at 11 and thereafter carries the forward side of the step in the path described by the circumference of the sprocket-wheel. The guide-wheel 15, attached to the rear side of each step, engages the guide 16 at 17 and prevents the step from tilting and also assists in holding it in its proper position in its course to the lower side at 18, whence it requires no further aid. 19 is a cable-drum mounted on the journal 3 and is designed to hold the cable in a true circle as it is carried around by the sprocket-wheel. The sockets 20 receive the step-shafts, so as to bring the face of the drum on a line with the center of the shafts, or near them, so as to hold the cable in the direct line of the circle. The face of the drum may be slightly curved for the cable to rest in. It will be readily seen that but for this cable-drum the cable would flatten to a straight line between the shafts of the steps to which it is attached, and thus bend it sharply each time it is revolved around the sprocket-wheel, causing it in time to break, just as a wire is broken by bending it sharply forward and backward.

A worm-gear 21, Fig. 2, is shown in dotted lines in Fig. 1. It is mounted on the shaft 3 and engages with a small gear 22. A gear-shaft 23 is mounted in brackets, of which but one, 24, is shown, and is driven by any suitable power to revolve the endless flight of steps.

Fig. 2 is a cross-section of Fig. 1 along the dotted line *y z*, showing the relation of the parts described in Fig. 2 and a roller-bearing of a step-shaft engaging with a sprocket of the sprocket-wheel 2.

On the step-shaft 25, Fig. 2, are mounted the forward wheels 7 7, which travel on the cam track or rails 10. Outside of the wheels 7 is located a roller-bearing 26, which engages with the sprocket-wheel 2, as shown in Fig. 1 at 13, in Fig. 2 at 2, and also in cross-section, Fig. 3. These roller-bearings coacting with the sprockets of the sprocket-wheel serve to make a smooth, quiet, and frictionless engagement with the sprockets, and thus instead of the sprocket-wheel engaging with the links of a chain or a cable the engagement is made direct with the step through its forward journal. The chain or cable by this construction serves to link the steps together; but we do not limit ourselves to this use of the cable.

While a roller-bearing is the preferred construction, any other form or means may be employed in its place to engage with the step-shaft for the same purpose and be within the scope of this invention. We do not limit ourselves to sprocketing with the forward journal, as it will be readily seen that we may so sprocket with a central or rear journal. On each side of the roller-bearing we place a collar 27 and 28, though these may be omitted in favor of any other means properly separating the parts.

Outside of the roller-bearings we locate the cable 9, which serves to link the steps together. The manner of attaching the cable to the journal is of paramount importance in order to secure accessibility, ease of adjustment, secure attachment, and safety to the cable. The end of the shaft is slotted at 29, as shown in Fig. 3, the inner end of the slot preferably being round, so that the cable may fit neatly in it. A grip-plug 30, Fig, 3, having its inner end conformed to the round form of the cable, is inserted in the slot. The outer end of the shaft is threaded and a cap 31 is screwed over it and drives the grip-plug 30 firmly onto the cable 9, thereby binding it in place. The cap 31 is preferably made hexagon. It will be seen that by this construction the cables can easily be adjusted to the steps after they have been set in place and that in case of repairs or readjustment for any purpose they can readily be gotten at and removed, as can all the working parts of each step. This is an important matter not only in the process of erection, but for change or repair in brief time, so as not to interrupt service.

Attached to the framing 32 (shown in section, Fig. 2) are the guide-rails 16 for holding the step from tilting when passing through the grated landing 33.

The lower or *z* portion of Fig. 2 shows the rear side of a step after it has passed around the sprocket-wheel and is on its return trip to the lower landing.

Traveling balustrades 34 are provided at each side of the steps, as shown in Figs. 2 and 5. In Fig. 5 one of them is omitted only for the purpose of the better illustration of the steps in their evolutions. For some purposes it is desirable to omit the side balustrades and have only a central one, as shown at 35, Fig. 2. The lower end of the flight of steps is preferably carried on an idler 4, mounted on the shaft 5. In this case the sockets 36, Fig. 5, are cut in the wheel for the roller-bearings 26 to engage with in place of the sprockets of the sprocket-wheel. This form of a sprocket-wheel can be used for a driving-wheel when so desired, and by adding driving-gear it may be made to drive in unison with the sprocket-wheel at the top of the stairway.

The paneled sections of the traveling balustrade (shown in Fig. 5) are attached to a seg-

ment of the steps in any suitable manner. They close upon each other just before the step has risen through the landing 36 and the balustrade passed out of the hood or case 37. An elastic cushion 38, preferably a rubber tube, is attached to the upper side of the balustrade to effect a tight and noiseless joint between the balustrade-sections.

The assembling of the step-sections into the continuous traveling balustrade is best shown in Fig. 5. In this form of moving hand-rail or traveling balustrade each step, in a sense, becomes a separate compartment in which the passenger can ride without soiling her garments by brushing against the casing of the stairway. The general character of the steps is the grated form and the same as that set forth in the patents of Edwin Baltzley, hereinbefore referred to, and differs only in details of construction. The forward side of the step is attached to the cable.

In Fig. 2 at the top or *y* side is shown a vertical section of the step in engagement with the grated landing. The lower or *z* side is a rear view of the step on the under side of the stairway. As shown in Fig. 6, the forward shaft 25, which carries the wheel 7, is journaled in the bracket 39, (shown in dotted lines,) which bracket is bolted to an **I**-beam 40. The rear shaft 41, which carries the wheel 8, is journaled in a bracket 42, which is bolted to the **I**-beam 40, as shown in Fig. 6.

The **I**-beam is the base or foundation of the step to which the wheels and steps are adjusted. Both faces of the **I**-beam are slotted or grooved for the purpose hereinafter set forth and shown in section in Fig. 7, wherein the step-legs are also shown.

The step proper is composed of segments spaced apart, as shown in Figs. 2 and 5. The segments are made of any suitable material. They may be cast-iron, malleable iron, or stamp-forged. We prefer to stamp-forge them. They are made skeleton, as shown in Fig. 6, with a central brace 43. In order to make them as light as possible and at the same time strong, the skeleton is a web or **T** shape, as indicated in Fig. 6. The segments have the two legs 44 and 45 extending downwardly. These fit snugly into the slots 46, Fig. 7, and the lower end 47 is driven or clenched over the under side of the **I**-beam, as shown in Fig. 6 at 47. It is a quick and simple process to slot the two faces of the **I**-beam, as also is the stamp-forging of the segments and their assembling into the finished step.

In Figs. 8 and 9 we show a modification of the end of a shaft having the wheel and roller bearing, but with a link chain instead of a cable. The general principle of our invention covers this construction. The details, however, being different, will be the subject-matter of another application for patent.

It will be observed that all the operating parts of the step, being the wheel, roller-bearing, and cable, are outside the vertical plane of the steps, and hence away and protected from all dirt falling through the gratings of the steps, thereby increasing their working life and freedom from wear and noise.

In Fig. 10 we show a modification in which the socket form of the sprocket-wheel is employed as the driving-wheel and the cable used directly as a part of the driving mechanism. 48 is a clamp bolted firmly to the cable. It is shown as broken off at the top where the shaft of the step would be attached to it. Extending below the cable it is shaped as a tooth or sprocket, which engages in the sockets of the sprocket-wheel. Thus the socket sprocket-wheel drives the cable directly by means of this tooth clamped to it.

While this construction is included within the general principles of our invention, the details thereof will form the subject of another application for patent.

In operation the sprocket-wheel is driven by the worm-gear. The sprockets engage with the journal or shafts of the steps, which are linked together by the cables attached to each end of the shafts. The roller-bearings on the shafts reduce the noise and friction and facilitate the sprocket engagement. The cable-drum preserves the cable in a true circle and free from breaking bend. The guide-rail in coöperation with the track at the top landing preserves the steps in proper position during their evolutions in passing through the landing and unloading the passengers thereon.

Having thus described the invention, what we claim as new is—

1. In a stairvator, having a framework, landings, an endless flight of steps, and means to operate the same, the cam-track, the guide-rail at its upper end, track-wheels, and the guide-wheel on the rear side of each step to engage with the guide-rail.

2. In a stairvator, having a framework, grated landings, an endless flight of grated steps, and means to operate the same, the cam-track, the guide-rail at its upper end, track-wheels and the guide-wheel on the rear side of each step to engage with the guide-rail.

3. In a straight-incline stairvator having a framework, landings, an endless flight of steps, a horizontal driving-shaft, and means to operate the same, the cable in combination therewith.

4. In a stairvator having a framework, landings, and an endless flight of steps and means to operate the same, a plurality of cables in combination therewith.

5. In a stairvator having a framework, grated landings, an endless flight of grated steps and means to operate the same, a cable or cables in combination therewith.

6. In a stairvator having a framework, landings, an endless flight of steps, and means to operate the same, a cable attached to each of the outer ends of a journal of each step.

7. In a stairvator having a framework, grated landings, an endless flight of grated steps, and means to operate the same, the cable attached to the outer ends of the shaft of each step.

8. In a stairvator having a framework, landings, an endless flight of steps and means to operate the same, a cable and means of attaching it to the outer end of the step-shaft, composed of the slotted end of the shaft and a cap to grip the cable in place.

9. In a stairvator, having a framework, landings, an endless flight of steps, and means to operate the same, a cable and means for attaching it to the outer end of the step-shaft, composed of the slotted end of the shaft, a grip-plug, and a cap to fasten over the end of the shaft.

10. In a stairvator having a framework, landings, an endless flight of steps, and means for operating the same, a cable and means for attaching it to the outer end of the shaft, composed of the slotted and threaded end of the shaft, and a threaded cap to screw over the said end to grip the said cable.

11. In a stairvator having a framework, grated landings, an endless flight of grated steps, and means to operate the same, the step-journals to engage with the sprocket-wheels.

12. In a stairvator having a framework, grated landings, an endless flight of grated steps and means to operate the same, the roller-bearings on the step-shaft to engage with the sprocket-wheels.

13. In a stairvator having a framework, grated landings, an endless flight of grated steps and means to operate the same, the roller-bearing near each end of the step-shaft, to engage with the sprocket-wheel.

14. In a stairvator having a framework, grated landings, an endless flight of grated steps and means to operate the same, the roller-bearing to engage with the sprocket-wheel.

15. In a stairvator having a framework, landings, an endless flight of steps, and means to operate the same, the step-shaft having a wheel, a sprocket-bearing and a cable attached to each end thereof.

16. In a stairvator having a framework, landings, an endless flight of steps, and means to operate the same, the wheel, sprocket-bearing and cable on each end of the step-shaft being located outside the vertical plane of the steps.

17. In a stairvator, having a framework, landings, an endless flight of steps, and means to operate the same, a cable attached to the step-shaft, and a cable-drum to hold the cable in circle.

18. In a stairvator having a framework, grated landings, an endless flight of grated steps, and means to operate the same, the grated step composed of an **I**-beam, with spaced slots across each face, and segments having legs, said legs fitting and fastening into said spaced slots.

19. In a stairway having a framework, grated landings, an endless flight of steps and means to operate the same, the grated steps composed of an **I**-beam having spaced slots across its two faces, and segments having legs to fit in said slots, and fastened by clenching the lower ends of the legs over the lower side of the **I**-beam.

20. In a stairvator having a framework, grated landings, an endless flight of steps and means to operate the same, the grated step composed of the slotted **I**-beam and segments attached thereto, and the brackets attached to the **I**-beam to carry the wheel-shafts.

21. In a stairvator having a framework, grated landings, an endless flight of grated steps and means for operating the same, the driving-shaft carrying the sprocket-wheel and driven by a worm-gear, the larger gear of which is attached to said shaft.

22. In a stairvator having a framework, grated landings, an endless flight of grated steps and means for operating the same, the two sprocket-wheels, the upper one of which is a male sprocket driving-wheel and the lower one a female idler, the recesses of which engage with the sprocket-bearings on the step-shafts.

23. In a stairvator having a framework, landings, an endless flight of steps, and means to operate the same, the segmental, single traveling balustrade located between the two ends of the step.

24. In a stairvator having a framework, landings, an endless flight of steps, and means for operating the same, the segmental traveling balustrade having elastic buffers between the segments.

25. In a stairvator having a framework, landings, an endless flight of steps, and a horizontal driving-shaft and means for operating the same, a straight-incline driven cable in combination therewith.

26. In a stairvator having a framework, landings, an endless flight of steps, and means for operating the same, a cable for linking the steps together.

In testimony whereof we have affixed our signatures in presence of two witnesses.

EDWIN BALTZLEY.
DAVID M. QUAY.
THOMAS R. QUAY.

Witnesses:
LOUIS C. GAERTH,
W. LA TOUR.