No. 722,687. PATENTED MAR. 17, 1903.

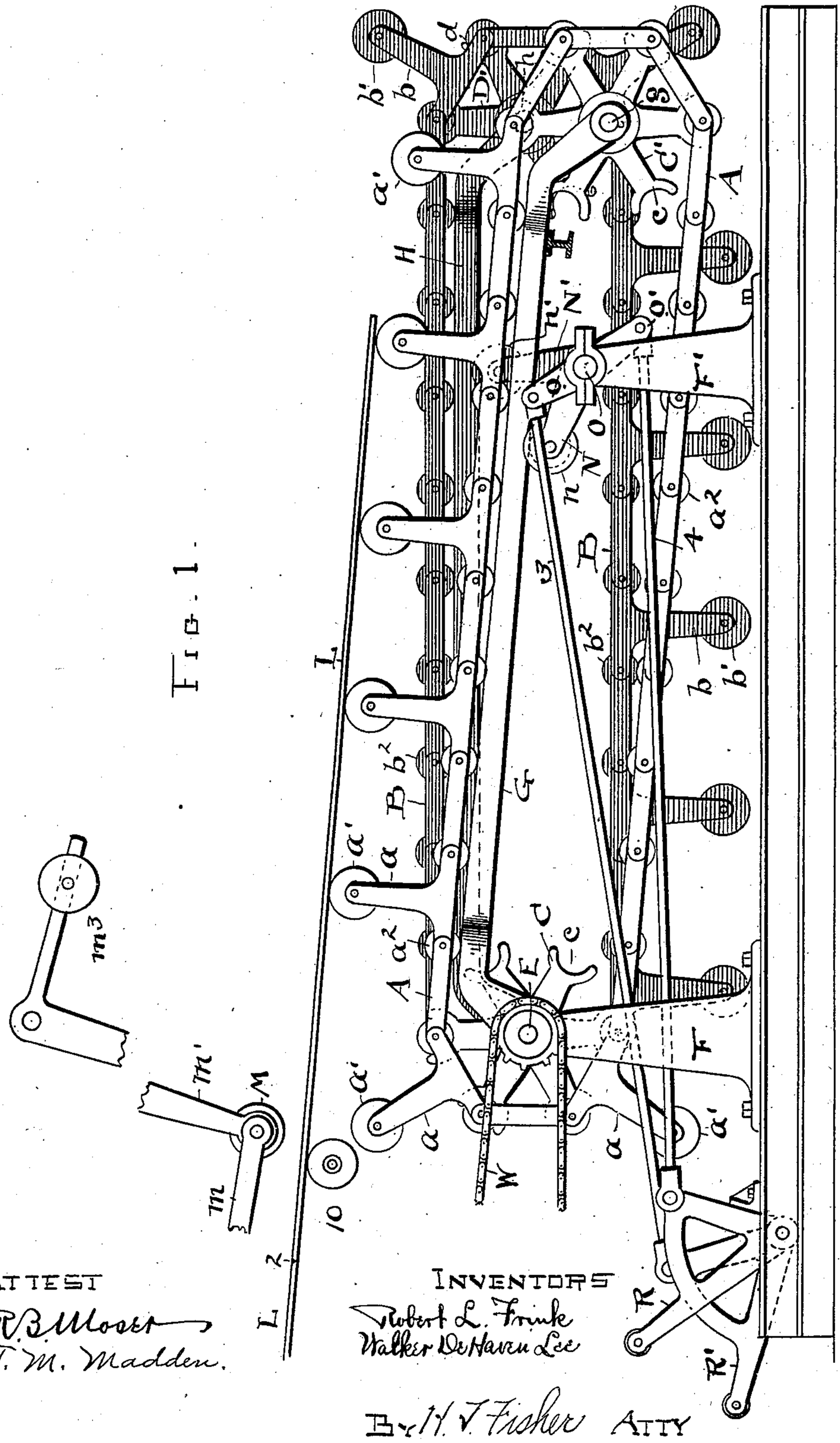
R. L. FRINK & W. DE H. LEE.

MACHINE FOR MAKING SHEET GLASS.

APPLICATION FILED JAN. 2, 1902.

NO MODEL. 4 SHEETS—SHEET 1.

FIG. 1.



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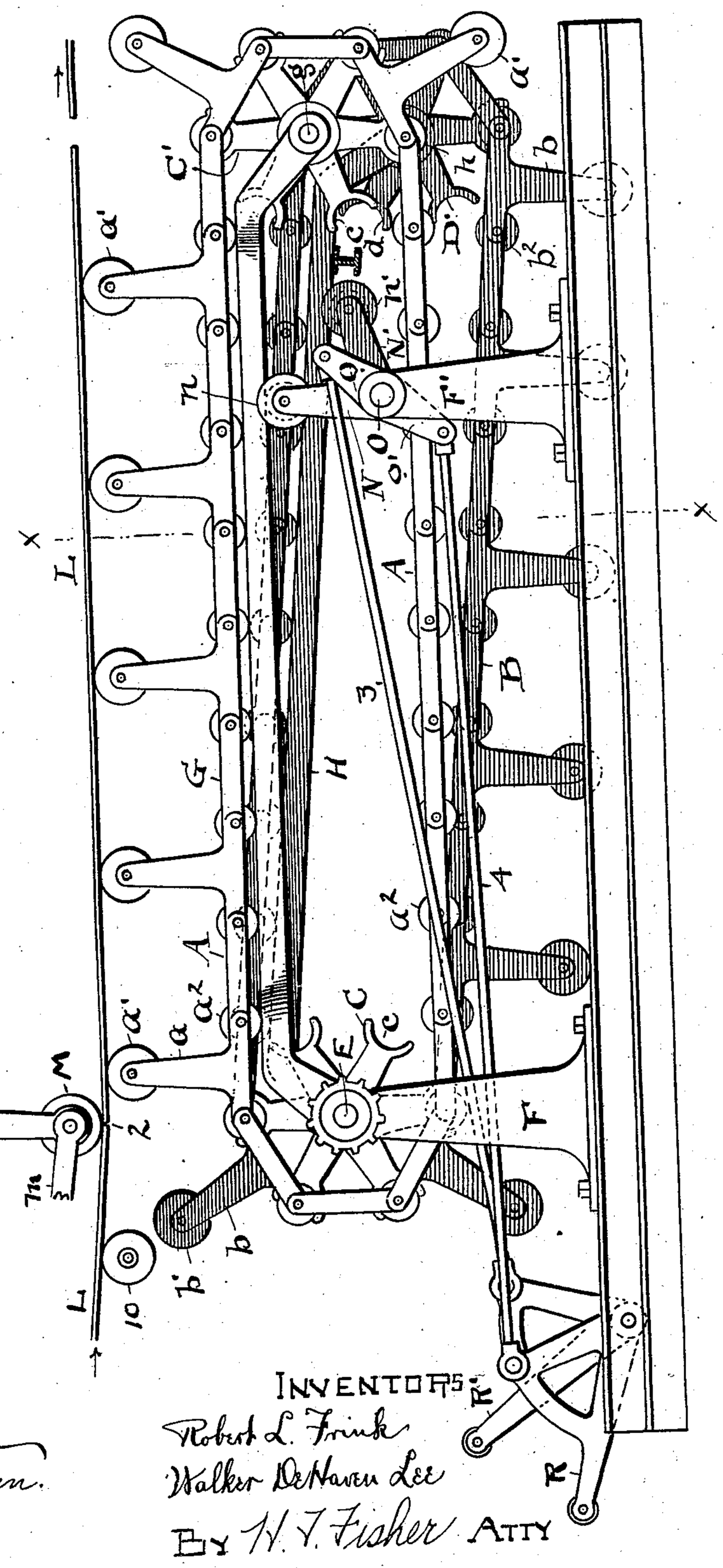
NO MODEL.

FIG. 2.



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NO MODEL. 4 SHEETS—SHEET 3.

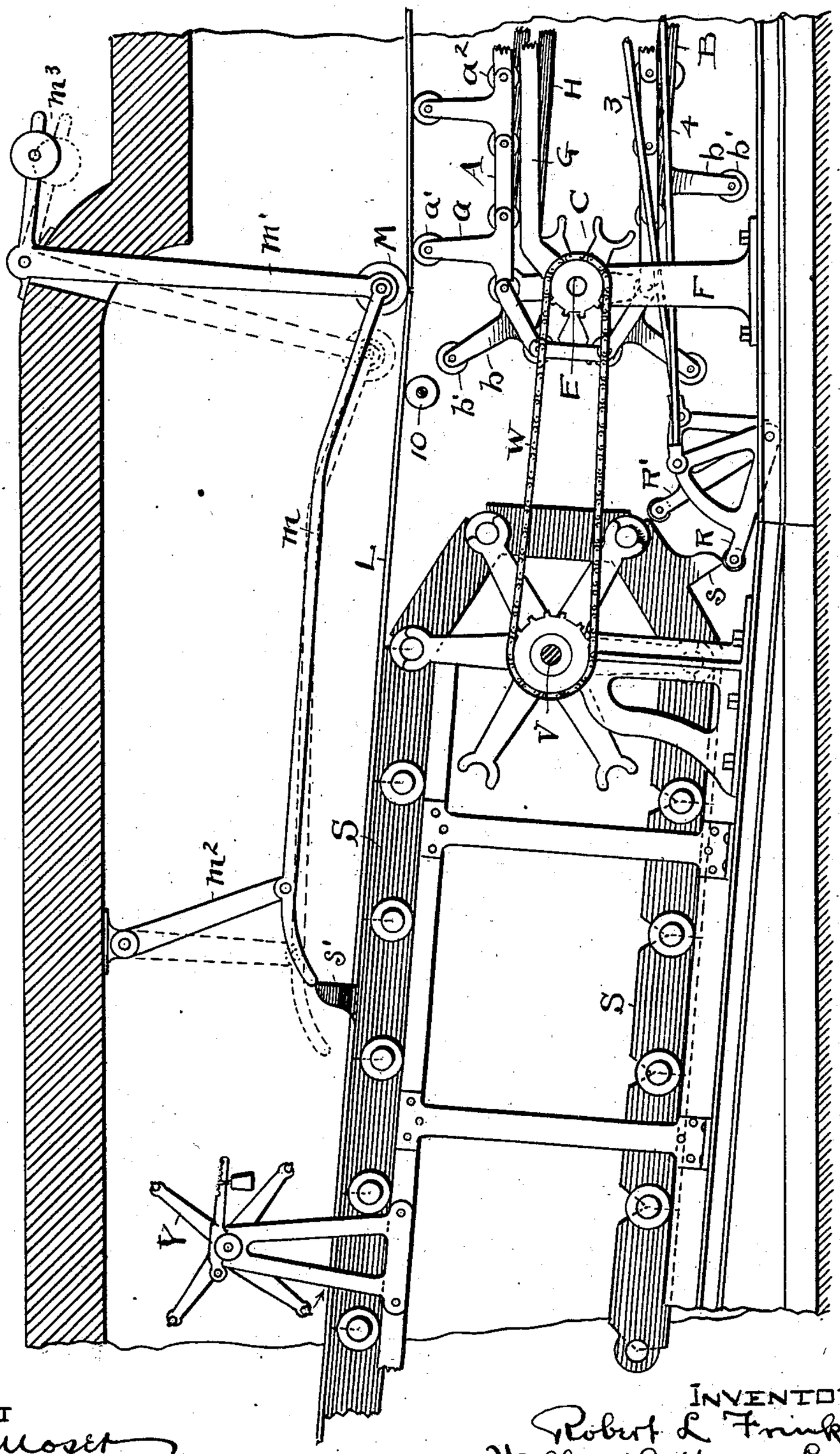

FIG. 3.

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NO MODEL. 4 SHEETS—SHEET 4.

FIG. 4.

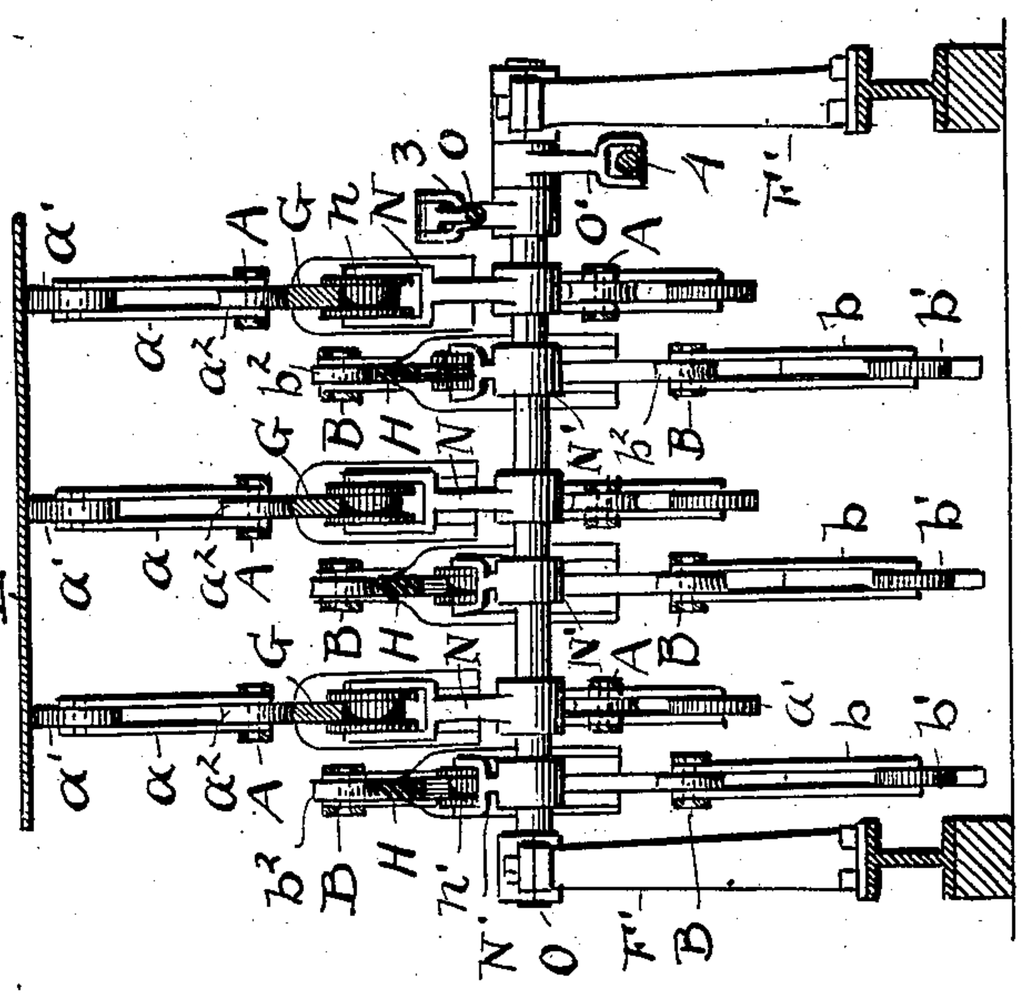


FIG. 6.

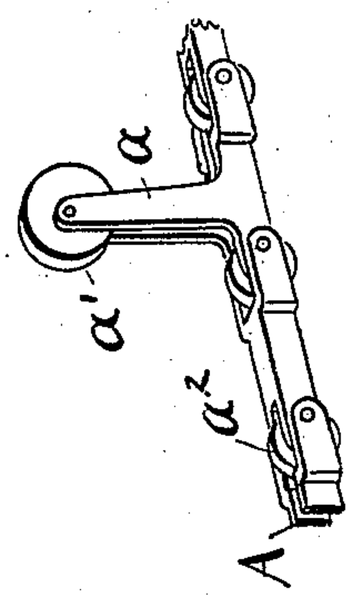
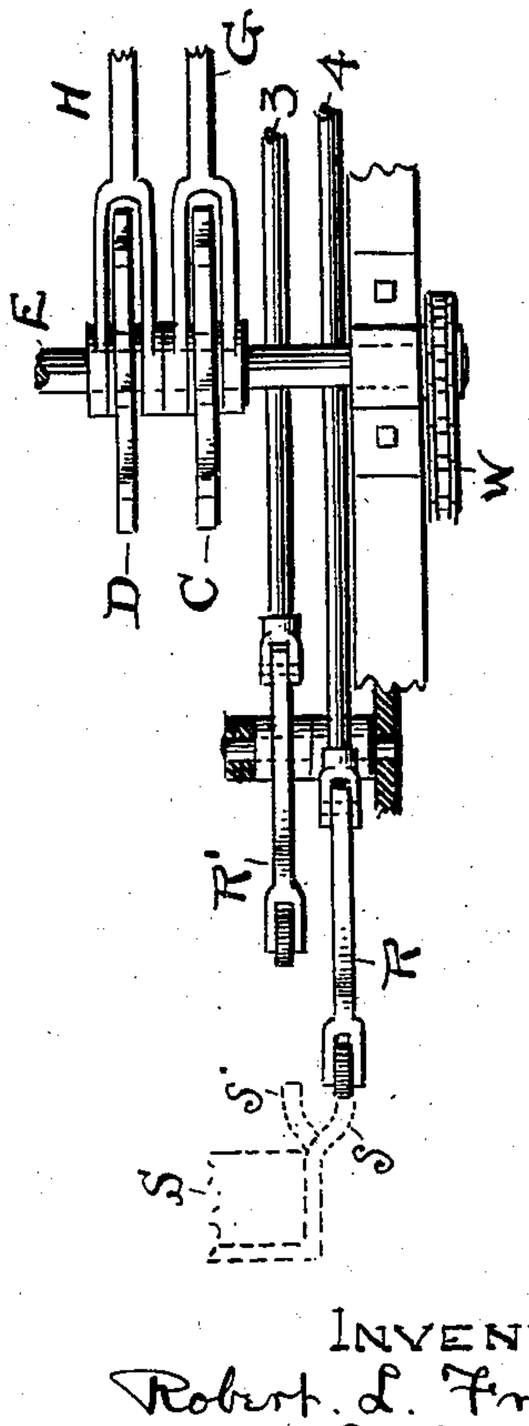


FIG. 5.



ATTEST

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UNITED STATES PATENT OFFICE.

ROBERT L. FRINK AND WALKER DE HAVEN LEE, OF CLEVELAND, OHIO, ASSIGNORS, BY DIRECT AND MESNE ASSIGNMENTS, TO THEMSELVES, H. R. SANBORN, J. N. CLARKE, AND J. A. LANNERT, OF CLEVELAND, OHIO.

MACHINE FOR MAKING SHEET-GLASS.

SPECIFICATION forming part of Letters Patent No. 722,687, dated March 17, 1903.

Application filed January 2, 1902. Serial No. 88,055. (No model.)

To all whom it may concern:

Be it known that we, ROBERT L. FRINK and WALKER DE HAVEN LEE, citizens of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Machines for Making Sheet-Glass; and we do declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

Our invention relates to improvements in machines for making sheet-glass; and the invention consists in the construction, combination, and arrangement of parts, as hereinafter fully described, and particularly pointed out in the claims.

In the accompanying drawings, Figure 1 is a side elevation of that part or portion of our invention described and referred to herein as the "cracking-off table." Fig. 2 is a side elevation of the same table as shown in Fig. 1, with the difference that here certain of the parts are in a different working relation from what is shown in Fig. 1, as hereinafter fully described. Fig. 3 is a side elevation of a section of the flattening-table and a section of the cracking-off table shown in Figs. 1 and 2 and disclosing the relationship of the said tables and of certain other parts in that connection, also as hereinafter fully described. Fig. 4 is a cross-section of the mechanism shown in Fig. 2 on line X X looking to the right. Fig. 5 is a plan view of the initial shaft of the cracking-off table and of certain parts connecting same with the mechanism of the flattening-table, as hereinafter fully described. Fig. 6 is a perspective elevation of a section of one of the several endless chains and one of the arms with rollers or wheels characteristic of said chains.

The mechanism thus shown constitutes a chain in the method or operation for the manufacture of sheet-glass automatically and wherein the glass is delivered in semihardened state from the supply-tank, (not shown,) at the outlet of which there is mechanism for reducing the outflowing glass to sheet form, from which it passes upon the flattening-table, Fig. 3, and thereupon it is carried forward to the cracking-off table, Figs. 1 and 2. The glass is exposed to a measure of heat within the inclosing walls of these two tables, but is supposed to have hardened sufficiently when it reaches the cracking-off table to be cracked or broken off into sections on the lines previously marked for breakage and is in condition not to further yield or bend or get out of its flat shape when it has reached said table. After leaving this table the separate sheets are supposed to be taken up by a further carrier (not shown here) and delivered where wanted in a perfectly-cooled state.

The means for preparing and supplying molten glass preparatory to reducing it to the sheet form is the subject-matter of another application filed by us and bearing Serial No. 83,479, and hence said means do not form a part of the invention covered in this application.

The flattening-table as herein shown likewise is the subject-matter of a separate concurrent application, Serial No. 88,056, and hence is not specifically claimed herein.

The present invention therefore comprises, first, the cracking-off table, and, secondly, the combination therewith of the flattening-table and the construction and combination of associated parts here and there, as fully described and set forth in the claims.

Referring now more especially to the cracking-off table, it will be noticed that the said "table," so called, consists of two endless carriers A and B, constructed after the manner largely of sprocket-chains and provided with arms a and b, respectively, at intervals on opposite portions of said chains, on which are also mounted rollers a' and b', respectively, and in the chains themselves there are other rollers a^2 and b^2, respectively. These chains travel over their own wheels C and C′ and D and D′, respectively. These wheels have radial arms with cavities c and d, respectively, adapted to engage the rollers a^2 and b^2 of the respective series of chains, through which power is supplied to carry the said chains in continu-

ous operation. The wheels C and D are supported upon a shaft E, having bearings in posts F, and said wheels rotate with said shaft. The wheels C′ and D′, however, are supported upon their own spindles or bearings *g* and *h*, respectively, in the bifurcated ends of the long arms of lift-bars G and H, and the said bars are bifurcated also at their other ends, between the arms of which the wheels C and D rotate, Fig. 5. The said bars G and H are pivotally supported upon the shaft E and adapted to be raised and lowered at their outer or free ends, where they carry wheels C′ and D′, and they are designed to be raised alternately to the higher position. (Shown in Fig. 2.) When one set of said arms and the endless carriers thereon is down the other is up, and they each change positions at the same time. This is for the purpose of breaking off the glass into separate sheets or sections on the cross-lines marked for such breaking upon the flattening-table, and with it is used a fulcrum M to effect such breakage or cleavage of the glass, as will be seen. Practically, therefore, the cracking-off table is dual in its structure, each table consisting of one of said endless carriers and the carrying-arms *a* and *b*, with their rollers, and each set of carrier-arms follows directly the other set in the operation. Thus, referring to Fig. 1, the glass sheet L is seen as coming at a slightly-downward inclination in direct line from the flattening-table and unbroken on its breaking line or mark 2; but the instant the fulcrum M, Fig. 3, is thrown down into acting position the endless table or carrier A is raised bodily up by the rocking arm N, and its roller *n*, bearing against the bottom of bars G, lifts them to the higher plane, Fig. 1, with shaft E as the pivot. Now fulcrum M is down, and while the glass sheet at that point does not change its position its farther end is raised far enough to crack off the glass on the line of said fulcrum and leave the detached sheet free to be carried off by chain A on its arms and rollers *a a′*. Meantime arms *b* and rollers *b′* of carrier or table B have come around to take the free end of the glass sheet that is now approaching, and while arms *a* are delivering the severed sheet arms *b* are getting under the next sheet. Then as the cracking-off point is reached again fulcrum device M comes down and table or carrier B is raised or tilted by arms N′, as occurred with carrier A, and so on alternately. The arms N and N′ are each fixed on shaft O, and said shaft has two other opposite fixed arms *o* and *o′*, and rods 3 and 4 connect therewith to rotate shaft O first in one direction and then in the other, and thus rock arms N and N′ alternately to the raised and lowered positions. When one set of said arms is up, the other is down, and the change of both occurs at the same time by the same means. This change or operation is effected by separately-pivoted levers R and R′, arranged to be engaged at their free ends by projections *s s′* on the endless flattening-table S, Figs. 1 and 5. These projections *s* occur at intervals, according to the length of sheet to be made, and are constructed to engage first one of the levers R and R′ and then the other. Now as arms *o* and *o′* are on reverse sides of shaft O the effect of rotation of said shaft in one direction through the depression of one of said levers is to carry the other and then lower lever back out of the path of projection *s′*, while at the same time the corresponding arm N or N′ is raised, and the table A or B, which it actuates, is raised also, and the cracking off of the glass occurs, as described. It follows that there is always one of the levers R R′ in position to be reached by a passing projection *s s′*, and the entire change of position of traveling tables A and B has its initiative in these levers. The fulcrum or cracking-off bar or device M likewise is actuated from projections *s s′*, and reach *m* corresponds to the length of sheet to be broken off. So when, say, lever R is released, Fig. 3, reach *m* is released at the same instant, having cracked off the glass, and the fulcrum M swings free on its counterweighted hanger *m′*. Hanger m^2 supports the engaging end of reach *m*, and counterweight m^3 keeps the fulcrum M normally back. All this work is atuomatic and requires no personal attention at any point.

The rollers or wheels *a′* and *b′* in the endless carriers serve to accommodate the said carriers to different speeds as compared with table S and protect the surface of the glass sheet against injury.

A sprocket-chain W connects shafts V and E, the former carrying the sectional table S and tables A and B, so that power is transmitted thereby and the relative speed of said tables is determined.

A rotatable reel Y serves to score or indent the glass transversely on the breaking-lines.

The cracking-off tables comprise all the carriers A and B, respectively, and their "ends," as herein referred to, are defined by the wheels C C′ and D D′, respectively, with posts F as the support of their fixed ends and posts F′ as the support of their free ends, supplemented by the rocking arms N and N′, engaging bars G and H.

The rollers or wheels *n* and *n′* are preferably channeled to engage the bars G and H, and each bar has its own arm N or N′, as the case may be.

A bridging-roller or cross-piece 10 supports the sheet of glass between the table S and the cracking-off table, and this or other sufficient means may be used for this purpose.

What we claim is—

1. In a machine for making sheet-glass, an endless carrier adapted to be raised and lowered in respect to the frame in which said carrier is supported, in combination with a cracking-off device for the glass, substantially as described.

2. In a glass-manufacturing machine, an endless carrier and rotatable supports there-

for, one of said supports being on a fixed bearing and the other on a vertically-movable bearing, whereby one end of said carrier may be raised and lowered, and means to raise and lower the carrier at its free end at predetermined times, substantially as described.

3. In glass manufacture, a cracking-off table for glass comprising an endless carrier having a series of arms of equal length to receive the glass and a track on which said carrier runs pivoted at one end and free to be raised and lowered at the other end, and means to move said track up and down at its free end, substantially as described.

4. In glass manufacture, a set of cracking-off tables and separate pivoted supports for said tables, said supports having one end pivoted on the same axis and the other ends free to be raised and lowered, and means to raise and lower said supports alternately, substantially as described.

5. In glass manufacture, a set of cracking-off tables consisting each of an endless carrier constructed to support sheet-glass, separate pivoted supports for each table, and means to raise and lower said supports and tables alternately, said means comprising rocking mechanism, substantially as described.

6. In glass manufacture, two endless carrier-tables for sheet-glass, a separate pivoted support for each table, and mechanism to raise one table and lower the other on said supports at the same time, substantially as described.

7. The endless cracking-off tables, bars pivoted at one end supporting said tables at the other end, and means to engage the free ends of said bars to raise and lower them and thereby raise and lower said tables, substantially as described.

8. A set of endless cracking-off tables, a fixed support with wheels carrying one end of said tables, and pivoted supports with wheels carrying the opposite end of said tables, and a double set of rocking arms beneath said pivoted supports, substantially as described.

9. The continuous carrier-tables having each a series of wheeled uprights to support a sheet of glass, said uprights arranged oppositely on said tables whereby only one set is in use at a time, the means to support said tables pivoted at one end, so that the opposite end may be raised and lowered, and mechanism for alternately raising and lowering said tables at their free ends, substantially as described.

10. In glass manufacture, a flattening-table to support a sheet of glass, in combination with a pivotally-supported cracking-off table, and a transverse fulcrum bearing upon the glass at the breaking-off point, substantially as described.

11. A flattening-table for sheet-glass and a device to indent the sheet transversely at fixed intervals, in combination with a cracking-off table adapted to be raised and lowered at one end and pivoted at the other end, and a fulcrum for the sheet at the cracking-off point, substantially as described.

12. A single flattening-table for a continuous sheet of glass in combination with a set of traveling endless tables to crack the glass off into given lengths, and a fulcrum at the cracking-off point, substantially as described.

13. The flattening-table for the sheet of glass in combination with a cracking-off table, a transversely-arranged fulcrum for the sheet at the cracking-off point, and means on the flattening-table to control the position of said fulcrum.

14. In glass manufacture, an endless flattening-table, in combination with an endless cracking-off table and a cracking-off part over one end thereof, and means to raise and lower the other end of said table, and a device connected with said flattening-table to actuate said raising and lowering means for the cracking-off table, substantially as described.

15. In glass manufacture, a cracking-off table and a pivoted frame therefor, in combination with a rotatable shaft and arms thereon, rollers on said arms supporting said frame, in combination with means to rock said shaft at fixed intervals, substantially as described.

16. In glass manufacture, a cracking-off table pivoted at one end and movable up and down at the other end, in combination with a cracking-off device over the pivoted end of said table adapted to be carried into and out of working position, substantially as described.

17. In a glass-manufacturing machine, a flattening-table and means connected therewith to indent the glass transversely, in combination with a cracking-off table and a cracking-off device over said table, substantially as described.

Witness our hands to the foregoing specification this 11th day of December, 1901.

ROBERT L. FRINK.
WALKER DE HAVEN LEE.

Witnesses:
R. B. MOSER,
H. T. FISHER.