

No. 713,734.

Patented Nov. 18, 1902.

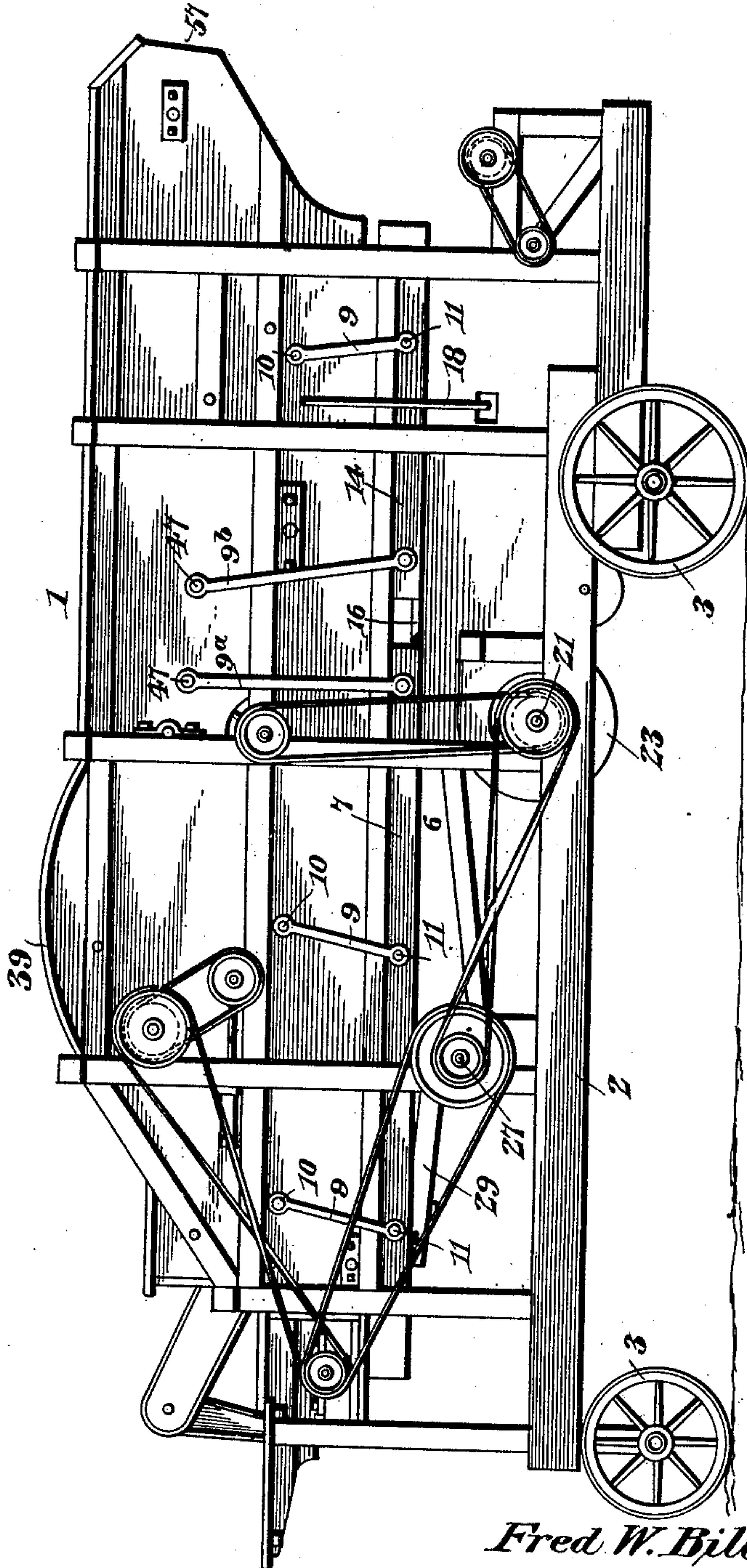
F. W. BILLINGS.
GRAIN THRESHING MACHINE.

(Application filed May 4, 1900.)

(No Model.)

3 Sheets—Sheet 1.

Fig. 1.



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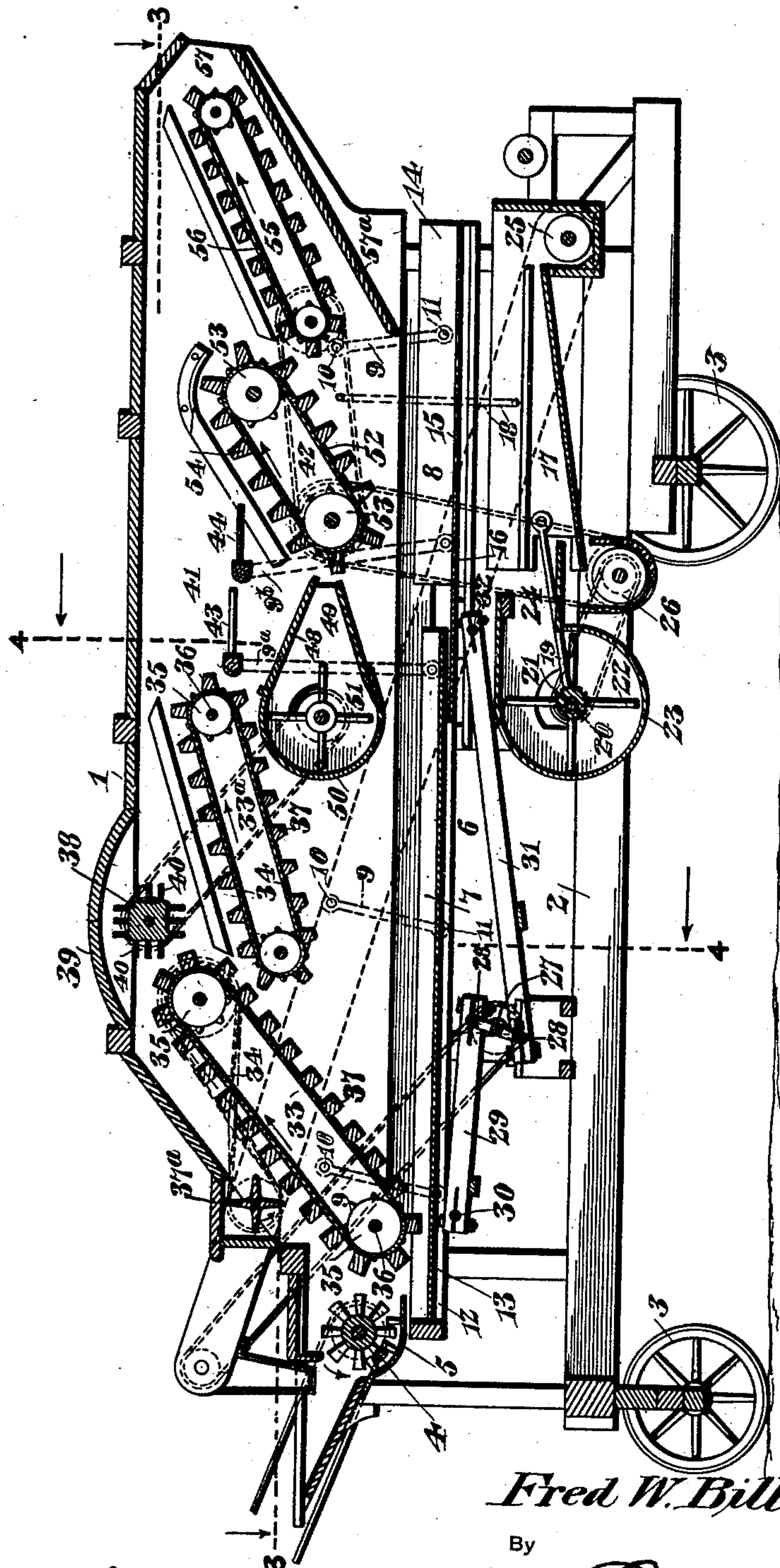
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3 Sheets—Sheet 2.

Fig. 2.



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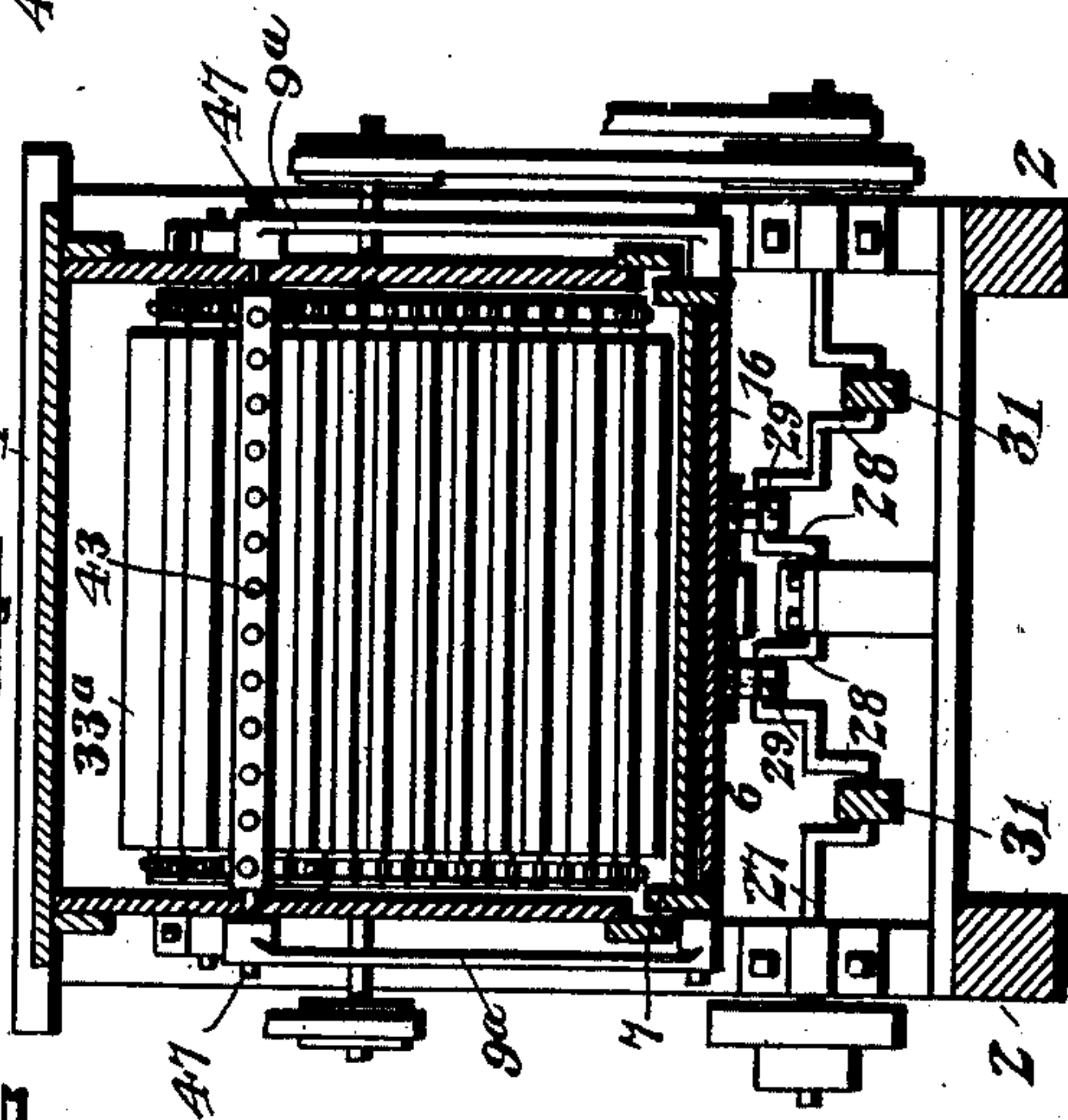
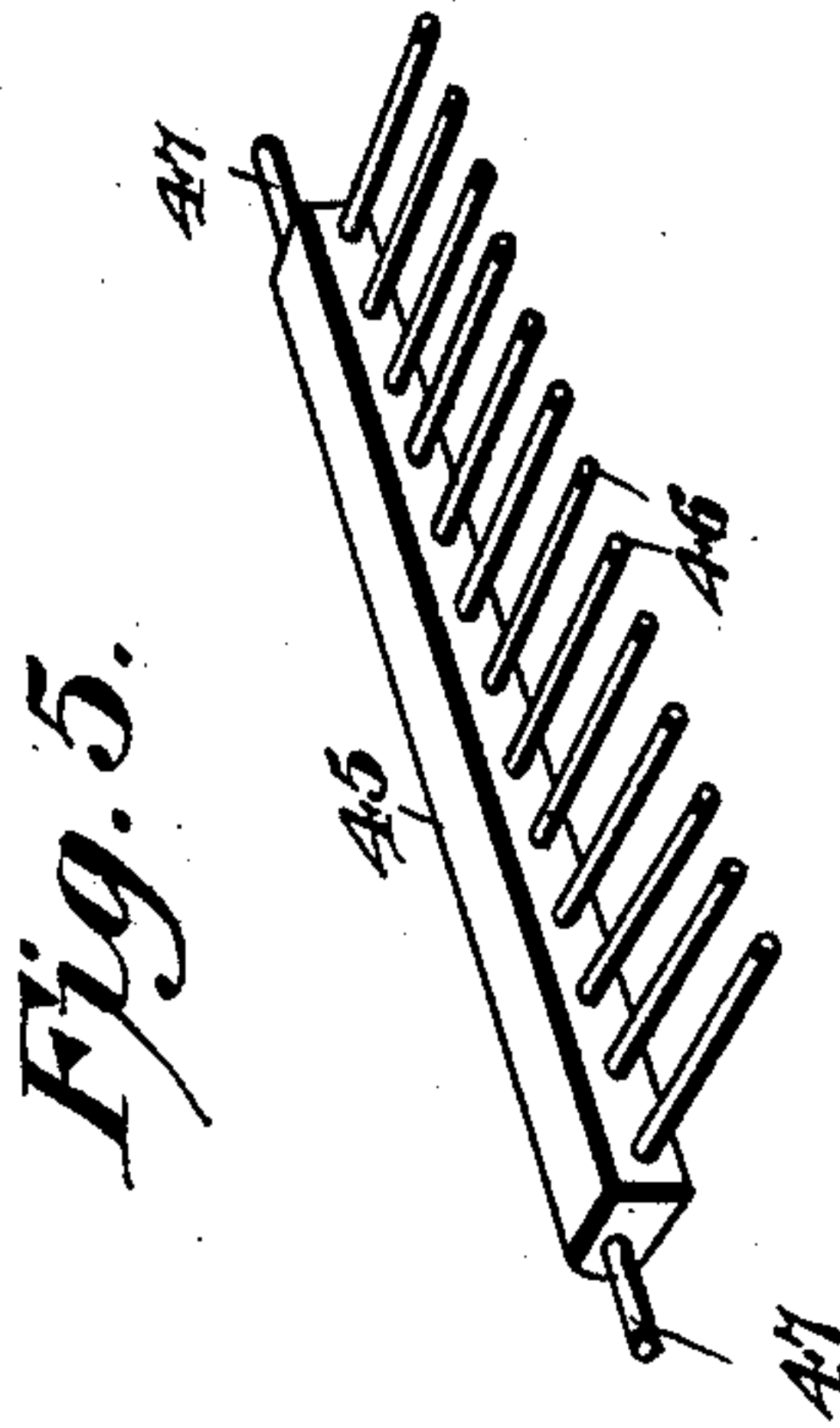
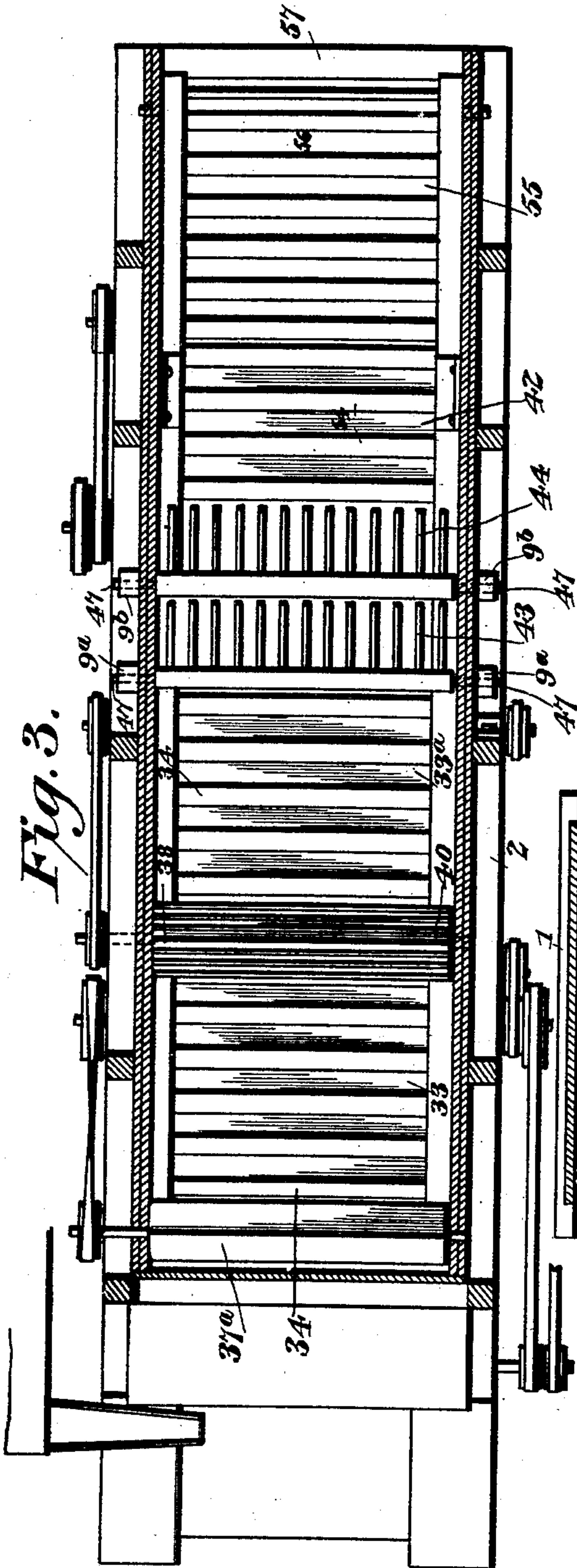
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3 Sheets—Sheet 3.



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UNITED STATES PATENT OFFICE.

FRED W. BILLINGS, OF PETERSBURG, NORTH DAKOTA.

GRAIN-THRESHING MACHINE.

SPECIFICATION forming part of Letters Patent No. 713,734, dated November 18, 1902.

Application filed May 4, 1900. Serial No. 15,523. (No model.)

To all whom it may concern:

Be it known that I, FRED W. BILLINGS, a citizen of the United States, residing at Petersburg, in the county of Nelson and State of North Dakota, have invented a new and useful Grain-Threshing Machine, of which the following is a specification.

This invention relates to grain-threshing machines; and it has for its object to effect certain improvements in machines of this character whereby the same shall be rendered more efficient in thoroughly threshing out all kinds of grain.

To this end the invention primarily contemplates a novel construction and arrangement of parts whereby the straw is handled very rapidly and at the same time subjected to a thorough agitation to insure the separation of the grain therefrom, thus adapting the machine for effectively operating upon a maximum quantity of grain.

A further object of the invention is to provide novel means for handling the straw, whereby there is no period in the operation of the machine during which the straw is held back or retained, and another important object of the invention is to provide means for subjecting the grain to a primary cleaning, whereby the chaff is eliminated therefrom before the grain is delivered to the grain-pan and main cleaning-shoe of the machine, thus relieving the sieves of the chaff which ordinarily passes therethrough together with the good grain.

With these and many other objects in view, which will more readily appear to those familiar with the art as the nature of the invention is better understood, the same consists in the novel construction, combination, and arrangement of parts hereinafter more fully described, illustrated, and claimed.

The essential features of the invention, involving the construction of the grain-pan and the manner of operating the front and rear members thereof, as well as the novel arrangement of the carriers and aprons and the parts associated therewith, are necessarily susceptible to modification without departing from the spirit or scope of the invention; but the preferred embodiment of the improvements is shown in the accompanying drawings, in which—

Figure 1 is a side elevation of a threshing-machine embodying the herein-described improvements. Fig. 2 is a vertical longitudinal sectional view thereof. Fig. 3 is a horizontal sectional plan view on the line 3 3 of Fig. 2. Fig. 4 is a cross-sectional view on the line 4 4 of Fig. 2. Fig. 5 is a detail in perspective of one of the vertically-vibrating horizontally-disposed agitating or lifting forks for the straw during its passage through the machine.

Like numerals of reference designate corresponding parts in the several figures of the drawings.

In carrying out the invention the several parts thereof are arranged for use in connection with a casing 1, of the usual form and built within a framework 2, supported by the wheeled trucks 3, the same constituting the ordinary type of threshing-machine body. The said casing 1 has mounted within the front or feeding end thereof the usual threshing-machine cylinder 4, working over the concave 5, and no novelty is claimed for this part of the machine, as the threshing-cylinder is intended to perform its functions in the usual way; but an important part of the invention resides in the employment of a sectional grain-pan 6, which is arranged to work within the bottom portion of the casing 1 and extends longitudinally thereof from end to end, the forward extremity of the sectional grain-pan extending beneath the threshing-cylinder concave 5, so as to receive therein the grain, which is worked out of the straw by the action of the threshing-cylinder. This grain-pan 6 is also disposed in an approximately horizontal plane and consists of a pair of separate front and rear oppositely-reciprocating pan members 7 and 8, respectively, which, while practically forming parts or members of a continuous grain-pan, at the same time separately operate beneath the front and rear portions of the machine-casing, and each of the pan members 7 and 8 is loosely suspended, so as to have a free swinging vibration in a longitudinal direction by means of a plurality of swinging hanger-links 9, pivotally supported at their upper ends, as at 10, on the sides of the machine-casing and pivotally connected at their lower ends, as at 11, to the opposite sides of the separate pan members, as plainly shown in Figs. 1 and 2 of the drawings.

The front longitudinal vibrating pan member 7 essentially consists of an approximately rectangular frame-rim 12 and an imperforate grain-floor 13, fitted therein, while the complementary rear pan member 8 also consists of an approximately rectangular frame-rim 14 and a perforate grain floor or sieve 15, fitted therein; but the said perforate grain floor or sieve 15, constituting a part of the rear pan member 8, is provided with a front imperforate section or apron extension 16, which, during the movement of the pan members, underlies the rear end portion of the floor 13 of the front pan member 7, whereby there will be no escape of grain from the grain-pan until it reaches and is worked over the perforate or sieve portion of the floor 15. At this point it may be observed that the perforate or sieve portion 15 of the rear pan member 8 is arranged to work directly over the vibratory cleaning-shoe 17. This vibratory cleaning-shoe 17 is mounted within the rear end portion of the machine-body in the usual position and is fitted with the ordinary sieves, (not shown,) which provides for the cleaning and separation of the grain in the usual way; and the said cleaning-shoe 17 is preferably loosely suspended from the swinging hanger-links 18, pivotally hung from the sides of the machine-casing, and a vibratory motion is imparted to the shoe 17 from the actuating-pitmen 19. These pitmen 19 are pivotally connected at one end to the shoe 17 and at their other ends with the eccentrics 20 on the fan-shaft 21 of the main fanning-mill 22. The said fanning-mill 22 is arranged to work within the cylindrical fan-casing 23, having a blast-spout 24 disposed toward the front end of the cleaning-shoe 17 and serving to direct a blast of air through said shoe to provide for the final cleaning out of the grain in the manner common to threshing-machines employing a vibratory cleaning-shoe and a main cleaning-fan in the relation specified. The said cleaning-shoe 17 also coöperates with the usual tailings-conveyer 25 at the rear end thereof and with the main grain-conveyer 26, receiving the good grain from the front discharging end of the shoe in the usual manner.

In connection with the separate pan members 7 and 8 of the sectional grain-pan 6 an important feature of the invention resides in the means for transmitting a simultaneous opposite reciprocation to the pan members. This may be accomplished by various expedients, but preferably by a common driving means in the form of a multiple crank-shaft 27, journaled in suitable bearings transversely of the machine-body beneath the front pan member 7 and having a plurality of cranks 28. To certain of the said cranks 28, projecting at one side of the plane of the shaft 27, are pivotally connected the rear ends of the short operating-pitmen 29, the front ends of which pitmen are pivotally connected by a suitable coupling connection 30 with the

under side of the front swinging pan member 7, preferably near the front end of said pan member. The remaining cranks 28, projecting at the opposite side of the plane of the shaft 27, have pivotally connected thereto the front ends of the operating-pitmen 31, the rear ends of which pitmen are pivotally connected by means of a rod or other suitable coupling 32 to the under side of the rear pan member 8. This arrangement of the pitmen provides separate and independent operating connections between the multiple crank-shaft and the front and rear pan members 7 and 8, and also by reason of the pitmen connections for the separate pan members being connected with the crank-shaft respectively at opposite sides of the axis of rotation thereof an opposite reciprocation is necessarily simultaneously imparted to the two pan members 7 and 8. This simultaneously opposite reciprocation of the pan members, together with the swinging movement permitted by the hanger-links 9, insures a positive feeding of the grain from the imperforate front pan member 7 to the rear pan member 8 as well as the thorough agitation and working of the grain over the perforate or sieve portion 15 of the said rear pan member, whereby a final separation of chaff and other foreign matter may be accomplished before the grain and tailings are delivered to the cleaning-shoe for the final treatment.

To provide for the disposition of the straw, as well as the grain carried therewith, after leaving the threshing-cylinder 5, there are employed a plurality of endless straw-carriers in the front portion of the machine-casing above the working plane of the front pan member 7. Preferably only a pair of these carriers is employed, as shown in the drawings, said carriers being designated, respectively, by the reference-numbers 33 and 33^a. The carriers 33 and 33^a are preferably of duplicate construction, each consisting of an endless imperforate belt or apron 34, passing over oppositely-arranged belt-wheels 35, carried by supporting-shafts 36, the endless imperforate belt or apron 34 of each carrier being provided on the outer working surface thereof with a continuous series of regularly-spaced transverse slats 37, which are arranged sufficiently apart to insure the carrying of the straw, while at the same time providing therebetween pockets which will carry such grain as may separate itself from the body of straw as the same is being carried over the two carriers 33 and 33^a.

By arranging the lower portion of the initial apron or carrier 33 in rear of the cylinder and concave the flying kernels strike against the imperforate body of the carrier and the flights or slats thereof, the said parts thereby forming a check or stop for the flying grain, effecting an initial separation and causing a large proportion of the grain to fall upon the grain-pan, which is overhung by the discharge end of the concave.

The straw-carrier 33 is arranged at an inclination, preferably of about forty degrees, within the extreme front portion of the machine-casing directly in rear of the threshing-cylinder 4, so as to receive the straw and grain immediately upon the same leaving the said cylinder, and to insure a thorough agitation and beating of the straw as it passes upon and over the upper run of the carrier 33 a revolving winged beater 37^a is mounted within the front portion of the machine-casing and is disposed over the upper inclined run of the carrier 33 at a point intermediate the upper and lower end portions of said carrier. The straw as it is thrown from the threshing-cylinder is caught by the carrier 33, and passing beneath the revolving winged beater 37^a is delivered from the upper end portion of the carrier onto an auxiliary beating device 38, arranged within the top portion of the casing immediately beyond the said upper end portion of the front carrier 33. The said auxiliary beating device 38 works partly within an arched housing 39 at the top of the machine-casing and essentially consists of a cross-sectionally angular drum, usually of a rectangular or square shape and provided upon each flat or plane face thereof with a plurality of parallel beater wings or slats 40, which subject the straw to a very severe agitation or shaking up to materially assist in the working out of the loosened grain and define pockets within which the grain is received. In connection with said auxiliary beating device 38 it will be observed that the plurality of wings 40, arranged on the plane or flat faces of the drum, provide pockets into which the grain may fall from the straw and be discharged upon the imperforate secondary straw-carrier 33^a. This imperforate secondary straw-carrier 33^a, which is of the same construction as the front carrier 33, is arranged at an inclination within an intermediate portion of the machine-casing below the plane of the auxiliary beating device 38, and the front end portion of the said carrier 33^a extends beneath the upper rear end portion of the front carrier 33, so that all of the straw and grain delivered from the said front carrier will be caught by the upper run of the imperforate carrier 33^a and carried thereby to the grain-throat 41, which is formed within the casing at an intermediate point.

The novel relative arrangement of the conveyers 33 and 33^a and of the beater 38 is important, and their coöperation in the initial separation of the grain and straw after the latter has passed the threshing mechanism may therefore be explained before proceeding with the description of the various other parts of the apparatus. The conveyer 33 is provided with pockets, as stated, for the reception of the flying grain from the threshing mechanism. This grain is caught in the pockets and with the straw is carried upwardly

and rearwardly to the rear end of the primary straw-carrier.

From the rear end of the primary straw-carrier the grain carried in the pockets thereof is dropped into the pockets of the secondary carrier 33^a, whose front end is located directly below the rear end of the primary straw-carrier. The straw, however, passes over the beater 38, the action of which detaches a large percentage of the grain held by the straw, and such grain drops into the pockets defined between the slats or wings of the beater. As the straw is fed over the beater it is deposited upon the secondary carrier 33^a at a point adjacent to the rear end of the latter; but the grain held in the pockets of the beater will be dropped down into the pockets of the secondary carrier at a point comparatively near the front or lower end thereof. In other words, the grain held in the pockets of the primary carrier and beater will be dropped into the pockets of the secondary carrier near the front end of the latter, and as the straw is deposited upon the rear end of the carrier the grain retained in the pockets will be carried rearwardly under the straw and will be prevented from mixing therewith after having once been separated.

The said grain-throat 41 is a vertical space left between the rear discharging end of the intermediate straw-carrier 33^a and the inclined chaff-apron 42, which is mounted at an inclination within the casing at a point beyond and spaced from the carrier 33^a for the purpose of leaving a well-defined throat or opening 41, within which the grain may be thoroughly worked out of the straw and subjected to a primary separation before being delivered onto the grain-pan 6. To secure this result, a combined agitating device and bridge is arranged within the throat 41, so as to extend over and across the space between the upper discharging end of the carrier 33^a and the chaff-apron 42. This bridge-agitating device preferably consists of a pair of approximately horizontal agitating and lifting forks 43 and 44, arranged in approximately the same horizontal plane and extending transversely of the machine-casing and from side to side thereof, so as to provide a substantially complete platform over which the straw may readily pass to the agitating-apron 42 without dropping through the throat 41. The said agitating and lifting forks 43 and 44 are duplicates in construction, and each essentially consists of a straight fork-bar 45 and a plurality of straight tines 46, arranged in regularly-spaced relation and projecting from one side of the said bar. The tines 46 of both forks 43 and 44 project in the same direction toward the rear end of the machine-casing, and the bar 45 of each fork is, in effect, a rock-bar, provided with pintle or journal ends 47, mounted in bearings in opposite sides of the machine-casing.

The pintle or journal extremities 47 of the

front fork 43 nearest the carrier 33^a have fitted thereto the upper ends of the operating-links 9^a, the lower ends of which links are pivotally connected with the sides of the front pan member 7, so that motion may be transmitted from this pan member to the said front fork to provide for the vertical rocking or vibrating movement thereof. A corresponding movement is imparted to the rear fork 44 from the rear pan member 8 through the medium of the operating-links 9^a, pivotally connected at their lower ends with the sides of the rear pan member 8 and secured fast at their upper ends to the pintle or journal extremities 47 of the said rear fork 44, and at this point it may be observed that the links 9^a and 9^b also cooperate with the main hanger-links 9 for the support of the front and rear pan members. By reason of operatively connecting the separate forks, respectively, with the front and rear pan members the same are alternately vibrated or swung in opposite directions, thus securing a thorough agitation of the straw and the working out of the loosened grain, whereby the latter will fall through the throat 41 and largely upon the inclined deflecting-board 48, extending transversely across the casing between the carrier 33^a and the apron 42 and preferably forming the upper side of the blast-spout 49 of the transversely-arranged cylindrical fan-casing 50, within which is mounted the rotating primary chaff-fan 51—that is to say, that part of the constantly-advancing stream of straw and grain located above these oppositely-vibrating bridge members is tilted up and down, and the stream is thus alternately broken in opposite directions to disengage the smaller ingredients thereof—viz., the grain, heads, chaff, &c. Thus while the long straw passes on over the fingers the short particles are allowed to fall through the bridge and are subjected to a preliminary winnowing for the removal of the chaff and lighter impurities, which are carried off by the apron 42, while the grain falls through to the fanning-mill.

The blast-spout 49 for the primary chaff-fan 50 is disposed toward the rear end of the machine-casing and is arranged to direct a blast of air from the fan across the space between the said spout and the apron 42, through which space the grain falls from the forks 43 and 44. The effect of this blast is to separate the chaff from the falling grain and to blow the same onto the chaff-apron 42. This apron is arranged on an inclination, preferably of about forty-five degrees, within the machine-casing, and essentially consists of an endless imperforate belt 52, working over oppositely-arranged wheels or rollers 53 and carrying upon its working side a continuous series of regularly-spaced slats 53, forming in the spaces therebetween chaff-pockets and also serving as carrying elements for the straw, which passes thereto from the rear fork 44.

It should be noted particularly that the

blast from the fanning-mill 51 is not directed up through the slatted bridge composed of the vibratory members 43 and 44, but that, on the contrary, the blast is directed in an almost horizontal direction and against the lower end of the chaff-apron 42, which is disposed opposite and close to the spout 49 of the fan. The blast therefore does not interfere with the gravitation of the grain and lighter particles—as, for instance, chaff, &c.—through the bridge, and as a consequence the alternate upward and downward breaking of the stream of straw as it passes over the bridge is caused to release the smaller particles, which gravitate without interference until they are brought within the range of the blast from the fan 51, while the main stream of straw passes on and is delivered to the apron or carrier 42 at a point adjacent to its upper rear extremity. Thus while the blast from the fan does not interfere with the initial separation produced by the vibrating members of the bridge it does effectually winnow the falling grain and deposit the chaff and lighter particles upon the lower end of the adjacent chaff apron or conveyer 42.

The inclined chaff-apron 42 extends from a point contiguous to the blast-spout 49 to a point above and beyond the plane of the forks 43 and 44, so that the straw passes directly from the forks onto the upper run of the apron 42 and is discharged thereby onto the rear slatted delivery-rake 55, mounted at an inclination within the extreme rear end portion of the machine-casing. The delivery-rake 55 essentially consists of an open endless belt comprising an endless series of regularly-spaced slats 56, through which grain may readily pass and fall onto the inclined return-board 57^a at the rear end of the casing, which return-board overhangs the rear pan member 8 and serves to direct onto the perforate or sieve portion 15 thereof any loose grain which may fall through the said open rake. The said open rake 55 extends beyond the apron 42 to the delivery-mouth 57 of the machine-casing; but the front lower end of the said rake 55 is arranged below and contiguous to the upper end portion of the apron 42, so as to receive the straw and chaff therefrom. The blast of the main fan 22 effects the cleaning of the grain in the shoe, while at the same time preventing the chaff from working back into the shoe. The blast from the fan 50 not only secures the primary separation of the chaff from the grain as it falls through the throat 41, but also insures the working out of the chaff with the straw through the delivery end 57 of the machine-casing.

From the foregoing it is thought that the construction, operation, and many advantages of the herein-described improvements in grain-threshing machines will be readily apparent to those familiar with the art without further description, and it will be understood that various changes in the form, proportion, and minor details of construction

may be resorted to without departing from the principle or sacrificing any of the advantages of this invention.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is—

1. In a threshing-machine, the combination with a straw-carrier and a chaff-apron separated by an interval defining a grain-throat, of a bridge located in the interval between the carrier and apron, said bridge being composed of a plurality of vibratory forks, and means for imparting simultaneous vibratory movement in opposite directions to said forks, whereby that part of the constantly-advancing stream of straw and grain located over the bridge is tilted up and down and the stream thus broken alternately in opposite directions to permit the separation and gravitation of the smaller particles, as for instance grain, chaff, &c.

2. In a threshing-machine, the combination with the threshing mechanism, and the oppositely-movable pan members, of a straw-carrier and a chaff-carrier located above the pan members and separated by an interval defining a grain-throat, a bridge spanning the interval between the carrier and apron and composed of a plurality of vibratory forks, and means operatively connecting said forks with the pan members respectively, whereby said forks will be simultaneously vibrated in opposite directions to tilt the advancing stream of straw and grain up and down and thus break the stream alternately in opposite directions to permit the separation and gravitation of the grain, chaff, &c., from the straw.

3. In a threshing-machine, the combination with a straw-carrier and a chaff-apron spaced apart by an interval defining a grain-throat, of a bridge spanning the interval between the carrier and apron and composed of a plurality of rocking or vibratory forks movable simultaneously in opposite directions to break the stream of straw alternately in opposite directions, and thus effect the disengagement and gravitation of the grain, chaff, &c., and a blower disposed directly below the bridge and arranged to project a blast of air through the falling grain, chaff, &c., and toward the chaff-apron at a point thereof below the bridge, whereby said blast is not opposed to the gravitation of the smaller particles from the bridge, but serves to winnow the falling grain and deposit the chaff and lighter particles upon the chaff-apron.

4. In a threshing-machine, the combination with a straw-carrier and a chaff-apron spaced apart by an interval defining a grain-throat, of a bridge spanning the interval and disposed to convey the straw from the straw-carrier to the chaff-apron at a point intermediate of the ends of the latter, a blower arranged below the bridge and disposed to project a blast of air in a direction substantially parallel with the travel of the stream of straw passing over the bridge, and toward the lower end of the

chaff-apron, whereby the blast from said blower will not interfere with the gravitation of the grain and chaff through the bridge, but will winnow the falling grain and deposit the chaff upon the chaff-apron at a point below the bridge.

5. In a threshing-machine, the combination with a straw-carrier, and a chaff-apron disposed at an angle and separated from the straw-carrier by an interval defining a grain-throat, of a bridge extending from one end of the straw-carrier to a point above the chaff-apron intermediate of the ends of the latter, said bridge being composed of a plurality of vibrating forks, means for vibrating the forks simultaneously in opposite directions to break the stream of straw alternately in opposite directions as it passes from the straw-carrier to the chaff-apron, and a blower located directly below the bridge and disposed to project a blast of air in a horizontal direction, and against the lower end of the chaff-apron, whereby the blast from said blower will not interfere with the gravitation of grain, chaff, &c., from the bridge, but will winnow the falling grain and deposit the chaff upon the lower end of the chaff-apron for removal with the straw.

6. In a threshing-machine, the combination with the threshing mechanism, the oppositely reciprocatory pan members, and the fanning-mill, of a straw-carrier located above the pan members and disposed to remove the straw from the threshing mechanism, a chaff-apron located beyond the straw-carrier and spaced therefrom by an interval defining a grain-throat, a bridge spanning the grain-throat, and composed of a plurality of vibratory forks, means operatively connecting said forks with the pan members respectively, to effect the simultaneous vibration of the forks in opposite directions, and a blower located directly below the bridge with its spout closely adjacent to the lower end of the chaff-apron, said blower being disposed to project a blast of air in a direction parallel to the stream of straw passing over the bridge, and against the lower end of the apron.

7. In a threshing-machine, the combination with the threshing mechanism and the grain-pan, of an endless primary straw-carrier provided with pockets and inclined upwardly and rearwardly from a point immediately in rear of the threshing mechanism, a secondary straw-carrier likewise of endless form and provided with pockets and extended upwardly and rearwardly from a point below the upper end of the primary straw-carrier, and a rotary beater located beyond and above the upper end of the primary straw-carrier and above the secondary carrier, said beater being of rectangular cross-sectional contour and having a plurality of parallel slats extending from each of its plane faces to define intermediate pockets, whereby the straw and flying grain will be conveyed rearwardly by the primary straw-carrier, the straw pass-

- ing over the beater and thence to the secondary carrier at a point adjacent to the rear end of the latter, and the grain located within the pockets of the primary carrier and beater being delivered to the pockets of the secondary straw-carrier adjacent to the front end thereof, so that said grain will be separated from the straw being conveyed rearwardly by the secondary carrier.
8. In a threshing-machine the combination with the threshing mechanism, the straw-carrier, and a chaff-carrier spaced apart from the straw-carrier, of an agitator bridging the space between the straw and chaff carriers, a grain-pan extending beneath the straw and chaff carriers and agitator, and a primary blower arranged above the grain-pan and beneath the agitator and comprising a casing, the upper wall of which constitutes a deflecting-board for deflecting the grain and chaff falling from the agitator into the blast.
9. In a threshing-machine, the combination with the threshing mechanism, and the straw

and chaff carriers, of a grain-pan located beneath the straw and chaff carriers and composed of overlapping and relatively movable sections, a cleaning-shoe, and a blast-fan located beneath the grain-pan, and comprising a fan-casing, the discharge-orifice of which is located in the rear of the overlapping portions of the grain-pan.

10. A beater for threshing-machines comprising a rotary drum of rectangular cross-sectional contour, said drum being provided upon each plane face thereof with a plurality of parallel beater-wings defining intermediate pockets and terminating in a plane parallel with the face.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

FRED W. BILLINGS.

Witnesses:

CHAS. H. BOBB,
ISABEL BOBB.