(No Model.)

4 Sheets—Sheet 1.

R. H. AVERY, Dec'd.

F. R. AVERY, Administrator.

THRASHING MACHINE.

No. 561,552. Patented June 9, 1896.

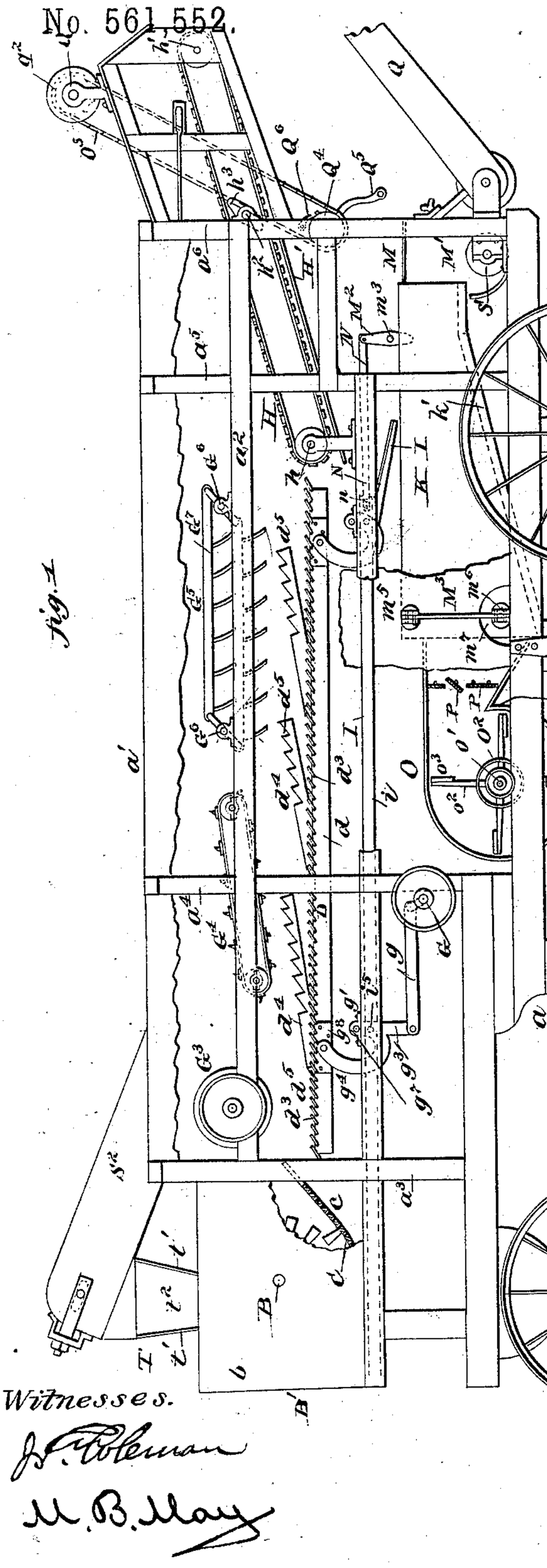

Fig. 1.

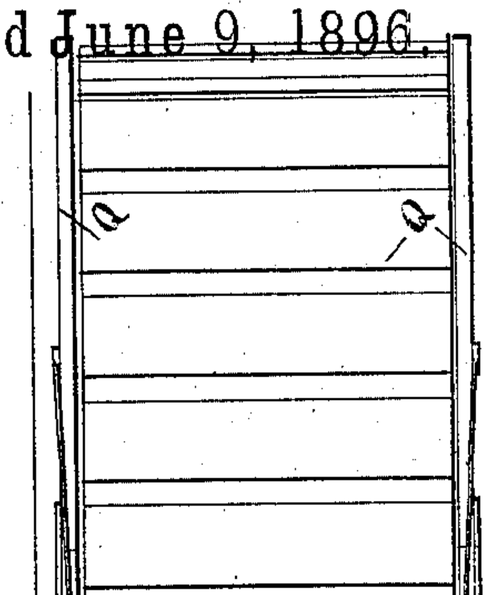

Fig. 2.

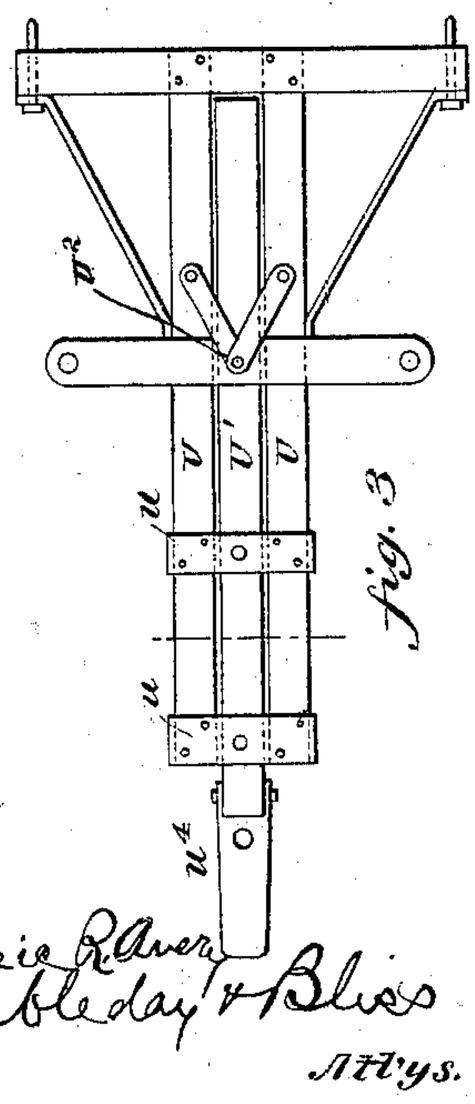

Fig. 3.

Witnesses.

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THRASHING MACHINE.

No. 561,552. Patented June 9, 1896.

fig. 4

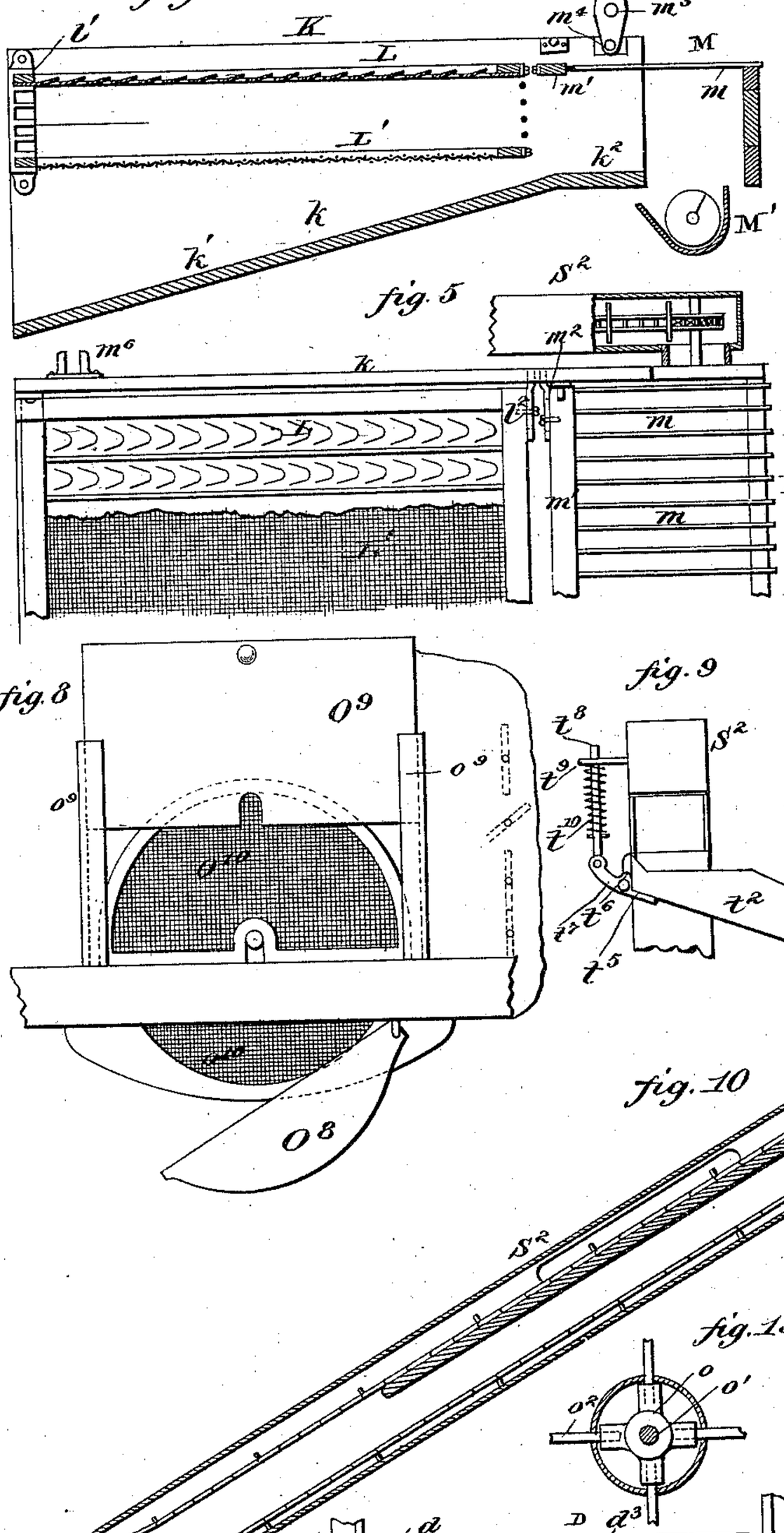

fig. 5

fig. 6

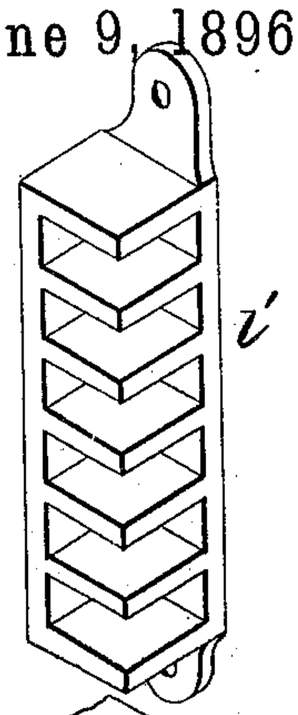

fig. 7

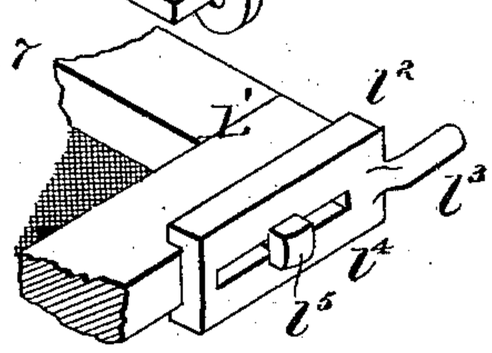

fig. 8

fig. 9

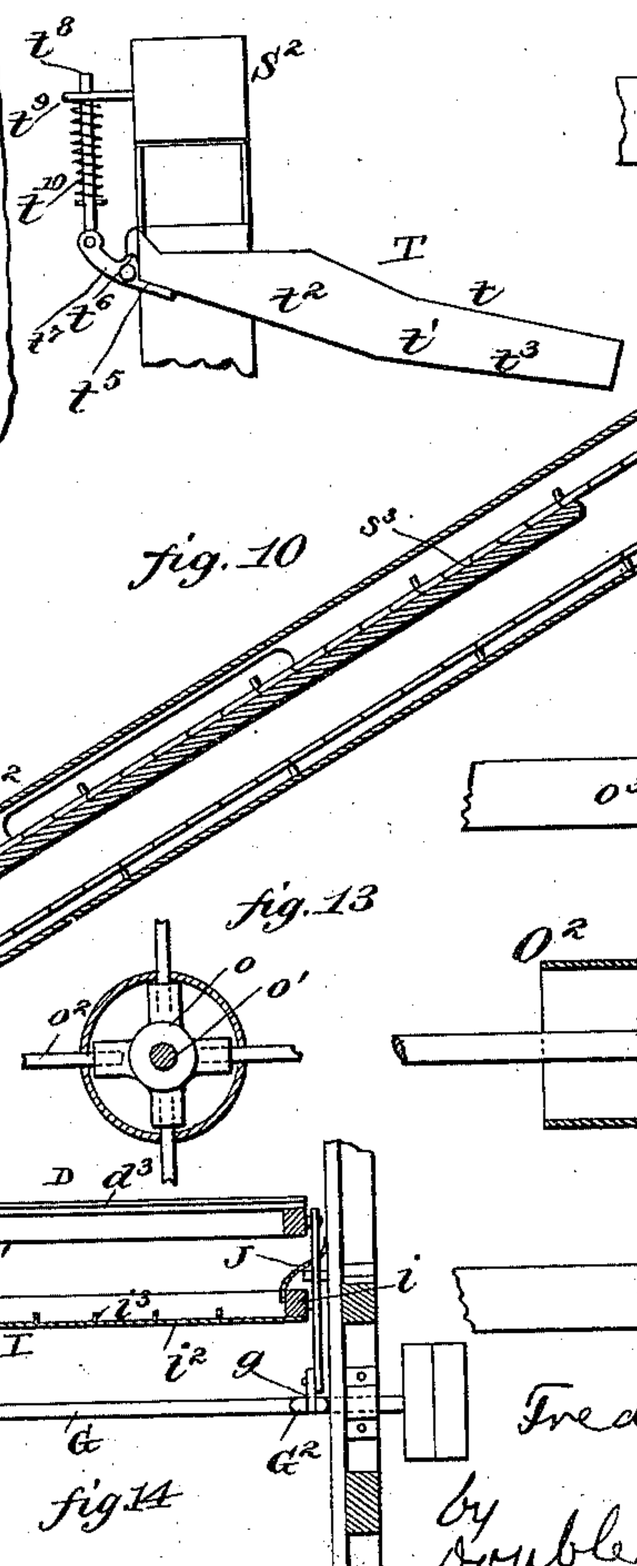

fig. 11

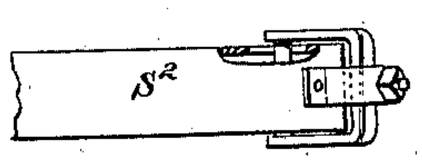

fig. 10

fig. 12

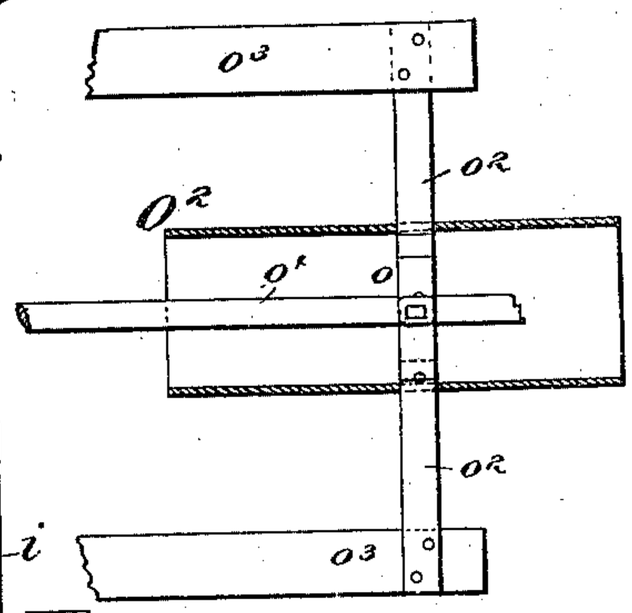

fig. 13

fig. 14

Witnesses.

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THRASHING MACHINE.

No. 561,552. Patented June 9, 1896.

Fig. 18

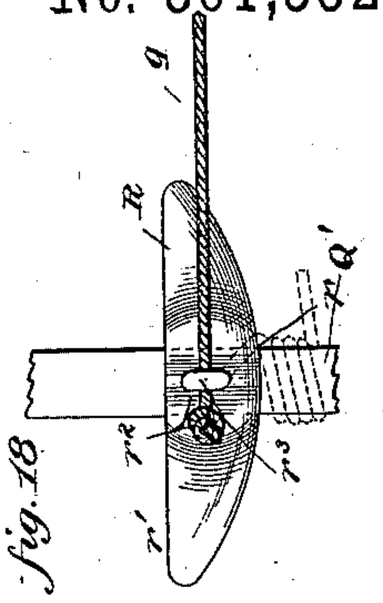


Fig. 19

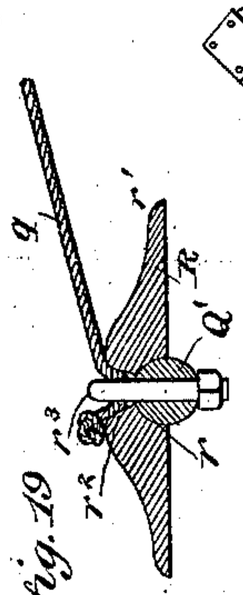


Fig. 24

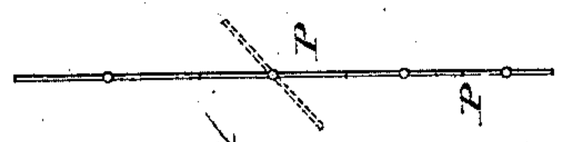


Fig. 17

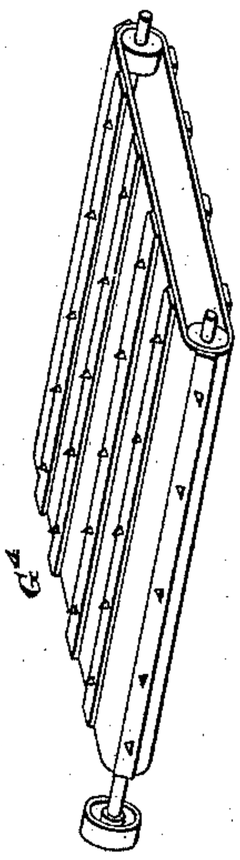


Fig. 21

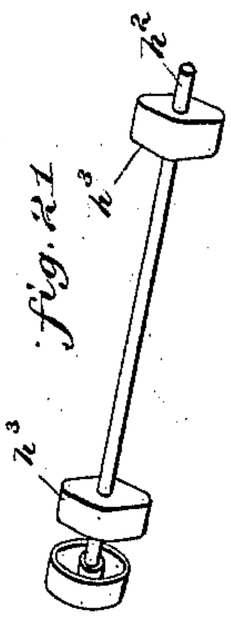


Fig. 22

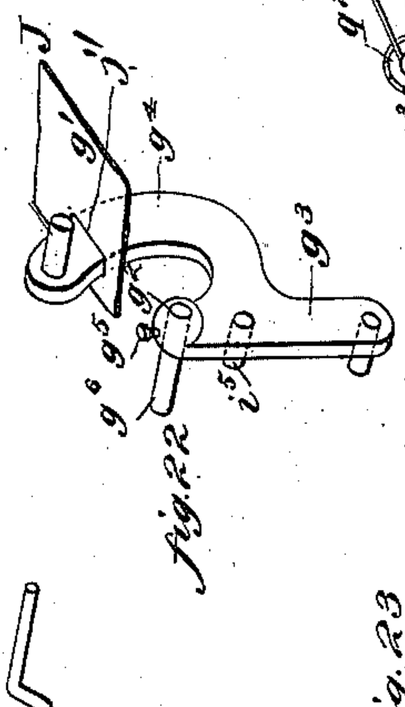


Fig. 16

Fig. 20

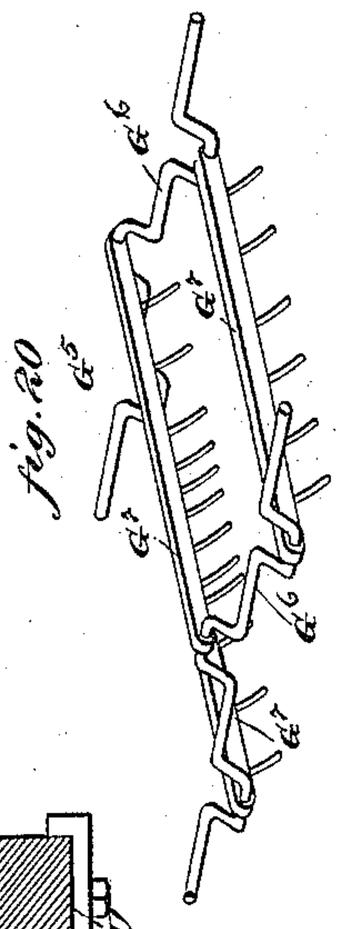


Fig. 15

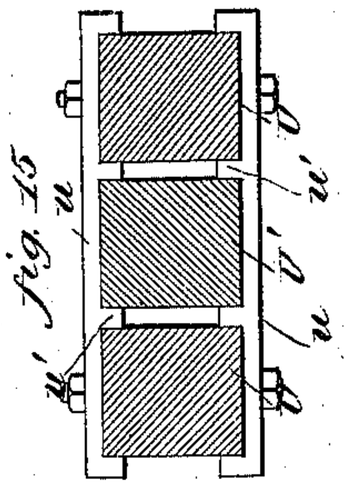
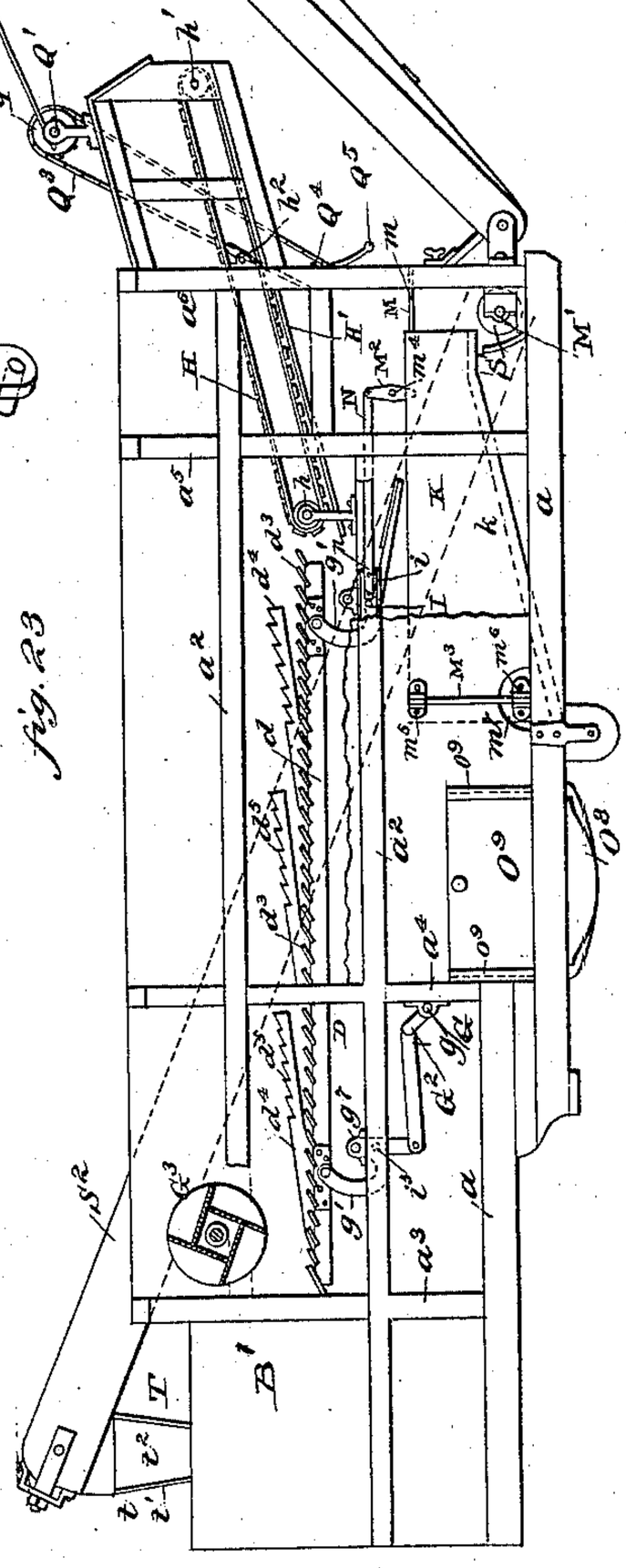


Fig. 23



Witnesses.

J. F. Coleman

N. B. Hay

Frederic R. Avery
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R. H. AVERY, Dec'd.

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THRASHING MACHINE.

No. 561,552. Patented June 9, 1896.

Fig. 25.

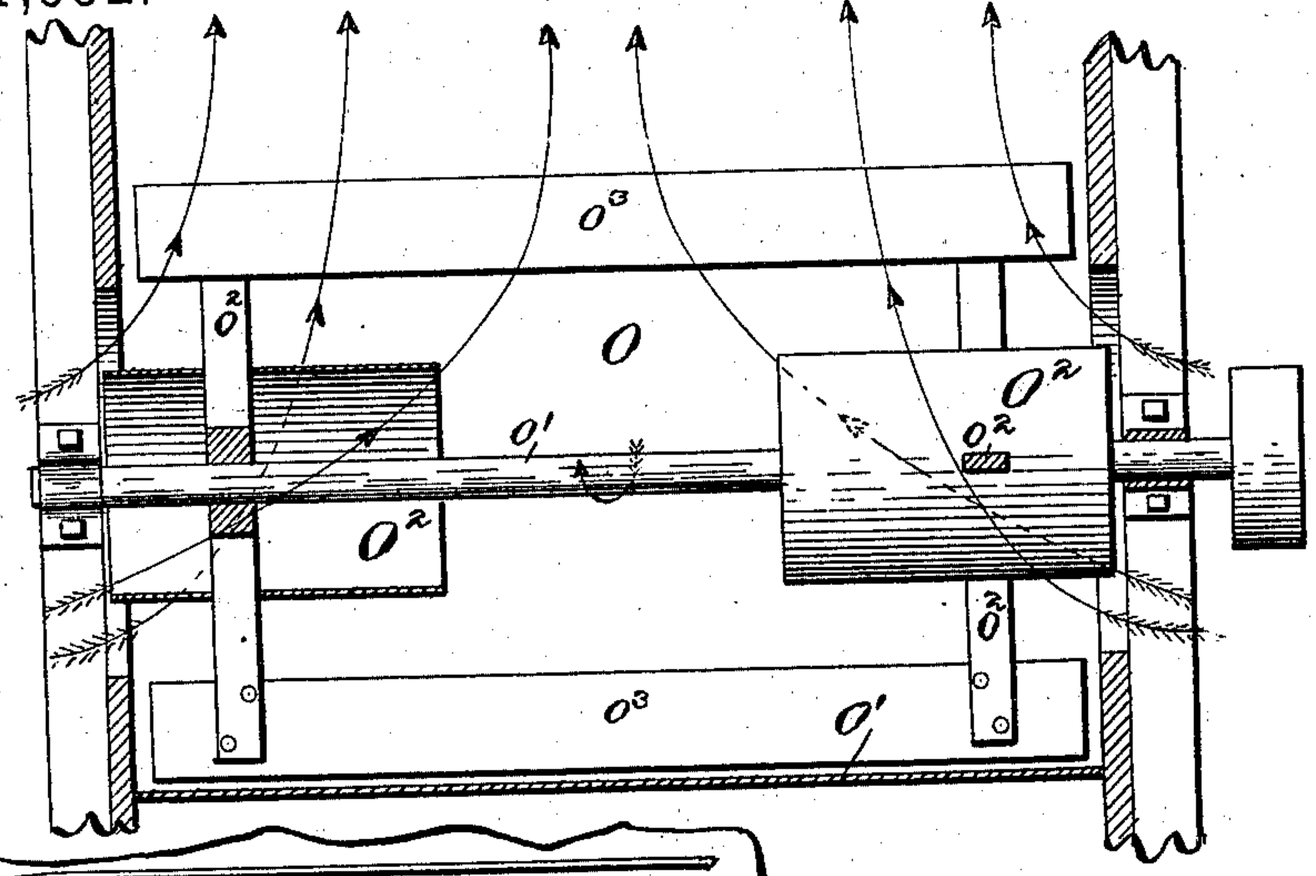


Fig. 26.

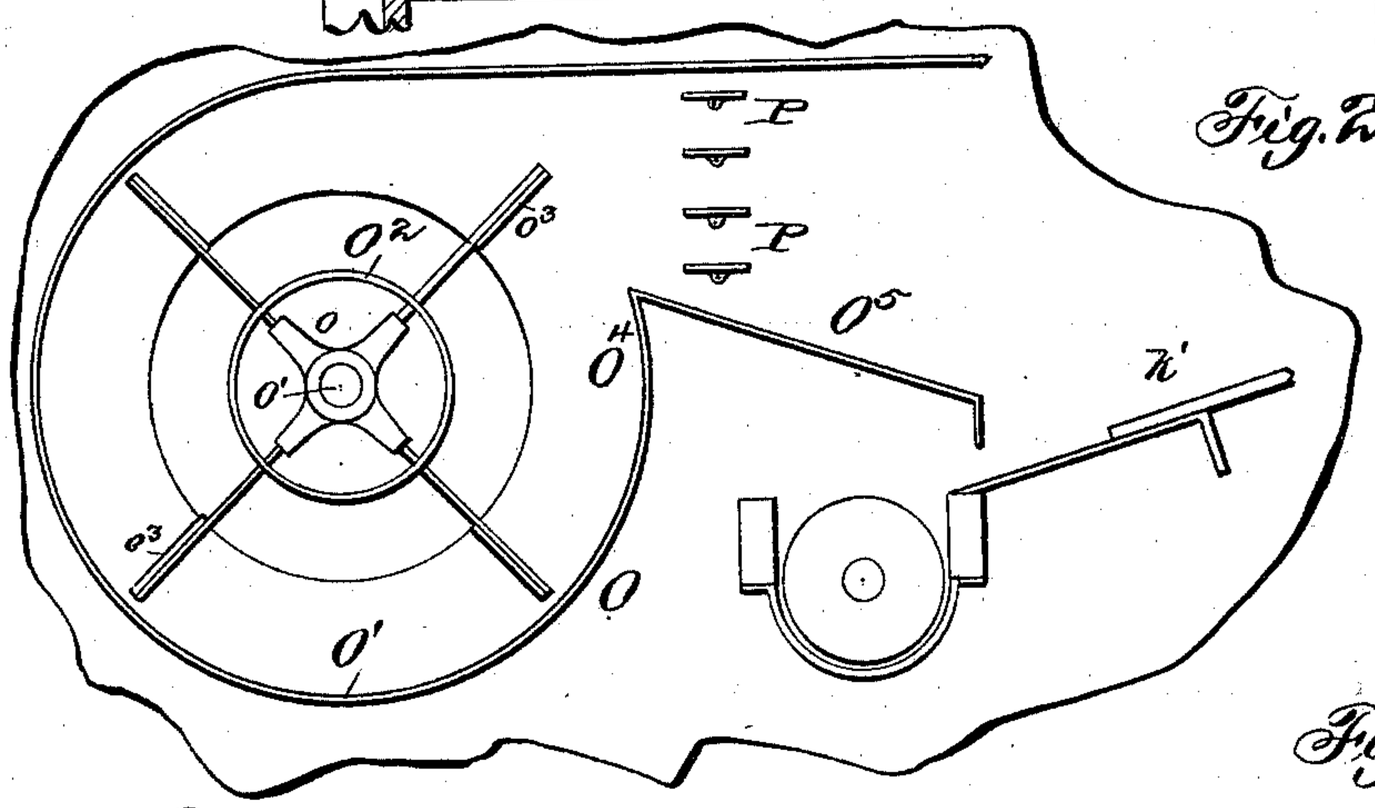


Fig. 27.

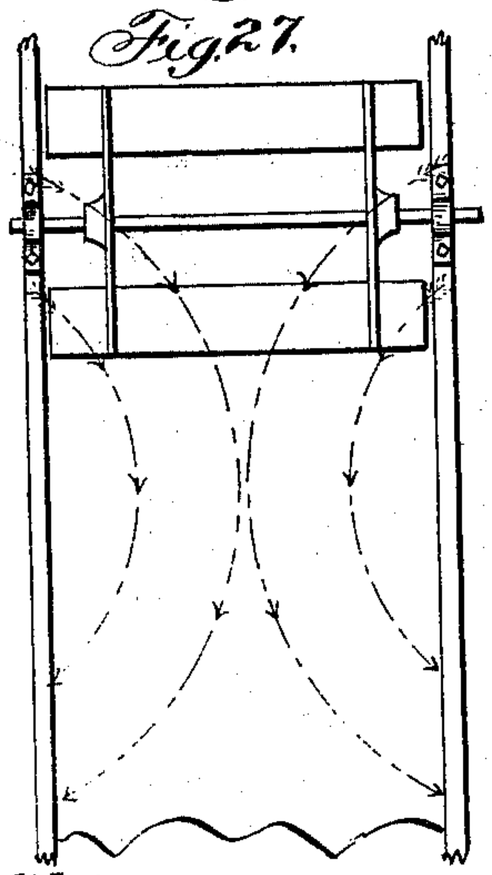


Fig. 28.

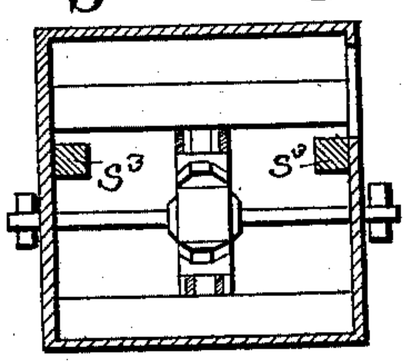


Fig. 30.

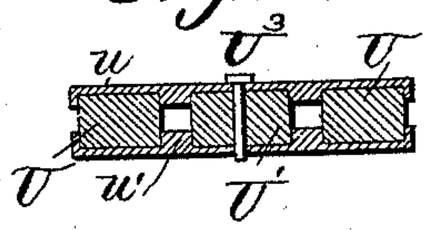


Fig. 29.

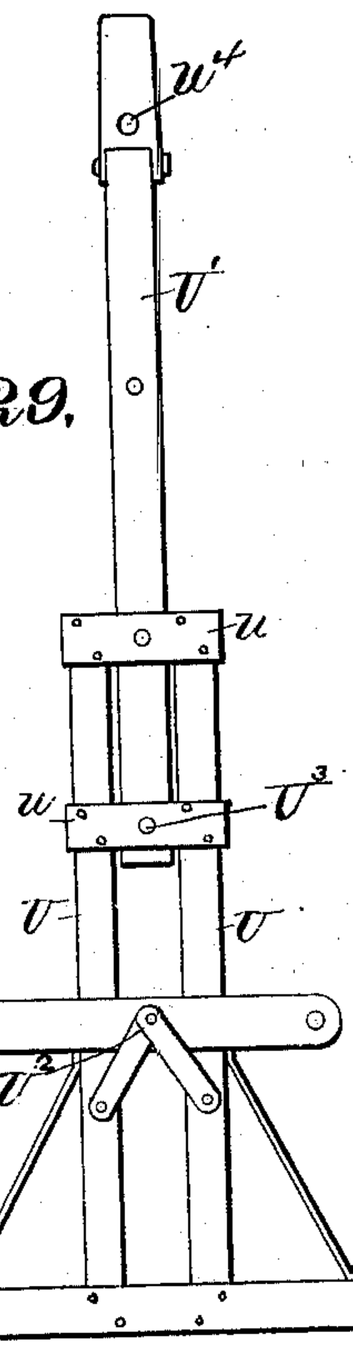
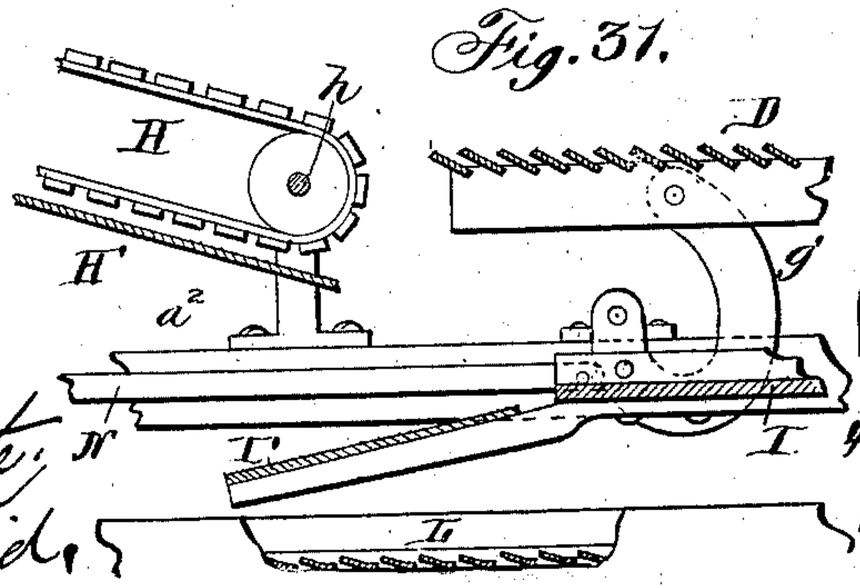


Fig. 31.



Witnesses;
Chas. F. La Porte;
William A. Reid.

F. R. Avery by
Doubleday & Rhas
Att'ys

UNITED STATES PATENT OFFICE.

FREDERIC R. AVERY, OF PEORIA, ILLINOIS, ADMINISTRATOR OF ROBERT H. AVERY, DECEASED.

THRESHING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 561,552, dated June 9, 1896.

Application filed May 8, 1893. Serial No. 473,479½. (No model.)

To all whom it may concern:

Be it known that ROBERT H. AVERY, deceased, late a citizen of the United States, residing at Peoria, county of Peoria, State of Illinois, and of whose estate FREDERIC R. AVERY, of Peoria aforesaid, is now the administrator, has heretofore invented new and useful Improvements in Threshing-Machines, of which the following is a specification, reference being had to the accompanying drawings, wherein—

Figure 1 is a side elevation of a machine embodying the improvements herein set forth. Fig. 2 is a top plan of the stacker. Fig. 3 is a plan of the draft devices. Fig. 4 is a longitudinal section of the fan-shoe. Fig. 5 is a top view of a part of the shoe. Figs. 6 and 7 are perspectives of the sieve-supports. Fig. 8 is a side view of the fan-casing and adjacent parts. Figs. 9, 10, and 11 show the tailings-spout, Fig. 10 being a longitudinal section, Fig. 9 an elevation of the upper end, and Fig. 11 a plan of said end. Fig. 12 shows one end of the fan, the air-tubes being in section. Fig. 13 is a cross-section of parts of the fan. Fig. 14 is a vertical section through the vibrating table and the grain-pan. Fig. 15 is a cross-section on the dotted lines in Fig. 3. Fig. 16 is a perspective of the beater-cylinder in Fig. 1. Fig. 17 is a perspective of the upper endless straw-carrier. Fig. 18 is a plan, and Fig. 19 a section, of the rope-guide on the stacker-shaft. Fig. 20 is a perspective of the straw-forks. Fig. 21 is a perspective of the devices for shaking the rear endless straw-carrier. Fig. 22 is a perspective of the hanger-arms for the straw-table. Fig. 23 is a side view, partly in section, of a modified machine; and Fig. 24 is an end view of the wind-slats of the fan. Fig. 25 is a longitudinal section of the fan and adjusting parts. Fig. 26 is a view showing the same parts with one side of the casing of the machine removed and also showing the parts adjacent to the fan. Fig. 27 is a view, largely conventional, of an ordinary thresher-fan to illustrate its action on the air. Fig. 28 is a cross-section of the tailings-elevator shown in Fig. 10. Fig. 29 is a plan of the draft devices for the thresher (shown folded in Fig. 3) when they are extended to apply horses. Fig. 30 is a cross-section of the same enlarged somewhat. Fig. 31 is a partial longitudinal central section of the straw-table, the grain-pan, the rear endless straw-carrier, the shoe, and the deflector-chute below the straw-table.

In the drawings the machine is illustrated as being mounted upon transporting-wheels A at the front and A′ at the rear, and as having a main frame, more or less similar to some heretofore in use—that is to say, a frame having bottom sills a and one or more upper sills a^2, together with front uprights a^3 a^4 and rear uprights a^5 a^6—this frame supporting a board housing and a cover, as at a'.

At the front end the cylinder B is mounted in the casing at B′, there being a concave at C with a suitable grating c in rear thereof. The straw passes over the grating and is received upon the vibrating table D. This table is formed with longitudinal bars d and cross-bars d', Fig. 14, secured thereto. The longitudinal bars d are notched or serrated, and in each of the notches there is secured a slat or narrow strip d^3, these being parallel to each other, but inclined somewhat upward and backward. To the tops of these inclined slats there are secured upwardly and backwardly inclined bars d^4, which are provided with means for temporarily catching the straw and forcing it backward. Preferably such means are provided by forming notches or serrations, as at d^5, in the upper edges of these inclined bars d^4.

The table is actuated by means of a shaft G, which is connected to the table by pitmen g g and oscillating rockers at g' g'. Each of these rockers is formed with a hinge-eye g^2, a downwardly-extending arm g^3, and a curved arm g^4, which is concentric with the hinge-eye g^2. The pitmen g g are pivoted to the arms g^3. The eyes g^2 are secured by set-screws g^5 to short shafts g^6, which are mounted in bearings g^7, and the curved arms g^4 are at the upper ends pivoted in bearings g^8, secured to the vibrating table. It will be seen that the curved arms g^4 lie in front of the hinge-shafts g^6—that is, between said shafts and the cylinder.

The straw-table should be caused to move vertically as well as longitudinally. To accomplish this, the pivot at g^8 must during

a considerable part of the movement of the rocker-arm g' be in horizontal lines below the upper end of the vertical radius of the rocker—that is to say, the required movements of the grain-table necessitate the placing of the pivot g^8 between the vertical plane of the hinge g^2 and the threshing-cylinder. To provide for this to the greatest advantage, the curved parts g^4 are placed between the hinges g^6 and the threshing-cylinder.

Heretofore it has been customary to employ a shaft supplemental to that at G for the purpose of vibrating the table. The supplemental shaft and its attachments are here dispensed with and the shaft at G is provided with eccentrics G^2 or equivalents and connected directly to the vibrating table, the vibrating parts at g' being reversed in comparison with the ordinary arrangement, whereby important advantages, to be hereinbelow referred to, are attained.

G^3 represents a beater. It is placed behind the thresher-cylinder and is formed as a smooth-surfaced drum. It revolves at a relatively high speed and is so situated that the material which is thrown out from the cylinder strikes it at such an angle that the berries of grain glance downward, while the straw is carried upward on the surface of the cylinder and thrown violently by the latter up and back. In order to attain this result, it is preferred to so arrange the beater with respect to the cylinder, the concave, and the grate behind the concave that the latter shall lie in a plane intersecting the surface of the beater at a line somewhat below the line which is nearest to the grate in order that the grain-berries shall glance or rebound downward.

There is a tendency for the straw to accumulate behind the beater, and consequently the proper treatment of it is interfered with. This clogging is overcome in the present machine by means of an endless belt or carrier G^4, formed of leather or other belts, and cross-bars, and so situated as to engage with and carry backward the straw, which, as aforesaid, tends to accumulate. Back of this and above the straw-shaker a reciprocating mechanism G^5 is placed for the purpose of still further loosening up the straw and distributing it uniformly over the shaker. This mechanism consists of a series of forks or toothed arms G^7, which are supported upon crank-shafts G^6. When the machine is in operation, the arms act successively to engage with and force backward the straw.

Threshing-machines have been heretofore proposed each having a table or carrier below the straw with an endless belt or carrier above it in some cases, and in other cases a reciprocating fork mechanism; but it is believed that this is the first threshing-cylinder, the beater or drum, the lower vibrating table, the endless belt at the inner end of the straw-table, and the fork mechanism at the rear end of which are arranged in the way herein shown, and so as to accomplish the purposes aimed at.

As is well known, the straw tends to leave the threshing-cylinder in varying masses depending upon the feeding of the bundles to it, there being almost unavoidably periods of full load on the cylinder with intervening periods of light load. As a result there are thrown backward from the cylinder masses varying in their quantity and volume. These are received by the beater or drum, and are in turn delivered by it to the parts beyond, beginning with the vibrating straw-table. The presence of these varying masses is detrimental to thorough separation of the grain. If an endless belt is used to support and carry them back, they tend to maintain their irregularity in volume; and even if a reciprocating fork mechanism be placed above such endless carrier there is still a failure to break up the masses properly.

It is the aim to produce a uniform layer or sheet on the vibrating table. The endless belt above the inner end of the table presses more or less on these masses and holds them so that the teeth or upwardly-extending projections of the vibrating carrier can attack them repeatedly as they are moving backward and tear the straws apart, so that the lumps or masses become such a comparatively uniform layer. After this the vibrations of the lower table can more freely remove the grain-berries, and, finally, the reciprocating fork mechanism breaks up the sheet or stream, still further disintegrating it into loose straws, and a comparatively perfect separation is attained.

The straw passes from the rear end of the vibrating table to the endless raddle-belt H, formed of leather or equivalent belts and wooden cross-slats, and mounted upon the lower power-shaft h and the upper shaft h'. Intermediate of these shafts there is a shaking mechanism, which, as shown, consists of a shaft h^2, having eccentrics or cross-heads h^3, which lie beneath the belts and impart rapid jolts or blows to the straw as it is being carried upward and outward, to insure the separation of grain therefrom. Below the raddle-belt is placed the returning boards or chute H', which extends downward and back to a point above the shoe.

Below the rear end of the straw-carrier there is a downward and backward inclined chute I', which is in such position relative to the lower end of the bottom board H' as to prevent the material which drops from the latter from passing too far forward and causing it to be delivered sufficiently far back from the front edge of the shoe. This chute receives also from the straw-carrier any heads, fine straw, or other fine particles which fail to fall through the passages between its slats.

Below the above-described vibrating straw-carrier D is placed the grain pan or table I. This extends from the front end of the machine (from a line below the front end of the cylinder-casing) back to a line above the shoe. It has longitudinal sills i i, connected by cross-bars i', and it is provided with a tight

bottom, preferably of sheet metal, as at i^2. The space above it is divided longitudinally by ribs or bars i^3 for a more perfect backward propelling of the grain. This grain-table is also connected to the above-described vibrating mechanism, it being pivoted at i^5 to the arm g^3, and to the table are imparted vibratory movements simultaneous with those imparted to the straw-carrier D, but in opposite directions. At the sides of this grain-table flexible strips J, Fig. 14, of canvas or equivalent, are placed and joined both to the table and to the wall or casing of the machine, so as to form perfectly-tight joints and to prevent any of the grain from passing downward. The curved arms g^4 pass upward through these joining strips; but by having them concentric with the axis around which they rock they do not require apertures larger than their own cross dimensions, and therefore they do not interfere with the tightness of the aforesaid joints, as has been the case with machines of this class as heretofore constructed. (See Figs. 14 and 22.)

The chute I′ above referred to is carried by the grain-pan, it being secured thereto by arms or in any other suitable way to hold it properly below the straw-carrier and below the returning-chute H′. Chute I′ insures that the material of a coarser and less desirable nature (heads, chaff, fine straw, &c.) which drops from the end of the straw-table and from the chute shall be carried down toward the shoe on lines other than those of the descent of the grain from the pan I. The forward or inner edge of the chute I′ should be carried inward far enough to catch the material from above, as aforesaid, and yet be situated so as to permit a free falling of the cleaner grain from the end of the pan, there being a passage for the latter to drop through.

The grain, both that which is delivered from the rear or outer end of the grain-table I and that delivered from the returning board or chute H′, is received in the fan-shoe K. This is constructed with the main-frame boards, more or less similar to those heretofore in use, having the side boards k, inclined bottom boards k', and tail-boards k^2. In the frame thus formed the screens or sieves are placed as occasion requires, as at L L′. The front or inner edges of these are supported by brackets l', secured to the front edges of the side walls k, and they are supported at their rear edges by means of detachable and adjustable cleats l^2, Figs. 4 to 7. Each of these cleats is formed with a portion l^3 and a slotted plate l^4, which can be adjustably secured against the rear edge of the screen by a bolt l^5. In Fig. 4 the shoe is shown with parts adapted to the winnowing of wheat, these being in this case made of the two screens L and L′. That at L is a chaffer and is made of a rectangular framework and one or more sheets of metal cut and crimped, so as to provide ribs, apertures, and upwardly-extending lips. The chaff and heads of wheat which may fall over the upper tables or chutes are received on this, and by reason of the vibrations imparted to them the grain is separated from the chaff and heads and falls through the apertures, while the chaff is forced backward by the lips or projections. The wheat-screen L′ receives the grain from the chaffer together with the small particles of foreign material, and after being winnowed the grain falls through to the bottom board k', while the impurities are carried backward by the blast.

In order to prevent small pieces of straw from passing over the rear edge of the chaffer down to the grain-screen or into the "tailings-elevator," there is combined with the parts above described a screen, (indicated by M.) It may consist of a series of parallel rods or wires m of such nature and so arranged as to afford no obstruction to the backward passage of the straw; but they are spaced far enough apart to permit heads or any of the material generally referred to as "tailings" to fall below and be caught by the transversely-acting conveyer M′. As shown, this supplemental screen has a cross-bar m', detachably hinged by clips and pins at m^2, so constructed as to permit the screen to be rocked up or down as wanted. These pins and clips for this screen are the same in structure and mode of attachment as that illustrated in Fig. 7 for the screen L′.

The shoe as a whole is suspended upon two links at each side of the machine, as at M^2 M^3. The links M^2 are of the nature of comparatively short levers pivoted at m^3 to bars secured to the walls or frame of the machine and at the lower ends pivoted to bars m^4, attached to the rear end of the shoe. The links M^3 are longer than those at M^2 and are connected to the shoe at or near its inner end. They are placed outside of the machine-casing and are fastened at m^5 to said casing and at m^6 to studs secured to the shoe and projecting through apertures m^7 in the casing.

By having the supporting-links related to each other in length and in location in the way described advantageous movements of the shoe are secured.

Power is imparted to the shoe for vibrating it by pitmen N, placed inside of the casing, they being pivoted to the upper ends of the aforesaid links or levers M^2 and at n being pivoted to the sill-bars i of the grain-table.

Heretofore a more or less complicated mechanism extending from the front of the machine has been employed for imparting the vibrations to the shoe.

The pitmen or links N are situated inside the casing and above the shoe, so that the side walls of the latter are not placed in from the walls of the casing, and consequently there are no air-spaces left at the sides of the shoe behind the fan. It is desirable to maintain throughout the entire separating-chamber a substantial continuity of the side walls of the casing, and the boarding thereof is

placed on the inside of the main frame $a\,a^2\,a^3$. By following the above-described plan of construction and arrangement of the parts which transmit motion from one to the other of the vibrating devices they are compactly placed within the casing without destroying the above-mentioned continuity of the side walls and without requiring the long heavy outwardly-projecting arms, journal, &c., that would be necessary if the transmitting devices were placed outside of the framework. There are no vibrating parts on the outside of the sides of the machine, with the exception of the wooden spring-like supports M^3 for the rear end of the shoe, and even these are inside of the outer plane of the framework, so that they are practically not exposed. These vibrating supports M^3 are so disposed as to permit the side walls of the shoe to be brought snugly close to the inner wall of the casing, so that there shall be no air-outlet except through the shoe. Relatively long supports like the spring-hangers M^3 are requisite for the forward or inner end of the shoe, as it is desired that this part should move without any material rising or falling, whereas it is desirable that the rear end of the shoe shall have vertical motion for the purpose of shaking up and loosening the straw, heads, &c., delivered to that part of the shoe, as above described, from the straw-carriers D and H over the chute I'.

The blast devices are indicated by O. The fan has the cross-shaft o', upon which are mounted the spiders o, to which are attached the carrier-arms o^2 and the blades o^3. The casing O' of the fan is closed upon the front side and has openings or eyes at the ends, through which the air is drawn in and then forced backward.

It has been found that the ordinary end-feeding fans have caused disadvantageous eddies of the air above and around the shoe, particularly along the central longitudinal lines, due to the fact that the air is not driven backward by all parts of the fan-blades uniformly. To overcome this, a tubular air-guide is employed, as at O^2. Preferably there are two sections of these tubes O^2, secured to the fan in such way that some of the air which enters through each of the eyes will be drawn to the center, longitudinally, before it can be driven backward by the blades. This invention is not limited to any particular dimensions of the parts described, as they may be varied to meet different conditions—that is to say, the air-tubes may be longer in some cases and shorter in others in relation to their diameter and to that of the eyes. Good results are obtained when the diameter of the tubes is from one-fourth to one-half that of the fan and from one-half to two-thirds that of the eyes; but, as said, there can be considerable modification in these respects.

One of the ways for securing the tubes in position is shown—namely, by connecting them to the part which holds the blades—but in this respect also there can be variations, as will be readily understood.

When a thresher-fan of the ordinary sort is in use, the air is drawn in through the eyes in two volumes whose paths are inclined or curved from the eyes, respectively, to points in the central longitudinal planes of the machine, somewhat to the rear of the fan. At these points the two volumes or currents of air impinge upon each other and are deflected outward away from the central planes on curved or inclined lines at an angle substantially equal to the angle of incidence.

When the fan is constructed in the way shown herein, there are three main jets formed, one at the center and one adjacent to each eye, and the volume of air is driven back more uniformly than in the ordinary machine. The sections of the two fans and the paths taken by the air in the two machines, respectively, will be understood when a comparison is taken of Figs. 25 to 27, the latter showing the general paths taken at first by the air when drawn in and blown backward by the ordinary thresher-fan, and Fig. 25 illustrating clearly how these main volumes of air are, in the present machine, divided up and delivered to the fan-blades in such way that they are prevented from transversely impinging on each other and rebounding outward and from the casing-wall. Careful investigation has shown that with the ordinary fans there are within the compartment containing the shoe areas of rarefaction to such an extent that air on some longitudinal lines is actually sucked back from the tailings end of the screen. The employment of the tubes O^2 effectually overcomes this and practically all the air is forced out uniformly on parallel lines.

The main part of the fan-casing O' at the bottom is extended upward, as shown at O^4, for the purpose of delivering a strong and condensed blast of air in the directions and at the places desired relatively to the shoe. From the upper edge of this part O^4 the chute or floor O^5 is extended backward and downward, leaving the throat at O^4 between it and the shoe-floor k' for the escape of the grain to the conveyer. The volume and the direction of the air as it leaves the fan are governed by a series of relatively narrow slats P, which are mounted upon trunnions and can be adjusted from the outside by devices at p. The lower part of the eye of the fan is closed by a pivoted door O^8 and the upper part by a sliding door O^9, held in cleats o^9, and the eye is provided with a shield o^{10} of wire-netting in two sections to prevent the entrance of straw or foreign material.

The straw-stacker is indicated by Q and may be of any of the ordinary forms. It is supported at its lower end and at the upper end is held by the ropes q. The latter can be wound upon the shaft Q', mounted upon the top of the machine casing or frame. One of the novel features of the present machine

consists of the clamp by which the end of the rope q is connected to shaft Q'. This clamp comprises the clip R, which is formed with a recess r to fit the shaft, an extension r', and the socket r^2. r^3 is an eyebolt passing through an aperture in the shaft and also through the socket in the part R. The end of the rope is passed through the eye of this bolt and by means of the nut can be drawn tightly to the part R and the latter fastened tightly to the shaft Q'. The extensions r' are so arranged that as soon as the shaft begins to revolve they will engage the rope and guide it so that it shall be coiled inward and smoothly upon the shaft, (see Fig. 18,) and thus there is an avoidance of the uneven and outward winding of the rope incident to the devices before used and arising from the fact that the outer or stacker ends of the ropes are separated more than the ends at the shaft Q'. (See Fig. 2.) The shaft Q' is provided with the sprocket-wheel q^2, driven by the chain Q^3, which also engages with the sprocket-wheel Q^4, situated where it can be reached from the ground, and provided with a crank Q^5 and pawl Q^6. The tailings, the material passing over the parts L and L', and also some of what is blown backward by the fan, is received in the conveyer-trough at N' and is pushed by the conveyer S' transversely into the elevator S^2. The box of the tailings-elevator in threshing-machines is generally tightly closed. It is desirable to maintain a certain tension upon the chain and carrier-flights secured thereto. In order to furnish the operator with a gage for ascertaining the tension of these parts, guides s^3 are placed in the box in the present machine at a point where they can be readily visible, and there is an aperture in the box near said guides, so that the position of the chain and the flights can be seen at any time. As shown, these guides are formed of cleats so placed that when the chains are in proper tension the flights will pass above the guides; but instead of this a guide or gage of any suitable sort can be employed.

At the upper end of the elevator there is placed an automatically-acting delivery device T for the tailings. As shown, it consists of a hinged spout t, having the side walls or flanges l' and the bottom t^2 t^3, the part t^3 normally lying more nearly horizontal than the part t^2. The spout can drop and rise automatically. It is supported by the bar t^5, having hinge-ears t^6 and arms t^7. To the latter, rod t^8 is secured, which passes through a guide-eye t^9 and is provided with a spring t^{10}. When these devices are used, there is no trouble experienced from a clogging or stopping of the tailings, as the vibrations imparted to the spout when the machine is running are sufficient to keep it clear.

The draft mechanism has been devised particularly for use in connection with threshing-machines, such as that herein, which it is sometimes desired to haul by horses and sometimes by a traction-engine.

U U' indicate generally the two parts of a draft mechanism, that at U being a frame-work with a passage-way at the center longitudinally, and that at U' being a bar or beam adapted to be adjusted and fastened at one or another point in the said passage-way. Threshers have been heretofore provided with a draft mechanism comprising some of these features; but in the earlier ones the central or adjustable part was fitted closely to the side parts throughout the whole length, and with such a construction great difficulty is experienced arising from the binding or cramping of the parts. This is overcome in the present construction by the employment of spacing or guiding cleats u, formed of metal, having cleats or guides at u', Fig. 15, and which serve also to bind together and strengthen the frame part U. At U^2 there is a fastener adapted to secure the whiffletree, and at U^3 there is a fastener to secure the adjustable parts in any desired position.

When the thresher is to be hitched to a traction-engine, the part U' is moved to its innermost position and fastened, there being at u^4 means for connecting it to the engine. When it is to be hauled by horses, it is unlocked and moved to its outermost position. This is shown in Fig. 29, and at such times the draft devices are of the nature and dimensions of a tongue, and can have horses applied, there being a whiffletree shown at the rear end.

It will be understood, of course, that this invention is not limited to a machine containing each and all of the above-described parts, as some of them may be omitted and others substituted without departing therefrom. Thus the cylindrical drum or beater G^3, Figs. 1 and 16, may be omitted and a beater of the ordinary character may be employed. (See Fig. 23.) So, too, the endless carrier G^4 and the forking mechanism G^5 can be omitted, and the vibrating table D can be employed alone, as in Fig. 23.

What is claimed herein is—

1. In a threshing-machine, the combination with the threshing-cylinder, and the over-acting beater-drum behind the cylinder, of the longitudinally-vibrating straw-carrier immediately below the drum or beater and receiving the straw therefrom in masses on vertical lines, and the endless straw-carrier behind the beater-drum and above the vibrating carrier, the last said carrier having teeth or projections below the endless carrier adapted to engage with the straw as it moves backward under the pressure of the endless carrier, substantially as set forth, whereby the masses formed by or received from the drum or beater are formed into a substantially uniform sheet or layer, and at the same time are agitated and advanced on both the under side of the layer and the upper side by the teeth of the carriers.

2. In a threshing-machine, the combination with the threshing-cylinder, and the drum or

beater behind it, of the lower, longitudinally-reciprocating, straw-carrier with upwardly-extending teeth or projections, which receive the masses of straw from the beater or drum, the endless rotating belt above the forward part of the reciprocating carrier whereby the masses of straw are held down while being advanced by the longitudinally-reciprocating teeth for the forming of a substantially uniform relatively thin sheet of straw, and the reciprocating fork mechanism above the rear end of the lower reciprocating carrier adapted to finally loosen and open up the straw of the said sheet or layer, substantially as set forth.

3. The combination with the reciprocating straw-carrier, the grain-table, and the shield which connects said table with the stationary wall, of the rocker-arms for said table formed on the arcs of circles concentric with their axes of vibration and passing through said shield, substantially as set forth.

4. The combination with the grain-table, the parts reciprocating above it, and the shield that connects said table to the wall, of the vibrating arms below the said shield formed on the arcs of circles concentric with the axis of vibration and passing through said shield, and the power devices below the shield, substantially as set forth.

5. The combination with the vibrating straw-carrier, the vibrating grain-table, and the shield J, of the vibrating rockers pivoted to said table and connected to said carrier by arms curved on the axis of vibration and lying between said axis and the threshing-cylinder, substantially as described.

6. The combination with the inner straw-carrier, the grain-pan beneath it, and the upwardly-acting straw-carrier arranged in rear of the inner carrier, of the rearwardly-inclined chute arranged below and extending across the space between the adjacent ends of the carriers, substantially as and for the purposes described.

7. The combination with the inner straw-carrier, the grain-pan beneath it, and the upwardly-acting straw-carrier in rear of the inner carrier, of the straw shield or chute connected to the grain-pan to vibrate therewith and extending below the adjacent ends of the straw-carriers, to throw material falling from said carriers to the rear part of the shoe, substantially as set forth.

8. The combination with the inner straw-carrier, the grain-pan beneath it, and the rear or outer straw-carrier, of the shield or chute supported from but having its inner edge beyond the rear edge of the grain-pan, whereby a clear passage for grain is formed between it and the pan, said shield or chute extending below and across the space between the adjacent ends of the straw-carriers, substantially as set forth.

9. The combination of the threshing-cylinder, the vibrating straw-carrier, the vibrating grain-pan below it, the shaft G having cranks, the vibrating arms g^2 for supporting the carrier and table extending from their axes forward and attached to the inner end of the table at points in transverse planes between the axes and the threshing-cylinder whereby they elevate the inner end of said table as they begin their movement, substantially as set forth.

10. In a threshing-machine, the combination of the vibrating straw-carrier D, the oppositely-vibrating grain-pan below it, the shoe vibrating oppositely to the pan, the rocker-arms hinged within the casing between the grain-pan and the straw-carrier and pivotally connected to said pan and carrier on opposite sides of their hinges, there being a pair of such arms at each end of the carrier and pan, the pitman N lying within the casing and connecting the grain-pan to the shoe, and the driving-shaft connected to one of the rocker-arms, substantially as set forth.

11. In a threshing-machine, the combination with the vibrating winnower-shoe, the vibrating straw-carrier, the grain-pan vibrating oppositely to both said shoe and carrier, and the casing inclosing said parts, of the rockers hinged to the frame within the casing and arranged in pairs one near the forward end of the carrier and the other near the rear end thereof, said rockers being pivoted to the carrier above their hinges and to the grain-pan below their hinges, the pitmen inside the casing and connected at one end with one pair of rockers, and the vibrating levers M^2 fulcrumed within the casing and connected on one side of their fulcrum with the shoe and on the other side thereof to the pitmen, substantially as set forth.

12. In a threshing-machine, the combination with the threshing-cylinder at the front end of the machine, the winnower-shoe at the rear end, the vibrating grain-pan extending approximately horizontal from lines beneath said cylinder to lines above said shoe, the approximately parallel vibrating straw-carrier above the pan and moving oppositely thereto, of the two pairs of substantially similar rocker-arms all supported on horizontally-arranged hinges between the pan and straw-carrier, each rocker having a longer arm, which extends upwardly substantially concentric with the hinge and is pivoted to the straw-carrier, and a shorter downward-extending arm pivoted to the grain-pan, substantially as set forth, for the purpose specified.

13. In a threshing-machine, the combination with the vibrating winnower-shoe, the casing which incloses it, and the straw-separating mechanism in said casing, of the relatively long links or swinging supports for the inner end of the shoe and lying outside the casing, and the shorter links or swinging supports for the inner end of the shoe mounted inside the casing, substantially as set forth.

14. In a threshing-machine, the combination with the vibrating shoe, the separating mechanism, the grain-pan arranged to deliver

the grain at points near the inner end of the shoe, and means for delivering straw or similar material relatively near the rear end of the shoe, of the relatively longer links or swinging supports for the inner end of the shoe, and the relatively shorter links or swinging supports for the rear end thereof, substantially as set forth.

15. In a threshing-machine, the combination, of a rotary fan having rotary, axial, tubular air-ducts secured to the fan, and a fan-casing having eyes or apertures at its ends through which the air enters on lines parallel to the axis, substantially as set forth.

16. In a threshing-machine, the combination with a rotary fan, and a casing therefor having air-inlets at the ends of the fan and an air-outlet radial or tangential thereto, of tubular air-ducts at the axis of the fan, shorter than the fan-blades and of a diameter less than the air-inlet apertures, substantially as set forth.

17. In a threshing-machine, the combination with the fan having the relatively long blades and the shaft or central support therefor, of the relatively shorter air-ducts secured to the central support, and the casing having air-inlets adapted to deliver air to the fan-blades through the said ducts to the central parts of the fan-blades, and also independently of said ducts to the ends of the fan-blade, substantially as set forth.

In testimony whereof I affix my signature in the presence of two witnesses.

FREDERIC R. AVERY,
Administrator of estate of Robt. H. Avery, deceased.

Witnesses:
F. H. TICHENOR,
W. N. KILBOURN.