(No Model.) 3 Sheets—Sheet 1.

J. H. HAMAKER.

GRAIN AND SEED THRASHER AND SEPARATOR.

No. 283,778. Patented Aug. 28, 1883.

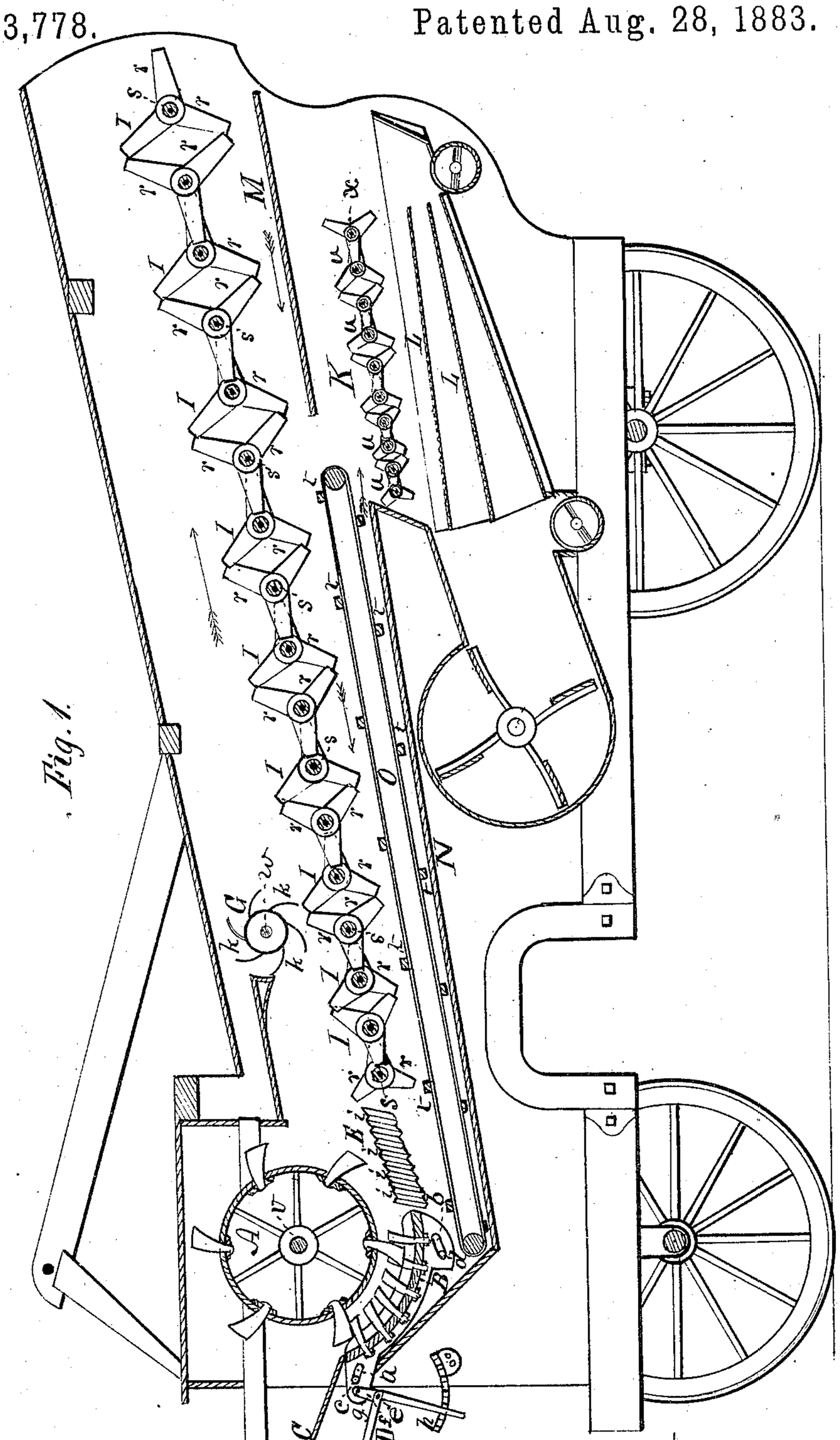

Fig. 1.

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Fig. 6.

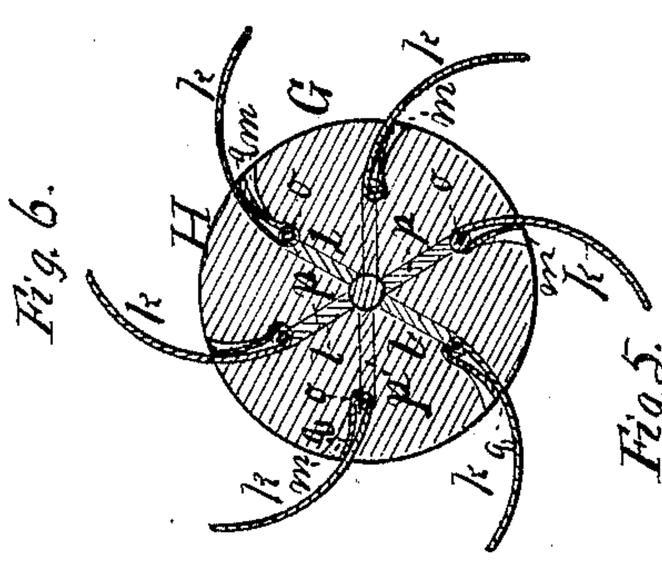


Fig. 5.

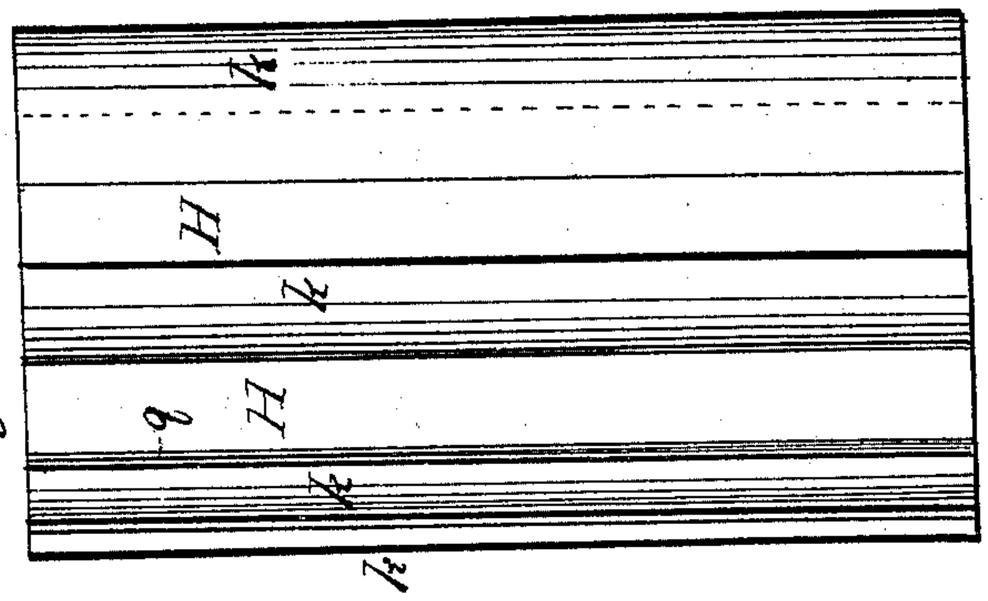


Fig. 3.

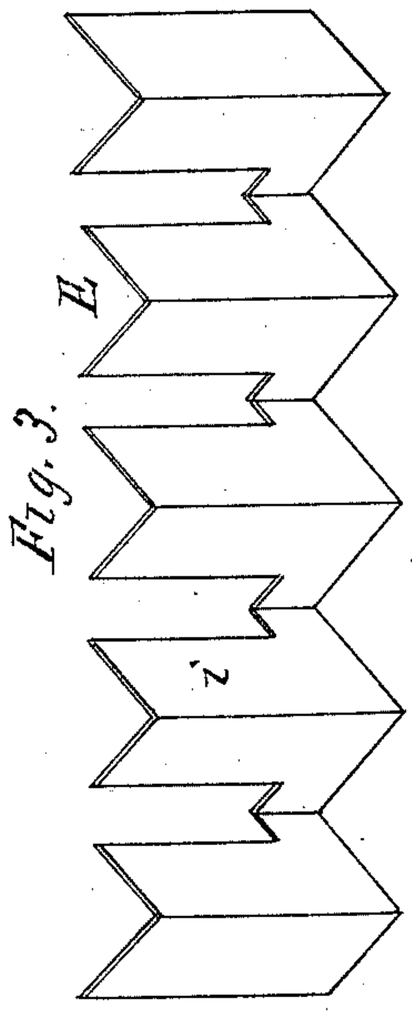


Fig. 4.

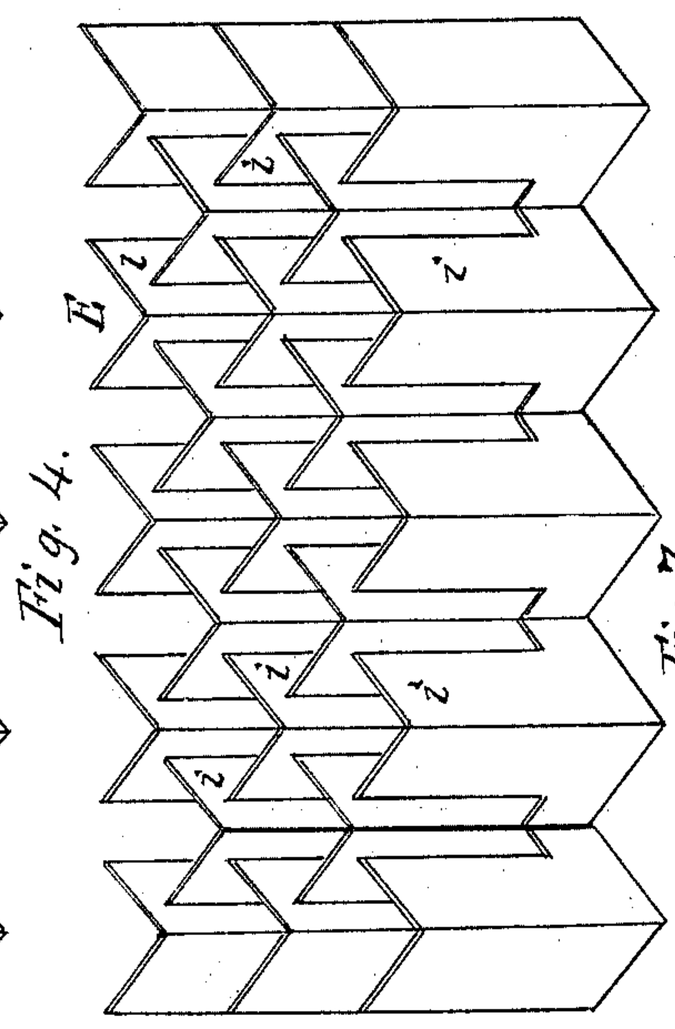


Fig. 7.

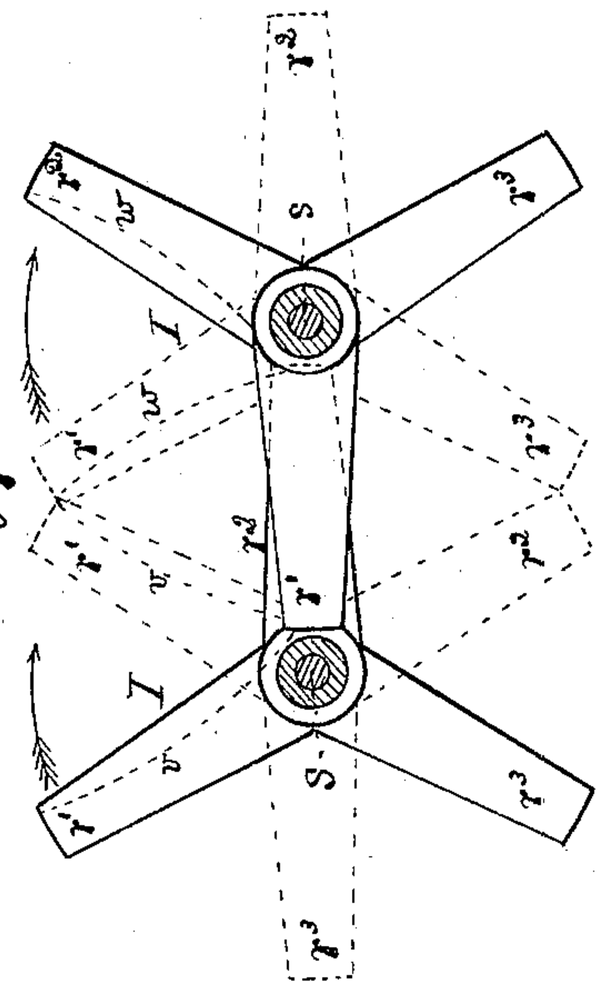
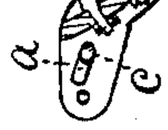


Fig. 2.



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J. H. HAMAKER.

GRAIN AND SEED THRASHER AND SEPARATOR.

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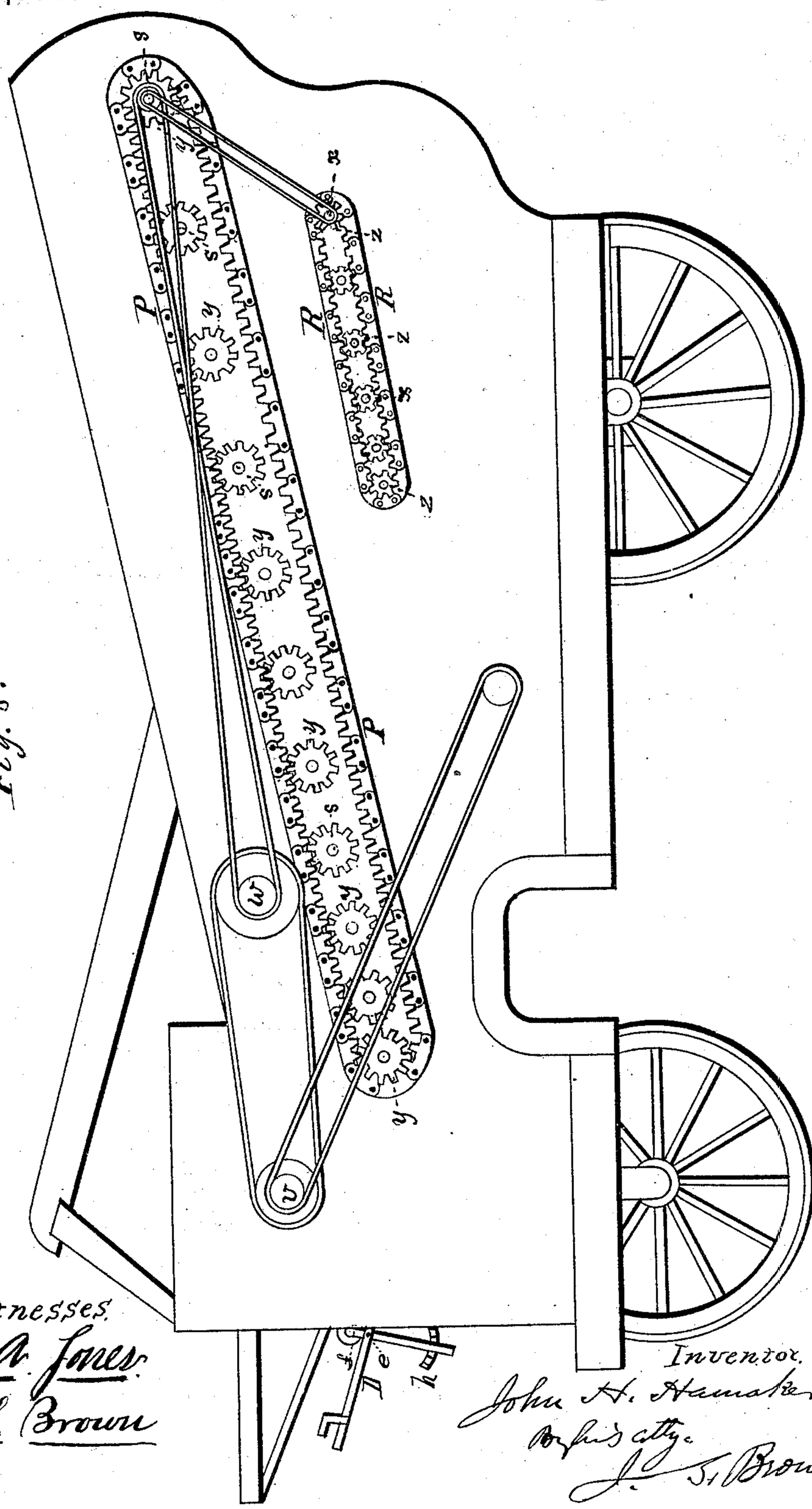

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Inventor.
John H. Hamaker,
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UNITED STATES PATENT OFFICE.

JOHN H. HAMAKER, OF CANTON, OHIO, ASSIGNOR OF ONE-THIRD TO EDWIN W. HAMAKER AND ULYSSES S. HAMAKER, BOTH OF SAME PLACE.

GRAIN AND SEED THRASHER AND SEPARATOR..

SPECIFICATION forming part of Letters Patent No. 283,778, dated August 28, 1883.

Application filed February 5, 1883. (No model.)

To all whom it may concern:

Be it known that I, JOHN H. HAMAKER, of Canton, in the county of Stark and State of Ohio, have invented an Improved Grain and Seed Thrasher and Separator; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, making part of this specification—

Figure 1 being a central longitudinal vertical section of a thrashing-machine and grain-separator constructed with my improvements; Figs. 2, 3, 4, 5, and 6, views of parts in detail; Fig. 7, a detail view and diagram illustrating the movements of the revolving rakes comprising the grain-separator; and Fig. 8, a side view of the machine, showing the driving-gear for operating the beater and the carrier and chaffer-rakes of the machine.

The same letters designate the same or corresponding parts in all the figures.

The objects aimed at in my invention are, first, to reduce the machine to the utmost simplicity consistent with the proper fulfillment of its functions; secondly, to render the operation of all its working parts as direct and effectual as possible, and with the least expenditure of power; third, to apply the operations of the parts just where and when they will be most efficient; and, fourth, to overcome certain difficulties and correct some defects which heretofore have seriously interfered with the satisfactory working of such machines.

One of the defects of the thrashing-machines in general use is dirty thrashing or a failure to thrash all the grain clean out of the heads. This is mainly due to the adjustment of the concave directly toward and from the thrashing-cylinder, since when the concave is moved downward away from the cylinder for rapid thrashing the straw is deflected so little from a straight line in its passage between the cylinder and concave, and the spikes or teeth of the cylinder then lap so little by those of the concave that room is allowed for some of the heads to pass through untouched or only partially thrashed. I remedy this defect by an improved method of adjusting the concave, as follows:

In the drawings, A represents the cylinder, B the concave, and C the feed-board, of a thrashing-machine. Instead of adjusting the concave directly away from the cylinder to increase the rapidity of the thrashing, I cause the forward edge of the concave B to be moved upward a little and forward, or nearly parallel with the inclination of the feed-board C, while the rear edge of the concave is moved downward and forward, as indicated by the directions of the slots *a b* in the side jaws or flanks of the concave, which work over guide-pins *c d* in the sides of the machine-frame, whereby the adjustment is directed and determined. This method of adjustment preserves or even increases the abruptness with which the straw enters between the cylinder and concave as the capacity for thrashing increases, and the proper relation of the forward part of the concave to the feed-board is preserved.

As a suitable means of effecting the adjustment of the concave, in connection with the slots and guide-pins specified, I make use of a bent lever, D, pivoted at *e* below the front edge of the concave, and connected therewith by an arm, *f*, and pivot projection *g* on the concave. The movement of the forward end of the lever up and down effects the adjustment of the concave, and a ratchet-holder, *h*, retains the lower arm of the lever in various fixed positions. Any equivalent of this device for effecting the adjustment may be used instead of the same. Fig. 2 represents the concave adjusted to a position different from that shown in Fig. 1.

Another defect in thrashing-machines lies in the operation of the grate directly back of the concave and cylinder, through which the greater part of the grain is intended to pass directly after it is thrashed from the heads, in this, that with the usual construction of cross-bars rising one behind the other, the grain forcibly striking their front surfaces, much of it rebounds by the simple law of incidence and reflection upward and backward into the straw just passing away from the thrasher, thereby increasing the quantity to be shaken therefrom instead of relieving the straw of grain as much as possible at the start, so as to render the complete separation of grain therefrom more difficult. I remedy this defect and overcome this difficulty by a peculiar construction of the grate E, as shown in Figs. 1, 3, and 4.

Each bar *i* is made of zigzag form, so as to present cross-angles *x x y y* and horizontally-inclined surfaces between them, the angles being sufficiently acute and the surfaces sufficiently inclined to deflect the grains horizontally and stop their course in the rear angles, so that they drop through the grate without fail. The single bars may be of the form and construction shown in Fig. 3, and may be formed of sheet metal or of cast-iron. Unessential variations from the form and construction shown may be used without departing from my invention and the principle of its action.

Another feature of my invention consists in a beater, G, of special and peculiar construction, to be placed over the front part of the separator for beating down the straw as it first comes from the thrasher upon the separator, and also what grain reaches that position over the separator. This beater has preferably six vanes or wings, *k k*, which are made elastic or yielding, so as to effectually lay the straw down upon the separator, however little there may be, or yield and allow to pass over the separator all the straw, however great the quantity at any time, thus adapting itself to different thicknesses of straw on the separator. The construction of the beater which I have adopted to fulfill its desired functions perfectly is shown in Figs. 5 and 6, one being a side view and the other a transverse section of the beater. A cast-iron cylindrical head, H, is made with radial grooves *l l*, reaching half-way (more or less) to the periphery, and from these outward to the periphery narrower and preferably curved grooves *m m* extend, as shown in Fig. 6. These grooves extend nearly the whole length of the head, and are open at one end of the head for the admission of the vanes *k k*, which I prefer to make of sheet metal, curved backward, as represented. The inner edges of the vanes are beat around rods or wires *o o*, which rest in the outer edges of the inner radial grooves, *l l*, and after the insertion of the vanes the said inner grooves are plugged with narrow boards or strips of wood *p p* to hold the vanes securely in position. The vanes have room for lateral movement or yielding in the outer grooves, and they are held to the front sides of the grooves by coiled or equivalent springs *q q*, thereby giving elasticity to the yielding movement of the vanes. This construction of the beater also prevents any wrapping or tangling of the straw and effectually stops any throwing of grain back beyond it.

The greatest difficulty in all grain-separating thrashing-machines arises from the imperfections of the straw-carrier and separator. The principal defects and objections encountered are, first, the inability to carry away the straw promptly and with sufficient speed, so that it accumulates sometimes to the depth of a foot or more, rendering it impossible to completely separate the grain therefrom; second, failure to agitate the straw enough to effectually separate the grain; third, insufficient separation of the straw to let the grain fall through; fourth, lack of proper adaptation to different speeds of thrashing; and, fifth, liability to tangle the straw. As the result of numerous experiments and many trials, I have adopted, as the best means of conveying straw and of separating the grain therefrom to overcome all the defects specified, a series of revolving rakes intermeshing and taking the straw one after another to convey it to the place required. I have made important improvements in the construction and operation of this kind of separator and carrier, which I now proceed to describe:

The revolving rakes I I are formed of sections, each having three teeth or projections, *r r r*, at equal distances apart, these sections being mounted on a shaft, *s*, separated by blocks or washers, so that the sections of the adjacent rakes may mesh between them. The sections are suitably made of papier-maché, or they may be made of wood, sheet metal, or other material, if desired. The series of rake-shafts are arranged, as shown, at the proper distances apart to allow the teeth of one to just clear the washers or separating-blocks of the adjacent rakes, and in a row preferably ascending toward the rear end of the separator. An essential requirement of these rakes, in addition to the placing of the teeth equidistant from each other around their shafts, is that all the shafts shall revolve at equal and uniform speeds, so that they shall time properly with one another. These motions, all in one direction, are communicated to the rakes from any proper driving part of the machine by an endless chain and chain-pulleys or sprocket-wheels, or by a connecting-rod and cranks, or by transmitting-gearing producing uniform motions. These means are well known to those skilled in the art.

My first essential improvement in these revolving rakes consists in not merely timing the equidistant teeth *r r r* so that the extremities of the teeth of adjacent rakes shall accurately meet each other in the revolutions of their shafts, but in also so forming the teeth that the extremities of all the ascending teeth shall be covered or shielded by adjacent descending teeth, and the extremities of all the descending teeth shall be covered or shielded by adjacent ascending teeth. The form of teeth to effect this result is shown in the drawings, or approximate forms should be used. The figure and diagram, Fig. 7, will illustrate how this form fulfills the function specified. This figure represents a cross-section of two adjacent rakes. The three teeth of each rake-section are here marked, respectively, r', r^2, and r^3. The ascending tooth r' of the right-hand rake is shown just starting from a horizontal position, while the upper tooth, r', of the left-hand rake next to descend has not quite reached its highest position. When these rakes then shall have revolved one-sixth of a revolution farther, as shown by dotted lines, the points

of the two teeth r' r' will be opposite to and will shield each other. The pathway or line of motion of the ascending tooth by the side of the descending tooth is shown by the dotted line v on the latter tooth; and this shows that the end of the ascending tooth was completely shielded during its entire ascent by the other tooth. Then when the rakes shall have revolved another sixth of a revolution the right-hand tooth r' will have reached the position represented by the position of the preceding tooth r^2 of the same rake, as shown by full lines, and the left-hand tooth r' will have reached the position of the preceding tooth r^2 of that rake, as shown by full lines. The pathway of the descending tooth r' in this latter movement is marked on the right-hand tooth r^2, and designated by w, this tooth now representing the position of its fellow r' after the said movement, as just stated. It will be seen here, also, that the point of the descending tooth was completely shielded by the said right-hand tooth r'. The two succeeding teeth on the rakes will then perform the same movement for another third of a revolution, and then the third teeth will repeat the movement, and thus the entire revolution of the rakes is shown to fulfill the stated requirements of this part of my invention. The under side movements of the teeth may be similarly shown to produce similar actions, and this part of the movements of the rakes is of additional use and importance, since by this means all the chaff, grain-heads, and grain which fall through the separator upon the chute M are quickly moved back thereby and conveyed to the chaffer or the sieves beneath; also, especially in threshing clover-seed, which is one of the purposes to which my present invention is especially applicable, these rake-teeth will quickly convey back to the thrashing-cylinder all the loose heads which fall through this apparatus and which may be imperfectly thrashed.

In the drawings, which represent a grain-thrasher, I have shown an endless belt, O, under the straw-carrier, over a chute-board, N, whatever falls upon the belt being carried downward and then upward over the chute-board, the grain being left at the bottom. Cross-slats t t on the belt facilitate this movement.

Another important feature of my improvement of the carrier and grain-separator is its construction to accelerate the motion of the straw from the front end to the rear end of the separator, so as to give it the distinctive character of an accelerating separator. This improvement must not interfere with the improvement previously described, and consequently the acceleration cannot be effected by increasing the rapidity of the revolution of the rear rakes. I accomplish this result in a perfect manner by the means represented in Fig. 1. From the front to the rear rakes the teeth of each successive rake are a little longer than those preceding, there not being sufficient difference in the lengths of the teeth of adjacent rakes to derange the timing and covering feature of the teeth, above described, and the distances between the shafts of the rakes correspondingly increase from front to rear. Thus, though the increase from one rake to the next is slight, in the aggregate it is considerable, and may be made as great as desired. I have represented an increase in the length amounting to a length of the teeth of the last rake double that of the teeth of the first rake. The result of such a construction is that the straw at the rear end of the separator travels twice as fast as at the front end. Thus if the front rake-teeth are of a size to describe a circle eight inches in diameter and the rear rake-teeth describe a circle sixteen inches in diameter, and all the rakes make one hundred revolutions per minute, the straw would travel at a speed of about two hundred feet per minute at the front end and four hundred feet per minute at the rear end of the separator. By this means the body of the straw is constantly pulled apart as it travels over the separator, becoming thinner and thinner toward the rear end of the separator, and increasing the facility with which the grain may drop out of the straw and be saved. I have found this construction to be nearly perfect in operation. A feature incidental to this construction for accelerating the motion of the straw is that the increase in the length of the rake-teeth also increases the vertical motion of the straw and the agitation thereof, which also contributes to a perfect separation of the grain therefrom.

Another difficulty encountered in the operation of thrashing-machines and grain-separators is the imperfect chaffing of the grain after it is thrashed and separated from the straw, which arises from an imperfect agitation and separation of the chaff. This is especially troublesome in thrashing damp grain, when the chaff is apt to accumulate in the sieves to such an extent as to prevent the blast from raising the mass, so that much of the grain passes off into the tailing-trough, and if the blast is at any time strong enough to raise the mass of chaff on the sieves the whole may be carried off bodily, so that the grain therein is wasted. To overcome this difficulty I employ a chaff carrier and separator, K, situated under the grain-separator and over the sieves L L. I make this chaff-separator, in the same manner as the straw and grain separator, of rakes u u, revolving at equal speed, and having teeth covering and protecting one another, and also increasing in length from front to rear, in the same manner as described for the said straw and grain separator, and for similar purposes; but the rakes are much smaller and are not so many in number. Motion is also imparted to them in a similar way. By this chaffer, also, all unthrashed heads of grain and all coarse and heavy materials are carried off and deposited in the tailing-trough, thereby relieving the sieves of such matters and leaving them free to perform their proper func-

tions. The blast is also unimpeded and rendered more effectual, and the grain is delivered to the sieves evenly and gradually, thus insuring a better action of the blast in passing through the grain.

The uniform movement of the carrier and chaffer rakes may be produced in various ways. I have shown in Fig. 8 a suitable construction, which I have found to be convenient and effective. The thrashing-cylinder A receives motion from the driving-power. A belt or drive-chain transmits motion from the shaft *v* of the cylinder to the shaft *w* of the beater G. A cross-belt or drive-chain transmits motion from the beater-shaft to the upper shaft, *s*, of the set of carrier-rakes, and another belt or drive-chain transmits motion from the said shaft *s* to the upper shaft, *x*, of the set of chaffer-rakes. An endless gear-chain, P, takes into a set of equal-sized pinions, *y y*, on the several shafts of the carrier-rakes I I, actuated by the said upper shaft; also, a similar endless gear-chain, R, takes into a set of equal-sized pinions, *z z*, on the several shafts of the chaffer-rakes *u u*, actuated by the said upper rake-shaft, *x*.

What I claim as my invention is—

1. In a grain and seed thrasher, the combination, with the cylinder, of the concave B, situated beneath the cylinder, and means for adjusting its front edge upward and forward and its rear edge downward and forward simultaneously, and vice versâ, substantially as and for the purpose herein specified.

2. The combination of the cylinder, the concave B, situated beneath the cylinder and provided with front slots, *a*, inclined upward and forward, and with back slots, *b*, inclined downward and forward, stationary guide-pins *c d*, and adjusting-lever D, substantially as and for the purpose herein specified.

3. The grate E, composed of successive bars or plates *i i*, of zigzag form, and having surfaces alternately inclined in opposite directions, substantially as and for the purpose herein specified.

4. In a thrashing-machine and grain-separator, a beater, G, provided with elastically-yielding sheet-metal vanes *k k*, in combination with the straw-carrier and grain-separator beneath, substantially as and for the purpose herein specified.

5. The beater G, constructed with grooved head H, hinged vanes *k k*, and springs *q q*, substantially as and for the purpose herein specified.

6. In a grain-separator, the combination of revolving rakes I I and means for causing them to revolve at equal speeds, the said rakes being respectively provided with intercurrent teeth *r r r*, constructed and arranged substantially as described, whereby the descending teeth of each rake have sufficient width to shield the ends of the ascending teeth of the next adjacent rake, and the ascending teeth of each rake have sufficient width to shield the ends of the descending teeth of the preceding adjacent rake.

7. A straw-carrier and grain-separator provided with intermeshing revolving rakes I I, constructed to cause an accelerating motion of the straw thereon from front to rear, for the purpose herein specified.

8. In a straw-carrier and grain-separator, the combination of intermeshing revolving rakes I I and means for causing them to revolve at equal speed, the said rakes being respectively provided with teeth *r r r*, gradually increasing in length from the front to the rear of the carrier, substantially as and for the purpose herein specified.

9. In combination with the straw-carrier and grain-separator, a chaffer, K, composed of intermeshing rakes, and means for causing the rakes to revolve at equal speed, the said rakes having teeth gradually increasing in length from front to rear, for the purpose herein specified.

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

JOHN H. HAMAKER.

Witnesses:

FRED W. BOND,

EDWIN W. HAMAKER.