(No Model.) 4 Sheets—Sheet 1.

H. M. ROUNDS.

ROLLER REDUCTION MACHINE FOR FLOUR MILLS.

No. 271,742. Patented Feb. 6, 1883.

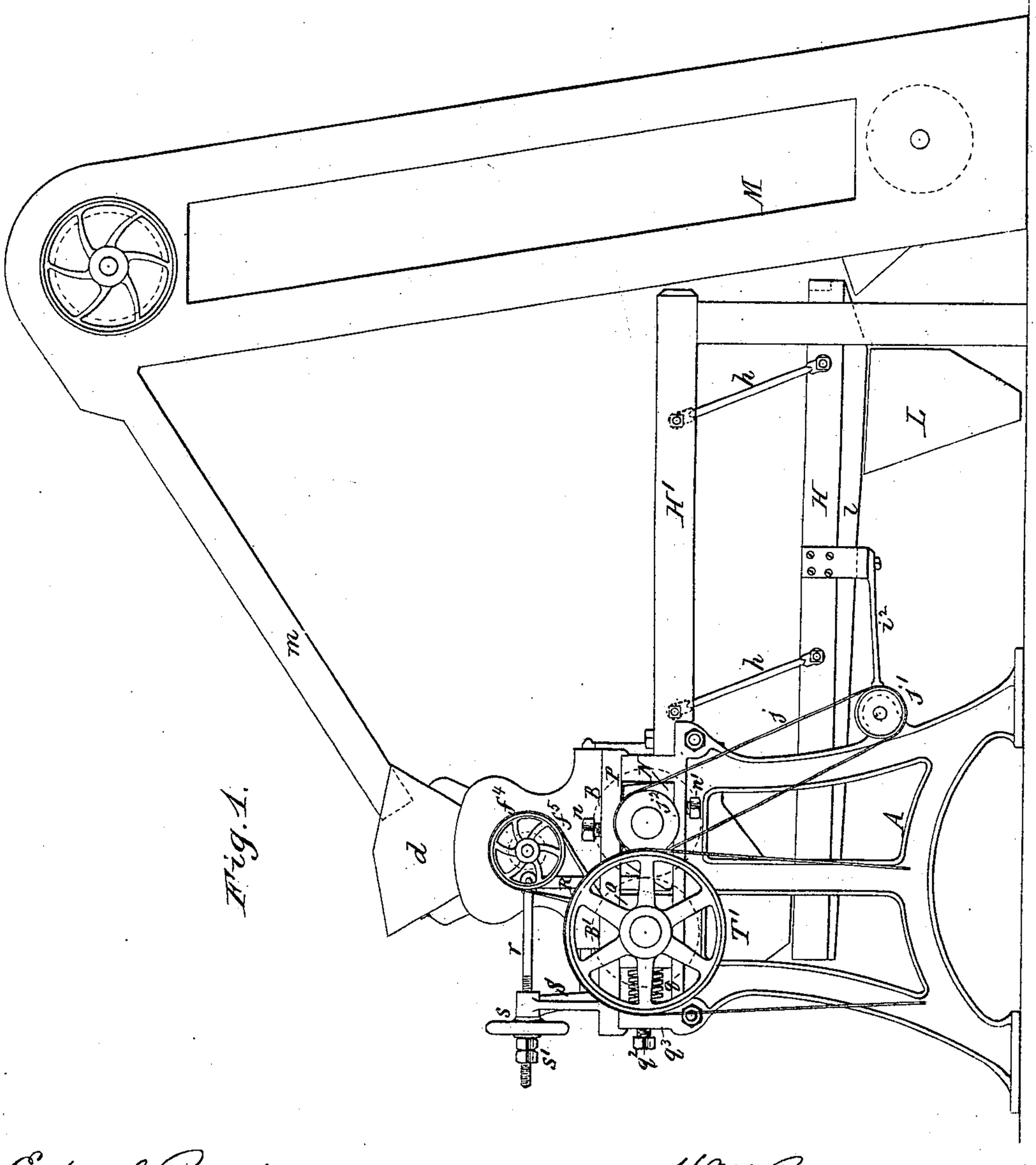

Fig. 1.

Witnesses.
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(No Model.) 4 Sheets—Sheet 2.

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Fig. 3.

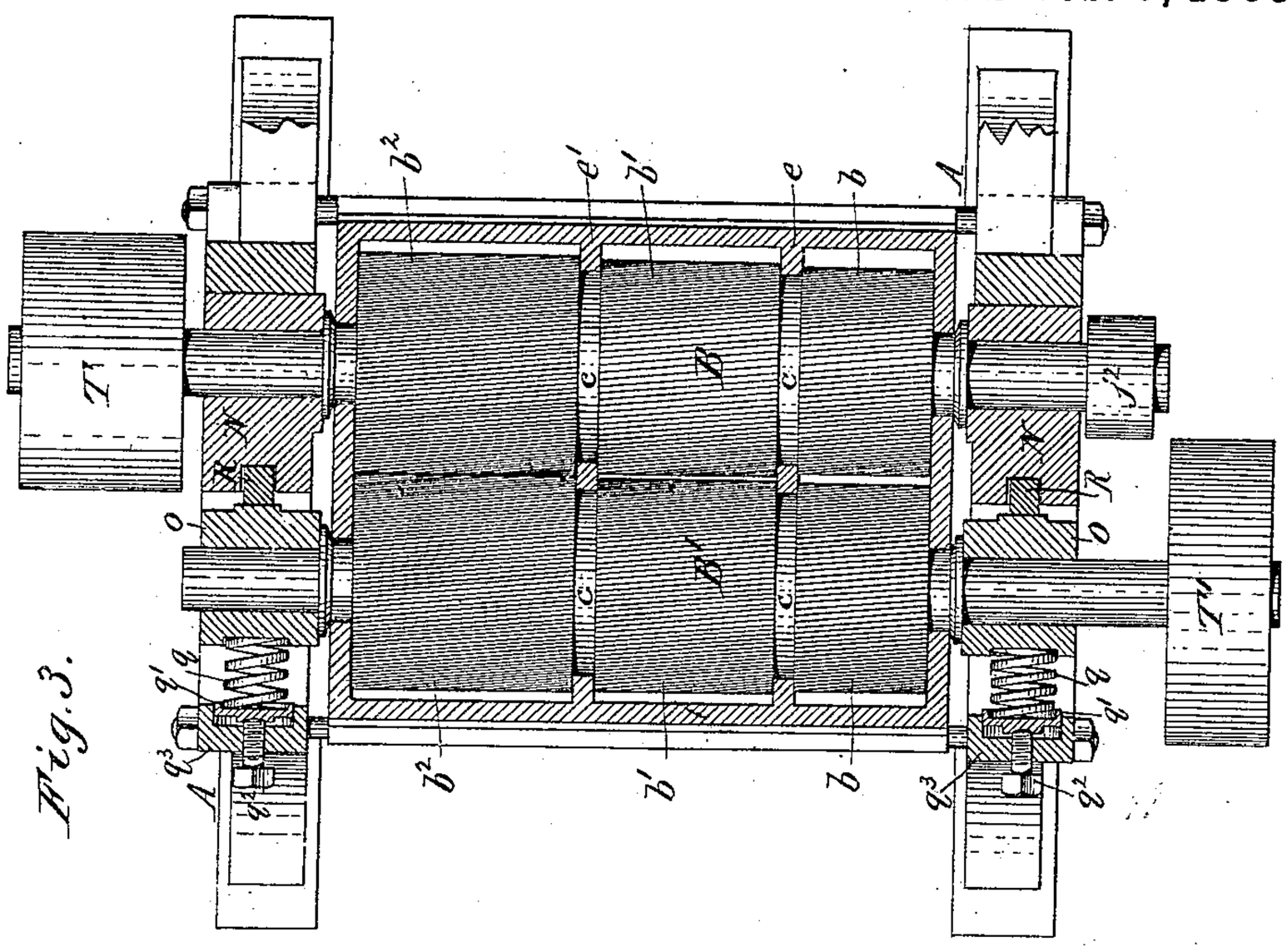
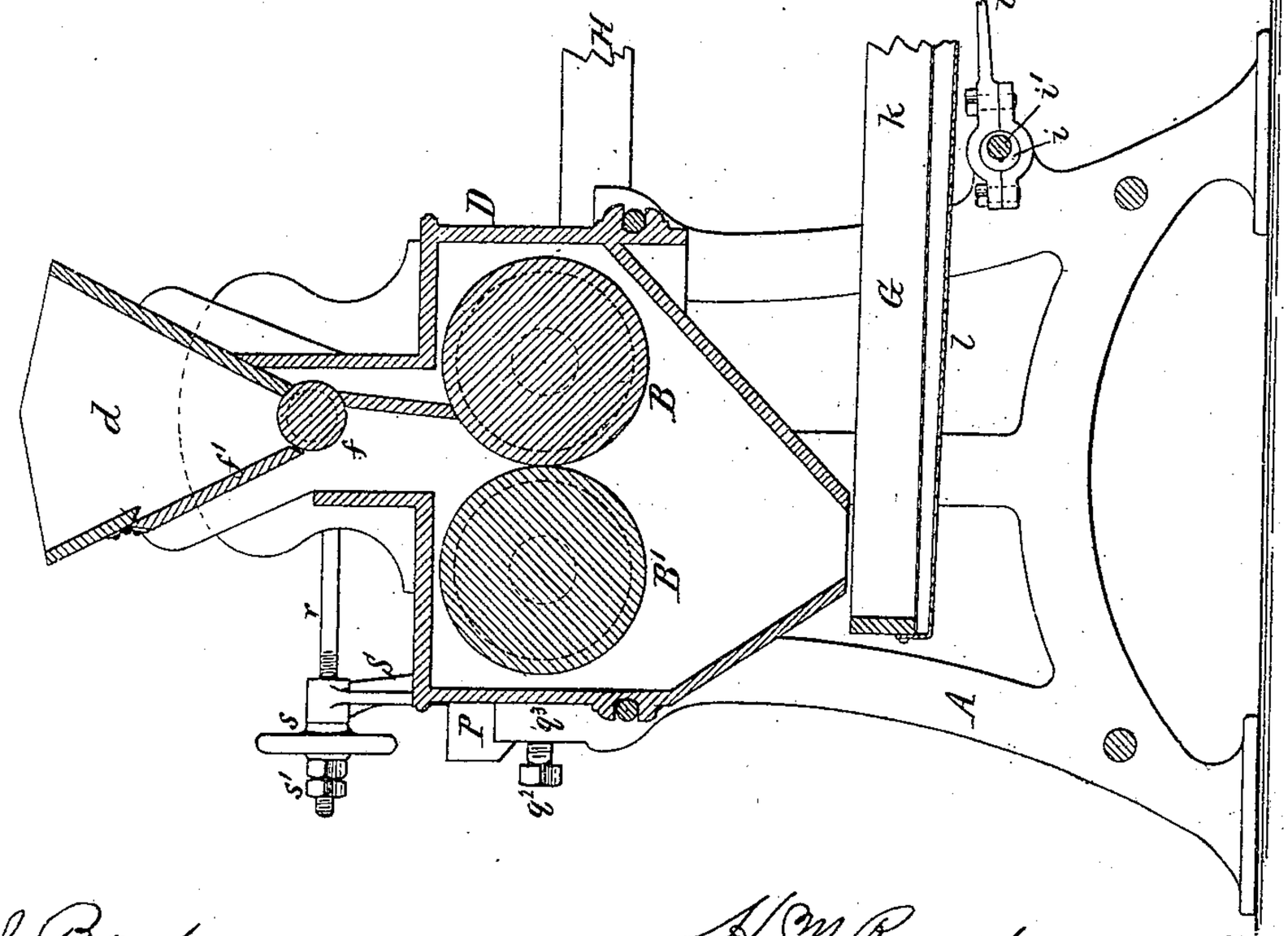


Fig. 2.



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(No Model.)

4 Sheets—Sheet 3.

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Fig. 4.

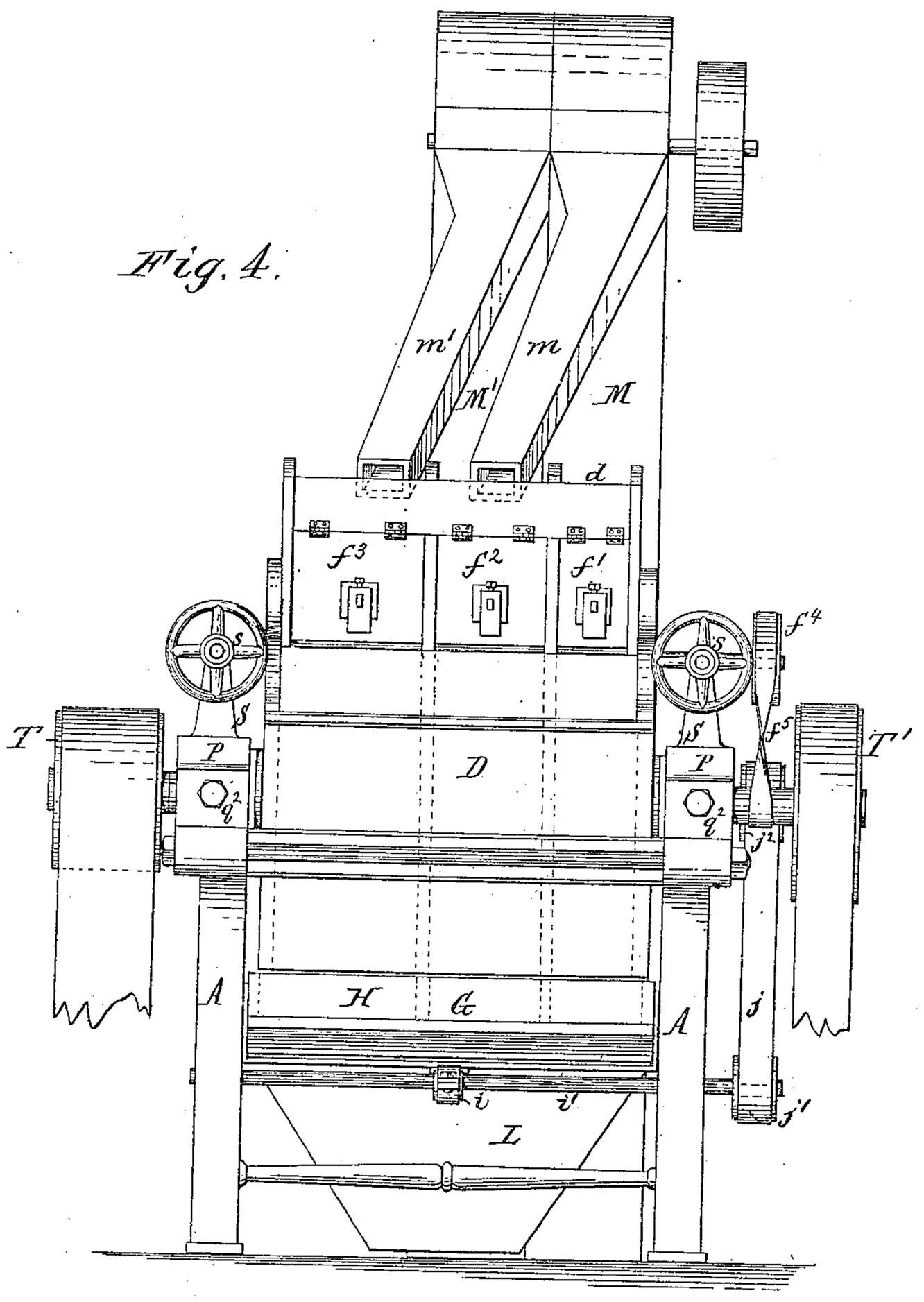
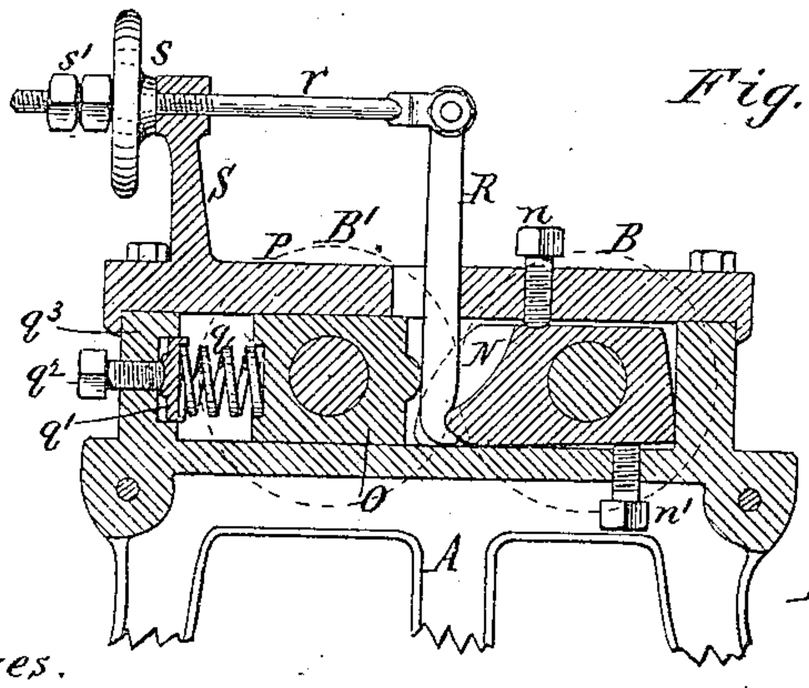


Fig. 5.



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(No Model.) 4 Sheets—Sheet 4.

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ROLLER REDUCTION MACHINE FOR FLOUR MILLS.

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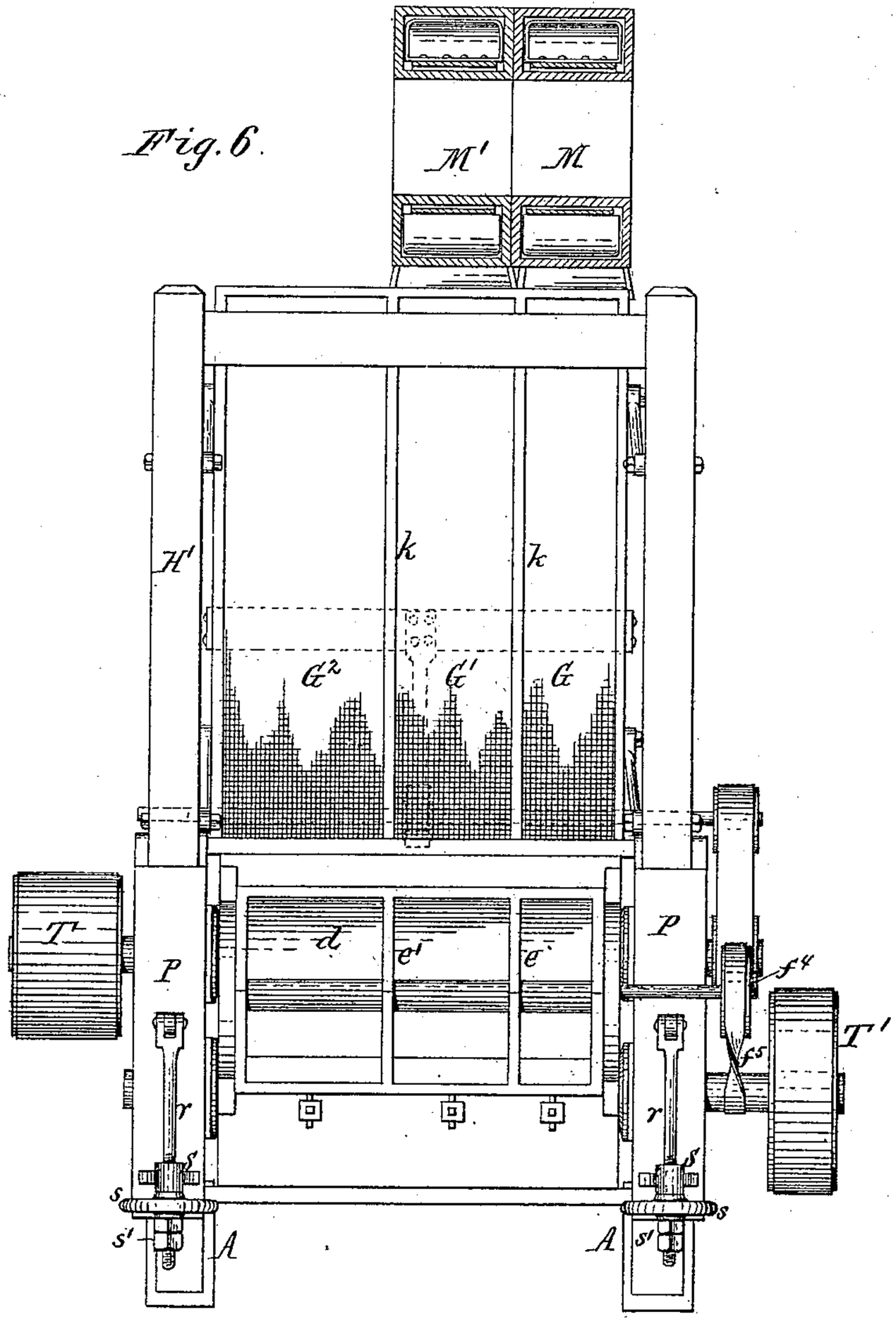
Fig. 6.



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UNITED STATES PATENT OFFICE.

HARLEY M. ROUNDS, OF CLEAR LAKE, IOWA.

ROLLER REDUCTION-MACHINE FOR FLOUR-MILLS.

SPECIFICATION forming part of Letters Patent No. 271,742, dated February 6, 1883.

Application filed May 27, 1882. (No model.)

To all whom it may concern:

Be it known that I, HARLEY M. ROUNDS, a citizen of the United States, residing at Clear Lake, in the county of Cerro Gordo and State of Iowa, have invented certain new and useful Improvements in Roller Reduction-Machines for Flour-Mills; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to that class of roller-mills which are employed in the reduction of grain, and has for its object to so organize the roller-mill that the material operated upon is passed successively between different portions or sections of the same pair of rollers, and subjected to a screening operation after each reduction, whereby the fine product of each reduction is separated from the coarse product, and the latter fed to the next following pair of sections or portions of the rollers, so that the same pair of rollers is utilized for effecting a number of reductions, the coarse bran or residue being finally discharged, while the finer portions, composed of the flour-producing parts of the kernels of grain, are collected and further treated as may be necessary to produce the desired ultimate product.

My invention consists in the improvements in the roller-mill which will be hereinafter fully set forth, and pointed out in the claims.

In the accompanying drawings, consisting of four sheets, Figure 1 is a side elevation of my improved roller-mill. Fig. 2 is a vertical section of the roller-mill proper. Fig. 3 is a horizontal section of the same. Fig. 4 is a front elevation of the roller-mill. Fig. 5 is a sectional elevation of the adjusting device applied to the journal-boxes of the rollers. Fig. 6 is a top plan view of my improved roller-mill.

Like letters of reference refer to like parts in the several figures.

A A represent the side frames of the roller-mill proper, and B B′ the two rollers, which are supported in the side frames, A A, by means of suitable journal-boxes. The rollers B B′ are each composed of a corresponding number of cylindrical sections or portions, b b' b^2, arranged side by side upon the same shaft. The sections b b, which first receive the material to be reduced, are made smallest in their aggregate diameters, so that the space between the opposing portions of these sections is larger than the space between any of the succeeding sections. The next following pair of sections, b', is made somewhat larger in their aggregate diameters, and the space between their opposing faces correspondingly smaller than the space between the opposing faces of the preceding pair of sections, b, and the next following pair of sections are made still larger in their aggregate diameters, and the space between the opposing faces still smaller, and so on to the last pair of sections on the same pair of rollers, if more than three pairs of sections are employed on the same pair of rollers. The several pairs of sections on the same pair of rollers are provided with ribs or corrugations suitable for the reduction of the grain, the corrugations being coarsest on the first pair of sections, b, and increasing in fineness on the succeeding pairs of sections. The ribs or corrugations are preferably arranged lengthwise of the rollers, at a greater or less angle to the axis thereof, and in the same direction on both rollers, as indicated in Fig. 3. The several sections or working-faces on both rollers increase in length from the first pair of sections, b, to the last pair of sections—that is, the second pair of sections, b', are made longer than the first pair of sections, b, and the third pair of sections, b^2, are made longer than the preceding pair of sections, b', and so on, if more than three pairs of sections are employed on the same pair of rollers. The lengths of the different sections are so graduated that each pair of sections after the first pair will have the proper capacity to reduce that part of the material which is delivered to such pair of sections after the separation of the coarse from the fine product of the last preceding pair of sections has been effected, and as the working-faces of such pair of sections more closely approach each other than those of the last preceding pair the length of such pair of sections is correspondingly increased to reduce all the material which it receives

without unduly crowding such pair of sections. By this means the work is evenly distributed over the several successive pairs of sections, and the pressure is correspondingly equalized upon all of the working-faces of the different pairs of sections, as well as upon the bearings at both ends of the rollers, and the length of the rollers is reduced to that which is necessarily required to do the desired amount of work. The several working faces or sections of each roller are separated by annular grooves or depressions *c*, which recede to or below the bases of the ribs or corrugations formed in the working-faces of the rollers, and which permit these ribs or corrugations to be formed in the working-faces by suitable cutting-tools when the several sections of each roller are constructed in one piece.

D represents the casing, which incloses the rollers, and *d* represents the feed-hopper, arranged above the rollers and supported upon the casing D. The latter and the feed-hopper *d* are provided with vertical partitions *e e'*, which are arranged between the several sections of the rollers and project into the grooves *c* thereof, so as to separate the material passing to and from each pair of sections from that which passes to and from each other pair.

f represents a feed-opening arranged in the discharge-opening of the feed-hopper *d*, and *f' f² f³* are adjustable feed-gates, of any well-known and suitable construction, provided in the feed-hopper *d* for the several compartments thereof, so that the feed to each pair of sections of the rollers can be regulated independently.

f^4 represents a pulley mounted on the end of the shaft of the feed-roller *f*, and f^5 represents an endless belt, whereby the pulley f^4 is rotated from the shaft of the roller B'.

The lower portion of the casing D is constructed with inclined sides or made hopper-shaped, as represented in Fig. 2.

G G' G^2 represent separating-sieves, which are arranged below the discharge openings of the casing D, so as to receive the material which escapes from the several sections of the rollers. As shown in the drawings, these separating-sieves are supported in a shaking-frame, H, which is hung to a stationary frame, H', by means of rods *h*. The frame H is vibrated by means of an eccentric, *i*, which is mounted upon a horizontal shaft, *i'*, and a rod, i^2, which connects said eccentric with the shaker-frame H. The shaft *i'* is rotated by means of an endless belt, *j*, which runs around a pulley, *j'*, on the shaft *i'* and around a pulley, j^2, upon the shaft of the roller B. The sieves G G' G^2 are separated by partitions K, corresponding in position with the partitions *e e'* of the roller-casing, so that each sieve receives only the material delivered from one pair of sections and treats the same separately. The several successive sieves or separators G G' G^2 are preferably made of increasing width as the roller-sections increase in length, in order to adapt the separating capacity of the successive sieves to the increasing quantity of fine material produced by the successive breaks or reductions.

l represents a tight inclined bottom arranged underneath the sieves G G' G^2, so as to receive the fine material which passes through the meshes of the sieves, and L is a hopper or receptacle, which is arranged underneath the rear portion of the tight bottom *l* for the reception of the material, which is delivered from said bottom into the receptacle L by the shaking motion of the frame H through an opening formed in said bottom above the receptacle L.

M M' represent elevators, which receive the coarse products of each separation, except the last, and deliver the same by spouts *m m'* into the compartments of the feed-hopper over the next following pairs of sections of the rollers.

N N represent the journal-boxes of the roller B, and O O represent the journal-boxes of the roller B'. Both boxes on the same side of the machine are supported in the upper part of the side frame, A, and confined by means of a cap-piece, P, which covers the boxes and is secured to the side frame, A. The box N rests with its outer side against the vertical portion of the side frame, and is capable of a slight vertical adjustment between the side frame and the cap P, which adjustment is effected by means of two set-screws, *n n'*, applied respectively to the upper and lower sides of the box N. The inner end of the box rests upon the side frame, A, while its outer end can be raised and lowered by said set-screws, as may be necessary. The box O slides horizontally in the ways formed by the horizontal upper side of the side frame, A, and cap P, and is pressed toward the box N by means of a spring, *q*, interposed between the box O and a follower, *q'*, which is adjusted by means of a set-screw, q^2, working in a threaded opening in the vertical portion q^3 of the side frame, whereby the tension of the spring can be regulated.

R represents an upright lever, which bears with its lower end against the inner lower edge of the box N, and which finds its fulcrum at the inner side of the box O, so that by moving the lever R in one or the other direction the box O will be moved toward or from the box N, as may be desired.

r represents an adjusting-rod, which is attached, with its inner end, to the upper end of the lever R, and which passes with its screw-threaded outer portion through an opening formed in a standard, S, which is cast on or secured to the cap P.

s represents a screw-nut provided with a hand-wheel, and applied to the screw-threaded portion of the rod *r* on the outer side of the standard S, and *s'* represents jam-nuts applied to the rod *r* on the outer side of the screw-nut *s* for securing the latter in position after it has been adjusted. The screw-nuts *s'* are also employed for forming a stop on the screw-threaded rod *r*, whereby the inward movement of

the rod is limited, either in such manner as to arrest its movement before the rollers come in contact with each other or so that the movable roller B′ is arrested in its movement toward the stationary roller B at a certain point of adjustment, thereby enabling the operator to return the rollers to this predetermined adjustment when the rollers have been separated. By moving the upper end of the lever R outwardly the rollers are separated, and by a reverse movement of the lever the rollers are permitted to approach each other. A separate adjusting device is provided for each pair of boxes at each end of the rollers, and by adjusting the rollers at one end only the space between the working-faces near that end can be increased or lessened without materially affecting or altering the position of the working-faces at the opposite end of the rollers. The gradually-decreasing spaces between the working-faces of the different pairs of sections of the rollers provide for the relative adjustment of the different reductions, and the adjustment of the roller B′ with reference to the roller B enables the reductions to be adapted to the varying conditions of the grain, whether hard or soft, dry or damp, &c.

T represents the driving-pulley mounted on the shaft of the roller B, and T′ represents the driving-pulley mounted on the shaft of the roller B′. The pulley T′ is made somewhat larger in diameter than the pulley T, so that the rollers revolve with different peripheral rates of speed. Any other suitable driving mechanism whereby the desired relative motion of the rollers is attained may, however, be used, if preferred.

The grain to be reduced is delivered into the first compartment of the feed-hopper above the first pair of sections, *b*, and in passing between these sections it is coarsely cracked, and the material derived from the first reduction is delivered upon the head of the first sieve, G. The material now passes over the sieve and is separated thereby according to fineness, the fine material passing through the meshes of the sieve, while the coarse material escapes over the tail of the sieve G and passes into the foot of the first elevator, M. The sieves G G′ G² are so clothed that the fragments of the flour-producing portions of the grain pass through the meshes of the sieve, while the bran or coarse fragments escape over the tail end of the sieve. The elevator M delivers the coarse material derived from the first separation into the second compartment of the feed-hopper, above the second pair of sections, *b′*, from which it passes between said sections, whereby the material is further reduced. The product of the second reduction is delivered upon the head of the second sieve, G′, which again effects a separation of the finer material from the bran and material adhering thereto, the finer material passing through the meshes of the sieve, and the bran and material adhering thereto passing over the tail of the sieve into the foot of the second elevator, M′, by which the material is delivered into the third compartment of the feed-hopper above the third pair of sections, *b²*. The material is now further reduced between the third pair of sections, and the product of this reduction is delivered upon the third sieve, G², which effects a third separation of the fine material and the coarse residue, and this operation is repeated as many times as there are pairs of sections on the same pair of rollers. The fine material, which passes through the meshes of the separating-sieves G G′ G², and which consists of fragments of the flour-producing parts of the grain, falls upon the inclined tight bottom *l*, and is delivered by the same into the receptacle L, from which it is conducted to such other machines as may be desirable or necessary to produce the desired ultimate product. The coarse material derived from the last separation, and which consists of bran deprived of the flour-producing parts of the grain, is discharged from the tail end of the last separating-sieve and conveyed to any suitable receptacle.

Instead of shaking-sieves, revolving or other suitable screens may be employed for separating the products of the several reductions, if preferred. The first pair of sections of the rollers, whereby the first reduction is effected, may be constructed with smooth working-faces; but I prefer to employ a coarse dress on these sections, as it gives better results.

My improved roller-mill is especially adapted to be used in small mills, as it combines in one machine all the advantages of a train or set of roller-mills. It is very simple in construction, and occupies but little space. It is easily managed and constructed at comparatively small expense, considering its capacity, and it is operated with less power than a corresponding number of rollers of the same capacity.

I claim as my invention—

1. The combination of a pair of rollers, each composed of several sections having the spaces between the working-faces increasing in fineness and the working-faces increasing in length in the several successive pairs of sections, a separate feed and discharge compartment, and a separate sifting device for each pair of sections, substantially as set forth.

2. The combination of a pair of rollers, each composed of several sections having the spaces between the working-faces increasing in fineness in the several pairs of sections, a separate feed and discharge compartment for each pair of sections, means whereby a differential peripheral rate of speed is imparted to the rollers, and a separate sifting device for each pair of sections, substantially as set forth.

3. The combination of a pair of rollers, each composed of several sections having the spaces between the working-faces increasing in fineness and the working-faces increasing in length in the several successive pairs of sec-

tions, and a separate feed and discharge compartment for each pair of sections, substantially as set forth.

4. The combination, with a pair of rollers, each composed of several sections having the spaces between the working-faces increasing in fineness in the several successive pairs of sections, means whereby a differential rate of speed is imparted to the rollers, a separate feed and discharge compartment for each pair of sections, means whereby the spaces between the working-faces of the several pairs of sections can be increased or reduced, and a separate sifting device for each pair of sections, substantially as set forth.

5. The combination of a pair of rollers, each composed of several sections having the spaces between their working-faces increasing in fineness and the working-faces increasing in length in the several successive sections, a separate feed and discharge compartment for each pair of sections, and separating-sieves corresponding in number with the several pairs of sections and increasing in width as the sections increase in length, substantially as set forth.

6. The combination of a pair of rollers, each composed of several sections having the spaces between the working-faces increasing in fineness in the several successive pairs of sections, means whereby a differential rate of speed is imparted to the rollers, a separate feed and discharge compartment for each pair of sections, separators whereby the product from each pair of sections is separately sifted, and an elevator whereby the coarse product of each separation is delivered to the next following pair of roller-sections, subtantially as set forth.

7. The combination of a pair of rollers, each composed of several sections having the spaces between the working-faces increasing in fineness in the several successive pairs of sections, means whereby a differential rate of speed is imparted to the rollers, a separate feed and discharge compartment for each pair of sections, separators whereby the product from each pair of sections is separately sifted, an elevator whereby the coarse product of each separation is delivered to the next following pair of roller-sections, and a discharge whereby the coarse residue of the last separation is separately discharged, substantially as set forth.

8. The combination, with the rollers B B′ and journal-boxes N O, of the levers R, screw-threaded rods *r*, standards S, screw-nuts *s*, and springs *q*, substantially as set forth.

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

HARLEY M. ROUNDS.

Witnesses:

JAS. B. ERWIN,

C. T. BENEDICT.