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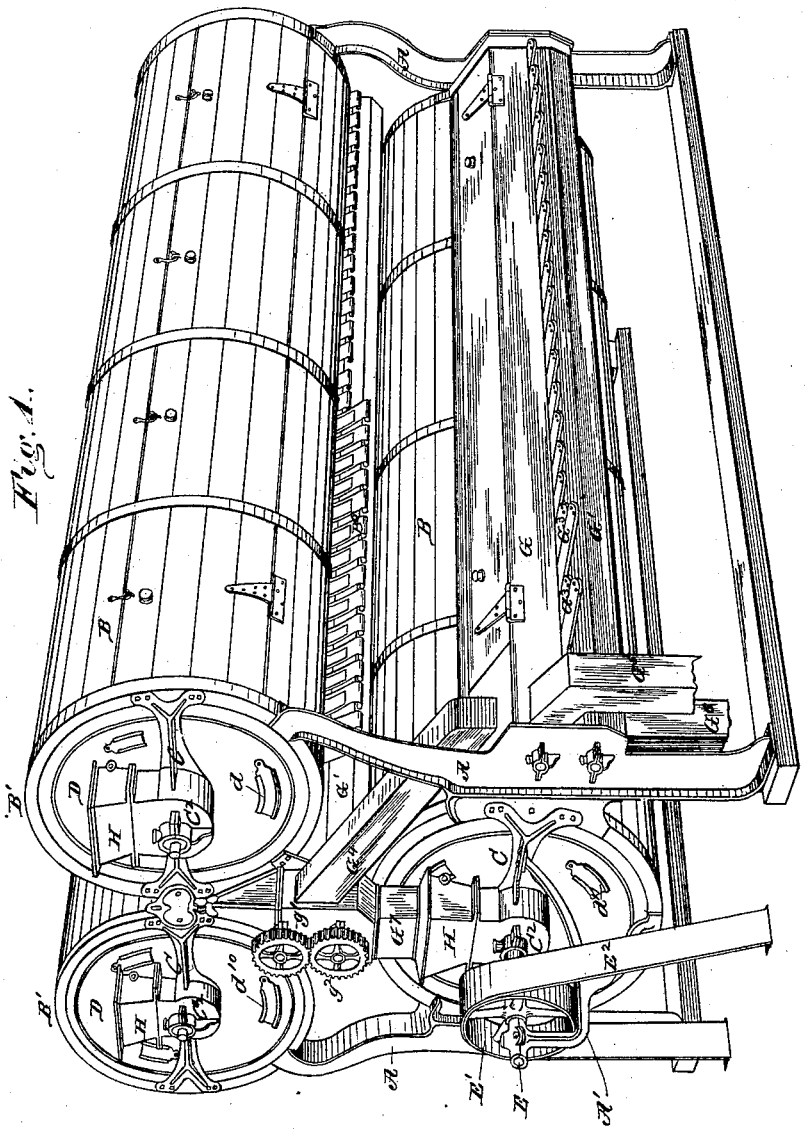
J. MILLS.

CENTRIFUGAL BOLT.

No. 267,098. Patented Nov. 7, 1882.

Fig. 1.



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(No Model.) 5 Sheets—Sheet 2.

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CENTRIFUGAL BOLT.

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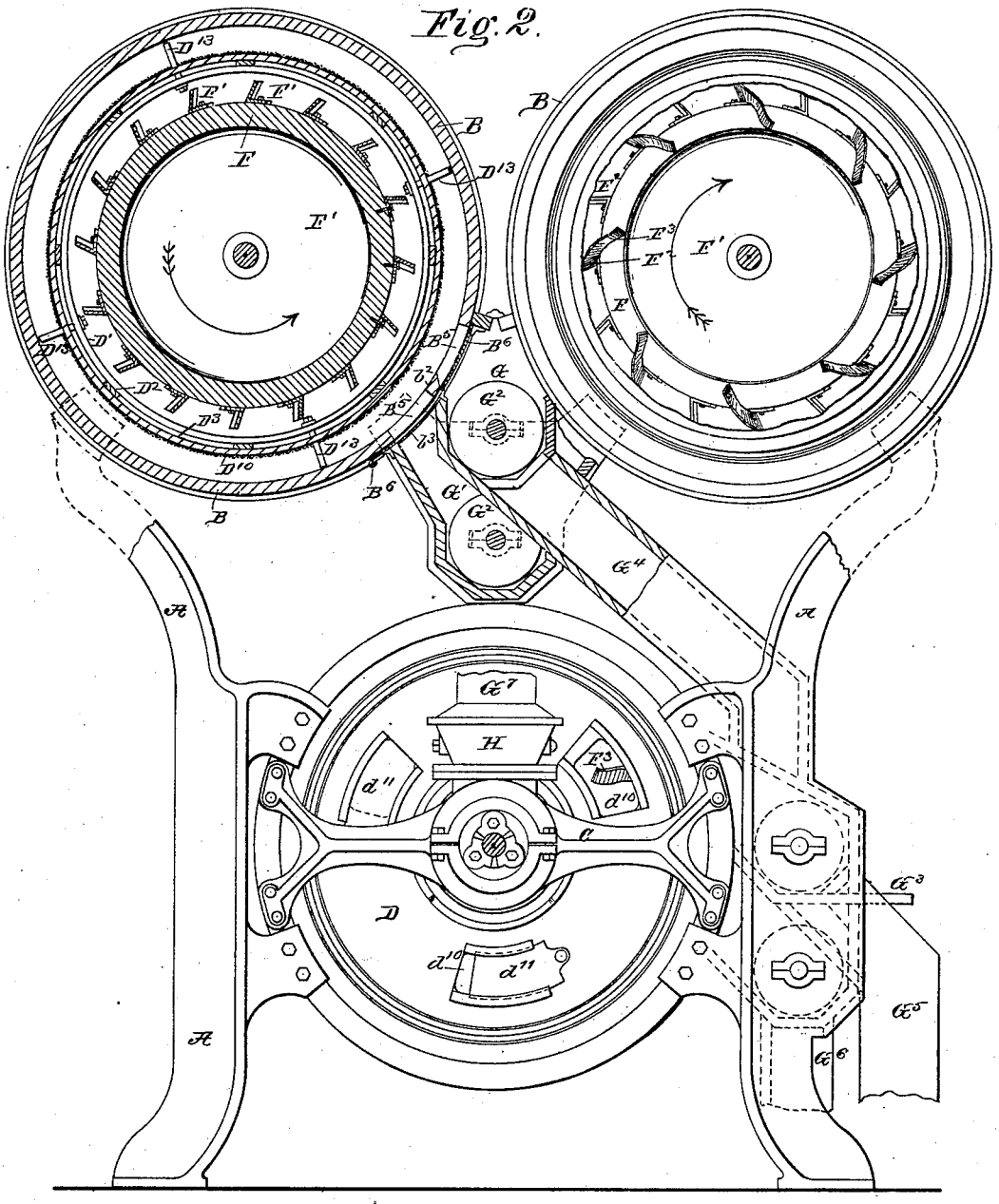
Fig. 2.



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(No Model.) 5 Sheets—Sheet 3.

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Fig. 3.

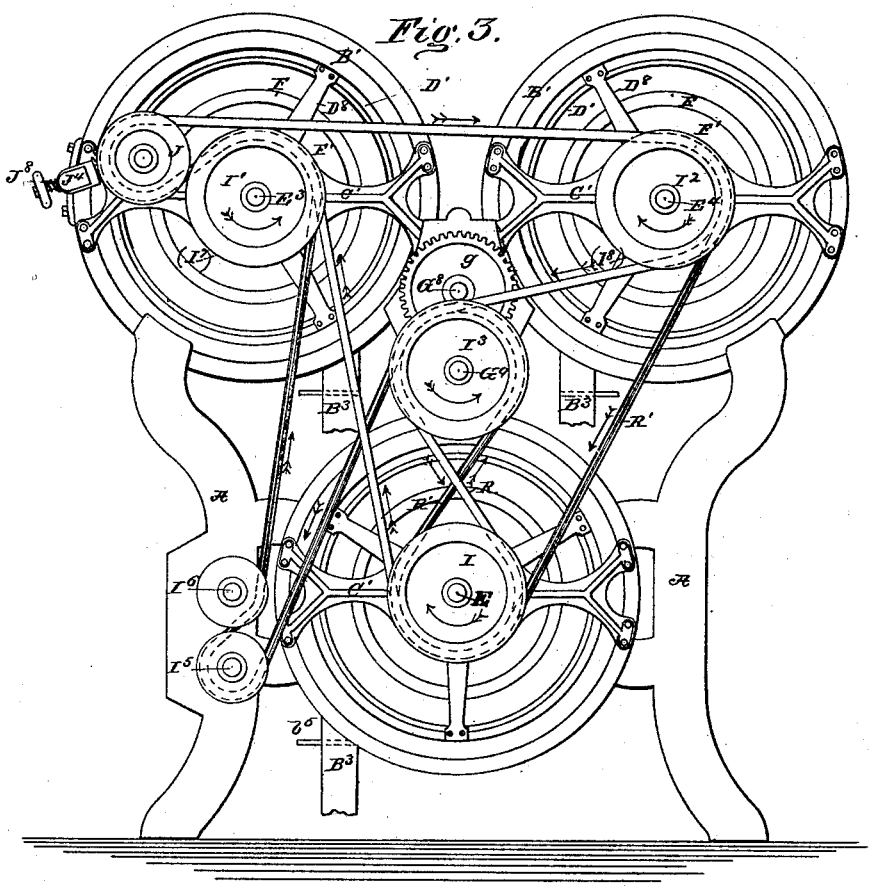
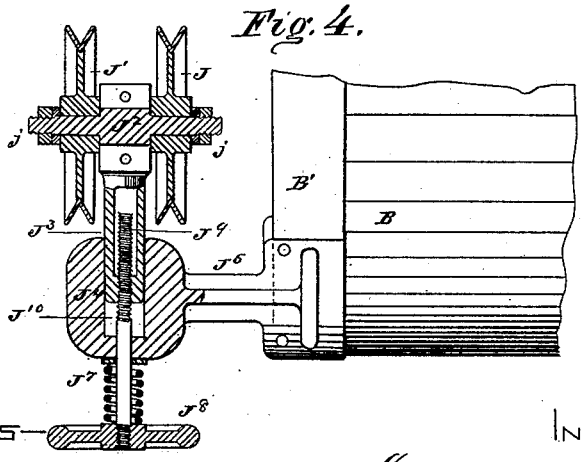


Fig. 4.



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(No Model.) 5 Sheets—Sheet 4.

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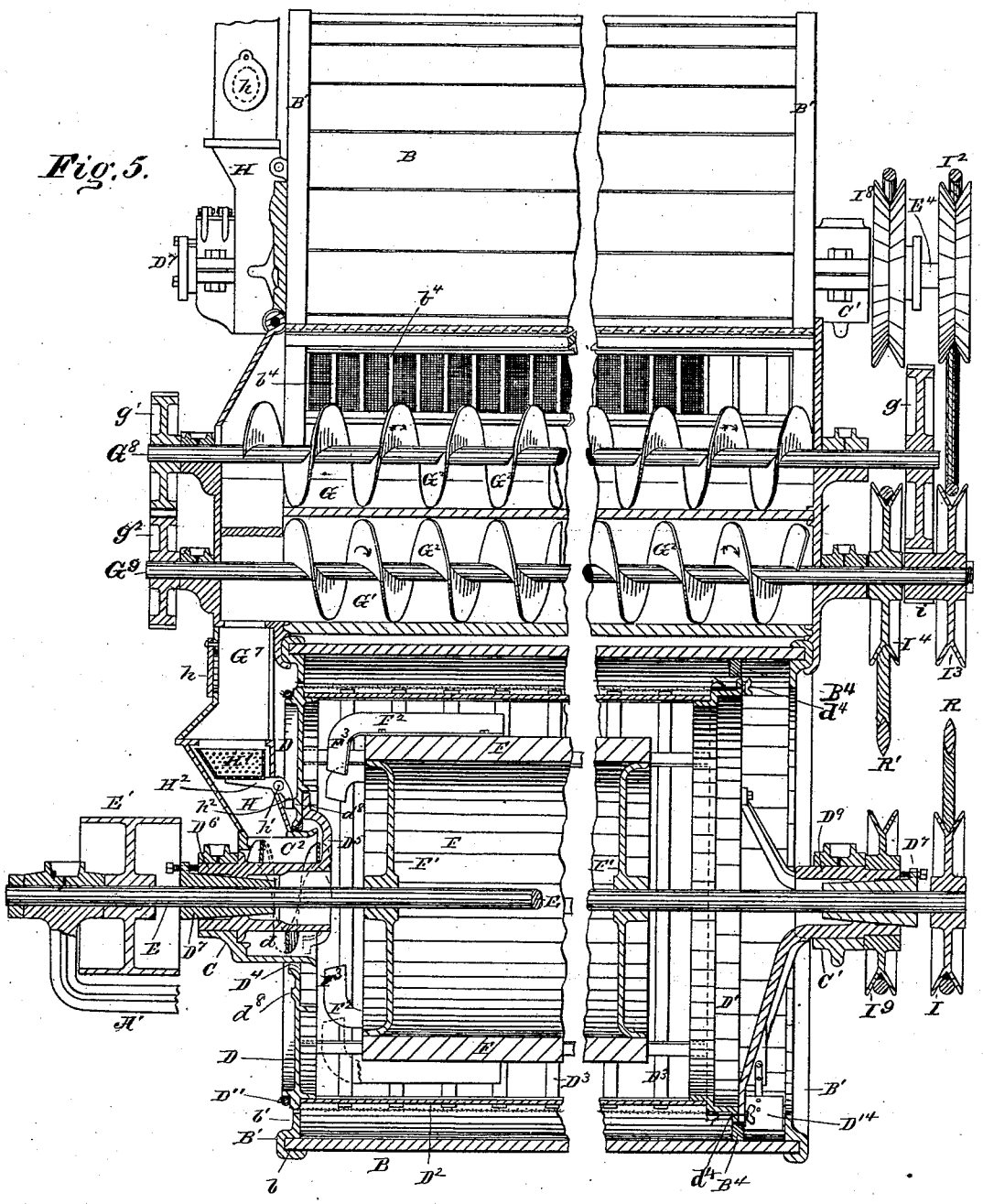
No. 267,098. Patented Nov. 7, 1882.

Fig. 5.



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(No Model.) 5 Sheets—Sheet 5.

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CENTRIFUGAL BOLT.

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Fig. 6.

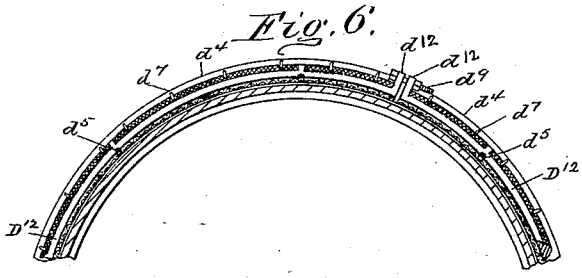


Fig. 8.

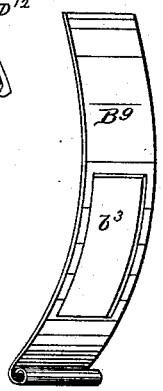


Fig. 7.

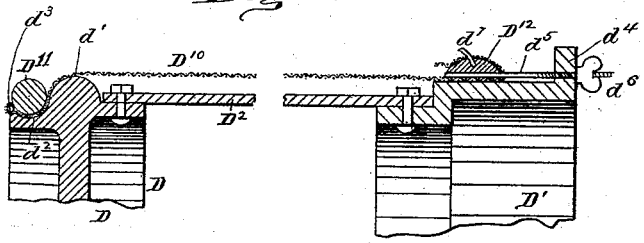


Fig. 9.

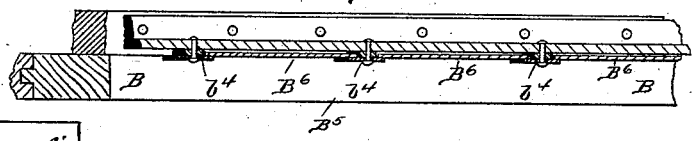


Fig. 10.

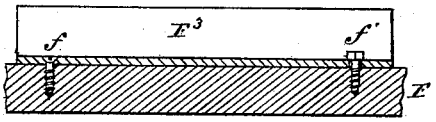


Fig. 12.

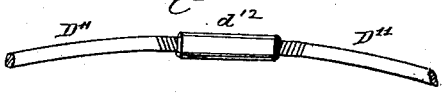
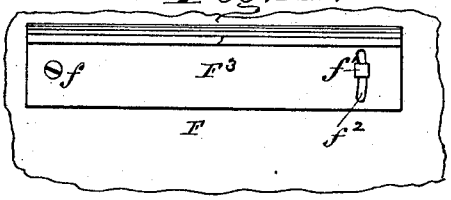


Fig. 11.



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UNITED STATES PATENT OFFICE.

JONATHAN MILLS, OF CHICAGO, ILLINOIS.

CENTRIFUGAL BOLT.

SPECIFICATION forming part of Letters Patent No. 267,098, dated November 7, 1882.

Application filed June 30, 1882. (No model.)

To all whom it may concern:

Be it known that I, JONATHAN MILLS, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Centrifugal Bolts; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to that class of devices for bolting in flour-mills known as "centrifugal" bolts or reels, and contemplates an arrangement of the principal parts on a substantially horizontal axis.

For the purposes of brevity and clearness in this specification, the following nomenclature is adopted: Entire machines of this class will be denominated "bolts" or "centrifugal bolts." The outer case or shell will be called the "chest." The bolting-cloth, with the frame on which it is mounted, will be called the "reel," and the inner rotating part the "flier." The central part of the flier of my improved bolt will be called the "drum."

In horizontal centrifugal bolts heretofore constructed the flier has consisted of a central shaft provided with radial arms, or with disks having marginal projections, to which are secured longitudinal radial or nearly radial blades, arranged at equal distances from and parallel with the central shaft. The blades are not connected with each other, except through the medium of the supports described, and material being acted upon by the flier may therefore drop inward between the blades and through the flier. As a consequence, a very high speed of the flier is necessary to hold the material outward. Even this measurably fails, and the said material constantly falls through the flier to the bottom of the surrounding bolting reel. The result of this action is to overload the reel at the bottom and to limit the work principally to that portion of the reel which is situated on the ascending side of the flier. In this mode of operation it is evident that much less than the full capacity of the reel is attained. In attempting to "dust" middlings by a bolt of this construction the high speed required, moreover, operates to pulverize the middlings, so that perhaps as much fine dust is made as is removed through the reel, and the tailed middlings require dusting as much as they did before being passed through the bolt. To obviate this fault in bolts as heretofore constructed I make the flier in the form of a close barrel or drum, a few inches less in diameter than the interior of the surrounding reel, and preferably attach the blades directly to the surface of the drum. The latter therefore closes the space between the blades and prevents the material being operated upon from falling to the bottom of the surrounding reel. By a moderate speed of the flier said material, as it falls back from the reel-cloth upon the drum, is again promptly thrown outward, being caught by the following flier-blades, without first passing to the bottom of the reel. Useless and harmful movements of the stuff being bolted are thus avoided, accumulation and overloading at the bottom of the reel are prevented, and attrition of the stuff—such as takes place when so accumulated at the bottom of the reel and violently struck by the flier-blades—is obviated. On the other hand, the material is more evenly distributed over the entire area of the reel-cloth, and the successive movements of said material outward against the reel-cloth are more frequent and less violent. As a result, the capacity of the machine is materially increased and the work performed thereby is materially improved.

Another object of my invention is to better control the movement from the head to the tail of the reel of the material being operated upon. I have found that it is generally desirable that the progress of the material being bolted through the reel from front to rear should not be uniform, or, in other words, that it may advantageously be carried along more rapidly for the first two-thirds of the length of the reel, or thereabout, and thereafter retarded. This is because the greater portion of flour fine enough to pass through the meshes of the cloth is bolted out in the first half or two-thirds of the reel, and if it be carried along at a uniform rapidity to the reel-tail there will be less stuff present in the last half or third of the reel. When this is the case there is more likelihood of passing dirt through the reel-meshes, while if the stuff be retarded near the

tail of the reel, so as to give a greater body or quantity in this part of it, the flour bolted out will be clearer. This rearward feed of the stuff being bolted is effected, as is well known, by a spirally-inclined arrangement of the flier-blades; but as machines have been heretofore made these blades are as much inclined at one end as the other, so as to give the uniformity of rearward feed above stated to be objectionable. As a means of remedying this fault, and to effect the unequal progress of the material being passed through the reel, I make the flier-blades of less length than the drum, and set those at the rear end of the drum—say for about one-third of its length—at a less incline spirally than those upon the remaining portion of the drum-surface. I prefer to make said flier-blades from six to eighteen inches in length, and to secure them adjustably to the drum-surface, so that their spiral inclination may be fixed or adjusted at will and according to the requirements of the particular material being bolted.

It is a further object of my invention to induce a current of air more or less strong, as may be desired, from front to rear, or from the head to the tail of the machine, between the bolting-reel and the flier or drum, in order to carry out those light fibrous substances usually present in the middlings or flour and calculated to obstruct the reel-cloth, and in order, also, to give an outward blast through the reel-cloth, and thereby increase its efficiency. For this purpose I provide suitable openings in the otherwise closed front reel-head, and apply slides or registers thereto in order to control the volume of air admitted. As a means of inducing a draft through these openings, the flier-drum (the heads of which are closed) is provided with wings at its front and so directed as to draw in the air when the drum is rotated. Usually these wings will be extensions of some of the flier-blades; but they may be wholly separate parts.

Another object of my invention is to provide a grouped arrangement of two or more bolts in a single unitary machine mounted on a single portable frame, or having their several moving parts actuated from a single "drive," or connected to deliver one into another, or having other relations of dependence. This feature of my invention is devised for the purpose of effecting greater economy in the cost of the machines and in the space which they will occupy in the mill, most mills requiring more than one machine, and their considerable cost and the space they will take up being material considerations.

In the accompanying drawings a group of three bolts is shown supported from a single portable frame connected by a single drive, and arranged so that one pair delivers into conveyer-boxes common to both, and having the conveyer which receives the imperfect flour from said pair connected to deliver into the third bolt.

My invention has other objects and features which will more fully appear in connection with the following description, wherein reference is made to the accompanying drawings.

In said drawings, Figure 1 is a perspective view of the group of three centrifugal bolts, each containing my improvements, and secured detachably to the same frame, so as to be together portable. Fig. 2 is a view, partly in elevation and partly in section, of the group of bolts shown in Fig. 1, the lower one of said bolts being shown in end elevation, the upper one at the right being shown with the greater portion of the reel-head broken out, so as to reveal the end of the flier-drum, and the upper one at the left being shown in central transverse section. Fig. 3 is a rear elevation of the group of bolts shown in Fig. 1, showing the drive by which the several rotating parts, including the bolting-reels, fliers, and conveyers, are driven. Fig. 4 is a detail view of the belt-tightener. Fig. 5 is a central, vertical section through *x x* of Fig. 3, having its central parts broken out, and showing the lower bolt and the conveyers connected with the upper bolts in central vertical section and one of the upper bolts in side elevation. Fig. 6 is a fragmentary transverse section of the bolting-reel, and Fig. 7 is a fragmentary longitudinal vertical section thereof, enlarged for the purpose of showing the manner in which the bolting-cloth is secured to the reel. Fig. 8 is a perspective detached view of one of the apertured or cut-off slides which are applied to the passages leading from the chest of the bolt to the two conveyer-boxes therewith connected. Fig. 9 is a section in perspective of the cleat and its attachments by which the slides are supported and guided. Fig. 10 is a fragmentary section of the flier-drum, showing the manner of attaching one of the adjustable blades thereto. Fig. 11 is a top view of one of said blades or floats seen applied to a fragment of the drum, more clearly indicating the means by which the blade is adjustably secured to the drum. Fig. 12 shows a right and left threaded connection for joining the ends of a metal binding-hoop used to secure one end of the reel-cloth.

A is any suitable form of frame, and B B B are three non-rotating cylindrical shells forming the chests of my improved bolt. The chest B is constructed of longitudinal staves tongued and grooved together, and set at each of their ends in a cast-iron annular rim, B′, rigidly secured to the frame A in any suitable manner.

Across the ends of each reel, and attached to said frame or to the rim B′ of the chest, are located bridge-trees C C′, which support the bolting-reel and the drum or flier. Said bolting-reel consists of the frame formed of the annular metal head D at the front end and the narrower annular rim D′ at the tail. These annular parts are joined on their peripheries by longitudinal ribs D^2, which are externally embraced by a series of metal hoops or circum-

ferential ribs, D^3. The head D, at the front of the reel, has a central opening, D^4, and to the inner margins of the head, about said opening, are attached the arms D^5 of the central hub, D^6. Said hub is mounted on the conical gib D^7, through which passes the shaft E. The bridge-tree C is provided with the box C^2, surrounding the hub D^6, into which box the material to be supplied to the reel is fed through the feed-spout H and hopper H'. Surrounding the hub D^6 is fixed the spiral blade *d*, operating as a conveyer, which works in the box C^2 for the purpose of carrying forward the material to be bolted into the bolting-reel. At the rear end of the bolting-reel arms D^8 D^8 connect the rim D' with the hub D^9, similar to the hub D^6, and similarly mounted by a gib, D^7, on the shaft E.

The cloth D^{10} is secured to the reel-frame in the manner following—that is to say: The periphery of the head D is provided with a rounded rib, *d'*, between which and the outer edge of the head is located an annular groove, d^2, adapted to admit a binding hoop or cord, D^{11}. If the binder D^{11} be a cord, the same may be tied to confine the end of the bolting-cloth firmly within the groove d^2, and in case said binder is of metal it may be right and left threaded at its contiguous ends and drawn together by a corresponding nut, as shown in Fig. 12. To enable such a binding device to retain the cloth against strain which may be put upon it, said cloth may be provided at its edge with a cord, d^3, confined in a suitable hem or binding of the same or added material. For the purpose of securing the opposite end of the reel-cloth D^{10}, and also for the purpose of adjusting the tension of said cloth, the reel-frame rim D' is provided with a circumferential flange, d^4, through which pass a number of small threaded rods, d^5, each provided with a thumb-nut, d^6, external to the flange. Said rods d^5 are preferably arranged at a slight distance from the outer or peripheral surface of the rim D' to admit the cloth beneath them, and to their inner ends is secured a metal ring, D^{12}, provided on its outer surface with a series of projections or hooks, d^7, as clearly seen in Fig. 7. The rear end of the reel-cloth is attached to this ring D^{12} by being passed beneath said ring and beneath its supporting-rods *d*, and then bent over forward outside of the ring D^{12} and caught upon the hooks d^7, suitable notches or slits being cut in the cloth wherever the hooks d^7 occur, to allow of its being bent thus forward over the ring D^{12}, as seen in Figs. 6 and 7. Said ring D^{12} will be made in halves provided with outwardly-bent ends d^{12}, Fig. 6, through which a clamping-bolt, d^9, is passed for the purpose of drawing said ring D^{12}, after the application of the cloth thereto, as described, firmly down upon the outer surface of the rim D'. By this means the strain of said cloth need not fall wholly upon the hooks d^7. In thus clamping the ring D^{12} to its place the rods d^5 yield laterally all that is necessary to permit the required movement of the binding-ring. To give greater strength to the reel-cloth at the points of its attachment, as described, said cloth is preferably provided with a broad hem or border of stout ticking, with which the fastening devices come in contact or with which they engage.

To the bolting-reel described, and externally to the cloth D^{10}, are secured any desired number of longitudinal blades or sweeps D^{13}, projecting outwardly into proximity to the surrounding chest or cylinder B, and intended to carry the bolted material or flour to openings provided for its discharge, as will be described.

The part of my improved bolt herein denominated the "flier," by which a centrifugal impulse is given to the material to be bolted, is of peculiar construction, consisting essentially of a relatively-large cylinder or drum, F, of external diameter, say, about six inches less than the interior of the bolting-reel frame. Said drum is composed of rigid staves closely tongued together and mounted on solid heads F', rigidly secured to the shaft E. Upon the external surface of said cylinder are applied a number of wings, floats, or blades, F' F'', which are preferably about an inch and three-fourths in width and from six to eighteen inches long. Said blades may be made of angle-iron, either wrought or cast or malleable, and are attached to the drum by screws or bolts passing through one flange of the iron, so as to hold the other flange projecting outward, as shown. The projecting flange or blade should be somewhat inclined from a radial line of the drum backward with reference to the direction of motion, as shown in Fig. 2. One of the apertures, *f''*, for the fastening-bolts *f f'*, by which the blades are secured to the drum, is made in the form of a slot arranged transversely, as shown in Fig. 11, whereby the blade may be fastened at any desired inclination from a direct longitudinal line upon the drum. Any desired number of these blades may be secured to the surface of the drum, and they may be set in longitudinal series or out of line, as preferred; but in order to obtain the full capacity of the bolt no portion of the length of the drum will be without blades, so that if set out of line they will have the effect of continuous blades of the full length of the drum, operating at all points of the reel opposed to said drum. Ordinarily the blades described will be set in a spiral arrangement or direction, and for the purpose of giving more rapid feed through the reel of the material being bolted I set the blades which are located near the rear of the drum F at a less inclinaton longitudinally than the remainder of them; but by means of their adjustable attachment to the drum any desired change in their spiral direction may at any time be made and any desired effect as to rapidity of feed obtained. Some or all of the blades which are located at the extreme front end of the drum F are provided with an extension, F^3, such as are thus provided being marked F^2. These extensions are directed inward over the head and from the periphery of

the drum toward its axis, and also forward with reference to the direction of motion of the drum. The effect of this construction is, by the rotation of the drum, to induce a current of air backward around the outside of the drum F and within or through the surrounding bolting-cloth D^{10}. In order to provide for the admission of air to be thus conducted, the front reel-head, D, has apertures d^{10}, provided with slides or registers d^{11}, the latter serving to regulate the amount of air admitted, and the consequent force of the draft. In the lower bolt of Fig. 2 one of the extended wings F^3 may be seen through one of the openings d^{10} in the reel-head D.

The head D of the bolting-reel substantially fills the space within the front rim, B′, of the chest B, there being only sufficient space between the two to insure freedom of movement or non-contact of these two parts. The opposite end of the chest B is open, except as partially closed by the flange b' of the rim B′, as shown clearly in Fig. 5. The tail of the bolting-reel is open, and said reel terminates a short distance within the chest B, so as to discharge its tailings inside the flange b'.

To secure the separate discharge of the tailings from the chest, a spout, B^3, is provided, leading from the interior of the chest at the rear end thereof, and a blade or sweep, D^{14}, Fig. 5, is fastened to one of the arms D^8, or otherwise secured to the bolting-reel frame in position to carry the tailings out through said spout B^3. A rim or flange, B^4, of wood or other material, preferably having lamb's wool attached to its free edge, is fixed in the chest B opposite and proximate to the flange d^4 of the reel-rim D′, so as to prevent the tailings from being mixed with the flour passed through the bolting-cloth.

From end to end of the chest B two longitudinal openings, B^5, are provided, one above the other, at the ascending side of the reel, for the discharge of the flour into the conveyer-boxes, which are arranged externally to said chest. The boxes indicated by dotted lines in connection with the lower bolt in Figs. 1 and 2 may illustrate the arrangement of these conveyers when applied to a single bolt, and those connected with the two upper bolts illustrate their preferred arrangement when applied to a group of two.

Two conveyer-boxes, G G′, each provided with a conveyer, G^2, will be placed in communication with each chest B, the upper box being intended for the finished flour and the lower one—called the "cut-off"—for conducting the flour that is imperfect to any desired point or machine, for further finishing or for other disposition. The lower of these cut-off conveyer-boxes, G′, may also be made to receive the tailings by providing a slide, b^5, in the tailings-spout B, near the chest B, so that the tailings will be carried forward to the lower passage, B^5, which will be opened to receive them. In a group of three bolts arranged as shown the conveyer-box G′, which receives from the two upper bolts, delivers into the feed-spout G^7, leading to the lower bolt.

As a means of controlling the delivery of the bolted flour from the chest B to one or the other of the conveyer-boxes G G′, as may be desired, slides B^6 are provided, preferably curved to conform to the shape of the cylindrical chest B, and arranged to run circumferentially of said chest. Each of said slides is provided with an aperture, b^3, arranged to stand opposite the lower opening, B^5, when the slide is thrust upwardly in, as more plainly seen in Fig. 8, which illustrates one of said slides detached, and in Fig. 2, wherein one of the slides is seen in place. The slides B^6 are preferably made of sheet metal—say six inches wide, or thereabout—and are held and directed by having their edges fitted in narrow metal guides b^4, arranged across the openings B^5 of the chest, as seen in Figs. 5 and 9. In Fig. 5 three of said slides (at the right) are shown closed and the remaining ones open, revealing the bolting-reel cloth D^{10} through the passage B^5. Instead of using transverse guides b^4, the edges of the slides may be bent to interlock with each other in a well-known manner, so that each slide will be guided by contiguous slides. The upper opening, B^5, in the chest B may not, and preferably will not, extend back of the flange B^4, as there will obviously be no occasion for taking the tailings into the upper conveyer, and a plain unapertured slide may be applied to the lower opening, B^5, where it leads from the tailing-compartment of the chest B. By means of the slides B^6 any portion of the bolted material may be delivered to either conveyer, as may be desired, so that if a hole should be made in the reel-cloth at any point and imperfect flour passed into the chest B, then by pushing in the slide opposite said hole, or as many neighboring slides as are necessary, the upper conveyer will be cut off at this point and the imperfect flour will be discharged through the apertures b^3 of the slides into the lower conveyer. This form of slides, or other forms by which the flour may be sent to either upper or lower conveyer, as desired, should be applied to each bolt or chest.

In the case of a lower bolt of a group, or of a single bolt, the slides described may be reversed in their arrangement—that is, they may be arranged to draw upward and to be accessible over the top of the upper conveyer-box. In this case the aperture b^3 will coincide with the upper passage, B, when the slide is thrust in, and the lower passage will be opened by raising the slides.

In the case of a single bolt, or of the lower one of a group of bolts arranged as shown, I prefer to employ additional slides, G^3, which unite to form the bottom of the upper box, G, and by being drawn out serve to open a communication between the upper box, G, and the lower box, G′, as indicated in Figs. 1 and 2.

The two upper conveyer-boxes, G, of a group

of three bolts are connected, as shown in Figs. 1 and 2, by a spout, G^4, and both conveyer-boxes belonging to the lower bolt are provided with suitable discharge-spouts G^5 G^6. The lower conveyer-box, G′, belonging in common to the two upper bolts, delivers into the lower reel-hopper, H, through the spout G^7. (Shown plainly in Figs. 1, 2, and 5.)

Within each feed-spout H of the several bolts, and arranged to catch the material fed into the spout, is located a hopper, H′, having its bottom, and preferably its sides also, made of slotted or perforated metal or wire-netting, whereby dough balls or foreign substances present in the material to be bolted and calculated to injure the reel-cloth may be arrested, and a hand-hole, *h*, is provided in the feed-spout through which such arrested substances may be removed.

In order that the hopper H′ may not clog, it is mounted on a bracket or support, H^2, pivoted at *h*′, and having its inner arm, h^2, directed downward, so as to bear against a circular cam face, d^8, of the head D, having one or more short projections or prominences, which operate as cams and serve to vibrate the bracket and hopper as the reel revolves.

The conveyers G G′ all carry from the rear to the front of the machine, as indicated by the arrows applied to them in Fig. 5.

The motions usually given to the several parts are relatively as follows: The central drum or flier, F, and the surrounding bolting-reel travel preferably in the same direction, the former or drum at from, say, one hundred to two hundred revolutions per minute, or more, and the bolting-reel at from eighteen to thirty revolutions per minute, or thereabout. The conveyers run at any desired or suitable speed.

For the purpose of driving the several drums, reels, and conveyers of a group of three bolts from the same shaft, I have devised the "drive," herein illustrated in Figs. 3, 4, and 5, and next to be described.

The shaft E of the lower bolt is provided with a driving-pulley, E′, on its front end, over which passes the driving-belt E″, and outside which said shaft has a supporting-bearing on the bracket or arm A′, as seen in Figs. 1 and 5. Said shaft E rotates in the gibs D^7 within the reel-hubs D^6 D^9, and at its rear end is provided with the fixed pulley I, from which the high-speeded parts or flier-drums F are driven throughout the group of bolts. For the drive here shown I prefer to employ rope or other cylindrical belts; but other forms may be used. The pulleys are shown grooved to receive the cylindrical belts herein illustrated. Two belts are employed—one, R, for the high speeds and another, R′, for the lower speeded parts.

The arrangement of pulleys on the various shafts and of the tightening devices employed with the belts R and R′ is shown in Fig. 3, in which the belt R is represented unshaded and the belt R′ shaded.

On the outer rear end of the shafts E^3 and E^4, which correspond with the shaft E, are fixed respectively the pulleys I′ and I^2, equal in diameter to the pulley I, and on the rear end of the conveyer-shaft G^9 is a loose pulley, I^3, also, as here shown, of the same diameter, all being arranged in the same vertical plane with the driving-pulley I of this high-speeded series, and connected by the fast belt R. Behind these pulleys I, I′, I^2, and I^3, as the machine is presented in rear view in Fig. 3, or between these pulleys and the rear ends of the bolts, other pulleys are located as follows, to wit: On the shaft G^9 is a fixed pulley, I^4. On the hub D^9 is a fixed pulley, I^9, and on the similar hubs of the upper bolts, similarly arranged on the shafts E^3 and E^4, are fixed pulleys I^7 I^8, located behind pulleys I′ I^2 in Fig. 3. The former I^7, is not shown, the same being, however, entirely like the latter, or I^8, which is seen in Fig. 5. These pulleys I^4, I^9, I^7, and I^8 are in the same vertical plane with each other and with pulleys I^5 and I^6 on the lower conveyer-shafts, and are connected by the slow belt R′.

A belt-tightener bearing two loose pulleys, J J′, situated respectively in the planes of the two series of pulleys described and located at the left of the upper left-hand belt-pulleys, as shown in Fig. 3, completes the series of pulleys over which the belts R and R′ are trained. The further construction of said tightener will be hereinafter described more at length.

The unequal speeds of the two belts R and R′ are obtained as follows: On the inner end of the hub of the loose pulley I^3 is cast or secured a small pinion, *i*, which meshes with a larger spur, *g*, on the rear end of the shaft G^8, as seen in Fig. 5, and on the front ends of the shafts G^8 and G^9 respectively are secured intermeshing gear-wheels g' g^2. By means of the unequal gear-wheels *i* *g*, arranged as shown, the speed of the conveyer-shafts G^8 and G^9 is reduced from that of the drum-shafts, and the pulley I^4 becomes the driver of the low-speeded belt R′. Of course the pulleys in either series may be of unequal diameter, if desired, so as to give any required speed to any part driven thereby.

For the particular arrangement of the belts R and R′, by which the several parts thereby driven are given the proper direction of rotation, reference is made to Fig. 3, it being understood that from the point in said figure at which the belt R passes to the pulley I^2 to the point at which it leaves the pulley I^2 the belt R′ is hidden by said belt R. In this arrangement neither belt is crossed.

The belt-tightener is supported by an arm, J^5, secured to the end of the chest, or to the rim B′ thereof, and is composed of the pulleys J and J′, mounted on a transverse shaft, J^2, which is supported by an arm, J^3, adjustably secured in a recess, J^{10}, of the fixed head J^4. The arm J^3 and recess J^{10} are preferably squared, in order to support the pulleys J and J′ in a vertical position, and longitudinal adjustment of the arm J^3 is effected by means of a screw

passing through the head J^4 and threaded into the end of said arm J^3.

For the purpose of allowing the tightener-pulleys to yield more or less, a spring, J^7, is interposed between the head J^4 and the nut or hand-wheel J^8 about the screw-shaft. This is desirable, more especially in the use of V-grooved pulleys and cylindric belts, because unevenness in the thickness of the belt allows it to sink more or less into the grooves, and to thereby vary its tension. It will be noticed that the belt R′ is the longer of the two, so that in tightening the belts this belt will be less strained than the other, R; but as the latter runs at the higher speed it requires to be the more taut of the two, and is likely to become loose more rapidly in use, so that connection of the two tightener-pulleys on one shaft is calculated to give about the effect desired. If preferred, however, each of said pulleys may be made separately movable.

Some of the advantages resulting from the drum or barrel form of the flier herein described would be obtained by locating a non-rotating or a loose drum within the skeleton form of flier heretofore used and causing the blades, supported independently of the drum, to revolve outside of and proximate to the latter. This construction would obviously operate to prevent the material being bolted from falling through the flier to the bottom of the reel and cause such material to be caught by successive arms of the flier, provided the latter run closely to the drum. Such construction would manifestly be inferior to that herein set forth, wherein the drum directly supports the blades and revolves with them. So far, however, as the possible construction referred to will perform any function of my machine, I wish it to be regarded as the equivalent thereof and as being embraced in my invention as herein claimed.

The effect of overloading the reel by the descent of the material being bolted through or between the flier-blades may be prevented by a construction in which the flier drum or shaft is relatively smaller than that herein shown, provided the blades are correspondingly widened and extended inward to the drum or shaft. Such a construction will present a flier having a series of troughs closed at the bottom, so that the material being operated upon cannot pass through the flier to the bottom of the reel. While I prefer that the drum shall be of relatively-large diameter and provided with narrow blades, I wish it to be understood that a flier having troughs included between adjacent blades and closed or substantially closed at the bottom is a feature of my invention, and is embraced in my appended claims.

It will be noticed that the perforated hopper H′ is constructed to bear continually by the bracket-arm h^2 against the cam-face d^8; but it is evident that in place of a continuous elevated face, d^8, provided with prominences, the head may have the desired projections arranged in a circle, so as to strike the arm h'', and that, except when so struck, the hopper and bracket may be upheld by any convenient stop arranged to engage either with the hopper or the bracket. Such projections are meant to be included in the expression "cam-face," employed in the following claims relating thereto.

It is understood that by opening any one of the slides G^3, which divide the lower pair of conveyers, that portion of flour received by the conveyer-box back of the opened slide will be discharged into the lower conveyer, and the remainder will go forward to the spout G^5, which delivers to the packer. The spout G^6, which takes the imperfect flour from the lower conveyer of the lower bolt, may deliver to an elevator or conveyer, which will carry it back to either bolt in the machine, or will send it to any other point for further treatment or disposal.

I am aware that coffee-hullers and whole grain and bran scourers have been constructed which have a drum provided with pins or substantially transverse blades on its surface, and surrounded wholly or in part by a cylindric wire-cloth screen, which is sometimes a reel. These machines do not contain my invention. They operate, by attrition of the coffee or grain kernels upon themselves, upon the opposite rough and rubbing surfaces of the drum and surrounding wire-cloth or reel, and upon the projecting pins or transverse attrition-blades, as the case may be. They do not contemplate throwing the material that is being operated upon outward by centrifugal action of the revolving pins or blades, which either are not of such a character or are not so placed as to be suited for this purpose; but they contemplate a cramming of the material into the space between the drum and surrounding wire-cloth, so as to obtain a rubbing action between their surfaces. In the centrifugal bolt described no such effect is desired or permissible. The middlings or flour is hurled outward radially against the reel-cloth by the revolving blades, not for its further reduction, but solely for the purpose of separating and expelling the finer parts thereof through the reel-meshes, and the drum is designed specifically to prevent that massing of the material at the bottom of the reel which in the other class of machines referred to is necessary to their proper action. To this end the blades of a centrifugal bolt are substantially longitudinal of the reel or of the drum—a feature of arrangement unlike that found in the scouring-machines referred to and inconsistent with the purpose and action of the latter.

Another feature of difference between said scouring-machines and my improved bolt, as herein shown, lies in the fact that in said scouring-machines the drum and wire-cloth rotate in opposite directions, or the wire-cloth is stationary. This construction obviously favors the massing of the material between the opposing attrition-surfaces. In my bolt, on the other hand, the reel is shown as being rotated in the same direction with the drum, so as to co-

operate with the closed drum to prevent accumulation of a mass of material at the bottom of the reel. Except in the claim, which specifies this feature of corresponding direction of movement of the reel and flier, however, I do not wish to be restricted thereto, since it is merely auxiliary to other specified devices for the same purpose.

I claim as my invention—

1. In a horizontal centrifugal bolt, the combination of an outer shell, a reel, revolving longitudinal continuously-arranged flier-blades, and a central drum having a close or continuous peripheral surface, together arranged, and operating subtantially as described, and for the purposes set forth.

2. In a horizontal centrifugal bolt, the combination, with the outer shell and reel, of a flier having a number of longitudinal troughs or recesses in its circumferential surface, said troughs being closed at their bottom and embraced laterally by longitudinal spirally-directed flier-blades, whereby material falling into said recesses is prevented from falling to the bottom of the reel, substantially as described, and for the purposes set forth.

3. In a horizontal centrifugal bolt, the combination, with the outer shell, and with the reel, of a flier consisting of a peripherally-closed drum proximating in diameter that of the reel, and provided with longitudinal spirally-directed blades applied to the circumferential surface thereof, substantially as described, and for the purposes set forth.

4. In a horizontal centrifugal bolt, the combination, with the surrounding bolting-reel, of the inner drum, and secured to the drum-surface a number of longitudinal blades, each separately adjustable, and shorter than the length of the drum, but arranged together to operate as a continuous blade or series of continuous blades, for the purpose of acting at all points of the reel opposed to the drum, substantially as described.

5. In a horizontal centrifugal bolt, the combination, with the bolting-reel, of an inner flier constructed with one or more series of short blades, arranged substantially longitudinally of the flier, so as to throw the material being acted upon outward against the bolting-reel, said blades for a part of the length of the flier being slightly inclined from a longitudinal direction for the purpose of feeding the material along in the reel, and those near the tail of the reel being less inclined, or otherwise set so as to retard the progress of the material lengthwise of the reel, substantially as described.

6. In a horizontal centrifugal bolt, the combination of an outer stationary shell, an inner rotating bolting-reel, and a central drum having a close or continuous peripheral surface, said drum being provided with longitudinal blades on its peripheral surface, arranged to operate together as a continuous blade or series of continuous blades, and having a rotary motion in the same direction with, but at a higher speed than, the reel, whereby material being bolted is prevented from overloading the bottom of the reel, substantially as described.

7. In a centrifugal bolt, the combination, with the flier-drum F and with the reel having an opening or openings in its front end for the admission of air, of oblique blades applied to the front end of the drum to induce an air-current through the reel-head by the rotation of the drum, substantially as described.

8. In a reel, the combination, with a fastening for securing the reel-cloth at one end thereof, of an adjustable fastening for the opposite end, consisting essentially of a contractible clamping-hoop, D^{12}, provided with external hooks, d^7, and tension-rods d^5, combined with the reel-rim D′, substantially as described.

9. In a centrifugal bolt, the combination, with the feed-spout having a door, h, and with the reel-head provided with a cam-face, d, of an apertured hopper, H′, pivotally mounted within the spout, engaged with the cam and accessible from the door h, whereby objectionable substances in the material to be bolted are retained and may be removed, substantially as described.

10. A group of three centrifugal bolts mounted on a single frame and forming a unitary machine, two of said bolts being elevated equally and the third arranged centrally beneath them, combined with conveyers and a spout or spouts forming part of the machine, whereby material may pass from either of the elevated bolts to the lower one, substantially as described.

11. In a group of two or more centrifugal bolts, the combination of two of said bolts, arranged side by side, inclosing chests therefor provided with discharge-openings on their adjacent sides, and a conveyer box or boxes located between said two bolts, and common to both, the moving parts in said bolts which carry the bolted flour out of the chests being arranged to revolve in opposite directions inwardly and upwardly, substantially as described.

12. As a means for communicating reduced motion from a flier-shaft to the reel and conveyer-shafts in a centrifugal bolt, the combination, with a rotating reel, a flier, and two parallel conveyers, of gear connecting the conveyer shafts with each other, reducing-gear leading from the flier to one of said conveyer-shafts, and gear leading from the other of said conveyers to the reel, substantially as described.

13. In a group of three centrifugal bolts arranged as shown, the combination of the flier-shaft E, the driving-belt E^2, the conveyer-shafts G^8 and G^9, gear-wheels g, g', and g^2, fixed pulley I^4, loose pulley I^3, having the pinion i, flier-pulleys I, I′, and I^2, arranged in the plane of I^3, reel-pulleys I^7, I^8, and I^9 in the plane of the pulley I^4, the conveyer-pulleys I^5 and I^6, also in the plane of the pulley I^4, the belts R and R′, and tightening-pulleys J and

J′, arranged in the respective planes of said belts and located at the left of pulleys I′ and I^7, substantially as described.

14. In a group of centrifugal bolts, the combination, with the flier, reel, and conveyer-shafts and their pulleys, and with the belt or belts forming the "drive" of the group, of the fixed head J^4, provided with a recess, J^{10}, the arm J^3, supporting a pulley or pulleys on an axis, J^2, at right angles with said arm, a screw, J^8 J^9, arranged and applied as shown, and a spring, J^7, interposed between the head J^4 and wheel or head J^8, all substantially as described, and for the purposes set forth.

In testimony that I claim the foregoing as my invention I affix my signature in presence of two witnesses.

JONATHAN MILLS.

Witnesses:
M. E. DAYTON,
JESSE COX, Jr.