(No Model.) 5 Sheets—Sheet 1.

W. F. COCHRANE.

GEARING AND RELIEF MECHANISM FOR DRIVING ROLLS.

No. 327,240. Patented Sept. 29, 1885.

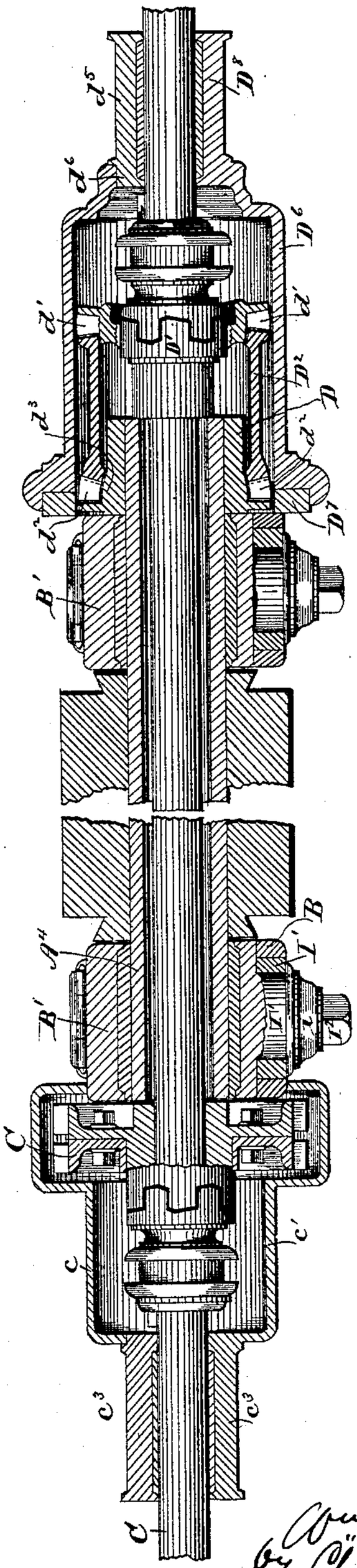

Fig. 1.

Witnesses.
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(No Model.) 5 Sheets—Sheet 2.

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Fig. 2.

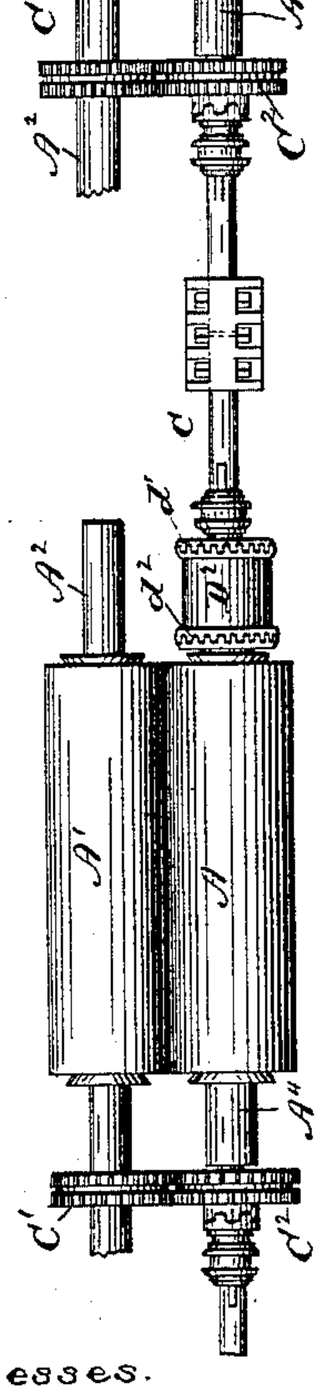

Fig. 3.

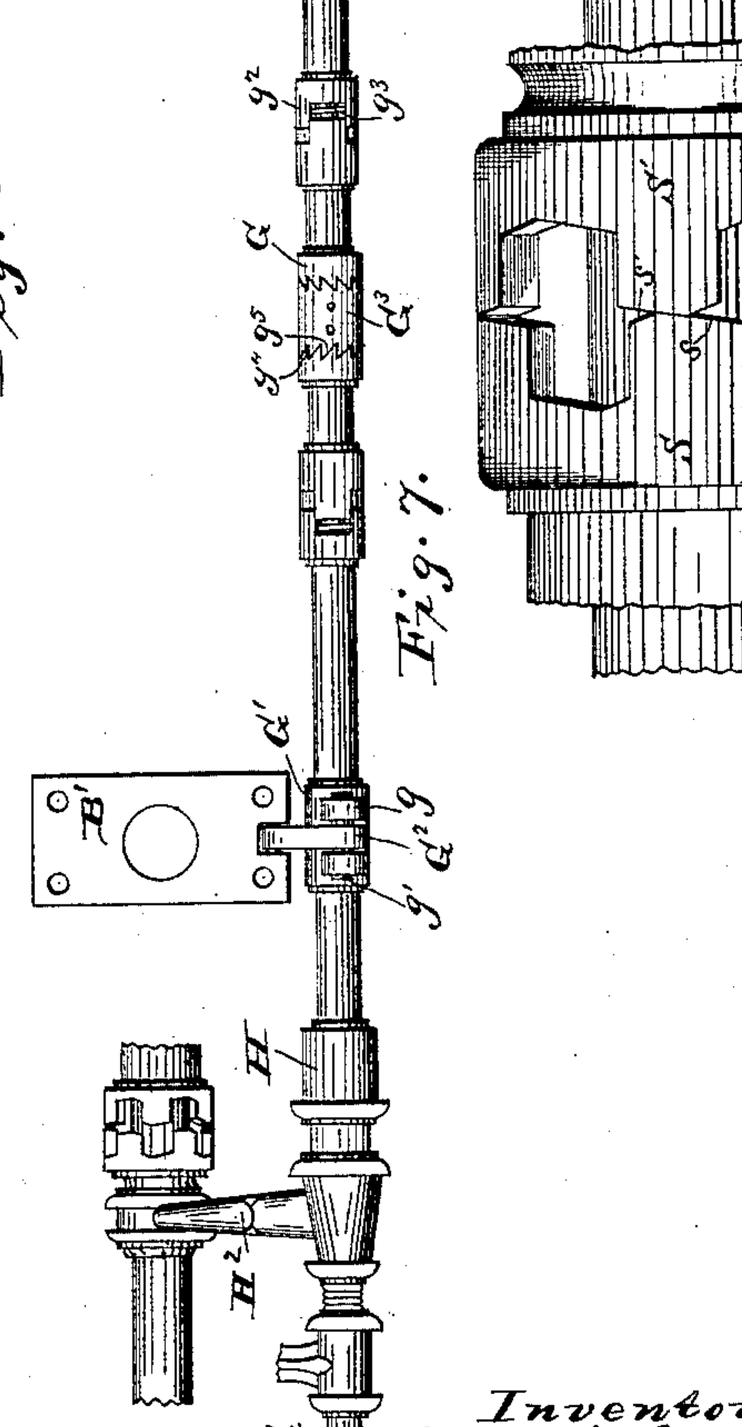

Fig. 7.

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(No Model.) 5 Sheets—Sheet 3.

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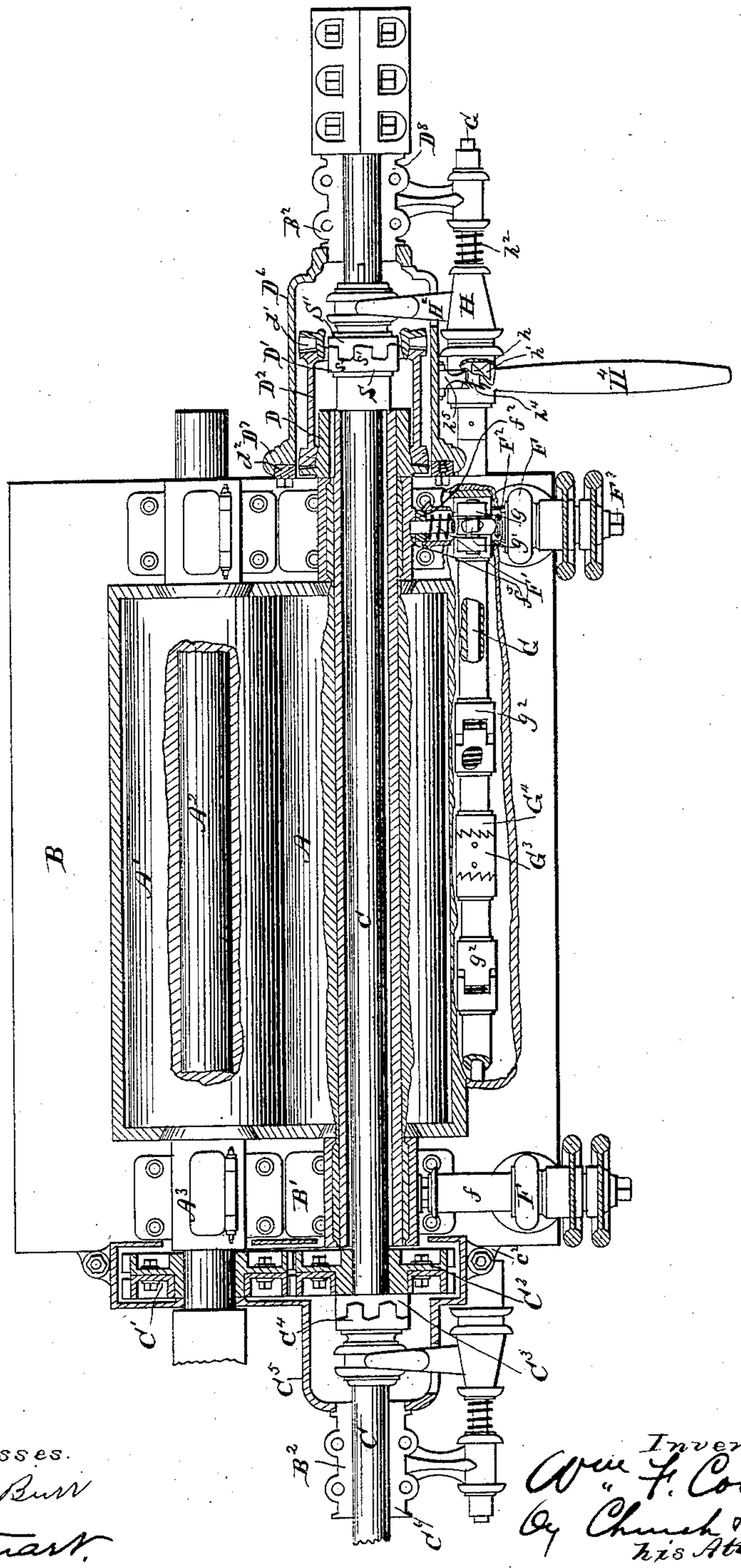

Fig. 4.

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(No Model.) 5 Sheets—Sheet 4.

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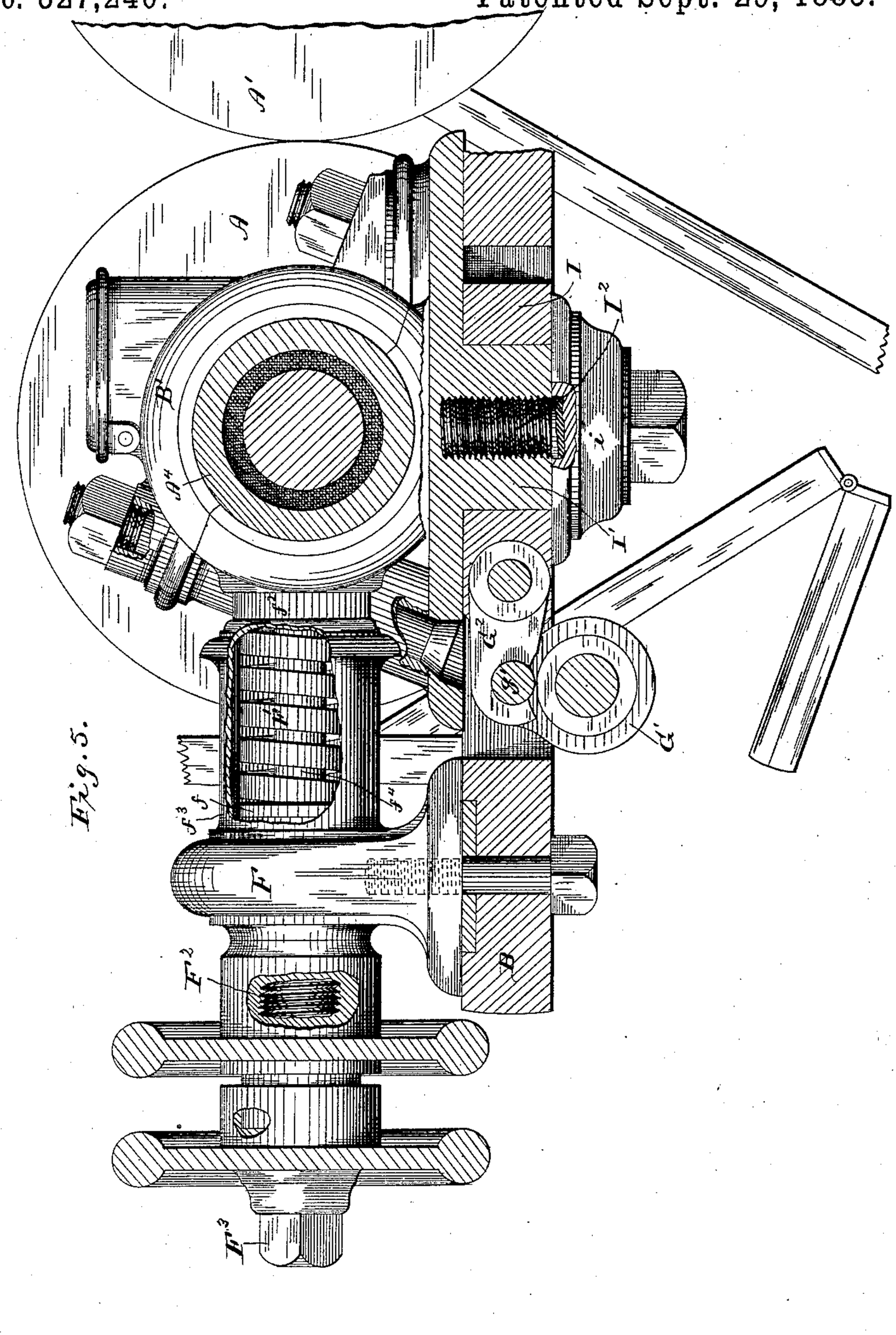

Fig. 5.

Witnesses.
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(No Model.) 5 Sheets—Sheet 5.

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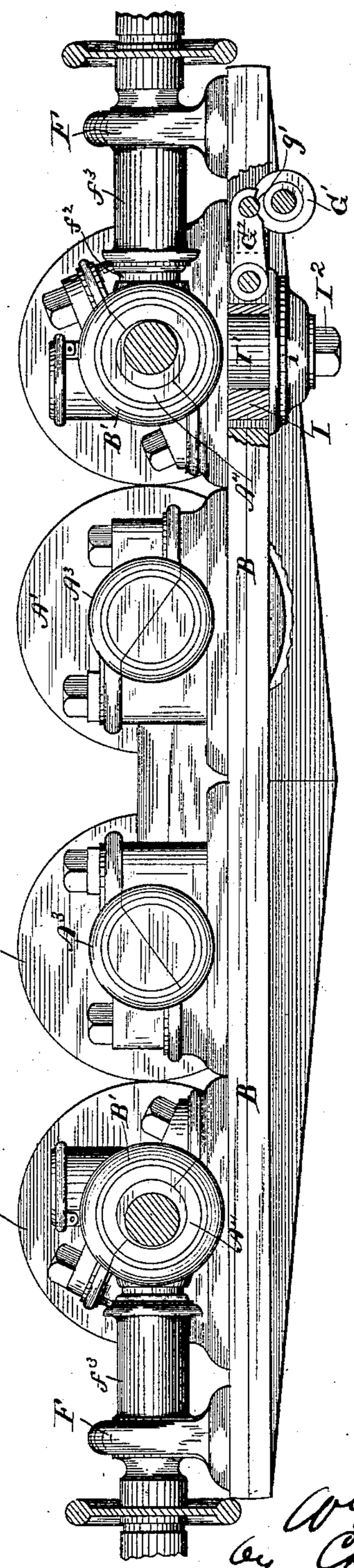

Fig. 6.

Witnesses.
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UNITED STATES PATENT OFFICE.

WILLIAM F. COCHRANE, OF CAMBRIDGE CITY, INDIANA.

GEARING AND RELIEF MECHANISM FOR DRIVING ROLLS.

SPECIFICATION forming part of Letters Patent No. 327,240, dated September 29, 1885.

Application filed August 21, 1885. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM F. COCHRANE, of Cambridge City, Wayne county, Indiana, have invented certain new and useful Improvements in Gearing and Relief Mechanism for Driving Rolls, &c.; and I do hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, and to the figures and letters of reference marked thereon.

This invention relates to a new and improved system of gearing, embracing driving and relief mechanisms, designed for application to one or both of a pair of rolls, and to each of a series of pairs or sets of rolls when combined to form a system, said inventions being more particularly adapted for use in connection with the rolls constituting a pair or set of which one roller is adjustable toward and from the other, and the two rollers driven at such a speed that the surface of the one shall move relatively faster than that of the other, an example of which is furnished in the roller grinding-mill in common use, and to which my said invention is especially adapted as furnising a simple, effective, and convenient substitute for the complicated system of belts, pulleys, counter-shafts tighteners, &c., heretofore found necessary in practice and universally employed in operating such rolls,

The general system to which my present invention is, in part at least, intended to be applied, and to that extent is an improvement in or upon, is such as described in a patent No. 312,392, issued February 17, 1885, in the name of George T. Smith and myself. The said joint invention as developed and illustrated in the before-mentioned patent comprehends the use of hollow rolls mounted in bearings supported upon a main frame, with separate driving-shafts of less diameter than the longitudinal openings in the rolls through which they pass, said shafts being mounted in independent bearings and extending in parallel lines through the front and rear rolls, respectively, of the entire series. These shafts being thus supported from lateral movement and geared together, were connected to the laterally-adjustable rolls through which they passed by a species of universal couplings applied to the end of each roll in such manner as to permit the free adjustment of the rolls without disturbing the connection through which motion is communicated to the roll from the shaft. In this manner any desired number or sets of rolls were arranged to be driven from the two parallel shafts, and by separating the members of the universal coupling any particular set of rolls could be thrown out of action without interfering with the working of the remaining sets included in the series.

The improvements which I have made upon the system of gearing such as above described relates to the manner of supporting the driving-shaft in bearings applied to the frame supporting the rollers, whereby the machine is made more compact; the location and construction of the universal coupling and the provision for inclosing the same; the construction of the driving-shafts in sections united by couplings, whereby each machine is made complete in itself, can be used singly or in series with other similar machines, and when so combined in series any one or more machines can be bodily withdrawn or removed without dismantling or otherwise disturbing the remaining machines of the series.

Another feature of my present invention, applicable not only to the construction above described, but also, with slight changes and modifications, to other well-known systems of mechanism for driving-rolls, consists in the manner of supporting the rolls at opposite ends in independent pivoted or swiveled bearings, against which the yielding adjusting devices are applied, and combining with said bearings, or sliding the plates upon which they are mounted, a clutch-operating mechanism so arranged and applied that when any hard substance or material is fed between the rolls the latter will yield at one or both ends, according to the point at which the said substance is introduced, and in so doing will automatically actuate a clutch located intermediate the roll and driving-shaft, whereby that particular set of rolls will be disconnected from the driving-shaft and be held at rest until purposely connected to the driving-shaft after the foreign body has been removed; and the said invention further contemplates the use in such connection of an improved form of clutch for effecting a gradual starting of

the roll by frictional contact of the members comprising the clutch, and prior to the more positive locking of the clutch-sections for final operation. It also includes certain minor features of constructions and combinations of parts, all as hereinafter more fully described, and pointed out in the appended claims.

In the accompanying drawings I have shown a mechanism serving to illustrate the principles of my present invention and a practical mode of carrying the same into operation; but I do not desire to be understood as limiting my claims to the precise mechanism or arrangement of parts shown, as the several elements or members may be modified in form and arrangement without departing from the spirit of my said invention.

In the annexed drawings, Figure 1 is a vertical section through the adjustable roll, showing the manner of applying the driving-gear thereto. Fig. 2 is a top plan view illustrating the manner of associating together several sets of rolls arranged in series. Fig. 3 is a top plan view of the relief mechanism detached. Fig. 4 is a top plan view, partly in section, of a set or pair of rolls with driving and relief mechanism applied. Fig. 5 is a sectional view, partly in elevation, of one end of the adjustable roll, showing the manner of applying the adjusting devices and of connecting the relief mechanism to the bearing of the roll. Fig. 6 is an end view, partly in section, of the frame adapted to receive two sets of rolls. Fig. 7 is a detail illustrating the construction of the compound friction and locking clutch employed for starting the rolls from the driving-shaft.

Similar letters of reference in the several figures indicate the same parts.

The rolls A A′, forming a pair or set of rolls, are mounted in bearings sustained upon a single bed-plate or frame, B, and, if desired, two sets or pairs of such rolls may be associated together upon the same frame, as shown in Fig. 6.

The roll A′, in the example given, is mounted upon and secured to a shaft, A^2, as by keying or shrinking, and the latter is supported in fixed journal-bearings A^3, rising from the bed-plate B. The front or movable roll, A, is in like manner mounted upon and secured to a hollow or tubular shaft, A^4, which latter is supported in journal bearings B′, one at each end of the roll, said bearings B′ being movable together or separately toward and from the bearings of the roll A′ to adjust and determine the distance between the faces of the rolls.

Passing longitudinally through the hollow or tubular shaft A^4 of the movable roll, and supported in bearings B^2, secured to the main frame or bed-plate B at opposite ends of said roll, is the main driving-shaft C, to which motion is communicated through any convenient or appropriate mechanism from the prime motor. The diameter of the shaft C is sufficiently less in cross-section than the internal diameter of the tubular shaft or longitudinal opening through the roll A to permit of the requisite lateral movement of the said roll with respect to the shaft for effecting the desired adjustment or movement of the roll.

It will be observed that the centers of the driving-shaft and back roll, A′, maintain a fixed relation, which is not changed by the lateral adjustment of the movable roll A, thereby enabling me to gear from the driving-shaft directly upon the shaft or journal of the roll A′, preserving the pitch-centers of the teeth and at the same time permit of the movement of the front or movable roll, A, which latter is connected to the driving-shaft by an improved form of universal coupling, as will be hereinafter described.

The arrangement of gearing for driving the back roll, A′, is shown in Figs. 1, 2, and 4. Upon one end of the shaft A^2 is secured a gear-wheel, C′, preferably composed of two gears or toothed sections arranged side by side and with their teeth alternating, (friction or other suitable gearing may be employed,) and upon the shaft C is secured a corresponding gear-wheel, C′, formed or provided on one side with a clutch-section, C^3, co-operating with a similar clutch-section, C^4, rotating with the shaft C, but free to move longitudinally thereof. The gears C′ C^2 and the clutch are inclosed within a casing, C^5, formed in two sections, *c c′*, bolted together, and to lugs c^2 on the main frame B. Formed integral with or attached to the outer end of this casing C^5 is the journal-box C^6, to receive and support the driving-shaft C, said journal-box being also made in two sections, c^3, attached, respectively, to the sections *c* and *c′* of the casing. By thus forming the bearing for the driving-shaft in or upon the casing for inclosing gears and clutch not only are the latter well protected from dirt and injury, but the machine, at this end at least, is rendered more compact and serviceable. The movable roll A is also driven from the main shaft through the medium of a universal coupling similar in some respects to that described in the before-mentioned Patent No. 312,392, but of an improved form and construction, whereby the parts are simplified and compacted.

To the end of the tubular shaft A^4 carrying the roll A is secured a flanged hub or collar, D, and upon the driving-shaft C, and beyond the said collar, is fitted a similarly-flanged hub or collar, D′.

Upon the flanges *d* of the hubs D D′ are formed a series of teeth or projections, *d′*, the said flanges being located on opposite ends of the hubs, with the teeth or projections *d′* thereon facing each other.

Surrounding the hubs D D′, and supported at each end upon spherical bearings d^3 thereon, is a tubular coupling or sleeve, D^2, whose ends are provided with a series of teeth or projections, d^2, corresponding with and engaging the teeth or projections *d′* on the flanges of the hubs D D′. The outer end or face of the hub or collar D may be constructed to form half of a clutch, as at D^4, the other half or

member whereof, D^5, is arranged to slide longitudinally upon the driving-shaft C. This universal coupling permits of the lateral adjustment of the roll A with respect to the shaft C without disturbing the connection between them, as set forth in said prior patent, at the same time by placing the flanges at opposite ends of the hubs the strength of the coupling is increased and the space occupied by it is diminished. In order to protect the said coupling, I inclose it within a tubular or bell-shaped casing, D^6, which is firmly secured to an annular bracket, D^7, formed upon or attached to the end of the frame B, and in or upon the opposite end of said casing is formed the half box or bearing D^8 to receive the driving-shaft C, the upper or movable portion, d^5, of said bearing being provided with a semi-annular or other shaped flange, d^6, fitting within the end of the casing, as shown in Fig. 1, and being secured in position above the bearing D^8 by bolts in the usual manner.

The clutches described as applied to the gear and hub forming part of the universal coupling, although desirable, are not essential to the operation of my invention as thus far described, but belong more particularly to another part of my invention, referred to hereinafter.

In the Patent No. 312,392 two lines of driving-shafts are shown, one for each roll of a pair or set, and when a series of pairs of rolls are employed the shafts are continued through the rolls, while the bearings for the said shafts are located intermediate each set of rolls, and my present improvements are, as will be obvious, applicable to such an arrangement of driving-shafts; but I prefer to employ but a single driving-shaft extending through the movable roll only of the series to connect the back roll of each set or pair to the said driving-shaft, to mount all the bearings for the shafts and rolls of each set or pair upon its own separate bed-plate or frame, and to make the driving-shaft, when arranged to operate a series of rolls, in sections and connect said sections by removable couplings, as shown in Fig. 2; and this arrangement is preferred for the reason that when intermediate bearings and continuous shafts are employed it is difficult to set up or arrange a series of pairs of rolls, as the shafts have to be introduced through the whole series from one end, and if from any cause it becomes desirable to remove, repair, or replace any one set of rolls the whole series must be dismantled and taken apart, whereas by my improvement, which contemplates the making of each machine complete in itself, I am enabled to remove or replace any one or more pairs of rolls in the series by simply loosening the coupling at the ends of the driving shaft of the particular set of rolls, and, if the machine is removed, filling the interval with a section of shafting, when the series or train will be in condition to be started up at once.

When several sets or pairs of rolls are associated together, as described, to form a series, all being driven from one main shaft, it is desirable that some means be provided for disconnecting each and any pair of rolls from the driving-shaft, in order that the whole series may not be thrown out of operation whenever it becomes necessary to stop a particular set of rolls. It is desirable, moreover, in case of the accidental deposit between the rolls of any hard substance or foreign material—such as would offer a resistance proportionally greater than the material designed to be acted upon, and for which the roll sare adjusted—that the rolls should be quickly disengaged from the driving-shaft and their motion arrested, after which the foreign body is removed and the rolls are again connected to the driving-shaft.

It has been customary heretofore to rely upon the attendant, not only to detect the presence of such a foreign body, but by stopping the driving mechanism to apply the only remedy known for preventing further damage. As is obvious, the success of such a system depends wholly upon the vigilance of the attendant in discovering the danger and his promptness in affording relief, for he cannot, as a rule, anticipate the event, and hence is powerless to prevent, though he may diminish, the injury inflicted upon the rolls by the presence of the foreign body, particularly when the former are revolving at high rates of speed. In order to avoid this difficulty I propose to furnish each set or pair of rolls with what is herein termed a "relief mechanism," which, when a foreign body is introduced of sufficient size and strength to spread the rolls, shall act automatically to uncouple the rolls from the driving-shaft and retain them in that position until the interfering body is removed and the rolls are again thrown into operative connection with the driving-shaft by the attendant.

A mechanism such as above referred to is shown in Fig. 3, and its application to a pair of rolls in Figs. 4, 5, and 6.

As heretofore referred to the adjustable roll A is supported in bearings B', which are movable toward and from the back roll, A'. Any approved adjusting mechanism having an elastic or yielding connection with the bearings B' may be employed, and in the example given there is shown a bracket, F, attached to the bed-plate, B, opposite each of the bearings B' of the roll. These brackets F are each formed or provided with tubular casings f on one side, and upon one side of the bearing B' is formed a socket, f^2, fitting snugly within the end of the casing f. Within the said casing f is located a spring, F', resting with one end against the bearing B' and the other against a head or collar, f^3, formed upon or attached to an adjusting-screw, F^2, which latter passes through the bracket F, and is provided with a jam-nut, F^3, for locking or holding it in its adjusted position. A supporting-pin, f^4, passes through the spring and plays loosely in a socket, f^5, on the bearing. By this arrangement of devices the movable roller is set and maintained in posi-

tion by the pressure of the springs alone, and is free to be moved backward against the pressure of the springs by the foreign substance mentioned when the latter passes within the bite of the rolls. This backward thrust of the rolls I take advantage of and utilize for setting in action the relief mechanism, one form of which I will now proceed to describe.

Referring particularly to Fig. 3, G represents a shaft mounted in bearings attached to the bed-plate or frame, and G′ two sleeves, one at each end, fitting loosely upon the shaft. Each sleeve G′ is provided with lugs *g* to receive a pin, *g′*, the latter forming a pivot for one end of the link or latch G^2, whose opposite end is likewise pivotally secured to the movable bearing of the roll. The sleeves G′ turn freely upon the shaft G, and are provided at their inner ends with longitudinally-movable sections or extensions G^2, which latter are connected to rotate each with its own sleeve by an interlocking joint or connection, g^2, containing a spring, g^3, serving to hold the extensions G^2 normally projected, but permitting them to slide or be forced back toward the sleeve G′. The inner or approximate ends of the movable sections or extensions G^2 are furnished with a series of angular cams or ratchet-teeth, g^4, which incline in the same direction upon both sections G^2, and these cams or ratchet-teeth engage a corresponding series of cams or ratchet-teeth, g^5, formed upon the opposite ends of a sleeve or collar, G^3, secured to the shaft G.

The movable sections or extensions G^2 of the sleeves G′ serve as a means for communicating motion to the shaft G from both sleeves, or either one independent of the other, for when either sleeve is rotated in a direction to cause the teeth on its movable section or extension to engage the teeth on the sleeve G^3 it will cause a partial rotation of the latter and of the shaft G, to which it is secured, and if but one sleeve receives motion and, operating in the manner described, actuates the shaft, the other sleeve will not be affected, as the inclined surfaces of the teeth on the sleeve G^3, acting against the inclined surfaces of the teeth on the movable section of the sleeve G′, will simply cause the said movable section to be retracted without affecting the position of the sleeve to which it is connected.

The advantages secured by this arrangement of separate actuating devices connected to each bearing and operating in the same direction upon the shaft are both numerous and obvious. Thus when both bearings move in unison a duplex connection is made with the shaft, insuring prompt action. When the bearings are arranged to have an independent motion, as hereinafter described, the insertion of foreign material at or near one end and between the rolls, instead of causing a separation of both ends, involving the compression of both adjusting-springs and making a wide opening, it will, by forcing back one of the bearings against its spring only, actuate the shaft G. Moreover, when the backward movement occurs at both ends of the rolls, but unequally, that end only which moves the more rapidly will actuate the shaft, while the parts connected to the other bearing will be inoperative, thus avoiding the twisting or displacement and possible destruction of the mechanism.

Having provided for the partial rotation of the shaft G whenever either or both of the bearings are retracted, the principal object has been accomplished, as any skilled mechanic can apply shipping devices to be actuated by the said shaft to disconnect the driving mechanism of either or both rollers.

The preferred form and arrangement of shipping devices is that shown in Fig. 3, and its application to my improved gearing as illustrated in Fig. 4. Upon the shaft G, and at opposite ends of the frame, are secured two hubs or sleeves, H, each provided upon one end or face with inclines or cams *h*. Opposite each of these hubs, and preferably supported upon the shaft G, is a sleeve, H′, carrying a fork, H^2, or similar device, engaging the movable member or section of one of the clutches, through which motion is conveyed from the driving-shaft to one of the rolls. The end of each sleeve H′ facing the hub H is furnished with a series of inclines or cams, *h′*, corresponding to and engaging the inclines or cams *h*, and so arranged relatively to each other as that when the said hubs, being secured to the shaft G, are given a partial rotation through the medium of the bearings of the roll, as previously described, the sleeves H′ will be forced outward, or in a direction to withdraw the movable section of the clutch from the driving-gear, and thus stop the roll or pair of rolls connected therewith. The sleeves H′ are held pressed inward, or in a direction to hold the clutch in engagement, by springs h^2 applied to their outer ends.

In order that the relief mechanism when once set in action by the spreading of the rolls may be retained in position with the movable sections of the clutch retracted, I form upon or apply to one of the hubs H a series of ratchet-teeth, h^4, and mount upon the frame a pawl, h^5, which latter, as the shaft is thrown back by the rolls, will engage one of the teeth h^4, and thus prevent the clutching of the driving mechanism until the pawl is raised. A hand-lever, H^4, attached to the shaft G, or to one of the sleeves or hubs secured thereto, is also provided for rotating the shaft in either direction when desired for throwing the clutch-sections in or out of gear.

In order that the roll may be rendered capable of being retracted or yielding at each end independently for operating upon the relief mechanism, as described, without forming too great an opening between the proximate faces of the roll, I provide each bearing with a cylindrical hub, I, Fig. 5, which passes through or is received within a circular hole or socket formed in a plate, I′. This plate I′ is fitted to

slide in a slot or ways formed in or attached to the bed-plate, and to it is attached the rear end of the link or catch engaging the pin on the sleeve G′.

A bolt, I², passing up into the hub I, and provided with a collar or washer, *i*, engaging the under surface of the plate I′, serves to retain the latter in position upon the hub, thus forming a swivel-connection between the bearings and plates, whereby the former are adapted to accommodate themselves to the angular position assumed by the rolls when one end only is retracted.

As the driving-shaft in a system such as described is frequently driven at high speeds—from two hundred to four hundred or more revolutions per minute—it is practically impossible to start the roll up with the ordinary jaw-clutch, and serious damage is liable to result should the attempt be made to couple the roll when at rest to the rapidly-revolving shaft. I have discovered, however, a simple method of remedying this evil, while at the same time preserving all the advantages of an interlocking or jaw clutch for driving the roll when in operation. This I accomplish by cutting away or beveling the ends of the clutch-jaws, as shown at *s*, Fig. 7, the bevels on the gear-section S being formed substantially parallel with those on the sliding section S′, when the ends of the jaws are brought into contact. These bevels *s* form in themselves a friction-clutch, and as the one is revolved in contact with the other they operate to gradually bring the sleeve of the roll up to approximately that of the shaft, when by a sudden movement the jaws of the sliding section can be inserted between those on the gear and caused to operate as a positive interlocking clutch.

In performing the operation of starting the roll, the attendant first raises the pawl which holds the shaft in retracted position, and gradually turns said shaft until the sleeve carrying the yoke which engages the sliding section of the clutch is forced inward by the spring, and the beveled or inclined ends of the rotating sections are brought to bear with an elastic pressure upon the inclined ends of the jaws of the gear-section. When the roll has been brought up to nearly the speed of the movable section of the clutch by a further movement of the latter, the sliding section may be forced into positive engagement with the opposite section. The ends of the jaws opposite the inclines *s* are beveled or cut away, as at *s′*, to prevent chipping the edge of the jaws, and to assist the interlocking of the two sections.

Having thus described my invention, what I claim as new is—

1. In combination with a hollow roll mounted in adjustable bearings, and a driving-shaft passing longitudinally through said roll and supported in fixed bearings, the improved universal gear or coupling consisting, essentially, of the two adjacent sleeves or hubs provided with toothed flanges at their opposite ends, and attached the one to the journal of the roll and the other to the driving-shaft, and the sleeve or coupling surrounding the first-mentioned sleeves or hubs, and provided with teeth at each end engaging the teeth on the flanges of said sleeves or hubs, substantially as described.

2. The improved universal coupling constructed substantially as described, and arranged for connection, two rotating shafts lying in parallel planes and adjustable laterally, the one with respect to the other, consisting of the two hubs or sleeves with toothed flanges upon their opposite ends, and the hollow coupling or sleeve having spherical bearings at each end upon one of said hubs, and provided with teeth engaging the flanges, substantially as described.

3. As a means for connecting and driving both of a pair or set of rolls, of which one roll is adjustable toward and from the other, the combination of the rolls supported in independent bearings, the driving-shaft passing through the enlarged longitudinal opening in the movable roll and supported in fixed bearings, the gears applied to the said shaft, and the roll supported in fixed bearings, and the universal coupling applied intermediate the shaft and movable roll for driving the latter, substantially as described.

4. In combination with a pair of rolls, one of which is adjustable toward and from the other, a driving-shaft mounted in bearings having a fixed relation to the journal of the non-adjustable roll and connected thereto by gears applied directly to the shaft and roll, and a universal coupling, such as described, connecting the adjustable roll and shaft, substantially as and for the purpose set forth.

5. The herein-described improved system of gearing for driving from a single line of shafting two or more pairs of rolls arranged in series, which consists in arranging in line two or more sets or pairs of rolls, each provided with a back roll mounted in fixed bearings, a hollow front roll mounted in adjustable bearings, a shaft mounted in fixed bearings and passing through the adjustable roll, said shaft being connected to the back roll by gears and to the adjustable roll by a universal coupling, uniting the proximate ends of the shafts of adjoining pairs of rolls by detachable couplings, and applying the power to drive the rolls to one of the said shafts, substantially as described, whereby all the rolls are driven from a single line-shaft, and any pair or set of rolls can be removed without disturbing the remaining pairs or sets in the series.

6. The combination, to form a series of two or more sets or pairs of rolls, substantially as described, each set provided with a separate frame or bed-plate, upon which are mounted the back roll in fixed bearings, the hollow front roll in movable bearings, and the shaft passing through the hollow roll and connected to the latter, said shaft being also sup-

ported in fixed bearings and connected to the shaft of the succeeding pair of rolls by a detachable coupling, substantially as and for the purpose set forth.

7. The combination of two or more sets or pairs of rolls, each arranged to be driven by a shaft mounted in bearings on the frame, and passing through the center of the adjustable roll, to which latter it is connected by a universal coupling, such as described, with detachable couplings applied to the proximate ends of the said shafts, thereby forming a sectional driving-shaft and permitting the removal of any set of rolls from the series, as and for the purpose set forth.

8. In combination with the bed-plate or frame provided with bearings for the back roll and movable bearings for the hollow adjustable roll, the driving-shaft passing through the adjustable roll, and connected to the latter at one end by a universal coupling and at the other end to the back roll by gearing, said shaft being supported in bearings attached to the bed-plate or frame, substantially as described.

9. The combination, with the rolls mounted in bearings upon the bed-plate or frame, the driving-shaft connected directly to one roll by a universal coupling and to the other roll by gearing, as described, of the inclosing-casings for the gears, and couplings secured to the bed-plate or frame and provided with bearings for the driving-shaft, substantially as and for the purpose set forth.

10. The combination, with a roll and its driving-gear, of a relief mechanism, substantially as indicated, connected to the bearings of a roll and actuating the clutching devices to effect the disengagement of the roll and its driving mechanism when the former is forced back, substantially as described.

11. In combination with a roll mounted in movable bearings and held to its work by an elastic or yielding pressure device, a driving-shaft with intermediate gearing connecting it to said roll, a clutch for connecting and disconnecting said gearing, and a relief mechanism, substantially such as indicated, connected to and actuated by the movable bearings of the roll to ship the clutch and stop or start the roll, substantially as and for the purpose set forth.

12. In combination with the main driving-shaft, the rolls, and the gearing intermediate the shaft and rolls, a relief mechanism of the character described connected to and actuated by the bearings of the movable roll, said relief mechanism being provided with shippers for disengaging the gearing from the driving-shaft and stopping the rolls, substantially as described.

13. In combination with the driving-gearing of a pair of rolls, one of which rolls is mounted in movable bearings, a relief mechanism connected to said movable bearings and provided with devices for unclutching or disengaging the driving-gearing, substantially as and for the purpose set forth.

14. In combination with the adjustable roll mounted in laterally-movable bearings, a shaft connected to and actuated by the said bearings when the latter are moved outward, and a clutch operating or disengaging mechanism connected to and operated by said shaft to uncouple the driving-shaft from the roll and stop the latter, substantially as described.

15. In combination with a roll supported at each end in laterally-movable and pivoted bearings, a relief mechanism, such as described, for actuating the clutch or disengaging devices, said relief mechanism being provided with independent attachments to each of the movable bearings, whereby the movement of either or both bearings will serve to set in motion the relief mechanism and stop the roll, substantially as described.

16. In combination with a roll supported in movable bearings, and elastic or yielding pressure devices applied to each of said bearings, a main driving-shaft, gearing connecting the main shaft and roll, a shipping or unclutching device intermediate the said shaft and the roll, and a relief mechanism, such as indicated, for actuating said shipping or unclutching devices, said mechanism having an independent connection with each bearing, substantially as and for the purpose specified.

17. The combination, with a pair of rolls supported respectively in fixed and movable bearings, the driving-shaft passing through the adjustable roll, gearing intermediate said shaft and the rolls, and clutches for controlling the application of the gearing to the shaft, of a pair of shippers connected with the clutches, and a rock-shaft actuating said shippers to simultaneously disengage both rolls from the driving shaft, substantially as described.

18. In combination with a rock-shaft which actuates the disengaging mechanism, the toothed sleeve secured thereto, the sleeve connected to the bearing of the roll, and provided with the movable extension having teeth engaging the said toothed sleeve, substantially as described.

19. In combination with the shaft for actuating the clutch-shipping devices, the toothed sleeve applied thereto, the two sleeves each connected to one of the movable bearings, and the extensions connected to said sleeves by a movable coupling and provided with inclined teeth engaging the toothed sleeve fastened to the shaft, substantially as described.

20. In combination with the shaft connected to and actuated by the movable bearings of the roll, substantially as described, the reciprocating sleeve carrying the shippers for engaging the movable sections of the clutch, and provided with the inclined teeth or cam-surfaces, and the hub fixed to the shaft and provided with a corresponding series of teeth or inclined cams, substantially as described.

21. In combination with the movable bearings of the roll, the links or latches, the sleeves mounted upon the clutch-operating

shaft, the toothed extensions rotating with but capable of longitudinal movement with respect to said sleeve, and the toothed collar fastened to the said shaft, and in position to engage the said toothed extensions, substantially as described.

22. In combination with the clutch-operating shaft and devices connected to the movable bearings for actuating said shaft, the ratchet secured to the shaft and engaging a pawl on the frame to prevent the accidental starting of the roll after its disengagement from the driving mechanism, substantially as described.

23. In combination with the roll, the driving-shaft, and the shipping mechanism, the compound interlocking and friction-clutch, consisting essentially of the two sections provided with a series of interlocking projections with their ends beveled, substantially as described.

24. In combination with a hollow roll mounted in movable bearings, a driving-shaft passing through said roll and supported in fixed bearings, a universal coupling intermediate the shaft and roll, a clutch for connecting the said coupling to the shaft, a shipper engaging the movable section of the clutch, a sleeve carrying the shipper and provided with inclined teeth or cams, a shaft carrying a hub provided with a corresponding series of teeth or cams, and a spring for holding the said sleeve in engagement with the hub, substantially as described.

25. In combination with a pair of rolls, one of which is supported in movable bearings and held in operating position by an elastic pressure device, a driving shaft detachably connected to said rolls through intermediate gearing or driving mechanism, shippers for uncoupling or detaching the gearing from the driving-shaft, and a shaft connected to and actuated by the bearings of the roll when the latter is forced back from the opposite roll, said shaft in turn being connected to and actuating the shippers in the manner and for the purpose set forth.

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Witnesses:
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