

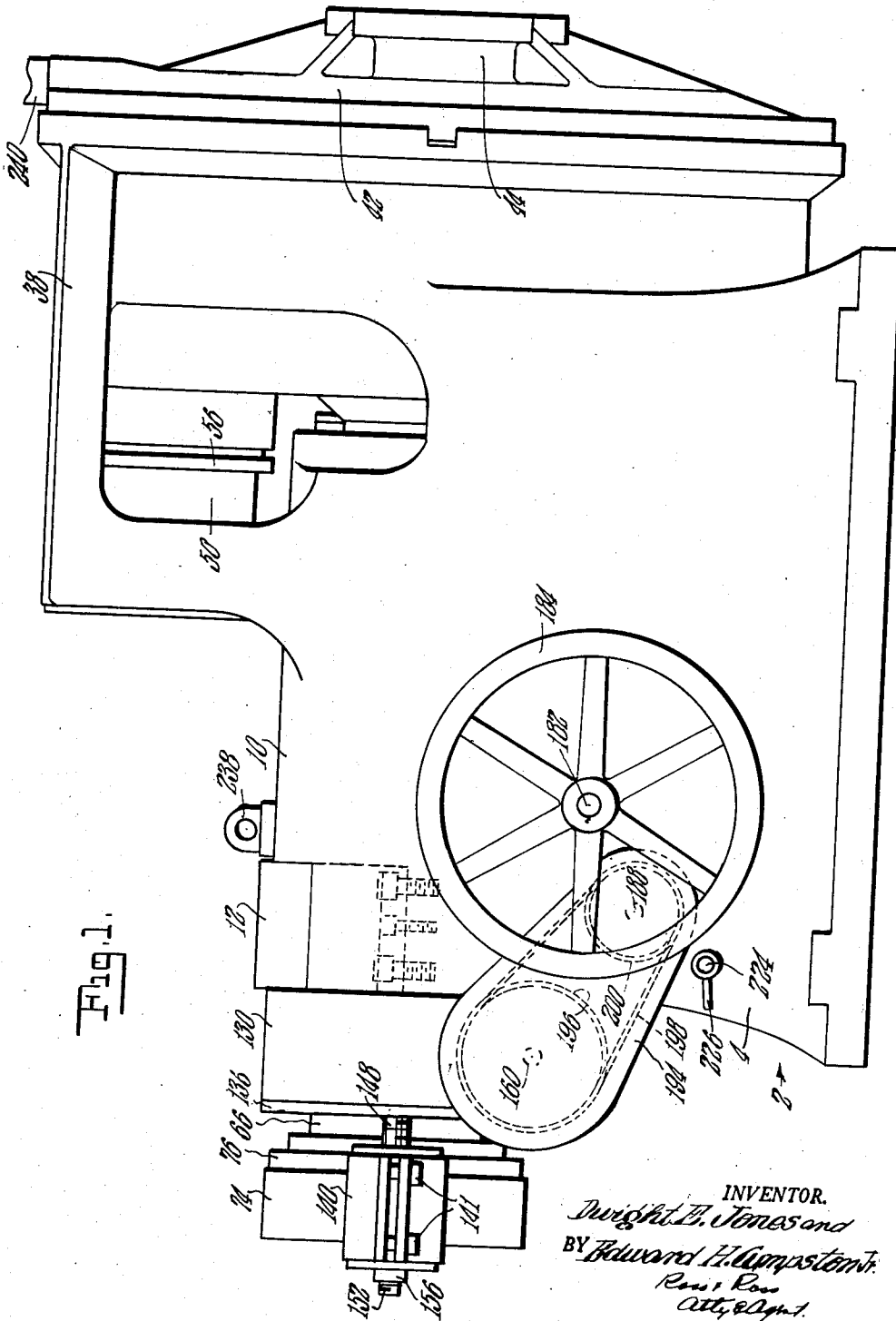
Sept. 28, 1954

D. E. JONES ET AL
REFINING APPARATUS

2,690,098

Filed Sept. 18, 1952

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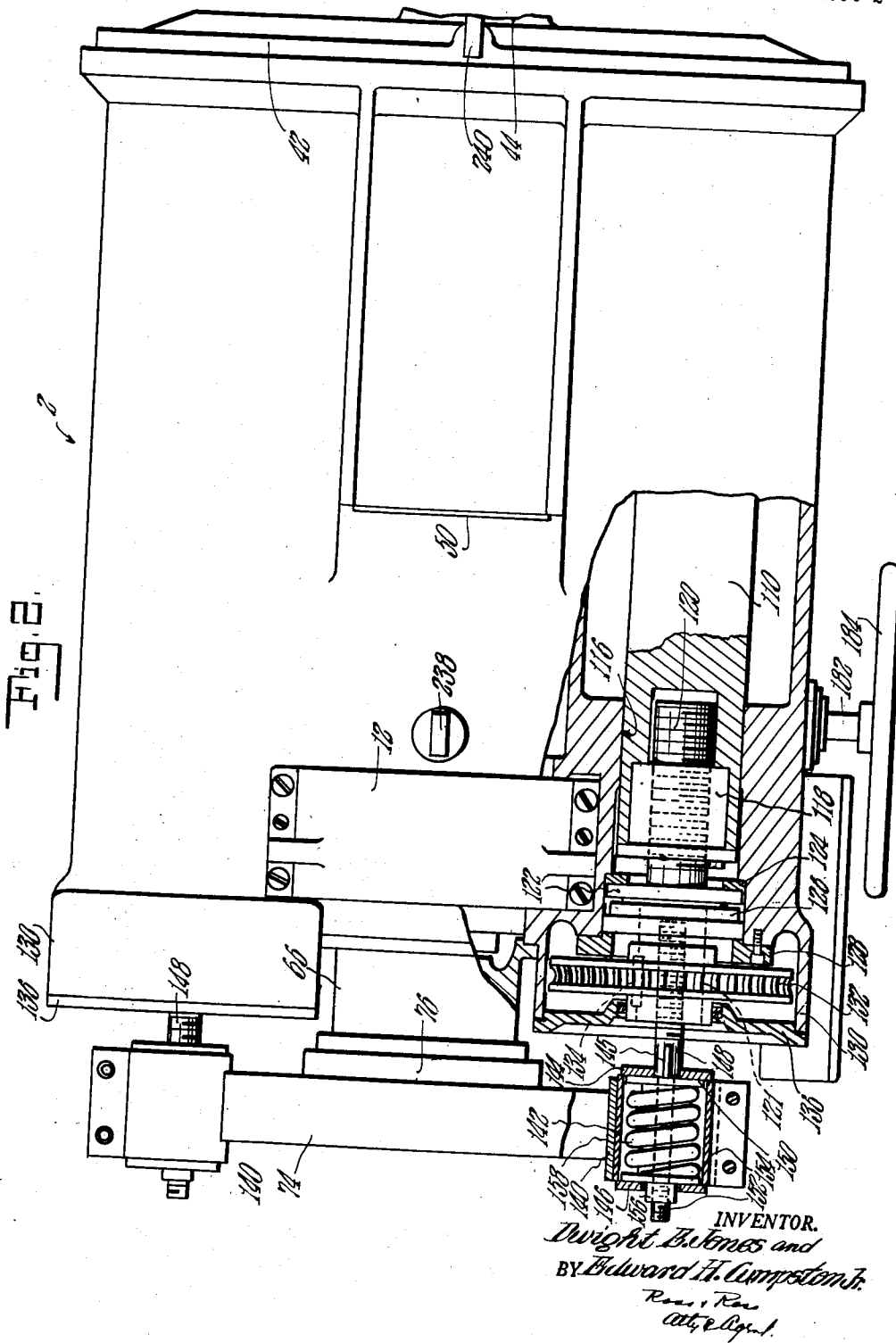
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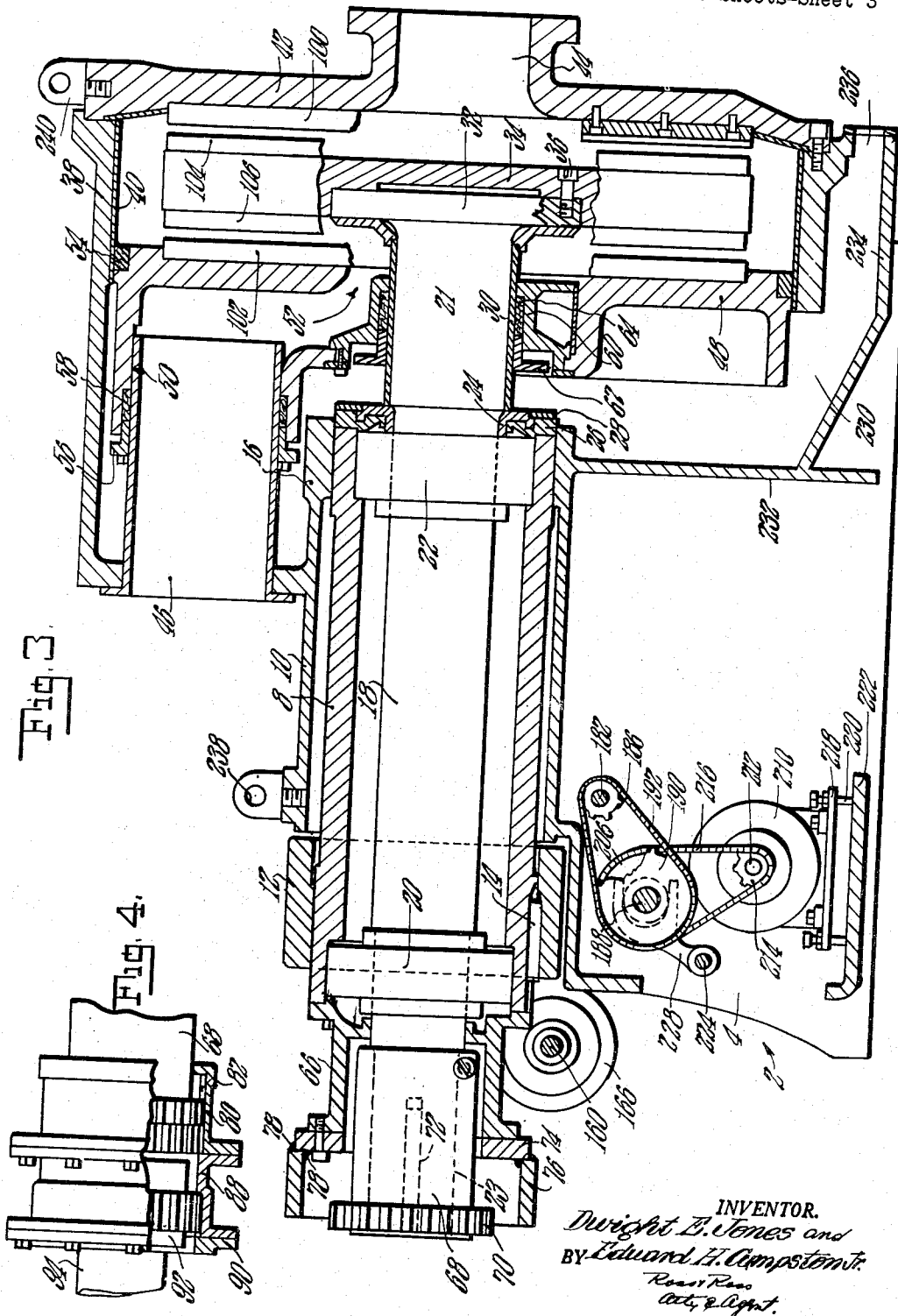
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Fig. 5.

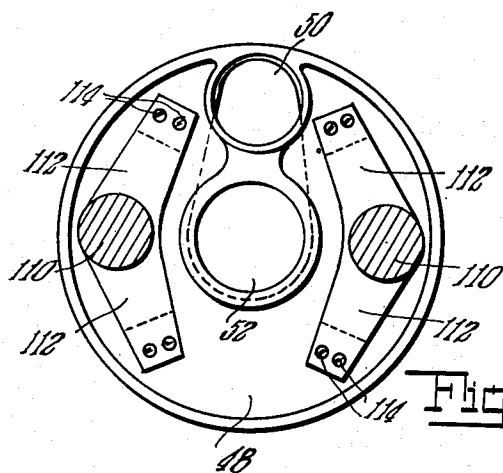
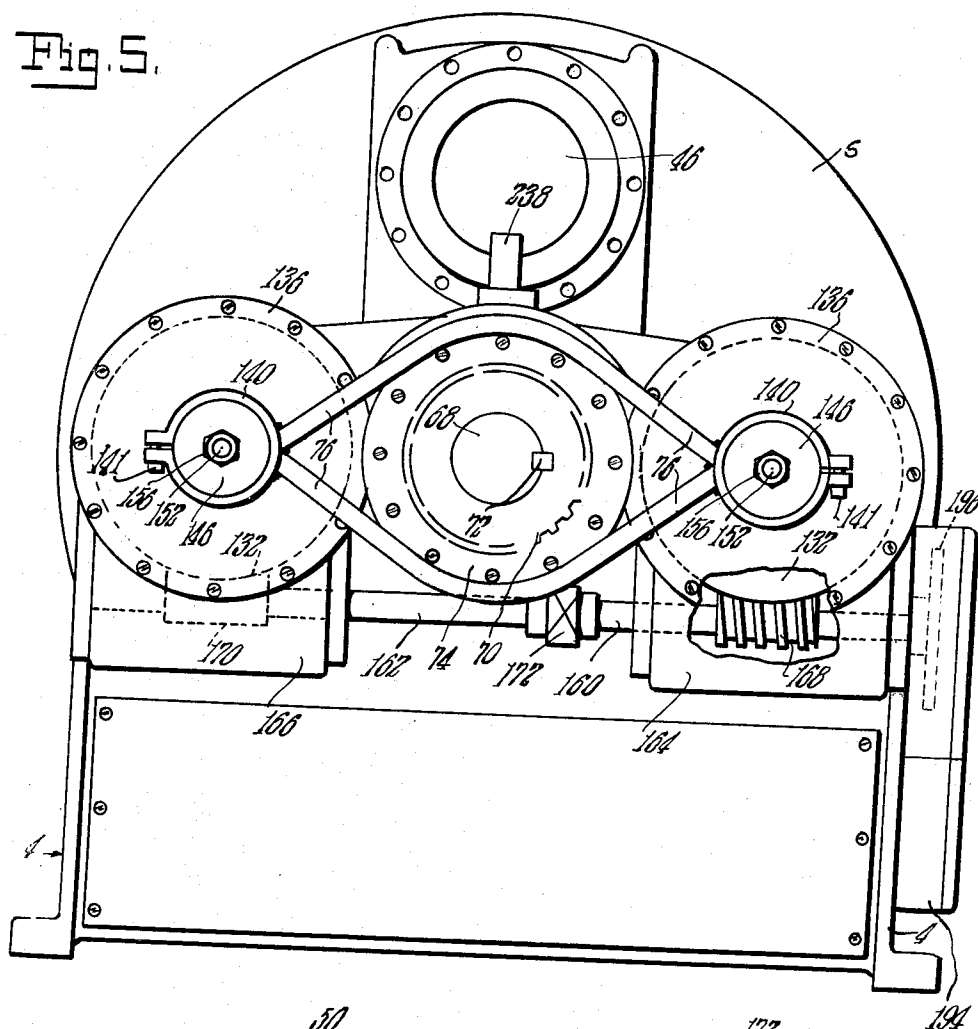


Fig. 6.

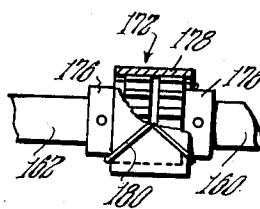


Fig. 5A.

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Fig. 7.

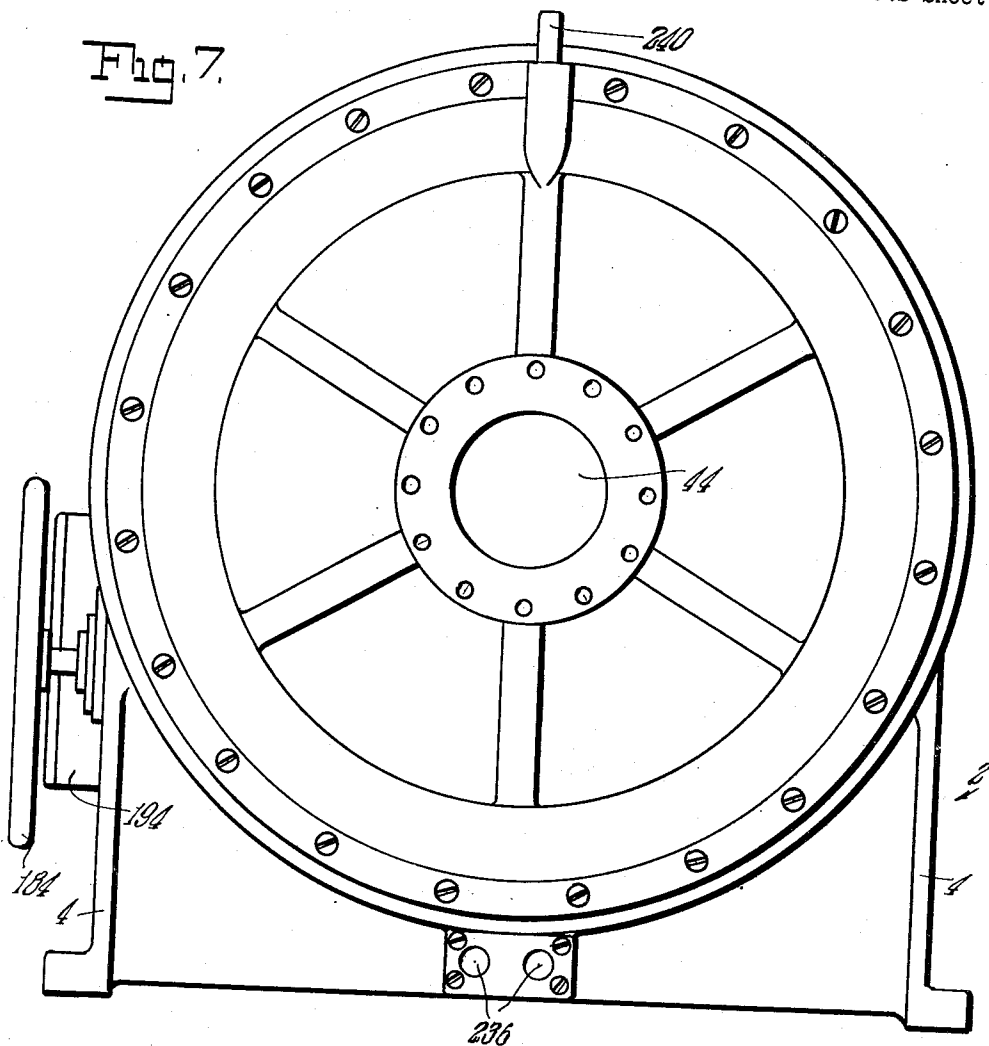
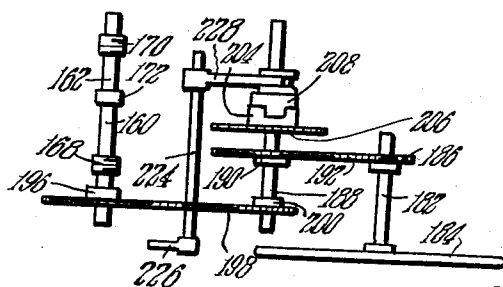


Fig. 8.



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REFINING APPARATUS

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12 Claims. (Cl. 92-26)

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This invention relates to improvements in refining apparatus adapted for refining or treating cellulose fibers and the like for paper-making and other purposes.

The machine of the invention is adapted for use other than for refining paper-making fibers such as an attrition mill for the reduction of grain, cereals and the like. Due to its novel features the machine is admirably suited for refining paper-making materials.

The apparatus is of the so-called "double disc" type where a rotatable disc is disposed between non-rotatable discs with blading on adjacent faces of the discs for the refining action. Stock is not necessarily pumped through the machine by the refining discs but rather by external means and it is possible to discharge refined material at such a pressure as facilitates the flow of stock to adjoining apparatus of some desired type.

Among important objects of the invention is the provision of a machine which is relatively short in length so as to occupy less space than former machines while at the same time the novel construction provides a refining capacity greatly in excess of prior art machines having refining discs of the same diameter.

As one feature of the invention, the mechanism for the relative adjustment of the refining elements is disposed at one end of the machine while the refining elements are disposed at the opposite or delivery end of the machine and said refining elements are operably supported in such a manner that any expansion caused by temperature condition takes place at the delivery end of the machine to obviate such distortion and the frame and machine components as would impair the operation of the machine.

As other features of the invention, the machine is characterized by internally developed and externally controllable pressures on the material being treated while pressure is continuously and uniformly applied during the refining operation.

Other novel features reside in the ability of the machine to be constantly worked under pressure so as to obviate the picking up of air which is common to other machines having a discharge free to atmosphere.

The machine while adequate in the field of refiners has simple and positive control throughout by external valve means and is provided with means for stabilizing the rotating shaft and disc assembly to obviate the necessity of heavy duty thrust bearings usual in other types of refiners.

As another feature of the invention, an outermost refining disc is fixed, the rotatable disc is adjustable towards and away therefrom and

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another non-rotatable inner disc is adjustable towards and away from the rotatable disc. This is accomplished by novel screw means for simultaneously adjusting the rotatable disc and the inner non-rotatable disc which is arranged and adapted to establish and maintain a predetermined relationship between the rotatable and non-rotatable discs.

As a still further novel feature of the invention, the working load is carried entirely within the machine structure which is unitary in character to avoid plural connected together components on separate supports which could result in misalignment and the like.

The components of the machine are constructed and arranged and connected together in such a manner that in initial assembly the utmost accuracy in alignment and relationship of the components is established and maintained.

Other various and numerous objects and advantages will be observed from the following description of the machine of the invention in the form at present preferred.

All of the above objects we accomplish by means of such structure and relative arrangements of parts thereof, as will fully appear by a perusal of the description below and by various specific features which will be hereinafter set forth.

To the above cited and other ends and with the foregoing and various other novel features and advantages and other objects of our invention as will become more readily apparent as the description proceeds, the invention consists in certain novel features of construction and in the combination and arrangement of parts as will be hereinafter more particularly pointed out in the claims hereunto annexed and more fully described and referred to in connection with the accompanying drawings wherein:

Fig. 1 is a side elevational view of a refining machine embodying the novel features of the invention;

Fig. 2 is a plan view of the machine shown in Fig. 1 with parts in section for clearness;

Fig. 3 is a longitudinal sectional elevational view through the machine shown in Figs. 1 and 2, and taken on the longitudinal center line thereof;

Fig. 4 is a side elevational view showing coupling means for coupling the main shaft of the machine to drive means;

Fig. 5 is an end elevational view of the rear end of the machine shown in Figs. 1 and 2;

Fig. 5A is an elevational view of a coupling of the worm shafts of the machine;

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Fig. 6 is a small scale elevational view of the rear side of the inner non-rotatable disc;

Fig. 7 is an elevational view of the front or delivery end of the machine shown in Figs. 1 and 2; and

Fig. 8 is a diagrammatic view, at small scale, of the operating connections of the adjusting mechanism.

Referring now to the drawings more in detail the invention will be fully described.

A frame or housing indicated generally by 2 which supports the components of the machine includes side walls 4, end walls 6 and other portions to be referred to as the description proceeds.

An elongated hollow quill 8 is provided which is slidable back and forth within a tubular portion 10 of the frame, see Fig. 3. A bearing 12 is provided in which the quill at its rear portion is slidable and held against rotation by means of a key 14. The forward end of the quill is guided for sliding movements in a bearing portion 16 of the frame.

A main shaft 18 is supported for rotation within the quill by spaced anti-friction bearings 20 and 22. The forward end of the quill 8 is sealed to the shaft 18 by means of interfitting parts 24, 26 and 28.

A forward part 21 of the shaft 18 is sheathed by a tubular member 30, and a flange or header 32 is provided on the forward end of said shaft part 21. A disc carrier 34 is secured to the forward face of member 32 as by screws or bolts 36. This is a rotatable carrier for refining discs.

A forward cylindrical part 38 of the frame is provided with a cylindrical lining 40 and an end head 42 is secured to the cylindrical forward end portion 38 of the frame and is provided with a discharge opening 44 for refined stock.

A tubular inlet 46 is provided in the upper part of the housing for stock to be refined and may be connected to any form of piping system desired. Similarly the outlet 44 may be connected to a piping system.

A reciprocable disc carrier 48 is reciprocable back and forth in the lining 40 and has an upper inlet opening 50 and a central opening 52, see Fig. 6. Packing means 54 around the periphery of the carrier at the forward end thereof seals the carrier in the lining 40 for sliding movements.

The inlet 46 is slidably received in the upper inlet opening 50 of member 48 and a gland 56 and packing means 58 shown in Fig. 3 is provided for sealing purposes as the carrier 48 slides back and forth relative to inlet 46.

A stuffing box housing 60 is secured to the carrier 48 around the opening 52 thereof and includes a gland 62 and packing means 64 to seal the sheath 30 for relative movements of the shaft part 21 relative to member 48.

A coupling housing 66 is secured to the rear end of the quill 8 and is tubular in form, see Fig. 3. A male coupling member 68 is fixed to the outer end 23 of the main shaft 18 and has a periphery in the form of an external gear 70. A key 72 fixes the member 68 against rotation on the shaft end 23.

A tubular female member 80 is provided with teeth 82 for meshing with the teeth 70 of member 68, see Fig. 4.

A tubular member 88 is bolted to the member 80 and has an end plate 90 bolted thereto. Said member 88 is provided with internal teeth, with which a coupling member 92 is in mesh. The member 92 may be fixed to the shaft 94 of a motor, not shown. The teeth 82 of the member 80

are elongated to permit longitudinal movements of member 68 as the quill 8 is moved longitudinally and the coupling arrangement is such that there are no undue strains imparted to the quill due to slight misalignment of the shaft 94 and quill.

An annulus 74 has pairs of relatively converging arms 76 fixed thereto as by welding indicated by 78 and said annulus is bolted to member 66, as shown.

As will be observed, the shaft 18 and quill 8 are relatively adjustable longitudinally while the said shaft is rotatable. The quill is non-rotatable, of course, by reason of key 14.

The front end member 42 on its inner rear side, the member 48 on its forward side and member 34 on forward and rear sides have refining discs 100, 102, 104 and 106 secured thereto. The shaft 18 and quill 8 are longitudinally adjustable as already described for positioning the adjacent faces of the cooperating refining discs in predetermined relationship.

Adjacent cooperating faces of the refining discs will be formed with blading or cutter bars of the desired form well known in the prior art and as an example such as shown in U. S. Patent No. 539,704 of May 21, 1895.

Means for simultaneously reciprocating the quill 8 and shaft 18 and thereby the refining disc carrier 34 and disc carrier 48 for relative adjustment of the refining discs will now be described.

Posts such as 110 disposed at opposite sides of the shaft 18 and quill are reciprocable in the frame and are similar in construction. Relatively diverging arms 112 extend from the forward ends of said posts 110 and have outer ends secured to the rear side of the disc carrier 48 by bolts or the like represented by 114, as best shown in Fig. 6.

The points of attachment of the arms 112 and carrier 48 are distributed about the periphery of the member 48 so that as the posts are urged forwardly, pressure is distributed over the said member 48. By means of machining or shimming between the arms and member 48 the forming between the arms and member 48 the forward face and refining discs may be accurately related to cooperating components.

The construction related to one of the posts will be described. The rear end of the post 110 is slidably guided in the rear end of the housing at 116 and is hollowed out as shown to receive an internally threaded nut which is fixed to the end of the post, see Fig. 2.

A primary screw 120 is in threaded engagement with a nut 118. A thrust collar 122 thereof is disposed between a washer 124 and an anti-friction bearing 126 held in the frame by a cap 128 secured thereto. The nut 118 is secured to the end of the post as by bolts or the like.

A cylindrical housing part 130 extends rearwardly from the main housing and a worm gear 132 disposed therein is fixed to a rear part 121 of the screw 120 and held against rotation by a key 134.

A cover 136 is fixed to the housing part 130 and sealing means is provided around the worm gear hub, as shown.

As the screw 120 is rotated in one direction or the other, the post 110 is moved thereby in one direction or the other so that the working faces of the discs 100 and 104 may be adjusted to predetermined relationship.

It will be understood that there are two posts such as 110 and duplicate mechanism for the posts at opposite sides of the main shaft and quill.

The members 76 previously referred to which diverge from the annulus 74 are secured at outer ends to split bands 140. Said bands 140 embrace a housing 142 which has forward and rear walls 144 and 146 secured thereto as by welding or in any desired manner.

A secondary screw 148 is in threaded engagement with the rear end 121 of screw 120 and has an outer portion in abutment with a spring seat 150 in the housing 142.

A reduced portion 152 of the screw 148 extends through spring seat 150 and an outer similar seat in the housing and has a nut 156 against the outer spring seat. A spring 158 is disposed around the screw part 152 between the spring seats, as shown.

A key 145 of screw part 148 in housing end 144 prevents relative rotation of screw 148 and the housing.

As previously stated, rotation of the worm gear 132 brings about endwise movement of the post 110. With the band 140 embracing the housing 142, the rotation of screw 120 by worm gear 132 brings about endwise movement of screw 148. Said screw 148 in threaded engagement with screw 120 brings about movement of housing 142. Said housing 142 being connected to the annulus 74 through arms 75 and the annulus being connected to the quill through 66, the quill is moved by movement of screw 148.

Thus by rotation of the worms 132 the posts and quill in which shaft 18 is rotatable are simultaneously moved longitudinally.

The pitch and hand of the screws 120 and 148 are arranged and adapted so that the quill is moved through a lesser distance than the posts 110 for the following reason. With reference to Fig. 3, assume that the working faces of discs 100 and 104 are a certain distance apart and the working faces of discs 102 and 106 are the same distance apart.

With this spacing in mind, assume it is desired to bring the adjacent working faces of the discs into closer relationship or into contact. This is accomplished by the arrangement of the screws which is such that the quill is moved through one-half the distance of the posts.

In other words, the screw arrangement is such that the members 34 and 48 are moved to bring the discs at opposite sides of member 34 into predetermined relationship.

The worm gear 132 shown in Fig. 2 and the one for the post at the other side of the machine are operated simultaneously by mechanism now to be described.

Worm shafts 160 and 162 are rotatable in housings 164 and 166 disposed below the housings 130 and have worms 168 and 170 fixed thereto which mesh with the worm wheels 132.

Said shafts 160 and 162 are connected by a coupling indicated by 172 which will be described with reference to Fig. 5A.

Gears 176 are fixed to inner adjacent ends of shafts 160 and 162 and are in mesh with the internal teeth of an annular sleeve or housing 178. The housing 178 is slidable axially from off one or both of the gears so that said shafts may be relatively adjusted angularly to adjust the relationship of the worms 132. The housing is held in place on the gears 176 by snap rings and is sealed by a tie member 180 as shown.

The shaft 160 is rotated by mechanism to be described in connection with Figs. 3 and 8. A shaft 182 is rotatable in the frame at a side thereof and has a hand wheel 184 fixed thereto

outside the frame and a sprocket 186 fixed thereto inside of the frame. A shaft 188 rotatable in the frame has a sprocket 190 fixed thereto which is connected by a chain 192 to the sprocket 186.

Worm shaft 160 extends into a housing 184 at an outside of the frame and has a sprocket 196 fixed thereto which is connected by a chain 198 to a sprocket 200 fixed to shaft 188. Thus, by rotating hand wheel 184 the worm wheels 132 are simultaneously rotated to bring about simultaneous movement of the posts and shaft carrying quill.

A clutch part 204 is fixed to shaft 188 and has a sprocket 206 fixed thereto. A clutch part 208 slidable and non-rotatable on shaft 188 is adapted to releasably engage clutch part 204.

A motor 210 which may have the desired low speed has a sprocket 214 fixed to the shaft 212 thereof which is connected by a chain 216 to the sprocket 206 of shaft 188. The motor 210 is secured to a base 218 which in turn is secured by bolts such as 220 to a lower transverse wall 222 of the frame.

A shifting rod 224 is reciprocable in the frame and has a manually engageable member 226 outside the frame. A shifting fork 228 fixed to the inner end of rod 224 is in operative engagement with the jaw clutch part 208 for engaging said part with jaw 204 and disengaging the same. With the clutch parts in engagement the worm shafts may be simultaneously rotated by the motor. Otherwise said shafts may be rotated by means of the hand wheel 184.

The split bands 140 around the housings 142 are adjusted by means of the bolts shown to frictionally embrace the housings in the desired manner.

In initially adjusting the relationship of the refining discs or in replacing a disc or discs, the bands 140 are loosened. The discs are then brought into the desired working relationship following which the said bands are tightened. Thereafter the refining discs are maintained in the correct and desired working relationship.

Material to be refined is introduced through inlet 46 and passes through opening 52 in member 48 so that it is acted upon by the cooperating faces of refining discs 102 and 106. The stock passes outwardly from between said discs and between discs 100 and 104 and finally outwardly through outlet 44.

While the quill and the posts are adjustable simultaneously, they are in effect yieldingly connected through the springs 158 which may be set to yield under predetermined load thus making it possible for the rotating discs 106 and 104 to be self-centering between stationary discs 100 and 102. Also should there be unequal wear between one pair of discs as compared to the other, the self-centering can take place regardless of the pressure between the discs without imposing an excessive thrust load on the quill bearings.

Since the mechanism for simultaneously adjusting the quill and posts axially includes yielding and frictionally engageable means between and connecting the quill and posts bearings and other parts are protected against injury in the event predetermined desired endwise pressures are reached or exceeded. And as a novel feature of the mechanism, the springs 158 and the bands 140 may be adjusted so as to yield under various predetermined conditions of pressure.

A duct 230 is formed by walls 232 and 234 having an outlet 236, see Fig. 3, for cleanout pur-

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poses and aperture members 238 and 240 are provided by which the apparatus may be transported.

It will be noted that the refining components are located at one end of the machine, such as the delivery end, and that the adjusting means is located at the opposite end. This is important for numerous reasons among which is the fact any expansion of parts in the vicinity of the refining elements due to elevated temperatures may take place without distortion of the frame generally and cause objectionable disturbance of the relationship of components.

An important feature relating to the assembly of the machine are the arms connecting the disc carrying member to the posts. An arm or arms may be scraped or a shim or shims placed between the arms and carrier to obtain the utmost accuracy in locating the carrier transversely relative to the longitudinal axis of the quill and shaft.

The invention may be embodied in other specific forms without departing from the essential characteristics thereof. Hence, the present embodiments are therefore to be considered in all respects merely as being illustrative and not as being restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all modifications and variations as fall within the meaning and purview and range of equivalency of the appended claims are therefore intended to be embraced therein.

What it is desired to claim and secure by Letters Patent of the United States is:

1. Refining apparatus of the double disc type comprising in combination, a support construction having an open forward end closed by an end member, a quill reciprocable in said support having a shaft rotatable and non-reciprocable therein which is provided with a forward disc carrier adjacent said end member, a rear disc carrier reciprocable in said support rearwardly of said forward carrier, refining discs on forward and rear faces of the forward disc carrier and refining discs cooperating therewith on the rear side of the end member and forward side of the rear disc carrier, elongated posts reciprocable in said support construction having longitudinal axes disposed in parallelism with and spaced at opposite sides from the longitudinal axis of said quill and shaft, means extending from the forward end of each of said posts having outer ends secured at circumferentially spaced points to the rear side of said rear carrier, and means for simultaneously reciprocating said quill and posts through predetermined relative distances disposed at the rear end of said support construction.

2. Refining apparatus of the double disc type comprising in combination, a support construction having an open forward end closed by an end member, a quill reciprocable in said support having a shaft rotatable and non-reciprocable therein which is provided with a forward disc carrier adjacent said end member, a rear disc carrier reciprocable in said support rearwardly of said forward carrier, refining discs on forward and rear faces of the forward disc carrier and refining discs cooperating therewith on the rear side of the end member and forward side of the rear disc carrier, elongated posts reciprocable in said support construction having longitudinal axes disposed in parallelism with and spaced at opposite sides from the longitudinal axis of said

quill and shaft, means extending from forward ends of said posts having outer ends secured at circumferentially spaced points to the rear side of said rear carrier, and means for simultaneously reciprocating said quill and posts through predetermined relative distances disposed at the rear end of said support construction, said means yieldingly connecting said posts and quill adapted to yield under predetermined conditions of end thrust.

3. Refining apparatus of the double disc type comprising in combination, a support construction having an open forward end closed by an end member, a quill reciprocable in said support having a shaft rotatable and non-reciprocable therein which is provided with a forward disc carrier adjacent said end member, a rear disc carrier reciprocable in said support rearwardly of said forward carrier, refining discs on forward and rear faces of the forward disc carrier and refining discs cooperating therewith on the rear side of the end member and forward side of the rear disc carrier, elongated posts reciprocable in said support construction having longitudinal axes disposed in parallelism with and spaced at opposite sides from the longitudinal axis of said quill and shaft, means extending from forward ends of said posts having outer ends secured at circumferentially spaced points to the rear side of said rear carrier, and means for simultaneously reciprocating said quill and posts through predetermined relative distances disposed at the rear end of said support construction, said rear disc carrier provided with an opening therethrough for material to pass to said refining discs and said support and rear disc carrier provided with sealed telescoping connections in communication with said opening.

4. Refining apparatus comprising in combination, a supporting structure having a cylindrical chamber at a delivery end thereof closed by an end member having an outlet, a refining disc carrier inwardly of said end member rotatable in the chamber, a second disc carrier inwardly of said first-named carrier reciprocable in the chamber, cooperating refining discs carried on adjacent faces of said end member and carriers, operating means inwardly of said first-named carrier mounted in said supporting structure for reciprocation and rotation of said carrier, other operating means rearwardly of said second carrier in said supporting structure for non-rotative reciprocation thereof relative to the first-named carrier, and adjusting mechanism at an opposite end of said supporting structure operatively connecting both said operating means, and other means for simultaneous reciprocation of said operating means through predetermined relative distances.

5. Refining apparatus comprising in combination, a supporting structure having a cylindrical chamber at a delivery end thereof closed by an end member having an outlet, a refining disc carrier inwardly of said end member rotatable in the chamber, a second disc carrier inwardly of said first-named carrier reciprocable in the chamber, cooperating refining discs carried on adjacent faces of said end member and carriers, operating means inwardly of said first-named carrier mounted in said supporting structure for reciprocation and rotation of said carrier, other operating means rearwardly of said second carrier in said supporting structure for non-rotative reciprocation thereof relative to the first-named carrier, and adjusting mechanism at an oppo-

site end of said supporting structure operatively connecting both said operating means, and other means for simultaneous reciprocation of said operating means through predetermined relative distances including yieldable means adapted to permit relative axial movements of the said operating means under predetermined conditions of axial pressure.

6. Refining apparatus comprising in combination, a supporting structure having a cylindrical chamber at a delivery end thereof closed by an end member having an outlet, a refining disc carrier inwardly of said end member rotatable in said chamber, a second disc carrier inwardly of said first-named carrier reciprocable in said chamber, cooperating refining discs carried on adjacent faces of said end member and carriers, operating means inwardly of said first-named carrier mounted in said supporting structure for reciprocation and rotation of said carrier, other operating means rearwardly of said second carrier in said supporting structure for non-rotative reciprocation thereof relative to the first-named carrier, and adjusting mechanism at an opposite end of said supporting structure operatively connecting both said operating means and other means for simultaneous reciprocation of said operating means through predetermined relative distances, said supporting structure provided with a stock inlet intermediate opposite ends thereof and said second carrier provided with an opening therethrough with connections between said inlet and openings in all positions of the said carrier relative to the supporting structure.

7. Apparatus according to claim 4 wherein the means for reciprocating and rotating the second-named carrier includes an elongated quill reciprocable and non-rotatable in the supporting structure having a shaft rotatable therein to the forward end of which said first-named carrier is secured.

8. Apparatus according to claim 4 wherein the means for reciprocating and rotating the second-named carrier includes an elongated quill reciprocable and non-rotatable in the supporting structure having a shaft rotatable therein to which said first-named carrier is secured, and said other operating means includes posts at opposite sides of and in parallelism with said quill reciprocable in said supporting structure having forward ends connected to the second carrier by arms extending between said posts and carrier.

9. Refining apparatus comprising in combination, a supporting structure having a forward end provided with a chamber closed by an end member having an outlet, a rotatable and reciprocable disc carrier inwardly of said end member and a reciprocable non-rotatable disc carrier inwardly of said first-named carrier, cooperating refining disc on adjacent faces of said end member and carriers, a quill rearwardly of the first-named carrier reciprocable in said supporting structure having a shaft rotatable therein supporting said carrier, a pair of posts parallel to and at opposite sides of said quill reciprocable in said supporting structure supporting said second-named carrier on forward ends thereof, primary screw members threadedly and axially engaging rear ends of said posts, and means holding said screw members against axial movement relative to said supporting structure, secondary screw members threadedly and axially engaging rear ends of the first-named screw members, operating means for simultaneously rotating said primary screw members for reciprocating said posts, connections between said secondary screw members and quill holding said screws against rotation arranged whereby the quill is reciprocated simultaneously with the posts, said primary and secondary screw members so arranged that in all positions of the disc carriers the distance between them and the distance between the first-named carrier and end member are equal.

10. Refining apparatus set forth in claim 9 wherein the operating means includes intermeshing gearing fixed to the primary screws and to separate rotatable shafts which are operatively connected by adjustable coupling means.

11. Refining apparatus comprising in combination, a supporting structure having a rear end and a forward end provided with a chamber closed by an end member having an outlet, a rotatable and reciprocable disc carrier inwardly of said end member and a reciprocable non-rotatable disc carrier inwardly of said first-named carrier, cooperating refining disc on adjacent faces of said end member and carriers, a quill rearwardly of the first-named carrier reciprocable in said supporting structure having a shaft rotatable therein supporting said carrier, a pair of posts parallel to at opposite sides of said quill reciprocable in said supporting structure supporting said second-named carrier on forward ends thereof, primary screw members threadedly and axially engaging rear ends of said posts, and means holding said screw members against axial movement relative to said supporting structure, secondary screw members threadedly and axially engaging rear ends of the first-named screw members, operating means for simultaneously rotating said primary screw members for reciprocating said posts, housings held against rotation on outer end portions of said secondary screws and preloaded springs in said housings held on the said portions of the screws between outer extremities and inner portions thereof, and rigid connections between said housings and outer end of said quill, all adapted and arranged whereby the simultaneous reciprocation of the posts and quill is effected through said springs.

12. Refining apparatus comprising in combination, a supporting structure having a cylindrical chamber at a delivery end thereof closed by an end member having an outlet, a primary refining disc carrier inwardly of the end member rotatable in the chamber, a secondary disc carrier inwardly of said primary carrier reciprocable in the chamber, cooperating refining discs carried on adjacent faces of the end member and said primary and secondary carriers, primary operating means disposed inwardly of said primary carrier for the reciprocation and rotation thereof, secondary operating means disposed rearwardly of said secondary carrier for non-rotative reciprocation thereof relative to said primary carrier, and adjusting mechanism operatively connecting said primary and secondary operating means.

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