

Jan. 9, 1923.

1,441,707.

C. H. OSLUND.
CONTINUOUS WIREWORKING MACHINE.
FILED APR. 6, 1921.

4 SHEETS—SHEET 1.

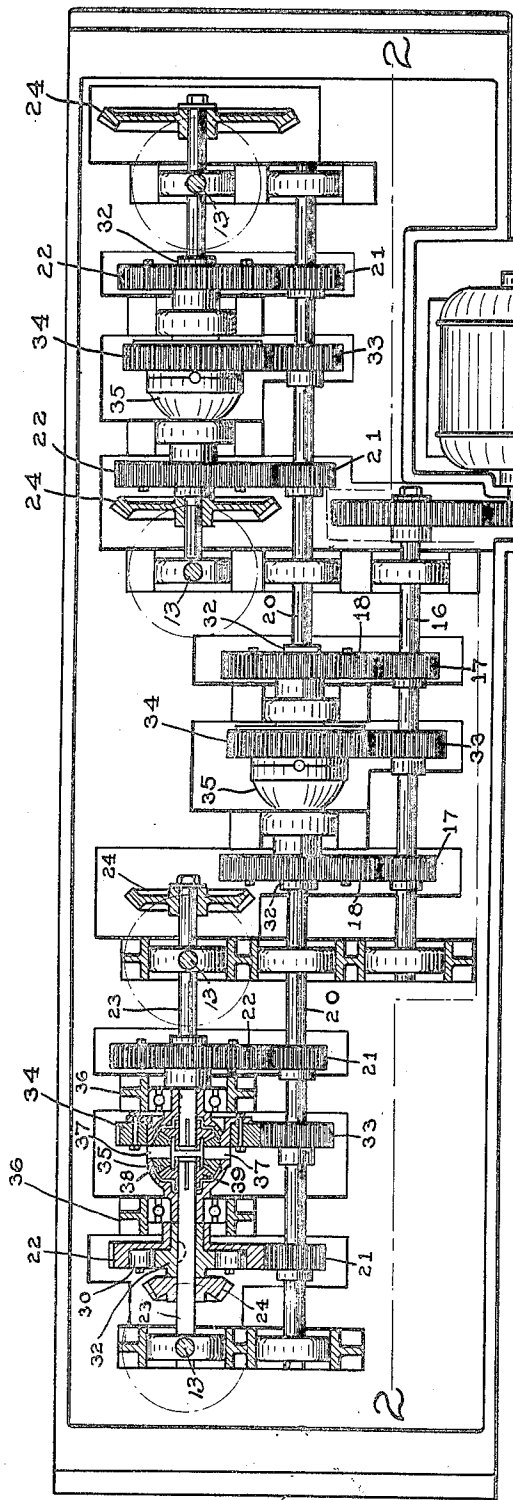


Fig. 1.

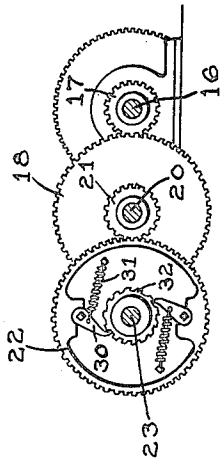


Fig. 3.

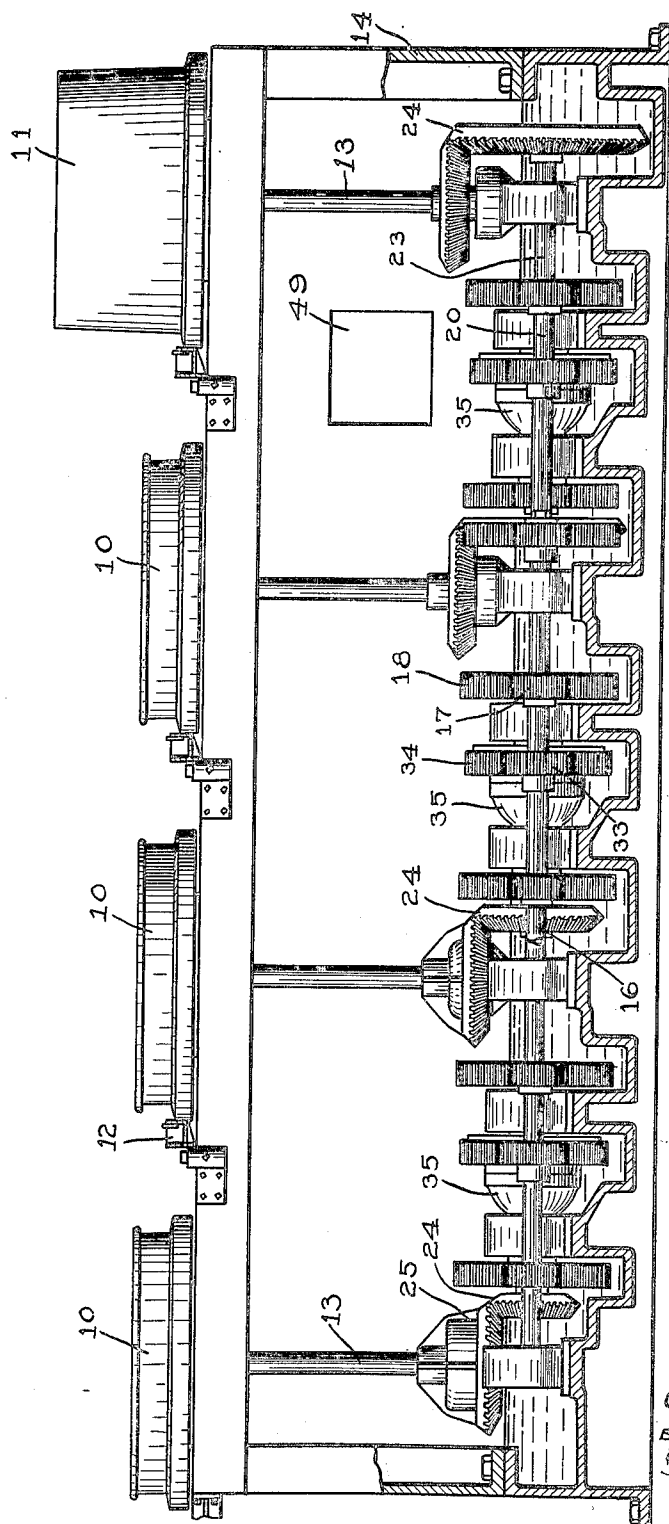
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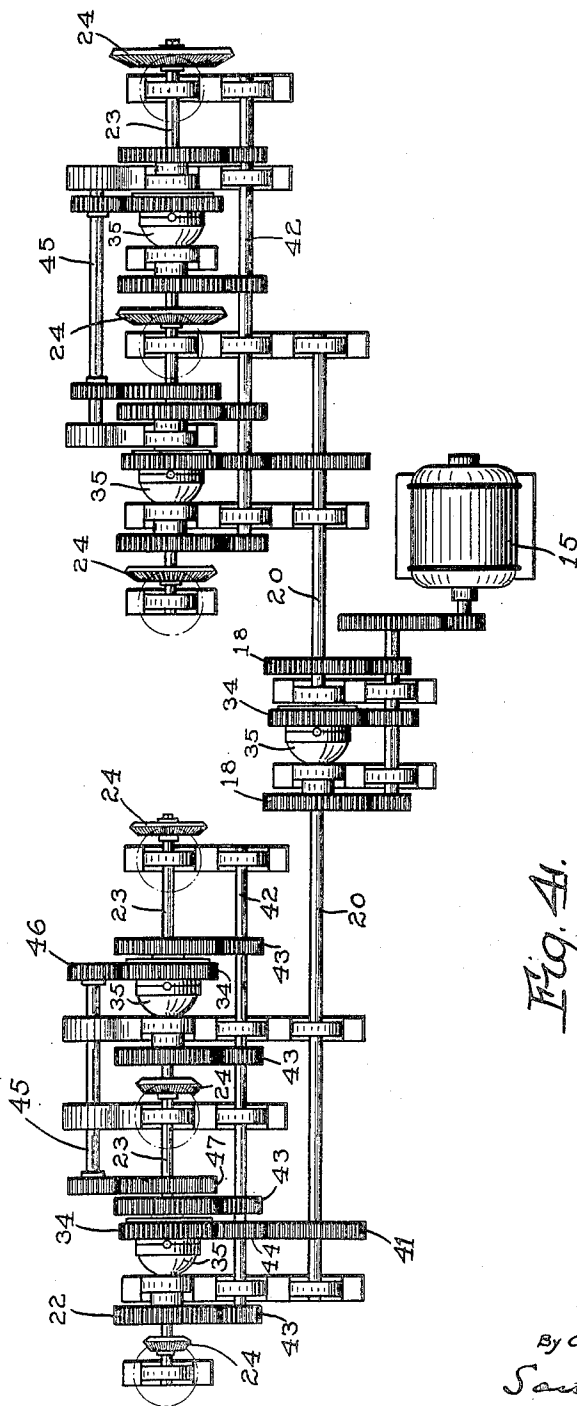
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4 SHEETS—SHEET 3.



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4 SHEETS—SHEET 4.

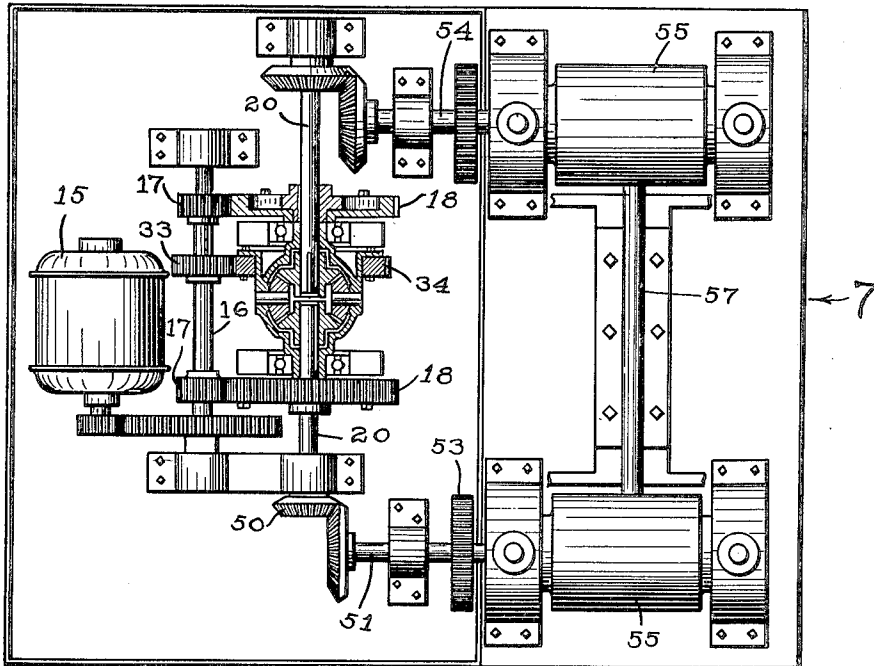


Fig. 5.

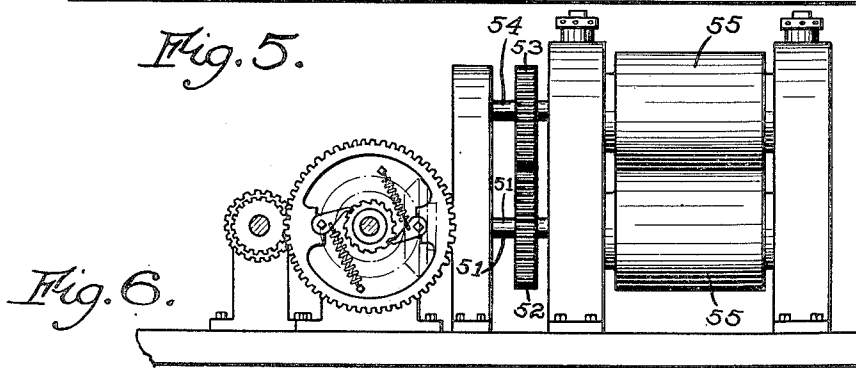


Fig. 6.

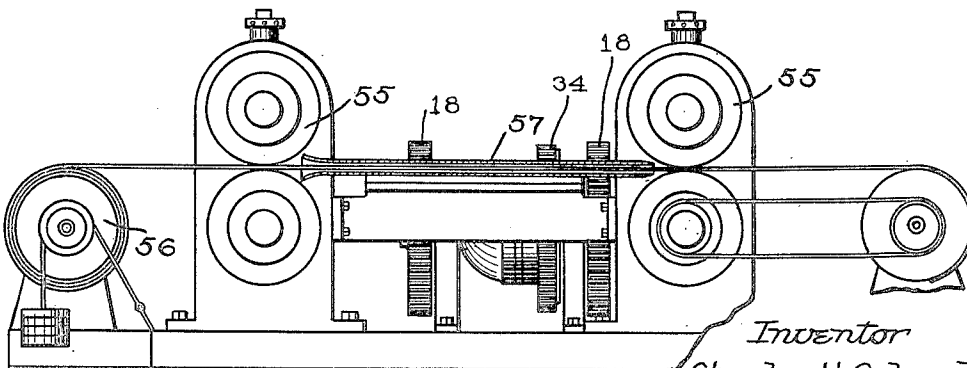


Fig. 7.

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UNITED STATES PATENT OFFICE.

CHARLES H. OSLUND, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO THE O AND J MACHINE COMPANY, OF WORCESTER, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

CONTINUOUS WIREWORKING MACHINE.

Application filed April 6, 1921. Serial No. 459,027.

To all whom it may concern:

Be it known that I, CHARLES H. OSLUND, a citizen of the United States, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Continuous Wireworking Machine, of which the following is a specification.

This invention relates to the wire working art. It is capable of use for the drawing and rolling of wire and rods in a heated condition but is especially designed for the manipulation of the metal in a cold state.

The principal object of the invention is to provide a continuous machine in which the several rolls or drawing drums will be driven positively at all times and yet the increase of drag on any roll or drum of the machine will be compensated for automatically and instantly. By providing a positive drive and doing away with frictional constructions I am enabled to draw wire in a continuous manner through any desired number of dies, and roll it continuously through a plurality of pairs of rolls thus greatly reducing the expense of the operation and the amount of machinery and floor space required. Other features of advantage will appear hereinafter.

Reference is to be had to the accompanying drawings in which—

Fig. 1 is a plan of a continuous wire drawing machine constructed in accordance with this invention designed for operating four wire drawing drums;

Fig. 2 is a longitudinal sectional view of the same on the line 2—2 of Fig. 1;

Fig. 3 is an elevation of a part of the mechanism;

Fig. 4 is a view similar to Fig. 1 showing the invention arranged for operation with six wire drawing drums;

Fig. 5 is a plan of a rolling mill with a practical embodiment of this invention applied thereto;

Fig. 6 is an end view of the same, and

Fig. 7 is a side elevation looking in the direction of the arrow 7 in Fig. 5 and showing the wire or rod guide in section.

As is well known, the drawing of wire through dies by the use of a corresponding

number of drums on which the wire is wound is a process that, for large sizes of wire at least, is usually carried out by means of a separate machine or section for each drum and die. The reason for this is that on account of extremely slight variations in the quality of the wire, and the wearing of the dies the drums are not required to rotate at exactly the same speed at all times and if they did they would result in many breakages of the wire. It is not possible, either, to figure out mathematically the exact ratio between the speeds of the different drums necessary to compensate for the slightly differing sizes of the dies operating on the wire being run through in a continuous process.

One of the problems that has resulted in the expenditure of perhaps the greatest amount of money and inventive genius in the wire drawing industry is to provide a continuous cold drawing machine suitable for large sizes of wire and capable of automatically compensating for the difficulties above mentioned.

By my invention I have provided a positive acting means by which any one of the series of wire drawing drums can automatically rotate slower than the rest or slower that its normal speed practically at all times in order to compensate for any resistance that it meets. At the same time the mechanism is of such a nature that it can be located in a casing entirely below the drums away from the heat which is set up on their surfaces by the wire drawing operations. Furthermore, the mechanism can be located in a big oil pocket at the bottom and lubricated by running constantly in oil, thus being capable of running practically indefinitely without reoiling.

Many similar difficulties in continuous rolling are overcome in a similar way as will appear.

In the form shown in the first two sheets I have illustrated a wire drawing machine in which there are three drawing-through drums 10 and the usual winding drum 11. These receive the wire through the dies in the die holders 12 in the usual way and can be geared to the same circumferential speed

or to a gradually increasing speed if desired. These drums, as is usual, are mounted on four vertical shafts 13 extending down into a casing 14.

5 The whole device is shown as driven by an electric motor 15, although any driving means may be employed. The motor drives positively a shaft 16 located at the bottom of the casing. This shaft is shown as provided with two pinions 17 of the same size, 10 each meshing with a gear 18 mounted freely on the hub of a ratchet wheel 32 which is located on a longitudinal shaft 20 and keyed thereto. These two shafts are in alignment 15 with each other and abut substantially together at their adjacent ends but are capable of rotating separately.

On the shaft 16 is a third driving gear 33, larger than the pinions 17, and meshing 20 with a gear 34. The gear 34 is smaller than the gears 18 and constitutes means for driving a differential 35 by which the shafts 20 are driven in a manner to be described more in detail below. It is necessary, in 25 accordance with this invention, to provide for constantly driving both of these shafts 20 at the same speed through the gears 33 and 34 and the differential, when subjected to the same resistance, and to drive them at 30 different speeds through the gears 17 and 18 whenever the resistance varies, all driving operations being positive.

If this invention is applied to a two drum machine, each of the drums, and therefore 35 each of the two vertical shafts 13 in that case, will be geared to one of the shafts 20. In the form shown, however, I have illustrated each of these shafts 20 as serving the same purpose as the shaft 16, namely to 40 transmit power constantly to another shaft. Therefore, each of the shafts 20 is provided with a pair of pinions 21 of the same size meshing with two gears 22 of equal diameter. These two gears 22 run loosely 45 on the two shafts 23 which are located in alignment with each other. Each of the shafts 23 is provided with a bevel gear 24 which meshes with a bevel gear 25 on the bottom of one of the shafts 13. In the form 50 shown these bevel gears 24 are of gradually increasing diameter from one end of the machine to the other for the purpose of providing for increased speed of the wire as it is drawn. The gearing on both sides of 55 the machine in connection with the shafts 23 at the right and left is the same, as is the gearing used in connection with the shafts 20 at the center in the form here illustrated.

60 Each gear 22 is provided with a pawl arrangement, in this case shown as a pair of pawls 30, each pressed by a spring as 31 against the surface of a ratchet wheel 32. Each ratchet wheel is positively fixed to the 65 shaft 23 and if for any reason the pawls

are caused to positively engage the teeth of the wheel they will positively drive the shaft 23. However, in ordinary operation the pinion 21 drives the gear 22 at a certain speed and the mechanism which will now 70 be described drives the shaft 23 at a higher speed so that normally these pawls do not drive anything. It is to be understood that the pawls are located on all four of the gears 22 and on the two gears 18 and in 75 each case they turn in the same direction, that is, forwardly.

On each of the shafts 20, and also on the shaft 16 as stated above, there is another pinion 33 keyed to the shaft and larger than 80 the respective pinions 21 and 17. This pinion in each case, meshes with a gear 34 which is a part of a differential. On account of the relative sizes of the pinions mentioned the gear 34 rotates faster than 85 the gear 22 or gear 18 under normal conditions. The gear 34 is fixed to a casing 35 which is mounted to rotate in ball bearings carried by brackets 36 on the frame, preferably supported from the base thereof. 90 This casing carries a pair of transverse studs 37 in central alignment with each other and transverse to the two shafts 23 or 20 as the case may be. On each of these studs 37 is a bevel gear 38 and each of these 95 bevel gears meshes with two bevel gears 39 located opposite each other fixed to the respective shafts 23 or 20.

This will be recognized as an ordinary differential commonly used in automobiles and 100 in various other arts. The rotation of the gear 34 at a speed greater than the gears 22 carries the bevel gears or pinions 38 with it at this speed. When the resistance is the same on both sides these two shafts will be 105 rotated at the same speed by the positive planetary rotation of these two pinions 38. Although I have mentioned two, it will be obvious that four or any other convenient number can be used. These shafts 23, therefore, are rotated normally at the same speed. 110 The several drums 10 and 11 are thus rotated at the same speed if desired, but in the present case at gradually higher speeds. The rotation of each of these drums and this driving mechanism is constant normally but 115 let it be presumed that an increase in drag occurs on one of them, as for example, let us say on the last drum to the left in Figs. 1 and 2. This might be caused by an 120 increase in the diameter of the wire coming to it, due to faulty drawing in the previous machine, or to a hard spot in the wire or lack of proper lubrication. Now the result of this drag is to put an un- 125 usual resistance on the drum and tend to retard the rotation of the first shaft 23 and the smallest bevel pinion 24, inasmuch as the last spur gear 22 at the left is the one relied upon for driving this drum in ques- 130

tion. It is to be noted that during the normal operation the ratchet wheels 32 keyed on the shafts 23 have been rotating faster than these gears 22 which carry the pawls 30. These pawls therefore, have performed no function, but have simply been rotating idly at a faster speed and therefore slipping over the teeth of the ratchet wheel. Now the retarding of this left hand shaft 23 results in the shifting of the differential in a manner that is well understood in the art. While the differential still positively drives the left hand shaft 23, it allows the right hand shaft 23 to go more rapidly. The gear 22 on the left continues to rotate at its normal and ordinary speed while the shaft 23 tends to slow up.

The result is that the ratchet pawl 30 on that gear, which under normal circumstances performs no function, will catch up with the slower rotating ratchet wheel 32 and drive it positively at a lower speed than normal. This action will continue as long as the drag is not compensated for but as soon as the difficulty stops the gear 34 will immediately take up the load and rotate both shafts 23 faster than the gear 22 and the teeth of the ratchet wheel 32 will immediately be seen to draw away forwardly from the pawls 30 so that they again will continue to rotate idly over the teeth of the wheel 32. This is the normal operation.

Although I have described the operation of the left hand section and indicated how the parts drive the left hand drum 10 in case of difficulty, it is to be understood that all the shafts 23 and both of the shafts 20 are operated and controlled in exactly the same way.

I have shown in Fig. 4 a plan of a machine for driving six drums in the same way. In this case the changes are comparatively immaterial. The shafts 20 are merely lengthened out and driven in the same way as before. In this case they do not directly support the spur pinions which drive the differentials and the drums directly, but they are provided with a gear 41 which, in turn, meshes with a pinion 44 on an intermediate shaft 42. This shaft 42 is provided with four pinions 43 of one size and smaller than the pinion 44, the large pinion meshes directly with the gear 34. The two final driving shafts 23 are connected by an intermediate shaft 45 having two pinions 46 of the same size, one of which receives power from the shaft 23 through the gear 47, and the other of which drives at the same speed the other gear 34. In other words, two differentials 35 are used, one for driving one drum and the shaft 45, and the other for driving two drums. On account of the use of a well known form of differential or any equivalent thereof, no time is lost in resetting the parts or allowing them to get into position

for normal operation. This description refers to the driving of the two shafts 20 and it will be obvious that the same operation takes place in driving either of the two pairs of shafts 23 from the shaft 20.

In the form shown in Fig. 4 the two shafts 20 are driven in the same way as in Figs. 1 and 2. Each one of them also drives a shaft 42 at a constant speed through the gears 41 and pinions 44 keyed to this shaft. The several gears 22, four of which are shown in each half of the machine, are thus driven positively just the same as the gears 22 in the other figures. However, the gear 41 and loose pinion 44 drive a left hand differential gear 34 at a higher speed just as the differential gear 34 is driven in Fig. 1. Furthermore, the right hand differential gear 34 is also positively driven at this higher speed through the gear 47 and the shaft 45 and gears 46. Therefore, each one of the three shafts connected with the bevel gears 24 to be operated thereby is controlled automatically in the same way as described above in connection with the four drum construction.

It is to be observed that I have provided a construction in which all the shafts in either form shown can be arranged in a plane at a low level in the bottom of the casing 14 and that all the differentials and other gears on these shafts can run in a bath of oil located in the bottom of the casing. I merely provide an oil hole 49 for replenishing this supply and this will not have to be done except at very long intervals. By placing the gearing so far from the drums and in a large oil well I have eliminated the problems of heating and lubrication above mentioned and avoided the difficulties due, in many old constructions, to the drawing-through drums containing the driving gearing.

In the form of the invention shown in the last sheet it is applied to a rolling mill for the purpose of rolling rods or wire, and I have shown it in connection with two pairs of rolls. It is to be understood, however, that it can be expanded in manners indicated in the other figures to apply to a larger number. In this form the arrangement is substantially the same as shown in Fig. 1 having a motor 15 driving a shaft 16 on which are three gears. Two of these gears 17 are of small size, and one gear 33 is of larger size. They mesh respectively with gears 18 and 34.

Each of these gears 18 is provided with a ratchet arrangement shown in Figs. 3 and 6, the details of which will not be described again. The two gears 18 are loose on two shafts 20 which are connected by a differential shown as of the same type as in the other figures. These two shafts deliver power to bevel gears 50, each of which drives

a shaft 51 having on it a gear 52 driving a gear 53 of the same size on a parallel shaft 54.

On the two shafts 51 and 54 are the rolls 55 between which the wire is drawn. The two rolls of a pair, of course, will rotate at the same speed, but the speeds of the rolls of the two pairs will change automatically as in the case of the drawing machine. In this case, the wire is taken from a drum 56, between the first two rolls 55 through a guide 57, then between the second pair of rolls 55 and delivered.

The results and advantages are substantially the same as indicated above, as the difficulties with continuous rolling mill construction have been very similar to those encountered in connection with continuous wire drawing apparatus. In this construction I am enabled to drive each pair of rolls positively at all times and yet, in case of resistance encountered by one pair, they can slow up for a short period and be driven at a lower speed but still positively. The wearing out of the surface of friction driving devices is of course eliminated and the impossibility of properly lubricating such frictional driving devices does not arise. The drive is always positive and the changes take place automatically in accordance with the resistance encountered by each individual pair of rolls.

The provision of a separate shaft for driving each pair of drawing-through drums or each pair of couples of rolls is an important feature of this invention. In that way each of these separate shafts 20, 42 or 45 can be driven in connection with another through an additional differential. Or, if only two pairs of rolls are being driven, the separate shaft, as 16 in Fig. 5, will be driven positively just as the first shaft 16 is in the other forms. This is an improvement over the driving of all the differentials in a single series, because in that case all the resistance would have to be borne by the first one. That would prevent that one working easily. If too much total resistance were encountered all along the line the first differential would be likely to work so hard as to cause breaks in the wire, particularly if fine wire were being drawn.

It is to be understood, of course that this invention is not limited to the driving of any particular number of drums or rolls nor to the particular kind of differential illustrated. I am aware of the fact also that many other modifications can be made in the details of construction of the parts without departing from the scope of the invention as expressed in the claims. Therefore, I do not wish to be limited in these respects but

What I do claim is:—

1. In a wire working machine, the combination of a set of rotary devices for han-

dling a single length of wire and delivering it from one to another in a continuous manner, a separate shaft for driving each of said devices positively, a wheel loose on each of said separate shafts, a differential directly connected to two of said shafts, means for driving said differential at a higher speed than that of the separate shafts, and means connected with said wheels for picking up and positively driving their respective shafts therefrom at a lower speed, whenever they meet resistance enough to slow them down through the differential.

2. In a wire working machine, the combination of a pair of rotary devices for handling a wire in a continuous manner, a separate shaft for driving each of said devices positively, a third shaft, means for driving the third shaft positively, a gear loose on each of said separate shafts, a differential connected with said separate shafts, means connected with the third shaft for positively driving said gears and for driving said differential at a higher speed, whereby said separate shafts will be driven by the differential normally and positively, and means connected with said gears for picking up and positively driving their respective shafts at a lower speed, whenever they encounter abnormal resistance.

3. In a wire drawing machine, the combination with a set of drawing-through-drums, and shafts therefor, of means for rotating each drum at its normal speed comprising a set of differential gearing connected to directly drive two shafts and permit either of the drums to slow down under excessive strain, and means for automatically driving the slowed drum positively and individually and independently of the differential gearing at a lower speed than normal.

4. In a continuous wire drawing machine, the combination with the drawing-through-drums and separate shafts therefor, of a set of differential gearing connected with said shafts to drive two of them normally at predetermined speeds, but capable of allowing either of said two to slow up when excessive resistance is applied to it, without interrupting the rotation of the other of the two by the differential, and means for automatically driving the slowed shaft positively and independently of the differential and of the other separate shaft.

5. In a continuous wire working machine, the combination with a set of rotary wire handling devices and the same number of separate shafts, each having means for positively driving one of said devices, certain of said shafts being located end to end, a set of differential gearing connected with the adjacent ends of each two of said shafts so located as to drive both of them normally at equal predetermined speeds, but capable of allowing either of them to slow up when

excessive resistance is applied to it, without interrupting the rotation of the other shaft by the differential, and means for automatically taking up the driving of the slowed shaft and driving it positively and independently of the differential as long as the resistance continues to act.

6. In a wire working machine, the combination with a pair of separate shafts arranged end to end, and rotary devices for handling and advancing a wire continuously, a third shaft, means for driving the third shaft positively, a gear loose on each of said separate shafts, a differential connected with said shafts, means connected with the third shaft for driving said gears and for driving said differential at a higher speed, whereby said shafts will be driven by the differential normally and positively, and means connected with said gears for picking up and positively driving their respective shafts at a lower speed, whenever they encounter abnormal resistance.

7. In a continuous rolling mill, the combination with a plurality of pairs of rolls arranged in series, a shaft geared to drive both rolls of each pair positively, a set of differential gearing connected with said shafts to drive them normally at predetermined speeds, but capable of allowing either of them to slow up when excessive resistance is applied to it, without interrupting the rotation of the other by the differential, and means for automatically driving the slowed shaft positively and independently of the differential and of the others of said separate shafts.

8. In a wire working machine, the combination of a pair of rotary devices for handling a wire in a continuous manner, a separate shaft for driving each of said devices positively, a third shaft, means for driving the third shaft positively, a gear loose on each of said separate shafts, a differential connected with said shafts, a gear for driving the differential, two equal gears on the third shaft for driving said loose gears, a larger gear on the third shaft for driving said differential at a higher speed, whereby said shafts will be driven by the differential normally and positively, and means connected with said gears for picking up and positively driving their respective shafts at a lower speed, whenever they encounter abnormal resistance.

9. In a continuous wire working machine, the combination with a plurality of rotary wire handling devices and the same number of separate shafts arranged in pairs located end to end, each shaft having means for positively driving one of said devices, a single set of differential gearing positively connected to the adjacent ends of each pair

of said shafts arranged to drive them normally at equal predetermined speeds, but capable of allowing either of them to slow up when excessive resistance is applied to it, without interrupting the rotation of the other shaft by the differential, a gear loose on each shaft of each pair having normally inoperative means for automatically taking up the driving of the slowed shaft and driving it positively independently of the differential as long as the resistance continues to act, a third shaft, two gears on the third shaft for driving each pair of separate shafts and a third gear on the third shaft connected to drive the differential positively at a higher speed.

10. In a wire working machine, the combination of a plurality of rotary devices for handling a single length of wire and delivering it from one to another in a continuous manner, a plurality of pairs of separate shafts each pair connected to drive two of said devices positively, a gear loose on each shaft of said pair of separate shafts, a single differential connected with both of said shafts and comprising a third gear, means for driving said loose gears positively, means for driving said differential gear at a higher speed, and means connected with said loose gears for picking up and positively driving their respective shafts therefrom at a lower speed, whenever said separate shafts meet resistance enough to slow them down through the differential.

11. In a wire working machine, the combination of a plurality of rotary devices for handling a single length of wire and delivering it from one to another in a continuous manner, a plurality of pairs of separate shafts, each pair connected to drive two of said devices positively, a gear loose on each shaft of said pair of separate shafts, and a single differential connected with both of said shafts.

12. In a continuous wire working machine, the combination with a plurality of rotary wire handling devices and the same number of separate shafts arranged in pairs located end to end, each shaft having means for positively driving one of said devices, and a single set of differential gearing positively connected to the adjacent ends of each pair of said shafts arranged to drive them normally at equal predetermined speeds, but capable of allowing either of them to slow up when excessive resistance is applied to it, without interrupting the rotation of the other shaft by the differential.

In testimony whereof I have hereunto affixed my signature.

CHARLES H. OSLUND.