

Dec. 20, 1927.

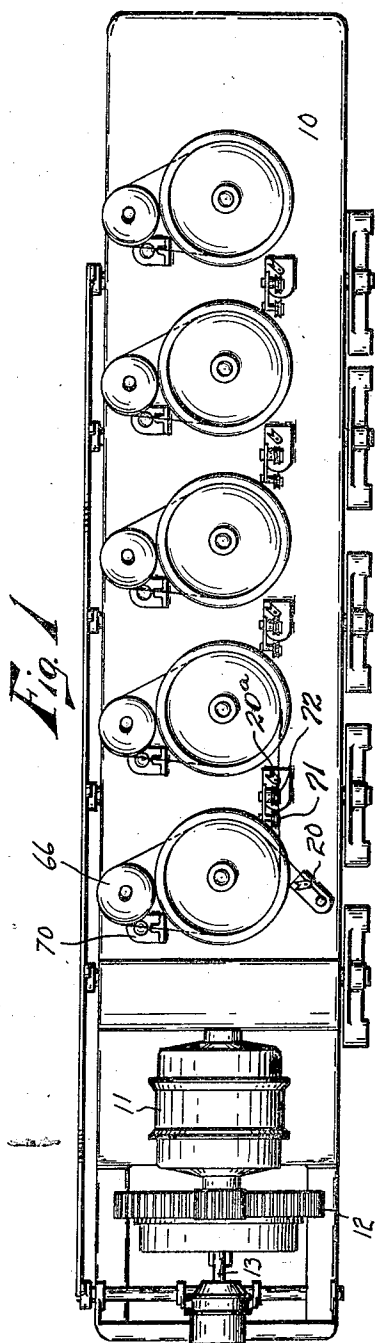
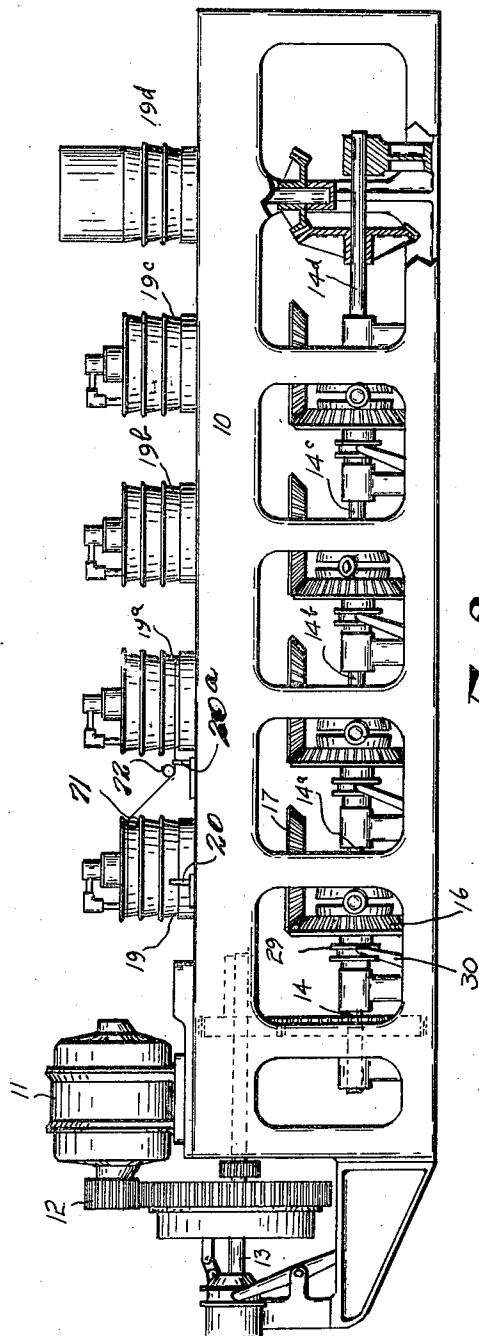
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1,653,097

MULTIPLE CONTINUOUS WIRE DRAWING MACHINE

Filed Nov. 9, 1923

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

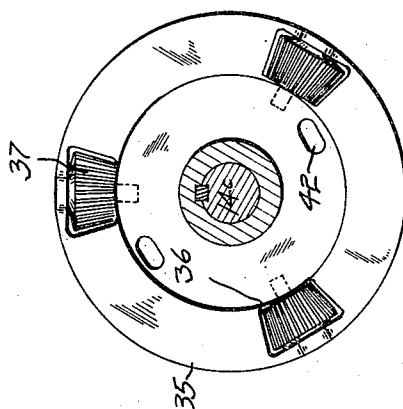


Fig. 4

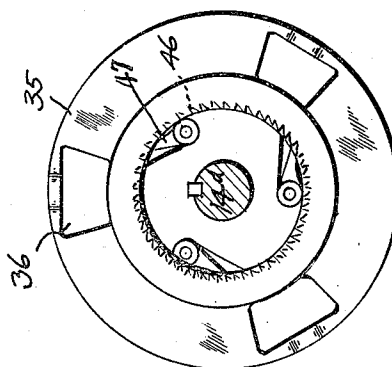


Fig. 5

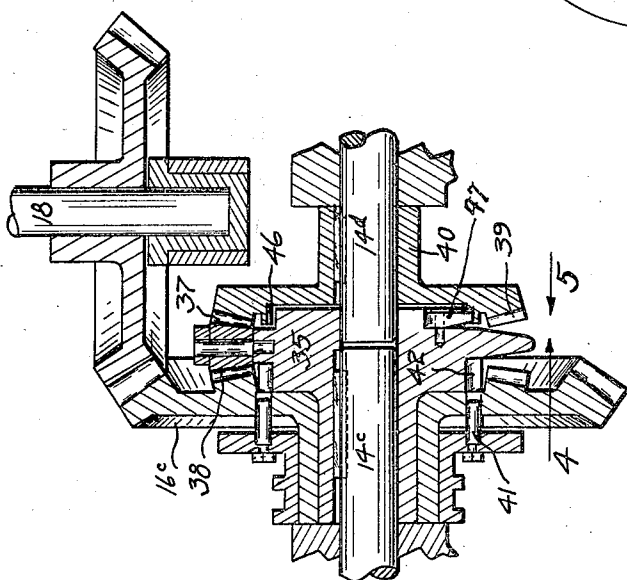


Fig. 3

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3 Sheets-Sheet 3

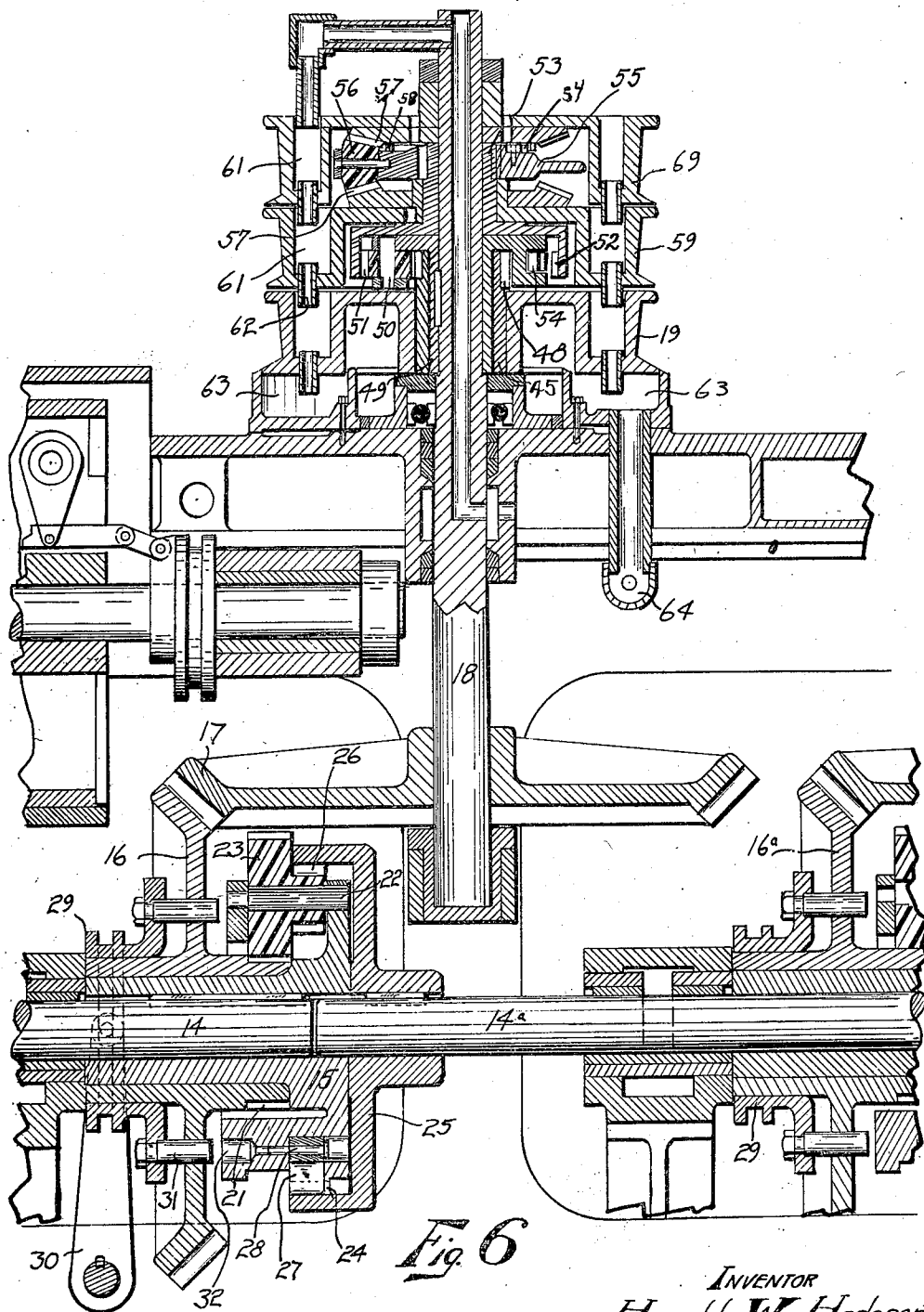


Fig. 6

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MULTIPLE CONTINUOUS-WIRE-DRAWING MACHINE.

Application filed November 9, 1923. Serial No. 673,733.

This invention relates to a multiple machine for continuous wire drawing. The principal object of the invention is to provide a wire drawing bench with means whereby the wire can be drawn consecutively through a large number of holes, as for example fifteen, without materially enlarging the bench over that that would be required for drawing wire through five holes.

Another object of the invention is to provide a machine of this character capable of drawing through one, two, three, four, five, six, eight, nine, ten, twelve or fifteen holes at the option of the operator. This is accomplished by using what is known as the slinger block on each of the vertical shafts of the machine and employing on it only drawing through drums and not providing it with any winding drum except on the last shaft, but, on the contrary, taking the wire from the last drum on one slinger block and drawing it through the first drum on the next one. The slinger block is also modified by arranging a specific relationship between the gears to provide for drawing without slipping on the drums. The invention also involves the provision of a locking device in the slinger block to facilitate stringing up and having other functions, as will appear.

Additional objects and advantages of the invention will appear hereinafter.

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

Fig. 1 is a plan of a wire drawing bench constructed in accordance with this invention;

Fig. 2 is a side view of the same;

Fig. 3 is a sectional view showing the connection of the last two of the sectional shafts with each other;

Figs. 4 and 5 are opposite face views of a portion of the same taken in the direction of the arrows 4 and 5 respectively in Fig. 3; and

Fig. 6 is a central sectional view through the first slinger block and its driving mechanism and showing how the next shaft of the sectional series is driven.

This invention is designed to apply the principles set forth in U. S. Patent No. 865,679 granted to Woodhouse Carter and

Edwin Hodgson on September 10, 1907, in such a way as to efficiently draw the wire through a much larger number of dies than they contemplated and also involves the invention set forth in my prior application for patent, Serial No. 646,687 filed June 30, 1923, which sets forth certain gearing relationships and other combinations by which the principles of the said Carter and Hodgson patent may be carried out in such a way as to avoid slipping and consequent disadvantages. This invention involves the application of the same principle to a different number of drums and furthermore its extension to the so-called slinger multiple block and the combination of the same in such a way as to make possible a great extension of the continuous wire drawing art as set forth above.

I have shown the invention as applied to a machine comprising a wire drawing bench 10 and operated by a motor 11 through change speed gearing 12 connected with a shaft 13 and driving a shaft 14 which I will call the first of a series of sectional shafts. It will be noted that other shafts are shown as located in alignment with this numbered 14^a, 14^b, 14^c, 14^d. These five shafts in the present instance constitute the main sectional driving shaft for the machine and, as is the case in the above mentioned patent, they are connected together by differential gearing.

In a machine such as that shown in the drawings having five or more dies I use a small sun gear in the first, second and third planetary gears, a large planet gear on the first section, and a smaller planet gear on the second section and a slightly smaller one at the third section. In the fourth planetary gear I use the combination of two gears so arranged that each has an equal distribution of power or pull and for that reason I can simplify this fourth differential.

On the first sectional shaft 14 is keyed a member 15 for carrying the planetary pinions. This member has a cylindrical hub on which is freely mounted to rotate independently thereof a bevel gear 16 constantly in mesh with a bevel gear 17 fixed on a vertical shaft 18. This mechanism is used for rotating the first drawing through drum

19 of the first slinger block and the drawing through drums 59 and 69 thereof to draw the wire through the first set of die blocks in the holder 20. Integrally mounted, preferably by being cut on the shank on this bevel gear, is a sun gear 21. The flange of the member 15 carries in this case three studs 22 on each of which is a planetary pinion 23. These planetary pinions constantly mesh with the gear 21 which they surround and they also have integral pinions 26 thereon which mesh with an internal gear or rack 24 mounted on a hub 25 keyed on the next length of shaft 14^a. With resistance on both shafts 14 and 14^a they both rotate, the former being the driving and the latter the driven shaft. It is to be noted that the internal gear 24 bears a ratio to the sun gear 21 of $2\frac{2}{3}$ to 1 or 8 to 3 as shown. On the member 15 are pivoted pawls 27 three of them being used preferably. These pawls are located to swing freely on pivots 28 carried by the member 15. Centrifugal force is depended upon whenever the machine is running at working speed, for throwing them out into a position to engage in the gear 24 whenever the wire breaks or is running off. In that case these pawls transmit the power positively without any let-up in the operation of the machine.

I also provide a sliding collar 29 on the hub of the gear 16 adapted to be operated by a rocking lever 30 to move it back and forth. On this collar are pins 31, shown as two in number, movable through the web of the bevel gear into slots 32 in the member 15. This constitutes a locking device for locking the gear 16 to the member 15, and therefore to the shaft 14. This is provided to facilitate stringing up the machine as will be obvious to those skilled in the art. It also can be used for the purpose of performing the function of the pawls 27. In other words, the pawls 27 constitute an automatic means for operating the machine positively in case of the end of the wire going on through the first or any succeeding die and thus driving the machine continuously. If these pawls were not used when the wire end came through the first or any succeeding die, that sun gear would revolve and the planet gear and the remainder of the machine would be stationary. These pawls automatically prevent that occurrence. If the pawls are not used, or if for any reason they should not work, the locking device can be manipulated by hand and the operation continued in that way. However, it is not intended that that should be done and the pawls constitute the simplest means for operating the rest of the machine when the wire is running off.

The shaft 14^a is provided with a gear 16^a for driving the next drum in the same way as has been described, and it is also provided with a pinion member 15, locking device 29,

and a differential just as described above, except that the ratio is slightly smaller. In this case the internal gear on the hub 25 attached to the shaft 14^a bears the ratio to the sun gear on the hub of the gear 16^a on the shaft 14^a of $2\frac{3}{8}$ to 1, or 19 to 8. Now the shaft 14^a becomes the driving shaft for the driven shaft 14^b. The other features and operation are the same at this point.

For the purpose of driving the next shaft 14^c from the shaft 14^b, which now becomes a driving shaft I use the same arrangement but with a speed ratio of $1\frac{7}{8}$ to 1 or 15 to 8. But for driving the last shaft 14^d from the shaft 14^c I find that while a differential gear is required, it is not necessary to have a difference in the speed ratio, and in fact these two shafts should be so connected by the differential that equal power can be obtained from the other side. In other words to secure an equal gear ratio in this construction I have simplified the construction as shown in Figs. 3 to 5 adopting some of the features above described.

On the shaft 14^c is keyed a member 35 which is provided with a comparatively thin periphery having perforations 36 for a plurality of bevel pinions 37, three being shown in the present instance. These bevel pinions are mounted on radial axes as is well understood in this art and they constantly mesh with a bevel gear 38 integral with the bevel gear 16^c which corresponds with the bevel gear 16, previously described and is intended to drive the drum 19^c in the same way.

The bevel pinions 37 also mesh with a bevel gear 39 of the same size as the bevel gear 38 and the same number of teeth. This bevel gear 39 is on a hub 40 keyed to the shaft 14^d. In this case this differential works similar to the sun gear differential shown in Fig. 6 except that the power transmission is equal on both sides. The device is provided with locking pins 41 entering slots or depressions 42 in the member 35 and operated in the same way as described above and for the same purposes. An internal rack 46 is also employed with pawls 47 the same as in the other device in all respects.

I have referred to the use of the so-called slinger block. It is to be understood however that I do not use the ordinary slinger block but provide certain improvements in connection therewith as will appear. I will describe one of these blocks on the shaft 18. It has at the bottom the drawing through drum 19 which runs loose on a cage 49 which is keyed to the shaft or spindle 18 and therefore rotates positively with it. This drum is provided with a hub 45 keyed to it which carries a small sun gear 48. The cage carries studs 50 on which are pinions 51 meshing with an internal rack 52 on a bushing 53 freely rotatable on the spindle 18. These pinions also mesh with the sun gear 48.

There are pawls 54 engaging this rack 52 like the pawls shown at the bottom of Fig. 6. The drum 19 is rotated from the spindle 18 through the differential and that differential is arranged to provide a gear ratio of 17 to 8 or $2\frac{1}{8}$ to 1. On the bushing 53 is loosely mounted the second drum 59 of this slinger block, so-called.

On this bushing 53 there is keyed a cage 55 which is provided with a series of bevel pinions 56 meshing with two equal bevel gears 57 on opposite sides, one of them fixed on the drum 59 and the other connected with the top drum 69 which, instead of being a winding drum, as in any ordinary slinger block, is a drawing through drum. On account of this arrangement this drawing through drum 69 is geared to the drum 59 at an equal speed ratio. There are also the pawls 54 for meshing with the rack 58 on the cage 55 for the same purpose as the similar pawls above described. The object of using this combination of gearing in the slinger block is to avoid slipping of the wire on the drums when drawing through a number of holes consecutively. As the elongation of wire is controlled by the differential gears when using single drums, the same controlling medium functions when using multiple drums. As the pull of the wire on a single drum controls the speed of the succeeding drums, so does the pull on the wire of two or three drums on the same spindle control the speed of the succeeding two or three drums of another spindle geared to it by differential gearing. All the drums are drawing through drums except the top drum on the fifth spindle, which is used as the winding drum preferably, no matter how many drafts are being made.

For the purpose of cooling the drums effectively I have shown the spindle 18 as hollow and provided with a passage for conducting water to the top of the spindle. This is then conducted down through the three drums of the slinger block inside their wire drawing and holding surfaces, these drums being provided with internal spaces 61 for receiving the water. The water is drained out from each drum into the drum below through drain pipes 62 and from the last drum into a receiving space 63 and the outlet pipe 64 as shown in my U. S. Patent, No. 1,390,714. This prevents excessive heat on each drum and eliminates the possibility of the figure 8 being formed by the wire. It also enables the machine to be run faster than it would otherwise.

Operation.

To draw the wire continuously on this machine, the wire is taken at a large size and reduced through a series of dies on draw plates 20 to a much smaller size. In the actual drawing of the wire more power is re-

quired to draw the first reduction than any of the succeeding ones. On account of the standard sizes of dies and wire now used, sufficient power or pull has to be transmitted through the first differential to drive all the succeeding reductions. Not as much power or pull is transmitted through each succeeding differential as the wire gets smaller and smaller. Therefore the smaller is the ratio in the differentials as we near the finishing point.

A length of wire sufficient to reach the usual wire holder on the first or bottom drum of the first vertical shaft is first drawn through the first die or draw plate 20 by any known means. The end of the wire is fastened to the wire holder on the top of the third drum on the first spindle and led down through grooves or slots to the bottom drum. The machine is then started at a slow speed through the gearing 12. It will be found that the three drums on the first spindle stand still while the rest of the machine is running. Then on account of the fact that the bevel gears are free to rotate on the cage which carries the planetary pinions, resulting in the sun gear being held stationary, the planetary pinions revolve around it and drive the internal gear at increased speed. The first locking lever 30 is now pressed into position to lock the first set of sun and planetary gears into a solid drive. Now the first set of slinger drums commences to turn. The machine is run preferably until there are about six turns of wire around the bottom drum 19 on the first spindle. Then the machine is stopped and the wire is loosened from the wire holder. Two turns of wire are taken off the first drum, passed around the lower guide pulley 66 at the rear of the machine, then by the usual means through a die in a die holder 70 at the rear. The wire is now led into the wire holder as before mentioned and led through a groove or slot so that the wire will move on the second drum.

The machine is started again at slow speed with the locking lever and locking plate left in locking position. The drums on the first spindle now rotate freely. The machine is run until a similar quantity of wire is wound on the second drum 59, then the operation repeated, the wire being passed around the upper of the two guide pulleys 66 at the rear through the upper die in the die holder 70 at the rear. The previous operation is repeated until six turns of wire are wound on the top drawing through drum 69 on the first spindle.

When sufficient turns of wire are wound on the top drawing through drum 69 on the first spindle 18, the locking pins on the slinger drum are pushed in to connect up the drum positively. The wire is loosened out of the wire holder, two turns of wire taken

from the top drum and the wire is passed over and under the two guide pulleys 71 and 72 on the front of the machine. From there it goes through the second die or die holder 20^a on the front of the machine and to the first drum on the second spindle. The previous operations are then repeated over and over until the whole machine is strung up.

On reaching the finishing size of wire it is fastened on the winding drum 19^d. The section of the shaft 14^d for driving this drum has no sun and planetary gearing. The machine is started at slow speed here and allowed to run until the wire is tight between the drums and then the several locking plates are all released by hand and the machine is started up at high speed. The sun and planetary gears are controlled in operation by the wire and there is no slipping on the drums.

If the machine is required to be used as a single hole machine, the top winding drum on the fifth spindle can be used. For two hole work the second drum and top winding drum on the fifth spindle can be used or the top drum on the fourth spindle and the winding drum on the fifth spindle to get the same results. From this simple explanation it will be seen that an operator can arrange the device to draw either one, two, three, four, five, six, eight, nine, ten, twelve or fifteen holes at one continuous operation by using the multiple drums on the spindles. It is not advisable to use one drum on the fourth spindle and the three drums on the fifth spindle for four hole work as the pull of the wire on the fourth spindle would not balance the pull of the wire on the three drums on the fifth spindle. It is better to use the two top drums on the fourth and fifth spindles or the top drums only on the second, third, fourth and fifth. In such case each drum would then control the speed of the succeeding drum or drums through the differential gearing on the line shaft.

Although I have shown herein a certain mechanism disclosed in my prior application, No. 646,687, filed June 20, 1923, I do not claim herein the said mechanism except in combination with features not illustrated and described in that application.

Although I have shown and described only a single form of the invention I am aware of the fact that modifications can be made therein by any person skilled in the art without departing from the scope of the invention as expressed in the claims. Therefore I do not wish to be limited to all the details of construction or to the acknowledged old forms of wire drawing elements herein shown and described but what I claim is:—

1. In a multiple continuous wire drawing machine, the combination with a series of

shafts for drawing through drums, an equal number of shafts arranged to be driven one from another in series, a gear loosely mounted on the driving end of each of said shafts and having means for driving its drum shaft positively therefrom, differential gearing for driving each sectional shaft from the next one, the first differential comprising a small sun gear and a large planet gear, the intermediate differentials each comprising a relatively small sun gear and a planet gear slightly smaller than the planet gear of the next differential toward the driving end of the sectional shaft, the last differential having an equal speed ratio, a series of drawing through drums mounted on each of the first named shafts, the first one having a differential with a speed ratio by which the second drum is speeded up higher than the first one, and a third drum being geared to the second through a differential at an equal speed ratio.

2. In a continuous wire drawing machine, the combination with a series of shafts arranged to be driven one from another in series, differential gearing for driving each shaft from the next one, the speed ratio of the differential gearing between the first two shafts being 8 to 3, the corresponding ratio between the second and third shafts being substantially as 19 to 8, the speed ratio between the third and fourth shafts being 15 to 8 and that between the last two being equal, whereby the wire will be drawn without slip on the drums, a series of transverse shafts equal in number to the sectional shafts, means for driving each transverse shaft positively from its sectional shaft, means for differentially connecting the first drum on each transverse shaft with that shaft to rotate it at a relative speed of 17 to 8, differential gearing for driving the second drum of each of said transverse shafts from the first one at a speed ratio of 17 to 8, to the transverse shaft, and differential gearing for driving the third drum on each of the transverse shafts from the second one at an equal speed ratio.

3. In a continuous wire drawing machine, the combination with a series of shafts arranged to be driven one from another in series, of differential gearing for driving each shaft from the next one, a series of transverse shafts equal in number to the sectional shafts, means for driving each transverse shaft positively from its sectional shaft, a series of drawing through drums on each of the transverse shafts, means for connecting the first drum on each transverse shaft with that shaft to rotate differentially, differential gearing for driving the second drum of each of said transverse shafts from the first one at a speed ratio of 17 to 8 and differential gearing for driving

the third drum on each of the transverse shafts from the second one at an equal speed ratio.

4. In a wire drawing machine, the combination with a shaft, of three drawing through drums on the shaft, differential gearing for connecting the first drum with the shaft to rotate it at the ratio of 17 to 8,

differential gearing for driving one of the other two drums from the first one at a speed ratio of 17 to 8, and differential gearing for connecting the second and third drums at an equal speed ratio. 10

In testimony whereof I have hereunto affixed my signature.

HAROLD W. HODGSON.