Dec. 13, 1966 C. LOUIS ETAL 3,290,916

WIRE DRAWING APPARATUS

Filed July 13, 1962 2 Sheets-Sheet 1

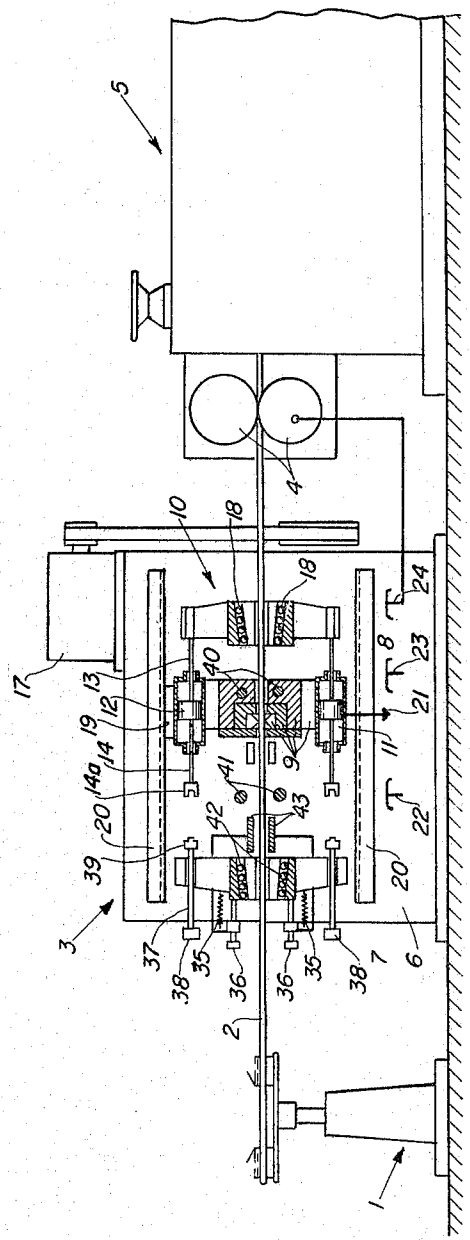

Fig. 1

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WIRE DRAWING APPARATUS

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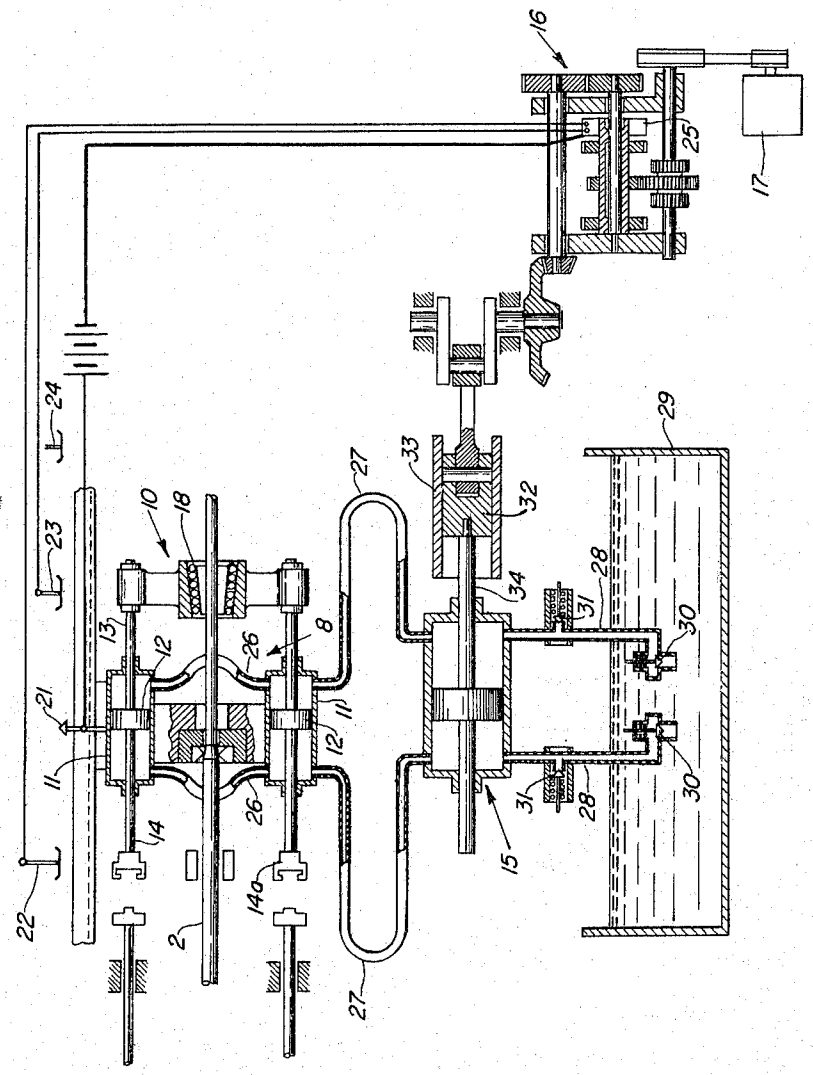

Fig. 2

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3,290,916

WIRE DRAWING APPARATUS

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8 Claims. (Cl. 72—285)

The present invention concerns an installation for deforming wires and the like, comprising a drawing device in combination with a treatment machine such as a press disposed at the end of the wire-transport path. It does in fact concern such an installation wherein the drawing device in addition to a ram rod has a drawing die with drawing tongs which execute a movement relative to this die firmly clamping the wire therein during each drawing stroke, and wherein the treatment machine is provided with a draw-in device. The draw-in device of the treatment machine serves to introduce the wire, whose cross-section has been reduced in the drawing device, into the treatment machine in synchronism with the stroke of the treatment machine. It is necessary therefore that the introduction of the wire into the treatment machine by the draw-in device be very accurate. To ensure this accurate operation it is necessary for the draw-in device associated with the treatment machine to be subjected to as little stress as possible. That is to say it should not be required to supply the very considerable power for pulling the wire through the drawing die which reduces the wire to a smaller diameter. Known installations conform only imperfectly to these requirements and are of a complicated structure.

With regard to the drive of prior arrangements for deforming wires and the like, these have already been so constructed that the power for the drawing device has been derived from the treatment machine for further processing of the wire, or in such manner that both have separate drives. Since however the drawing operation takes place mainly at a period in which the treatment machine has to perform the actual deforming work, it is necessary in the first-mentioned arrangement to make the drive of the treatment machine correspondingly stronger. If on the other hand the drawing device and the treatment machine are each furnished with a separate drive, it is necessary to have a complex control device for synchronization of the individual devices. Thus, by means of this control device in accordance with the timing of the treatment machine a clutch between the drive for the drawing device and the drawing device can be automatically engaged and disengaged. This engagement and disengagement of the clutch with each stroke produces considerable accelerations and braking actions, which have to be additionally absorbed by the clutch elements and produce heat. It has a particularly unfavorable effect in the case of rapid stroke sequences, which are required in modern machines with higher outputs.

It is an object of the invention to provide an arrangement for deforming wires and the like which does not show the disadvantages mentioned above of known arrangements.

The present arrangement provides an arrangement in which a synchronized co-operation of drawing device and treatment machine is not required. The solution of the problem consists in the feature that the drawing die and drawing tongs are arranged integrally, independently of their movement relative to one another, on the frame of the drawing device so as to be longitudinally displaceable in the direction of feed of the wire, thus preferably on a sliding guide the length of which amounts to a multiple of the maximum draw-in length required per stroke of the treatment machine. The drawing-die means and the drawing tongs of the clamping means are displaceably interconnected by means of the connecting rods of hydraulic working cylinders of the fluid-responsive means and the working cylinders are to be connected to a control or master cylinder, the output of which is somewhat greater than the total output of the working cylinder. The amount of the excess liquid supply is diverted via an excess pressure valve into a storage container from which the additional liquid required for each stroke is induced. In accordance with a further feature of the invention, contacts are arranged in the path of the feed means of the wire-drawing device (substantially comprising the drawing die, the drawing tongs and working cylinders) which includes the sliding guide; the contacts are actuated by contact levers mounted on the drawing device and of which contact levers a stop facing the ramming tongs is adapted to disengage an electric switch coupling for actuating the control cylinder, and a stop facing the draw-in device of the treatment machine adapted to engage this coupling.

A further preferred feature of the invention consists in the provision of a further stop behind the contact stop facing the drawing-in device in the direction of the drawing-in device, which stop is also to be actuated by the contact lever mounted on the drawing device, and which is adapted to disengage an electric switch coupling for actuating the draw-in device; the stops constitute an adjustable stop means on the support for the slide for limiting the reciprocating movement.

Furthermore the drawing device is lockable on the frame of the drawing apparatus by a releasable index means and in this position connected by means of connecting rods projecting from the working cylinders, to rods disposed in extension thereof, arranged so as to be longitudinally displaceable in the ram tongs and provided with stops and having such a length that the stops of these rods, after effecting the coupling, are able to move the ram tongs a short distance towards the end of a piston stroke in the direction of the treatment machine in the same direction. On the return stroke of the piston the ram tongs are drawn back by means of springs against stops adjustable to a certain distance relative to the advanced ram tongs. In a further feature of the invention it is proposed that for actuating the control cylinder of the hydraulic working cylinder a crosshead slide or the like connected with the connecting rod thereof is provided and driven in such a manner that during a variable-time unit the overall length of stroke of the drawing tongs exceeds the draw-in length of this machine caused by the draw-in device of the treatment machine by an adjustable amount.

The invention will be described further, by way of example, with reference to the accompanying drawing, in which:

FIG. 1 is a schematic elevational view of the overall arrangement of an installation for deforming wires and the like in accordance with the invention; and

FIG. 2 is a diagrammatic, fragmentary sectional view of the driving arrangement of the drawing device.

As shown in FIG. 1, a wire 2 to be unwound from a pay-out reel 1 first passes into a wire-drawing apparatus 3. The wire 2 is reduced in a diameter in the device 3 and then continues via a draw-in device 4, constituting a feed means engageable with the wire upon reduction of its cross-section for intermittently advancing it for further processing into a treatment machine 5 which may for instance be a cold-forming or molding press. The draw-in device 4 thus feeds the drawn wire 2 into the treatment machine 5 to an extent necessary

for synchronised treatment thereby. The drawing device 3 on its support means or frame 6 has ramming tongs 7, or inserting means which will be explained in detail hereinafter, and also the actual drawing mechanism or drawing-die means 8 which includes a drawing die 9 and drawing tongs 10 as clamping means. The drawing die 9 carries on its sides working cylinders 11 with double-acting pistons 12 and piston rods 13 or 14 together forming a fluid-responsive means for displacing the clamping means relatively to the drawing die. The piston rods 13 are thus rigidly connected to the drawing tongs 10. The piston rids 14 support coupling ends 14*a*.

The pistons 12 and working cylinders 11 are actuated by means of a control means including a master cylinder 15 (see FIG. 2), which in turn is connected to a mechanism for controlling the pistons of the master cylinder and including driving motor 17 via a transmission gearing 16. During this actuation of the pistons 12 of the working or power cylinders 11, the drawing die 9 and the drawing tongs 10 with one stroke move towards one another and away from one another with the second stroke. During the movement of the drawing tongs 10 and of the drawing die 9 away from one another, clamping jaws 18 arranged on the drawing tongs 10 are closed, so that the wire 2 is firmly clamped. This causes the die 9 to be drawn over the wire 2. When the drawing tongs 10 and drawing die 9 move towards one another, the clamping jaws however are open, thus preventing a displacement of the wire 2 relative to the drawing die 9.

A sliding runner 19 of the drawing device 8 can also be seen on each side of the working cylinders 11. These sliding runners 19 are adapted to slide on a guide 20 which is rigidly mounted on the frame 6. The length of the guide 20 should preferably amount to a multiple of the wire draw-in length of the treatment machine 5 required per stroke. As the drawing die 9 and the drawing tongs 10 are interconnected by means of the piston rods 13, it is possible for the drawing die 9 and the drawing tongs 10 to be displaced as a whole on the guide 6 independently of the movement between drawing tongs 10 and drawing die 9 relative to one another caused by the action of the piston 12. The drawing device 8 also has a contact lever 21 mounted thereon which is adapted to actuate several contacts 22, 23, 24 mounted in the path of the drawing device 8 reciprocated on the guide 20 and spaced along the guide path while connected in circuit with the fluid-responsive means. Thus, contact of the contact lever 21 with the contact stop 22 causes a switching clutch 25 situated in the transmission gearing 16 to be disengaged. This causes the power transmission from the driving motor 17 of the drawing device 8 to the pistons 12 of the working cylinders 11 to be interrupted. The drawing device is thus stopped. When the operating lever 21 makes contact with the switch contact 23, the switching clutch 25 is engaged and the drawing device actuated. When the operating lever 21 makes contact with the switch contact 24, the feed device 4 of the treatment machine 5 is put out of action by means of a clutch (not shown).

The displaceable arrangement of the drawing device 8 on the sliding guide 20, which constitutes a main feature of the invention, first of all avoids the need for designing the feed device 4 to perform additional drawing work, when the clamping jaws 18 of the drawing tongs 10 do not clamp the wire 2 satisfactorily. If for example, the whole arrangement operates in such a manner that the drawing stroke of the drawing device 8 coincides with the drawing in of the wire 2 by the draw-in device 4 into the treatment machine 5, and the clamping jaws 18 do not clamp correctly, the drawing device 8 owing to the action of the draw-in device 4 is only advanced in the direction of the treatment machine 5. The effort required for this, in comparison with the effort required for drawing the wire 2 through the drawing die 9, is considerably lower and can also be performed readily by the draw-in device 4. The displaceable arrangement of the drawing device 8 has the advantage compared with known arrangements that it is no longer necessary to synchronize accurately the stroke of the treatment machine 5 with the drawing device 8 via a complicated control gearing. It is necessary only to adjust the draft or stroke of the drawing device 8 in such a manner that its minimum output corresponds to the wire-length increments required by the treatment machine 5. The drawing stroke or draft is conveniently so adjusted however that the drawn wire length is somewhat greater than the wire length requirement of the treatment machine, and then accurate regulation is not necessary. The difference between the draft or stroke of the drawing device 8 occuring with the above mentioned adjustment and the wire length requirement of the treatment machine 5 acts so as to cause the drawing device 8 to slide away slowly from the treatment machine 5 on the sliding guide 20. However, as soon as the contact lever 21 makes contact with the switch contact 22 the drawing device 8, as already mentioned, is disengaged, so that no further wire is drawn. The disengaged drawing device 8 is thus advanced in synchronism with the draw-in device 4. As soon as the contact lever 21 reaches the switch contact 23 the drawing device is again engaged and the operation recommenced in that the drawing device 8 slides slowly away from the treatment machine 5. In the event of the switch contact 23 failing to function, so that the drawing device is not engaged, a further switch contact 24 is provided which also, as already mentioned, is adapted to be actuated by the contact lever 21, thus putting the draw-in device 4 of the treatment machine 5 out of action. This arrangement is also associated with a warning indication (not shown) for the operator of the installation; it is also associated with a stroke control for the draw-in mechanism, in order to avoid the draw-in device being disengaged during its advance. Otherwise it would be possible for the length of wire drawing required for the treatment machine 5 not to be achieved, which could lead to a breakdown of the treatment machine 5.

The driving arrangement for the drawing device is shown in more detail in FIG. 2.

The two working cylinders 11 are interconnected by means of the conduits 26. One of the two cylinders 11 has displaceable hydraulic conduits 27 connected thereto which lead to the control cylinder 15. The control cylinder 15 has two suction conduits 28 connected thereto, through which the liquid necessary for actuating the piston 12 in the working cylinders 11 is induced from a tank 29. These suction conduits 28 each have a non-return valve 30 and an excess pressure valve 31. The purpose of the excess pressure valves 31 is explained below: The displacement of the control cylinder 15 in accordance with a feature of the invention is selected to be greater than the capacity of the working cylinder 11. With each stroke of the control cylinder 15 the surplus hydraulic liquid is forced out via the excess pressure valve 31 into the tank 29. This ensures that the quantity of liquid which is pressurized is sufficient to give a reliable piston movement of the pistons 12 of the working cylinders 11, thus above all towards the end of the stroke of the pistons 12. The excess-pressure valves 31 are adapted to be adjusted to the momentarily required liquid pressure, which in any case must be higher than is required in accordance with the drawing force. A crosshead slide 32 which is guided in a crosshead guide 33 serves the guidance of the connecting rod 34 of the control cylinder 15. The driving motor 17 is constructed preferably to be continuously regulable, whereby it is possible, in combination with the transmission gearing 16, to obtain adjustment of the wire-feed increment very sensitively to the input required by the machine 5. In accordance with a further feature of the invention, as

already briefly explained initially, inserting means in the form of ram tongs 7 are also provided on the frame 6 of the drawing device 3. The ram tongs 7 are mounted so as to be longitudinally displaceable in the direction of the wire feed. Springs 35 are thus intended to draw the ram tongs in an unloaded state against adjustable stops 36 in the direction of the wire pay-out reel 1. The ram tongs in an unloaded state against adjustable stops 38 mounted therein so as to be longitudinally displaceable in the direction of the wire feed. These rods 37 moreover form releasable connecting means with coupling halves 39 by means of which they are coupled to the connecting rods 14 of the fluid-responsive means 11, 12 etc. For ramming in a wire 2 the drawing device 8 is slid in the direction of the tongs 7 and locked at a rearward location with an index locking device 40 so as to be non-displaceable on the frame 6 via an index 41 situated on the frame 6. Then the rods 37 and the connecting rods 14 are interconnected via their couplings 39 and 14*a*. The ram tongs 7 is then released by means of an actuating toggle (not shown in the drawing) and the wire end to be rammed is advanced to the drawing die 9. On eliminating the release of the ram tongs 7, the drawing device 8 is engaged in by means of a separate switch (also not shown), whilst the switch contacts 22 and 23 are switched off. After the drawing device 8 has been engaged, the pistons 12 and the working cylinders 11, due to the drawing device 8 being fixed, carry out the reciprocating movement simultaneously carrying the sliding rods 37 along therewith. When these rods 37 are reciprocated, they then abut at the end of the stroke of the pistons 12 with their stops 38 against the ram tongs 7 in the direction of the treatment machine 5 and advance the tongs 7 somewhat in the direction of the treatment machine. Depending upon the adjustment of the adjustable stop means 36, the tongs 7 are thus engaged over a small or large distance. During the return stroke of the piston the tongs 7 are then drawn back by the springs 35 against the stops 36 in the direction of the wire pay-out reel 1. With the advance of the ram tongs 7 in the direction of the treatment machine 5 the ram tongs 7 by means of their clamping jaws 42 clamp the wire so firmly that the latter is displaced into and through the die 9. To prevent the wire 2 from buckling during the ramming operation, a wire guide 43 is mounted on the frame 6 behind the ram tongs 7, through which guide the wire 2 is adapted to slide. The aforementioned ramming operation is repeated until the leading end of the drawn wire is inserted between the clamping jaws 18 of the drawing tongs 10. The jaws of these tongs 10 were open until then. They are now closed so as to permit the tongs 10 to clamp the wire in position. On the release of the clamping jaws 42 of the ram tongs 7, drawing of the wire takes place with the drawing device 8 locked, in that the tongs 10 advance the wire, thus by the overall length of stroke of the piston 12. This is repeated a number of times until the leading end of the wire has reached the draw-in device 4. The locating device 40, 41 is released and simultaneously the couplings 14*a* and 39 are released. Furthermore, the electric contact connection 22, 23 is changed over to the operative condition.

The draw-in device 4 now draws the wire 2 in synchronism with the treatment machine 5 and hence also the drawing device 8. When reaching the contact stop 23 the switch coupling 25 is adapted to be engaged, whereby the actual drawing process commences in combination with the operation of the treatment machine 5, as already explained before.

The displaceable arrangement in accordance with the invention of the drawing die and drawing tongs as a whole independently of its relative movement to one another is adapted to be used not only as described above in connection with installations comprising a drawing device and connected at the end a treatment machine executing in timed sequence alternately a working stroke and an idling stroke, but also in such installations in which the treatment machine does not operate in timed sequence but continuously.

We claim:

1. A wire-drawing apparatus for substantially intermittently advancing a wire for further processing while reducing its cross-section, said apparatus comprising:
- intermittently operable feed means engageable with said wire upon reduction of its cross-section for displacing same in a forward direction;
- support means rearwardly of said feed means forming a substantially linear guide path in said direction;
- drawing-die means movably mounted on said support means for reciprocation along said guide path;
- clamping means mounted upon said drawing-die means and reciprocable relatively thereto in said direction for releasable entrainment of said wire through said drawing-die means;
- fluid-responsive means on said drawing-die means connected with said clamping means for reciprocably displacing the latter relatively to said drawing-die means; and
- drive means connectable with said feed means for advancing said wire in said direction together with said drawing-die means and said clamping means.

2. A wire-drawing apparatus for substantially intermittently advancing a wire for further processing while reducing its cross-section, said apparatus comprising:
- intermittently operable feed means engageable with said wire upon reduction of its cross-section for displacing same in a forward direction;
- support means rearwardly of said feed means forming a substantially linear guide path in said direction;
- drawing-die means movably mounted on said support means for reciprocation along said guide path;
- clamping means mounted upon said drawing-die means and reciprocable relatively thereto in said direction for releasable entrainment of said wire through said drawing-die means;
- fluid-responsive means on said drawing-die means connected with said clamping means for reciprocably displacing the latter relatively to said drawing-die means; and
- drive means connectable with said feed means for advancing said wire in said direction together with said drawing-die means and said clamping means, said apparatus further comprising a pair of electrical contacts spaced along said guide path for operation by said drawing-die means upon displacement thereof by said feed means, and circuit means operatively connecting said contacts with said fluid-responsive means for controlling the operation of said clamping means in accordance with the movement of said drawing-die means along said guide path.

3. An apparatus as defined in claim 2, further comprising an additional contact disposed along said guide path forwardly of the first-mentioned pair of contacts and further circuit means operatively connecting said additional contact with said feed means for decoupling same from said drive means upon operation of said additional contact by said drawing-die means upon displacement thereof along said guide pair.

4. An apparatus as defined in claim 2 wherein said fluid-responsive means includes at least one hydraulic power cylinder mounted upon said drawing-die means and a double-acting piston reciprocable in said cylinder and connected with said clamping means, said apparatus further comprising control means for said fluid-responsive means, said control means including a master cylinder stationarily mounted upon said support means, flexible conduit means interconnecting said master cylinder and said power cylinder, a further piston movable in said master cylinder for supplying fluid to said power cylinder

through said flexible conduit means, and a mechanism for displacing said further piston.

5. An apparatus as defined in claim 4 wherein said mechanism includes a source of motive power, a transmission adapted to interconnect said source with said further piston, and electrically operable clutch means in said transmission operable by said contacts for selectively decoupling said source from said further piston and coupling said source therewith.

6. An apparatus as defined in claim 4, further comprising a reservoir for hydraulic fluid connected to said master cylinder, said master cylinder having a stroke such that its displacement is in excess of that required by the stroke of said power cylinder, said master cylinder being provided with a pressure-relief valve communicating with said reservoir for discharging excess fluid into the latter.

7. A wire-apparatus for substantially intermittently advancing a wire for further processing while reducing its cross-section, said apparatus comprising:

feed means engageable with said wire upon reduction of its cross-section for displacing same in a forward direction;

support means rearwardly of said feed means forming a substantially linear guide path in said direction;

drawing-die means movably mounted on said support means for reciprocation along said guide path;

clamping means mounted upon said drawing-die means and reciprocable relatively thereto in said direction for releasable entrainment of said wire through said drawing-die means;

fluid-responsive means on said drawing-die means connected with said clamping means for reciprocably displacing the latter relatively to said drawing-die means; and

drive means connectable with said feed means for advancing said wire in said direction together with said drawing-die means and said clamping means, said apparatus further comprising releasable index means for locking said drawing-die means to said support means at a relatively rearward location, inserting means mounted on said support means adjacent said location for driving said wire through said drawing-die means, and connecting means releasably coupling said inserting means with said fluid-responsive means for operation thereby.

8. An apparatus as defined in claim 7, further comprising adjustable stop means for limiting the reciprocable movement of said inserting means.

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