This invention relates to driving mechanism for machines, especially straight knitting machines, in which, in addition to mechanically or power driving the machine at a relatively high operating speed, it is necessary to turn the machine slowly by hand in order to observe its operation or make an adjustment. To turn a modern multi-section full fashioned knitting machine manually, requires considerable amount of physical effort which is quite fatiguing to the operator.

It has been proposed to use a small separate motor in addition to the main motor, to turn the machine slowly for inspection. While practical to an extent, this method is inconvenient and expensive.

This invention therefore pertains to a device to facilitate the hand turning of such machines and is characterized by its simplicity, the employment of but one motor, and by a corresponding economy in its application. In this device, when hand turning, the driving motor performs the work, but at as slow a speed as desired by the operator, who by turning a small hand wheel engages and disengages for short successive periods a clutch arranged between the driver and a driven element of the machine.

With the above and other objects in view that will become apparent as the nature of the invention is better understood, the same consists in the novel form, combination and arrangement of parts hereinafter more fully described, shown in the accompanying drawings and claimed:—

In the drawings:

Figure 1 shows the driving mechanism in elevation, partially in section;

Figure 2 is a section on line II—II of Figure 1;

Figure 3 shows driving mechanism in elevation, similar to Figure 1 but in modified construction;

Figure 4 shows cross section along line IV—IV of Figure 3;

Figures 5 and 6 illustrate the mechanism for operating the switch to change direction of rotation of driving motor, partly in side elevation, partly in end view respectively;

Figure 7 is a front elevation of the mechanism for controlling the electric switch and speed regulator; and

Figure 8 is an end view of Figure 7, partly in section.

Briefly describing the operation of the machine, the short driving impulses imparted to the machine, occur faster or slower, depending on how fast the operator turns the handwheel, the speed of machine increasing, the faster the operator turns. He can thus control the speed of the machine by judgment just as when turning the machine by hand.

The main feature of the invention consists in the combination of the above mentioned clutch with two hand control elements, one of which consists of a disengagement rod for starting and stopping the machine when turning at operating speed (by means of engaging and disengaging the clutch) whereas the other control element, consisting of a second rod equipped with a small handwheel, serves for engaging the motor to drive the machine at a crawling speed. This second rod can be actuated only after the clutch has been disengaged by the first rod and the machine brought to a standstill, but with the motor still running. Then by turning the handwheel on the second rod the clutch is engaged and disengaged in short jerks, corresponding to the speed at which operator turns it, and the machine is driven at a speed corresponding to that at which operator turns handwheel.

The clutch is spring engaged and brought into a disengaged position by turning disengaging rod so as to cause a brake element to oppose the action of the engaging spring. When clutch is thus disengaged from the running motor, the crawling speed may be effected by turning the second rod having handwheel, which action tends to momentarily overcome the braking force and permit the engaging spring to function. This is, however, only for a very short period because the braking force quickly overcomes spring pressure and disengages the clutch.

By continuously turning the handwheel in one direction a series of coupling and uncoupling actions follow each other in rapid sequence, so that in effect the machine will be driven at a crawling speed, corresponding to the speed at which the operator turns the handwheel.

The foregoing describes the driving of the machine either at operating or crawling speed in a forward direction. To turn the machine backward at a crawling speed a second clutch is provided between the driver and driven element.

This clutch, however, is not spring controlled but arranged to be engaged by turning the small handwheel backward. This backward driving clutch is designed to be engaged only after the forward driving clutch is disengaged. As the handwheel is turned backward, the driving direction of motor is first changed and then the backward driving clutch is engaged to impart short impulses to drive machine at crawling speed in a backward direction. One of the features...
of the invention is the means for changing the
direction of motor rotation by means of the hand-
wheel on crawl speed control rod.

The driving element 1, such as a belt or chain,
rotates the pulley 2 in the direction of the arrow
14 as soon as the driving motor or other prime
mover has been switched in. The pulley or chain
sprocket 2 is fixed on a clutch element or drum 3,
both of these being loosely mounted on the driven
shaft 4. Inside of drum 3 and keyed to shaft
4 is sleeve 5, while loosely mounted on sleeve 5
is a second sleeve 7. To radially arms 5' and 7' of
sleeves 5 and 7 respectively is fastened friction
band 6. A compression spring 8, placed between
arms 5' and 7', tends to spread them apart with
the result that friction band 6 is pressed against
interior of clutch drum 3 and shaft 4 is turned
with clutch drum in direction of arrow 14.

The loose sleeve 7 has the brake pulley 29 keyed
thereon which in turn is engaged by brake band 9,
one end of which is fastened to stationary point
22, while the other is connected thru tension
apparatus 23 to lever 24, fastened to the disengaging
rod 10, by means of which machine is started
and stopped. When machine is to be stopped
rod 10 is turned in the direction of arrow 23;
brake band 9 is drawn taut and arrows sleeve 7
thus counter-acting the spreading effect of spring
8. The effect of this is for arm 5' to move closer
to arm 7' which in turn releases friction band 6
from friction drum 3, and the machine is stopped,
although friction drum continues to rotate as
long as motor or prime mover is switched in.
Rod 10 is preferably rotated sufficiently to bring
brake band with attached spring past dead center
of rod 10 to provide for automatic locking of
brake band 9. (See position of lever 24 in dotted
lines.) When rod 10 is rotated in a direction
opposite to arrow 23, the braking effect of band
9 is released, permitting compression spring 8 to
spread arms 5' and 7' and cause friction band 6
to expand so as to engage friction drum 3 to
drive the machine.

Loose sleeve 7 also has keyed to it a gear wheel
adapted to be engaged by gear wheel 12, keyed
on hand control rod 13, the latter being used to
regulate the crawling speed at which machine is
to be driven. Rod 13 is journaled in bearings
on machine frame so that it may be turned as well as
shifted axially, like the disengaging rod 10, it
extends over the entire length of machine.

During normal operation, rod 13 is in such a
position that gear 12 does not engage gear 11.

When, however, it is necessary to closely observe
the operation of one of the operating elements,
the brake band 9 is pulled tight around brake
pulley 29 which serves to disengage friction band
6 from friction drums 3, and the machine is
stopped, as already described. With disengaging
rod 10 in stop position, as indicated by dotted po-
tion of lever 24 thereon, it is possible to laterally
shift rod 13 by hand to bring gear 12 into en-
gagement with gear 11, whereupon, by turning rod
13, which is provided with small handwheels
36 at intermediate places along length of the
machine, the braking action of band 9 is for an
instant overcome, thus permitting spring 8 to
cause friction band 6 to expand and engage clutch
drum 3 and drive the shaft 4. This driving im-
pulse is only of very short duration since brake
9 prevents sleeve 7 from following, and conse-
quently engagement between friction band 6 and
friction drum is quickly broken. Such a driving
impulse is very slight, causing the shaft 4 to be
moved but a fraction of a degree. By continuous-
ly turning shaft 13 a series of rapid engagements
and disengagements occur between 6 and 3, and
shaft 4 is driven at a speed corresponding to that
at which shaft 13 is turned. When turning of
13 is stopped shaft 4 is also stopped. On the other
hand a faster turning of shaft 13 results in a
more rapid engagement and disengagement be-
tween band 6 and drum 3 with a consequent in-
crease in speed of shaft 4. In all cases, however,
only a small turning effort need be applied to
shaft 13, for the reason that this need only be
great enough to overcome the braking effort of band
9 which in turn need be but slightly greater than
that to overcome action of spring 8. This in turn
need only be strong enough to expand friction
band 6 into engagement with drum 3 and over-
come friction between sleeves 5 and 7.

After the examination has been completed, the
control shaft 13 is shifted laterally to disengage
the gear wheel 12 from the gear wheel 11, where-
upon the machine can again be engaged at op-
erating speed by turning the disengaging rod 10
in a clockwise direction until lever 24 thereon
comes to rest in position shown in full lines in
Fig. 1.

Figures 3 and 4 show another form of con-
struction by which it is possible to effect the
crawling speed of machine in a backward as well as
in a forward direction as described above.

With this object in view a second friction band
15 is provided, which extends from the flange on
arm 5' to a second arm 16 of the loose sleeve 7,
but in a direction opposite to friction band 6.
During the forward running, friction band 15
is released and remains released when brake
9 releases friction band 6. If, however, the con-
rol rod 13 is first shifted laterally so that gear
12 engages gear 11, and then turned backward
in the direction of arrow X, friction band 6 be-
comes still slacker while friction band 15 is ex-
panded and pressed against clutch drum 3 and
affects a coupling. As the shaft 13 is turned
backward, a lever 17, mounted loosely thereon
and carrying friction band 18, is engaged by col-
lar 18' keyed to shaft 15, and is rocked in a 120
counter-clockwise direction (see Figures 5 and 6).
The rocking of lever 17, caused by friction exerted
on ring 18' by friction band 18 is limited by
stationary stop 19. The downward movement of
the lever 17 pushes rod 20 and lever 26 on switch
21, which changes the polarity of the current in-
cluding the direction of rotation thereof to be
changed. Pulley 2 is therefore driven in a di-
rection opposite to that of the arrow 14, and when
the backward rotation of control shaft 13 con-
tinues, the coupling and uncoupling is effected
similar to that for the forward crawl drive (but
machine is driven in a reverse direction).

The drive may be further combined with an ar-
range ment illustrated in Figures 7 and 8, which
permits a variation of speed or crawl speed by
stoppage of motor from any point along the
machine. Mounted on rod 13 is a circular rack 39 engaging
gear wheel 38, fastened to axle 37 of rheostat
21A, carrying electrical resistance in the rotor
35 circuit of the motor. By turning rheostat 21A
the amount of resistance is varied which causes
speed of motor to be varied accordingly.

The gear wheel 12 is mounted on shaft 13
through the intermediary of a key or splint 33, 145
and its position is controlled by the action of com-
pression spring 34, bearing against a set collar
35 on shaft 13.

While machine is operating, parts are posi-
tioned as shown in Figure 7, gear 12 being dis-
engaged from gear 11. To stop the machine, rod 10 is turned in a counterclockwise direction so that friction band 6 is disengaged from clutch drum 3, machine stops but motor keeps on running. To stop motor, rod 13 is moved to left (gear 12 being stopped by abutment 41) which causes the speed regulator 21A to be turned, which adds additional electrical resistance to rotor circuit of motor, the speed of which being thus gradually reduced. When rod 13 is in its extreme left position contacts in rheostat may be so arranged to cut off current from motor entirely.

Rod 13 is provided with fixed collar 44 which abuts against projecting arm 43 fixed to rod 10. It is therefore impossible to move rod 13 to right to engage crawl drive unless rod 10 is turned into position where machine is disconnected from motor. In this position of rod 10, arm 43 is raised permitting rod 13 to be moved toward right to bring gear 12 into mesh with gear 11 in order to effect the crawl drive. Projecting pin 42 on key 33 serves to push gear 12 into mesh with gear 11 when rod 13 is in proper position to turn it for effecting the crawl drive.

I claim:

1. On a machine, especially a straight knitting machine, a device for facilitating the turning of the machine, by hand at an extremely slow or crawling speed, comprising in combination with the driving motor and driven shaft of the machine, a clutch member between said motor and said shaft, and two control elements each adapted to actuate said clutch member, one of the control elements serving to engage and disengage the machine at operating speed, and the other control element to effect the crawling speed.

2. On a machine, especially a straight knitting machine, a device for facilitating the turning of the machine, by hand at an extremely slow or crawling speed, comprising in combination with the driving motor and the driven shaft of the machine, a clutch member between said motor and said shaft, a control element adapted to continuously engage and disengage said clutch, a second control element adapted, when operative, to intermittently engage and disengage said clutch member when first control element is in disengaged position and thus impart intermittent driving impulses to the driven shaft corresponding to the speed at which the operator turns by hand the second control element.

3. On a machine, especially a straight knitting machine, a device for facilitating the turning of the machine by hand, comprising in combination, a clutch member, a spring tending to continuously hold clutch in an engaged position, a disengaging brake adapted to counteract action of spring and disengage the clutch, a disengaging rod adapted to control the disengaging brake, a second control rod provided with hand wheels adapted by short turning movements, to momentarily release the disengaging brake and permit the spring to engage the clutch and impart a short driving impulse to the machine until resistance of disengaging brake again counteracts the clutch spring, the spring engagement and disengagement following each other in quick sequence so that as the second control rod is turned by hand the machine is driven at a speed corresponding to that at which the second control rod is turned.

4. On a machine, especially a straight knitting machine, a device for facilitating the turning of the machine by hand, comprising in combination with the motor and the driving shaft of the machine, a clutch member between said motor and said shaft, a brake adapted to disengage said clutch, a disengaging rod extending along the entire length of the machine adapted to act as a control element to actuate said brake to disengage the clutch, means for automatic locking of the disengaging brake, a second control rod extending along entire length of the machine, a gear wheel on the second control rod adapted to be manually aid into mesh with gear wheel fastened to disengaging brake so that by turning by hand the second control rod when the disengaging brake is applied, the motor drives the machine at a speed corresponding to that at which the second control rod is turned.

5. On a machine, especially a straight knitting machine, a device for facilitating the turning of the machine by hand, comprising in combination with the parts specified in claim 4, a second clutch member adapted to be engaged only when second control rod is turned backward, a reversing switch adapted to reverse the driving direction of said motor during the backward turning of second control rod and to cause said motor to drive the machine slowly in a backward direction corresponding to the speed at which second control rod is turned backwards.

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