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54 Actuator assembly for a picker head in a wire cloth making machine.

57 The actuator assembly comprises essentially a gear pair (2, 3), whereof one gear (2) is driven rotatively by the loom own crankshaft and the other (3) caused to mesh with the former, being driven thereby to follow a substantially epicycloidal path around it. Rigidly attached to the latter gear (3) is a washer (7) with which a first connecting rod element (13) engages which is connected to a rod linkage (16) having a bow divider-like configuration, and has a second connecting rod element (51) articulated thereto which reciprocates the picker head actuating carriage, thereby the picker head is caused to pass through the shed to engage with the weft wire and pull, by a substantially constantly applied tension, the weft through the shed, and is held back for an adjustably preset time period prior to completing another stroke. Thus the picker head can be moved with a very high speed and in perfectly timed relationship with the motion of the loom sley thereby providing a wire cloth of optimum characteristics.

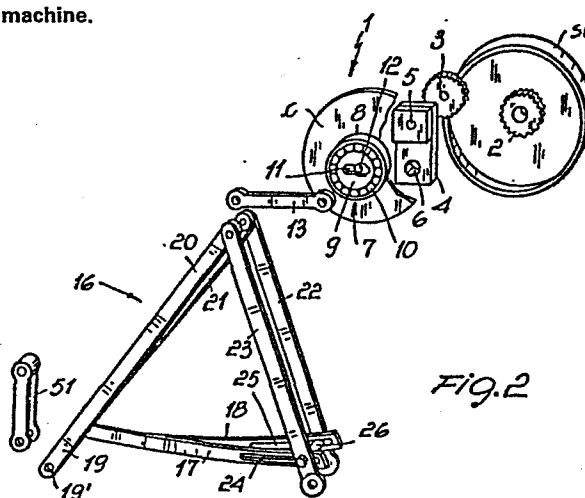


Fig. 2

ACTUATOR ASSEMBLY FOR A PICKER HEAD IN A WIRE CLOTH
MAKING MACHINE

This invention relates to an actuator assembly for a picker head in shuttleless looms for making wire cloth, particularly wire cloth for use in the manufacture of strainers, window screens, etc.

5 As is known, in wire cloth looms, a picker head, provided with a wire engaging latch and being reciprocated in timed relationship with the loom sley, is arranged to pass the weft wire through the shed formed by warp wires laid on mutually parallel planes,
10 thereby weaving the wire cloth.

To that end, the picker head is passed, over an initial portion of its stroke distance, through the shed up to one side thereof, whereat it will pick up the weft wire by means of its openable end bill;
15 thereafter, the picker head is returned rapidly through the shed to take the weft wire in between the warp wires and thus weave, at each back and forth stroke, a portion of the cloth.

In such loom types, the picker head movement is
20 implemented by means of complex camming mechanisms which receive their motion from the loom main drive via additional driving and timing members.

This contributes, of course, to the complexity of the loom as a whole, while with such prior looms,
25 the wire insertion is not entirely satisfactory on account of frequent breakages caused in the wire by the vibration and irregular motion of the picker head.

In a prior Italian Patent Application, No. 27712 A/79, filed on November 29, 1979, and opened to
30 public inspection on May 29, 1981, this Applicant

already disclosed a picker element and related drive which have been effective to greatly reduce the occurrence of breakages in the weft wire, so as to result, with fairly high efficiency, in the production
5 of a wire cloth having satisfactory characteristics.

However, actual tests conducted on production looms so constructed, and further extensive studies by the Applicant, have shown that the mechanism proposed in the cited Italian Patent Application No.
10 27712 A/79, while being generally satisfactory, was not entirely faultless, among its deficiencies being that it could not provide a very high rate of operation for the cited picker element.

A further disadvantage shown by said mechanism
15 was that adjustment for operative transition from one cloth type to a different, especially heavier grade, one involved a significant degree of complexity.

Thus the task of this invention is to provide an improved actuator assembly and/or mechanism for a
20 picker head in shuttleless looms for making wire cloth, which can move the picker head at a very high speed and in perfectly timed relationship with the motion of the loom sley at each operative phase of the picker head.

Within that task it is an object of the invention to provide
25 an assembly as indicated, which can actuate the picker head during the return or weft wire drawing stroke thereof such that the weft wire is held under constantly applied tension, thus preventing it from becoming
30 entangled and producing a cloth having optimum

characteristics.

It is another object of this invention to provide an assembly as indicated, which can be readily adjusted for adaptation in an optimum fashion to the production of the various types of wire cloth presently on demand by the market.

Still another object of the invention is to provide an assembly as indicated, which is construction-wise simple and reliable, and in particular which may be easily fitted on existing loom 5 without involving substantial alteration of the latter.

It is a further object of this invention to provide an actuator assembly as indicated, which is compatible, in particular, with currently available commercial picker actuating carriage assemblies.

Yet another object of the invention is to provide an assembly as indicated, which can be easily manufactured from materials and on equipment commonly available on the market.

According to one aspect of this invention, the above task and objects are achieved by the invention defined in claim 1, the actuator assembly for a picker head in shuttleless looms for making wire cloth, is characterized in that it comprises a first gear made rotatively rigid with the crankshaft of said loom, a second gear supported rotatably on a gear holder element of plate-like, substantially rectangular configuration and in mesh engagement with said first gear, a washer element rotatably carried on said gear holder element at the opposite side thereof to the side carrying said second gear, a

first connecting rod element rigidly engaged at one end thereof with said plate-like supporting element and extending on a substantially vertical plane, a set of rods interconnected to define a substantially
5 triangular arrangement and lying on a substantially vertical plane with two sides projecting by preset distances beyond the base of said triangle, the upper vertex of said triangle being pivoted to the other end of said first connecting rod element, the
10 lower end of one of said projecting sides from said triangle being pivoted to an adjustment carriage, and the lower end of the other of said projecting sides from said triangle being pivoted to one end of a
second twin connecting rod element having the other
15 end connected to an actuator carriage element for actuating said picker head, said preceding elements being interconnected and constructed such that, on rotating said crankshaft, said second gear performs, along with said plate-like element, a substantially
20 epicycloidal movement around said first gear, and said second twin connecting rod element linearly reciprocates said actuator carriage for said picker head, said reciprocating motion being timed to the
sley motion in said loom and including a forward stroke
25 of said picker head to pick up the weft wire and a return stroke of said picker head to release the weft wire, on completion of said return stroke and prior to the successive forward stroke a standstill phase being provided for said picker head for an adjustable
30 preset time period.

Further features and advantages of the actuator assembly for a picker head in shuttleless looms for making wire cloth, according to this invention, will be more readily understood from the following
5 detailed description of a preferred embodiment thereof, with reference to the accompanying illustrative drawings, where:

Figure 1 is a perspective view of the inventive actuator assembly, as associated with one abutment
10 shoulder of a shuttleless loom for making wire cloth;

Figure 2 is an exploded view showing the main components of the actuator assembly of this invention;

Figures 3 to 5 are diagrams showing how the actuator assembly of this invention operates;

15 Figure 6 is an enlarged scale detail view showing the adjusting carriage element associated with the actuator assembly according to this invention; and

Figure 7 is a fragmentary perspective view showing the gear case in a closed condition and the
20 main connecting rod element deriving motion therefrom for the actuator assembly of this invention.

Making now specific reference to the drawing views, and in particular to Figures 1 and 2, the actuator assembly for a picker head according to this
25 invention will be next described in detail, although a detailed discussion of the loom incorporating it is omitted herein inasmuch as reference can be had for its description to the aforementioned prior Italian patent application by this same Applicant.

30 More specifically, the actuator assembly for a

picker head, according to the invention, is generally designated with the reference numeral 1.

Said assembly, as shown best in Figure 2, comprises a gear case SC affixed to an abutment shoulder SP (Figure 1) on the loom, which gear case has a substantially cylindrical shape and contains a first spur gear 2 (Figure 2) keyed to one end of the loom crankshaft (not shown) and made rotatively rigid therewith, and a second spur gear 3 arranged to mesh with the first spur gear 2. The first and second gears 2 and 3 are provided in a 1:1 drive ratio and are supported on a plate-like gear carrier or holder element 4 of substantially rectangular shape, which supports the gear 3 rigidly at its upper end, and the gear 2 rotatably at its lower end. To that aim, formed in the plate-like carrier 4, respectively at the upper and lower ends thereof, are two throughgoing round holes, indicated at 5 and 6, respectively, which are arranged to accommodate conventional means of securing the spur gears 3 and 2, respectively. However, such conventional means will not be described in detail herein.

It may suffice to say that the crankshaft (not shown) and cited gears 2 and 3 are associated with the plate-like element 4, and the gear 3 is in mesh engagement with the gear 2, thereby, on rotating the loom crankshaft, the plate-like element 4 and gear 3 are rotated, the gear 3 describing an epicycloid around the gear 2 with which it meshes.

On the opposite side of the plate-like element 4

with respect to that side which carries the gear 3, a washer element, generally indicated at 7, is supported rigidly which, in one embodiment, may comprise an outer bearing race 8 and a center disk element 9, between the disk element 9 and bearing race 8 there being arranged, in a manner known per se, plural bearing balls 10. The center disk element 9 has a slot or throughgoing aperture 11 formed therein which is sized and configured to receive one end of a first connecting rod element 13, as explained more detailedly hereinafter.

It may be seen that between the washer element 7 and plate-like gear carrier element 4 there intervenes a cover C, provided to close the gear case as shown more clearly in Figure 7.

In particular, the cover C is made pivotally rigid with the washer 7 and gear carrier plate 4, so that in operation said cover C will also turn. Again with reference to Figure 2, the elongate slot 11, which may have an enlarged end to facilitate coupling to the connecting rod 13, is arranged to accommodate, fixedly but adjustably, one end of said first connecting rod element 13, the other end of which is engaged articulatedly with a set of rods, generally designated with the reference numeral 16, formed essentially by six rods which are interconnected to define a substantially triangular arrangement lying on an essentially vertical plane, with the actuator assembly in a fully assembled condition. More specifically, the rod set 16 comprise two rods 17 and 18 which

have a substantially yoke-like configuration and define the base of said triangular configuration, two additional rods 20 and 21 defining one side of said triangular configuration, and two rods 22 and 23 defining the other side of the triangular configuration. The yoke-like shape of the rods 20 and 21 causes them to meet each other at a substantially common end, e.g. their welded end indicated at 19, having a through connection hole 19'. As may be seen, the common end 19 of the rod pair 20 and 21 projects farther than the two base rods 17 and 18, which have their common end located more to the rear than said end 19, the common end of the rods 17 and 18 being for example welded at said rearward location.

On the other hand, the rods 22 and 23 are substantially straight and parallel ones, and have coupling holes, not referenced herein, formed at each end, their respective lower ends also projecting from the aforementioned two base rods 17 and 18 defining the aforementioned triangular configuration.

In particular, the two base rods 17 and 18 in the triangular configuration set, or bow divider-like set, are formed at their diverging ends with two slots or elongate longitudinal apertures, indicated at 24 and 25, respectively, for engaging adjustably therewith the pair of substantially parallel rods 22 and 23.

For said adjustable coupling, there is provided a throughgoing peg element, or threaded bolt, 26 which couples the two rods 22 and 23 together at their lower end portions, said peg being passed, as may be

seen, through the slots 24 and 25. The peg 26, which comprises as mentioned a releasable bolt, will enable, as is apparent, adjustment of the positions of the rods 23 and 24 in the slots 24 and 25, and such rods to be locked in the adjusted positions.

Thus, the actuator assembly of this invention provides at least two adjustment points already, namely the aforementioned coupling of the first connecting rod 13 within the slot 11 and the coupling just described of the two rods 22 and 23 within the slots 24 and 25 of the rods 17 and 18. Said dual adjustment affords the faculty of synchronizing in an optimum fashion the motion transmitted by the actuator assembly of this invention with the motion of the other main loom members, and in particular the sley.

The triangular rod arrangement described hereinabove is articulated at one side, respectively at the lower ends of the rods 22 and 23, to an adjustment carriage assembly, generally indicated at 30, shown more detailedly on an enlarged scale in Figure 6.

In particular, the lower ends of the rods 22 and 23 are made rigid, e.g. through a pin 32, with a pivot connection 33, which pivot connection 33 is made rigid with a plate-like element 34 of substantially C-like configuration, which plate-like element 34 is adapted for sliding movement in a longitudinal slot 35 formed in the lower body 36 of the carriage. For producing said sliding movement of the plate 34, and hence of the pivot connection 33 attached thereto, a handwheel element, indicated at 37, is provided,

the handwheel 37 being coupled to the sliding plate 34 through any suitable means, such as a worm and gear means, not shown.

It may be appreciated that the adjusting carriage
5 assembly 30 is substantially rigid with the abutment
SP of the loom, a plate-like element 40 being also
made rigid, via a support 41, with the abutment of
the loom, the element 40 being provided to function
as a stop for the sliding motion of the plate 34
10 associated with the adjusting carriage assembly 30.

Again in connection with the cited adjusting
assembly 30, it should be noted that it is quite easy
to adjust the positions of the two rods 22 and 23 in
the cited triangular arrangement by simply threading
15 out substantially no more than three bolts, namely
the bolt or pin 26 joining the two rods 22 and 23,
and the two bolts 41 and 42 which locate the sliding
positions of the sliding plate 34 in the longitudinal
slots 35 of the carriage body 36. This easily carried
20 out adjustment, required to suit the motion supplied
by the inventive assembly to the type of cloth being
weaved, constitutes a peculiar aspect of the invention
not to be found with the complex camming devices of
the prior art, which were on the contrary quite
25 difficult to adjust, the adjustment thus achieved
being less fine than that to be obtained with the
carriage assembly of the inventive actuator assembly.

At the end portion 19 of the two rods 20 and 21,
and through the hole 19', the cited triangular rod
30 arrangement, or bow divider-like arrangement, are

articulated, by conventional means, such as a pin 50,
to a twin connecting rod element 51 which has its
opposite end connected, through an additional pin
element 52, for example to a picker head actuating
5 carriage 54. The carriage 54 is a part of an actuating
assembly 55, which is available commercially and
requires no further detailed discussion herein.

It is considered that the foregoing description
is adequate for understanding the operation of
10 the actuator assembly according to the invention.

Making reference to Figures 3 to 5, which
illustrate different operative steps in the actuation
of the picker head, the operation of the actuator
assembly according to the invention will be next
15 described. The main motion is in particular derived
from the loom main shaft as driven by the motor M
(Figure 1), through a drive belt 56 and flywheel-pulley
57. Assuming that the flywheel-pulley 57 turns in a
clockwise direction, as indicated by the arrow A in
20 Figure 1, the rotary motion is transmitted from the
main shaft to the crankshaft mentioned hereinabove,
which in turn drives the gear system of the actuator
mechanism according to the invention, thereby the
rotation of the outward gear 3 and elements connected
thereto, in particular the plate 4, cover C, and washer
25 7, will occur in a counterclockwise direction, as
shown by the arrow B. Consequently to the rotation of
the crankshaft, the gear 3 will describe an epicycloidal
path around the gear 2, wherein the washer 7 turns
30 together with the cover C. The rotary motion imparted

to the washer 7 will cause the first connecting rod element 13 to drive in a push-pull mode the triangular rod arrangement which, being pivoted at 33, reciprocates the picker head actuating carriage.

5 In particular, Figure 3 shows the main connecting rod 13 in the fully backward position, which in accordance with the invention is a picker rest position. Of course, the dimensions of the connecting rod 3 and rod mechanism as a whole should be selected to
10 determine a desired rest interval for the picker head after drawing the weft wire through the shed. In Figure 4, the connecting rod 13, under the drive from the gears 2 and 3, plate 4, and washer 7, begins its outward travel, which corresponds to a working stroke
15 during which the picker head (not shown) starts through the shed in its movement across it for picking up the weft wire from the left-hand extremity of the shed.

In particular, the weft wire is engaged with the
20 connecting rod in its fully extended position and the carriage 54 at the bottom travel limit of its back-and-forth stroke distance. Said fully extended position of the connecting rod 13 is shown schematically in Figure 5. Thus, in the condition corresponding
25 substantially to that shown in Figure 5, the picker head is engaged with the weft wire. As the crankshaft is rotated further, the connecting rod element 13 starts its backward movement, thereby the picker head will be caused to move backward through the shed with
30 the wire (not shown) engaged therewith, dimensions

being selected such that the picker head is at a standstill over an angle of substantially 120-130°. This standstill phase of the picker head constitutes an advantageous aspect of the invention, because during
5 that phase, the weft wire may be cut in ideal conditions to yield an optimum cloth in a nearly finished condition.

It should be noted in this respect that the cited standstill interval of the picker head does
10 not jeopardize, as actual tests have shown, the cloth production rate, which is higher than the rates currently achieved with conventional looms of the same general type.

It should be further pointed out that the
15 inventive actuator assembly enables, by virtue of its peculiar construction, the picker head to hold the weft wire at all times under tension, which is effective to prevent the wire from becoming entangled and further improve the quality of the resulting wire
20 cloth.

Also to be enhanced is the cited dual adjustment ability of the inventive actuator assembly, which adjustment is easy to make as well as being extremely accurate. Thus, ease of adjustment brings about a
25 corresponding ready adaptability of the whole machine to produce a desired cloth type, especially as regards the cloth grade.

It may be appreciated from the foregoing that the invention fully achieves its objects.

30 While but one, presently preferred embodiment of

the invention has been described by way of example,
the skilled one in the art will readily recognize
that many modifications and variations may be
introduced therein without departing from the true
5 scope of the inventive idea. As an example, the
specific dimensions of the main component parts of
the actuator assembly according to the invention
may be selected contingent on individual application
requirements.

CLAIMS

1 1. An actuator assembly for a picker head in shuttle-
2 less looms for making wire cloth and the like, char-
3 acterized in that it comprises a meshing gear pair (2,
4 3), whereof one gear (2) is driven rotatively by the
5 loom crankshaft and the other (3) is driven by said one
6 gear (2) to follow a substantially epicycloidal path
7 around it, said other gear (3) being rigid with a wash-
8 er member (7) with which a first connecting rod element
9 (13) is engaged which is coupled to one end of a rod
10 linkage (16) to another end whereof a second connecting
11 rod element (51) is articulated for reciprocating the
12 picker head actuating carriage (54).

1 2. An actuator assembly for a picker head in shut-
2 tleless looms for making wire cloth, characterized in
3 that it comprises a first gear (2) made rotatively rig-
4 id with the crankshaft of said loom, a second gear (3)
5 supported rotatably on a gear holder element of plate-
6 like, substantially rectangular configuration (4) and
7 in mesh engagement with said first gear (2), a washer
8 element (7) carried on said gear holder element (4) at
9 the opposite side thereof to the side carrying said sec-
10 ond gear (3), a first connecting rod element (13) rig-
11 idly engaged at one end thereof with said plate-like
12 supporting element (4) and extending on a substantially
13 vertical plane, a set (16) of rods interconnected to
14 define a substantially triangular arrangement and lying
15 on a substantially vertical plane with two sides projec-
16 ting by preset distances beyond the base of said trian-
17 gle, the upper vertex of said triangle being pivoted to
18 the other end of said first connecting rod element (13),
19 the lower end of one of said projecting sides from said

20 triangle being pivoted to an adjustment carriage
21 (30), and the lower end of the other of said pro-
22 jecting sides from said triangle being pivoted to
23 one end of a second twin connecting rod element (51)
24 having the other end connected to an actuator carriage
25 element (54) for actuating said picker head, said pre-
26 ceding elements being interconnected and constructed
27 such that, on rotating said crankshaft, said second
28 gear (3) performs, along with said plate-like element
29 (4), a substantially epicycloidal movement around said
30 first gear (2), and said second twin connecting rod
31 element (51) linearly reciprocates said actuator car-
32 riage (54) for said picker head, said reciprocating
33 motion being timed to the sley motion in said loom and
34 including a forward stroke of said picker head to pick up
35 the weft wire and a return stroke of said picker head to re-
36 lease the weft wire, on completion of said return stroke and
37 prior to the successive forward stroke a standstill phase being
38 provided for said picker head for an adjustable preset time period.

1 3. An actuator assembly according to claim 2, char-
2 acterized in that said plate-like gear holding element
3 (4) of substantially rectangular configuration has two
4 substantially round apertures (5, 6) formed near the
5 ends thereof, one (6) of said apertures (5, 6) being
6 engaged rotatably, on opposite sides of said gear hold-
7 ing element (4), by said first gear (2) and said support-
8 ing washer (7), and the other of said apertures (5) being
9 engaged rotatably by said crankshaft and said second
10 gear (3).

1 4. An actuator assembly according to Claim 1, char-
2 acterized in that said supporting washer element (7)
3 includes a bearing outer race (8) and center disk-like

4 portion (9) provided with a substantially diametrical-
5 ly extending aperture (11) which widens at one end
6 for adjustably securing said one end of said first con-
7 necting rod element (13) therein.

1 5. An actuator assembly according to Claim 1, char-
2 acterized in that said first gear (2), said second
3 gear (3), and said gear holding element (4) are accom-
4 modated within a bearing case (SC) of substantially
5 cylindrical shape and attached, on a substantially ver-
6 tical plane, to an abutment shoulder (SP) on said loom,
7 said washer (7) protruding from the cover (C) of said
8 case (SC) and also extending on a substantially vertical
9 plane, said case (SC) cover (C) being made pivotally
10 rigid with said gear holding element (4).

1 6. An actuator assembly according to any of the
2 preceding claims, characterized in that said adjustment
3 carriage (30) having the projecting end of said one
4 side of said substantially triangular arrangement piv-
5 oted thereto includes a substantially parallelepipedal
6 carriage body (36) made rigid with the frame of said
7 loom, said body having two longitudinal guide slots
8 (35) formed through opposite sides thereof, a support-
9 ing plate (34) being slidably engaged in said guide
10 slots (35), said supporting plate supporting rigidly
11 therewith the articulation or pivot means (33) for said
12 projecting end of said one side, and a handwheel con-
13 trol means (37) being operatively coupled to said plate
14 (34) to translate said plate and time the motion of said
15 assembly to the motion of said sley in accordance with
16 the type of wire cloth to be made.

1 7. An actuator assembly according to any of the

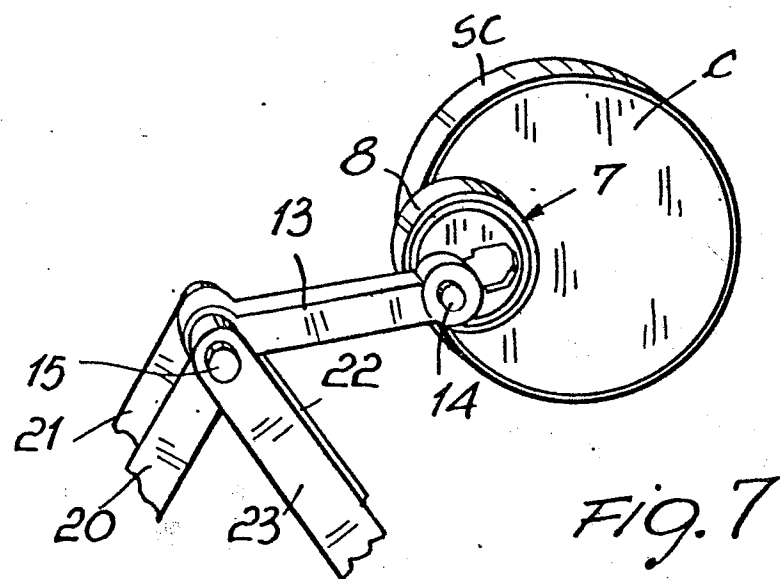
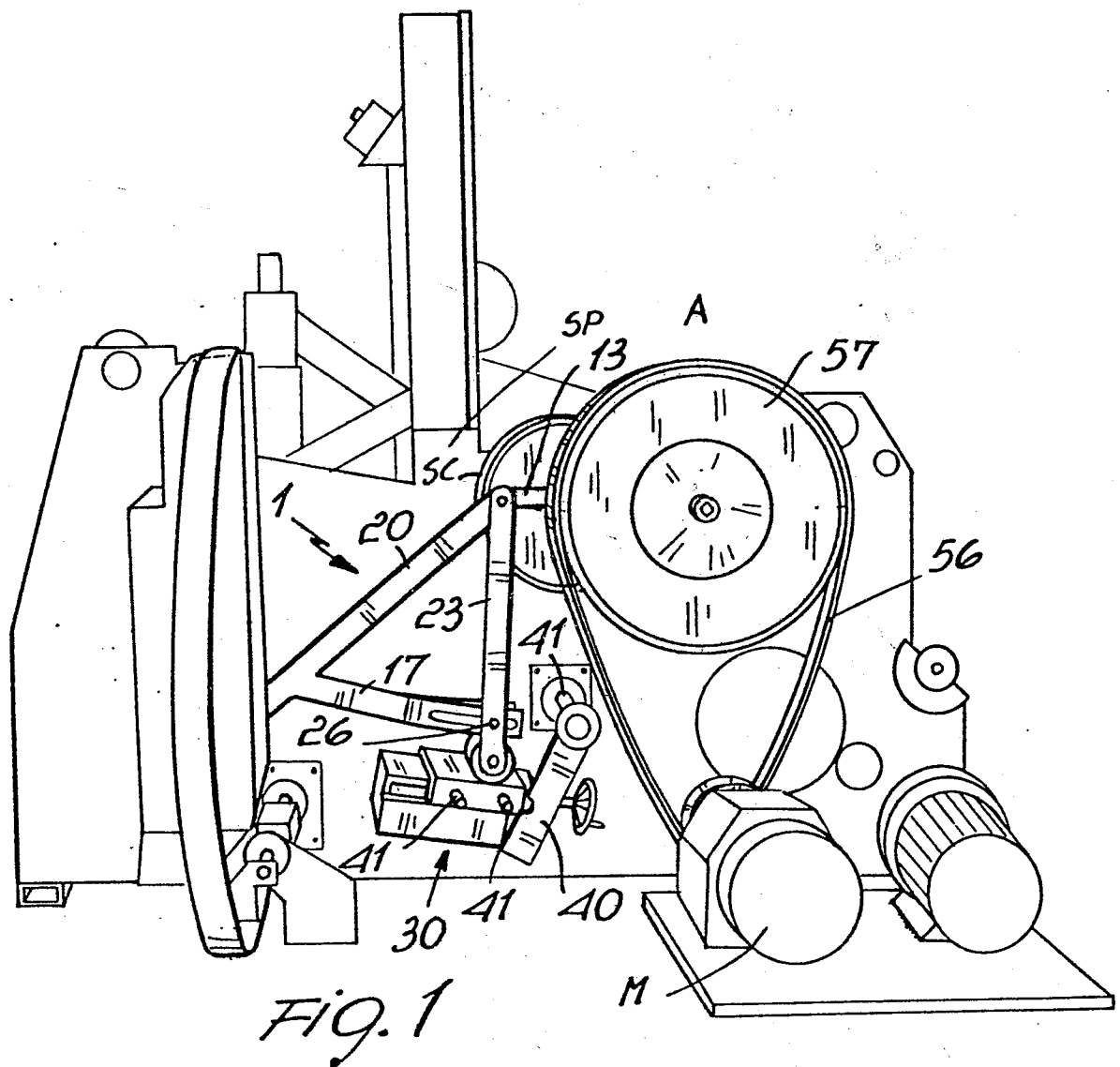
2 preceding claims, characterized in that said rod set
3 (16) includes essentially six rods (17, 18, 20, 21, 22,
4 23) in juxtaposed pairs to define said substantially
5 triangular arrangement, the two base rods (17, 18) in
6 said triangular arrangement being bent yoke-like to
7 provide respective end portions converging to a point
8 located inwardly of the projecting end from said base
9 of said triangular arrangement, to said ~~same~~ point
10 there also converging the respective ends of two rods
11 (20, 21) defining said side of said triangular arrange-
12 ment, the remaining rod pair (22, 23) defining the
13 other side of said triangular arrangement being juxta-
14 posed in substantially mutually parallel relationship.

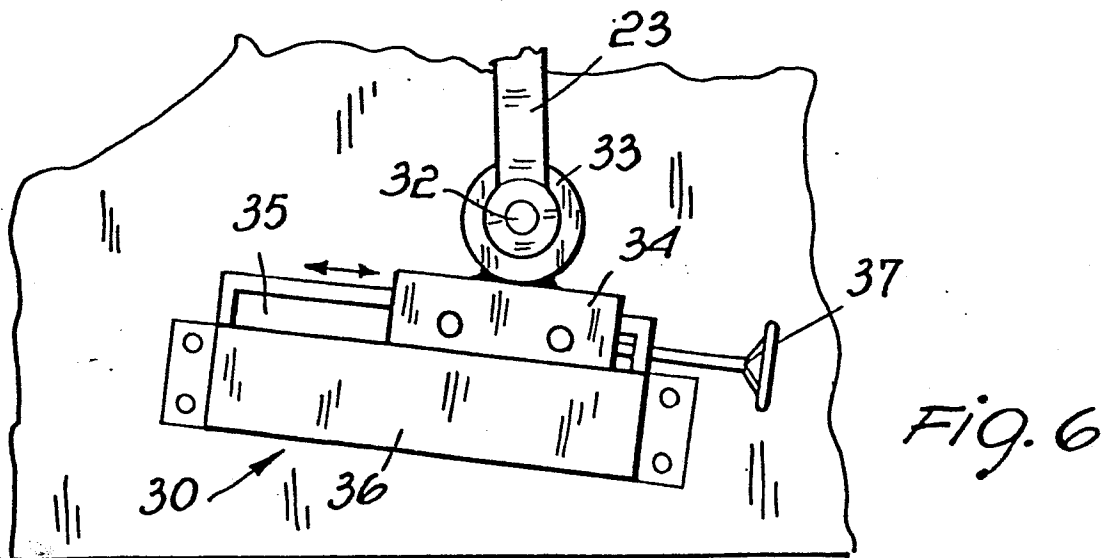
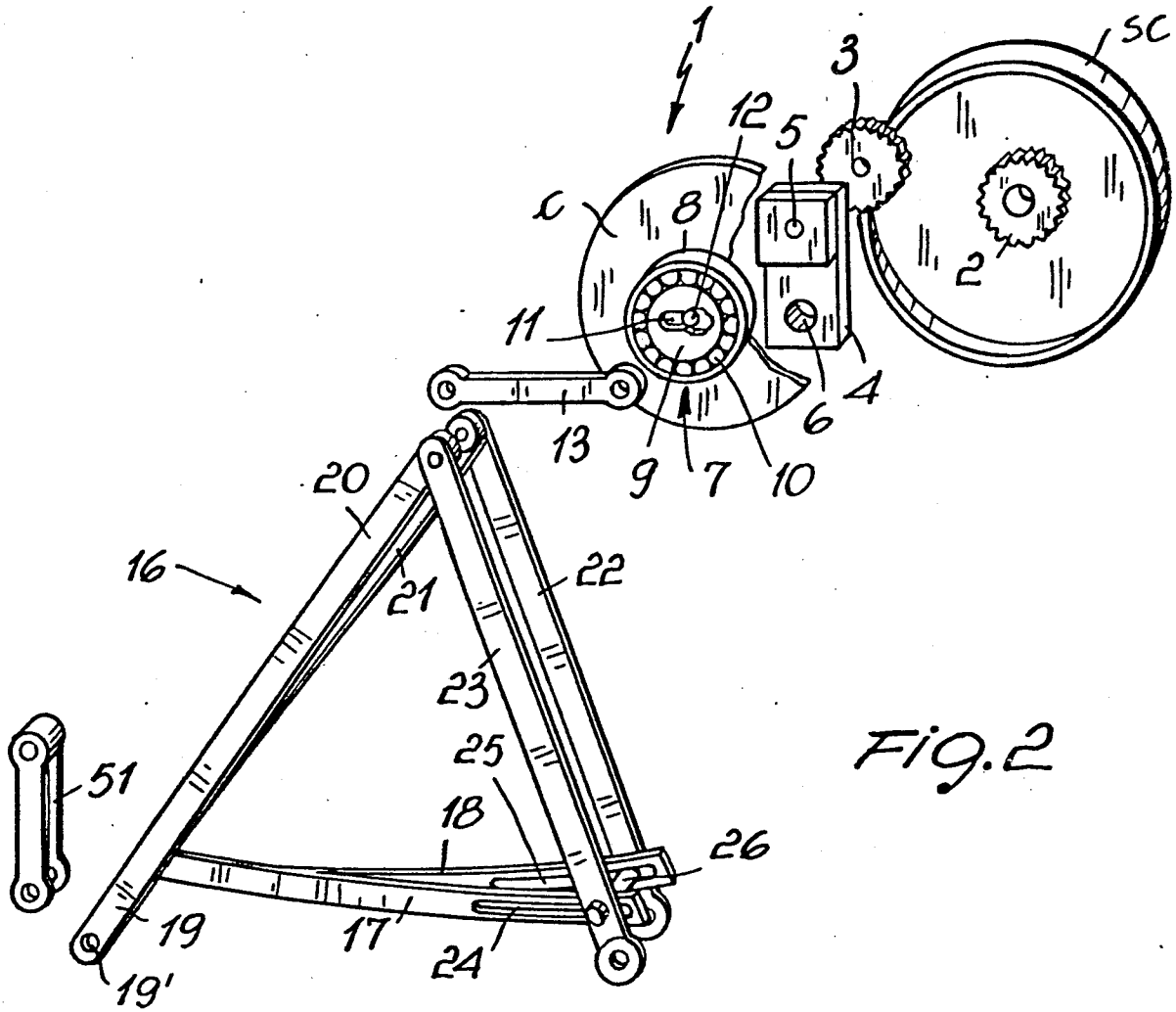
1 8. An actuator assembly according to Claim 7, char-
2 acterized in that said two base rods (17, 18) are each
3 provided, near the non-converging ends thereof, with
4 a respective longitudinal slot (24, 25), said longitu-
5 dinal slots (24, 25) extending in juxtaposed relation-
6 ship and each said slot being engaged in an adjustable
7 fashion by a respective end portion of said two sub-
8 stantially parallel rods (23, 22) of said other side
9 of said substantially triangular arrangement.

1 9. An actuator assembly according to Claim 8, char-
2 acterized in that said end portions of said two sub-
3 stantially parallel rods (22, 23) are engaged in an
4 adjustable fashion within said longitudinal slots (25,
5 24) of said two base rods (18, 17) by means of a cross
6 bolt (26) passed through said two slots (25, 24) and
7 coupling together said end portions of said two substan-
8 tially parallel rods (22, 23), the coupling region being

9 located more to the rear than said end portions of said
10 projecting rods from said base side.

1 10. An actuator assembly according to any of the
2 preceding claims, characterized in that said support-
3 ing plate (34) for said adjustment carriage (30) has a
4 substantially U-like configuration and is slidably en-
5 gaged on said carriage body (36), said plate (34) being
6 lockable at each adjustment position thereof by means
7 of two bolts passed through said two guide slots (35) in
8 said carriage body (36) and coupling together the paral-
9 lel wing portions of said plate and wherein said adjust-
10 able duration time preset for said standstill phase of
11 said picker head corresponds substantially to a 120-130°
12 rotation of said second gear (3), said gear holding ele-
13 ment (4), said washer (7), and said first connecting rod
14 element (13) around said first gear (2) and wherein the
15 drive ratio of said first gear (2) to said second gear
16 (3) is substantially 1:1.





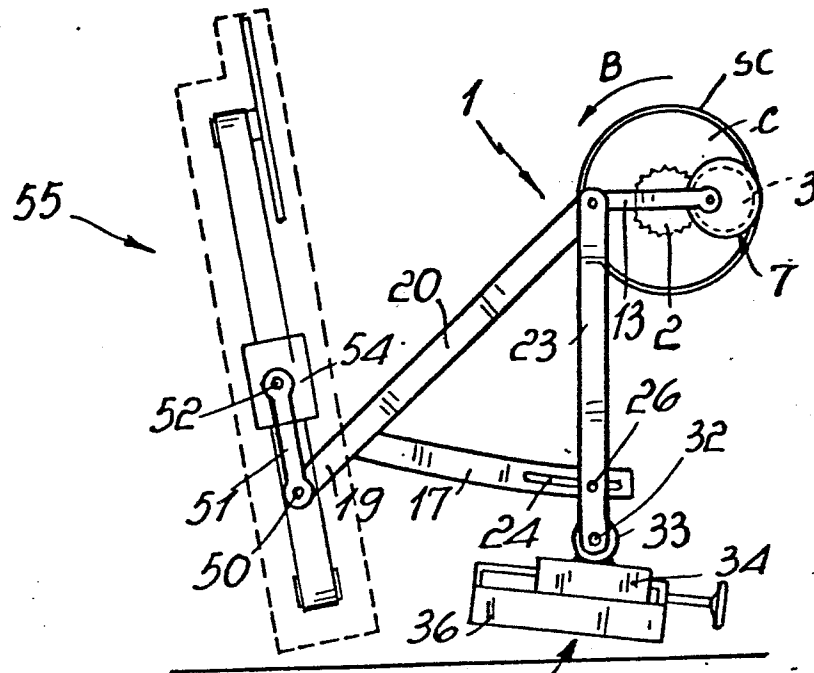


Fig. 3

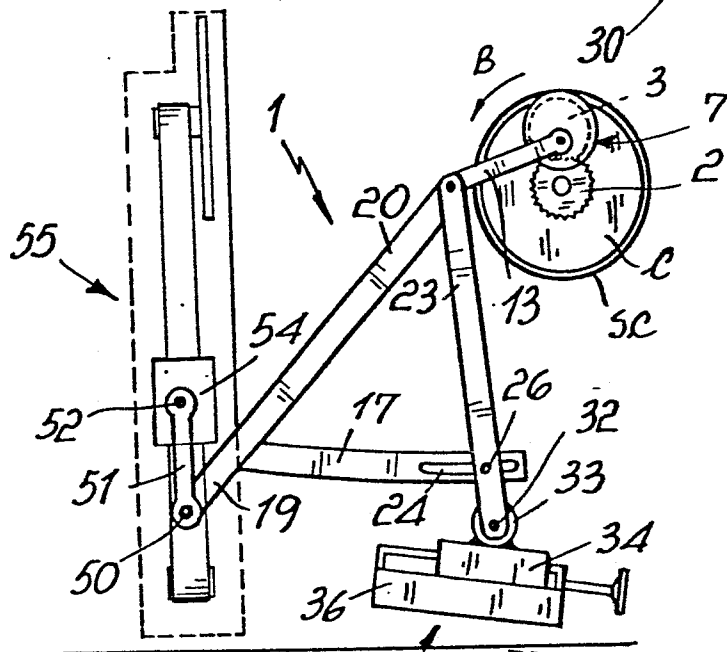


Fig. 4

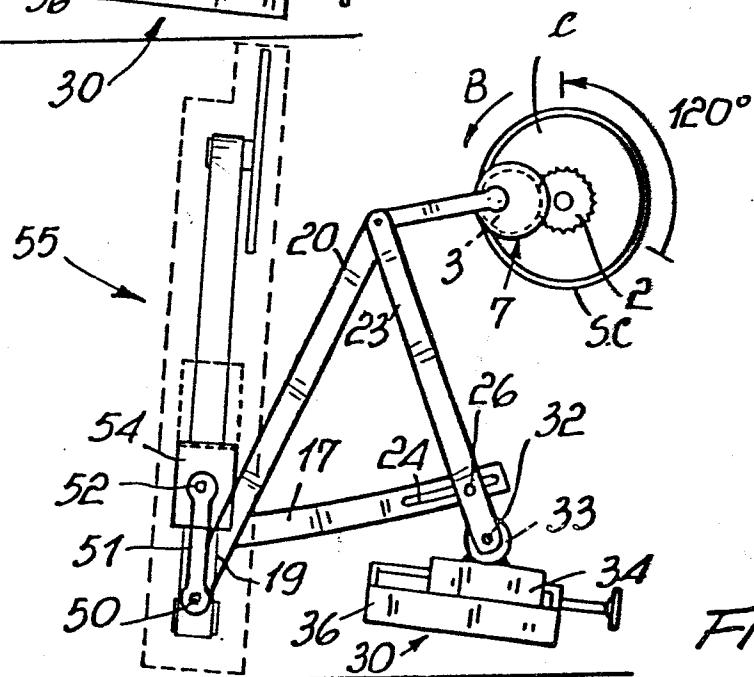


Fig. 5



European Patent
Office

EUROPEAN SEARCH REPORT

0120357
Application number

EP 84 10 2421

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
A	US-A-1 563 305 (AMBLER)		D 03 D 47/12
A	FR-A-1 465 062 (TUBAU QUINTANA)		
A	GB-A-1 407 632 (MACKIE)		
			TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
			D 03 D
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 15-06-1984	Examiner BOUTELEGIER C.H.H.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone			
Y : particularly relevant if combined with another document of the same category			
A : technological background			
O : non-written disclosure			
P : intermediate document			
T : theory or principle underlying the invention			
E : earlier patent document, but published on, or after the filing date			
D : document cited in the application			
L : document cited for other reasons			
& : member of the same patent family, corresponding document			