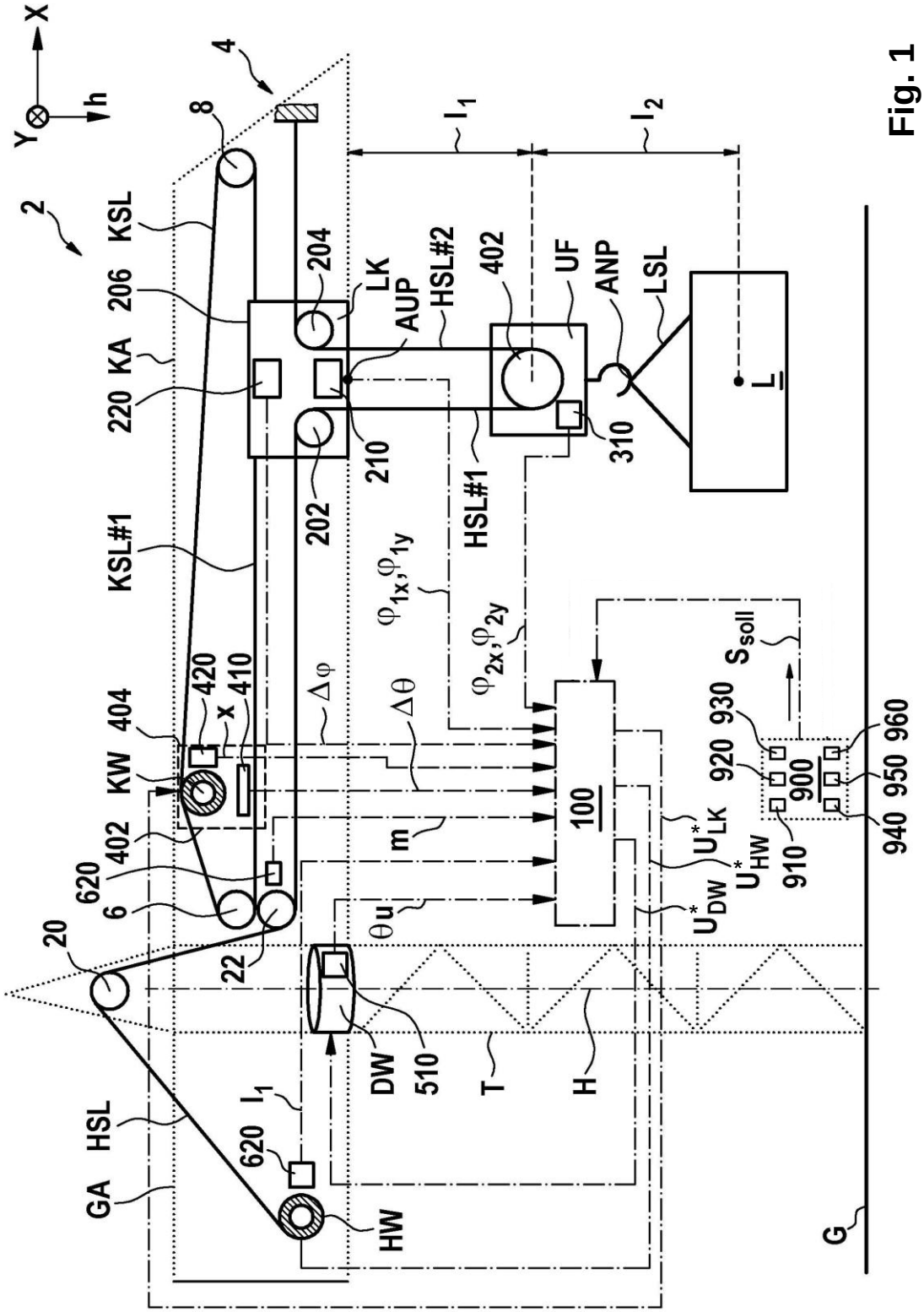

X
Y
h
2
4
8
KSL
206
KA
220
KSL#1
404
KW
420
410
x
402
620
6
20
22
HSL
GA
620
HW
l_1
DW
510
T
H
204
LK
AUP
HSL#2
402
UF
ANP
LSL
L
l_1
l_2
210
202
HSL#1
310
$\varphi_{1x}, \varphi_{1y}$
$\varphi_{2x}, \varphi_{2y}$
$\Delta\varphi$
$\Delta\theta$
m
θu
100
U^*_{LK}
U^*_{HW}
U^*_{DW}
S_{soll}
930
920
900
910
940
950
960
G

Fig. 1

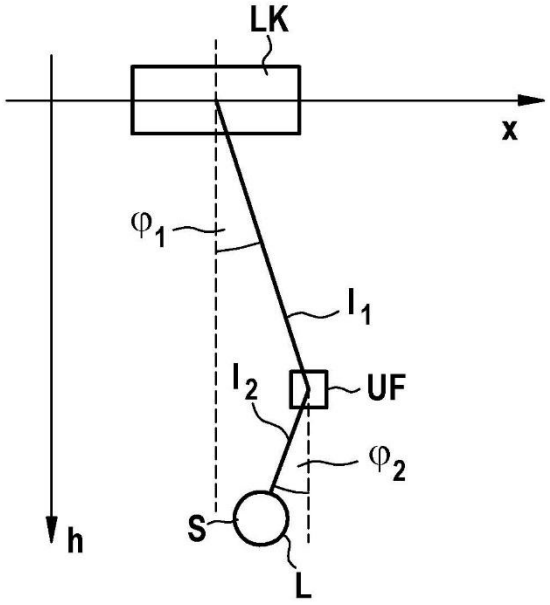


Fig. 2

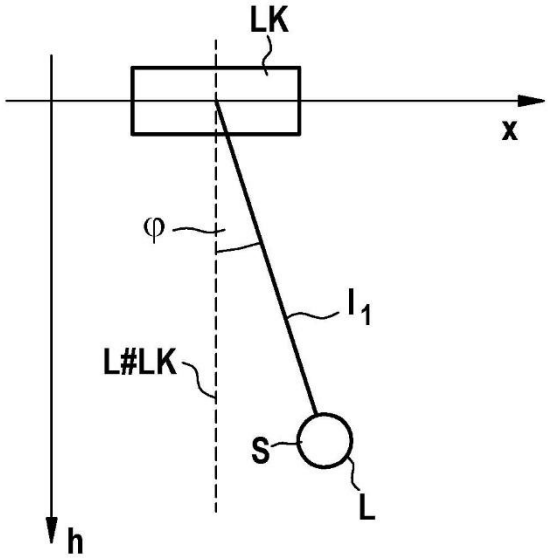


Fig. 3

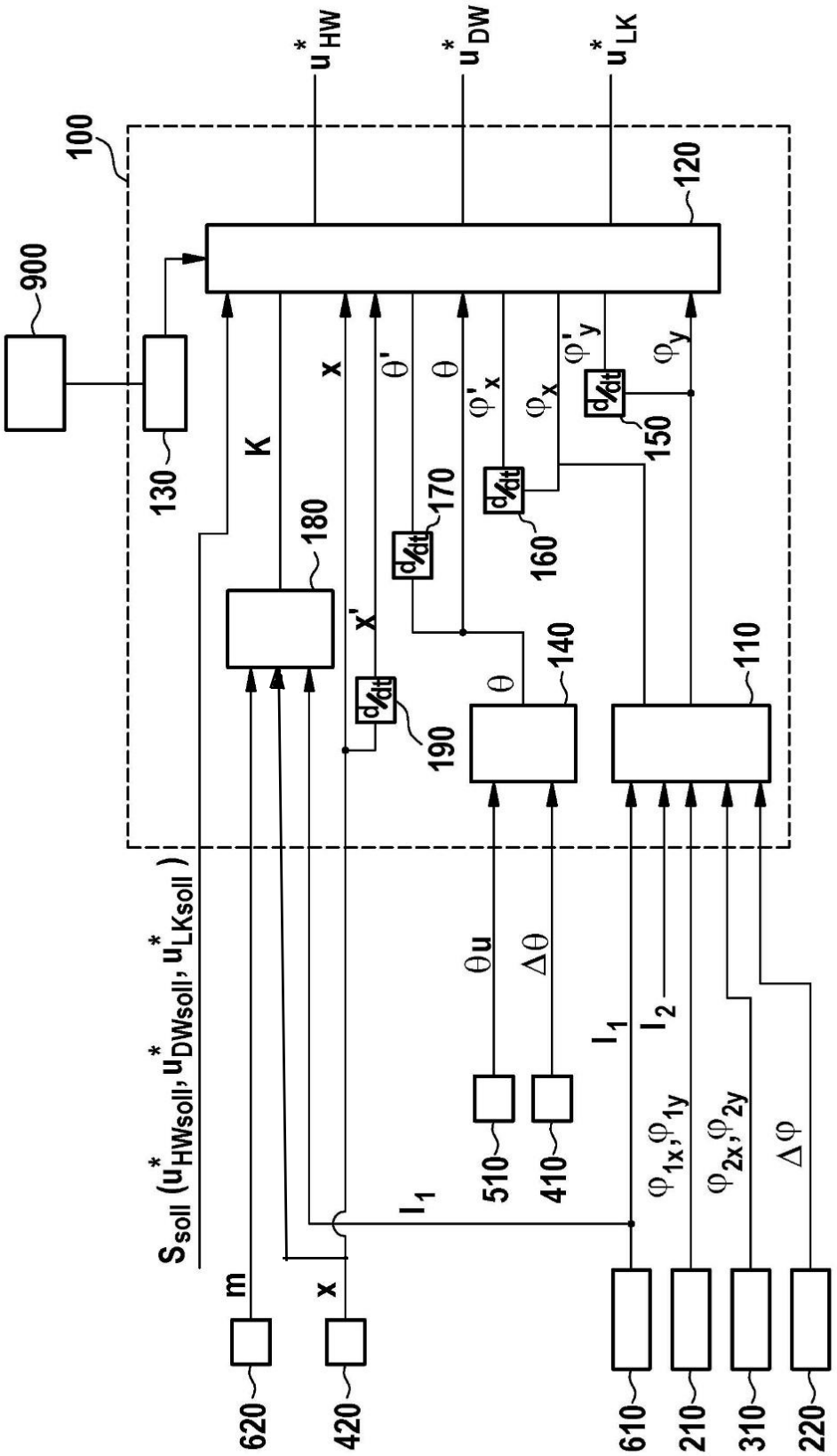

100
900
130
120
180
170
160
150
140
110
190
u^*_{HW}
u^*_{DW}
u^*_{LK}
K
x
θ'
θ
φ'_x
φ_x
φ'_y
φ_y
x'
θ
θu
Δθ
l_1
l_2
l_1
$\varphi_{1x},\varphi_{1y}$
$\varphi_{2x},\varphi_{2y}$
Δφ
S_{soll} (u^*_{HWsoll}, u^*_{DWsoll}, u^*_{LKsoll})
m
x
620
420
510
410
610
210
310
220

Fig. 4

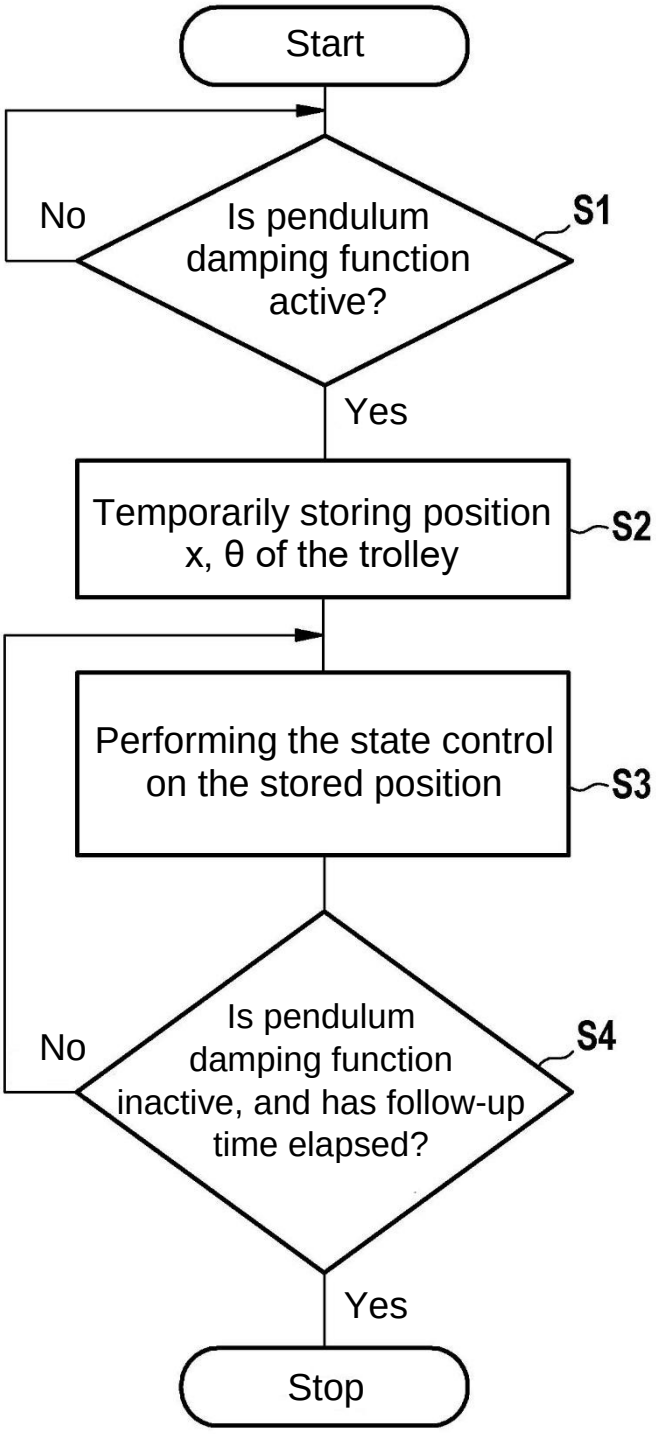

Start
Is pendulum damping function active?
S1
No
Yes
Temporarily storing position x, θ of the trolley
S2
Performing the state control on the stored position
S3
Is pendulum damping function inactive, and has follow-up time elapsed?
S4
No
Yes
Stop

Fig. 5

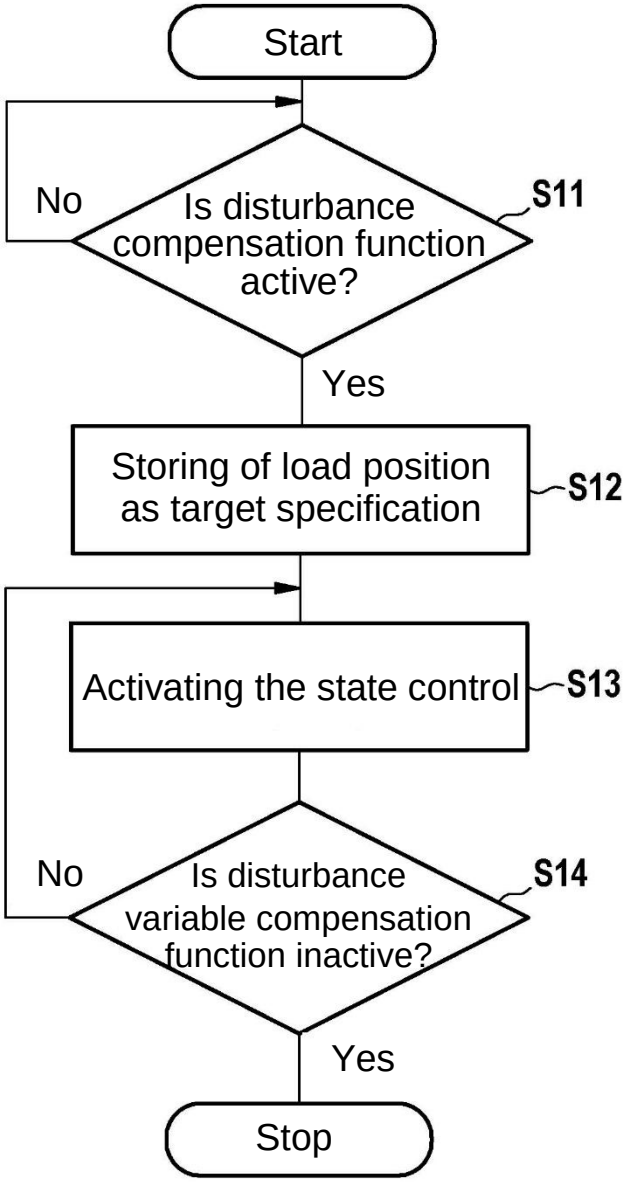

Start
No
Is disturbance compensation function active?
S11
Yes
Storing of load position as target specification
S12
Activating the state control
S13
No
Is disturbance variable compensation function inactive?
S14
Yes
Stop

Fig. 6

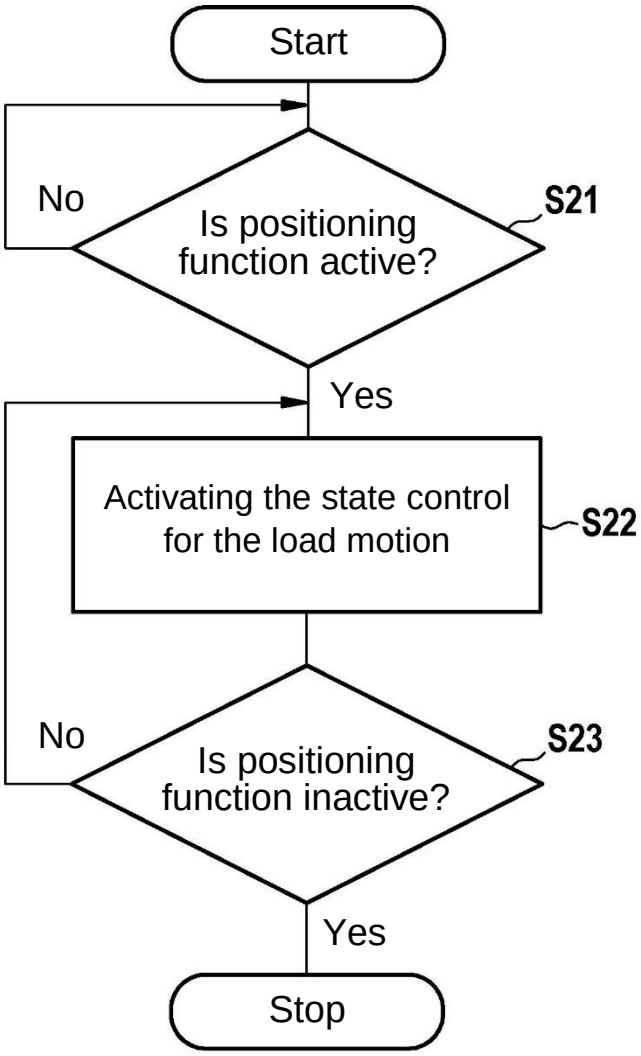

Start
No
Is positioning function active?
S21
Yes
Activating the state control for the load motion
S22
No
Is positioning function inactive?
S23
Yes
Stop

Fig. 7

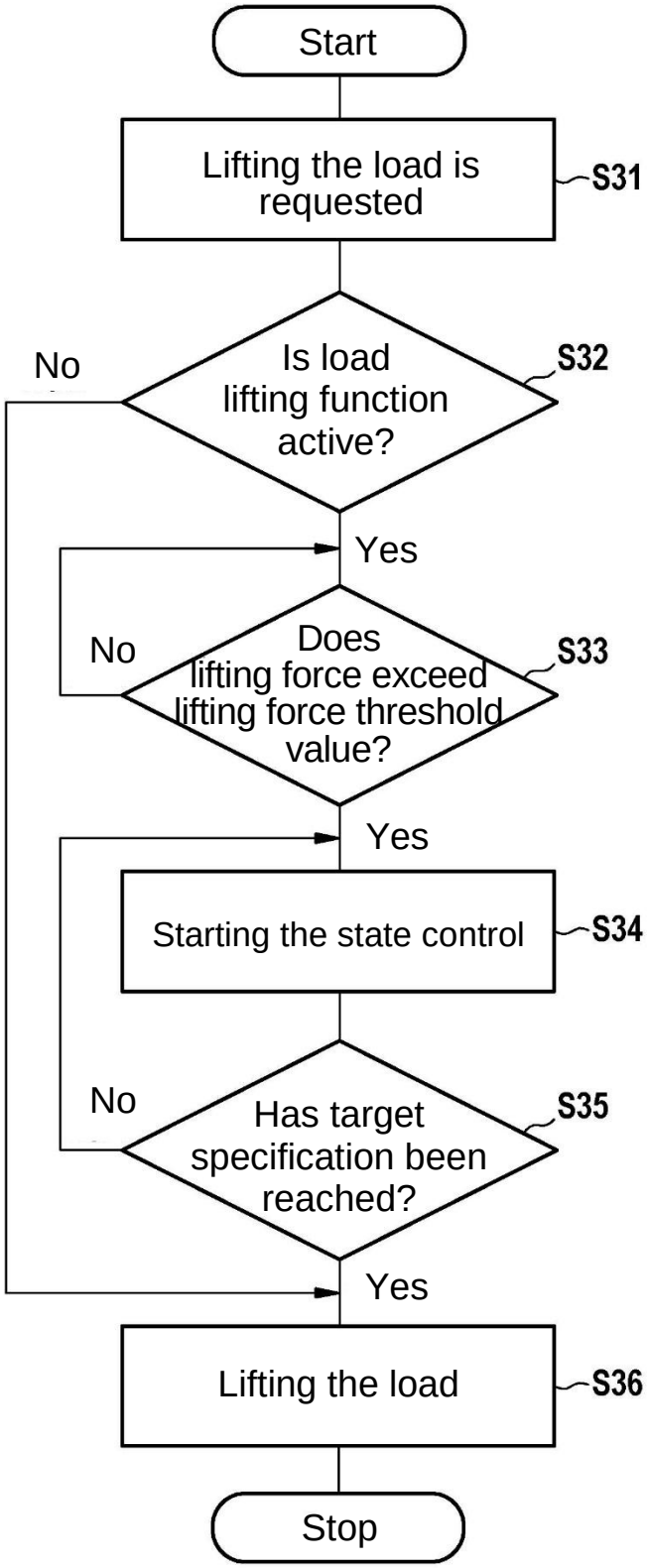

Start
Lifting the load is requested
S31
Is load lifting function active?
S32
No
Yes
Does lifting force exceed lifting force threshold value?
S33
No
Yes
Starting the state control
S34
Has target specification been reached?
S35
No
Yes
Lifting the load
S36
Stop

Fig. 8

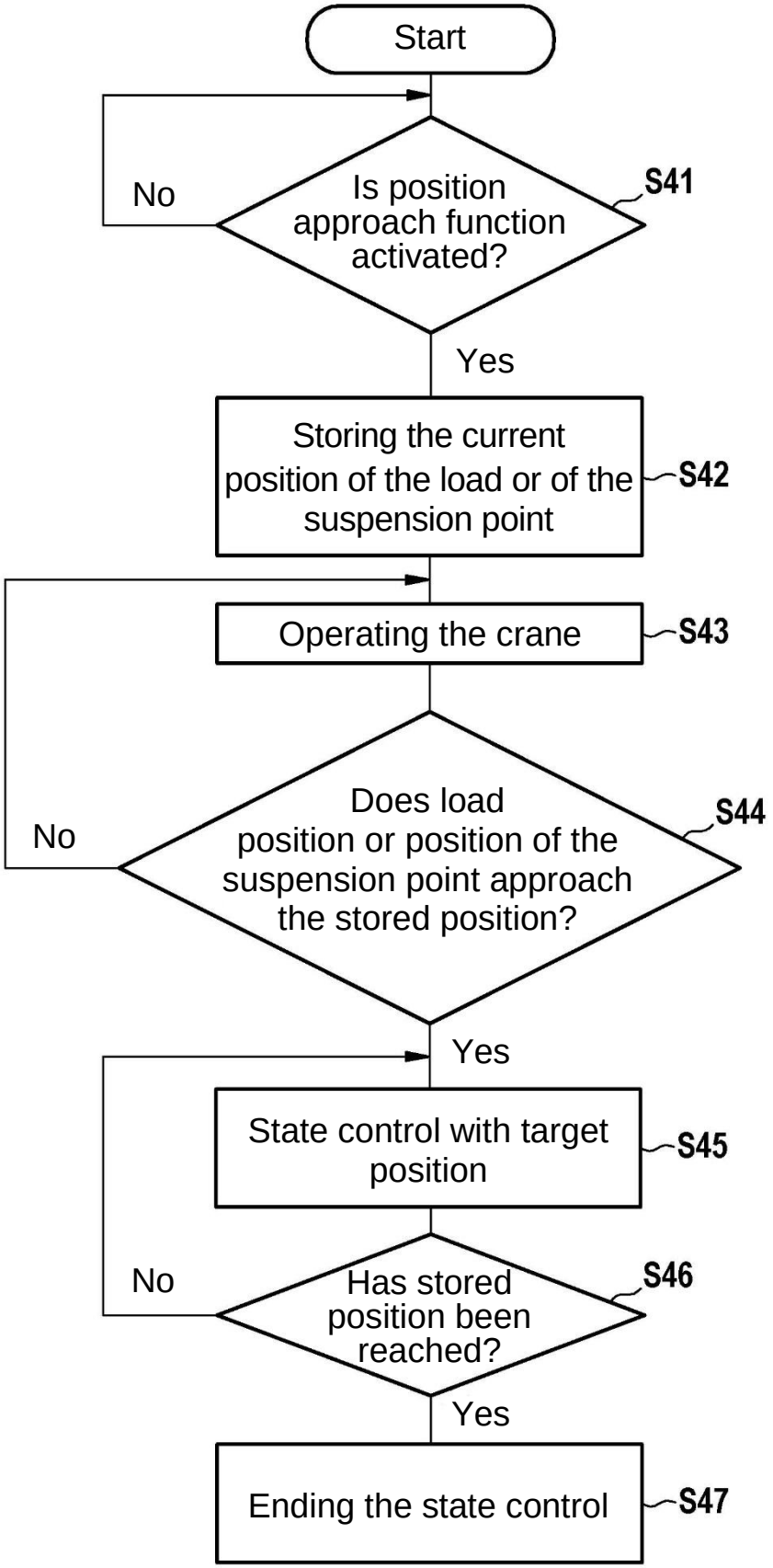

Start
Is position approach function activated?
S41
No
Yes
Storing the current position of the load or of the suspension point
S42
Operating the crane
S43
Does load position or position of the suspension point approach the stored position?
S44
No
Yes
State control with target position
S45
Has stored position been reached?
S46
No
Yes
Ending the state control
S47

Fig. 9