

July 25, 1950

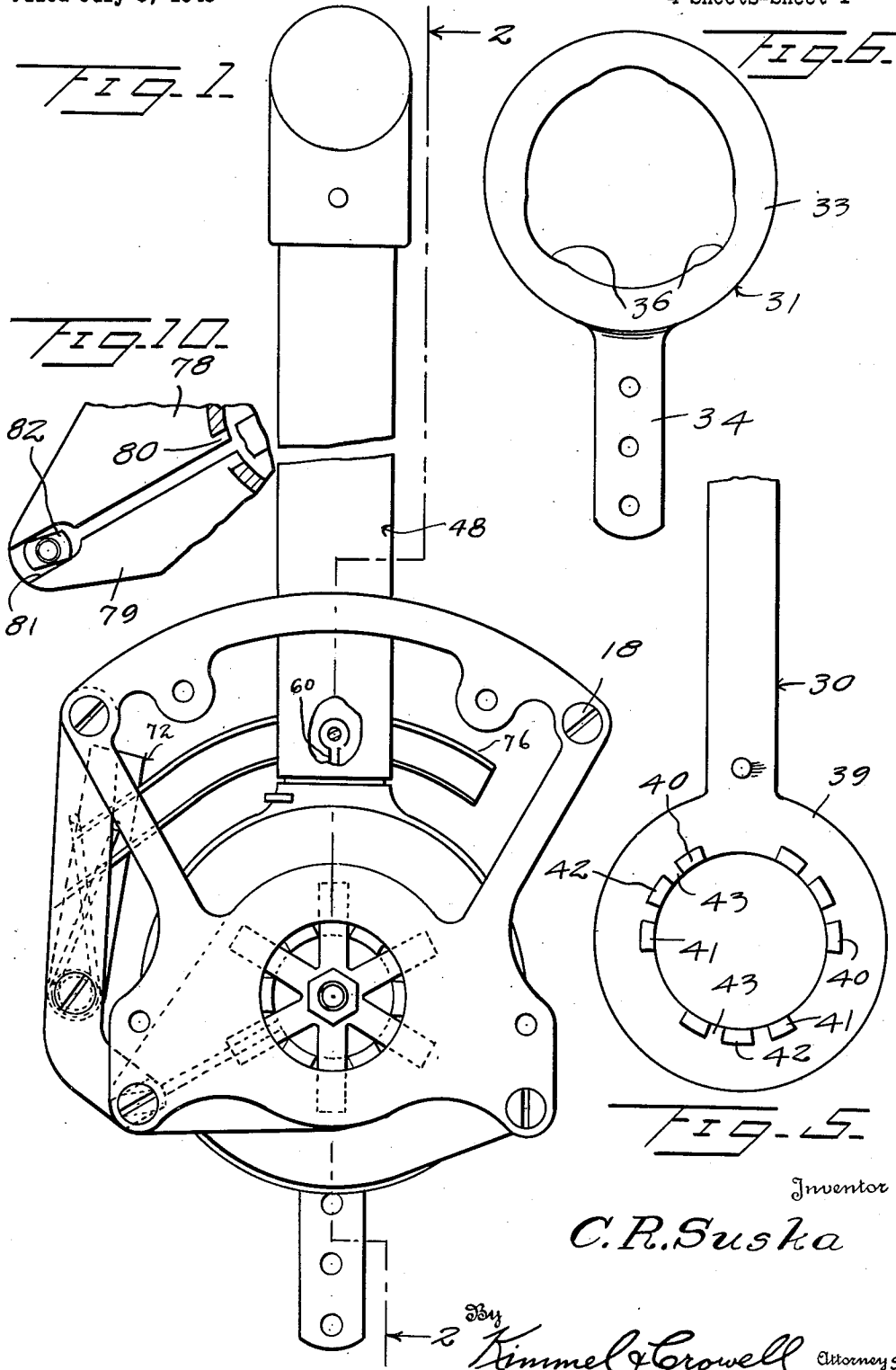
C. R. SUSKA

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MASTER LEVER AND SYNCHRONIZABLE MULTIPLE CONTROL

Filed July 8, 1948

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C. R. SUSKA

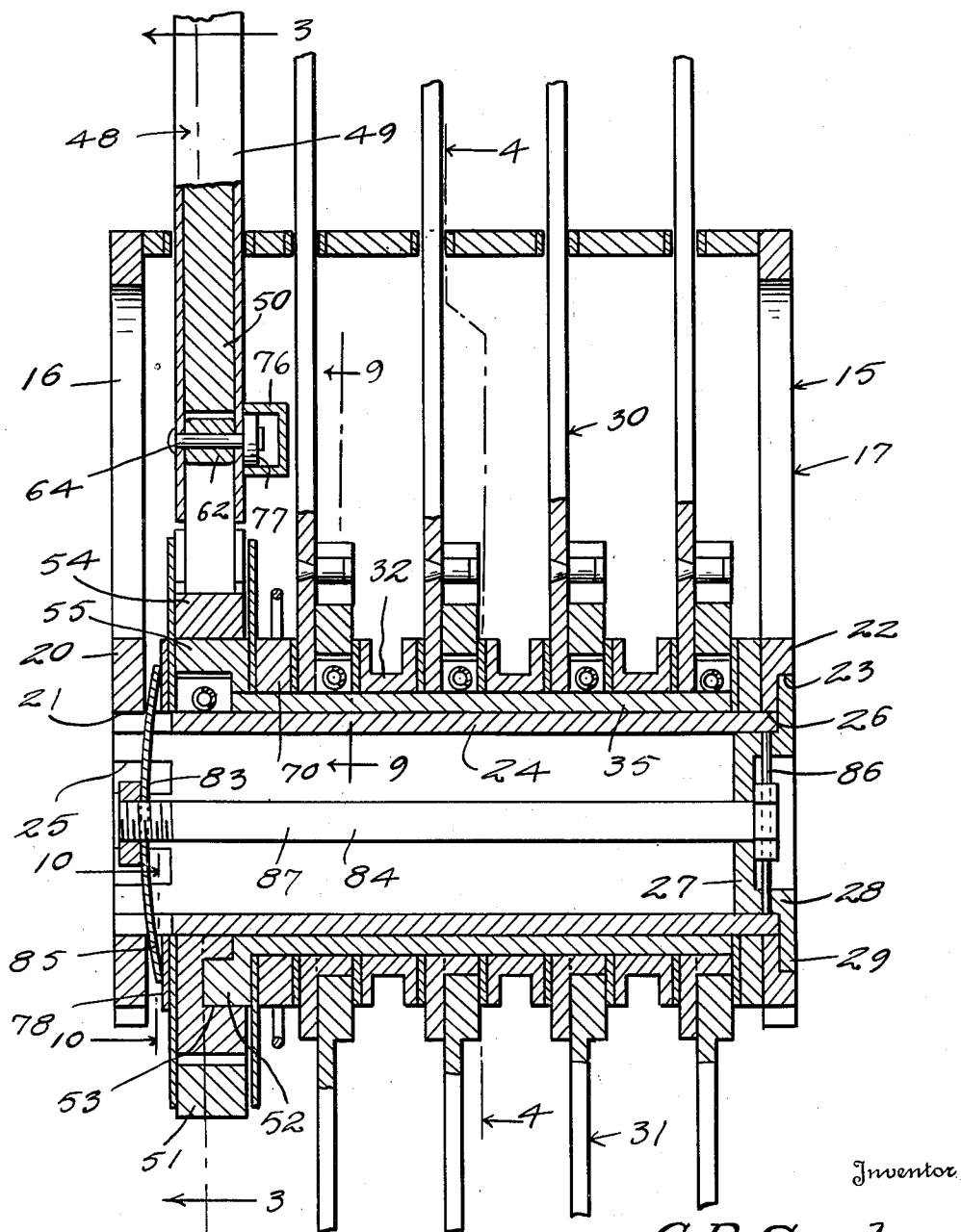
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FIG. 2.



Inventor.

C.R. Suska

By

Kimmel & Crowell Attorneys

July 25, 1950

C. R. SUSKA

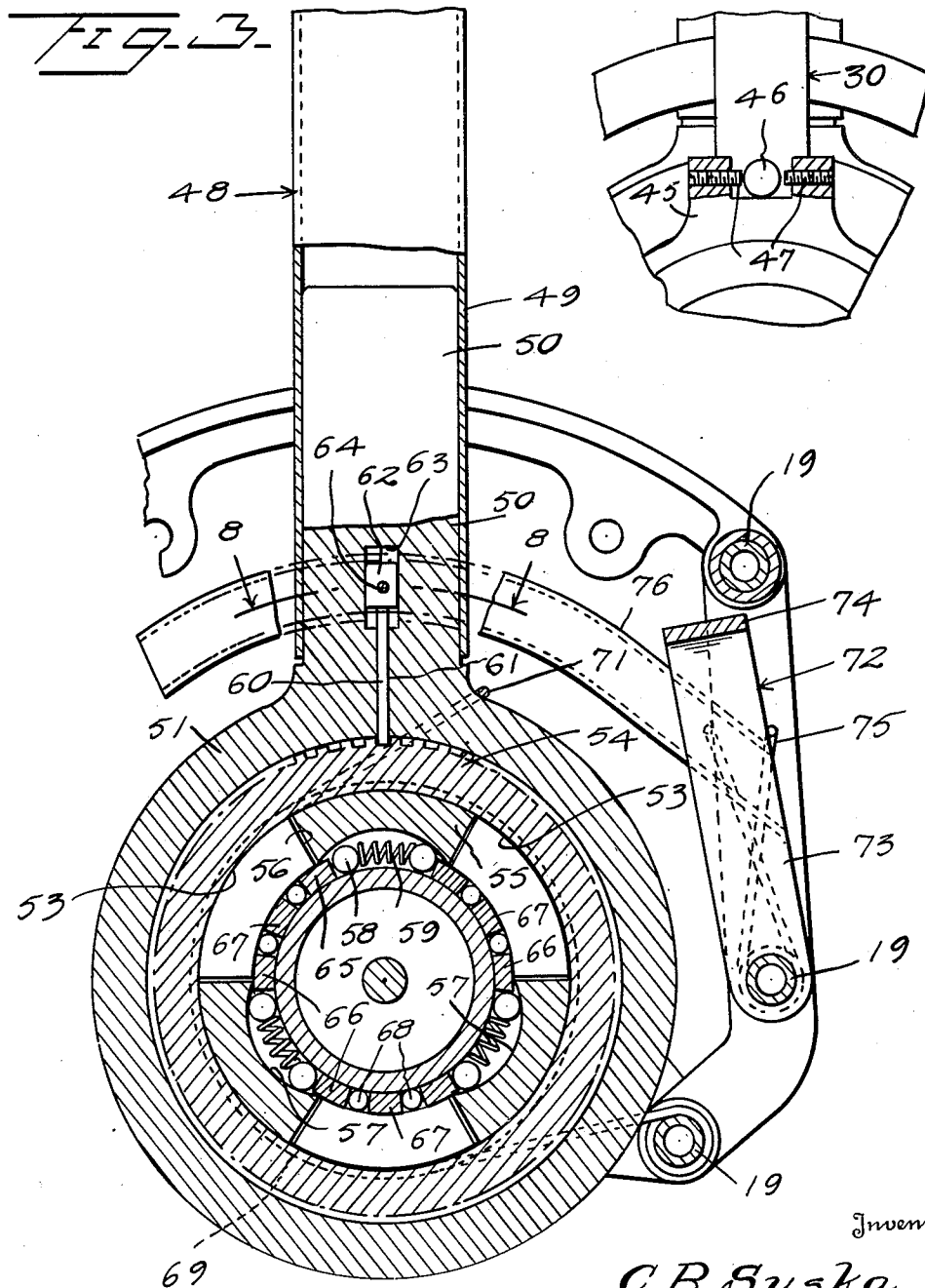
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Filed July 8, 1948

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Fig. 9



Inventor

C.R. Suska

By Kimmel & Crowell Attorneys

July 25, 1950

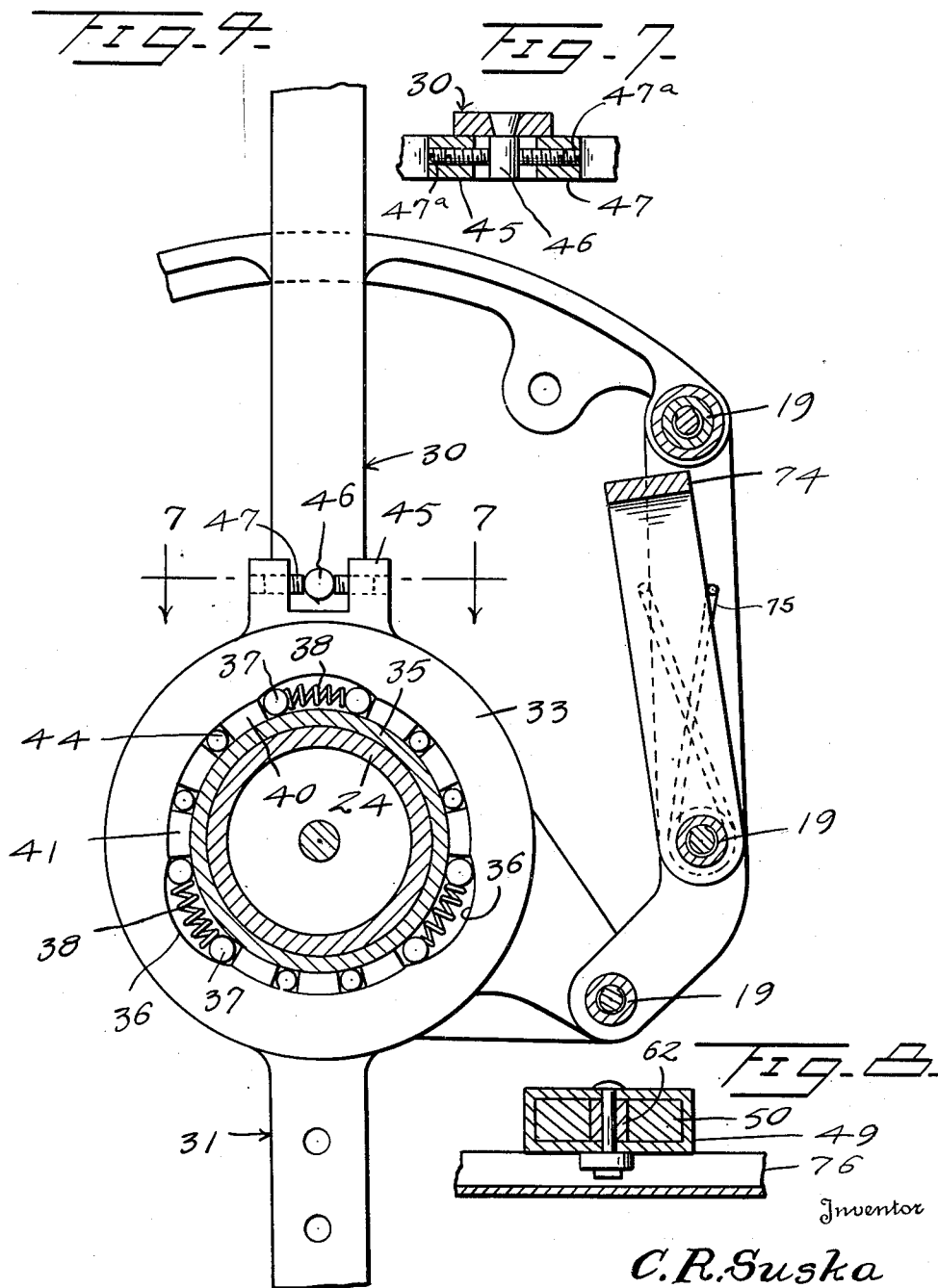
C. R. SUSKA

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MASTER LEVER AND SYNCHRONIZABLE MULTIPLE CONTROL

Filed July 8, 1948

4 Sheets-Sheet 4



Inventor

C. R. Suska

By

Kimmel & Crowell

Attorneys

UNITED STATES PATENT OFFICE

2,516,433

MASTER LEVER AND SYNCHRONIZABLE
MULTIPLE CONTROLCharles R. Suska, Corry, Pa., assignor to Aero
Supply Mfg. Co. Inc., Corry, Pa.

Application July 8, 1948, Serial No. 37,653

7 Claims. (Cl. 74-479)

1

This invention relates to a driving and driven lever assembly.

An object of this invention is to provide an improved lever assembly embodying multi-driving and driven levers wherein the driving levers may be separately adjusted in order that the elements connected with the driven levers may be accurately synchronized with each other, and when the elements are synchronized the driving levers therefor may be adjusted as a unit by a main driving lever.

Another object of this invention is to provide an improved lever assembly which is so constructed and arranged that when one of the individual driving levers is moved to extreme position, the main or synchronized driving lever is released with respect to the other levers so that the remaining individual driving levers may be separately operated, and subsequent movement of the main driving lever will be ineffective as to the remaining driving levers.

A further object of this invention is to provide in combination a plurality of regulating levers, each connected, as an example, to an engine for regulating the speed of the engine, with each regulating lever having associated therewith a driven lever and an irreversible clutch between the levers, all of the levers being mounted on a rotatable tubular shaft which also has associated therewith an irreversible clutch correlated with a main lever.

A further object of this invention is to provide an improved release means for the main control or driving lever which is automatically operative when one individual lever is moved to cut-off or extreme position to render the main lever inoperative. An additional release means is also adapted to be operated when one portion of the main lever is moved endwise relative to the other portion, so that the main lever can be adjusted to any desired position independent of the other levers in order that the engines or other elements connected with the individual levers may be set up or synchronized, the main lever being subsequently adjusted to a mean position with respect to the individual levers.

One adaptation of this invention is a control unit for a plurality of engines designed to operate at the same speeds, such as airplane engines. It will be understood that this invention may have other uses which are not herein enumerated and that this invention is not limited to engines for airplanes, but may be used in any location where a series of operated elements are synchronized

2

one relative to the other and may be adjusted as a unit when so synchronized.

With the above and other objects in view, my invention consists in the arrangement, combination and details of construction disclosed in the drawings and specification, and then more particularly pointed out in the appended claims.

In the drawings,

Figure 1 is a detail front elevation, partly broken away, of an irreversible lever assembly constructed according to an embodiment of this invention,

Figure 2 is a fragmentary sectional view taken on the line 2-2 of Figure 1,

Figure 3 is a fragmentary sectional view taken on the line 3-3 of Figure 2,

Figure 4 is a fragmentary sectional view taken on the line 4-4 of Figure 2,

Figure 5 is a fragmentary front elevation of one of the driving levers,

Figure 6 is a front elevation of one of the driven levers,

Figure 7 is a fragmentary sectional view taken on the line 7-7 of Figure 4,

Figure 8 is a fragmentary sectional view taken on the line 8-8 of Figure 3,

Figure 9 is a fragmentary sectional view taken on the line 9-9 of Figure 2,

Figure 10 is a fragmentary sectional view taken on the line 10-10 of Figure 2.

Referring to the drawings, the numeral 15 designates generally a frame which is formed of end frame members 16 and 17 which are secured together in spaced relation by means of fastening bolts 18, and spacer sleeves 19 are interposed between the frame members 16 and 17.

The frame member 16 includes a lower plate 20 formed with an opening 21, and the frame member 17 includes a lower plate 22 having a rabbeted groove 23. A stationary pivot sleeve 24 is disposed between the two end members 16 and 17, being provided with a slotted end having slots 25, and the slotted end which is the rear end of the sleeve 24 engages in the opening 21 of plate 20. The opposite end of pivot member 24 engages in opening 26 of front plate 22.

A flanged cap 27, having a cylindrical flange 28 engages in the forward end of sleeve 24 and the cylindrical flange 28 has formed integral therewith an annular flange 29 engaging in the rabbeted portion 23 of the plate 22. A plurality of driving and driven levers 30 and 31 respectively are disposed about the pivot member 24 and the driving and driven levers are spaced apart by means of grooved spacer members 32,

3

The driven lever or member 31 comprises an annular hub 33 having a radial arm 34 extending therefrom. A cylindrical sleeve 35 is interposed between the hub 33 and the stationary pivot member 24, and comprises a means whereby all of the driving and driven levers may be rocked as a unit when the engines or other elements associated with the driven levers have been synchronized. The hub 33 of driven lever 31 is formed with a plurality of circumferentially spaced apart cam recesses 36 within which pairs of wedging rollers 37 are adapted to engage. The members of each pair of wedging rollers 37 are constantly urged apart to wedging or locking position by means of a spring 38.

The driving lever 30 is formed with an annular hub 39 having pairs of releasing fingers 40 and 41 extending forwardly therefrom, and a lug 42 is disposed between the releasing fingers as shown in Figure 5, thereby forming spaces 43 within which anti-friction rollers 44 are adapted to engage. Releasing fingers 40 will engage one member of each pair of rollers 37 to thereby move said one roller to released position and permit rotation of lever 30 in one direction, whereas releasing fingers 41 will engage the other member of each pair of rollers 37 to permit rotation of lever 30 in the opposite direction.

Each hub 33 of the driven levers 31 has extending upwardly therefrom a pair of ears 45 between which a pin or operator 46 fixedly carried by the driven lever 30 is adapted to loosely engage. A pair of opposed set screws 47 which are locked by locking screws 47a are threaded through the ears 45, engaging on opposite sides of the operator 46 and spaced slightly therefrom so that during the initial rocking of the driven lever 30 in either direction, the associated releasing fingers 40 or 41 will engage the adjacent wedging rollers 37 and thereby move these rollers to released position. After the wedging rollers 37 engaged by the releasing fingers are moved to released position, operator or abutment 46 will engage one of the set screws 47 and at this time driven lever 31 will move with driving lever 30.

In order to provide for unitary movement of the several driving and driven levers after they have been initially set so that the engines or other elements associated therewith are operated in synchronism, I have provided a main driving lever generally designated as 48. The main lever 48 comprises an elongated tubular lever member 49 which slidably engages a lever 50 carried by an annulus or hub 51. The sleeve 35 at its rear end is formed with a cylindrical flange 52 which engages in a recess 53 formed in the inner side of a ring gear 54. The gear 54 is locked relative to the flange 52 and the sleeve 35 by means of a plurality of outwardly projecting sector-shaped fingers 55 which engage through slots 56 formed in the gear 54. These fingers or projections 55 which are formed integral with the cylindrical flange 52 are also formed on their inner sides with cam recesses 57. The slots 56 are slightly longer than the width of the fingers 55 so that there will be initial lost motion between the gear 54 and the fingers 55 during which cycle the releasing fingers carried by the gear 54 will move the wedging members locking the sleeve to the pivot to released position.

Pairs of wedging rollers 58 constantly urged apart by means of springs 59 are disposed in the cam recesses and engage the periphery of the stationary sleeve 24 to provide a brake for preventing rotation of the sleeve 35 relative to the

4

stationary sleeve 24. The gear 54 is rotatably disposed within the hub 51 of the lever 50 and the gear 54 is selectively locked relative to the hub 51 by means of a locking bolt or plate 60 which is slidable in a slot 61 formed in the lower end portion of the lever 51 and projecting through the hub 51 so that the bolt 60 may engage between selected teeth of the gear 54.

The bolt 60, as shown in Figure 3, is formed at its upper end with a head 62 slidable in a recess or opening 63 formed in the lever arm 50, and a pin 64 extends through the head 62 and also extends through the flat sides of the tubular lever 49. In this manner upward or endwise movement of the lever 49 will pull the key 60 outwardly to released position so that hub 51 may be freely rotated about the gear 54 without movement of this gear. Gear 54, as shown in Figure 3, is provided with pairs of releasing fingers 65 and 66 confronting rollers 58, and a lug 67 is disposed between each of the fingers 65 and 66. Anti-friction rollers 68 are disposed in the spaces between the lugs 67 and the releasing fingers 65 and 66 and provide a bearing for the flange 52 of the sleeve 35.

The driving or main lever 48 is under spring tension, urging this lever to rock in a counterclockwise direction by means of a spiral spring 69 which is wound about a spacer ring 70 interposed between the forward side of the main lever assembly and the adjacent auxiliary engine lever 30. One end of the spring 69 is looped about a spacer sleeve 19 and the other end of the spring 69 is hooked over the junction between the lever arm 50 and the hub 51, as indicated at 71.

In order to provide for release of the main lever 48 when one of the driving levers 30 is moved clockwise to off position for cutting off the associated engine, I have provided a U-shaped releasing member 72.

The releasing member 72 has the opposite legs 73 thereof pivoted on a spacer sleeve 19 at the lower portion of the frame, and the bight 74 of the releasing member 72 extends lengthwise of the frame 15 in the path of the movement of the levers 30. The releasing member 72 is constantly urged inwardly by means of a spring 75. The releasing member 72 has secured to one leg 73 thereof, a channel-shaped longitudinally curved lock operating member 76. The lock operating member 76 extends inwardly of the frame, as shown in Figure 3, on the forward side of the main lever 48, and a roller 77 carried by the pin 64 engages in the channel member 76 so that rocking upwardly of the channel member 76 by outward rocking of the U-shaped releasing member 72 will move the locking bolt or plate 60 upwardly and out of engagement with the teeth of the gear 54.

The driving levers 30 are adapted to be individually adjusted for synchronizing the engines or other elements one with another, rocking of the levers 30 effecting rocking of the driven levers 31. The levers 30 are rocked counterclockwise to increase the engine speed, and are rocked clockwise to decrease or cut off the engine speed. The driven levers 30 are automatically locked, as hereinbefore described, by the locking rollers 37 and during the initial rocking of the driving levers 30, the fingers 40 or 41 will move the adjacent rollers 37 to released position and further movement of the driving levers 30 will bring the operator or abutment 46 into engagement with one of the adjustable set screws 47 so that the driven lever 31 will rock with driving lever 30. These

5

driving levers 30 and 31 rotate about the sleeve 35 which is rotatable on the stationary pivot 24.

The stationary pivot or sleeve 24 is locked against rotation relative to the frame by means of a locking ring 78 which is formed with a split projection 79 having key members 80 engageable in one of the slots 25 of the sleeve 24. The projection 79 is formed with a slot 84 at its outer end, within which a flattened or cam-shaped spacer member 82 engaging between the end members 16 and 17 is adapted to engage. A resilient spider 83 carried by an axially disposed bolt 84 has the arms 85 thereof projecting through the slots 25 and bearing against the locking ring 78. A cross pin 86 extends through flange 28 and the head of bolt 84 to hold this bolt against turning so that the nut bearing against spider 83 may be adjusted to tension spider 83. After the levers 30 and 31 have been adjusted to synchronize the engines one with the other, the engines may be accelerated or decelerated as a unit by rocking of the main lever 48. Rocking of lever 48 will release the locking or wedging members 58 so that sleeve 35 will turn with lever 48, and as the levers 30 and 31 are locked to sleeve 35 by the wedging members, the levers 30 and 31 will rock as a unit with the main lever 48, and the main lever 48 may be adjusted independently of the levers 30 and 31 by pulling the tubular lever member 49 outwardly, thereby moving the locking bolt 60 to released position. The main lever may then be circumferentially adjusted to the desired position.

In the event one of the engines is cut off for any desired reason, the associated driving lever 30 may be moved clockwise and when this is done, the driving lever 30 will strike the releasing bar 74 of the releasing member 72, rocking releasing member 72 forwardly or outwardly and at the same time swinging channel member 76 upwardly and thereby moving locking bolt 60 to released position. Spring 69 will then move main or master lever 48 to the extreme forward position, automatically placing it in a non-interfering position, for operation of the individual levers 30.

In the event the pilot should rock the main lever 48 with one or more of the engines cut off, the main lever will be ineffective in its operation as to the other engine levers so that at this time it will be necessary for the pilot to adjust the remaining engine levers individually to obtain proper engine operation.

I do not mean to confine myself to the exact details of construction herein disclosed, but claim all variations falling within the purview of the appended claims.

What I claim is:

1. A lever assembly comprising a frame, a stationary pivot carried by said frame, a sleeve rotatable on said pivot, a plurality of driving levers rockably carried by said sleeve, a driven lever associated with each of said driving levers and rockably carried by said sleeve, said driven levers being capable of limited rocking relative to said driving levers, releasable clutch means normally locking each of said driven levers to said sleeve and disposed therebetween, clutch release means carried by each of said driving levers engageable with said clutch means for releasing said driven levers, correlated means carried by each of said driving and driven levers active after releasing of said clutch means for rocking said driven levers with said driving levers, a main lever, and operative connections between said main lever and said sleeve.

2. A lever assembly comprising a frame, a sta-

6

tionary pivot carried by said frame, a sleeve rotatable on said pivot, a plurality of driving levers rockably carried by said sleeve, a plurality of driven levers rockably carried by said sleeve, releasable clutch means normally locking said driven levers to said sleeve, clutch release means carried by said driving levers engageable with said clutch means for releasing said driven levers, correlated means carried by said driving and driven levers active after releasing of said clutch means whereby said driven levers will rock with said driving levers, a main lever, operative connections between said main lever and said sleeve, releasable brake means normally locking said sleeve to said pivot, and release means correlated with said main lever and active upon the initial rocking thereof for releasing said brake means.

3. A lever assembly comprising a frame, a plurality of rock levers, a rotatable pivot for said levers carried by said frame, releasable clutch means for locking said levers to said pivot, each lever including clutch release means for releasing said levers relative to said pivot, releasable brake means for locking said pivot relative to said frame, a main lever, and operative connections between said main lever and said pivot, said operative connections including brake release means engageable with said brake means upon movement of said main lever for releasing said brake means whereby said pivot may be rotated with movement of said main lever.

4. A lever assembly comprising a frame, a plurality of rock levers, a rotatable pivot for said levers carried by said frame, releasable clutch means for locking said levers to said pivot, releasable brake means for locking said pivot relative to said frame, a main lever, operative connections between said main lever and said pivot, said operative connections including releasable latch means whereby said main lever may be angularly adjusted independently of said first named levers, and means carried by said frame operatively connected with said latch means and disposed in the path of said first named levers in one direction of movement of the latter whereby said latch means will be moved to released position by at least one of said first named levers and said main lever will be thereby uncoupled relative to said pivot.

5. A lever assembly comprising a frame, a plurality of rock levers, a rotatable pivot for said levers carried by said frame, releasable clutch means for locking said levers to said pivot, releasable brake means for locking said pivot relative to said frame, a main lever, operative connections between said main lever and said pivot, said operative connections including releasable latch means whereby said main lever may be angularly adjusted independently of said first named levers, a U-shaped member rockably carried by said frame and disposed in the path of movement of said first named levers, a spring constantly urging said U-shaped member toward said first named levers, and an arm carried by said U-shaped member engaging said latch means whereby the latter will be moved to released position upon outward rocking of said U-shaped member upon engagement of the latter by one of said first named levers.

6. A lever assembly comprising a frame, a stationary shaft carried by said frame, a sleeve rotatable on said shaft, releasable brake means normally locking said sleeve to said shaft, a plurality of levers rockably carried by said sleeve, releasable clutch means normally locking said levers

7

to said sleeve, a main lever including an inner part and an outer part slidably carried by said inner part, a toothed latch member correlated with said first named brake means, and a locking bolt fixed relative to said outer lever part whereby said main lever may be selectively angularly adjusted relative to said first named levers, and brake releasing means carried by said inner part adapted to engage said brake means for releasing the latter whereby said rotatable sleeve and said plurality of levers may be rotated as a unit.

7. A lever assembly comprising a frame, a stationary shaft carried by said frame, a sleeve rotatable on said shaft, releasable brake means normally locking said sleeve to said shaft, a plurality of levers rockably carried by said sleeve, releasable clutch means normally locking said levers to said sleeve, a main lever including an inner part and an outer part slidably carried by said inner part, a toothed latch member correlated with said first named brake means, a locking bolt fixed relative to said outer lever part

8

whereby said main lever may be selectively angularly adjusted relative to said first named levers, and a locking bolt releasing member rockably carried by said frame, connected to said bolt and disposed in the path of swinging in one direction of said first named levers whereby said bolt may be moved to inoperative position upon movement of one of said first named levers in said one direction.

CHARLES R. SUSKA.

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