May 2, 1967 J. B. FINDLAY 3,316,773

REVERSIBLE PUMP CONTROL LINKAGE

Filed Feb. 14, 1964

3 Sheets-Sheet 1

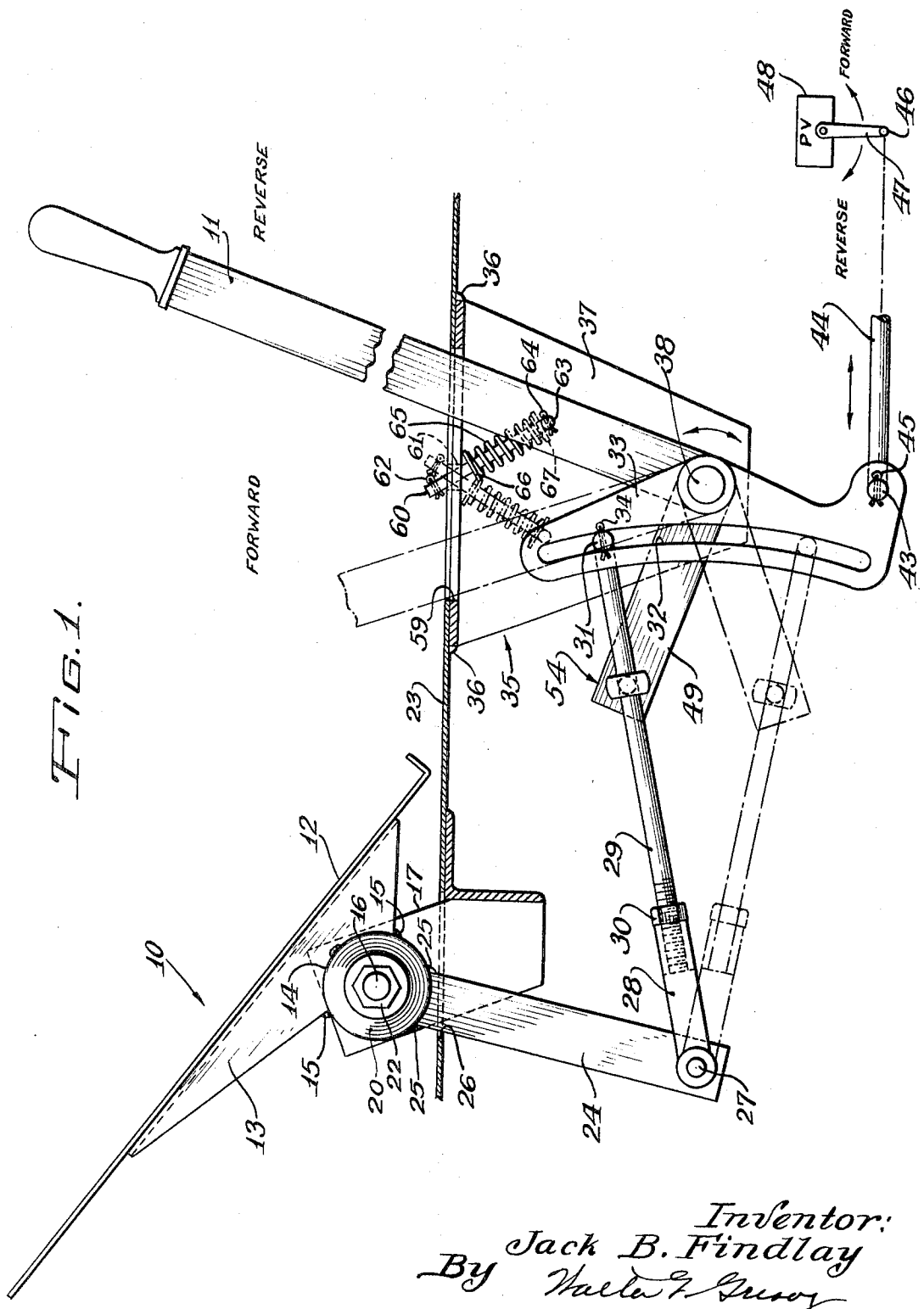

FIG. 1.

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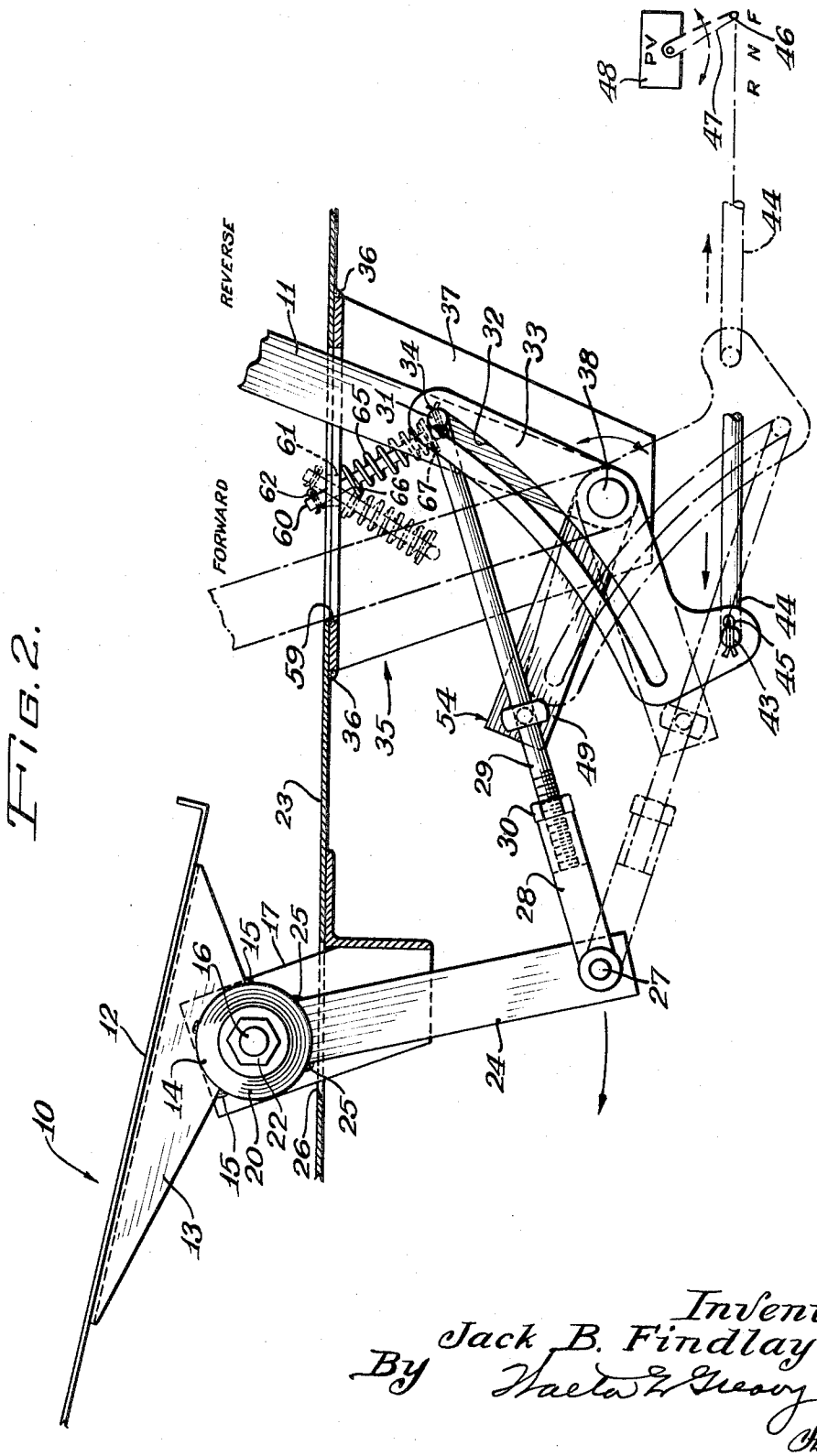

FIG. 2.

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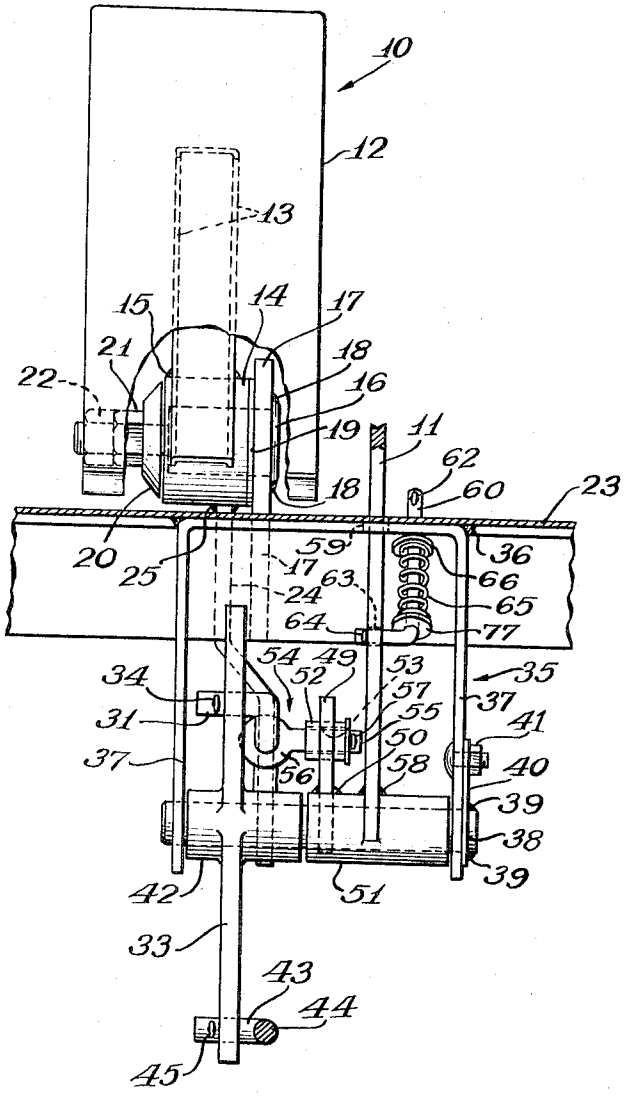
FIG. 3.



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United States Patent Office 3,316,773
Patented May 2, 1967

3,316,773

REVERSIBLE PUMP CONTROL LINKAGE

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Filed Feb. 14, 1964, Ser. No. 345,002
4 Claims. (Cl. 74—481)

This invention relates to motion-transmitting devices but more particularly it is directed to a device for converting foot pedal or hand lever force and displacement into angular displacement at a controlled component. More specifically, however, it is concerned with provision of an assembly including two cooperatively operable levers adaptable for use with a component requiring forward and reverse control input as well as maximum and minimum limits control all from a neutral position.

A suitable and highly adaptable use for such an assembly, although not being limited to such use, would be the control for a reversible variable displacement hydraulic pump.

A primary object of the present invention is to provide an improved mechanism for selectively furnishing to an associated controlled component forward and reverse control input from a neutral position.

Another object is to provide an improved motion-transmitting mechanism employing two operable control levers for furnishing forward and reverse position control through the maximum and minimum ranges of each such position to an associated hydraulic pump mechanism.

A further object is to provide a motion-transmitting mechanism having one foot-operated pedal and one hand-operated lever cooperatively operable for providing forward and reverse control to an associated controlled component.

A still further object is to provide a motion-transmitting mechanism arranged to receive input control from a plurality of cooperatively operable members and translating such control movement into forward and reverse control of an associated component from a neutral position thereof through a full range of control in the forward as well as the reverse position thereof, and wherein an over-center type spring is provided to maintain one of said cooperatively operable members in each selected position thereof.

A yet still further object is to provide a motion-transmitting mechanism employing one foot-operated lever and one hand operated lever interconnected by linkage including a rotatively shiftable plate or walking beam-like assembly for translating the movement of said levers into forward and reverse control from a neutral position of an associated hydraulic component.

Another important object is to provide a motion-transmitting mechanism utilizing a pair of interconnected cooperatively operable members wherein movement of one of said members provides directional control for an associated hydraulic pump component while movement of the other of said members provides flow control for said component selectively in the forward and reverse direction of movement thereof.

The foregoing and other objects and features of the invention will become apparent as the disclosure is more fully made in the following detailed description of a preferred embodiment of the invention as illustrated in the accompanying sheets of drawings in which:

FIGURE 1 is a side elevational view of the proposed motion-transmitting mechanism wherein the controlled component is in neutral and the forward position of the directional control lever is shown in broken lines;

FIGURE 2 is a side elevational view of the proposed mechanism showing said mechanism positioned for the maximum flow position of the controlled component and having the forward position of the directional control lever shown in broken lines; and

FIGURE 3 is an end elevational view partly broken away of the proposed mechanism looking generally from the right toward the left of FIGURE 1, the mechanism being shown in the reverse control position.

Reference being had now to the drawings it will be seen that a preferred embodiment of the device has been shown in association with a reversible flow, variable displacement hydraulic pump. Such an installation might be found on a hydrostatic ground drive agricultural combine or other vehicle powered by a pump of this character such as shown in co-pending U.S. patent application, Ser. No. 310,593 assigned to the same assignees as the present invention, now Patent No. 3,270,826 but wherein no separate directional control valve is employed in the system. As illustrated, the proposed mechanism utilizes a foot-operated pedal **10** and a hand-operated lever **11** although it will be appreciated that both said operating members may be either foot or hand operated without deviating from any of the inventive concepts hereof. The pedal **10** may be fashioned to provide a treadle member **12** having a pair of parallel flanges **13, 13** affixed to and depending from said treadle that may be suitably interconnected at opposite ends thereof. Cut-away portions of said flanges are dimensioned to receive a hub member **14** which may be secured to the flanges by suitable means such as the welds indicated at **15, 15.** Hub **14** is centrally apertured to receive a stud bolt **16** positioned in a bracket **17** and fixedly secured therein by suitable means such as the welds **18, 18.** A friction washer or disc **19** is positioned between one face of hub **14** and bracket **17,** and a cone-shaped member such as the Belleville washer **20** is disposed in abutting engagement with the opposite face of said hub and with a nut **21** threaded on bolt **16.** A lock-up nut **22** may also be provided on bolt **16** outside nut **21** for purposes well understood.

Support bracket **17** is secured by any suitable means to a fixed support which, as illustrated, may be the floor **23** of a vehicle (not shown) in which the proposed device is incorporated. Now as the pedal **12** is actuated by application of foot pressure thereon by the operator it will be rotated against the frictional resistance of friction washer **19** and Belleville washer **20** which resistance, of course, may be varied or adjusted as desired by manipulation of lock nuts **21** and **22.**

An actuating arm **24** depends from hub **14** and may be secured thereto for movement therewith by any suitable means such as the welds indicated at **25.** It will be understood, also, a suitable aperture **26** may be provided in floor **23** to accommodate bracket **17** as well as arm **24.** The opposite end of arm **24** has pivotally attached thereto at **27** one end of a link member **28** while the opposite end of said member has threadably positioned therein a connecting rod **29** which may be secured against displacement therefrom by a lock nut **30.** The opposite end of rod **29** is overturned to provide a laterally extending pivot portion **31** which is slidably positioned in an arcuate slot **32** in a plate or walking beam-like member **33** and secured against displacement therefrom by suitable means such as the cotter pin **34.** As arranged the arm **24,** link member **28** and connecting rod **29** may be said to constitute an articulated motion-transmitting linkage interconnecting pedal **10** and beam member **33.**

A U-shaped bracket **35** is secured by any suitable means such as the welds shown at **36** to the support or floor member **23,** and depending parallel arms **37, 37** supportably carry a pin or shaft **38** at the lower ends thereof with the end of said pin welded as shown at **39** to a locking plate member **40** which, in turn, is demountably affixed to

one of the arms **37** of said bracket by suitable bolt and nut means **41**.

Beam or plate **33** intermediate the ends thereof has affixed thereto a journaling hub **42** which extends laterally in both directions therefrom and is pivotally mounted on pin **38**. The opposite end of said beam has pivotally affixed thereto a bent over end portion **43**, of a rod **44**, which is secured in place in the beam by suitable means such as the cotter pin **45**, while the opposite end of rod **44** may be pivotally affixed at **46** to an arm **47** which actuates the control elements (not shown) of a variable displacement hydraulic pump component indicated schematically at **48**.

A crank arm **49** is secured, by suitable means such as the welds **50**, to a journaling sleeve **51** pivotally carried on pin **38** and extends outwardly therefrom and proximate the opposite end of the arm has fixedly mounted therein a bushing **52** which pivotally receives and carries in a central aperture **53** therein an eye-rod member, designated generally by reference numeral **54**. Said eye-rod member includes a rod or shank portion **55** pivotally positioned in aperture **53** in said bushing, and an enlarged eye portion **56** dimensioned to slidably receive in the eye thereof connecting rod **29**. A cotter pin **57**, or other suitable means, may be used to prevent accidental displacement of eye-rod **54** out of aperture **53**.

Control handle member **11** is secured, by suitable means such as the welds indicated at **58**, to the sleeve member **51** and extends outwardly therefrom at an angle approximately 90° from that of crank arm **49** and thence upwardly through aligned openings, such as indicated at **59** in the U-shaped bracket **35** and floor member **23**, to a position such that it will be within ready reach of the operator.

A rod **60** has one end thereof positioned through aligned apertures **61** with a cotter pin **62** in the portion of said rod that extends outwardly of said aperture. The opposite end of rod **60** is overturned and positioned through an aperture **63** in the control handle member **11** and suitably secured in place as by the cotter pin **64**, while a spring **65** positioned over rod **60** reacts against washers **66**, **67** at opposite ends thereof to prevent accidental movement or displacement of the said control handle out of any selected operating position thereof. It will be noted that spring **65** as arranged functions as an over-center type of resistance or reaction element since one of the anchors thereof swings to one side or the other, of the pivotal axis of a bell crank comprising control lever **11**, interconnecting sleeve **51** and crank arm **49**, for the selective forward and reverse positions of lever **11**.

In operating the proposed device it will be seen, by reference to FIGURE 1, that with the pedal **10** elevated and handle **11** in the rearward position the controlled element **48** is set for reverse flow upon application of pressure to pedal **10**. With handle **11** thus positioned when pedal **10** is depressed by application of pressure thereto (see FIGURE 2) arm **24** pivoting about the axis of bolt **16** rotates counterclockwise and carries with it attached rod **29** which causes pivotally connected beam **33** to rotate clockwise about pin **38** thus pulling rod **44** to the left and actuating crank arm **47** of the controlled pump component **48** in such manner as to cause an increase of flow therethrough. As beam **33** rotates rod **29** slides in eye-rod **54** without disturbing the angluar displacement of arm **49** which is rigidly interconnected by way of sleeve **51** with control handle **11**.

Now, assume it is desired that the direction of flow through pump component **48** be reversed, whereupon foot pedal **10** is returned to its raised position by application of pressure on the heel portion of the pedal causing it to rotate in the opposite direction about its pivotal connection bolt **16**. With the pedal again in raised position the hand operated control lever **11** is rotated counterclockwise, to the broken line position shown in FIGURE 1, carrying with it interconnected crank arm **49**. Since arm **49** is pivotally and slidably interconnected through eye-rod **54** with rod **29** when said arm rotates counterclockwise, it carries the latter rod with it and causes the pivotal interconnection of said rod with beam **33** to move downwardly in slot **32** therein to the position shown generally by the broken lines in FIGURE 1. As lever **11** is moved past a line representing a vertical extension of the pivotal axis of pin **38**, the spring **65** is moved over-center to a forward position to securely retain said lever in its newly selected position. Now the controlled component **48** is set for forward flow upon application of pedal pressure, hence when pedal **10** is depressed crank arm **24** rotates counterclockwise and carries with it pivotally interconnected rod **29** which, in turn, pushes beam **33** counterclockwise to a position such as indicated by the broken lines in FIGURE 2. This latter movement causes the interconnected control rod **44** to actuate crank arm **47** of the controlled component **48** in such manner as to cause an increase in flow therethrough in the opposite direction. Pressing the heel of pedal **10** again raises the pedal and returns the controlled pump component to its neutral position.

From the above it should now be apparent that a novel hydraulic pump control linkage mechanism employing one foot pedal and one manually operated lever has been shown and described, and it is to be understood that changes may be made in the construction without departing from the spirit of the invention or the scope thereof as defined in the appended claims.

What is claimed is:

1. A control device for operating a component having a neutral position and alternate positions in opposite directions from the neutral position thereof, comprising: a support; a foot pedal mounted for pivotal movement on said support; bell crank means mounted for pivotal movement on said support; one arm of said bell crank means including a handle and being manually rotatable selectively between a forward and a reverse position thereof; a beam member having an arcuately extending slot therein and mounted for pivotal movement coaxial with but for movement independent of said bell crank means on said support; motion-transmitting means pivotally connected at one end to said beam member and at an opposite end to said component; articulated motion-transmitting linkage connected at one end to said pedal and constrained for movement therewith, and having an opposite end thereof pivotally and slidably mounted in the arcuate slot of said beam; an intermediate portion of said linkage being slidably connected to another arm of said bell crank means for guide movement therewith; yieldable interlocking means extending between said support and said one arm of said bell crank means and operative for maintaining said one arm in each of the selectable forward and reverse positions thereof; said pedal being operative between a neutral position and a full range of movement position in each of the alternate positions of said component; said linkage, beam and said another arm of said bell crank means being operatively cooperative upon movement of said one arm of said bell crank means into each of the forward and reverse positions thereof and upon actuation of said pedal for selectively providing operative control to said component between maximum and minimum range of movement limits thereof in each of the alternate positions of the component.

2. The invention according to claim **1** and further characterized in that the articulated linkage extending between said foot pedal and said beam is adjustable for increasing or decreasing the length thereof.

3. The invention according to claim **1** wherein said interlocking means comprises an over-center type spring mechanism which is yieldable upon application of a predetermined force to said one arm of said bell crank to permit movement of said bell crank between the selectable forward and reverse positions thereof.

4. The invention according to claim 1 and further characterized in that friction washer means and cone-shaped resilient washer means are respectively disposed between opposite sides of the pivotally mounted pedal and said support whereby resistance to the free pivotal movement of said pedal is provided, and further characterized in that adjustable means are provided for varying the resistance to movement established by said friction washer and resilient washer means.

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