Aug. 13, 1968 D. R. WRIGHT 3,396,601

EXTENSIBLE ELEMENT

Filed Feb. 16, 1966

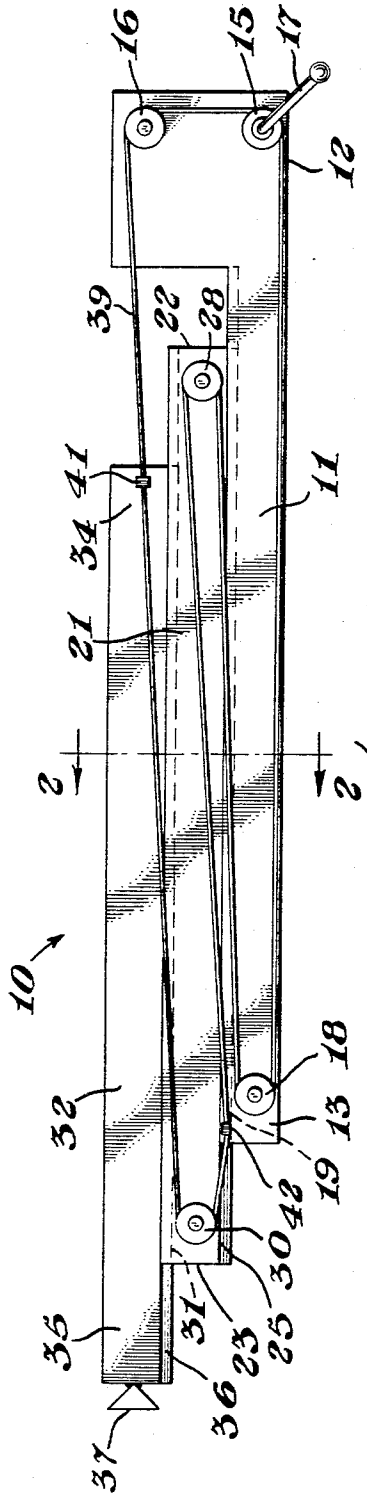


Fig. 1

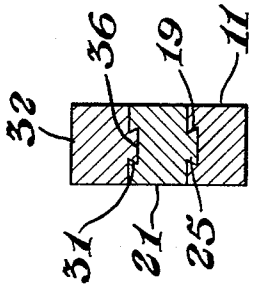


Fig. 2

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EXTENSIBLE ELEMENT

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ABSTRACT OF THE DISCLOSURE

An extensible boom is prepared from three sliding arms, four pulleys and a cable. The arms are positively driven.

This invention relates to an improved mechanical linkage or extensible element. It more particularly relates to an improved mechanical linkage capable of positioning a point on a predetermined line or surface.

Frequently, in the construction of buildings having curved surfaces, it is desirable to provide a guide or a tool which is readily positionable on or adjacent to a building structure in such a manner that the required design is adhered to. In cases of circular or spherical structures this is readily accomplished, for example, by pivoting an arm on the center of the desired structure. However, oftentimes it is desirable to generate structures wherein there is no ready access to the center. For example, in a spherical or spheroidal dome, often a suitable geometric center is not available or in the case of a dome having an elliptical cross-sectional configuration the centers of generation may be remote and inaccessible such as being positioned well within the earth. Oftentimes, it is desired to support a construction unit, such as a bricklaying machine or the like, at the end of a boom or arm and position the terminal portion of the boom in such a manner that it serves as a guide and determines the final form of the structure. Such a technique is particularly advantageous when buildings are constructed from strips or portions of synthetic resinous foam which are adhered together to form the desired configuration.

It is an object of this invention to provide an improved mechanical linkage adapted to position an arm on a desired curved surface.

A further object of this invention is to provide a mechanical linkage for an extensible element.

A further object of this invention is to provide an apparatus for the positioning of an operating mechanism in a guided pattern capable of generating a dome-like surface.

These benefits and other advantages in accordance with the present invention are achieved in an extensible element which comprises in cooperative combination a first arm member having a first end and a second end, a second arm member having a first end and a second end, the first and second ends of the second arm being disposed generally adjacent the first and second ends of the first arm member, respectively, the second arm member being slidably affixed to the first arm member, a third arm member having a first end and a second end, the first and second ends of the third arm member being disposed generally adjacent the first and second ends of the second arm member, respectively; the third arm member being slidably affixed to the second arm member; a first wheel disposed adjacent the first end of the first arm member and rotatably secured thereto, a second wheel secured rotatably to the second end of the first arm member, a third wheel rotatably secured to the first end of the second arm member, a fourth wheel rotatably secured to the second end of the second arm member, a flexible motion transmitting means passing about the first wheel to the second wheel, about the second wheel to the third wheel, about

the third wheel to the fourth wheel, and about the fourth wheel to the first wheel, means to rotate at least one of said wheels and means to secure the motion transmitting means to the third arm member.

Further features and advantages of the present invention will become more apparent from the following specification taken in combination with the drawing wherein:

FIGURE 1 schematically represents an apparatus in accordance with the invention; and

FIGURE 2 is a section of the arm members of the apparatus of FIGURE 1 taken along the line 2—2.

In FIGURE 1 there is schematically represented an embodiment of the apparatus in accordance with the present invention generally designated by the reference numeral **10**. The apparatus **10** comprises in cooperative combination a first arm member **11**. The first arm member **11** has a first end **12** and a second end **13**. The arm member **11** has a generally elongated configuration. A first wheel, gear or drum **15** is rotatably secured to the first end **12** of the arm **11**. Generally adjacent the first wheel **15** is an idler wheel gear or drum **16**. The first wheel **15** has affixed thereto a rotation means or crank **17**, a second wheel **18** is rotatably affixed to the second end **13** of the first arm **11**. The first arm **11** has defined therein means **19** to slidably secure a second arm or dovetail groove. A second arm **21** is disposed adjacent the first arm **11**. The second arm **21** has a first end **22** and a second end **23**. The second arm **21** defines a dovetail **25** which slidably engages the dovetail groove **19** of the first arm **11** permitting the first arm **21** to be slidably secured to the first arm **11**. A third gear **28** is rotatably affixed to the first end **22** of the second arm member **21**, a fourth gear **30** is rotatably affixed to the second end **23** of the second arm **21**. The second arm **21** defines a dovetail groove **31** remotely disposed from the dovetail **25**. A third arm **32** is disposed generally adjacent the second arm **21**. The third arm **32** has a first end **34** and a second end **35**; the third arm **32** defines a dovetail **36** which is in operative engagement with the dovetail groove **31** of the second arm **21** and operating means **37** is secured to the second end **35** of the third arm **32**. When arm members **11**, **21** and **32** are in maximum engagement, the first ends **12**, **22** and **34** are in generally adjacent relationship and the second ends **13**, **23** and **35** are in generally adjacent relationship. A flexible motion transmitting means **39** such as a cable, sprocket chain or belt passes from the first wheel **15** to the second wheel **18**, about the second wheel **18** to the third wheel **28**, about the third wheel **28** to the fourth wheel **30**, about the fourth wheel **30**, to the idler wheel **16**, about the idler wheel **16**, to the first wheel **15**. The motion transmitting means **39** is secured to the first end **34** of the third arm member **32** by the retaining means **41** and to the second end **13** of the first arm **11** by the retaining means **42**.

In FIGURE 2 there is depicted a section of the first, second and third arms **11**, **21** and **32**, respectively, taken along the line 2—2 of FIGURE 1 illustrating one manner in which adjacent arms may be slidably secured to each other.

In operation of the apparatus **10** as illustrated in FIGURE 1 rotation of the first gear **15** by the operating means or handle **17** causes movement of the motion transmitting means **39** to or from the first end **12** of the first arm member **11** causing the third arm to move at a rate equal to the rate of motion of the motion transmitting means **39**. The mechanical advantage presented by the second and third wheels **28** and **30** causes the second arm to move at a rate one-half of the rate of travel of the third arm **32**. The apparatus **10** can be extended or retracted to about three times the length of the second or third arms. In actual practice, it is obvious that this extension will be

somewhat less than three times as the arm members remain in engagement with each other.

In practical application of the apparatus **10**, generally it is beneficial that it be pivotally mounted at the first end **12** of the first arm member **11** in a manner generally similar to the arm **28** of FIGURE 2 of U.S. Letters Patent 3,206,899. By controlling the motion of the first wheel **15**, the operating means **37** such as a brick laying machine or foam sealing head (which is illustrated in FIGURES 3 and 4 of U.S. Letters Patent 3,206,899) may be selectively positioned to provide a desirably shaped structure of a non-spherical design. Advantageously, domes of low profile, that is, a spherical segment having an inaccessible center, are prepared or alternately a structure having cylindrical walls and a hemispherical roof are typical examples of forms which can be prepared. Beneficially, the mechanism, in accordance with the present invention, may be utilized to advantage for such application as a ram for a charging car and other obvious applications wherein an extensible element is required.

As is apparent from the foregoing specification, the apparatus of the present invention is susceptible of being embodied with various alterations and modifications which may differ, particularly from those that have been described in the preceding specification and description. For this reason, it is to be fully understood that all of the foregoing is intended to be merely illustrative and is not to be construed or interpreted as being restrictive or otherwise limiting of the present invention, excepting as it is set forth and defined in the hereto appended claims.

What is claimed is:

1. An extensible element which comprises in cooperative combination a first arm member having a first and a second end; a second arm member having a first and second end; the first and second ends of the second arm member being disposed generally adjacent the first and second ends of the first arm member, respectively; the second arm member being slidably affixed to the first arm member; a third arm member having a first end and a second end; the first and second ends of the third arm member being disposed generally adjacent the first and second ends of the second arm member, respectively; the third arm member being slidably affixed to the second arm member; a first wheel disposed adjacent the first end of the first arm member and rotatably secured thereto; a second wheel secured rotatably to the second end of the first arm member; a third wheel rotatably secured to the first end of the second arm member, a fourth wheel rotatably secured to the second end of the second arm member; a flexible motion transmitting means passing about the first wheel to the second wheel, about the second wheel to the third wheel, about the third wheel to the fourth wheel, about the fourth wheel to the first wheel, means to rotate at least one of said wheels, and means securing the motion transmitting means to the first and the third arm members.

2. The apparatus of claim **1** wherein the first wheel is in cooperative combination with means to rotate the wheel.

3. The apparatus of claim **1** wherein the transmission means passing about the wheels secured to the second arm member is secured to the second end of the first arm member.

4. The apparatus of claim **1** wherein an operating means is affixed to the second end of the third arm member.

5. The apparatus of claim **1** wherein the wheels are sprocket wheels and the flexible motion transmitting means is a sprocket chain.

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