Sept. 29, 1970 E. PULK 3,531,054

APPARATUS FOR APPLYING A SPRAYABLE MATERIAL TO A SURFACE, E.G. A ROCK WALL

Filed June 21, 1968

2 Sheets-Sheet 1

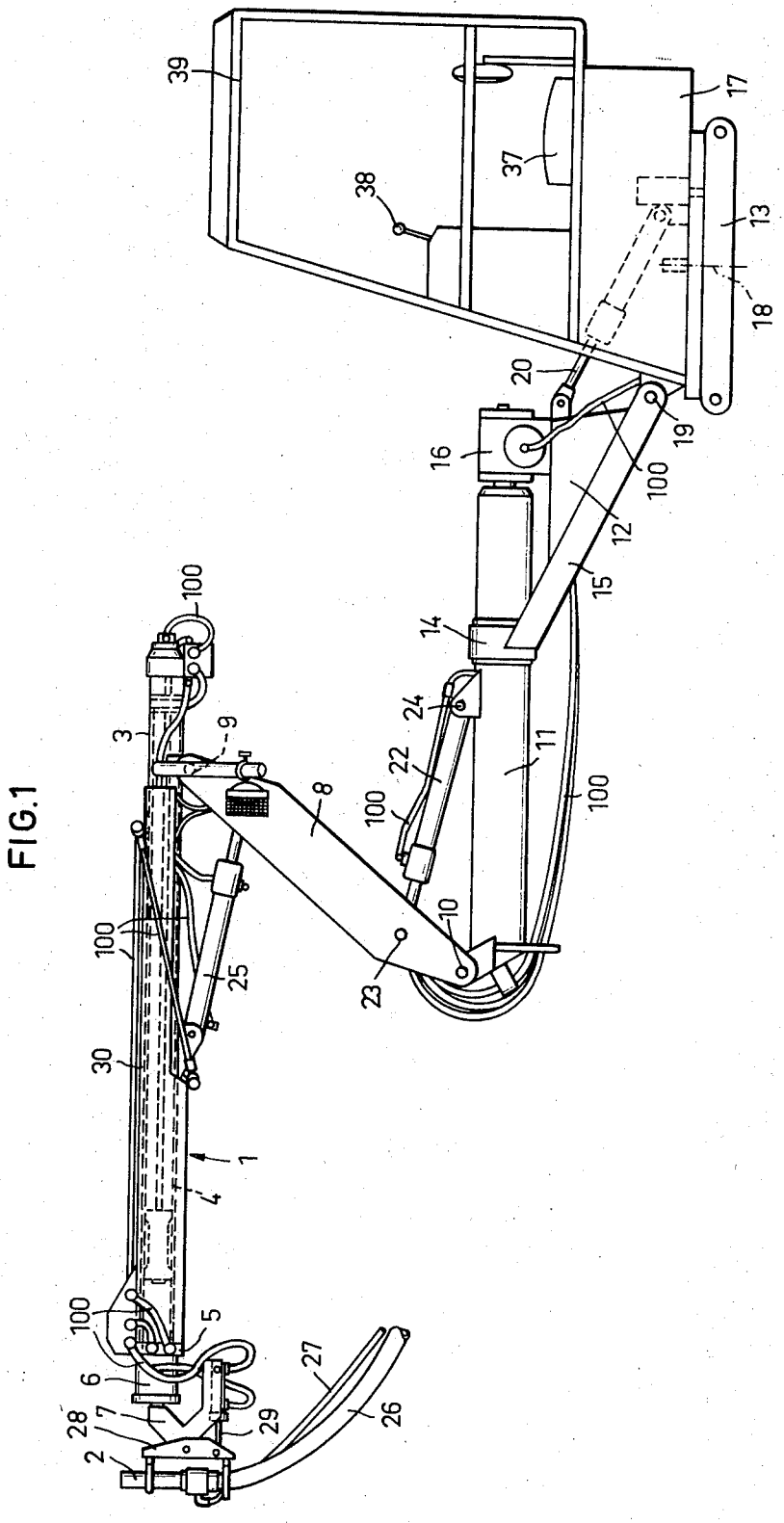


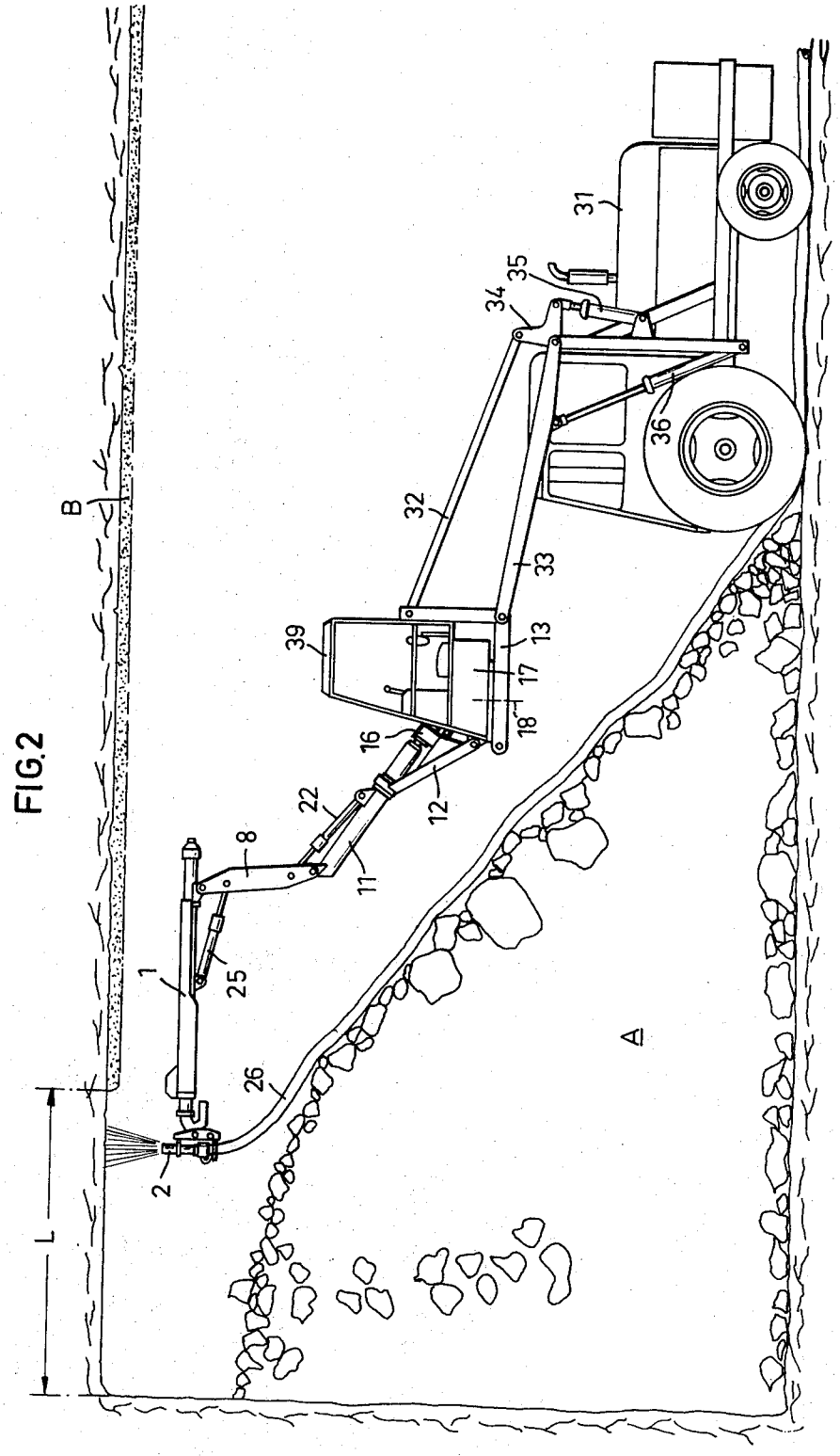
FIG.1

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FIG.2



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APPARATUS FOR APPLYING A SPRAYABLE MATERIAL TO A SURFACE, E.G. A ROCK WALL

Elgas Pulk, Stockholm, Sweden, assignor to AB Skanska Cementgjuteriet, Stockholm, Sweden, a corporation of Sweden

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ABSTRACT OF THE DISCLOSURE

Apparatus, supported on a platform, for spraying coating material on a rock wall or the like, in which the platform carries a support shaft on which there is rotatably mounted a link arm to which a nozzle-holding arm is articulated, the holder arm and link arm and support shaft cooperating to form a Z. The support shaft is journaled in a platform fitting so that the nozzle may be extended in any desired direction.

The present invention is concerned with an apparatus supported on a platform and intended for applying a sprayable material as a protective coating or a supporting coating of material onto a surface, e.g. a rock wall, the apparatus including a nozzle which is arranged for movement at the free end of a preferably extendible holder arm. It is previously known to arrange a pivotably mounted nozzle for a concrete mixture at the end of an extendible holder arm which can be operated from a working platform, but the present invention is concerned with means which enable a more positive and more effective spraying operation to be effected than was previously possible with the known apparatus, since a wider spray area can be reached when operating from the platform.

The invention is mainly characterized in that the holder arm is connected by an adjustable link arm or slewing bracket to a support shaft carried by the platform said shaft being rotatable about its longitudinal axis and extending from the platform towards the same side as the holder arm. The configuration presented by the holder arm, link arm and support shaft when in normal position, is essentially in the form of a Z. Furthermore, it is expedient that the link arm is pivotably arranged relative to the holder arm and the support shaft, in a plane common to the arms and angularly adjustable relative to the holder arm and the support shaft.

These arrangements afford an increase in the area covered by the spray nozzle, compared to known arrangements in the art, not only with regard to the perpendicular distance from the platform but also laterally and above all it is possible, because of these arrangements, to position either the holder or the support shaft or both essentially parallel to the longitudinal direction of the surface to be sprayed, so that the spraying operation can be effected by moving the spray nozzle along the treatment surface solely by respectively extending and shortening the holder arm. In this way the nozzle is always at the same normal distance from the treatment surface so that a completely even and correctly directed spray is obtained over the area to be treated. The holder arm can then be moved parallel to the surface of a new area. Further, the spraying becomes very simple when treating circle segment formed surfaces, e.g. tunnel arches, when the support shaft is so adjusted that it extends in the centerline of said circle segment formed surface and the holder arm runs parallel with said centerline and on

a suitable distance from the surface by means of the link arm.

The support shaft is preferably journalled in a fitting connected to an intermediate part which is pivotally mounted vertically on a platform, whereby the free end of the shaft is vertically adjusted. In this manner the coverage afforded by and the adjusting possibilities of the spray means is further increased. It is particularly advantageous that the fitting supporting the shaft is pivotally mounted vertically in the intermediate part, which in turn is mounted on the platform so that it can be swung in the horizontal plane.

In order that the invention may be fully understood one embodiment thereof will now be described with reference to the accompanying drawing.

FIG. 1 is a side view of a spray apparatus according to the invention and FIG. 2 shows said spray apparatus in operation.

In FIG. 1 the reference numeral **1** indicates generally a holder arm, which supports at its outer end, in a manner described below, a spray nozzle **2**. The holder arm, which is telescopically extendible, comprises in the shown embodiment a part **3** in the form of a cylinder fed with a pressure medium and in which is displaceably arranged a piston rod **4** which presents an attachment head **5** for a pressure medium driven twist or rotation motor **6** of known construction. A fixture **7** for the nozzle **2** is rigidly connected with the shaft of the twist motor. The reference numeral **30** identifies a protective covering which is connected to the part **4**.

The part **3** is pivotally connected by a transversely extending shaft **9** having a link arm **8**, which is pivotally connected with the outer end of a support shaft **11** by means of a transversely extending shaft **10**. The support shaft **11** is mounted so that it can be turned around its longitudinal axis in a fitting **12** which is carried by a platform **13**. The support shaft **11** is rotatable in a bearing **14** which is retained by an arm **15** associated with the fitting **12**. Also arranged on the fitting **12** is a twist motor **16** of known construction and operated by a pressure medium, preferably hydraulically operated. The shaft of the twist motor **16** is connected to the support shaft **11** so that it can be turned by means of the motor.

The fitting **12**, and thus also the support shaft **11**, can be swung in a vertical plane relative to the platform **13**. In the shown embodiment the fitting is not connected directly to the platform **13**, but is connected via an intermediate part **17**, preferably adapted as an operating place for the operator. The intermediate part **17** is swingably mounted on the platform, about a vertical shaft **18** and, by means of known, e.g. hydraulic devices, can be adjusted and retained in desired positions of rotation. The fitting **12** is swingably conneced to the part **17** by means of a transverse shaft **19**. The fitting can be swung by means of a hydraulic piston-cylinder arrangement **20**, which is arranged in the intermediate part **17**.

Between the link arm **8** and the support shaft **11** is arranged a hydraulic device **22** which is pivotally connected to the link arm and the support shaft by means of transverse shafts **23** and **24**, respectively, and by means of which the angle between the two parts **8** and **11** can be adjusted and fixed. In a similar manner a hydraulic device **25** is arranged between the link arm **8** and the holder arm **1**. The relative positions of the parts **1**, **8** and **11** in a normal or starting position present a Z-formation, as shown in FIG. 1. The three parts can be made to adopt any desired angle relative to each other by means of the hydraulic devices, and the support shaft **11** can be rotated to the desired position. In a thus adjusted position nozzle **2** can be moved parallel to the longitudinal centre line of the holder arm by extending or shortening the holder arm **1**.

The nozzle shown in the drawing is intended for concrete mixing. For this purpose the solid concrete components are conducted by means of compressed air through a tube **26** and water through a tube **27**. It should be understood, however, that nozzles for other sprayable materials, such as synthetic resin or the like, can be used. The nozzle is carried by a holder **28** which is mounted in the fixture **7** so that it can be swung about a transverse shaft, by means of the piston rod **29**. The nozzle can then thus be swung relative to the holder arm **1** about two axes which form right angles with one another.

In the example of the spray apparatus shown in FIG. 2, the said apparatus is used in conjunction with blasting a tunnel. It is assumed that a portion L of the tunnel has newly been blasted out, and to begin with the rubble or muck A is to be allowed to remain where it fell whilst the newly formed arched contours along the length L are provided with a protective or carrying layer of, e.g. concrete, similar to the earlier applied concrete layer B.

The platform **13** is movable, and can be held in a horizontal position. In the shown embodiment the platform is carried by a mobile support means, e.g. a tractor **31**, lorry or the like. In the embodiment the platform is connected to the vehicle by articulated arms **32**, **33** of which the upper is connected to an angle lever **34** which is supported by the tractor and capable of being swung by means of a hydraulic device **35**. The lower arm **33** is supported by a hydraulic device **36** connected to the tractor. The arrangement is such that the platform **13** can be displaced vertically to mutually parallel positions. As shown in FIG. 1 the intermediate part **17** is in the form of a cabin **39** intended for the operator and provided with a protective roof, and may include an operating seat **37** located in front of a series of operating levers **38** for the various hydraulic devices and twist motors. The pressure medium lines controlled by means of the levers **38** are indicated generally with the reference numeral **100**. These conduits are connected to the various hydraulic devices and twist motors in a known manner and in a way which permits each element to be individually locked hydraulically in the adjusted position. A more detailed description of these connections is not necessary.

As can be seen from FIG. 2 the support shaft **11** has been swung upwardly in the vertical plane and the relative angle between the parts **1**, **8** and **11** has been adjusted so that the holder arm **1** is parallel with the rock surface

to be sprayed. Subsequent to adjusting the holder arm to this position the machine operator need only operate the hydraulic piston-cylinder arrangement **3**, **4** (FIG. 1) so that the nozzle **2** is moved forwards or backwards along the surface to be treated, and possibly also swing the nozzle by means of the twist motor **6**. After treating this particular area of the tunnel arch the support shaft **11** is rotated about its longitudinal axis by means of the twist motor **16** so that the support arm **1** is located opposite another portion of the tunnel arch. The side walls of the tunnel can also be treated in a similar manner, subsequent to removing the muck A. The entire spraying operation also be performed after the muck has been removed. Because the intermediate part **17** can be swung about the vertical shaft **18** the area covered by the spray apparatus laterally in the tunnel is increased most considerably.

The invention is not restricted to the embodiment shown in the drawing, and thus, for instance, the link arm **8** may be made of two or more parts and the support shaft **11** may also be telescopically extendible.

What I claim is:

1. A device for applying a sprayable material to a surface, e.g. a rock wall, which comprises a platform; a support shaft supported rotatably about its longitudinal axis on the platform; an angularly adjustable and secured link arm mounted on the support shaft; an extendable holder arm angularly adjustably and securedly connected to the link arm; and a spray nozzle arranged on the free end of the extendable holder arm.

2. A device according to claim **1**, in which the support shaft is mounted in a fitting which is vertically swingably carried by the platform.

3. A device according to claim **2**, in which the fitting is vertically swingably mounted in an intermediate part which latter is mounted on the platform and swingable in a horizontal plane about a vertical shaft, which intermediate part suitably provides an operating position for an operator of the device.

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LLOYD L. KING, Primary Examiner

G. A. CHURCH, Assistant Examiner