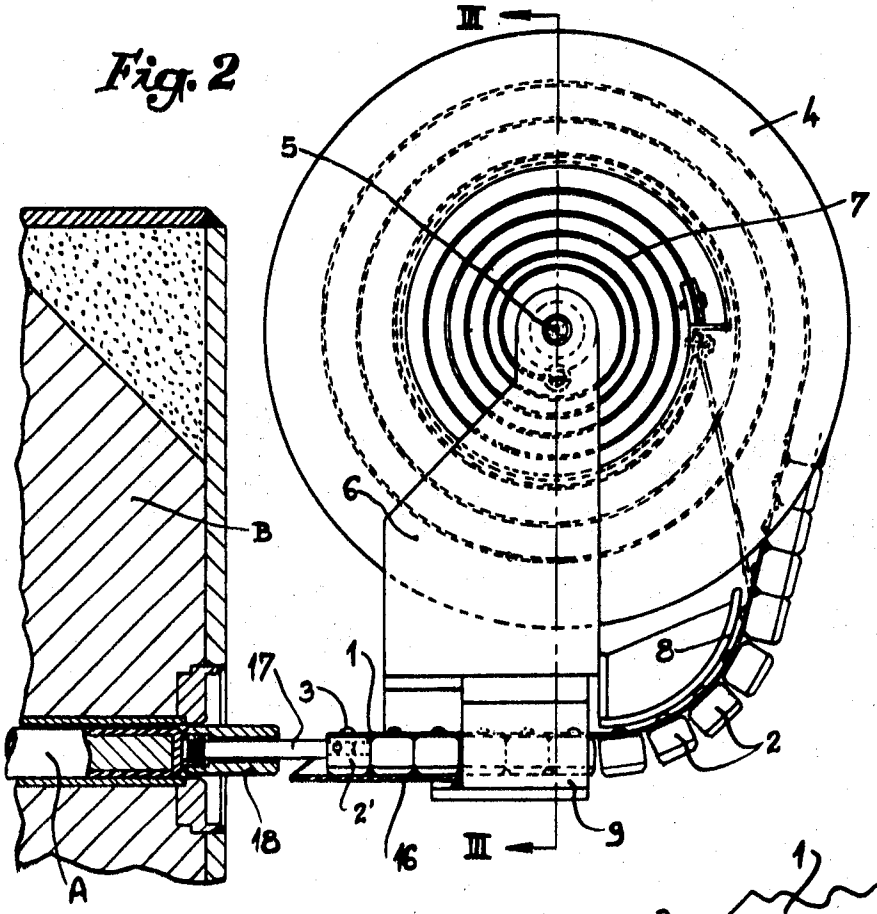
Dec. 7, 1971 H. BERNARD ET AL 3,625,077

TRANSFER RODS

Filed Aug. 18, 1969 3 Sheets-Sheet 1

Fig. 2



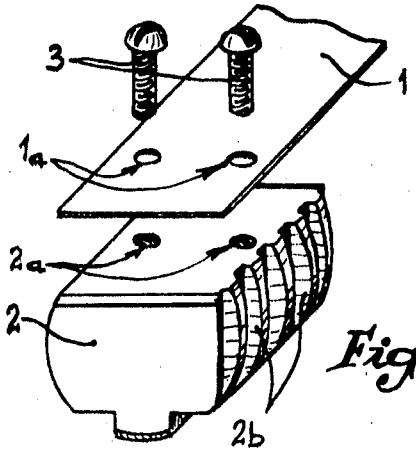




Fig. 1

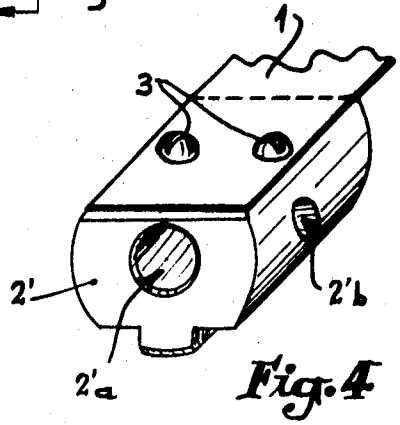



Fig. 4

Fig. 5

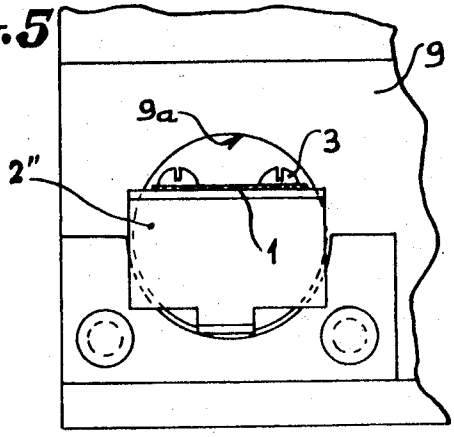
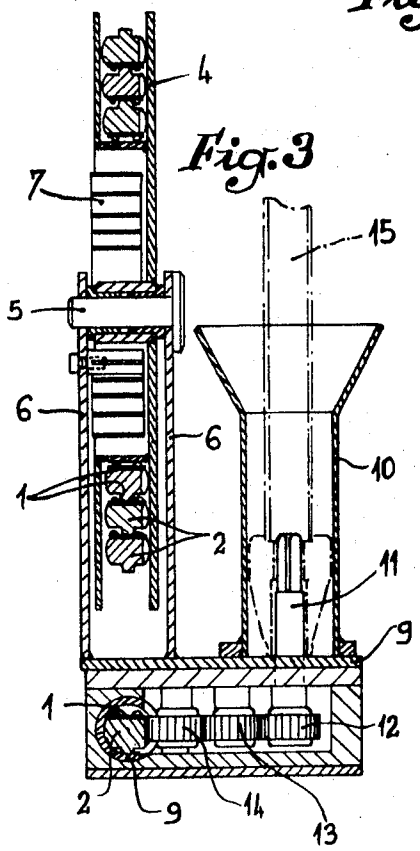



Fig. 3



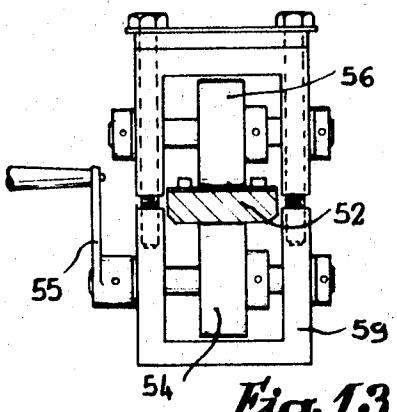




Fig. 13

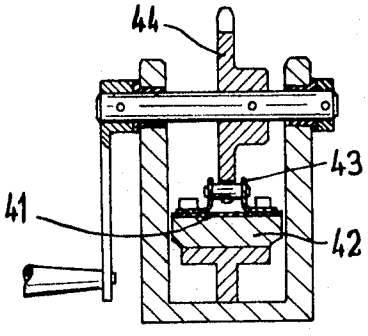



Fig. 11

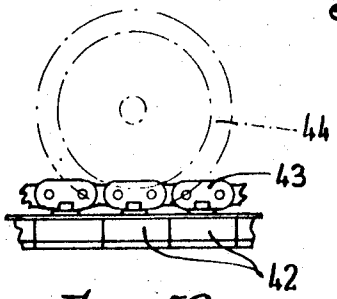



Fig. 12

Dec. 7, 1971 H. BERNARD ET AL 3,625,077

TRANSFER RODS

Filed Aug. 18, 1969 3 Sheets-Sheet 3

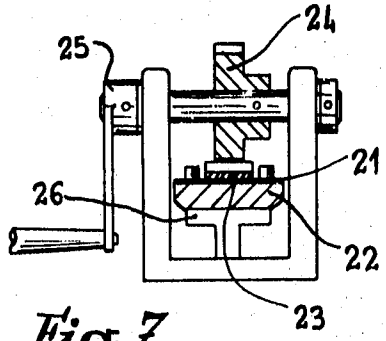



Fig. 7

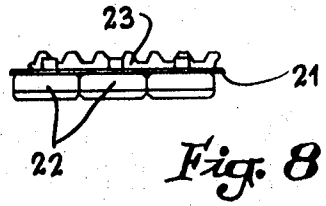



Fig. 8

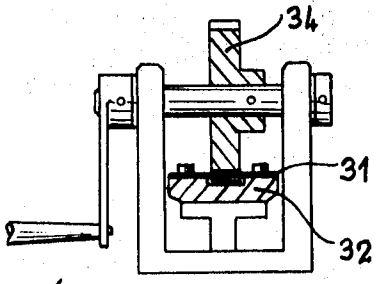



Fig. 9

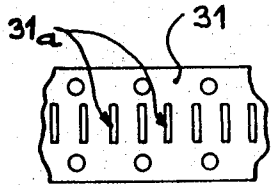



Fig. 10

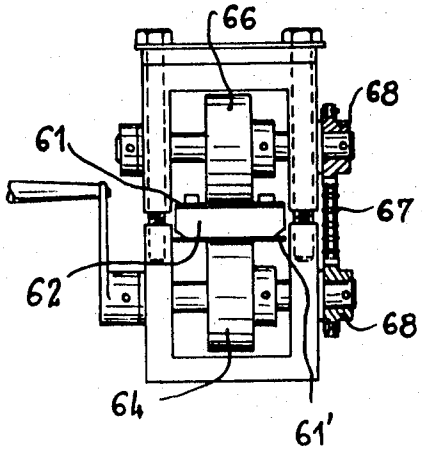



Fig. 14

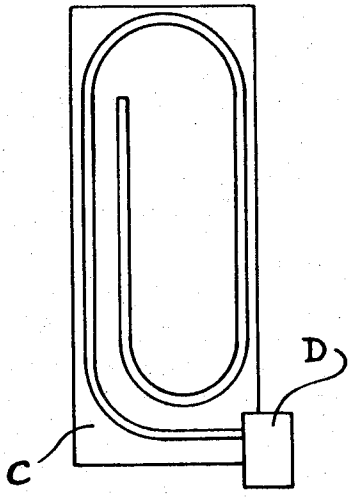



Fig. 6

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3,625,077

# TRANSFER RODS

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Claims priority, application France, Aug. 22, 1968, 163,779
Int. Cl. F16h 29/02
U.S. Cl. 74—89.21 6 Claims

## ABSTRACT OF THE DISCLOSURE

The transfer rod is made up of rigid blocks or plates referred to as rod elements which can be interlocked and are secured to at least one metallic strip having high tensile strength. The rod is stored on a freely rotatable take-up drum and delivered by guiding and actuating means in opposition to a spiral spring mounted in the drum.

The present invention relates to improvements made in transfer shafts or "rods" and, among the different applications which may be contemplated, is primarily directed to devices of this type which are employed for transferring a radioactive element from a transport container to a utilization cell or conversely.

It is known that, apart from conventional rigid transfer shafts which consist for the most part of telescopic or interfitting sections, there has also been proposed a system comprising a mechanical driving chain in which rigid elements or blocks are fastened to the links of the chain and capable of interlocking when the complete assembly is displaced longitudinally in a predetermined direction. A flexible transfer shaft or rod is thus prodvided and permits of storage within a relatively small space. However, it has been proved by experience that the rigidity of a device of this type is unstable since the locking elements or blocks have a tendency to lateral deviation, especially in the case of transfer rods of substantial length. Moreover, in spite of their flexibility, transfer rods of known types cannot be wound onto cylindrical drums of small diameter.

The improvements in accordance with the present invention are intended to overcome the disadvantages referred to above and to permit the construction of a flexible rod of the above-mentioned type which is particularly well suited to the different requirements encountered in practice.

The transfer rod in accordance with the invention is mainly characterized in that it comprises lockable and rigid elements or blocks which are fastened to a metallic strip having high tensile strength.

It is understood that said metallic strip can be directly arranged so as to displace the device as a whole in longitudinal motion. On the contrary, in other cases the metallic strip virtually duplicates the usual driving chain or belt.

The properties and advantages which are afforded by the invention will be more readily understood by referring to the accompanying drawings which are given by way of example, and in which:

FIG. 1 illustrates the arrangement of a transfer rod in accordance with the invention;

FIG. 2 is a diagrammatic sectional view of the complete assembly consisting of transfer device and magazine;

FIG. 3 is a vertical sectional view taken along line III—III of FIG. 2;

FIG. 4 is a view in perspective showing the front end of the device;



FIG. 5 is a diagrammatic view showing the locking of the device on completion of the unwinding operation;

FIG. 6 is a plan view of another type of magazine;

FIG. 7 is a vertical sectional view of the driving mechanism associated with the magazine according to FIG. 6;

FIG. 8 is a side view of the corresponding transfer rod;

FIGS. 9 and 10, 11 and 12 respectively are views which are similar to those of FIGS. 7 and 8 but correspond to two alternative forms of construction;

FIGS. 13 and 14 are vertical sectional views which illustrate two other forms of construction of the driving mechanism.

The flexible transfer rod which is illustrated in FIGS. 1 to 5 comprises essentially a metallic strip **1** formed of material having high tensile strength (plain carbon steel, stainless steel, plastic material or the like) and a series of lockable elements **2** which are fastened to one of the faces of said metallic strip **1** in substantially close contact therewith. In the example under consideration, each element **2** is secured to the strip **1** by means of two screws **3** which are inserted in drilled holes **1***a* of said strip and screwed home within corresponding internally-threaded bores **2***a* of the element.

With reference to FIG. 2, it is apparent that the transfer rod in accordance with the invention is thus capable of undergoing deformation when the strip **1** is applied against a cylindrical wall whilst the elements **2** are accordingly separated. On the other hand, in the case in which said device **1–2** is displaced longitudinally along a rectilinear path, the elements **2** come into contact with each other so that the complete assembly behaves in the same manner as a rigid body and the strip **1** prevents any angular displacement of said elements.

It is assumed in FIGS. 2 and 3 that the transfer rod **1–2** is associated with a cylindrical magazine provided with a gear drive mechanism. One end of the strip **1** is secured to the outer wall of a drum **4** which is mounted to rotate freely on a horizontal shaft **5** carried by two vertical side plates **6**. Between the above-mentioned outer wall and the hub of the drum, there is wound a spring **7** which tends continuously to cause the drum **4** to rotate in the direction corresponding to winding or take-up of the transfer rod **1–2**. As it is delivered from the drum **4** said transfer rod **1–2** is applied against a guide **8** (as shown in FIG. 2) having a profile in the shape of a circular arc and penetrates into the interior of the frame **9** of the driving mechanism, said frame being intended to form a support for the vertical side plates **6** which have already been mentioned.

As shown in FIG. 3, a vertical chimney **10** is fixed on the top wall of the frame **9**, a coaxial shaft **11** being mounted inside said chimney and suitably supported for rotational motion within said frame. A pinion **12** is keyed on said shaft **11** and, by means of a gear **13**, drives a pinion **14** whose toothed periphery is engaged through a lateral opening formed in a cylindrical sleeve **9***a* which is rigidly fixed to the frame **9**. The transfer rod **1–2** has a size and shape such as to permit of insertion within the sleeve **9***a* and of longitudinal sliding motion with as little play as possible. Moreover, each element **2** is provided on one lateral face with a set of teeth **2***b* (as shown in FIG. 1) which is intended to cooperate with the pinion **14**. It is understood that, under these conditions, the manual rotation of the shaft **11** by means of a key **15** or similar tool (as shown in FIG. 3) which is engaged within the chimney **10** causes the longitudinal displacement of the device **1–2** within the sleeve **9***a* and its delivery from the drum **4**. This delivery is carried out in opposition to the spring **7** with the result that the tranfer rod is taken up on the drum in a uniform manner as a result of actuation of the shaft **11** in the opposite direction.

As it passes out of the sleeve **9***a*, the transfer rod **1–2** is supported by a rectilinear horizontal guide **16** (as shown in FIG. 2) which carries out the alignment of said elements **2** in conjunction with said sleeve. The device **1–2** is thus endowed with perfect rigidity.

The front element **2'** of the transfer rod is hollowed out so as to form an axial bore **2'***a* (as shown in FIG. 4) within which is fixed a longitudinal rod **17** (shown in FIG. 2), for example by means of a key or screw inserted in a transverse bore **2'***b*. An internally threaded sleeve **18** is maintained axially while being freely rotatable on the free end of said rod **17** and is intended to be screwed onto the usual threaded end-piece of a radioactive element as a result of a movement of rotation. In FIG. 2, this element which is designated by the reference A is shown inside a transport flask B. It is apparent that, after the sleeve **18** has been screwed home, said element A can be displaced either forwards or backwards in the axial direction for its extraction from the flask B and its transfer into a utilisation cell.

In order to prevent the application of any tractive force on the metallic strip **1** which would be liable to damage this latter at the end of delivery of the transfer rod **1–2**, the last element **2''** (FIG. 5) of the device is advantageously endowed with a profile such that said element cannot penetrate into the interior of the sleeve **9***a* of the frame **9**.

It will also be understood that other forms of magazine may be devised. In particular, the magazine can have the rectangular profile which is illustrated at C in FIG. 6, the transfer rod being disposed in rectilinear portions which are separated from each other by curved portions. There is naturally associated with said magazine C a driving mechanism D which can be different from the mechanism illustrated in FIGS. 2 and 3.

It is assumed in FIGS. 7 and 8 that, in addition to a metallic strip **21** and a series of lockable elements **22**, said transfer rod additionally comprises a toothed belt **23** which is attached in any suitable manner to the free top face of said strip **21**. In this case, the driving mechanism is constituted by a toothed pinion **24** which is actuated by means of a crank-handle **25**, the tranfer rod **21–22–23** being supported by a longitudinal sectional member **26**. In the alternative form of FIGS. 9 and 10, the pinion **34** of the driving mechanism cooperates directly with perforations **31***a* which are formed in the metallic strip **31** of the transfer rod **31–32**.

FIGS. 11 and 12 illustrate another form of construction in which the transfer rod **41–42** is associated with an upper chain **43**, the links of which are suitably attached to the free face of the metallic strip **41**. The drive is effected in that case by means of a sprocket wheel **44**. In FIG. 13, the transfer rod device **51–52** which is similar



to that of FIG. 1 is frictionally driven by means of a lower roller **54** which is caused to rotate by means of the crank-handle **55**, said roller being adapted to cooperate with an upper counter-roller or pressure roller **56**; in this instance the frame **59** is intended to be adjustable for height. Finally, in the alternative form of FIG. 14, it is assumed that a counter-strip **61'** was associated with the metallic strip **61** of the transfer rod **61–62** and simply stretched along the free face of the elements **62**; longitudinal drive to the assembly **61–62–61'** is effected by means of a roller **64** and a counter-roller **66**, said rollers being coupled by means of a chain **67** which is held between two sprockets **68**, said sprockets being rigidly fixed to the shafts of said roller and counter-roller. It is evidently necessary in this instance to provide the magazine with a separate drum for taking up and paying out the counter-strip **61'**.

What is claimed is:

**1.** A transfer rod for the atomic energy industry, comprising lockable rigid elements secured to a metallic strip having high tensile strength and a second metallic strip said elements being placed between said two strips.

**2.** A transfer rod as claimed in claim **1**, said metallic strip supporting a driving chain.

**3.** A mechanism for storing and actuating the transfer rod of claim **1** comprising a drum which is mounted to rotate freely on a shaft supported by side plates and which is intended to contain said transfer rod, an arcuate component disposed beneath said drum for guiding said rod as it is delivered from said drum, a rotatable member housed within a sleeve located beneath said drum close to the extremity of said arcuate component, said rotatable member being intended to engage with said rigid plates and a horizontal guide member for receiving said rigid plates one after the other after they have passed out of said sleeve.

**4.** A mechanism as claimed in claim **3**, wherein said rotatable member is a pinion.

**5.** A mechanism as claimed in claim **3**, wherein said rotatable member is a sprocket-wheel.

**6.** A mechanism as claimed in claim **3**, said rotatable member consists of a roller, said roller driving said transfer rod by frictional contact.

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