United States Patent [19]

Renshaw

[11] **3,757,965**

[45] **Sept. 11, 1973**

[54] **STACKING OF ARTICLES**

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[21] Appl. No.: **153,540**

[30] **Foreign Application Priority Data**

July 9, 1970 Great Britain 33,393/70

[52] **U.S. Cl.** ..... **214/6 H,** 198/24, 214/1 P

[51] **Int. Cl.** **B65g 57/10**

[58] **Field of Search** ..... 214/6 H, 6 F, 6 DK, 214/6 D, 6 P, 6 R, 1 P, 1 PA, 1 PB, 1.1, 1.2, 1.3, 1.4, 1.5, 8.5 F; 198/24

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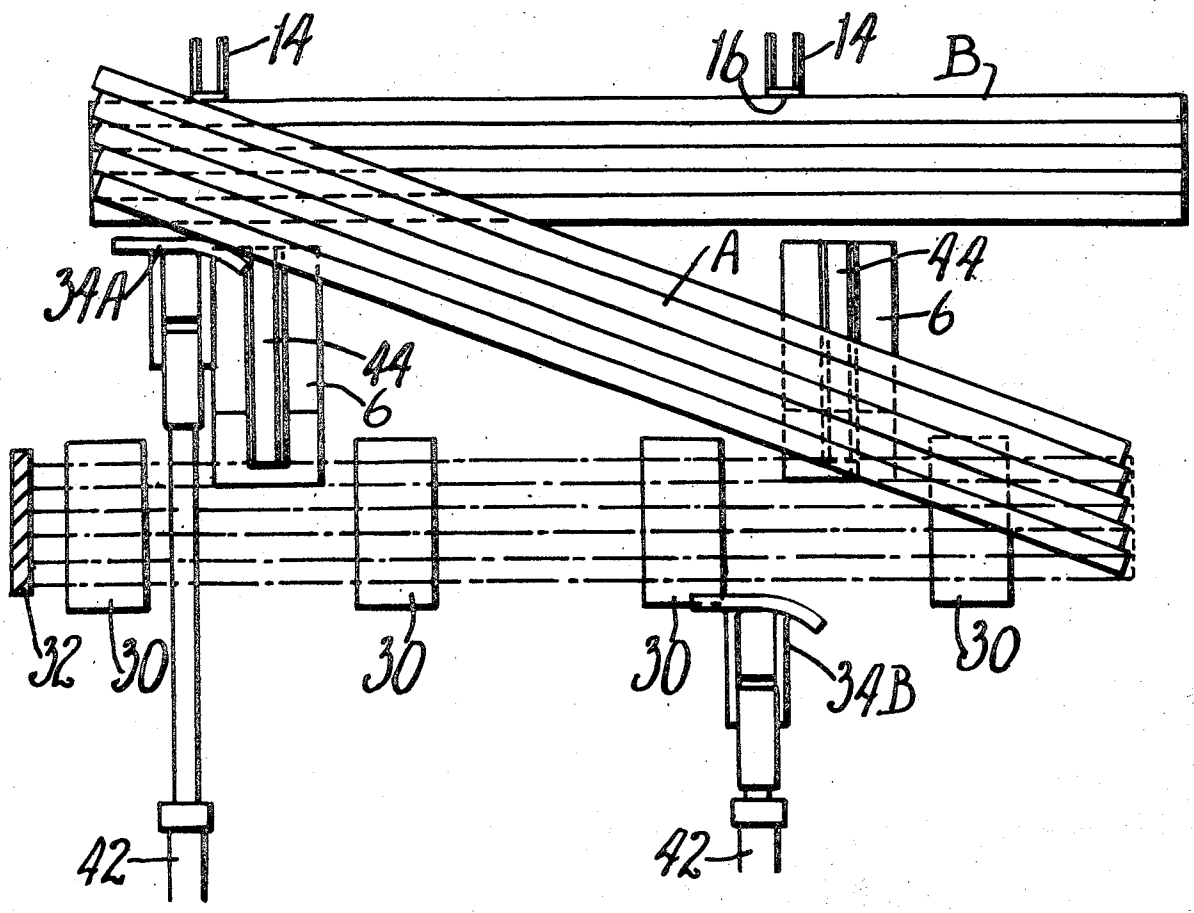
[57] **ABSTRACT**

To form a stack of elongate articles, such as steel bars, successive arrays of the articles are formed and each array in turn is pushed to a stacking location where it is moved over the preceding array with the lengths of the articles inclined to the length of the articles in the preceding array. When the new array has been brought to a position approximately above the previous array, the articles of the new array are brought into substantial parallelism with those of the preceding array.

6 Claims, 6 Drawing Figures



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3 Sheets-Sheet 1

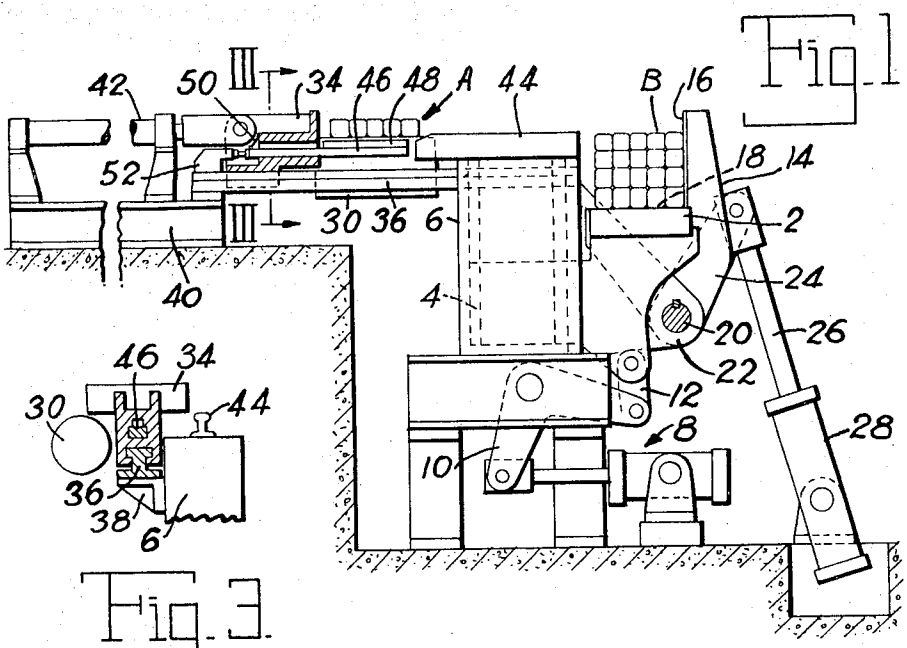

Fig. 1

Fig. 3

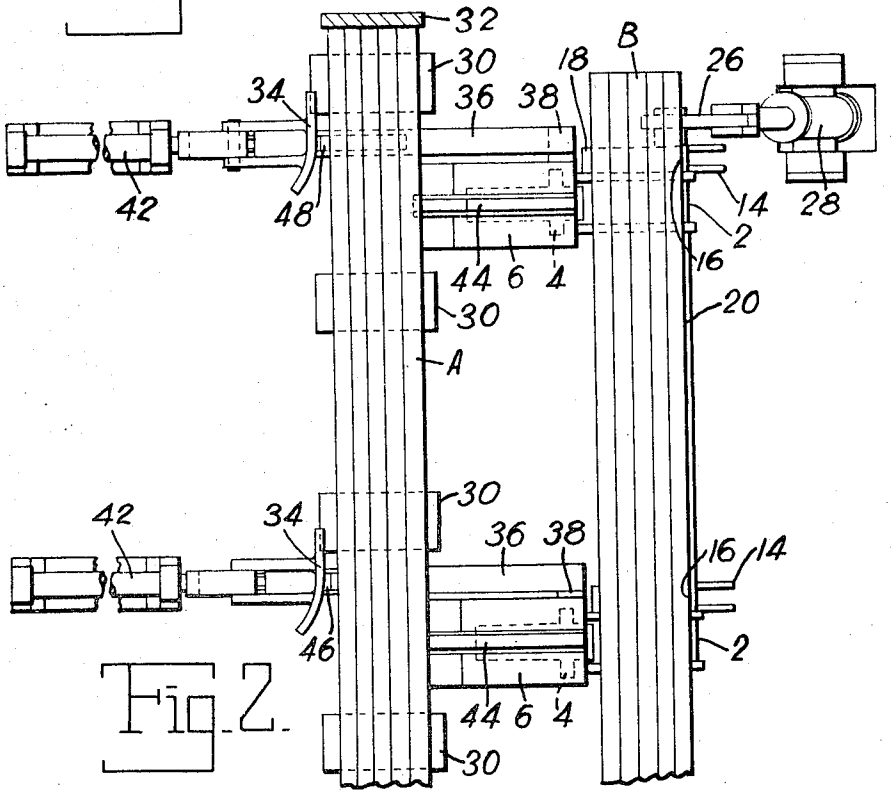

Fig. 2

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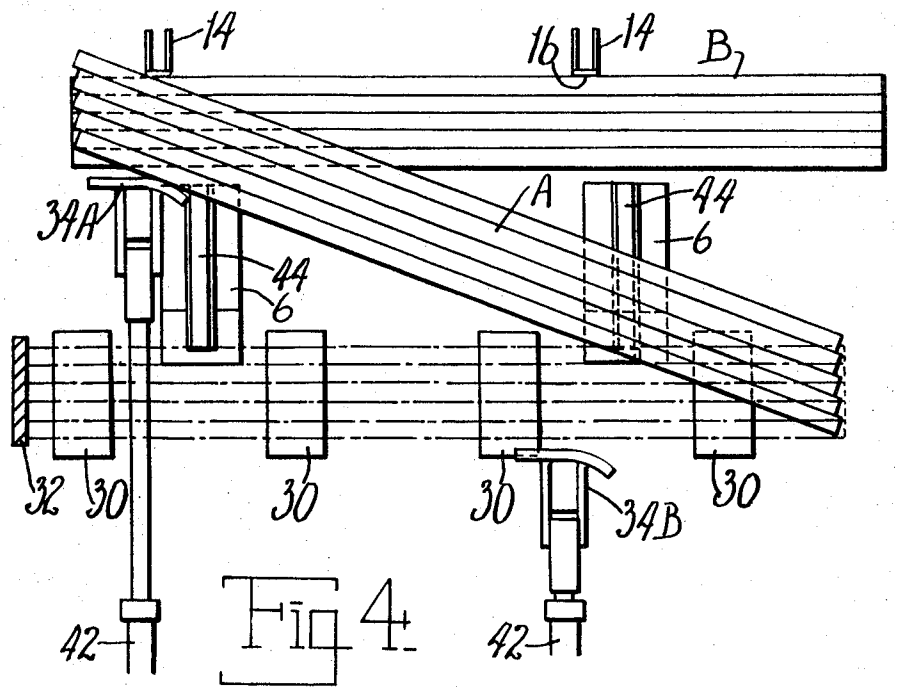

Fig. 4

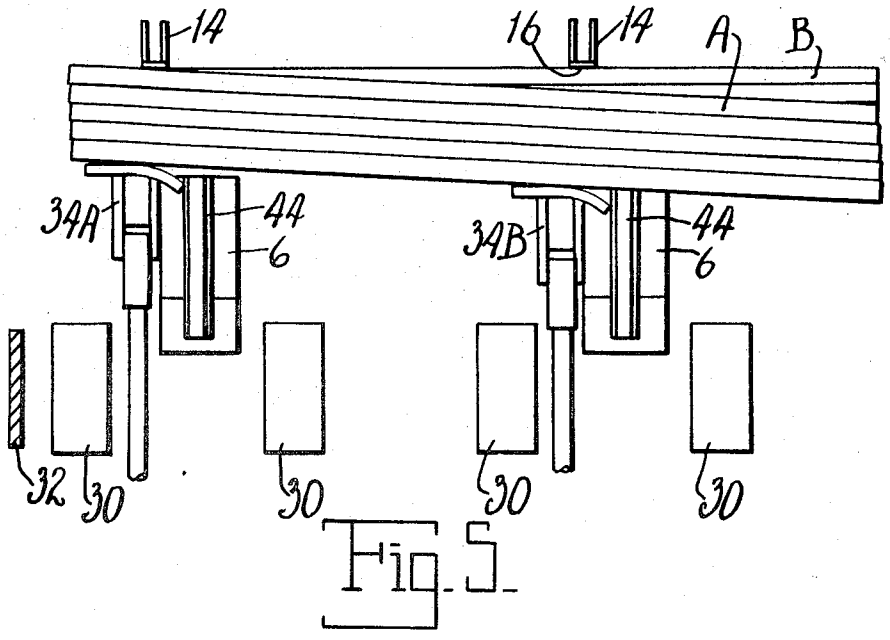

Fig. 5

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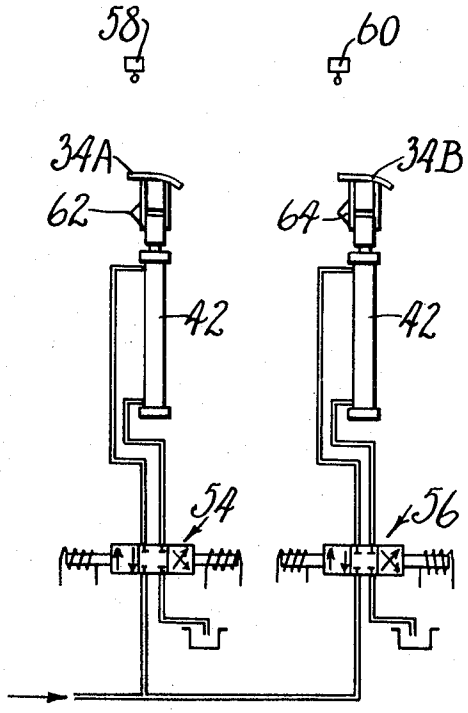

Fig. 6

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STACKING OF ARTICLES

This invention relates to the stacking of elongate articles into a stack having a number of superposed arrays with each made up of one, or more usually a number, of the articles in substantially parallel disposition; a stack of this type will be referred to in this specification as "a stack of the type described."

One application of the invention is the stacking of bars, as they come from a rolling mill, into a succession of stacks which are individually bound for ease of subsequent handling. One way of forming the stack is to bring the bars delivered on a roller conveyor to a stop so that the bars form an array with their lengthwise axes approximately parallel. The array of bars are then pushed transversely on to a vertically adjustable bed, which is lowered each time an array is loaded on to it. The second and each subsequent array of bars is pushed over the previous array, thus building up the stack. When the stack reaches a required height, it may be bound with wire or otherwise strapped and removed.

One of the difficulties of forming a stack in this way arises from the fact that when an array of rolled bars is pushed transversely across the top of another array of bars, it frequently happens that the corners of the bars being pushed foul against similar corners of those bars already on the stacker. The bars which are being pushed then become misplaced and frequently end up as a jumbled heap on top of the stack.

One aspect of the present invention resides in a method of forming a stack of the type described in which each successive array is first moved over the preceding array with the length of the article or articles inclined to the length of the article or articles in the preceding array and is then moved to bring the article or articles of the array being moved into substantial parallelism with that or those of the preceding array.

In accordance with another aspect of the invention, apparatus for stacking elongate articles into a stack of the type described comprises pushers for pushing each array in turn over the preceding array, and means for operating the pushers so that the array being stacked is first moved with the lengths of the article or articles inclined to the lengths of the article or articles of the preceding, already stacked, array, and, when the array has been positioned over the preceding array, the article or articles of the array are brought into substantial parallelism with that or those of the preceding array. Preferably the pushers are curved to ease the pushing action when the articles are moved with their lengths inclined to the direction of movement.

As the articles being stacked are moved over the preceding articles with their edges inclined to the edges of the preceding array, the danger of fouling is reduced.

The invention will be more readily understood by way of example from the following description of stacking apparatus in accordance therewith, and its operation, reference being made to the accompanying drawings in which:

FIG. 1 is a transverse section through the stacking apparatus,

FIG. 2 is a plan view of the apparatus shown in FIG. 1,

FIG. 3 is a section view on the line III—III of FIG. 1,

FIGS. 4 and 5 are diagrammatic views in plan showing the method and apparatus in operation, and

FIG. 6 shows a control arrangement.

A partly formed stack of bars B is shown in the drawings to be resting on a pair of spaced beds 2 each of which is mounted for vertical sliding movement in guides 4 in a member 6. Vertical adjustment of each bed 2 is accomplished by a hydraulic piston and cylinder unit 8 acting through a bell crank lever 10 and link 12. It will be understood that at the beginning of a stacking operation the bed 2 is at an elevation such that a first array of rolled bars would be pushed, as later described, directly on to this bed. The piston and cylinder unit 8 is then actuated to rock the bell crank 10 in a clockwise direction to lower the bed by an amount substantially equal to the height of the bars, so that the next array of bars is pushed across the top of the first array. This vertical lowering of the bed takes place after each array has been stacked.

Adjacent each bed 2 is a cradle 14, having a vertical face 16 against which the bars are pushed, and a horizontal face 18 which is approximately level with the upper face of the bed 2 when that bed is in its lowest position. The cradles 14 are not vertically adjustable but are keyed to a common shaft 20 pivotally mounted on lugs 22 depending from the members 6. A lever 24, also keyed to the shaft 20, is pivotally connected to a piston rod 26 of a hydraulic unit 28, so that when a stack is completed on the beds 2 the cylinder unit 28 may be actuated to rock the lever 24 and therefore the shaft 20 in a clockwise direction to transfer the cradle and the stack of rods to a position convenient for conveying the stack away from the stacker. The stack may be bound by a banding machine at this position before the stack is conveyed away.

The array of bars approaches the stacking area along a roller table, of which a number of rollers are indicated at 30, until they abut against a stop 32. Pusher members 34 are guided along rails 36 mounted between brackets 39 on members 6 and joists 40. The pushers are reciprocated by piston and cylinder units 42 and have curved faces as shown in FIGS. 3 to 5.

Each of the members 6 carries a rail 44 and the array of bars is pushed off the roller table and across these rails 44 to the stacking position. Should the stack being formed be so narrow that a gap is left between the right-hand end of the rail 44 and the left-hand edge of the stack, the possibility of bars of the succeeding arrays falling down the gap is prevented by a bridging member provided in each pusher. This consists of a bar 46 which passes through a convenient hole in the pusher and carries a wear plate 48 at its operative end. The bar 46 is frictionally gripped, by a spring 50, to the pusher. A stop member 52 is mounted on the guide 36.

At commencement of operation each bed 2 is at its topmost position and rolled bars are delivered successively on the roller table to engage with the stop 32. When an array of bars has been formed, pushers 34 are actuated by the cylinder units 42 to push this array of bars across the rails 44 on to the beds 2. The pushers are retracted and the beds 2 lowered by an amount substantially equal to the height of a bar. The next array of bars arrives at the stop member 32 and then one only of the pushers (34A in FIGS. 4 and 5) is actuated to push the newly arrived array of bars obliquely over the rails 44 and across the partly formed stack B on the beds 2 to the position indicated at A in FIG. 4. When the ends of the bars abut against the vertical face 16 of the cradle 14 opposite the pusher 34A, the other

pusher 34B is actuated to push the array of bars across the partly formed stack until it sits correctly in position on the stack with the lengths of the newly arrived array in parallelism with the already stacked rods. The beds 2 are next lowered by one bar-height, and the stacking operation continued until the desired number of layers is stacked. Because of the oblique approach of the arrays of bars to the stack the difficulty previously encountered and described is eliminated.

If it so happens that the stack being formed is comparatively narrow then the bridging members 46 are effective. As each pusher approaches the stack with the second layer of bars entrained, the member 46 travels with the pusher by virtue of the gripping effect of the spring 50, until the right-hand end of the member 46 abuts against the nearest bar of the stack. The movement of the bridging member will thus be arrested but the pusher 34 continues its travel pushing the new array of bars over the wear plate 48 on the member 46 to complete the stack. As the pusher retracts the bridging member will again travel with it by virtue of the friction imparted by the spring 50 until the left-hand end of the bridging member abuts the stop 52 where it will be arrested until the pusher has fully retracted.

The drawings show only two beds and pusher units, but it will be understood that any number of beds and pushers may be provided according to the lengths of the bars. The first operating pusher need not necessarily push the bars fully to abut the vertical face 16 before the other pusher or pushers begin their travel. These may be arranged to commence their movement soon after the first pusher has moved sufficiently to cause the array of bars to lie obliquely to those already on the stack. In fact, both pushers may start moving together, but one at a lower speed than the other, so that one end of the array moves over the previous array in advance of the other. When that one end engages the face 16 the pusher at that end is stopped, the pusher at the other end continuing its motion to bring the arrays into parallelism.

The cradle 14 opposite the first actuated pusher 34 is preferably disposed inwardly of the ends of the bars, so that the ends of each bar of the newly arriving array A extends beyond the bar of the preceding array B on which that bar will sit. This eases the final movement of the array A into parallelism with array B and minimises the possibility of the edges of the bars A fouling the edges of bars B during this final movement.

In the control diagram illustrated in FIG. 6, pressure fluid is fed to the front or rear of the cylinder units 42 through solenoid valves 54, 56. Limit switches 58, 60 are provided and these are adjustably mounted, for example on the guides 36, and are contacted by cams 62, 64 on the pushers 34*a*, 34*b*.

In operation the valve 54 is moved to the left by actuation of the appropriate solenoid. This may be effected either manually or by a suitable switch mounted, for example, on the stop. The pusher 34*a* then advances until cam 62 contacts limit switch 58 which actuates solenoid valve 56 to move that valve to the left causing pusher 34*b* to advance. When cam 64 contacts switch 60 both valves 54 and 56 are moved to the right by actuation of their solenoids and pressure fluid is supplied to the fronts of the cylinder units 42 to withdraw the pushers 34A, 34*b*.

Although each array is shown in the drawings as constituted by a number of bars, it is to be understood that an array may consist of as little as one elongate element.

In accordance with the provisions of the patent statutes, I have explained the principle and operation of my invention and have illustrated and described what I consider to represent the best embodiment thereof.

I claim:

1. An apparatus for stacking elongate articles into a stack of the type described,

a receiving station for said articles,

a stacking station spaced from said receiving station,

first and second moving means,

said first and second moving means being arranged to engage different longitudinal portions of an article or and array of articles to be stacked and to traverse between said two stations,

first means for operating at least said first moving means so that a portion of the article or the array being of articles stacked is moved from said receiving station toward said stacking station so that the length of the article or articles is or are inclined to the length of the article or articles of the preceding already stacked array in said stacking station,

a second means for operating said second moving means so that after the said portion of the article or the array of articles has been pushed over the preceding array the remaining portion of the article or articles of the array is or are brought into parallelism with that or those of the preceding aray in said stacking station, control means for sequentially actuating said first and second operating means, and wherein

the construction and relationship of the stations and the moving means are such that when the article or articles is or are pushed from said receiving station to said stacking station it or they is or are pushed across and supported by a preceding already stacked array.

2. Apparatus according to claim 1 in which said first and second means comprise a fluid operated cylinder for each moving means arranged to move that moving means in a dirction transverse to the lengths of the articles when stacked, and valve means for the cylinders which are arranged to be operated in sequence.

3. Apparatus according to claim 2 in which said control means includes a limit switch located in the path of the first operated moving means, the switch being arranged, when actuated by the moving means, to operate the valve means to initiate operation of the other or others of the cylinders.

4. Apparatus according to claim 1 in which each moving means is curved to facilitate turning movement of the elongate articles about them.

5. Apparatus according to claim 1 in which the first moving means to be operated is arranged to engage the nearest article of each successive array at a position displaced from the ends of that article.

6. An apparatus according to claim 1 in which said stacking station includes support means for receiving an array to be stacked, and

means for relatively adjusting the support means and said moving means to enable a succeeding array to be superimposed over a preceding already stacked array.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,757,965 Dated September 11, 1973

Inventor(s) Gilbert Lendrum Renshaw

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Claim 1, column 4, line 20 "being of articles"

should read -- of articles being --.

Signed and sealed this 19th day of March 1974.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents

FORM PO-1050 (10-69)

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* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334.