June 15, 1965 C. O. MERCHANT 3,189,193

ARTICLE TRANSFER MACHINE

Filed June 12, 1963 2 Sheets-Sheet 1

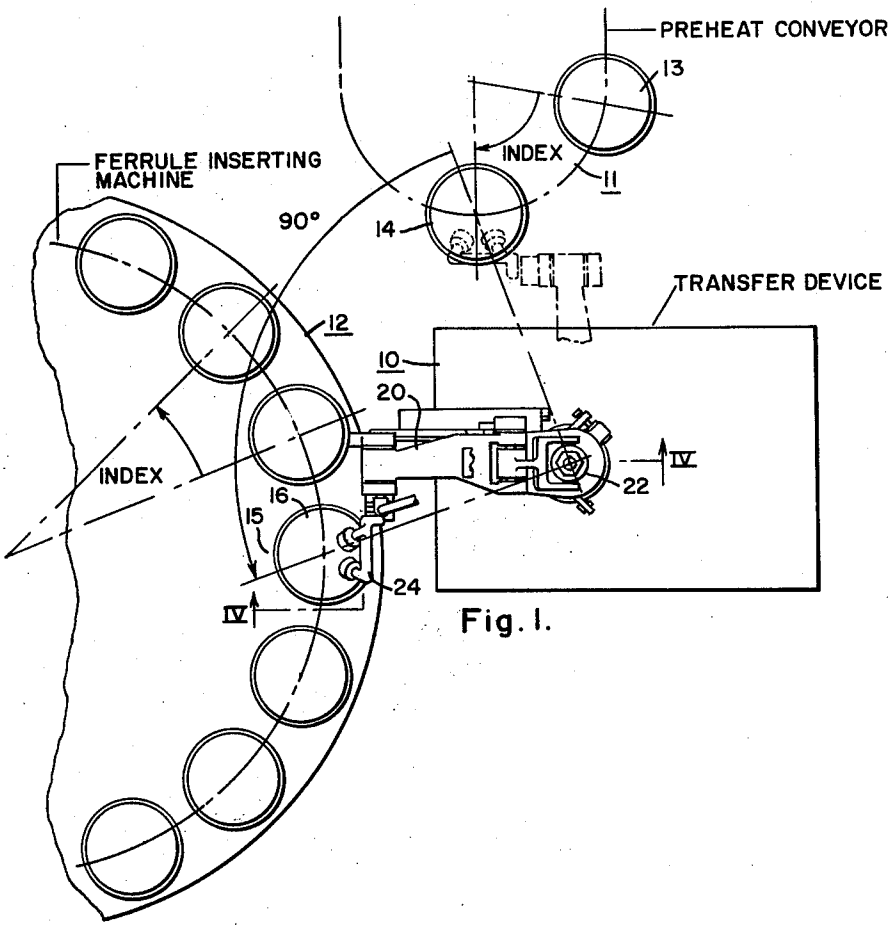


Fig. 1.

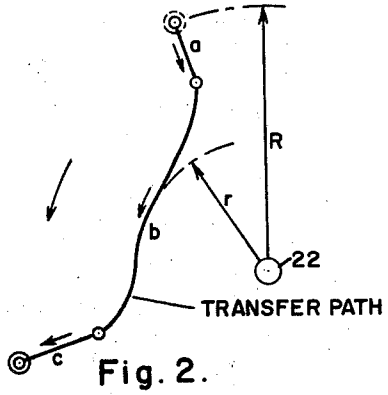


Fig. 2.

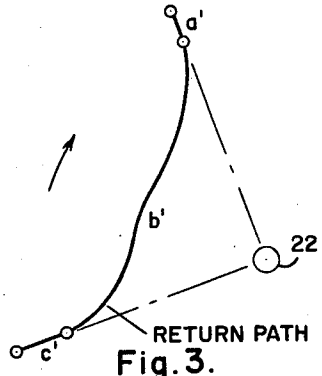


Fig. 3.

INVENTOR
Chester O. Merchant

BY

Francis E Blake

ATTORNEY

June 15, 1965 C. O. MERCHANT 3,189,193

ARTICLE TRANSFER MACHINE

Filed June 12, 1963 2 Sheets-Sheet 2

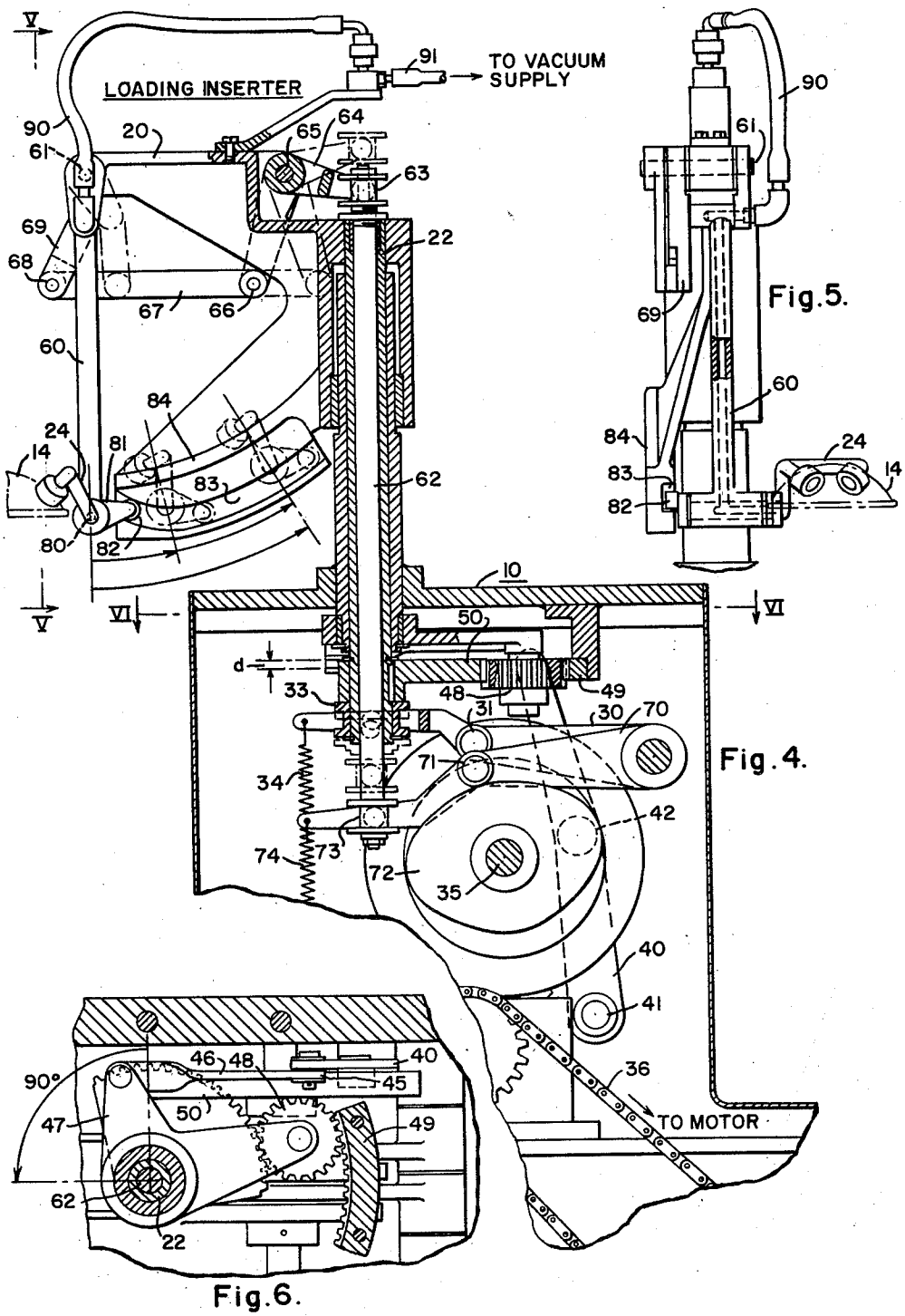


Fig.5.

Fig.4.

Fig.6.

United States Patent Office 3,189,193 Patented June 15, 1965

3,189,193

ARTICLE TRANSFER MACHINE

Chester O. Merchant, East Longmeadow, Mass., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Filed June 12, 1963, Ser. No. 287,269
4 Claims. (Cl. 214—1)

The present invention relates to article transfer machinery and more particularly to a machine for transferring relatively heavy ceramic articles such as the glass reflector bodies of sealed beam headlamps from one work station to another work station.

In the course of manufacturing sealed beam headlamps, the glass reflector bodies are submitted to various manufacturing operations which are performed in a largely automated manner by a series of machines in an assembly line arrangement. The particular assembly line arrangement to which this invention relates, requires that the reflector bodies be transferred from a preheat conveyor to a ferrule inserting machine and prior to this invention the transfer of the reflector body has been done by hand. Suction gripping means for lifting and moving a glass body such as a sealed beam headlamp reflector by mechanical means are known but difficulties are encountered when the relatively heavy ceramic or glass body carried by the suction means is moved rapidly over a circular path from one work station to another work station, due to the effects of centrifugal force which tend to cause the reflector bodies to be separated from the suction gripping means.

It is a principal object of this invention to provide an improved article transfer machine for rapidly transferring over a generally circular path a relatively heavy object from one work station to another work station.

Another object of the invention is to provide an improved article transfer machine for transferring the ceramic body of a sealed beam headlamp reflector from one work station to another work station over a generally circular path in a manner to minimize the effects of centrifugal force on the reflector body thus enabling suction gripping means to be reliably used as a part of the article transfer mechanism.

In accordance with the invention, the suction gripping means is carried at the lower end of a pivoted depending arm secured to the outer end of a radial arm carried by a rotatable generally upright column member. As the column member is rotated, the outer end of the radial arm together with the depending pivoted arm are moved over a generally circular path, but a feature of the invention is the provision of means to also pivot the depending arm inward towards the upright column thus reducing the radius of the arc of travel of the lower end of the pivoted arm while it is being rapidly moved by rotation of the column and radial arm. At the lower end of the pivoted arm, suction gripping means is pivotally mounted on a generally horizontal pivot together with means interconnecting the gripping means and the radial arm in a manner to rotate the gripping means upwards towards the column as the pivoted arm is moved inwards towards the column. In such manner, the actual path of travel for the article carried by the gripping means during rotation of the column and radial arm is inward at the beginning of rotation and outward at the end of rotation so that the radius of movement and the effects of centrifugal force will be reduced during the arcing movement of the reflector body from the first work station to the second work station. It may be desirable to also lift the article at the first work station prior to the inward and radial movements, and to lower the article after outward movement at the end of the radial movement at the second work station, and for this purpose means may be provided to longitudinally

move the upright column in timed relation to the other described movements of the column and radial arm.

Further objects, features and the attending advantages of the invention will be apparent with refernce to the following specification and drawings, in which:

FIGURE 1 is a plan view of a transfer device of the invention as positioned to transfer sealed beam headlamp reflector bodies from a preheat conveyor to a ferrule inserting machine, with the preheat conveyor and the ferrule inserting machine shown only partially schematically;

FIG. 2 is a diagrammatic view showing the transfer path of movement from the preheat conveyor to the ferrule inserting machine;

FIG. 3 is a diagrammatic showing of the return path for the article transfer machine when moving back from the ferrule inserting machine to the preheat conveyor;

FIG. 4 is a vertical cross-sectional view of a line IV—IV of FIG. 1 with some parts in elevation to show details of the transfer machine;

FIG. 5 is a partial side elevational view of the transfer machine taken on the line V—V of FIG. 4; and

FIG. 6 is a fragmentary horizontal sectional view on the lines VI—VI of FIG. 4 showing the driving means for causing the upright column and radial arm to rotate or oscillate between the first and second work stations.

Referring to FIGS. 1–3 of the drawings, the transfer machine of the invention is indicated as being mounted on the base structure **10** which is positioned at a point intermediate the preheat conveyor diagrammatically shown at **11** and the ferrule inserting machine diagrammatically shown at **12**. The lamp reflector bodies such as the bodies **13** and **14** on the preheat conveyor are to be transferred one at a time by the transfer device of the invention to the ferrule inserting machine **12** at the work station **15** where the lamp reflector body **16** is shown at the moment of transfer to the ferrule inserting machine. The ferrule inserting machine rotates counterclockwise and is provided with the plurality of stations for receiving in sequence the lamp reflector bodies as they are transferred from the preheat conveyor.

For purposes of description, it will be assumed that the lamp reflector **14** is shown in the position at the first work station from which the lamp reflector is to be transferred to the second work station **15** on the ferrule inserting machine **12**. Each lamp reflector body to be transferred by the transfer mechanism of the invention is a relatively heavy object usually formed of a ceramic such as glass. However, the invention in its broadest sense is not intended to be limited to its use for transferring glass sealed beam headlamp reflector bodies, but may be used to transfer other objects that are relatively heavy and difficult to handle by suction gripping means. It will be noted that each article to be transferred, such as the glass reflector body **14** must move through an arc of travel to a point angularly displaced by substantially 90°. In other words, the radial arm **20** and the upright column **22** to which it is secured must be rotated back and forth through approximately 90° of angular rotation. It is of course desirable that both the preheat conveyor and the ferrule inserting machine are operating at a reasonably fast rate in order that the production of sealed beam headlamp bodies will be sufficiently high in a given amout of time to be economical. Therefore, the article transfer mechanism of the invention must grip and move the glass reflector bodies rapidly through the desired arc of travel from the first work station to the second work station, and as previously mentioned, the effects of centrifugal force on the lamp body held by the suction gripping means must therefore be minimized.

In accordance with the invention, the article transfer device provides that after the article has been gripped by

the suction gripping means it is first moved inward along the path (*a*) then radially along the path (*b*) at the reduced radius of (*r*) to the second transfer station where it again moves outward along the path (*c*) to a position which is radially displaced from the axis of the upright column by the radius (*r* FIG. 2). After the article has been released at the second work station 15 the transfer arm follows a generally similar path as shown by FIG. 3 of the drawings by moving inward first towards the axis of the upright column 22 over the path (*c'*) then radially along the path (*b'*) to the first work station and then outwardly again along the path (*a'*). Since most of the arcing movement of the suction gripping means carrying the article to be transferred is over the path (*b*) which is of a considerably reduced radius compared to the actual radial position of the first and second work stations, the centrifugal forces imposed upon the article to be transferred are considerably lessened. In addition, the invention provides that the suction gripping means generally shown at 24 (FIG. 1 of the drawings) is pivotally mounted upon a generally horizontal axis so that the article gripping means 24 may be swung upward towards the radial arm 20 and upright column 22 thus further reducing the extreme radius from the article to be transferred, such as the lamp reflector body 14, to the axis of the upright column 22. Interconnecting means to be later described in detail are provided to cause the desired movement of the article gripping means 24 in timed sequence to the other movements of the transfer mechanism of the invention.

Referring to FIGS. 4, 5 and 6 of the drawings, the mechanical details for one form of the invention as arranged to provide the above-described movements during transfer are shown. It should be understood that various mechanisms other than the detailed mechanisms to be described may be used within the spirit of the invention. The upright column 22 is shown to be rotatably and slidably mounted upon the base 10 with a normal resting position shown by the solid line. The upright column 22 may be raised through the distance (*d*) by movement of the cam follower arm 30 having the cam follower roller 31 engaging the periphery of the cam 32, with the outer end of the arm 30 connected by the collar 33 to the upright column 22. A spring 34 causes the arm 30 to follow the peripheral contour of the cam 32 to return the upright column 22 to the normal lower position shown by the solid line at the required time as provided by rotation of the cam 32 which is rotated by rotation of the cam shaft 35 driven by the chain 36 connected to the electric motor (not shown). The cam shaft 35 is in effect the timing shaft for providing the desired sequence of movements of the article transfer mechanism to be described. It should be understood that the limited slidable or longitudinal movement of the upright column 22 through the distance (*d*) is only desirable when it is required that the article to be transferred be first lifted vertically a small distance before it enters into the path of movement as shown by FIG. 2 of the drawings. When it is not necessary to lift the article to be transferred before moving it through the transfer path, the above-described mechanism for slidably and longitudinally moving the upright column 22 may be omitted.

The column 22 is rotated back and forth between the first and second transfer stations by means of the linkage including the crank arm 40 pivoted at 41 to the base of the machine and having cam roller follower 42 engaging a cam (not shown in detail) on the cam shaft 35. The free outer end of the crank arm 40 is connected at 48 to the link 46 which in turn is connected to one end of the bell crank 47. As the crank arm 32 is oscillated back and forth, the bell crank 47 will be rotated back and forth and through the interconnection of the pinion gear 48 and sector gears 49 and 50 will cause the desired rotational movement of the upright column 22.

Secured to the upper end of the upright column 22 is the radial arm 20 for rotation therewith. A depending or pivoted arm 60 is pivotally connected at 61 to the outer end of the radial arm 20. A control shaft 62 is slidably positioned within the upright column 22 and is connected at its upper end by the collar 63 to the bell crank 64 which is pivoted at 65 on the radial arm 20. The other end of the bell crank 64 is pivotally connected at 66 to the link 67 which is pivotally connected at 68 to the crank arm 69 fastened to the pivotal arm 60 in a manner to cause the arm 60 to pivot inward about its pivot 61 as the crank arm 69 is moved to the dotted line position of FIG. 4. It will now be seen that when the control shaft 62 is slidably moved from the solid line position to the dotted line position the depending pivoted arm 60 will be moved inward towards the upright column 22.

A crank arm 70 is provided with a cam follower roller 71 in engagement with the periphery of cam 72 also driven by the cam shaft 35. The outer end of the crank arm 70 is connected by the collar 73 to the lower end of the slidable control rod 62 and a coil spring 74 insures that the crank arm 70 will follow the contour of the periphery of the cam 72. Thus, the rotation of the cam shaft 35 will cause the control shaft 62 to be slidably moved to the dotted line position to thereby move the pivoted depending arm 60 inward toward the upright column 22 at the desired times in the cycle of operation to be later described in more detail.

The article gripping means, namely the suction gripping elements 24 are pivotally connected at 80 to the lower end of the depending arm 60 by a pivot arrangement that may be described as having a generally horizontal axis. When the depending arm 60 is in the solid line position shown, the suction gripping mechanism 24 is in position at the first work station to grip the lamp reflector body such as the lamp reflector 14. However, in accordance with the invention, a crank arm 81 is provided to rotate the suction gripping mechanism 24 in a clockwise direction upwards toward the radial arm and the upright column 22 as the depending arm 60 is moved inwardly toward the upright column 22. For this purpose the cam follower roller 82 is mounted on the outer end of the crank arm 81 and engages a cam groove 83 formed in the member 84 that is secured to the radial arm 20. It will be seen that the shape of the cam groove 83 is such that the suction gripping mechanism 24 will be quickly moved to the dotted line position as the depending arm 60 begins to move inward toward the upright column 22. Conversely as the depending pivoted arm 60 is moved outwardly from the upright column 22 at either of the work stations, the gripping mechanism 24 will again be rotated in a counterclockwise direction to be in a position to either grip or deposit the lamp reflector body in the desired horizontal position.

The hoses 90 and 91 are connected to a vacuum supply (not shown) to supply the necessary vacuum to the suction gripping mechanism 24. Suitable valve arrangements (not shown) may be provided if desired to control the suction for the suction gripping devices 24 and since they do not form a part of this invention they have been omitted in the present description for the sake of brevity and clarity.

The operation of the article transfer mechanism of the invention should now be apparent to those skilled in the art. Obviously the peripheral contours for the timing cams 32 and 72 together with the cam driving the column rotating crank 40 will determine the exact sequence of movements of the mechanism over the transfer path of FIG. 2 or the return path of FIG. 3. As previously described, the shape for the cams and their position on the timing shaft 35 are chosen to provide the following desirous sequence of movements which will be traced for a transfer of an article such as the seal beam headlamp body 14 from the preheat conveyor or first work station to the second work station 15 at the ferrule inserting machine 12. It will be assumed that the upright column 12 is in

the normal lower position and the suction gripping means has gripped the lamp body to be transferred. The first movement, which as previously described may be omitted in some machines, is a slidable longitudinal movement of the column **22** upwards through the distance (*d*) as determined by the rotation of the cam **32**. Thereafter the rotation of the cam **72** causes a slidable upward movement of the control shaft **62** to pivot the depending pivoted arm **60** inward towards the upright column **22**. As the pivoted arm **60** moves inward towards the upright column **22**, the article gripping means **24** is pivoted upward to the dotted line position in response to the operation of the interconnecting means including the crank arm **81** and cam groove **83**. As the pivoted arm reaches the end of its travel inward towards the upright column **22** the crank arm **40** is caused to move by its associated cam driven by the timing shaft **35** to thereby rotate the column **22** with the radial arm **20** and the depending pivoted arm **60** carrying the lamp body through a circular movement of an angular amount of approximately 90°. As the radial arm **20** reaches the end of its counterclockwise movement through the arc of about 90°, the contour of the cam **72** again lowers the control shaft **62** to move the pivoted arm **60** outward away from the control column **22** and also rotate in a counterclockwise direction the article gripping means **24** back to the solid line position shown. Thereafter, the contour of the cam **32** causes the crank arm **30** to lower the upright column **22** back to the normal resting position and thus deposit the lamp reflector body at the second work station on the ferrule inserting machine. Thereafter, continued rotation of the cam shaft **35** causes the pivoted arm **60**, the radial arm **20**, and the upright column **22** to move in timed relation to each other so that the article gripping means **24** is returned from the second work station to the first work station over the return path shown by FIG. 3 of the drawings. Obviously, prior to the movement of the article gripping mechanism back over the return path, the suction valve (not shown) will be operated to block the suction for the suction gripping mechanism **24** so that the lamp body will be released at the second work station.

Various modifications will occur to those skilled in the art. For example, the details of the mechanical arrangements for providing the desired timed sequence of movements for the article gripping and transferring mechanism may be different such as the provision of a Geneva gear arrangement in place of the crank arm and sector gear arrangement for rotating the column **22** back and forth between the first and second work stations.

We claim as our invention:

1. An article transfer machine comprising,
a base,
an upright column rotatably mounted on said base,
a radial arm extending from said column for rotation therewith,
a pivoted arm depending from the outer end of said radial arm to be movable inward and outward of said column,
article gripping means pivotally connected to the outer end of said pivoted arm,
means to rotate said column and radial arm to and from first and second transfer work positions,
means to pivot said pivoted arm inward towards said column before said column is rotated to move from the first transfer position and to pivot the pivoted arm outward as said column approaches the second transfer position,
and means interconnecting said pivotally connected article gripping means and said radial arm to pivot said article gripping means upward as said depending arm is moved inward and downward as said depending arm is moved outward.

2. A machine for transferring glass lamp reflectors between first and second work stations comprising,
a base,
an upright column rotatably mounted on said base,
a radial arm extending from said column for rotation therewith,
a pivoted arm depending from the outer end of said radial arm to be movable inward and outward of said column,
suction means for gripping a glass lamp reflector,
means pivotally connecting said suction means to the outer end of said pivoted arm,
means to rotate said column and radial arm to and from first and second work stations,
means to pivot said pivoted arm inward towards said column before said column is rotated to move from the first work station and to pivot the pivoted arm outward as said column approaches the second work station,
and means interconnecting said pivotally connected gripping means and said radial arm to pivot said gripping means upward as said depending arm is moved inward and downward as said depending arm is moved outward.

3. An article transfer device comprising;
a base;
an upright column rotatably and slidably mounted on said base and having a normal resting position;
a radial arm extending from said column for rotation therewith;
a pivoted arm depending from the outer end of said radial arm to be movable inward and outward of said column;
article gripping means pivotally connected on a generally horizontal axis to the outer end of said pivoted arm;
means to slidably move said column back and forth above the normal position;
means to rotate said column and radial arm to and from first and second transfer stations;
means to pivot said pivoted arm back and forth towards said column;
means interconnecting said pivotally connected article gripping means and said radial arm to pivot said article gripping means upward as said depending arm is moved inward towards said column and downward as said depending arm is moved outward from said column;
and timing means to firstly operate said column sliding means to raise said radial and pivotal arms at the first transfer station, to secondly move said pivoted arm inward towards said column, to thirdly rotate said column from the first transfer station to the second transfer station, to fourthly move said pivoted arm outwards from said column as said radial arm approaches the second transfer station, and to fifthly operate said column sliding means to lower said radial and pivoted arms at the second transfer station.

4. A machine for transferring glass lamp reflectors between first and second work stations,
a base;
an upright column rotatably and slidably mounted on said base and having a normal resting position;
a radial arm extending from said column for rotation therewith;
a pivoted arm depending from the outer end of said radial arm to be movable inward and outward of said column;
suction means pivotally connected on a generally horizontal axis to the outer end of said pivoted arm to grip a glass lamp reflector,
means to slidably move said column back and forth above the normal position;
means to rotate said column and radial arm to and from first and second work stations;

means to pivot said pivoted arm back and forth towards said column;

means interconnecting said pivotally connected suction gripping means and said radial arm to pivot said suction gripping means upward as said depending arm is moved inward towards said column and downward as said depending arm is moved outward from said column;

and timing means to firstly operate said column sliding means to raise said radial and pivotal arms, to secondly move said pivoted arm inward towards said column, to thirdly rotate said column from the first work station to the second work station, to fourthly move said pivoted arm outwards from said column as said radial arm approaches the second work station, and to fifthly operate said column sliding means to lower said radial and pivoted arms at the second work station.

References Cited by the Examiner

UNITED STATES PATENTS

877,579	1/08	Lorenz.
930,702	8/09	Sprowles.
1,316,430	9/19	Davies.
1,750,419	3/30	Mojonnier.
2,069,086	1/37	Donovan.
2,675,153	4/54	Weimer.

HUGO O. SCHULZ, *Primary Examiner.*

MORRIS TEMIN, *Examiner.*