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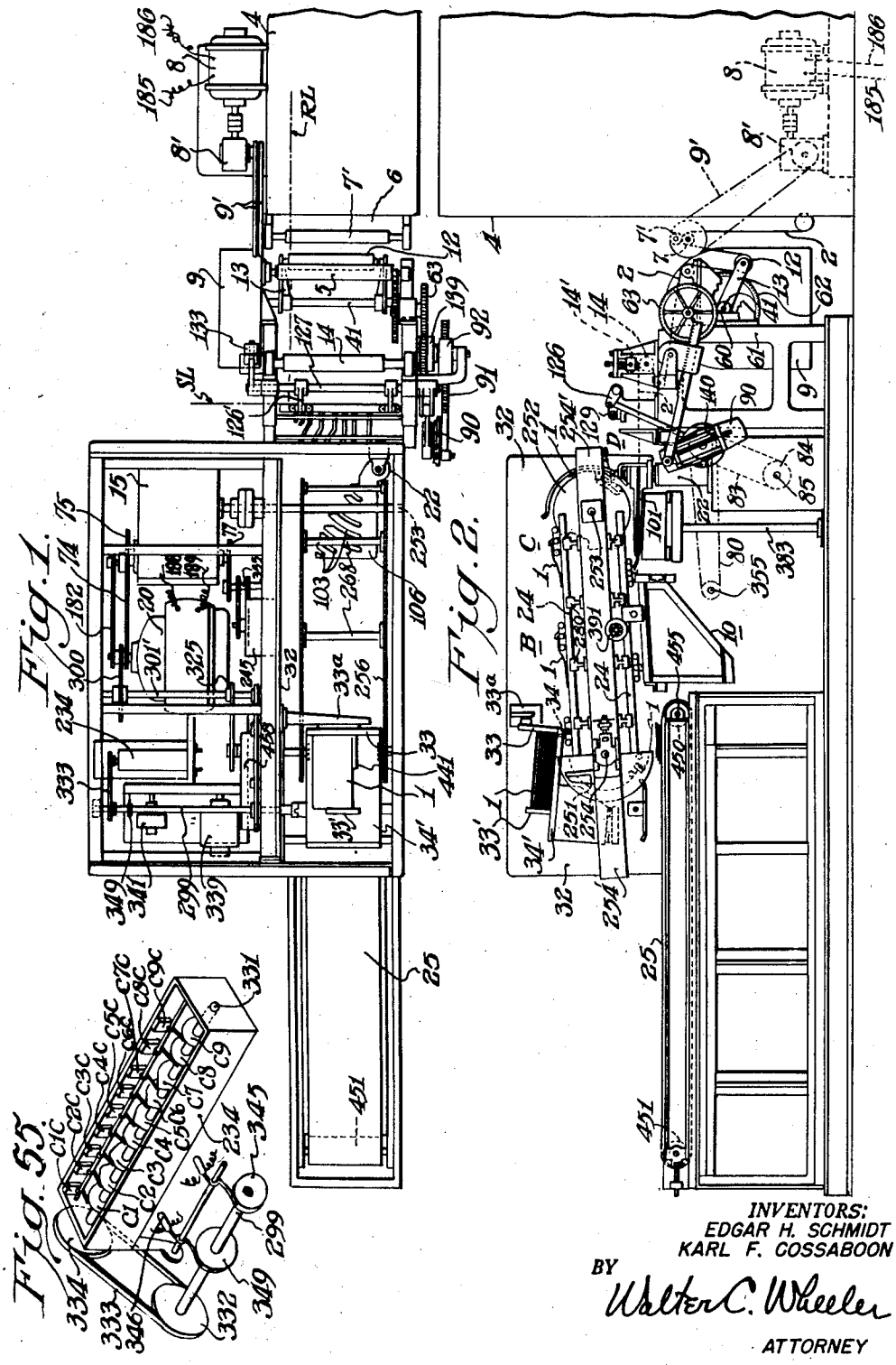


Fig. 1.

Fig. 2.

Fig. 55.

INVENTORS:
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KARL F. COSSABOON

BY
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Fig. 3.

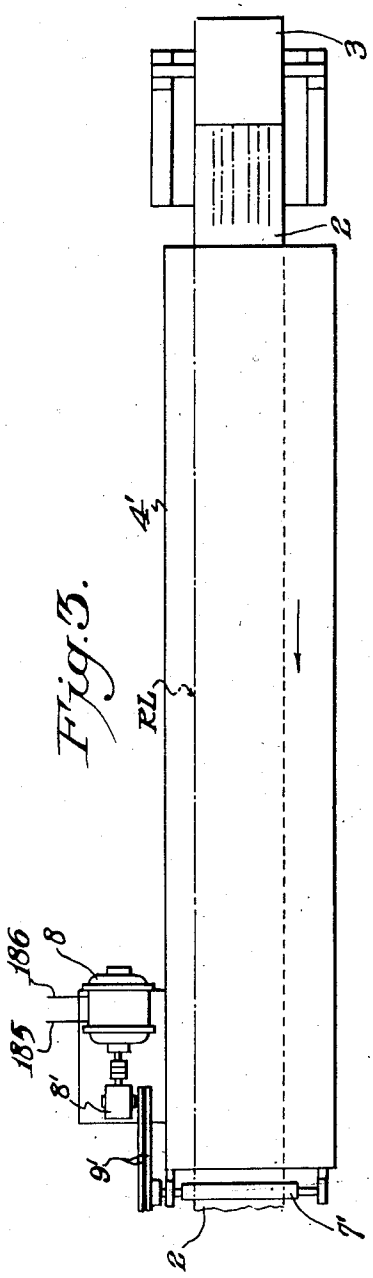
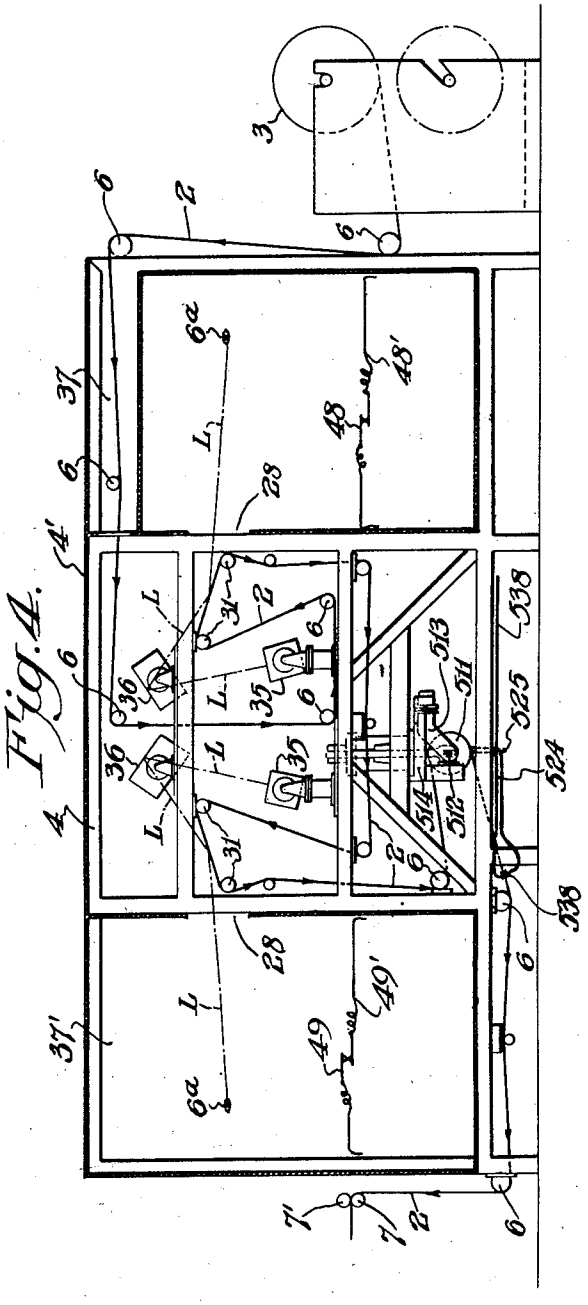


Fig. 4.



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Fig. 7.

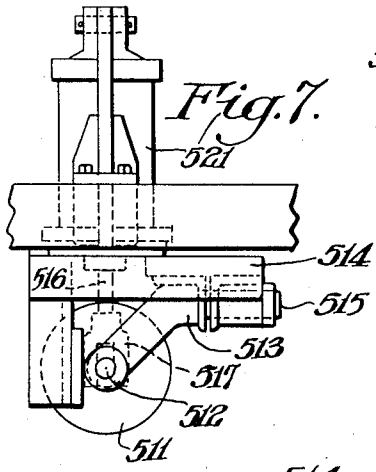


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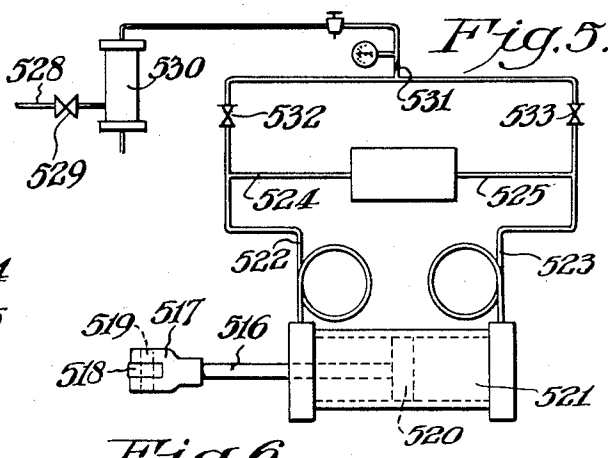


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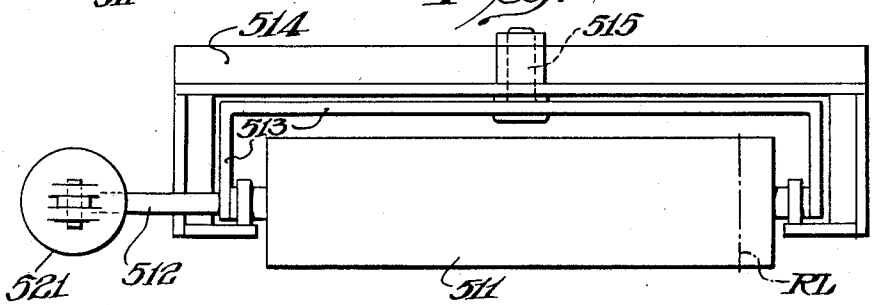


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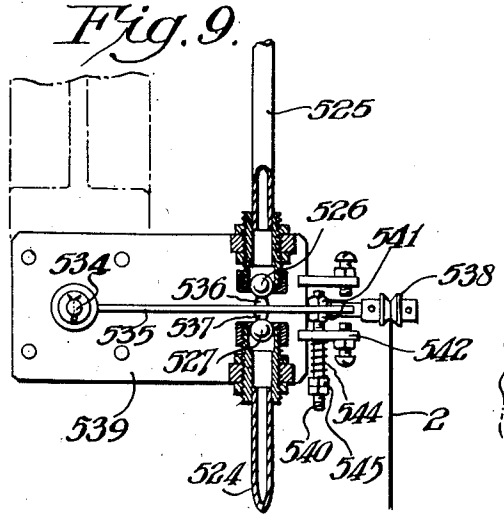
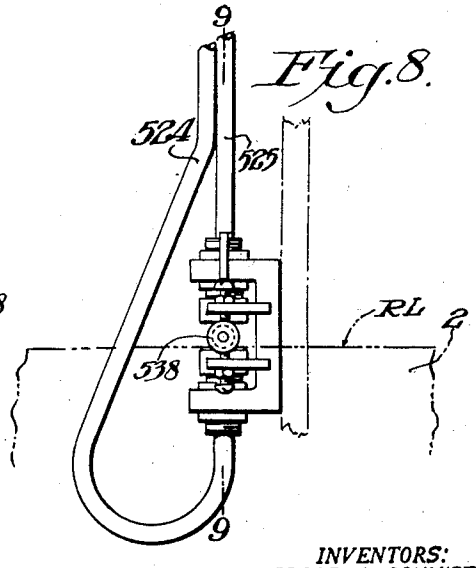


Fig. 8.



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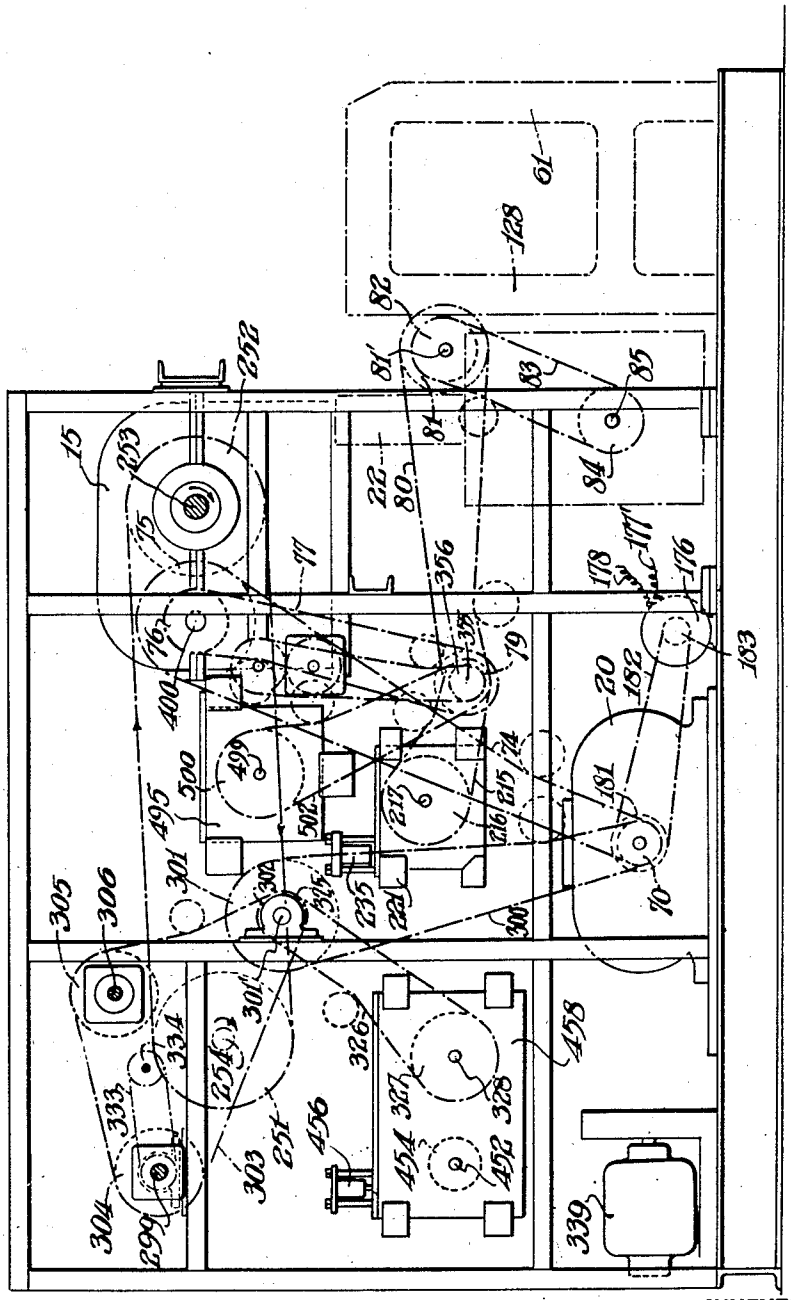
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Fig. 10.



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Fig. 11.

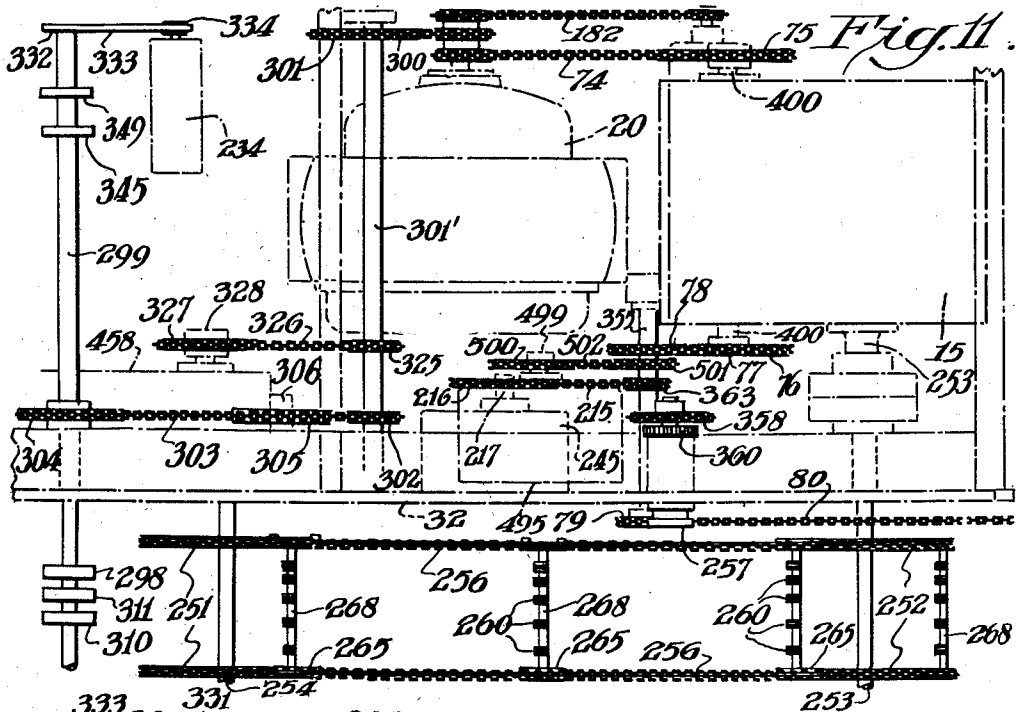
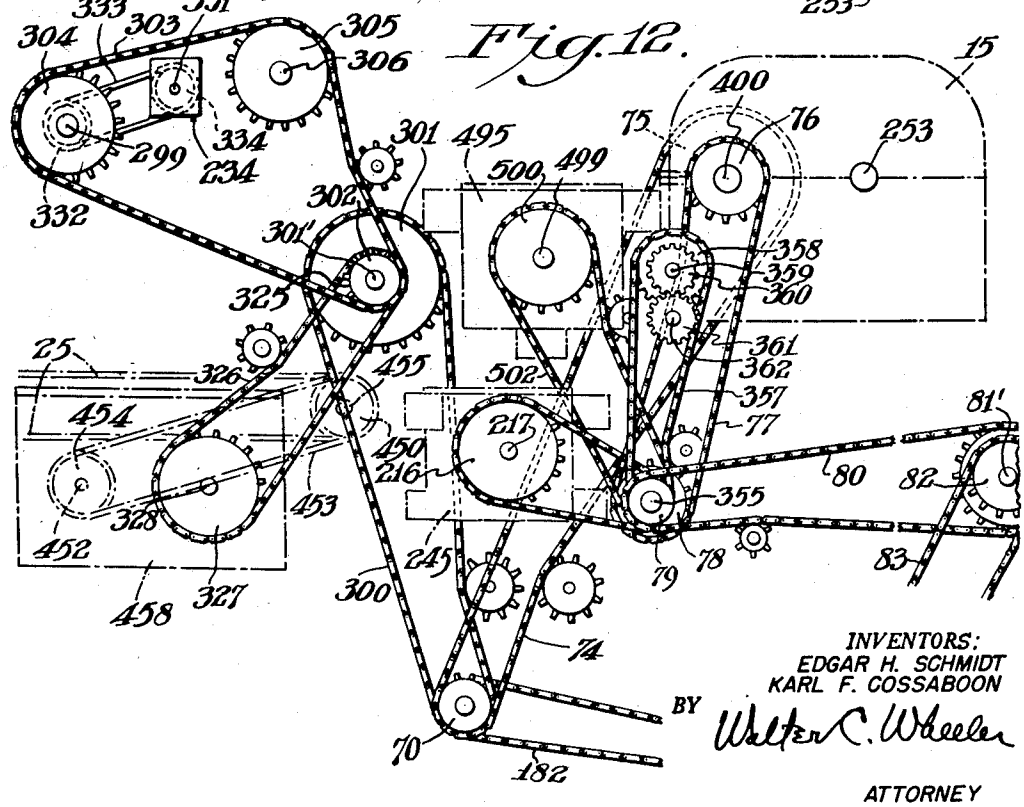


Fig. 12.



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KARL F. COSSABOON

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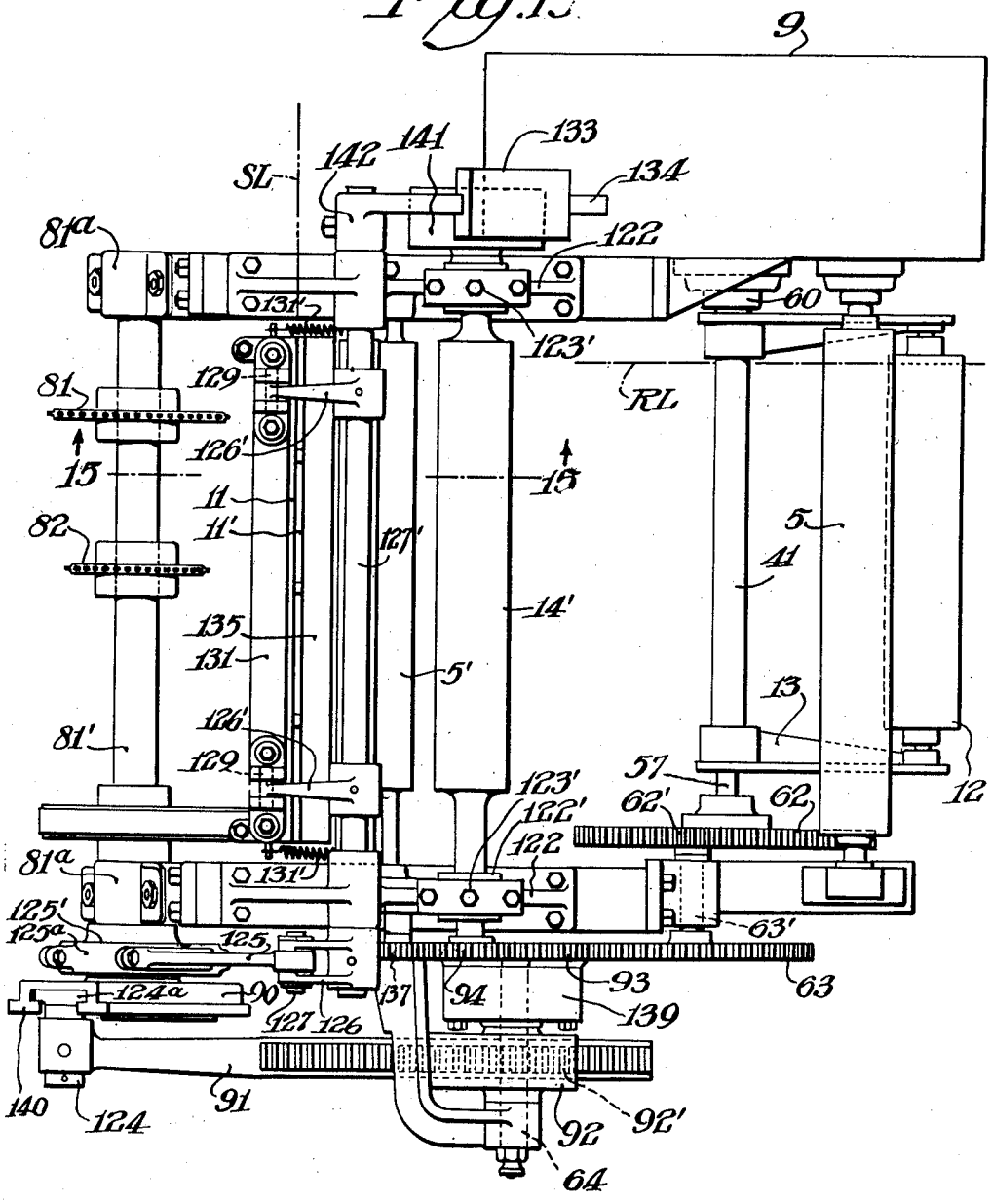
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Fig. 13.



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Fig. 14.

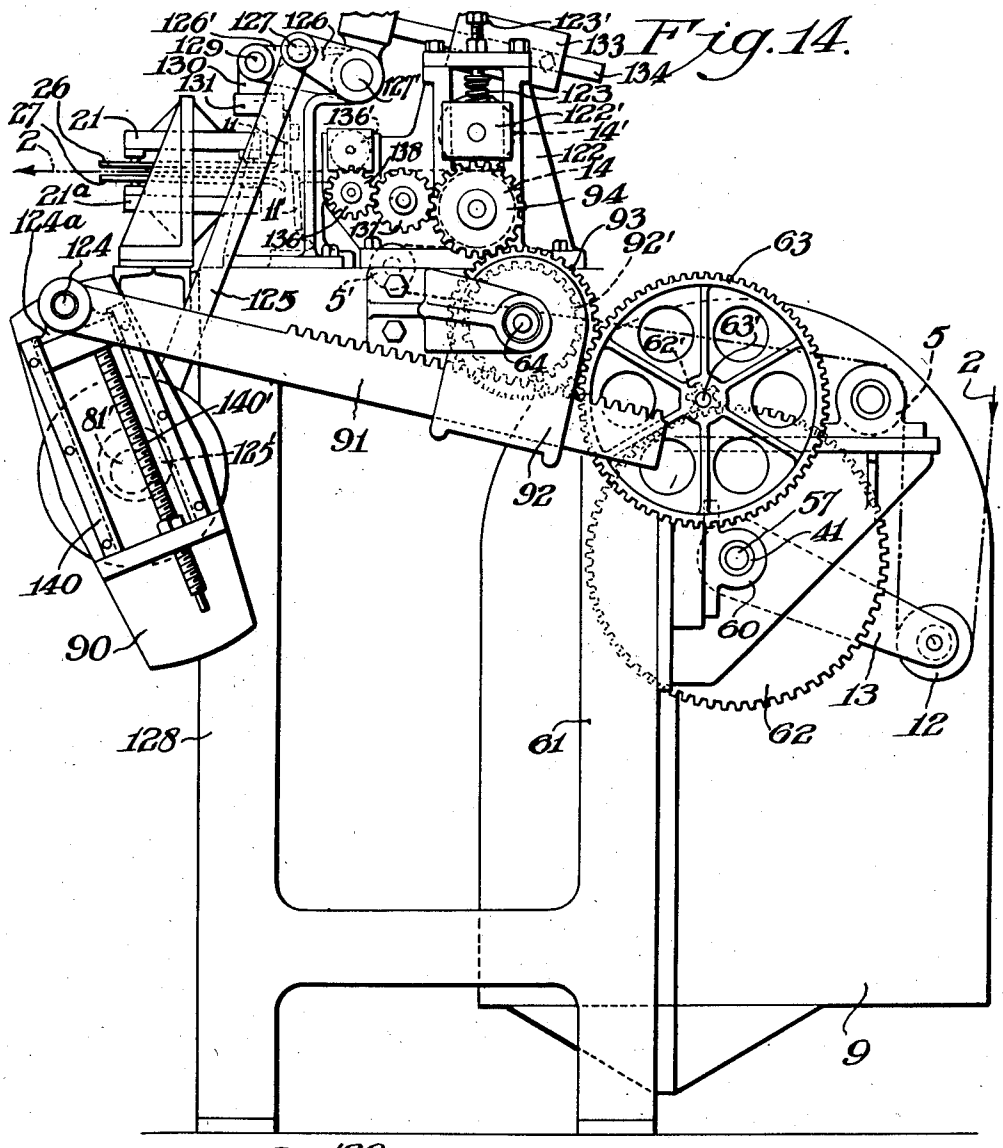
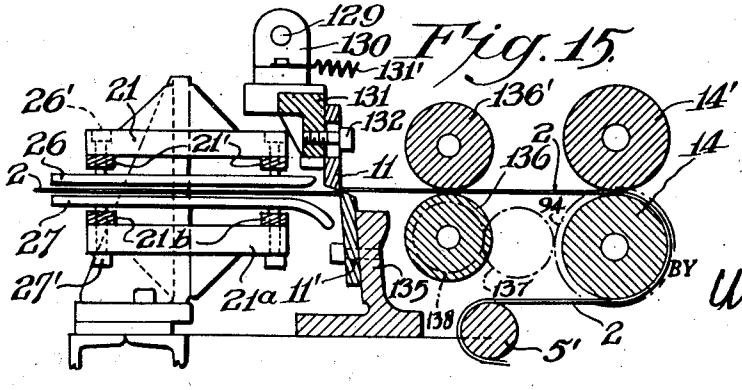


Fig. 15.



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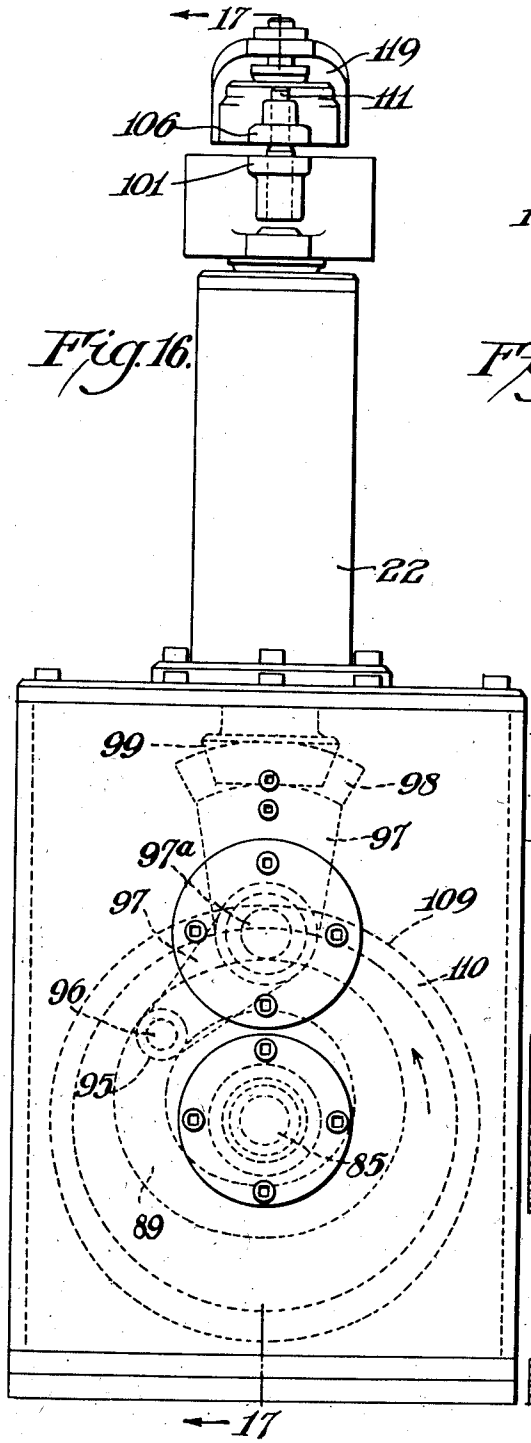


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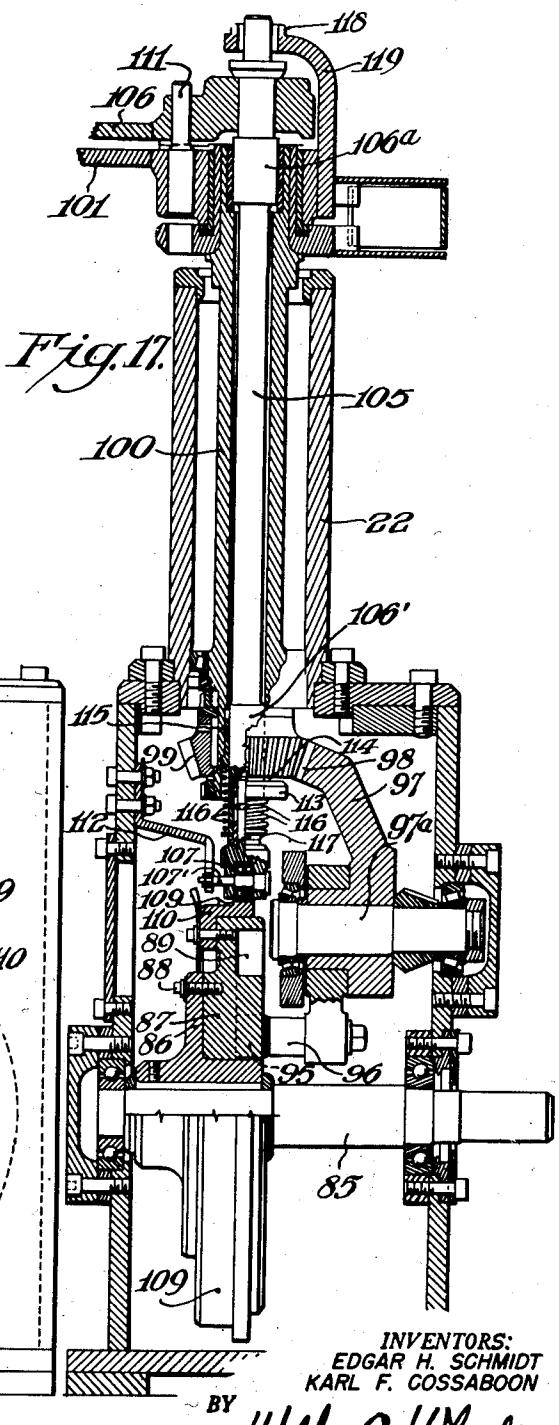


Fig. 17.

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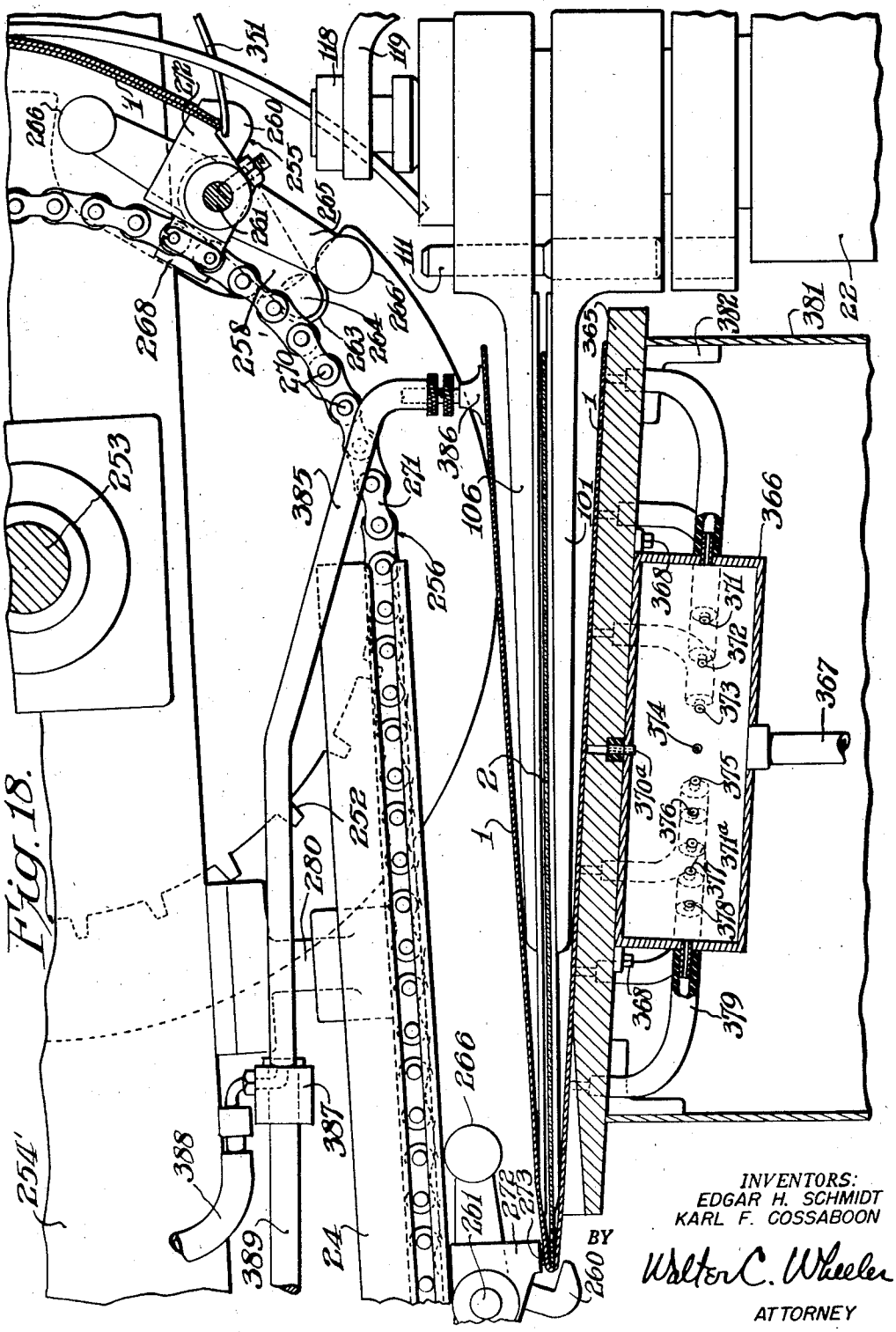


Fig. 18.

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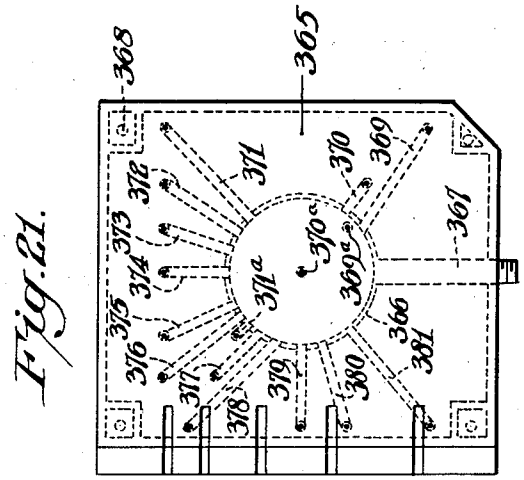


Fig. 21.

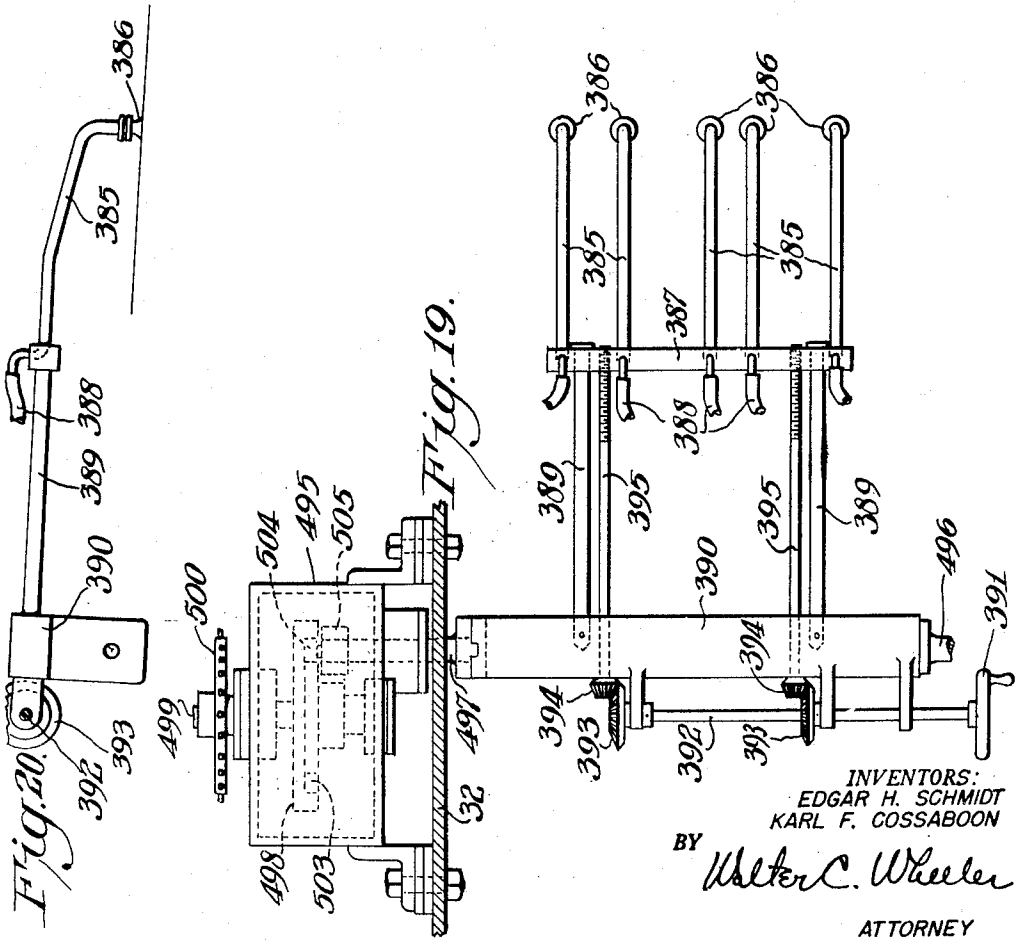


Fig. 20.

Fig. 19.

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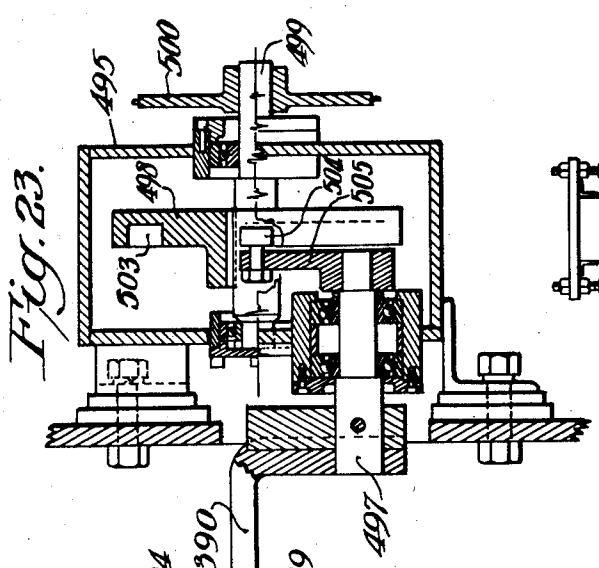


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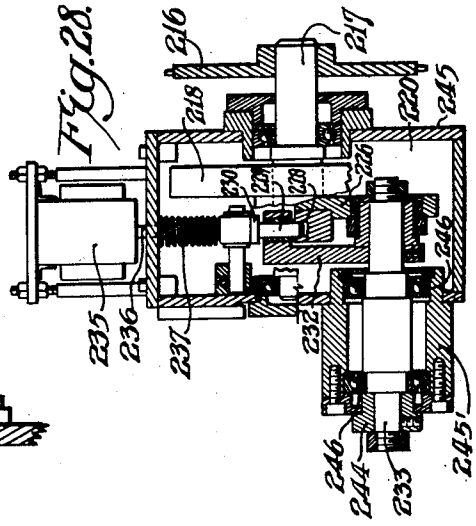


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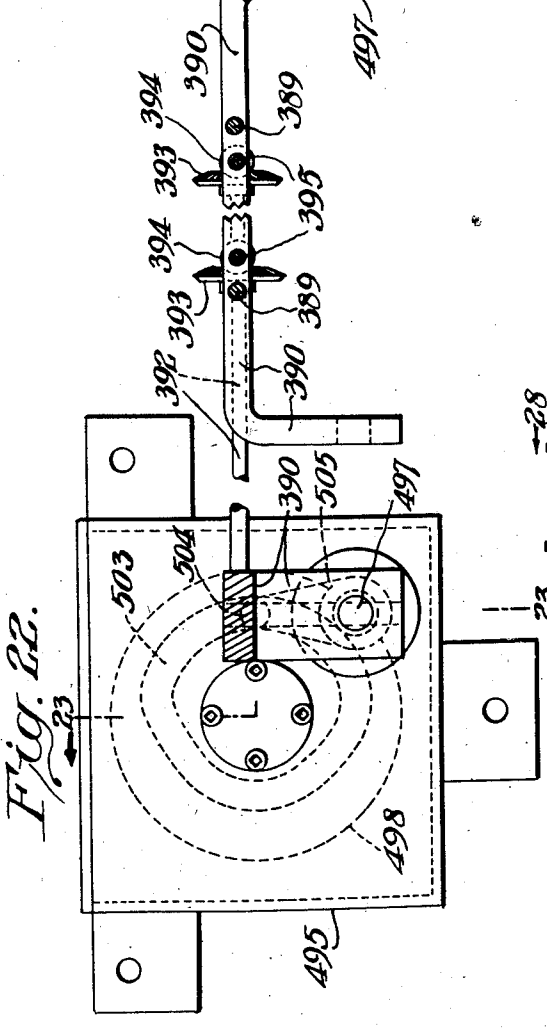


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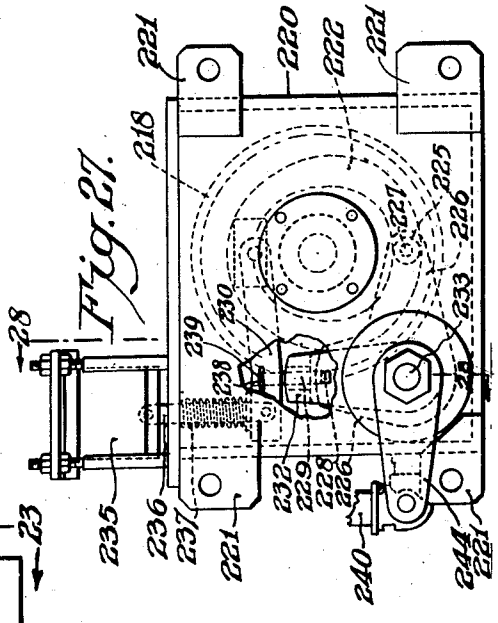


Fig. 27.

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Fig. 25.

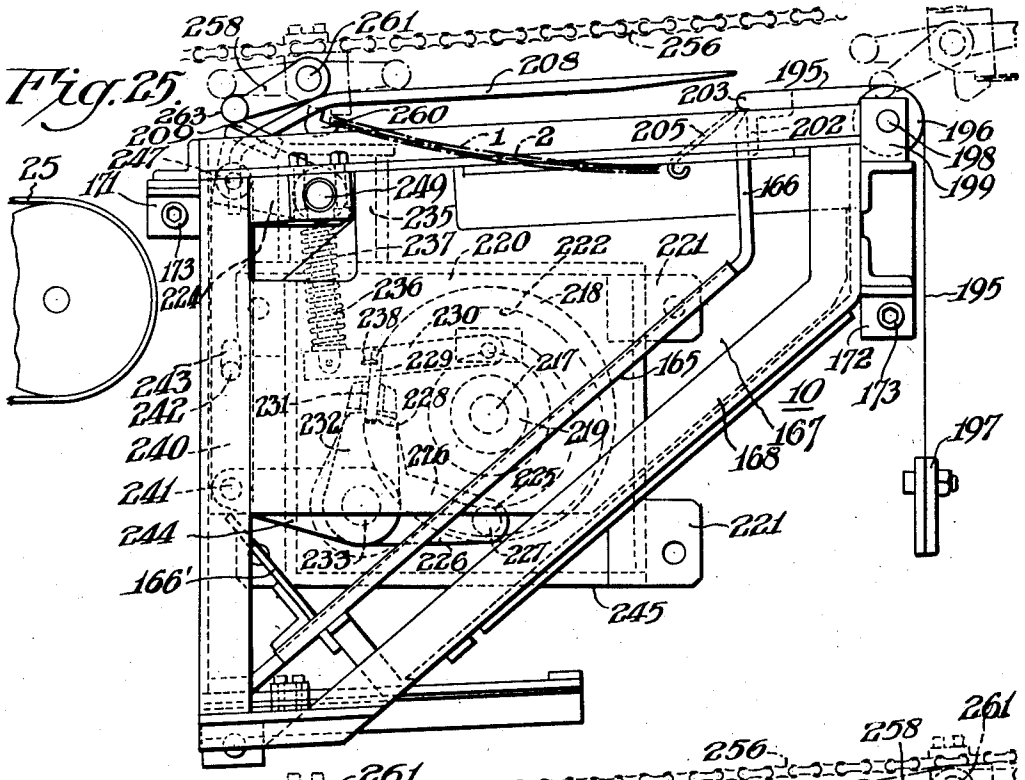
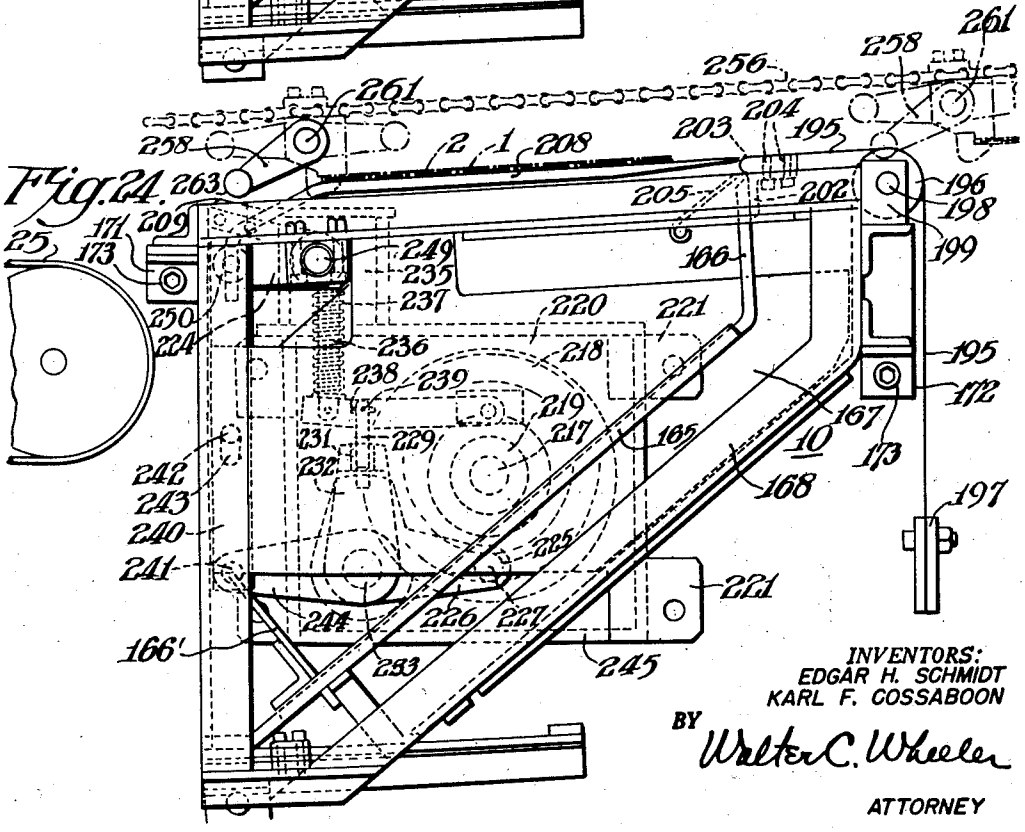


Fig. 24.



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Fig. 26.

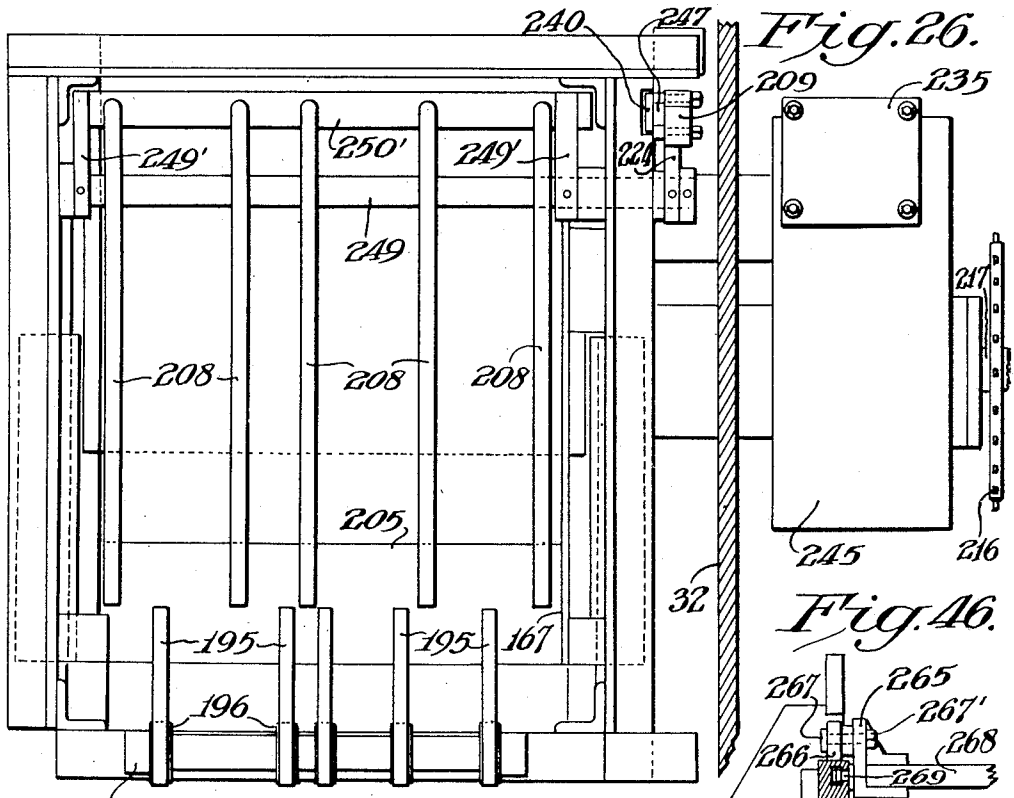


Fig. 47

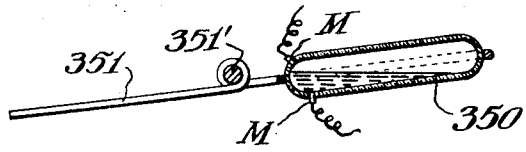


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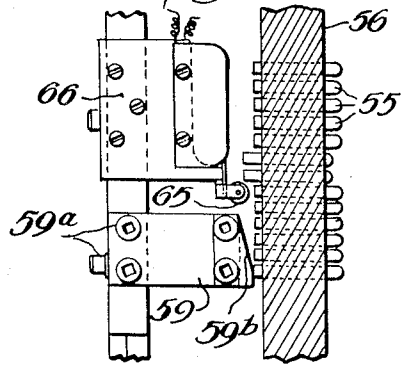
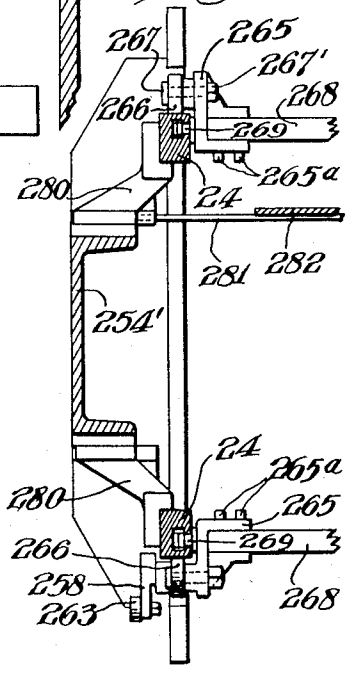


Fig. 46.



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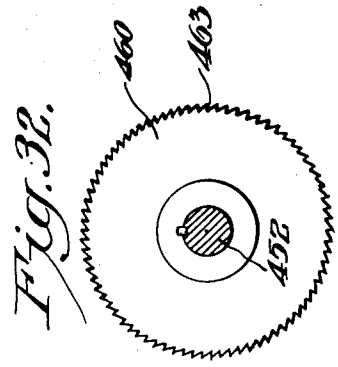


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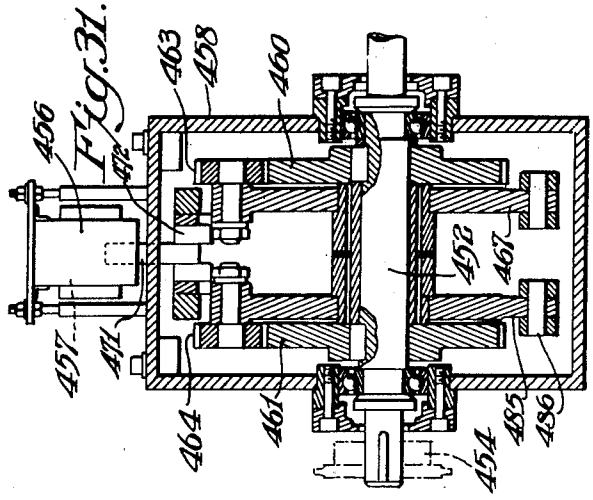


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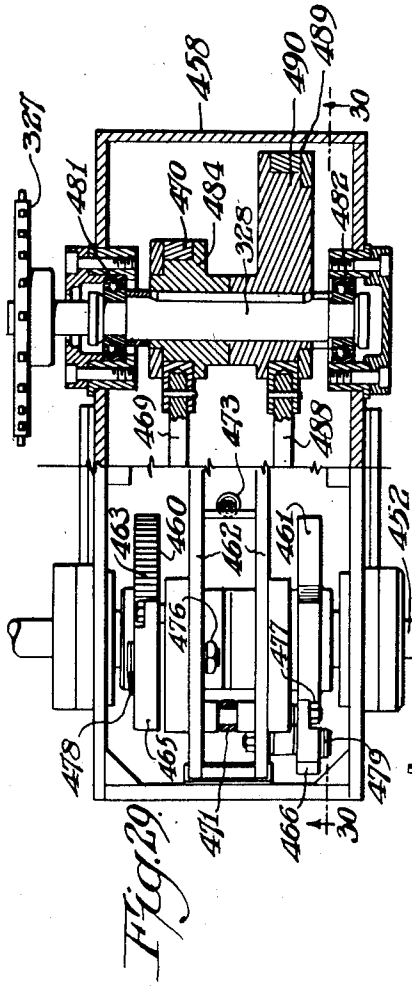


Fig. 29.

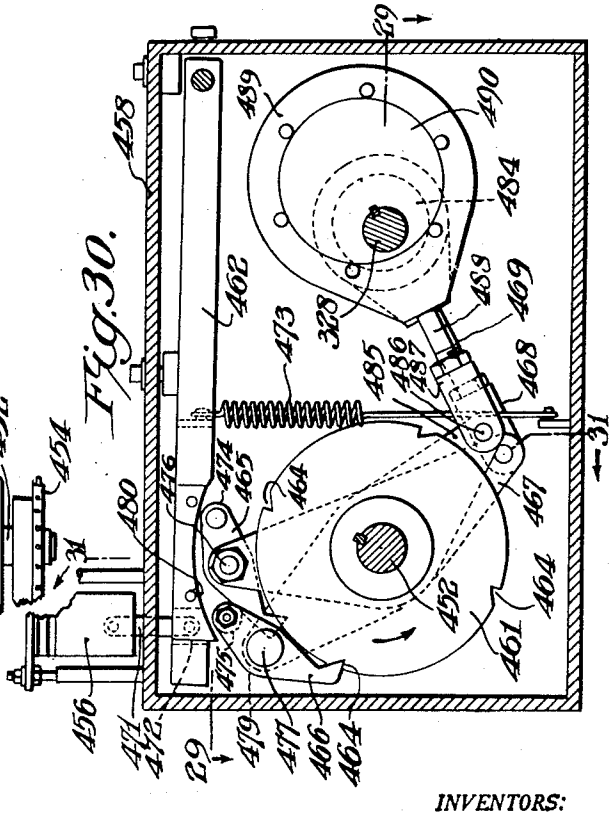


Fig. 30.

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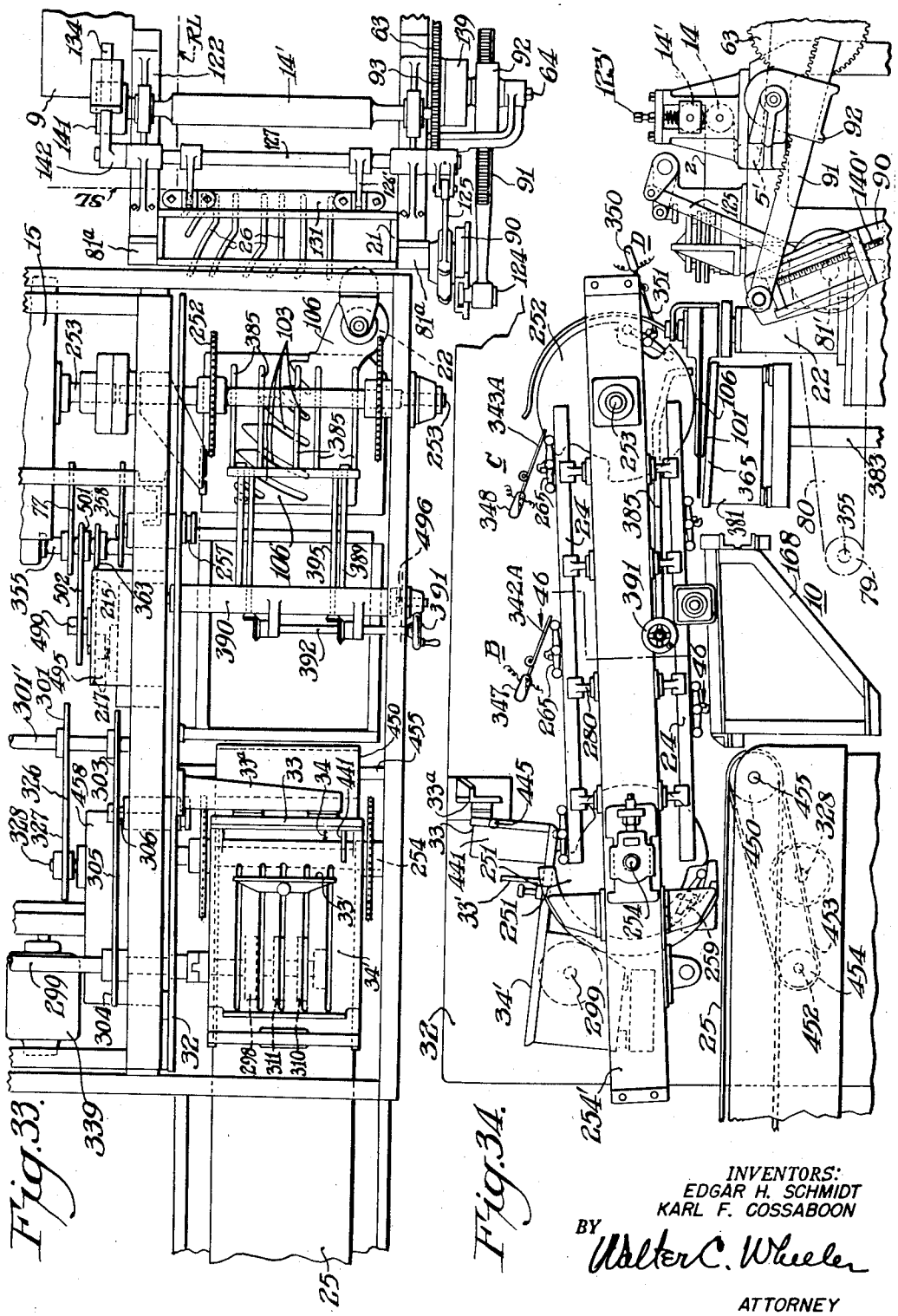


Fig. 33.

Fig. 34.

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Fig. 35.

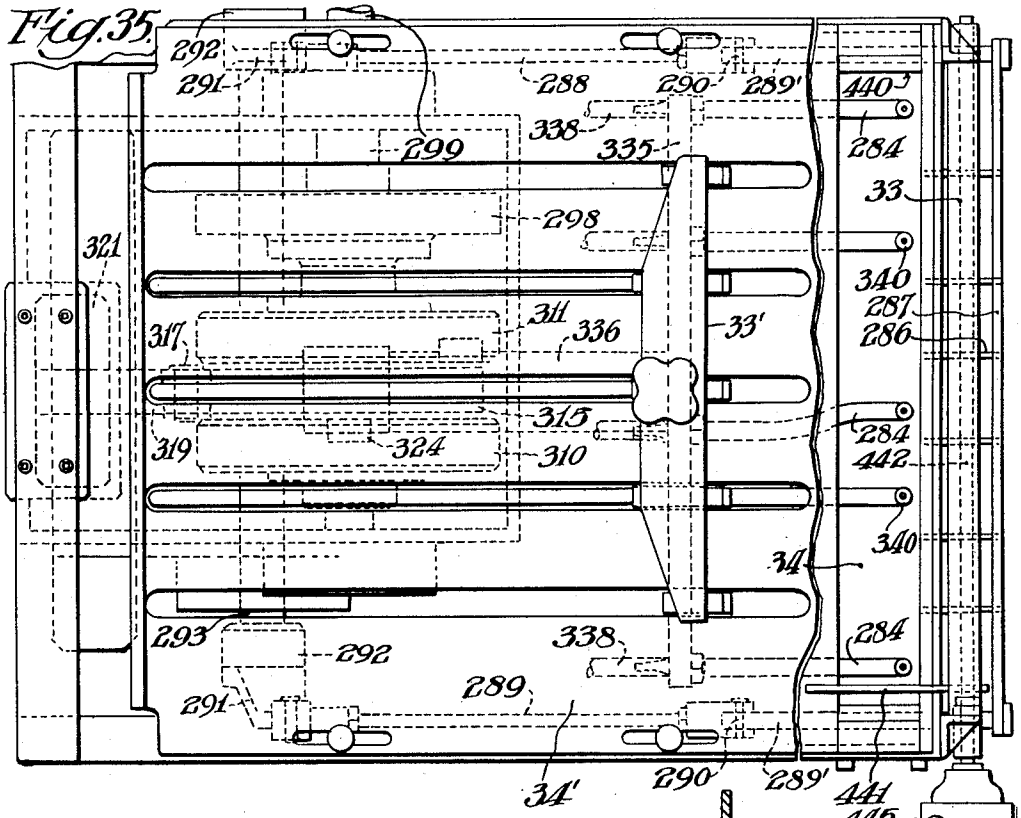
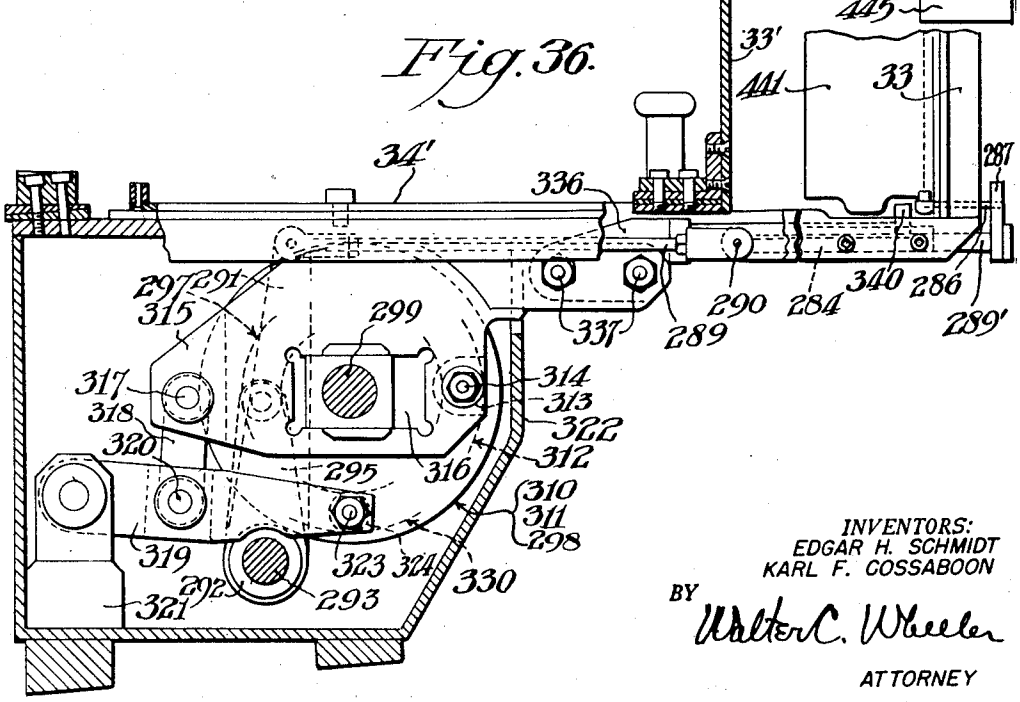


Fig. 36.



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Fig. 37.

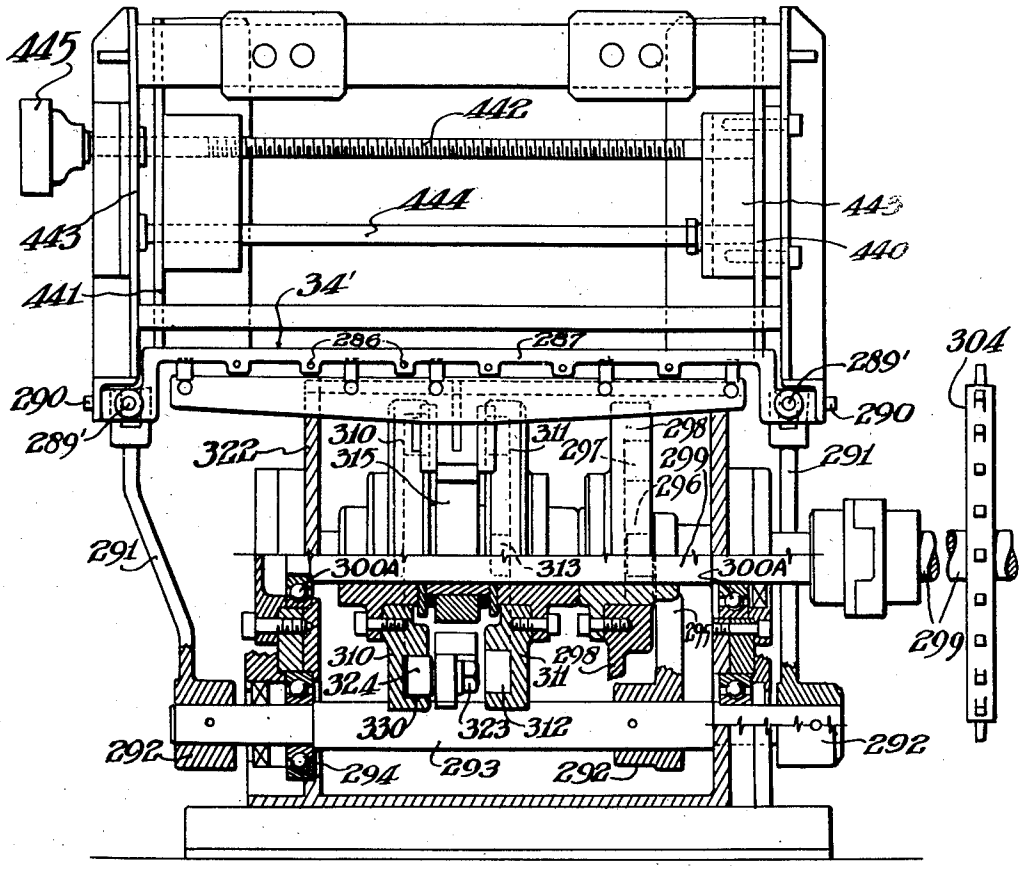
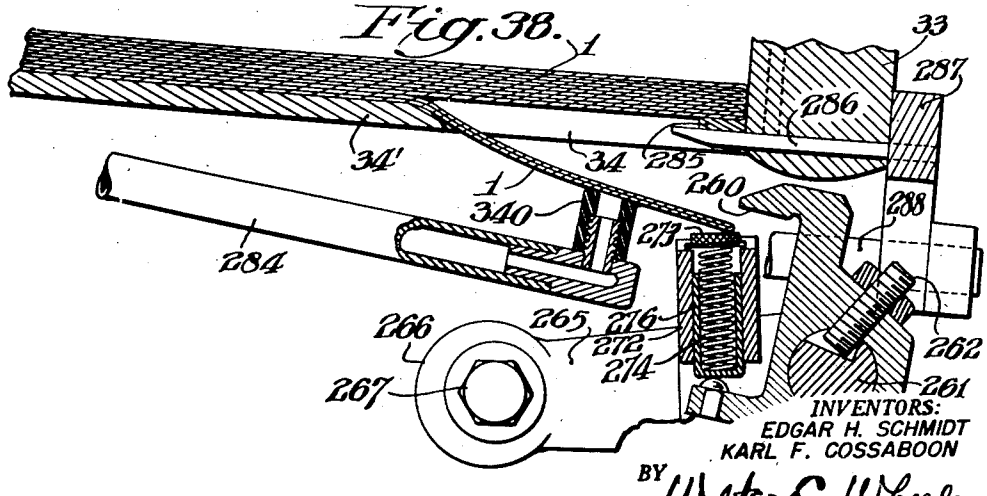


Fig. 38.



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Fig. 39.

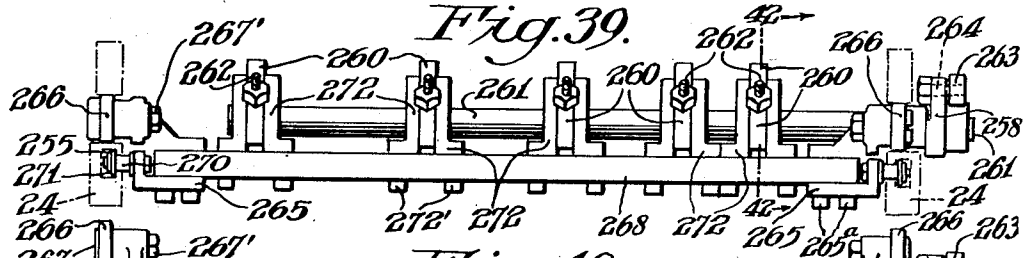


Fig. 40.

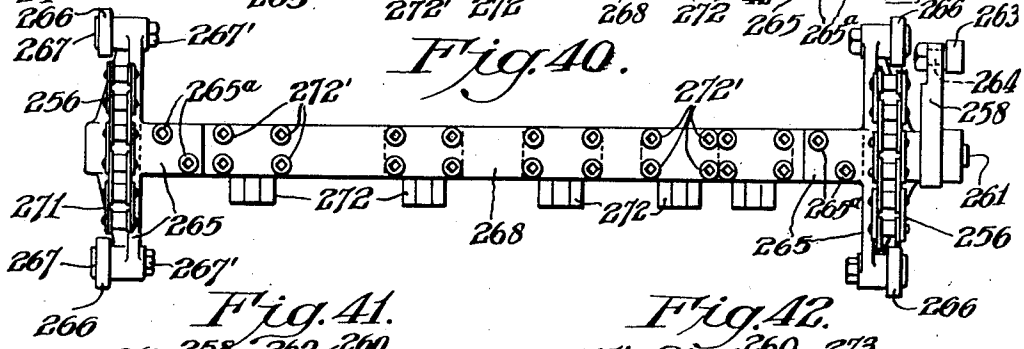


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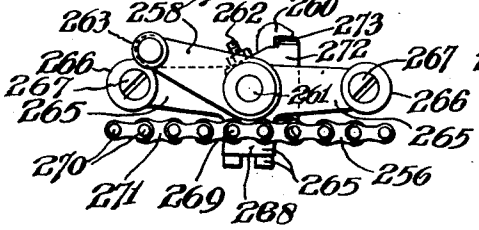


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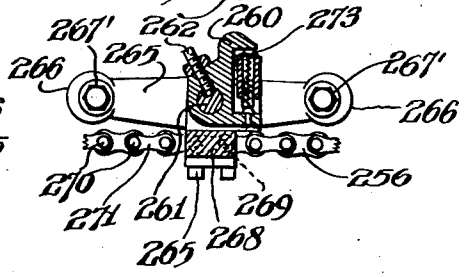


Fig. 43.

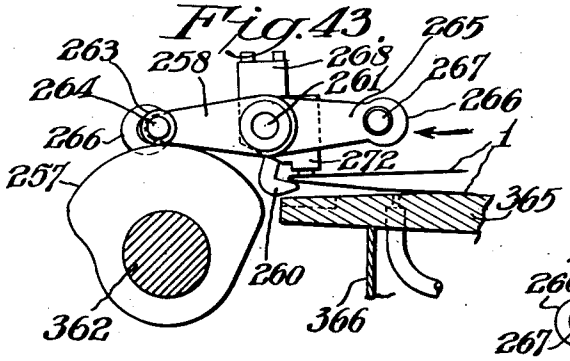


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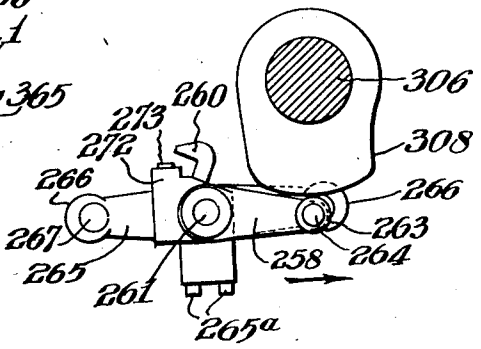
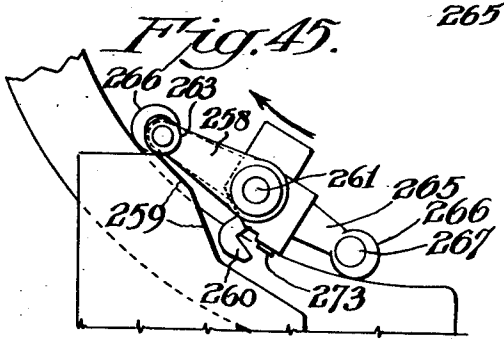


Fig. 45.



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Fig. 48.

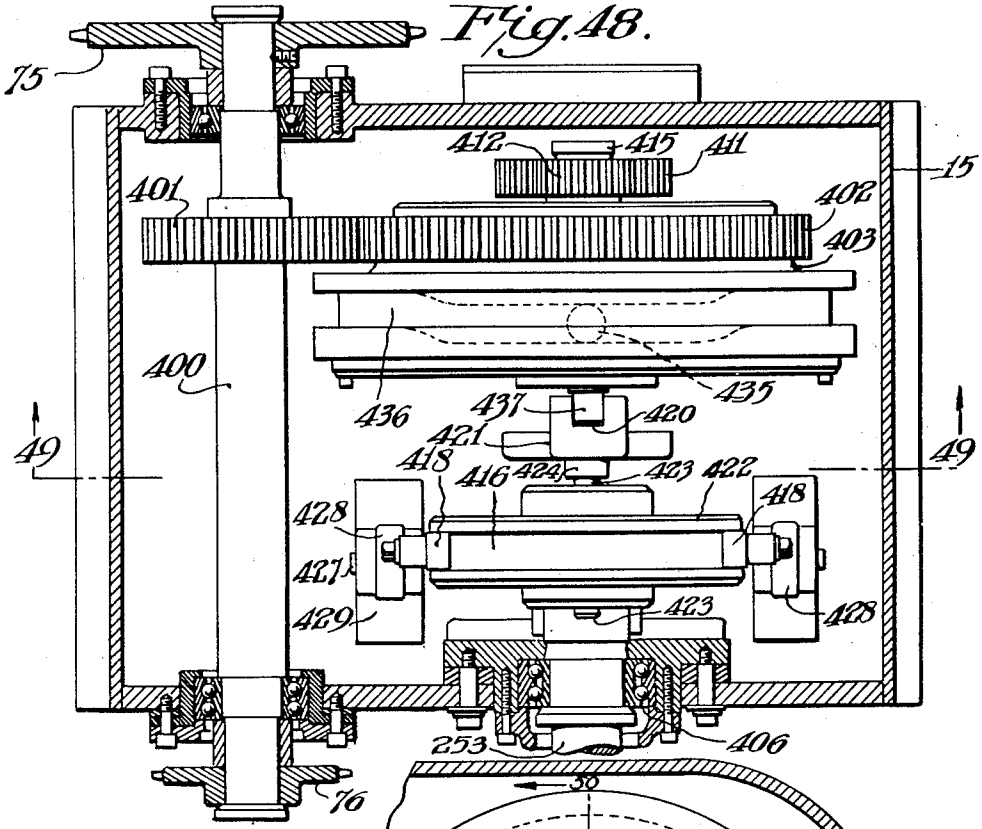
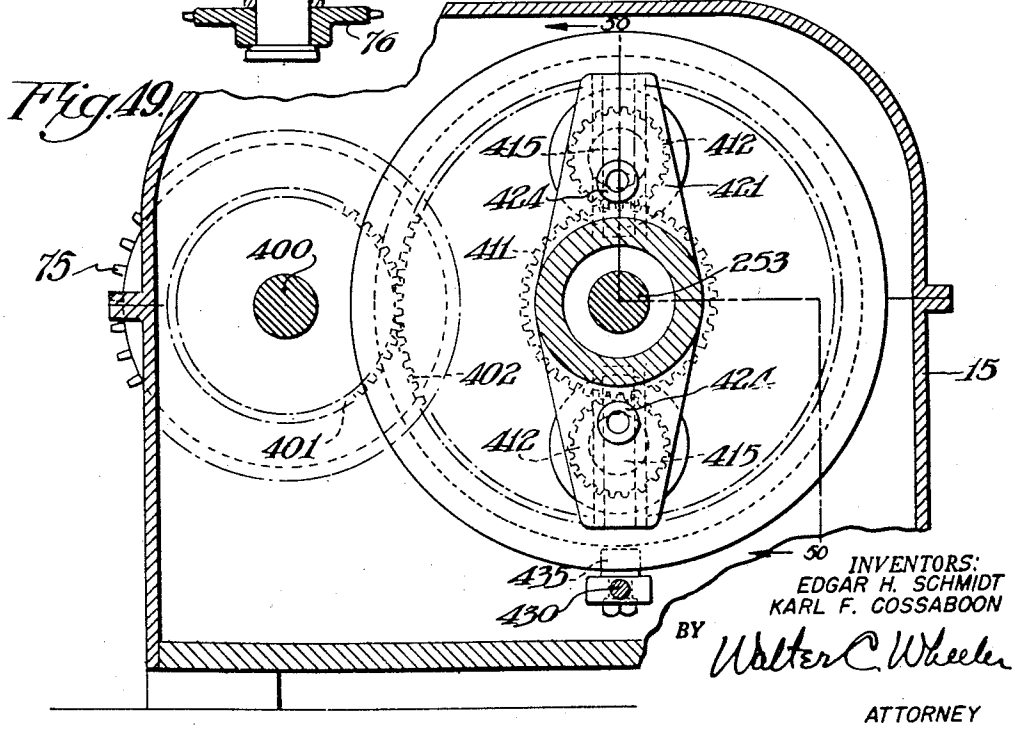


Fig. 49.



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Fig. 51.

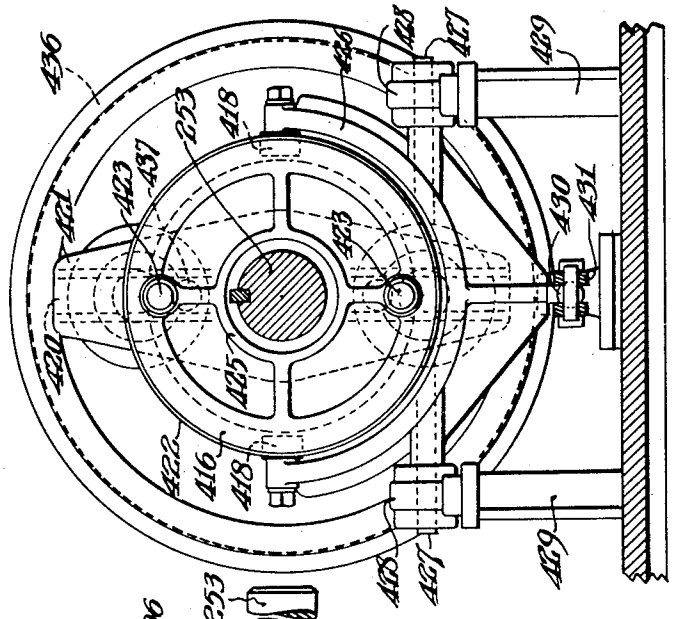
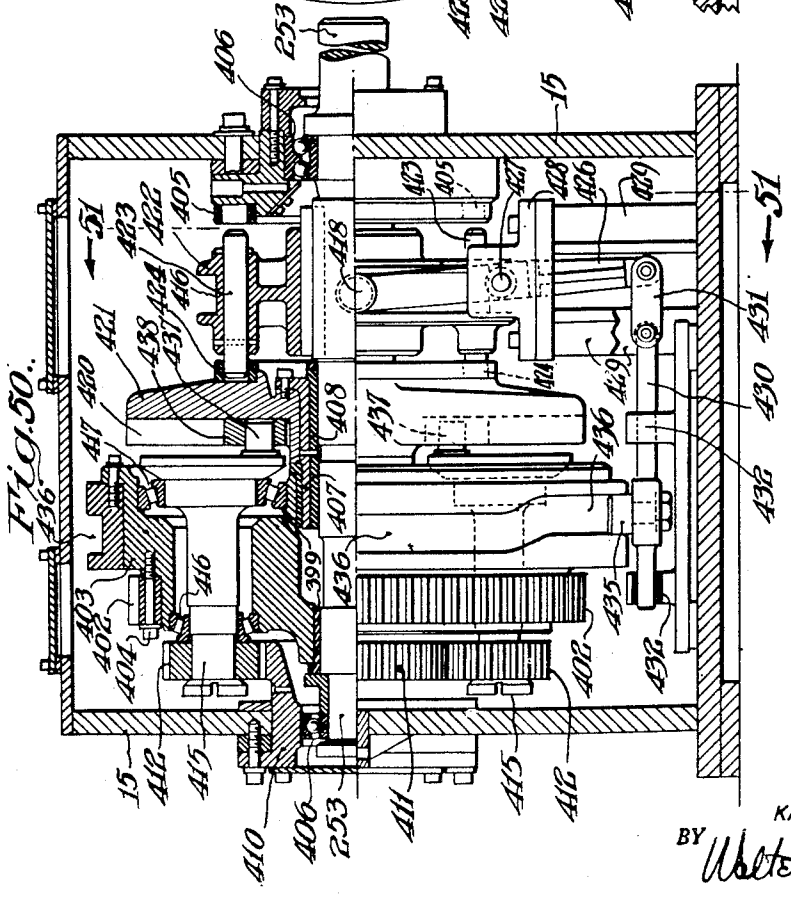


Fig. 50.



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MACHINE FOR ASSEMBLING SHEET FORM MATERIAL

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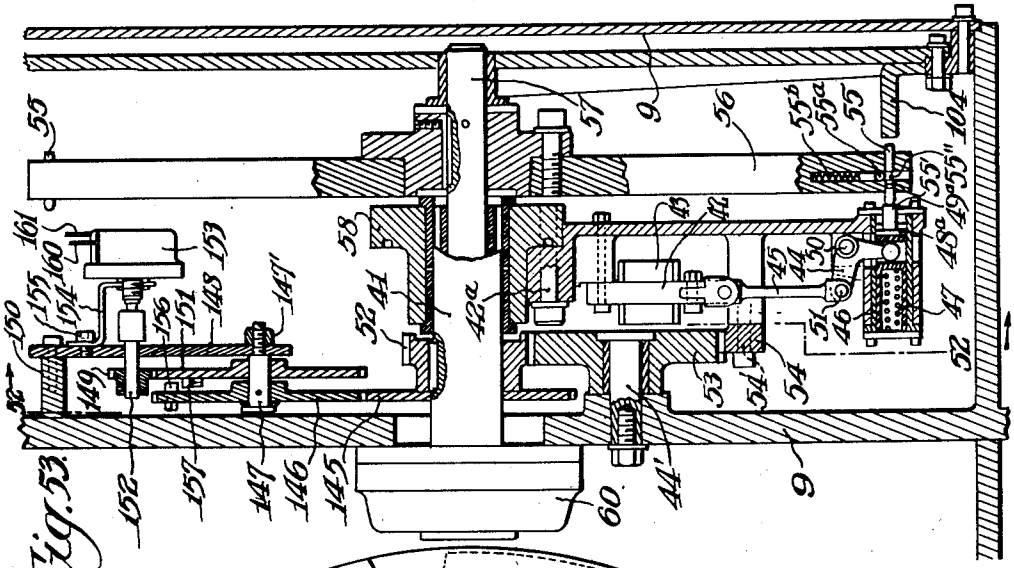


Fig. 53

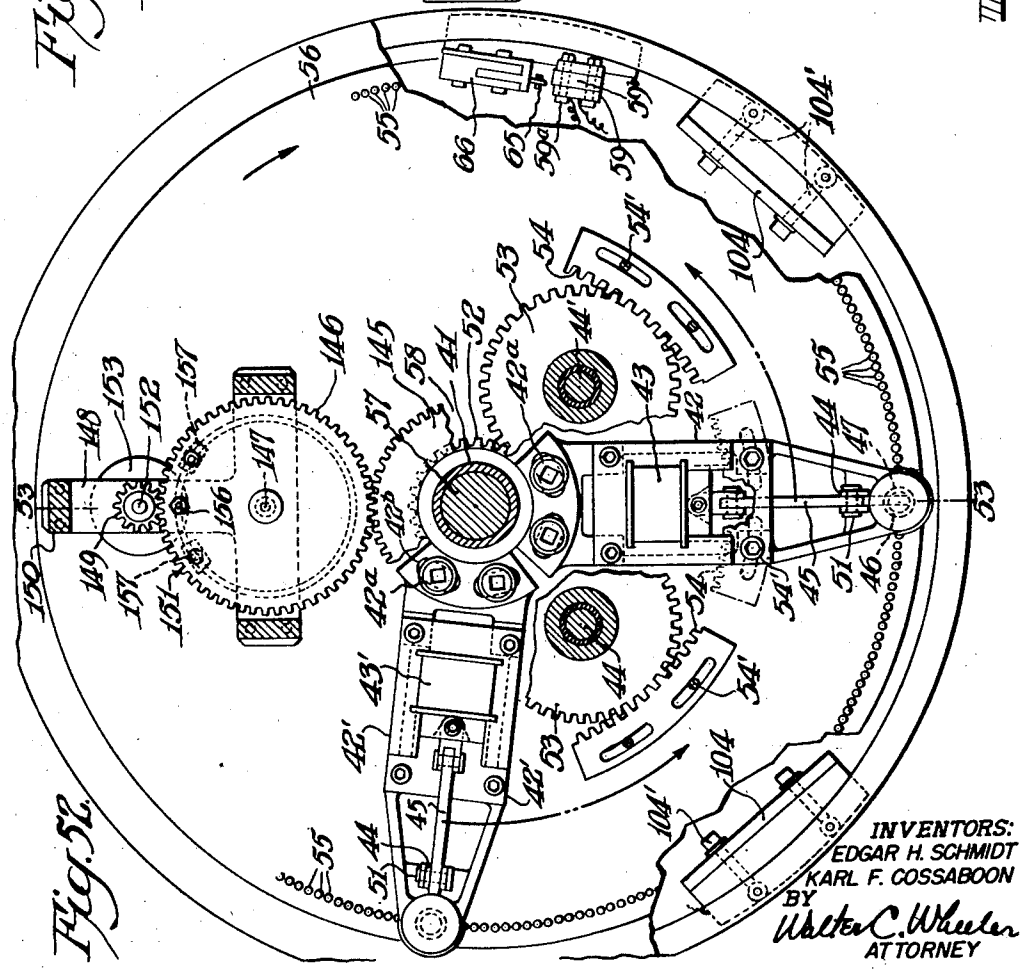


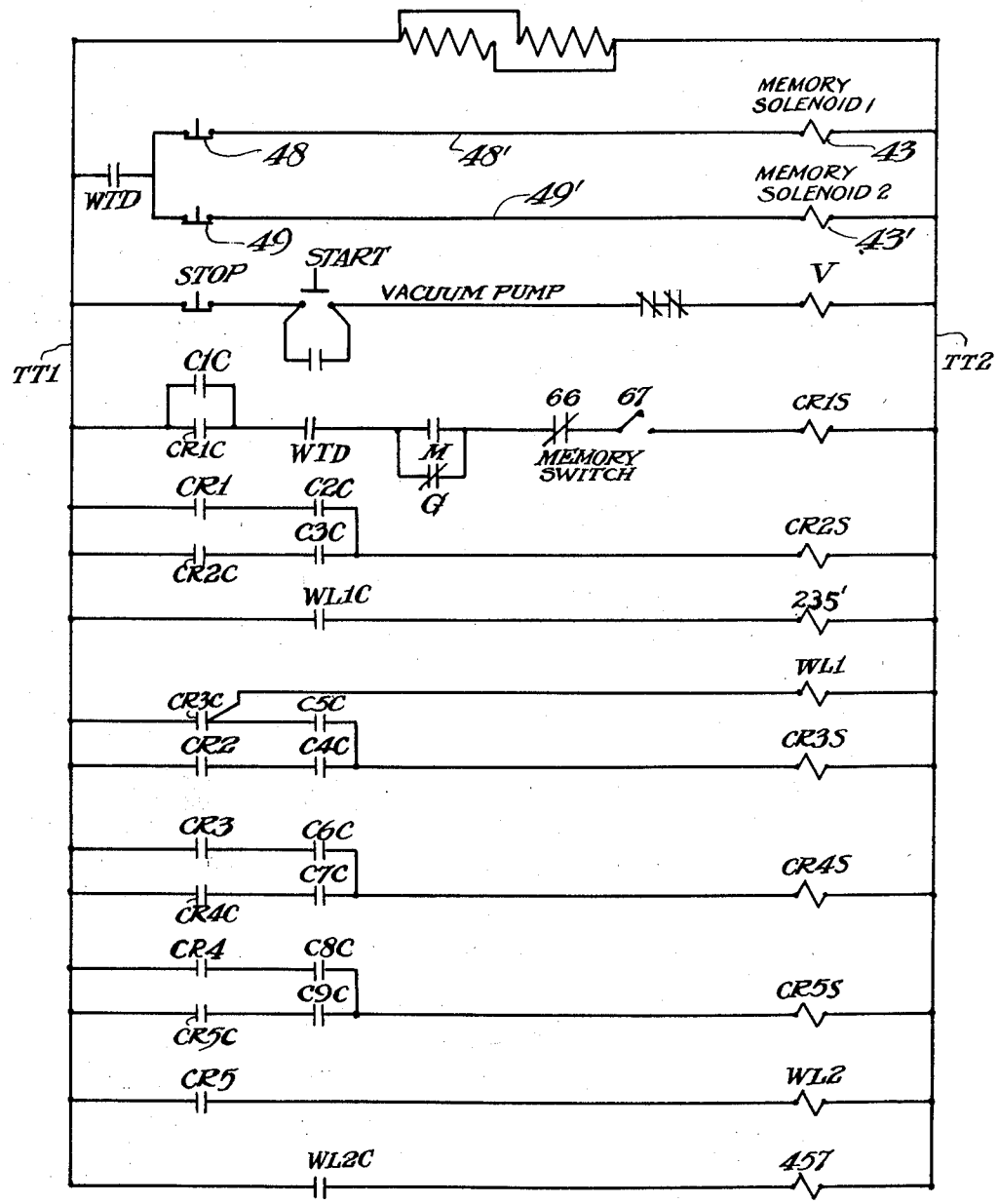
Fig. 52

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MACHINE FOR ASSEMBLING SHEET FORM MATERIAL

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Fig. 56.



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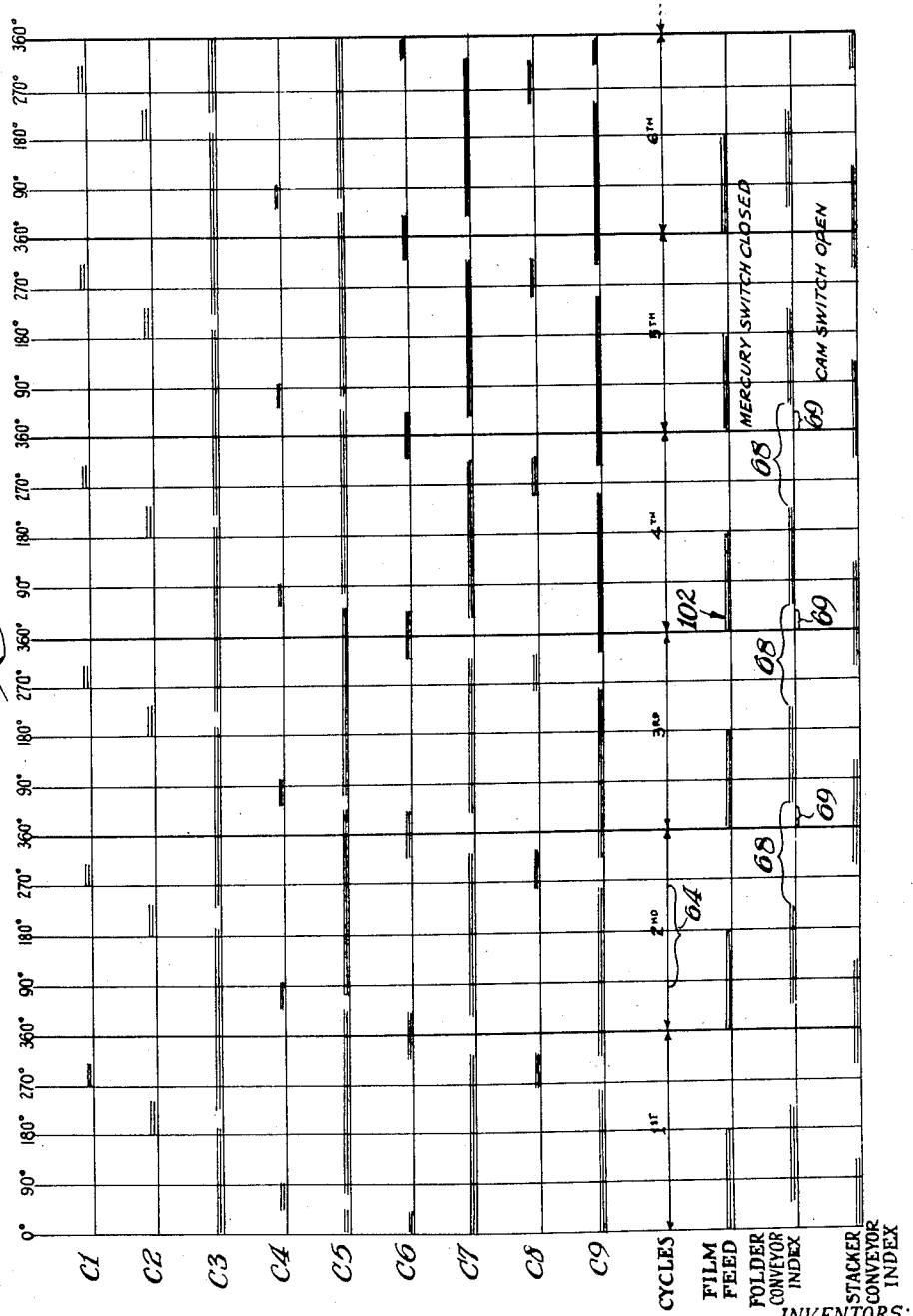


Fig. 57.

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Fig. 59.

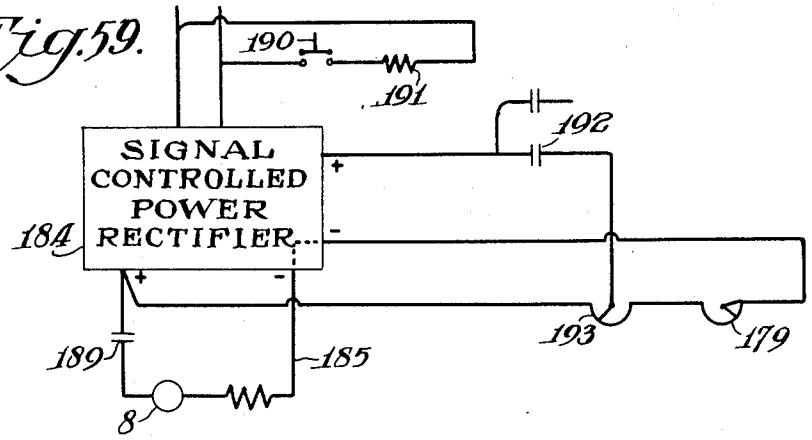


Fig. 58.

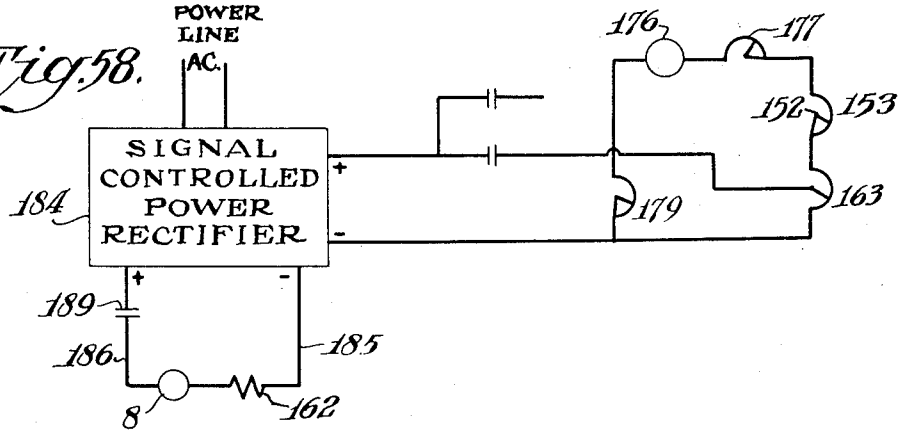


Fig. 60.

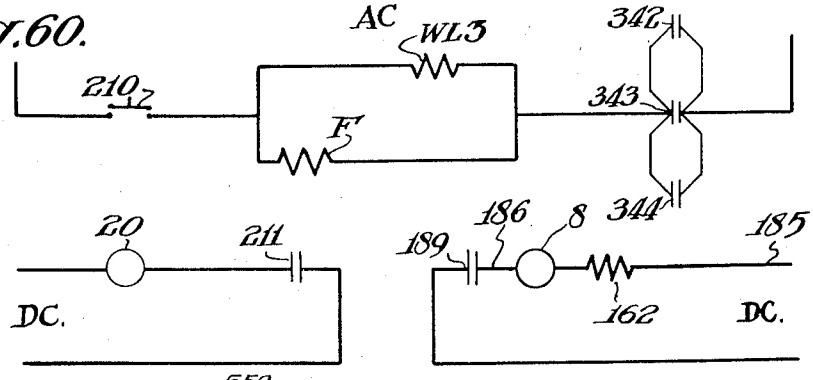
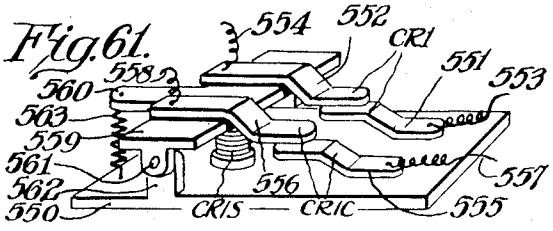


Fig. 61.



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Patented Dec. 12, 1950 2,534,070

UNITED STATES PATENT OFFICE

2,534,070

MACHINE FOR ASSEMBLING SHEET FORM MATERIAL

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Application June 25, 1949, Serial No. 101,382

32 Claims. (Cl. 270—58)

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This invention relates to automatic assembling devices, and especially to devices of the kind which are suitable for subdividing more or less sheet-form material into units and assembling the units with interleaving separators, folders or wrappers, all of which may be done in view of preparing them for packaging or for shipment. Devices embodying the invention are especially useful in preparing photographic film of required quality in given lengths and assembling the cut film with separators or in folders.

In the manufacture of various kinds of sheeted material where the production and preservation of a given surface condition is important, such as the manufacture of photographic film in cut sizes, it is customary to provide assurance of a given quality by inspection of the cut film and to interleave the cut films with protective separators, wrappers or folders, made of suitable material, such as paper. The nature of many such sheeted materials requires inspection in order to exclude from the finally assembled package any manufactured material which is not acceptable for use. The manual assembling and personal inspection for quality of such material heretofore practiced was an arduous routine, and means were desired to accomplish the assembling and/or inspection of such material with a minimum, or without manual or personal attention. In the preparation for packaging of materials, such as photographic film which requires handling mainly or entirely in darkness, the use of automatic packaging machines is particularly desirable.

It is one of the objects of the present invention to provide a device which will interleave inspected cut sheeted material with protective separators or folders. Another object of the invention is to provide a device for stacking the assembled sheets and separators. A further object of the invention is to combine a packaging device of the kind referred to and an inspection device which will reject defective sheets and improperly assembled wrappers and sheets in response to the results of inspection made before the sheets are ready to be stacked or cut into lengths. Another object of the invention is to provide a device of the kind which is capable of operating continuously as both a packaging and an inspection device as long as it is continuously provided with a strip of sheeted material, means to inspect the same and interleaving units. Still further objects of the invention will be discerned from the following description of the invention which will be made

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with reference to an embodiment thereof which is suitable for inspecting photographic film before it is cut, cutting the film into desired lengths, interleaving the film with separators or in folders, rejecting defective units or assemblies and assembling a predetermined number of non-rejected units in groups, all of which are combined into a continuously operated interrelated and automatically controlled system. In the drawings constituting a part hereof in which like numerals refer to like parts,

Fig. 1 is a plan view showing schematically and partially the general arrangement and relationship of certain interrelated parts of the device, a part of the inspection booth where the film enters the same being cut away, and some of the topmost parts of the device being removed,

Fig. 2 is an elevational view showing schematically and partially the general arrangement and relationship of the interrelated parts shown in Fig. 1, together with the separator conveyor which is not shown in Fig. 1,

Fig. 3 is a plan view of the inspection booth and the manner of continuously passing the strip of film therethrough,

Fig. 4 is an elevational view showing the inspection booth, partially cross sectional and partially schematically,

Fig. 5 is a partial schematic representation of the fluid pressure system for controlling the aligning roll,

Fig. 6 is a side elevational view of the aligning roll and its mountings,

Fig. 7 is an end elevational view of the aligning roll and its mountings,

Fig. 8 is an enlarged bottom plan view of the aligning wheel showing some of the fluid pressure conduits,

Fig. 9 is a side elevational view partially in cross section of the aligning wheel mounting and bleeder valves,

Fig. 10 is a side elevational view showing diagrammatically the scheme of mechanical power transmission,

Fig. 11 is a top plan view of the sprocket chain drives and is an elaborated view of the drives shown in Fig. 10,

Fig. 12 is a side elevational view of the drives shown in Fig. 11,

Fig. 13 is a top plan view of the film chopper, including similar views of the dancer arm and memory wheel casing,

Fig. 14 is a side elevational view of the film chopper, dancer arm and memory wheel casing,

Fig. 15 is an enlarged partial side elevational

and partial cross sectional view along the line 15—15 of Fig. 13, of a portion of the guides for the transfer mechanism, the film chopper knives and other details of the film chopper,

Fig. 16 is a side elevational view of the transfer turret, some of the parts mounted in the lower part thereof being indicated in dotted lines,

Fig. 17 is a partial cross sectional view of the transfer turret taken along the line 17—17 of Fig. 16,

Fig. 18 is an enlarged side elevational view of a portion of the folder conveyor, transfer device and interleaving mechanism in which some of the vacuum pipes and a part of the suction header are broken away,

Fig. 19 is a partial top plan view of a portion of the folder conveyor illustrating the arrangement and operation of the suction arms for opening the folders at the interleaving station,

Fig. 20 is a side elevational view of one of the suction arms shown in Fig. 19,

Fig. 21 is a top plan view of the suction header for retaining a separator or folder at the interleaving station,

Fig. 22 is a side elevational view showing the cams for operating the suction arms at the interleaving station,

Fig. 23 is a partial end elevational and partial cross sectional view of the cams for operating the suction arms taken along the line 23—23 of Fig. 22,

Fig. 24 is an enlarged side elevational view of the reject hopper, the solenoid controlled cam mechanism and a clamp on the folder conveyor, all disposed in normal position for passing a folder,

Fig. 25 is a view similar to Fig. 24 but with the parts in position to reject a folder,

Fig. 26 is a top plan view of the reject device and the cam housing therefor,

Fig. 27 on the sheet with Fig. 22 is a side elevational view with a part broken away of the cam arrangement and reject solenoid for operating the reject station,

Fig. 28 is a cross sectional view of the device shown in Fig. 27 taken along the line 28—28 of Fig. 27,

Fig. 29 is a partial top plan and partial cross sectional view along the line 29—29 of Fig. 30 of the cam controlled stacking device and counter,

Fig. 30 is a cross sectional view of the device shown in Fig. 29 taken along the line 30—30 of Fig. 29,

Fig. 31 is a cross sectional view of the device shown in Figs. 29 and 30 taken along the line 31—31 of Fig. 30,

Fig. 32 is a side elevational view of the counter ratchet wheel,

Fig. 33 is an enlarged partial top plan view of the device illustrating the relation of the film chopper to the chopped film transfer device, the interleaving device, the folder conveyor and the manner of driving these parts and the timing mechanisms therefor,

Fig. 34 is a side elevational view of the portion of the device shown in Fig. 33,

Fig. 35 is an enlarged top plan view of the folder hopper,

Fig. 36 is a side elevational view of the folder hopper and the cam controlled device for removing the separators from the folder hopper, parts of which are broken away,

Fig. 37 is an enlarged end elevational view with parts broken away of the folder hopper and the cams for controlling the removal of the separators therefrom,

Fig. 38 is an enlarged side elevational view with parts broken away showing the relationship of the folder hopper, the folder clamps on the folder conveyor and the suction arms for manipulating the edges of the folders and placing them within the bite of the folder grippers,

Fig. 39 is an end elevational view of the mounting and carriage for the folder grippers, showing their relation to the conveyor chain which carries them along the circuit of the folder conveyor and their relation to the guide rail,

Fig. 40 is a bottom plan view of the assembly shown in Fig. 39 showing the relationship on the folder conveyor of the conveyor chain, a set of folder grippers and the operators therefor,

Fig. 41 is an enlarged side elevational view of a folder gripper, the carriage for the grippers and the cam actuated lever for opening the grippers,

Fig. 42 is a partial cross sectional view of a gripper taken along the line 42—42 of Fig. 39 showing in elevation a part of the mounting for the gripper,

Fig. 43 is a side elevational view of an opened folder gripper and the gripper opening cam at the interleaving station in position to receive a cut film, together with a partial cross sectional view of the suction header at the interleaving station which operates to retain a separator or the lower leaf of a folder in fixed position below the level of the film to be interleaved,

Fig. 44 is a side elevational view of a gripper and the gripper opening cam at the folder hopper,

Fig. 45 is an enlarged side elevational view of the gripper opening cam at the interleaving station and a gripper in opened position,

Fig. 46 in the sheet with Fig. 26 is a partial cross sectional view of the folder conveyor taken along the line 46—46 of Fig. 34,

Fig. 47 is a side elevational view with parts broken away of the mercury switch and mounting which are located at the station preceding the interleaving station of the folder conveyor,

Fig. 48 is a top plan view of the cycloidal indexing device with portions of the casing broken away,

Fig. 49 is a partial end elevational and partial cross sectional view of the cycloidal device taken along the line 49—49 of Fig. 48,

Fig. 50 is a partial side elevational and partial cross sectional view of the device shown in Figs. 48 and 49 taken along the line 50—50 of Fig. 49,

Fig. 51 is an end elevational view of the cycloidal device with the casing removed.

Fig. 52 is a partial side elevational view of the memory device and tachometer, showing their relation to the dancer arms, one portion of the memory wheel being broken away to expose the master reject switch, the arms, however, being displaced in a clockwise direction an angle of about 30° for facilitating the description,

Fig. 53 is a partial end elevational and partial cross sectional view of the device shown in Fig. 52 taken along the line 53—53 of Fig. 52,

Fig. 54 on the sheet with Fig. 26 is an enlarged partial elevational and partial cross sectional view of a portion of the memory wheel showing the relationship of the pins on the memory wheel to the monitor switch of the pilot control relay circuit and the pin re-set cam,

Fig. 55 on the sheet with Fig. 1 is a perspective view of a gang of rotatable cams for opening and closing switch contacts in the sequence control relay circuits,

Fig. 56 is a schematic representation of the sequence relay connections, illustrating the manner of interconnecting and operating the various sequence control relays which are energized through switch contacts controlled by the series of mechanically actuated cams illustrated in Fig. 55,

Fig. 57 is a schematic representation illustrating the sequence and duration of the switches as they are related to the operation of the film chopper, the indexing of the folder conveyor, the operation of the stacker conveyor and other interrelated operations, the solid lines therein representing the duration that the switches are closed,

Fig. 58 is a schematic representation of a circuit illustrating the manner of connecting tachometer and a potentiometer which are operated in connection with the dancer arms of the memory wheel for maintaining a constant relationship between the speed of the motor for continuously feeding the film to the dancer arm film loop and the motor for intermittently telling out the film from the loop to the film chopper,

Fig. 59 is a schematic representation of a circuit for actuating the inspection booth motor independently of the motor which drives the folder conveyor and chopper, for threading the continuous length of film through the inspection device,

Fig. 60 is a schematic representation of a starter relay circuit for simultaneously closing direct current power lines for starting the motors which drive the several parts of the machine, showing a scheme of parallel contacts in the relay circuit which are operated by control switches, and

Fig. 61 is a perspective view of a normally open double contact relay.

In general the device shown in the drawings comprises automatic means for suitably extracting separators or interleaving units, such as sheets of paper or paper folders 1 (Figs. 1 and 2) from the bottom of a supply or pile of such units, and conveying the separators singly and consecutively into position for interleaving with lengths of sheeted material. The lengths of sheeted material, such as photographic cut film lengths 2, are prepared as by cutting them from the end of a longer strip of film. The lengths are delivered to the assembly station in a predetermined position and in timed relation to the delivery thereto of the interleaving units or separators. The film may originate in roll form, such as the roll 3 (Figs. 3 and 4). The strip of film may be passed through an inspection station or cabinet 4. At the inspection station defects in the film are detected by inspection, and detection of a defect is transmitted by signal to and recorded on a device comprising means designated herein in general as a memory device or memory wheel. Means for rejecting the cut lengths of film containing the defects detected in the strip of film is provided at a predetermined point in the progress of the film after the units 2' of sheeted material have been interleaved with separators but before the cut units are delivered to their ultimate destination or stacked. The operation of the rejecting device is initiated by a displaced element on the memory device. The relative position of this displaced element on the memory device is fixed by recording thereon a transmissible signal which is given when the defect in the strip of film appears at a predetermined point. Thus, the relative position of the displaced element on the memory device corresponds to the relative position of the defect on the advancing strip of film. Included also is means for rejecting lengths of material which are not accompanied by interleavers or folders. Included finally is means for combining into bundles or stacks a predetermined number of inspected acceptable sheeted interleaved units, and means for correlating the operation of the inspection and rejecting devices, and the operation of the rejecting and stacking devices.

Referring to Figs. 1 to 4, a strip of photographic film 2 is taken from a mill roll 3 or other suitable supply of the same and advanced over suitable guide rolls 6, an aligning device comprising roll 511 and driving or pinch rolls 7 and 7'. The latter advances the film toward a cutting station. The advancing of the film from the mill roll and toward the cutting station is a continuous feed, the speed being controlled by the driving rolls 7, one of which is driven continuously at a desired predetermined speed by a suitable motor 8 through the speed reducing gear 8' and chain 9'. The pinch rolls 7 propel the strip into the inspection station or booth 4 where means are located for scanning the film and identifying faults or defects. When faults are recognized as they pass a predetermined transverse line, a signal is given which is recorded on the memory wheel. Also means including roll 511 associated with the guide rolls 6 are arranged for advancing one edge of the film along a predetermined reference line (Fig. 1) which is designated herein as the line RL. The edge of the film is carried along this line until the sections of cut film are severed from the leading end of the strip. The identification and determination of the location of imperfections or faults in the strip of material passing through the inspection booths may be performed visually by attendants, indicated by the eyes 6a in conjunction with manual means for signaling knowledge of the identified defect, or it may be done by properly constituted physical devices, such as a suitably arranged combination comprising photo-electric cells which are arranged to actuate the signal.

By whatever means the defects are identified, the signaling means transmits knowledge of a defect at the moment of identification to a memory device comprising the rotatable memory wheel 56 (Fig. 52) upon which the signal is recorded by means responsive to the signal whereby pins are displaced on the wheel. Each time a length of film is indexed into chopping position, the memory wheel is arranged to be turned in one direction through an angle which is proportional to a length of film. A fixed pilot relay switch 65 operable by the displaced pins is located at a point such that the distance from where the pins are displaced to the switch bears the same relation to the distance from the inspection point to the chopper that the indexing of the memory wheel bears to the length of film to be cut off. Thus when a length of film to be cut off is indexed between the chopper knives all of the pins recording the defects in that length of film operate the fixed pilot relay switch as one pin would operate it. In consequence thereof one or all defects in that length of film pass along a single impulse or reject signal to the pilot relay circuit when the length of film is indexed into chopping position.

Between the chopper and the continuous feeding means a loop of film is maintained to which the inspected film is continuously fed from the inspection booth and from which the film is intermittently indexed to the chopper at an average rate equal to the continuous feed. In order

to compensate on the memory wheel for the regular changes in the length of film between the chopper and the inspection point caused by the intermittent feeding from the loop to the chopper, a pair of arms in the memory device which carry means for displacing the pins are operatively connected to a dancer roll which responds to the changes in the size of the loop and causes the arms to rove back and forth in front of the memory wheel distances which are in the same proportion to the changes in the distance from the point of inspection to the chopper that the indexing of the memory wheel bears to a length of film to be chopped off. Where two inspection stations are provided, two roving arms of the memory wheel are provided to receive the signals from the two stations, and these arms are separated from each other a distance which is in the same proportion to the film length between the inspection stations as the indexing of the memory wheel bears to the indexing of the film. With the latter arrangement a section of the memory wheel over which one arm roves during the inspection of a given length of film will be under the influence of the other arm when the same length of film reaches the second inspection station and the pins representing that length of film will be in position to be indexed past the pilot relay switch when the same length of film is in readiness to be indexed between the chopper knives and severed from the end of the strip. The pilot relay switch sets in motion means (hereinbelow to be described) for rejecting the defective unit or length of film at a suitably situated reject station which succeeds a station where the severed length of film is interleaved with a separator.

The cutter or chopper feed rolls **14** and **14'** are driven intermittently by a suitably controlled intermittent driving device, such as a crank which is driven by a suitably timed train from the main motor **20**. Any suitably controlled intermittent driving device may be used to drive the cutter feed rolls **14** which will give the desired intermittent output which is timed so that the average of the dwells and driving speed of the film told out from the loop will be the same as the speed of the ribbon of film **2** continuously fed to the loop by the driven supply rolls **7**. Thus the film is advanced intermittently underneath the chopper knife **11** by a suitable drive connected to the main drive motor **20** and the film is severed into desired lengths during a dwell of the film, after the predetermined desired length thereof has been advanced between the opened knives of the chopper by the intermittently driven rolls **14**. By this operation the end of the film is advanced upon a horizontally oscillatable transfer or assembly pallet **101** (Figs. 16, 17 and 34).

The assembly or transfer pallet is mounted on a turret **22**. The edge of the film is desirably advanced through the cutter along the reference line RL until the lengths are cut. The cut lengths are then transferred by the transfer pallet for interleaving with separators or folders. The transfer pallet is driven from and is caused to swing or be displaced from its receiving position into interleaving position through an angle of 90 degrees regularly after a length of the film **2** has been disposed for cutting and clamped upon the pallet **101**. At the interleaving position or position where a cut film **2** and a folder **1** are assembled, suitably prepared separators or folders **1** are brought regularly into interleaving position at the assembly station by the separator or folder conveyor (Figs. 1, 2 and 16 to 23). This conveyor carries grippers in which the edges of the separators or folders are clamped. The conveyor is desirably assembled on one side of the upright support frame or partition **32** upon the opposite side of which various of the control devices therefor are mounted. The folders **1** are brought into position for assembling in time to receive each cut portion of film **2** as the arm or table **101** carrying the film has completed its rotation of 90 degrees into assembling position. The intermittent advances of the folder conveyor and grippers are actuated in properly timed sequence from the output of a cycloidal device assembled in casing **15** (Fig. 1) which is driven from the main motor **20**.

By prearrangement when the section of cut film is swung into place and assembled with the separator, the gripper which held the separator at the edge is open and the separator is held in place by pneumatic means. Then when the film and separator or folder are assembled, the edge of the assembly is again clamped by the same gripper on the folder conveyor which formerly gripped the separator and brought it into assembling position. The assembled film and separator are then carried forward toward the reject station comprising the hopper **10** and the transfer pallet **101** is again swung into position to receive another section of film to be cut.

The assembled film and folder or separator are advanced by the folder conveyor over the reject station, where means are set in motion by a delayed signal sent out by the inspector at the inspection station **4**. The signal sent out by the inspector is first recorded and delayed by the memory device which is housed in casing **9**. The indexing of the memory wheel and consequent operation of the pilot relay switch transfers the signal to the cam controlled relay contacts housed in casing **234** which finally control and cause the film assemblies containing rejectable film to be diverted to the reject hopper **10**. At the reject station the film which is not enclosed in folders is also caused to be rejected by means later to be described. Acceptable film lengths properly assembled with separators or in folders are not released, rejected or diverted from the conveyor until after such assemblies have passed to the stacking station.

Unrejected assemblies continue to be clamped by the grippers on the conveyor after having been clamped together at the assembly station and they continue to advance toward the counting and stacking conveyor **25** which is suitably indexed for stacking the assemblies in bundles of a desired number of units. Upon reaching the predetermined discharge or stacking station, the clamps on the folder conveyor are caused to release the assembly of film and folder to the counter and stacking conveyor **25**.

The separators or folders with which the cut sections of film are interleaved may desirably be folders having a folded section or edge but plain sheets of paper or other material can be used. The separators are stacked one above the other in the separator hopper **33**, and folders are stacked with folded edges leading. The hopper **33** has a slit **34** across its bottom along its leading edge so that the leading edge of the lowermost paper folder or separator extends over the slit. The leading or folded edges of the folders or separators are removed one at a time from

the bottom of the stack through the slit by a manipulated suction arm. When the suction arm engages the separator through the slit, the edge thereof is caused to be drawn through the slit and located in the open jaws of the clamps which are located at the loading station and carried by the folder conveyor. When the folder conveyor is indexed, the removal of the folder from the hopper is completed by drawing out the rest of the folder.

The folder conveyor, the counter, the stacking conveyor, the cycloidal device 15, the transfer device and the chopper are driven preferably from the same source of power such as the main drive motor 20, so that any slight variation in the speed of this motor will not upset the originally established correlation of these units. The continuously driven rolls 7 which propel the strip of film past the inspection points in station 4 are driven from a separate motor 8 which is connected to the driven rolls 7 by a suitable sprocket wheel and chain drive. This permits independent adjustment of the continuous feed and provides means for correlating the speeds of the motors 8 and 20 so that the film will be supplied to the cutters at a rate which is equal to the average rate that the film is indexed past the chopper knife 11.

The inspection device

The inspection station for the photographic film (Figs. 3 to 9 and 52 to 55) in general comprises a series of guide rolls 6 and an aligning device which routes the continuous strip of film 2 in the direction indicated by the arrows in Fig. 4 with the upper or far edge of the film shown in Fig. 3 along a fixed or reference line RL. The strip of film is preferably routed over the rolls 31 into positions which are convenient for the inspection of both sides of the film since the detection of photographic imperfections from both sides of the film is desirable. Inspection may be attained visually or by means of suitable instruments. Such instruments may be arranged to actuate devices for reporting the defects to the memory wheel or other recording device. The reporting devices may be operated manually when the inspection is made by visual means.

For visual inspection the strip of film 2 may desirably be passed from the mill roll 3 over guide rolls 6 and 31 which are located in the closed booth 4, the roof 4' of which is coextensive with the roof of the booths 37 and 37'. The inspector's booths 37 and 37' are on either side of booth 4. The rolls 6 and 31 are arranged so that the inspection areas between the guide rolls 31 will be inclined to the horizontal and so that inspection may be carried on by the aid of reflected light of suitable quality, as indicated by the light beams L which are derived from suitable light sources 35 and are reflected from the reflectors 36 onto inclined areas to be inspected. An inspection reference line is located transversely across the inspection area, as for example along a transverse line indicated by the line of incidence of the light beam L, and signals of observed defects are sent out when defects pass this line. However, any convenient disposition of the film may be provided which is adapted to the method of inspection, whether the inspection is performed visually or by physical devices. For visual inspection, the booths 37 and 37' suitable for housing the inspectors, have openings facing the inspection areas, located on opposite sides of the inspection enclosure 4. When an inspector discerns a rejectable defect in the film through the slot 28, he gives a signal as by opening a switch 48 or 49 at the time the defect passes the fixed reference line. This switch opens a normally closed solenoid circuit and deenergizes one of two normally energized solenoids in the memory device which corresponds to the inspection station involved, and the solenoid releases a spring loaded shoe which displaces pins on the memory wheel for making a record of the signal.

An aligning device is provided for maintaining one edge of the strip along a fixed line RL in order to assure perfect operation of the interleaving operation at the interleaving station which succeeds the chopping station. For this purpose an aligning device may desirably be mounted on the frame underneath the inspection booth 4. The strip of film is passed from one of the rolls 6 around the aligning roll 511 which is located to form the film in a loop. This roll (Figs. 5 to 9) is journaled on the shaft 512 which is carried by the swivel frame 513, and the swivel frame 513 is pivotally mounted in turn on the fixed frame 514. The swivel frame is arranged to be tilted so that the axis of the roll 511 may be turned out of parallelism with the axes of rolls 6 at either side of the aligning roll so that the path of one edge of the strip may be corrected when it strays from the fixed reference line RL.

The swivel frame 513 is pivotally mounted on the fixed frame 514 by means of the pivot bolt 515. The tilting of the roll 511 on the pivot bolt 515 is controlled by the device illustrated in Figs. 5 to 9 which comprises a piston rod 516 which carries a pivotal connector 517 at its end. The connector 517 is pinned to the eye 518 at the end of shaft 512 by the pin 519. The piston rod may suitably be moved back and forth by fluid actuated means. For this purpose the piston rod 516 is connected to the piston 520 in the cylinder 521. Fluid pressure pipes, such as air pipes 522 and 523, communicate with the cylinder space at opposite sides of the piston 520. Branch pipes 524 and 525 are directed toward each other and pressure relief ball valves comprising the balls 526 and 527. Air under pressure is supplied from a source of pressure air (not shown) through the main supply pipe 528, reducing valve 529, air filter 530, the branching reduced air pressure-gauge pipe 531, and the adjustable reducing valves 532 and 533. These reducing valves are adjusted to give fluid pressures at both sides of the piston such that the piston will not be moved toward either end of the cylinder until the pressure in pipe 524 or 525 is reduced by opening one or the other of the relief valves at their ends.

The relief valves at the ends of pipes 524 and 525 are actuated by the pilot lever 535 which is mounted to turn on the pin 534 mounted on the bracket 539 of the frame. The pilot lever 535 carries a grooved wheel 538 at its free end which is disposed to roll along the reference edge of the film as the film is advanced in a direction to the plane of the drawing as shown in Fig. 9. Intermediate its ends the pilot lever 535 carries the exhaust valve operators 536 and 537 which contact the balls 526 and 527 of the bleeder valves when the grooved wheel is rolling along the edge of the film and the edge is passing along the reference line RL. Near the grooved wheel 538 a thrust bolt 540 is threadably mounted on the pilot lever by the adjusting nuts 541 to pass freely through an opening in the fixed bracket or

spring stop member 542 which is fixedly mounted on the bracket 539. The bolt 540 extends beyond the stop member 542 sufficiently to mount the coil spring 544 which is mounted thereon in compression between the stop member 542 and the adjusting nuts 545. The compression of the spring is desirably only sufficient to assure that the grooved wheel 538 will follow the edge of the strip of film 2 and that the pilot lever will be drawn over on occasion sufficiently to displace the ball 527 for venting pipe 524.

In operation the pilot lever 535 is adjusted in a neutral position with respect to the bleeder valve balls 526 and 527 so that no bleeding of air occurs and the pilot wheel 538 is in contact with the edge of the film strip when the edge lays along the reference line RL. When the edge of the film deviates from this line the pilot lever is displaced, thereby displacing one or the other of the bleeder valve balls 526 or 527 and reducing the pressure in one or the other of lines 522 or 523 leading to one side of the piston 520. The piston then moves toward the low pressure side and as a result the axis of the aligning roll 511 is tilted, whereby the edge of the strip of film will be caused to seek a line of travel nearer one end or the other of the roll 511.

The film chopper

After having passed the constantly driven pinch rolls 7 and 7' the strip of film passes under the dancer roll 12. It then travels over the guide roll 5 (Figs. 13 to 15) mounted on the memory wheel bracket, guide roll 5' mounted on the shearing knife standard and then back and between the driven pinch rolls 14 annd 14'. The upper or idler pinch roll 14' is mounted to rotate on the vertically adjustable bearings 122' which are mounted in the slots or vertical ways in the standards 122. These bearings 122' are spring pressed by the coil springs 123 which cause the rolls to pinch the film sufficiently in response to the adjusting bolts 123' to cause a definite length of film to be taken from the loop without lost motion and advanced toward the knives 11 and 11' of the chopper each time that the driven roll 14 is indexed for advancing one length of strip which is to be chopped off.

After passing between rolls 14 and 14' the strip travels horizontally between the auxiliary rolls 136 and 136'. The lower roll 136 of this pair is positively driven from gear 94 through the idler pinion 137 to gear wheel 138 which is integrally mounted at the end of the lower auxiliary roller 136. This drive is geared so that the peripheral speed of the film propelling roller 136 will be the same as that of the initial propelling roller 14. The upper auxiliary roller 136' is mounted in sliding ways similar to roller 14' but it presses on the film merely by its own weight. The rolls 136 and 136' serve as guides and as auxiliary propulsion rolls to prevent buckling of the film and lost motion between the memory wheel and the knives in order that the relative position of defects recorded on the memory wheel will correspond to the defects on the film, both before and after the film passes the chopper. The film then passes between the knives 11 and 11' when they are separated and the rolls 14 and 136 are indexed.

When the film is inserted between the knives 11 and 11' (Fig. 15) and placed in position to chop off the desired length of film, the transfer pallet 101 and its gripper blade 106 (Figs. 16, 17 and 18) will have been brought with the area along one of its edges between the upper and lower rectangular frame members which comprise the upper frame members 21 and 21' and the lower frame members 21*a* and 21*b*. This frame carries a system of upper and lower guide rods 26 and 27 which (Figs. 15 and 33) are mounted on the facing sides of the upper and lower frame members by means of studs 26' and 27'. The guide rods are normal to the plane of the knives 11 and 11' for a short distance at their ends near the knives, and then they are bent arcuately in an arc whose center is the upright axis of the transfer turret spindle 105 (Figs. 17 and 33).

The transfer pallet 101 and the spatulate gripping finger 106 are cut away arcuately at 103 (Fig. 33) to admit the arcuate portions of the guide rods 26 and 27 when the transfer pallet is swung near the knife 11 on the axis of the turret spindle for receiving the film. The transfer pallet 101 is operated in a fixed horizontal plane on the turret spindle and positioned so that the upper surfaces of the lower guide rods 27 are in the same plane as the upper surface of the pallet. The spatulate clamping finger 106 of the transfer device raises sufficiently from the pallet to freely admit the film. The plane of the lower elements of the upper bars 26 is in or below the plane of the lower surface of the clamping finger 106 when the finger is in release position. In this way the rods 26 and 27 with their arcuate projecting ends provide effective guides from a point next to the knives for an effective distance into the clamping area between the pallet 101 and clamping finger 106 so that the reference edge of the chopped-off film will be held precisely along the line RL. The same edge will be disposed as the leading edge and precisely along the fold of a folder or in coincidence with the edge of a separator when the pallet and film have been swung through 90 degrees into the interleaving position.

The film is chopped by the shearing action produced by lowering the sharp lower edge of the upper knife 11 into shearing engagement with the edge of lower knife 11'. The chopper (Figs. 13 to 15) is driven from sprocket 70 on motor 20 through chain 74, sprocket 75, sprocket 76, chain 77, sprocket 78, sprocket 79, chain 80 to sprocket 81 keyed to the shaft 81' (Figs. 15 and 16) which is mounted on bearings 81*a* on the chopper frame. At one end of shaft 81' is keyed a drive wheel 125' having an external journal eccentric to the axis of the shaft 81'. A bearing 125*a* at the end of push rod 125 is fitted to the journal at one end and is pivotally connected at the other by the pin 127 to crank 126 which is keyed at its other end to shaft 127'. The shaft 127' is mounted in bearings on the chopper frame and has keyed to it the arms 126' which carry the upper knife mounting 131 at their outer ends. The knife 11 is held over in shearing engagement with the knife 11' by the coil spring 131' which is held in tension by attaching the outer end to any convenient place on the frame. The rotation of shaft 81' and eccentric journal 125' causes the knife 11 to reciprocate up and down in shearing engagement with the knife 11' by the action of the train just described.

Attached integrally to the extreme outer end of the shaft 81' is a chopper crank 90 arranged for driving the train for indexing the pinch roll 14 and advancing the lengths of film from the loop into chopping position between the knives 11 and

11'. This arrangement comprises the wrist pin 124 mounted in the bearing 124a which has a base formed to slide back and forth in a flanged slideway 140. The flanged slideway is diametrically disposed to the shaft 81' and is formed in the chopper crank 90. An adjusting screw 140' threaded in a projection of the crank 90 and pivoted in the base 124a of the bearing member is arranged to adjust the stroke of the crank and rack 91 for advancing different lengths of film into chopping position. The wrist pin 124 is journaled in a bearing at one end of the rack 91. The rack 91 meshes with the pinion 92' which drives a one-way clutch of well known design housed in the casing 139 which is mounted on the chopper frame. At the outer end of the shaft 64 and mounted to rock back and forth thereon is a housing 92 which is provided in its lower part with a flat bearing surface which supports the rack 91 opposite its point of engagement with the pinion 92'. This bearing in the lower portion of casing 92 retains the rack 91 and pinion 92' in engagement so that the reciprocation of the rack 91 by the crank 90 causes the pinion 92' to turn back and forth. Pinion 92' is the input for the one-way clutch 139 and the output of the clutch is a shaft 64 which is journaled in the frame of the chopper and to which pinion 93 (Fig. 13) is keyed so that the pinion 93 is indexed in one direction by reason of the indexing action of the one-way clutch 139.

The indexed pinion 93 indexes in one direction and drive the pinch roll 14 through gear 94. It also drives through intermediate train 63, 63', 62' and 62 the shaft 57 upon which the memory wheel 56 is integrally mounted. This provides a direct positive connection between the length of film which is chopped from the end of the strip of film and the section of the memory wheel carrying the pins 55. The gear ratio of the train which drives shaft 57 is proportioned to index the memory wheel a distance which is proportional to a length of film as set forth herein in connection with the description of the memory wheel. This correlation through the gear driven trains from the originating pinion 93 assures an exact ratio between a given set of reference pins 55 on the memory wheel corresponding to a cut film length and a given length of chopped film, the only variation being the irreducible minimum present by reason of a slight back lash which may be present in the gear train and the variation at the ends of the film due to the pin cross section. The variation due to the pin cross section is ordinarily the only significant variation and that is significant only in the rare instance where a defect occurs within the distance of the diameter of a pin from where the cut is to be made. This can be minimized by using pins of relatively small cross section. A back lash which could be introduced in the train by the return movement of the rack 91 or friction which is incidental to the release of the one way clutch is prevented by connecting the opposite end of the lower driven roller 14 to a hold-back device such as a pawl and ratchet disposed to prevent a reverse turning of the roller 14, or preferably another one way clutch 141 which is connected to the roller 14 so as to prevent a backward turning thereof when the rack 91 is being retrieved.

The cut film transfer device

After the length of film is severed from the end of the strip by the knives 11 and 11', the chopped off film length is transferred to an interleaving position where it is interleaved with a separator or between the leaves of an opened folder. The section of cut film is carried into interleaving position upon the upwardly facing transfer pallet 101 (Figs. 1, 16, 17, 18, 33 and 34). The transfer pallet is arranged to rotate through an angle such as 90 degrees on the axis of an upright shaft 105 which is mounted in the turret housing 22. The rotating transfer table or pallet has a clamping finger or spatula 106 which is actuated to descend on the cut film for clamping it onto the rotatable pallet 101. The device for clamping and rotating these parts are assembled in turret 22.

The transfer device is driven from the sprocket wheel 84 (Figs. 10, 13, 16 and 17) which is keyed to the shaft 85. The sprocket 84 is driven by chain 83 which is driven by sprocket wheel 82 mounted on the shaft 81' with sprocket wheel 81 on the chopper knife assembly. Keyed to the driven shaft 85 of the transfer turret is a collar 86. A grooved cam 87 is bolted to the rotatable collar 86 by set screws 88. The grooved cam 87 has a groove 89 in which the roller or traveler 95 tracks. The roller 95 is mounted to rotate on a shaft 96 which is mounted at the lower end of the bell crank lever 97. The bell crank 97 is integral with a pivot shaft 97a which is mounted in a ball bearing on the casing. At the extremity of the upper arm of bell crank 97 a rack or sector of a beveled ring gear is cut which meshes with the beveled gear 99. The beveled gear 99 is pinned to the end of reciprocating hollow spindle 100 which carries the rotatable pallet or film transfer table 101. The groove 89 in the grooved cam for reciprocating the transfer pallet 101 is shaped so that the crank 97 will reciprocate back and forth and rotate the hollow pallet spindle 100 through 90 degrees. The groove is otherwise formed and positioned so that the hollow pallet spindle 100 will be rotated from its position during the chopping of the film to a 90° displacement when the film is being interleaved with the folder or separator. The pallet 101 and spatula 106 are then returned to their initial position by cam 89 while the end of the film strip is again being fed between the knives of the chopper. The cam 89 is set so that the pallet 101 dwells while the interleaved cut film and folder are being gripped for their further traverse on the folder conveyor, and while the roller 95 traverses the portion of the circular part of the groove which is centered in the axis of shaft 85. The roller then traverses the portion of the groove 89 where the outer end of arm 97 is raised for returning the pallet to its initial position, reaching that position while the film is indexed between the knives 11 and 11'.

Within the hollow shaft 100 is a spindle 105 which carries at the top a bearing 106a and in the portion passing through bevel gear 99 bearing 106' upon which the spindle reciprocates axially as a thrust rod within the hollow shaft 100. The spindle then extends downwardly and at the bottom end carries a cam roller 107 on the shaft 107'. At the upper end of the hollow shaft 100 the pallet 101 is mounted to be turned by the hollow shaft 100 through 90 degrees in order to transfer the cut film from its position where it is cut into the interleaving position where the film is interleaved with the folder and grasped by a conveyor clamp which advances the interleaved film toward the reject station and stacking device. At the upper end of the spindle 105 above the bearing 106a is mounted the gripper

finger or spatula 106 which is lowered by the action of external cam 109 to grasp and retain the cut film on the pallet 101 during the 90 degree turn of the pallet and the interleaving operation, and to rise in order to receive the film between the gripper 106 and the pallet 101 when the film is inserted before it is cut and when the film is released after it is interleaved with the folder at the end of the transfer operation.

For raising and lowering the spindle 105 and the gripping finger 106, the spindle 105 carries at its lower end a cam roller or caster 107 which is mounted to rotate on the shaft 107' and to follow the outer face 109 of the outer cam wheel 110. This cam is shaped to thrust the shaft 105 upwardly so that the gripper 106 will be raised for releasing the cut film from the pallet and will permit shaft 105 to be lowered for engaging the cut film on the pallet 101. The shaft 105 and gripper finger 106 are held from turning independently of each other at the upper ends by the locking pin 111. The locking pin 111 is mounted on the hub of the finger or spatula 106 and the thickened base of the pallet 101 is bored to fit the pin so that the pin will slide freely in and out of the bore in the pallet when the spatula is lowered. At the lower end of the spindle 105, the shaft 107' is extended through a slot in the bracket 112 which bracket is fixedly mounted on the spindle casing. The slot in the bracket 112 is elongated so that the shaft 107' may travel vertically and be restrained from rotating as the roller or caster 107 follows the face 109 of the cam wheel 110 and the arm or spatula 106 is rotated back and forth by the pallet 101.

The tubular rotatable pallet carrier 100 is threaded at the bottom end and carries the adjusting nut 113 which retains bevel gear 99 from endwise movement beyond the shoulder 114 of the crank arm 97. The bevel gear 99 is keyed on the hollow shaft 100 a short distance above the stop nut 113, say one-fourth of an inch which constitutes the upward thrust of shaft 105 and the space between pallet 101 and spatula 106 in open position. Mounted on the inside of the hollow shaft is a bushing 115 which constitutes a bearing or stop member for the lower bearing member 106' of the spindle 105 and as an upper stop member for the spring 116. The spring 116 is compressed between the lower end of the bushing 115 and a shoulder 117 on the spindle 105 so that the spindle or push rod assembly will be held down to a level which is controlled by the level of the roller 107 as it rolls on the cam face 109. In this way the outer cam face 109 controls the gripping and release of the film on the pallet 101 and the integral turning of the pallet and arm are controlled. The spindle 105 terminates at the top in a threaded end upon which the retaining nut 118 is screwed down upon the bracket 119 which is an upward extension of the hub portion of the pallet 101.

In this way the arcuately shaped rods 26 and 27 (Fig. 33) provide skid-like guides between which the leading end of the film is positively directed into position for cutting and for transfer on the transfer pallet. When the length of film has completed its advance between the knives 11 and 11', the transfer turret mechanism operates to lower the spatulate finger 106 and grip the film before the film is cut off. The transfer pallet 101 and its complementary gripping finger 106 will remain in this position until the film length is severed as illustrated in Fig. 15. Thereafter the pallet and gripper finger 106 with the gripped film are rotated through 90 degrees on the vertical turret shaft 100 of turret 22 which carries the pallet, thereby removing the chopped off length of film from the chopping station and placing it in interleaving position at the interleaving station.

The axis of the turret spindle or center of rotation of the pallet 101 (Figs. 15, 16, 17, 33 and 34) is located at one side of the nearer edge of the widest film to be handled and in a leading position with reference to the shear line of the knives of the chopper a distance which is not farther from the shear line SL than the distance to the reference line RL along which the farther side of the strip of film travels. The pallet and spatula are somewhat triangular in form. When in position to receive the end of the strip of film, the outer edges of the pallet and spatula lay along the reference line RL, the arcuate slots 103 envelop the arcuate portions of guide bars 26 and 27, the straight outer edges lay along the straight portions of the guide bars and the somewhat pointed ends reach near to the cutter knife so that only a very narrow gap remains between the knife of the chopper and the spatula. The line of the sides of the pallet and spatula parallel with the cutter in this position are perpendicular to the refernce line RL and may desirably pass through the axis of the spindle. With this relationship of the guide rods, pallet and film, the pallet is enabled to handle all lengths and widths of film up to the limit of its designed capacity, and to provide a maximum gripping area at all times near the reference and shear lines so that the edge of the film can be placed precisely along the desired line where it is to be gripped by the grippers when the film is swung into interleaving position.

The reject station

After the section of cut film has been transferred from the cutter by turning it through 90 degrees on the transfer table and the film has been interleaved with the folder or separator so that the edge formerly traveling along the reference line RL is swung within the folder in contact with the crease or contiguous to the clamped edge of the separator, the folder clamps on the conveyor then dwelling at the interleaving station are closed by the cam 257 (Figs. 33 and 43) during the dwell, thereby gripping both the folder along the crease and the edge of the enclosed film.

In the next indexing of the folder conveyor, after interleaving, the separator and enclosed film are indexed into the reject station. Referring to Figs. 1, 2, 24 and 25, the reject device comprises the hopper generally designated by the numeral 10 having a sloping bottom wall 165, a shallow vertical wall 166 at the upper end of the sloping bottom wall and a wall section 166' at the lower end of the sloping bottom wall which is perpendicular thereto. The back wall 167 of the hopper is vertical and the front and top of the hopper are open. The hopper is mounted on and supported by structural members 168 which are constructed generally in the shape of the hopper walls except that the uprights remote from the chopper are vertical, and these members are appended to the upright wall 32 of the frame. The top opening of the hopper is rectangular and of a size large enough to receive the folders to be used for the largest size of cut film intended to be handled by the machine. The hopper frame is supported in part from the wall 32 by brackets 171 and 172 which are welded

to the frame members of the hopper and are secured to the frame of the machine by bolts 173.

Extending from the chopper side of the reject hopper in the direction that the film is to be indexed and to the edge of the rectangular space over the hopper are a number of guide strips of thin flexible metal supports, skids or ribbons 195 which are secured to an angle iron 202 carried by the edge of the wall 166. The inner ends of the springs are attached to lugs 203 which have rounded edges facing the hopper space and the lugs are secured to the angle iron 202 by the bolts 204. Secured also to the angle iron 202 and lugs 203 are guide fingers or wires 205 which extend obliquely downwardly into the rectangular space above the hopper bottom for delaying the descent of the following edge of a rejected folder until the folder clamp at the leading edge which draws the folder over the space has reached the position shown in Fig. 25 where the clamp is opened to release the folder. The fingers 205 are lengthened and inclined so that the descent of the leading edge of a rejected folder will precede the following edge in planes somewhat parallel to the inclined bottom of the hopper. The ribbons 195 are attached at their outer ends to the weights 197 and are stressed thereby so that the portions between the lugs 203 and the pulleys 196 are horizontal. The pulleys are mounted to rotate on a shaft 198 which is mounted on brackets 199 on the frame. The pulleys are adjustable along the shaft 198 and are suitably spaced apart so that the ribbons will support folders of different lengths which are to be delivered to the station and so that the ribbons will not interfere with the folder grippers which are carried therebetween by the folder conveyor chain.

The skids 195 are spaced in the manner of spacing the folder clamps (Fig. 39) and they extend horizontally so that they will support the folders of different widths to be delivered thereto, and the pulleys 196 over which the skids are stressed are placed along a line near the delivery edge of the transfer table so that the following portion of the folders may be carried along the horizontal ways formed by the stressed ribbons. The pulleys are elevated so that the ways formed by the upper surfaces of the ribbons will be in the plane of the tops of the reject fingers 208 which normally extend across the remainder of the space over the reject hopper.

The reject fingers or deflectors 208, of which five are provided in the embodiment illustrated in Figs. 24, 25 and 26, may be round bars which are spaced similarly to the folder clamps but so that they will not interfere with them as the clamps are indexed through the reject station. The upper surfaces of the bars provide ways or skids which support the following portions of the non-rejectable folders as they are being advanced by the folder conveyor from the transfer table toward the stacking device, much the same as the plate 282 provides a skid during the upper flight of the folders. The reject fingers 208 are thus located so that they will provide support for the various widths of film and folders to be handled.

When the reject device receives a message which was delayed and then sent out by the memory wheel that a defective film is about to be advanced over the reject hopper in the next indexing of the folder conveyor, the reject solenoid coil is deenergized as described in the section hereof entitled The Analyzer and Circuit Control with the result that the fingers or deflectors 208 are raised so that the creased edge of the folder which is secured in the folder grippers will pass underneath the fingers during the next indexing of the folder conveyor. At or near the end of this indexing the following edge of the rejectable folder drops onto the guide fingers 205 and at the end of this indexing the folder grippers are opened by the engagement of the gripper cam lever 258 with the release cam 209 which was caused to be raised into the path of the lever 258 by the deenergization of the reject solenoid 235. This releases the folder. Then by the action of the guide fingers 205 the rejected folder and its contents are caused to drop with the creased edge downmost onto the sloping bottom of the hopper.

The device for effecting the raising of the fingers 208 comprises a cam on cam wheel 218 (Figs. 24 to 28, 10 and 33) which is keyed to shaft 217. The cam wheel 218 is driven from the main motor 20 through chain 74, sprocket wheels 75 and 76, chain 77, sprocket wheels 78 and 79, chain 215, sprocket wheel 216 and shaft 217. Sprocket wheel 216 is geared so that it makes one revolution for each cycle of the film or indexing thereof. The sprocket wheel 216 is keyed to the shaft 217 (Figs. 24 to 28) to which the reject cam wheel 218 is keyed. The bell crank lever 226 (Figs. 24 and 25) carries a stub shaft 227 at one end and a cam roller 225 is mounted on the stub shaft for engagement in a groove 222 in the face of the cam wheel 218. The groove in cam wheel 218 is formed so that the bell crank lever 226 will dwell in normal position with one arm vertical and the other horizontal for a portion of the revolution of the cam and will cause the cam roller 225 to reciprocate up into reject position and back to normal position during the rest of its revolution.

The bell crank 226 is mounted to rotate on the shaft 233 with one arm in an upright position. In the terminal facing of the upright portion of arm 226 is a bore or receptacle 228 which is shaped for receiving a locking or latching bolt 229 which is carried by the vertically movable reject solenoid lever 230 and which passes through a bore 231 in another crank lever 232 pinned to shaft 233 which is L-shaped at the outer end so that it will extend over the end of the upwardly projecting arm of the bell crank 226 (Fig. 27). This lever 232 carried by the stub shaft 233 rotates the shaft when its end is locked to the end of bell crank 226 by the bolt 229.

The cam 218 makes one complete revolution for each cycle, or for each film which is cut. The cam is set to cause the roller 225 on the bell crank lever 226 to raise to its extreme lower position just before the folder gripper reaches the free ends of fingers 208 (Figs. 24, 25 and 28) and to remain in that extreme position until the folder grippers have reached their dwell at the reject station and have released the folders. Then as soon as the folder will have been released, the roller 225, bell crank 226 and lever 232 are returned to normal position, lowering the fingers 208 to normal position into the plane of the skids or ribbons 195.

Whenever a signal is sent out by the memory wheel whereby the solenoid coil in the casing 235 is caused to be deenergized, the solenoid connecting rod 236 upon which spring 237 is mounted is caused to descend by reason of the biasing of spring 237 against the action of the reject solenoid so that the reject solenoid lever 230 carrying the locking pin 229 will insert the same into the receptacle 228 of the bell crank lever 226

when the upwardly disposed arm of the bell crank lever dwells in upright position. The upper end face of bell crank lever 226 is finished as a part of a cylinder having its axis coextensive with the axis of shaft 233 so that the end of pin 229 will smoothly engage the cylindrical surface if it is lowered before the cam 226 reaches its normal dwell position. The locking bolt 229 is pinned at its upper end to the reject solenoid lever 230 by passing a pin 239 through an arcuate slot 238 in the lever so that when the vertical arms of bell crank levers 226 and 232 are locked together the bolt 229 will reciprocate as the radius of a circle having its center in the axis of the shaft 233 and pin 239 will be manipulated in slot 238.

The stub shaft 233 (Fig. 28) carries at one end the L-shaped lever 232 which rocks the shaft 233 when this lever is latched to the bell crank lever 226. The roller bearings 246 carrying the shaft 233 are mounted in an extension 245' of the casing 245 which houses the cam 218 and extends through the vertical wall 32 (Fig. 26). Outside of the extension 245' another crank 244 is pinned to the shaft 233 in a position 90 degrees from the lever 226 so that the outer end of crank 244 will reciprocate vertically when the reject solenoid is deenergized and the bolt 229 is in latched position. The extension 245' of the casing 245 is provided in order to enable the push rod 240 to be suitably mounted on the outer end of lever 244 for vertical movement. The fingers 208 and cam 209 are elevated by the push rod 240 for effecting the rejection of a defective film.

For this purpose the lower end of push rod 240 is pinned by the pin 241 to the end of lever 244 and it slides up and down on the guide pin 242 which is secured to the upright frame member 168 through the elongated slot 243. Referring to Figs. 24, 25 and 26, the push rod 240 is loosely pinned at its upper end to a plate 224 upon which cam 209 is secured by the pin 247 and the plate 244 is pinned to the shaft 249 so that with the loose pin connection just mentioned the plate 244 pivots on shaft 249 as the push rod 240 and cam 209 are reciprocated up and down in response to the reject cam. As shaft 249 is reciprocated back and forth (Fig. 26), the levers 249' pinned thereto are operated. At the outer ends of levers 249' is mounted the bar 250' and the fingers 208 are fixedly mounted on this bar so as to extend horizontally over the opening of the reject hopper. Thus when the reject cam is operated to reject a folder or film, the push rod 240 is raised, raising cam 209 into the path of the gripper release lever 258, of the grippers 260 and pivoting the cam carrying plate 224 on the shaft 249. This pivoting raises the outer ends of levers 249' raising the bar 250' and the fingers 208 so that the folder passes under the free ends of the fingers as the folder enters the reject station. In operation the elevation of the fingers 208 and cam 209 occurs just before the folder or film enters the reject station so that the folder first passes under the fingers 208 during the indexing of the folder conveyor and the grippers 260 are opened to release the folder into the reject hopper as the indexing is being completed. After the folders are released the cam wheel 218 will have turned to the point where cam roller 225 will start to return to its unlatching position. In passing to this position the fingers 208 and cam 209 will be lowered, the reject solenoid will again be energized by the resetting operation of the electrical relays, elsewhere herein described, the locking bolt will be drawn out of locking engagement and the crank arm 226 will again reciprocate back and forth independently of crank arm 232 until these arms are again caused to be locked together by the deenergization of the reject solenoid. In this position where the fingers 208 have descended to their normal position, increased edges of nonrejectable folders and their enclosed films will be carried above the reject fingers 208 by the folder clamps which will remain closed, and the tops of the reject fingers will constitute ways for the folders so that they may be brought by further indexing of the folder conveyor into the stacking station.

The reject device operates to reject single folders which contain defective film and also to reject any film which is not enclosed in a folder. The operation of the reject station is the same in both cases, the only difference being that the reject solenoid in the latter case is caused to deenergize by the failure of mercury switch 350 to close contacts M (Figs. 34 and 47) by reason of the absence of a folder on the folder conveyor which would otherwise operate the switch lever 351 at the dwell point of the folder conveyor which precedes the interleaving or transfer station.

The stacking device and counter

Acceptable cut film interleaved with folders or separators are transferred on the next indexing of the folder conveyor into the stacking or counting station where they are deposited on a conveyor. The stacking device and counter (Figs. 1, 2, 29 to 32, 38 and 39) comprises a conveyor, such as an endless belt 25 carried on driving pulley 450 and idling pulley 451, which is indexed forwardly in short steps a number of times corresponding to the desired number of interleaved cut films to be stacked in a bundle as the packaged or interleaved films composing the stack are released to the conveyor from the clamps on the folder conveyor. The clamps successively bring the interleaved films forward into their releasing position at the stacking station after they have passed through the reject station. Thereafter the conveyor or belt 25 carrying the completed stack (say 12 films interleaved with separators or folders) is given a long index whereby a space for starting a new stack on the conveyor is brought forward and preparations for a new series of short indexes is established. This indexing of the endless belt 25, however, is momentarily stopped by a device actuated by a pawl release solenoid (Figs. 29 to 32 and 56) when by reason of a rejection the grippers on the interleaver or folder conveyor do not bring forward or release an interleaved film so that the completed stack of interleaved film will always be composed of the predetermined number of units.

The pulley 450 (Figs. 2, 10, 12 and 34) at one end of the conveyor is keyed to the indexed shaft 455 which is driven by chain 453 (Fig. 12) from indexed sprocket 454 (Figs. 29 to 31) fixedly mounted on the indexed shaft 452. The shaft 452 is driven from the indexed ratchet wheel 460 (Fig. 29). The indexing device which drives shaft 452, pulley 450 and the stacking belt 25 (Figs. 29 to 32) comprises a casing 458 secured to the frame upon which the counter pawl release solenoid 456 (containing solenoid coil 457, Fig. 56) is mounted and within which the indexed ratchet wheel shaft 452, the counter or short throw ratchet wheel 460, the long throw ratchet wheel 461 and a solenoid operated pawl release device comprising the lever 462, the cam wheels

484 and 490, and the power input drive shaft 328 are mounted.

In the normal indexing operation, the ratchet release solenoid 456 is arranged to be energized from a suitable source of current which is connected to the supply leads as shown in Fig. 56. In this normal indexing position of the lever and solenoid parts wherein the lever 462 is raised by the energized solenoid to its extreme upper limit, the short throw ratchet wheel 460 is allowed to advance in the direction shown by the arrow in Fig. 30 in steps by the action of the pawl 465 depending upon the number of teeth and notches in a portion of its perimeter, say a series of twelve notches 464 cut in the portion of the wheel 460 which corresponds to the segment of the long throw ratchet wheel 461 between alternate notches 464, and to the number of units of interleaved film to be included in a stack. For example, a series of twelve ratchets 463 on wheel 460 may span an arc which is proportional to the advance which the belt 25 makes during the stacking of the number of interleaved films to be included in a stack which in the modification shown in the drawings is about 54°. One such series of twelve ratchets extends to the right from the point where pawl 465 is shown in Fig. 30 and ends with the ratchet 463 in wheel 460 which registers with the ratchet 464 at the top and right of wheel 461 of this figure. The long throw ratchet wheel 461 is keyed to the same shaft as the ratchet wheel 460 and its pawl receptacles or ratchets 464 which are positioned so that the pawl 466 will turn both wheels 460 and 461 through the remainder of 90° on the stroke which immediately succeeds the deposit of the last film of the stack deposited. Thus for a stack of twelve units the notch 464 at the top of wheel 461 in Fig. 30 corresponds to the twelfth notch in a first series of twelve notches in wheel 460. The pawl 465 is shown resting in the first notch of the series. The throw of pawl 466 is arranged to rotate both wheels 460 and 461 through the remainder of 90 degrees in the modification shown in Fig. 30 in order to bring a new series of twelve notches on ratchet wheel 460 and a smooth edge portion of ratchet wheel 461 into operative position. Thus the peripheral distance on wheel 460 occupied by the series of twelve ratchets corresponds to the part of belt 25 occupied by the stack of interleaved films and the distance through which pawl 466 throws wheels 460 and 461 corresponds to the space on the belt between the stacks.

In normal operation a folder conveyor clamp may carry no film forward to be stacked when it reaches the stacking station. This contingency may occur by reason of the fact that a defective film or an improperly interleaved film will have been rejected at the reject station. As subsequently explained in the section hereof entitled "The Analyzer and Circuit Control," the coil 457 of the counter pawl release solenoid 456 is deenergized whenever this condition exists. When this coil of the solenoid 453 is deenergized, the link 471 connecting the solenoid armature and the cross arm 472 (Fig. 31) connected between the levers 462 are retracted or lowered by the action of the coil spring 473 which is maintained under tension. This lowers the pawl releasing cams 480 which are cut in the lower faces of arms 462 for engaging rollers 474 and 475 on the pawls 465 and 466. The pawls 465 and 466 are made in the form of levers having rollers 474 and 475 mounted at their outer ends so that they will be engaged by the lowering of the solenoid controlled arms 462. The levers are pivoted on bolts 476 and 477, and the pawls are normally maintained in engagement with the ratchet wheels by coil spring depressors 478 and 479 of known construction. When the cams 480 on the levers 462 are lowered as the result of the deenergization of the solenoid coil 457, the rollers 474 and 475 track on the cams 480 and raise the ends of the pawls free of the ratchet wheels 460 and 461. This prevents the indexing of the ratchet wheels and stacker conveyor so that after the next interleaved film is deposited on the conveyor, the solenoid 456 will have been energized, the levers 462 will have been elevated to normal position and the pawls will again have been sprung into normal indexing engagement with the ratchet wheels. After the interleaved film is deposited, the indexing is arranged to start and the indexing is completed before the next succeeding interleaved film is deposited.

Pawl 465 is pivotally mounted by bolt 476 at the end of the bell crank 467 which is keyed to the shaft 452 and the bell crank is pivotally connected at its opposite end to the connecting rod adjuster 468. One end of the connecting rod 469 is threaded and mounted in adjuster 468 so that its length can be varied for exact adjustment of the ratchet wheel 460. At the other end, the connecting rod 469 is pinned to the bearing ring 470 and the bearing ring is mounted on a bearing member 471, the center of which is eccentric to the axis of the shaft 328, forming a cam so that connecting rod 469 will be reciprocated as the shaft 328 is driven. The eccentricity of this bearing is small and it is proportioned with respect to the notches 463 so that the pawl 465 will be withdrawn the distance that the short throw notches 463 are spaced apart on the ratchet wheel 460 during each revolution of the shaft 328. The shaft 328 rotates continuously and is mounted in roller bearings 481 and 482 which are carried by the walls of the casing 458. The shaft 328 projects from one side of the casing where the drive sprocket 327 is mounted. Sprocket 327 is mounted to rotate once for each cycle of the film chopper and it is driven from a sprocket wheel mounted on the idler shaft 301' (Figs. 10 and 33) through the chain 326.

It is seen that the short throw ratchet 460 operates soon after an interleaved film is deposited on the stacker conveyor and it advances the stacker conveyor belt 25 only a short distance, say ⅛ inch, each time after an interleaved film is deposited. This advance or index is completed before the next succeeding film is deposited so that the edge of each newly deposited film will project at one edge over the edge of the next previously deposited film as indicated in Fig. 2. During the indexing of the short throw ratchet wheel 460, the long throw ratchet wheel is equally indexed and the pawl 466 reciprocates along the smooth periphery thereof between the notches 464. When the number of films has been deposited which corresponds to the number of the ratchets in one series on the short throw ratchet wheel 460 which correspond to the space between the alternate ratchets 464 of the long throw ratchet wheel 461, the pawl 466 no longer rides on the smooth periphery of wheel 461 but rather engages the following notch 464. Then the long throw ratchet wheel 461 is indexed to move the belt 25 forwardly a distance corresponding to the spacing between two ratchets 464 in order to present a new stacking area on the belt 25.

The long throw pawl 466 is pivotally mounted on the outer end of the long throw bell crank 485 by the pin 477 and at the other end it is pivotally mounted by the pin 486 to the connecting rod adjuster 487. This adjuster is connected to the long throw connecting rod 488 which has an adjustable screw connection at one end attached to the adjuster 487 and at the other end it is pinned to the collar member 489 which is journaled on the eccentric bearing 490. The bearing member 490 is keyed to the drive shaft 328 and its center of rotation is located sufficiently eccentric to the axis of shaft 328 to provide for throwing the ratchet wheel 461 through an angle of 90 degrees. It will be seen that both connecting rods 469 and 488 and both crank arms 467 and 485 with their pawls 465 and 466 are constantly reciprocated. Both ratchet wheels 460 and 461 are keyed to the shaft 452 and both are constantly being indexed but a part of the time the indexing is in response to the short throw ratchet arrangement on wheel 460, the teeth of which correspond to individual films; and the rest of the time it is indexed in response to the long throw ratchet arrangement on wheel 461, the teeth of which correspond to different stacks of films. It is evident that the number of units in a stack may be changed at will by installing different ratchet wheels 461 having the notches 464 separated different angular distances apart. In addition, however, means are provided for preventing any indexing when there is a failure of the folder conveyor to deliver an interleaved film to the stacker conveyor.

The folder conveyor

Each folder or separator with which a given length of cut film is to be interleaved is brought into position by the folder conveyor for interleaving or assembling with the film during a portion of the time that the film is being advanced between the cutter knives and it is desirably brought into position before the film completes its traverse into assembling position. The means for bringing the folders or separators into interleaving or assembling position serves also for transporting them from the assembly station into succeeding station such as the reject and stacking stations. This means comprises in general an endless chain conveyor (Figs. 1, 2 and 33 to 45) comprising two roller chains which pass over pairs of sprocket wheels 251 and 252 which are fixedly mounted on shafts 253 and 254, respectively. A number of bars 268 (Figs. 39 and 40) are mounted at their ends between the chains and at designated stations or dwell points along the chains. Folder or separator grippers 272 are mounted on the bars 268. The conveyor is indexed by an indexing device, preferably the cycloidal drive housed in casing 15 (Fig. 34, later to be described), and dwells are provided during which the separator grippers are caused to dwell simultaneously at the several stations where devices are located for performing numerous operations and control functions now to be described, namely at the separator pick-up station, at three dwell stations immediately preceding the assembly station designated generally by the letters B, C and D (Figs. 2 and 34), at the interleaving or assembly station, at the reject station designated generally by the numeral 10, and at the stacking station. Preferably a gang of grippers is mounted on each transverse bar 268 (Figs. 1, 18, 46, and 39 to 45) at each dwell point, but only one gripper could be used to grip each separator. The grippers are normally closed. The jaws 260 of the grippers are operated to open position by shafts 261 to which the jaws are integrally attached, and the shafts are reciprocated by the cam actuated levers 258. At the separator or folder pick-up station, at the interleaving station and at the stacking station, means are provided for opening the grippers at each dwell, and at the reject station the grippers are always opened when knowledge of a defective film or a missing folder has been recorded. At the three dwell stations, B, C and D succeeding the folder pick-up station, the grippers remain closed.

In the illustrated embodiment of the invention (Figs. 1 to 3, and 33 to 45), sets or gangs of seven grippers 272 are provided on the conveyor mounted on bars 268 which are suitably connected at their ends (Figs. 39–46) to the endless chains 256 which carry the gripper mountings with them in the upper and lower flights of the conveyor. The bars 268 are carried at right angles to the chains. The upper and lower flights of the chains 256 pass through grooves 255 opening inwardly and to the sides of the channeled tracks 24 (Figs. 2, 34, 39 and 46) in order to hold the grippers in aligned and fixed upright positions and to prevent sagging of the chains during their horizontal flights. The bars 268 (Figs. 39, 40, 41 and 46) are rectangular in cross section and they are bolted at their ends to arms 265 by means of the bolts 265a. The brackets have elevated arms 265 extending forwardly and backwardly, near the ends of which the stub shafts 267 are mounted. Rollers 266 are mounted on the stub shafts 267 by means of nuts 267'. These rollers travel along the top of the rail or track 24 in the top flight of the grippers and along the bottom of the rail in their lower flight. The brackets also carry bolts 269 spaced apart the length of a chain link, over which the parts of a chain link are mounted so as to preserve the continuity of the chain. These bolts 269 are spaced from the traction surface of the rail 24 so that the chain, or preferably the rolls of a roller chain will track along the groove in the rail 24 and the bolts will pass through the slit along the inner side of the rail which opens into the groove.

The rails 24 are mounted on brackets 280 which are mounted in turn on the frame members 254'. A gripper operating shaft 261 is journaled near one end in the bracket 265 midway of the rollers 266 and in the plane of the axes thereof. The shaft 261 extends horizontally across the conveyor and passes through the base portion of jaws 260 of the grippers and the jaws are prevented from turning on the shaft by the set screws 262.

The anvils 273 of the clamps are U-shaped. The flattened parts 260 of the clamps are fitted between the legs of the U-shaped part to bear surface to surface. The sides of a set of U-shaped anvils 272 are bolted to a cross bar 268 by bolts 272' and the shaft 261 is journaled to be supported by and turn in the legs of the U-shaped member. The shafts 261 are thus mounted on the anvils 272 and in the end member 265. At the end of shaft 261 outside of the conveyor track the cam lever 258 is keyed. This lever is mounted to engage the appropriately operated clamp operating cams which are located at the hopper, interleaving, reject and stacking stations. At the extreme end of the crank 258 a cam-engaging roller 263 is mounted on stub shaft 264 for directly engaging the cams which are located at the various dwell points, later to be described

more in detail. In order to prevent the trailing ends of the separators or folders from hanging loosely when they are being carried along the upper flight of the conveyor support, the rods 281 are mounted in the brackets 280 (Fig. 46) on both sides of the conveyor to extend horizontally inwardly as brackets for supporting the sheet or plate 282 which forms a table along which the trailing ends of the folders are drawn.

The conveyor chain passes over sprocket wheels 251 and 252 at either end of the conveyor support. These sprocket wheels are keyed to shafts 253 and 254, and the conveyor is driven by sprocket wheel 252 which is keyed to an extension of the output or driven shaft 253 of the cycloidal device in the casing 15. The shafts 253 and 254 turn in journals mounted to the side members 254' of the frame. The conveyor is driven by motor 20 through chain 74, sprocket 75, cycloidal device in casing 15 and shaft 253 to which the sprocket wheel 252 is keyed.

On the upper flight of the folder conveyor shown in Figs. 34 to 38 is the folder pick-up or loading station near the folder hopper 33 where the folders are first entered or loaded upon the conveyor and two other dwell stations B and C to the right of the folder hopper.

At stations B and C the edges of the folders encounter and operate mercury switch levers 342A and 343A (Fig. 34) which tilt mercury switches 347 and 348 to close the contacts 342 and 343 (Fig. 60), respectively. Contacts 342 and 343 are connected in parallel in the starter relay circuit which opens and closes the power supply circuits of drive motors 8 and 20. Also in this relay circuit and also in parallel with contacts 342 and 343 are contacts 344 in the starter relay circuit. Contacts 344 are opened by the switch cam lever of switch 346 (Fig. 55) which is moved to open position by the cam 349 on shaft 299 which is positively driven from the motor 20 (Figs. 1 and 11). Cam 349 is arranged to operate the switch lever 346 once each cycle and to open the contacts 344 (Fig. 60) after the contacts 342 and 343 will have been closed by folders which are brought into stations B and C. When two successive folders are missing at stations B and C, it follows that all three contacts 342, 343 and 344 will be opened simultaneously at the interval of opening contacts 344. The starter relay circuit will thus be broken and both motors 8 and 20 will be stopped.

The fourth dwell station is station D which precedes the dwell of the folder at the interleaving station. At station D a switch operating finger or arm 351 (Figs. 18, 34 and 47) of the mercury switch 350 is desirably mounted for closing the contacts M (Fig. 56) of the relay holding circuit. The contacts M are in series with the relay solenoid CR1S of the reject circuit and are connected in parallel with the contacts G of the cam operated switch which is opened momentarily each cycle during each dwell of the conveyor by the cam 345 on shaft 299 (Fig. 11). The switch arm 351 of the mercury switch is arranged to be tilted on the supporting pivot shaft 351' and operated to close the normally open circuit across the normally open contacts M by contact of the arm with the edge of a folder when a folder is brought into station D and to remain in open position when no folder is brought into the station, so that when any gripper fails to carry a separator at this station, both contacts M and G will open and the system of delayed action relays elsewhere described herein will be set in operation to cause the reject station to reject the film corresponding to the missing separator.

The fifth station of the conveyor and grippers is the interleaving station where the length of cut film is transferred from the cutter and is swung through 90 degrees by the transfer device and then interleaved with the separator or folder which was brought into position by the folder conveyor. At the interleaving station a cam 257 (Figs. 11, 33 and 43) which is driven from motor 20 (Figs. 10 to 12) through shaft 355, sprocket 356, chain 357, sprocket 358 and shaft 359. Sprocket 360 and shaft 362 are set to engage the roller 263 (Fig. 43) mounted on the stub shaft 264 at the outer end of the gripper lever 258 so as to open the gripper jaws during each dwell at this point in time to permit the leading edge of the cut film to be inserted next to the fold inside of the folder 1 or a corresponding edge of any separator when the film is fully transferred. Cam 257 is formed and timed to retain the gripper jaw in open position until after the interleaving is completed and then to close the gripper before the transfer pallet 101 starts to return for receiving another film from the cutter and before the next indexing of the conveyor starts. When the indexing of the conveyor takes place, the folder is withdrawn from the suction header top 365.

The next station in the direction of indexing the folder conveyor is the reject station which is described in a prior section hereof bearing that designation. At the reject station the grippers normally remain closed but in cases where a defect in a given length of cut film has been recorded on the memory wheel characterizing it as a defective film, the grippers are opened by the action of the reject cam 209 (Figs. 24 and 25) which is raised in the path of the gripper operating lever 258 of the gripper carriage and that set of grippers is opened as described in connection with the description of the reject station.

The last station on the folder conveyor is the stacking station where the gripper release lever 258 may engage the face of a fixed cam or stacking gripper cam 259 (Fig. 45) for opening the gripper and releasing the film and folder to the stacking conveyor. In place of fixed cam 259 a timed cam positively driven from the motor 20 may be interposed to engage and operate the release lever 258, such as a suitably driven release or like cam 257.

Each folder gripper comprises the jaw member 260 which is integrally fixed to the rocker shaft 261 (Fig. 38) by the bolts 262. The rocker shaft 261 is journaled in carriage 265 and at its outer end is affixed the gripper cam lever 258 (Figs. 39 to 45) which carries the roller 263 which is mounted on a stub shaft 264 at the outer end of the cam lever. The roller 263 directly engages the gripper opening cams such as cams 257 at the interleaving station, 259 at the stacker station and 209 at the reject station (Figs. 24 and 25), displacing the lever 258, thereby rotating the rocker shaft 261 and carrying the jaws 260 into open or release position as shown in Figs. 43 and 45. The gripper mounting comprises also the carriage 265 at the end of shaft 261 which comprises two arms extending forwardly and to the rear of the gripper.

The grippers comprise the complementary relatively stationary gripper jaw or anvil portion 273 (Figs. 38 to 45) mounted in a bored out portion of the socket 272 in which a retractable

gripping member, inset or anvil 273 is mounted for engaging the socket 272 has face of the reciprocating jaw 260. The gripping flange which retaines the anvil 273 but permits axial movement so that the outer end will engage the gripping face of the jaw 260 and be depressed against a spring 274 when the gripper is closed. The spring 274 is arranged to be depressed more or less against the bottom of the inset 273 to regulate the pinch of the clamp. This may be done by lengthening or shortening the spring so that it will be depressed more or less into the cup-shaped receptacle 276 which holds it. The cap 273 and receptacle 276 constitute a cylindrical enclosure for the spring 274 and they are mounted in a bore in the part 272. The bottom of the cup is engaged by a portion of the gripper member 260 which holds it in place. When a folder is engaged by the descent of the gripper jaw 260, the cap is retained so that it will always be depressed somewhat. Suitable clearance is provided so that the spring can be depressed more or less when folders of varying thickness are gripped.

A desirable form of film separator, interleaver or wrapper for use in the embodiment of the invention herein set forth is a paper folder. The folders 1 are stored for use in the folder hopper (Figs. 2 and 33 to 38) which has an upright forward wall 33 attached to a bracket 33a which is secured to the upright partition 32, a permanent far side wall 440, an adjustable near side wall 441 and a rectangular bottom 34' of suitable size and shape to retain the folders to be used. An adjustable rear partition 33' is mounted on the bottom 34' for keeping both the front and back edges of the folders in exact alignment with each other and uniformly stacked in the hopper. The adjustable near side wall 441 is threadably mounted in part on the threaded adjuster bar 442 which is journaled at its ends in the frame members 443. At a lower part the near partial side wall 440 slides along a guide bar 444 which is permanently mounted at its ends in the frame member 443. Adjustment of the near partial side wall is made by turning the adjuster knob 445 on the threaded rod 442. The bottom member of the hopper is provided with a transverse slit 34 near the forward wall 33, but separated by a short ledge therefrom, through which the separators or folders are drawn edgewise one at a time from the bottom of the pile stored in the hopper. The bottom member 34' of the hopper is preferably inclined with the slotted end lowest. Folded separators are stacked in the hopper with the folded edges in contact with the front upright wall 33, the inclined position of the hopper serving also to urge the folded edges of the folders or separators uniformly against the front wall.

Along the front margin of the slot 34 is a narrow cleat 285 (Figs. 35 to 38) which forms a ledge for supporting the lower forward edges of the folders or separators. Through bores which are suitably spaced apart at the base of the wall 33 and directly underneath the cleat 285 are inserted a number of rounded elongated fingers 286 which are mounted on the cross head 287. The fingers are tapered and rounded at the ends adapting them to reciprocate back and forth over the slot 34 for smoothing out and otherwise supporting the bottom-most folder for maintaining the same in proper condition to be removed from the bottom of the stack when the fingers are removed from in front of the slit.

A pipe or suction arm 284 is manipulated by cams hereinafter to be described to contact the lower surface of the folder or separator, extricate the forward edge from the bottom of the pack and locate the edge of the folder exactly along the grippers on the folder conveyor in position to be clamped as illustrated in Fig. 38. The open ended yieldable nipples, such as the soft rubber nipples 340, on the ends of arms 284 are raised into contact with the bottom-most folder in order to close the open ends and hold the separator by suction. Then the nipple 340 is lowered and drawn backwardly thereby adhering to and further extracting the folder from the bottom of the pile. Upon being lowered still further and advanced horizontally by a compound cam action, the arm positions the folded edge of the engaged folder exactly upon the retractable gripper caps 273 of the open folder grippers, thereby placing the edge of the folder in position to be clamped upon the timely closing of the gripper jaws 260 prior to the next indexing of the folder conveyor.

The supporting fingers or bars 286 are mounted on the cross-head 287 (Figs. 35 to 38) which is operated from its opposite ends by rods 289'. Rods 289' are pinned at their other ends to the reciprocating connecting rods 288 and 289 to which pivotal connection is made by the pins 290. The connecting rods are pinned at their other ends to levers 291 which have heads 292 that are pinned to the rocking shaft 293. The rocking shaft 293 (Fig. 37) is mounted in roller bearings 294 on the frame and is rocked back and forth by the cam lever 295 which is integrally affixed at one end to the shaft 293. The other or free end of cam lever 295 carries the cam roller 296 which tracks in the groove 297 of the pin reciprocating cam wheel 298. The pin reciprocating cam wheel 298 is keyed to the revolving cam line shaft 299 upon which the revolving hopper cams 310 and 311 are also mounted. Drive shaft 299 is mounted in turn in roller bearings 300A on the frame of the machine.

The folder hopper cams and the pin reciprocating cam in wheels 298, 310 and 311 make a complete revolution for each folder that is extracted from the folder hopper or, in other words, for each film that is cut at the film chopper. The action of cams 310 and 311 combine to regulate the movements of the suction arms 284. The shaft 299 is driven from the sprocket wheel 70 from the main motor 20 through chain 300, sprocket wheel 301 which is keyed to the idling shaft 301', sprocket wheel 302 keyed to the idling shaft 301', chain 303 and sprocket wheel 304 which is keyed to the shaft 299. The chain 303 is also passed over the gripper cam sprocket wheel 305 which is keyed to shaft 306. The gripper cam 308 (Fig. 44) is also keyed to shaft 306 so that the external cam face will engage the roller 263 on the gripper cam lever 258 and bring the jaws 260 of the grippers into open position as shown in Fig. 44 for receiving the edges of the folder 1.

The suction arm 284 is mounted on the suction arm carriage (Figs. 35 to 37) which comprises an upright plate 315. The plate 315 has an opening 316 having upper and lower horizontal margins which form guides or tracks on which the plate may be reciprocated parallel with the travel of the grippers along the top flight of the conveyor. This movement of the plate 315 is regulated by the rotating cam wheel 311 which has a groove 312 in which operates a cam roller 313 mounted on the stub shaft 314 (Fig. 36). The stub shaft 314 is secured to the plate 315 and the cam groove 312 is formed so that the plate 315

will be reciprocated parallel with the conveyor chain rail 24 through a complete cycle each revolution of the cam.

On an axis parallel with the horizontal margins of the opening 316 of the plate 315 is mounted a pin 317 upon which a link 318 pivots. The other end of the link 318 is attached to an intermediate pivot point of a lever 319 by the pin 320. The lever 319 is pinned at one end to pivot on a stationary mounting 321 on the casing 322 and at the other end a stub shaft 323 is mounted to carry the cam roller 324. The cam roller 324 tracks in the cam groove 330 of the cam wheel 310. The cam groove is formed to impart an upright arcuate movement to the axis of pin 317 around the axis of shaft 299.

The suction arms 284 of which five are shown in Fig. 35 are carried by the suction header 335 which is integrally mounted on an upper extension of the plate 315 by a bracket 336 by means of bolts 337. A hose connection 338 is provided on the suction header 335 for making hose connection with the source of suction, such as a low pressure cylinder (not shown) which is exhausted by an exhaust pump (not shown) driven by the motor 339 (Fig. 10). With this mounting, it is evident that the movement of the suction head 335 is a composite of the horizontal reciprocating movement on a horizontal axis passing through the axis of shaft 299 and a curved movement around the axis of shaft 299. The desired resultant movement may be obtained by suitably arranging the angular disposition of cam wheels 310 and 311 with respect to each other. These cam wheels are desirably turned so that the yielding nipples 340 at the ends of suction arms 284 will have an ultimate forward position when the suction cup is at the upper end of its arcuate movement and will have attained its ultimate backward movement at about the middle of the return arcuate movement. This serves (Fig. 38) to draw the leading edge or folded edge of the bottom folder backwardly to clear the cleat 285 and then downwardly through the slit 34 of the folder hopper. The folder conveyor is timed in respect to the foregoing operation of cams 310 and 311 so that the folder gripper will have completed its index, the gripper cam 308 on shaft 306 will have turned to open the gripper jaws and the leading edge of the folder or separator will rest well across the yielding gripper inset 273. The cam 308 (Figs. 10 and 44) is formed to permit closure of the gripper jaws immediately after the positioning of the leading edge of the gripper on the gripper bolt 273 and prior to the forward indexing of the gripper. Immediately after the grippers are closed, the cycloidal device is set to index the conveyor.

This indexing brings the grippers and folder into the second indexed position, marked B in Fig. 2. In this position the somewhat elevated leading edge of the folder which is clamped by the grippers encounters the arm of the first of a pair of mercury switches of well known design and tilts the switch so that its contacts 342 (Fig. 60) will be closed. These contacts are in the starter relay circuit of well known design and are in parallel with the normally closed contacts 343 and the mercury switch contacts 344 of a similar mercury switch at station C. At the same time that contacts 342 are closed in the folder-operated mercury switch, the contacts 343 are opened by a positively driven cam 349 on shaft 299 (Figs. 1 and 55) which engages the switch lever of switch 346 to open the circuit of a relay which opens the connection between contacts 343 when the relay is deenergized. The contacts 343 in the starter circuit are positively opened each time that the folder conveyor is indexed (each cycle), but the restoration of the circuit through contacts 342 is effected by the operation of the mercury switch if a folder is brought into the station.

The second mercury switch is located at the succeeding station marked C in Fig. 34. This mercury switch operates similarly to cause contacts 344 to close when a folder is present and the mercury switch lever is operated. It follows that if a folder is present in position B or in position C, the starter circuit will be maintained when contacts 343 are open. However, if two successive folders are missing at the same time in positions B and C in any index, both contacts 342 and 344 will remain open when the cam operated contacts 343 are positively opened. This will break the circuit of the starter circuit relay, open the starter circuit (Fig. 60) and stop both motors 8 and 20. In operating practice it is considered that the supply of folders is as well as exhausted when for any reason two folder grippers in succession are devoid of folders. This feature, however, may be omitted or by simple rearrangement more or less vacant grippers can be considered as indicating exhaustion of the folder supply.

At the fourth dwell or station marked D in Fig. 2, the folder will have been brought into the dwell which immediately precedes the transfer station. At this station means are provided to cause rejection of a cut film when it is not accompanied by a separator or folder. This means comprises a mercury switch 350 (Figs. 11, 18, 34 and 56) having a switch arm 351 disposed to encounter the edge of the separator or folder when it is indexed into station D which immediately precedes the interleaving station. Upon encountering the edge of the advancing folder, the finger or switch arm 351 is thrown outwardly so that the pool of mercury in the mercury switch closes the circuit of the no-folder switch relay which controls the opening and closing of the no-folder contacts M (Figs. 47 and 56) in the circuit of control relay CR1S. The no-folder switch relay circuit is normally closed across contacts G except when cam 345 on shaft 299 (Figs. 10–12, 33, 55, and 56) opens the switch, and when closed the circuit across contacts M is open. When the mercury switch is tilted to open the relay circuit across contacts M, the cam is arranged to operate to close the circuit across contacts M, as described in the section hereof entitled The Analyzer and Circuit Control. In operation the mercury switch 350 is undisturbed and the contacts M remain open as the result of the lack of a folder in station D. Then the periodic positive opening of the parallel connected contacts G by the cam operated means breaks the control relay circuit so that upon the second succeeding indexing when the film corresponding to a missing folder will have reached the reject station, the reject solenoid at the reject station will operate to raise the reject cam 209 and reject fingers 208 of the reject station (Figs. 24 and 25), for rejecting the film which is not accompanied by a folder.

Upon the cycle immediately succeeding that in which the clamps are brought into station D, the clamps and folder are brought into the interleaving station (Figs. 34 and 18 to 23). At this station, the folder or separator 1 is drawn by the clamps upon the perforate suction table 365

which retains the separator or the lower leaf of a folder in position for interleaving. Where the cut films are interleaved with folders, at least one suction arm is also provided for raising the corner or edge of the folder in the area where the film to be rotated on the transfer pallet first enters the folder. However, a number of such suction arms may be provided. Immediately after the folder is indexed into the interleaving station and before interleaving is completed, the clamps **260** which grasp the leading edge of the separator are opened each cycle by the cam **257** on shaft **362** (Figs. 10 to 12 and 33) which engages the roller **263** of the gripper jaw operator **258**. The cam **257** is driven from the motor **20**, through chain **74**, sprocket wheel **75**, shaft **400**, sprocket wheel **76**, chain **77**, sprocket wheel **78**, shaft **355**, sprocket wheel **356** (behind sprocket **79**, Fig. 12), chain **357**, sprocket wheel **358**, shaft **359** and gear wheel **360** which meshes with gear wheel **361** on the shaft **362** to which both the gear wheel **361** and cam **257** are keyed. The interleaving of the film takes place while grippers **260** are open and the separator is held in place on the suction table. Then the cam **257** is arranged to release the self-closing gripper jaws **260** so that both the edge of the interleaved film and the separator will be grasped at their contiguous edges before the conveyor is indexed out of the interleaving position. Thus the meshing gears **360** and **361** cause cam **257** to be driven in a direction counter to the movement of the conveyor for operating the grippers at the interleaving station.

Line shaft **355** integrally carries five sprocket wheels which are keyed or pinned thereto. The shaft is driven by (1) sprocket wheel **78** which receives power intermediately from motor **20** through input shaft **400** of the cycloidal drive in casing **15**, sprocket **76**, chain **77** and sprocket **78**. The driven line shaft **355** then drives four sprockets, to wit, (2) sprocket **79** which is the power outlet for driving chain **80**, sprocket **81**, shaft **81'** and the chopper; (3) sprocket **501** which is the power outlet for driving chain **502**, sprocket **500**, shaft **499** (Fig. 23) and the cams for operating the folder opener suction arms at the interleaving station; (4) sprocket **363**, which drives chain **215** and sprocket **216** keyed to shaft **217** for driving the rocker cam **218** at the reject station; and (5) sprocket **356** which drives chain **357** and cam **257** for operating the grippers at the interleaving station, as just described.

The folder opener is illustrated in detail in Figures 18 to 23 and the driving connections are illustrated in Figures 11, 12, and 33. Referring to Figures 18 to 23, when a gripper carrying a folder is brought into the interleaving station, the lower free part of the folder trails over and is brought to rest on the upper side of the top **365** of the suction or reduced pressure header **366**. The reduced pressure header **366** is a closed chamber connected through pipe **367** (Fig. 21) with a source of vacuum (not shown) which is exhausted by a vacuum pump (not shown) driven by motor **20** (Figure 18). The reduced pressure header **366** is enclosed in a casing **381** (Figs. 18 and 34) mounted on the leg **383**. The suction header **366** is secured to the suction header top **365** by set screws **368**. The top **365** is somewhat larger than the header **366** and it closes the upwardly opening casing **381** to which it is secured by the brackets **382**. The top **365** is provided with an arrangement of openings which are distributed so that any size of a large variety of folders may come to rest over several suction openings, such as openings **369***a* and **370***a*. The openings **369***a* and **370***a* lead directly through the top **365** from the header space and the other openings distributed about the top **365** are connected with the header **366** through pipes **369** to **381** respectively. The suction header is arranged so that when the folder closes a number of these openings the folder will be held flat and securely on the top **365** by the suction. When small sizes of folders are used the openings in the top **365** not covered by the folder may be plugged with suitable stoppers. The casing **381** is supported on a pedestal comprising the upright **383**.

The upper leaf of the folder is elevated from the lower leaf which rests on the top **365**, and the folder is opened up in order to receive the film and in order that the transfer pallet **101**, the pallet blade **106** and the film carried by these parts will freely pass between the leaves of the folder during the transfer operation which immediately succeeds the opening of the folder. For this purpose a number of tubular suction arms **385** are provided at their outer ends with suction cups **386** which are manipulated to contact near the edge of the upper leaf of the folder and raise it. The inner ends of the arms **385** are mounted upon a supporting bracket **387**. The tubular suction arms **385** are individually connected by flexible hoses **388** with the source of vacuum above mentioned. For locating the suction cups near the edge of the folder, the supporting bracket **387** (Fig. 19) is mounted to slide back and forth on ways **389** parallel with the pipe **385**. The ways **389** may be bars which pass through openings near the opposite ends of the bracket **387** and which are supported at their ends from the oscillating bar **390**. The bracket **387** is manipulated back and forth on the ways by turning the hand wheel **391** one way or the other in order to locate the suction cups **386** near the edges of the folders. The hand wheel **391** is conveniently located to extend to one side of the frame and it is mounted at one end of shaft **392** which is supported on brackets on the oscillating shaft **390**. Beveled gears **393** on the shaft **392** mesh with beveled gears **394** on the shafts **395**, and the shafts **395** are screw threaded into the bracket **387** so that when the wheel **391** is manipulated the bracket **387** and the suction cups will be moved lengthwise in respect to the frame.

For manipulating the suction cups up and down, the oscillating bar **390** is rocked back and forth by the jack shaft **497** and these members are connected to each other end-to-end by a tongue and groove connection. The jack shaft **497** is connected to the output of the cycloidal drive through the cam **498** in casing **495**. The oscillating of the bar **390** operates to raise and lower the vacuum cups **386** at the ends of arms **385** which are supported by the ways **389**. The ways **389** support the arms **385** so that at the beginning of a counter-clockwise oscillation of the bar **390** as viewed in Fig. 19, the vacuum cups then in contact with the upper leaf of the folder will raise and open the folder. Shaft **497** is manipulated by cam **498** in cam housing **495** which is mounted on the back of partition **32**. Cam **498** is keyed to shaft **499** which is turned by sprocket wheel **500** mounted outside of the suction finger cam housing **495**. The sprocket wheel **500** is driven from the output shaft **355** of the cycloidal drive **15** as previously described so that the cam **498** and the vacuum cups **386** are moved in a se-

quence which is coordinated with the folder conveyor and the transfer device, both of which are driven from the output of the same cycloidal device. Accordingly, oscillatory movement of the vacuum arm assembly is coordinated with the movement of the folder conveyor and transfer pallet so that the suction cups raise the top leaf of the folder and open the folder for interleaving during the interval just after the folder has come to rest on the suction header and just before the transfer pallet bearing the film is swung into interleaving position.

Referring to Figs. 19, 22, and 23, the shaft **499** is journaled in one wall of box **495** and the output crank shaft **497** is journaled in the opposite wall of the box. The crank shaft **497** carries at its inner end a crank arm **505** which is fixedly secured to the shaft **497** at one end and at the other end the crank carries a cam roller **504** mounted on a stud shaft. The cam roller **504** tracks in groove **503** of cam **498** and the cam **498** is keyed to and turns with input shaft **499** as it is indexed by the cycloidal device **15**. The cam groove is cut to impart an oscillatory movement to the support **390** which is connected to jack shaft **497** by the tongue and groove connection. The support **390** is supported at the other end by a stud shaft in bearing **496** on the frame.

The sequence of movement of the vacuum arm assembly is as follows, referring to the various points of cam **498** (as viewed in Figure 22) which contacts cam roller **504** as cam **498** rotates in a counter-clockwise direction. While cam **498** moves from a two o'clock contact to a four o'clock contact as indicated by the hands of a clock, conveyor chains **256** are just completing their indexing movement and when suction heads **386** are brought into contact with the upper side of a folder by the descent of pipes **385** (at about the five o'clock point of cam **498**) the folders are at rest at the interleaving station. As the cam turns to effect a six o'clock contact, the suction heads **386** are raised above suction plate **365** for opening the folder sufficiently to freely permit insertion of the cut film by the transfer device. Roller **504** then dwells holding the folder in open position while interleaving is accomplished until the 10–11 o'clock cam contact position is reached. From this point, until about the 12:30 o'clock position the pipes **385** are raised to an extreme upper position for clearing the grippers in anticipation of the indexing of conveyor chains **256** which occurs while cam roller **504** dwells and the two o'clock contact is again made.

As described below, the grippers are open during the interleaving and are again closed before the next indexing in order to clamp the edges of the folder and film after they are interleaved. Upon the next indexing of the grippers the folder is easily stripped from the suction header and suction cups. It will be evident that the suction arms **385** may be dispensed with where a single sheet instead of a folder is used as the separator, and that more or less than five suction arms **385** can be used to open the folders.

While the separator is in the interleaving station it, or the lower fold of a folder, is held flat on the interleaving orificed table top or suction header top **365** by the vacuum or reduced pressure in the reduced pressure header **366**. The header **366** is a closed chamber having a pipe **367** in the bottom which connects with the reduced pressure source (not shown).

The folder conveyor is indexed or driven by means of a cycloidal device in casing **15** which is driven in turn from motor **20** through sprocket wheel **70**, chain **74** and sprocket wheel **75** which is keyed to the drive shaft **400** of the cycloidal device. The film chopper, the folder conveyor and all parts of the device following the film chopper are driven by the motor **20** and it is evident that numerous variations in the inspection device and memory wheel arrangements can be made without affecting the operation of those parts driven by motor **20**.

The cycloidal drive

The indexing or cycloidal driving device is mounted on the frame and housed in the casing **15** (Figs. 1, 10, 33 and 48 to 51). The device receives power from the main motor **20** through sprocket **70**, chain **74**, sprocket **75** which is mounted on the shaft **400** on the casing **15** (Fig. 48), gear wheel **401** and ring gear **402** which is integrally mounted upon the cage **403** (Fig. 50) by means of bolts **404**. The cage **403** is mounted to rotate on the bearings **399** on the output shaft **253**. The output shaft **253** is mounted at its ends in roller bearings **406** which are mounted on the casing **15** and one end of shaft **253** is extended outside of the casing for making a connection for driving the folder conveyor. The inner side of the cage **403** turns on a cylindrical shell **407** upon which the slotted plate **421** of the cycloidal gear is mounted and this assembly rotates on bearing **408** on the shaft **253** independently of cage **403**.

Mounted on the cage **403** are two planet gears **412** which mesh with the stationary sun gear **410** which is mounted on casing **15**. The planet gears **412** are keyed to the stub shafts **415** which are mounted in ball bearings **416** and **417** on the cage **403**, and at their inner ends the shafts **415** carry crank pins **437** which are fitted into the sliding blocks **438** which reciprocate in the slots **420** of the planetary output plate **421**.

The input power sprocket wheel **75**, the ring gear **402** on cage **403**, and the cage **403** are constantly driven by the main motor **20** at a rate such that the cage makes one revolution for each cycle of the film chopper. The sun and planet gears are made in 2 to 1 ratio so that the planet gears which drive the shafts **415** and crank pins **437** and impart to the planetary output plate **421** a movement which passes through two cycloidal cycles for each cycle of the film chopper. Certain of these cycloidal cycles are utilized to drive the output or main drive shaft **253** which drives the folder conveyor. This is done by an engaging and disengaging device which throws the driven plate **421** into operative connection with the shaft **253** every other cycloidal cycle and disconnects these parts during the other half cycles of the film chopper so that the folder conveyor which is driven by the shaft **253** will be indexed during one cycloidal movement of the plate **421** and will dwell during the next cycloidal circuit of the plate.

A desirable engaging and disengaging device, clutch or latching device for this purpose comprises a circular yoke **422** having a hub portion which is splined to slide axially on the central shaft **253**. The hub of the yoke is connected by four web members to an outer circular rim in which the pins **423** are mounted diametrically opposite to each other and secured with engaging portions at both ends of the pins projecting from the sides of the yoke **422**. The inside projecting ends of the pins or latches **423** are located to engage diametrically opposite

fitting receptacles 424 in the planetary output plate 421 when the clutch is in the power transmitting or indexing position. When the yoke is shifted axially on the shaft 253 to an extreme opposite position, the pins 423 are disengaged from the plate 421 and the other ends of these pins are seated in the diametrically disposed locking receptacles 405 which are mounted on the casing 15 in line with receptacles 424. In the locking position the folder conveyor is in a dwell during one of the cycloidal movements of the output plate 421 and the conveyor and clutch mounting 422 are prevented from moving. At points 90 degrees from the mountings of pins 423, the forked ends of the clutch shift lever 426 carry pins or followers 418 which are fitted to track in a peripheral groove 416 in the member 422 so that the member 422 may be shifted back and forth on the shaft 253 when the shift lever 426 is manipulated.

The forked shift lever 426 is pivoted at a point intermediate its ends where it is carried by the shaft 427. The axis of the shaft 427 is in the plane of the forked ends of the shift lever and perpendicular to the vertical plane passing through the axis of the shaft 253. The shaft 427 is journaled at either end in bearings 428 which are mounted on the upright supports 429 of the frame. The lower end of the shift lever 426 is pivotally connected with the shift lever push rod 430 by the link 431 which is pinned at either end and the shift lever push rod is mounted to reciprocate axially in the bearings 432 which are mounted on the casing. The push rod 430 is held from rotating by the pinned connection to the shift lever by the flattened link 431, thereby providing a mounting which retains the cam follower 435 between the bearings 432 upright and in engagement with the cam slot 436. The follower 435 tracks in the cam slot 436 and the latter is cut in the external periphery of the cage 403 in a portion of the cage which projects to one side of the ring gear 402. This cam slot is cut to reciprocate the push rod 430 axially for operating the shift lever 426. In the position shown in Fig. 50, the yoke 422 and pins 423 are in an extreme or engaged position where output power is being transmitted to index the folder conveyor. The cycloidal drive is connected so that the cage 403 makes a complete revolution for each cycle of the film chopper and the cam 436 is cut so that the shift lever will be moved into engaged or power-output position during every other cycloidal movement of the plate 421 and into disengaged, dwell or locked position during alternate cycloidal movements.

The center of crank pins 437 are on radii which are slightly greater than the pitch radius of the planet gears 412 so that the curves of the hypocycloidal movement of the axes of crank pins 437 will be small loops rather than cusps at the ends. The shift points in the cam groove 436 are arranged so that the latch or locking pins 423 will be shifted into and out of the receptacles 405 and 424 during the time that the loops at the ends of the curves are being described. This provides a short interval at the ends of the cycloidal movements during which the pins may be fully entered in the receptacles and during which only a slight movement in either direction takes place. This interval for shifting may be varied at will by varying the relative diameters of the cranks and planet gears. The planetary drive mechanism provides an intermittent drive for the folder conveyor whereby the folder conveyor may be indexed from rest through first a desirable accelerated movement and then back to rest through a decelerated movement which puts a minimum of strain on the relatively heavy conveyor at high speeds and frequent indexing. The appreciable intervals of time at the ends of these accelerated and decelerated movements provide desirable intervals in which positive latching or bolting operations can be successfully completed. It is evident that any of a number of forms of latching or bolting devices can be used.

The memory device

The memory device (Figs. 52 to 55) is a part of a time delay electro-mechanically controlled device which receives and records the signals of defects in the film which are sent out from the inspection booth while the film is passing the chosen inspection point. The device comprises a memory wheel which is turned as the film advances from the inspection point to the chopper so that a given section of the wheel corresponds to a certain length of film. The record or memory of a defect is recorded on the memory wheel in the chosen section thereof. At a controlled subsequent time, such as the period when the given length of film containing the defect is being indexed into the chopper, the memory wheel transmits to a second electro-mechanical train or sequence control device as one signal all the records thereon corresponding to the given length of film. The latter or second train carries the impulse along in step with the advance of the cut film and causes a reject device to operate after a time delay while the given section of film is being severed from the strip and again advanced. At the reject station the sequence control or second time delay device causes a deflector to be actuated which engages the film or film and folder as they enter the station causing them to be deflected into the reject hopper 10 (Fig. 2) and the clamp on the conveyor which engages the film and folder are caused simultaneously to release the deflected folder and film.

Between the constantly driven feed rolls 7 and 7' (Fig. 4) and the intermittently driven feed rolls 14 and 14', the film is looped around an idler or dancer roller 12 which is mounted to rotate (Figs. 1, 2, 4, 13 and 14) on a shaft mounted between the outer ends of the roving or dancer levers 13. The levers 13 (Figs. 13 and 14) are secured to the hollow shaft 41 (Figs. 52 and 53) which carries the dancer arms 42 and 42' of the memory wheel 56 which is within the casing 9. The shaft 41 rotates back and forth as the dancer arm 13 roves up and down and responds to the increase and decrease in size of the loop of film as the film is constantly fed to the loop by the pinch rolls 7 and 7' and is intermittently told out therefrom to the chopper by the pinch rolls 14 and 14'. Because of the constant speed of feeding of the film to the loop and the intermittent telling out of the film from the loop to the cutter during each half cycle of the cutter operation, the loop regularly increases and decreases in size depending upon whether the intermittently driven cutter feed rolls 14 and 14' are at rest or are indexing a length of film under the cutter knife 11 at a speed considerably greater than the speed that the film is supplied by the constant speed rolls 7.

The intermittently driven roll 14 is driven by a one-way clutch 139 which is connected to a

crank-driven rack 91 (Figs. 13, 14 and 15). These are regulated by a suitable driving train so that a dwell plus an indexing operation of the film feeding roll 14 will pass the same length of film as the continuously driven constant speed feed rolls 7 and 7' pass during the same time. With the driving motors 8 and 20 turning at a predetermined speed, the result is that the loop of film between the feed rolls 7 and 14 regularly increases and decreases within fixed limits, thereby regularly reciprocating the arms 42 and 42' within fixed limits. The sector of the memory wheel over which the arms 42 and 42' dance while the memory wheel is dwelling in any given position represents one length of film.

The oscillating hollow shaft 41 of the memory device is mounted to extend into the memory wheel casing 9 and to turn back and forth freely, independently of and concentrically with the shaft 57 to which the memory wheel 56 is pinned or keyed. Within the casing 9, the arms 42 and 42' are attached to the collar 58 by the bolts 42a and the collar 58 rotates freely on the shaft 41.

As the roller 12 at the ends of the dancer levers 13 dances up and down in response to the decreases and increases in the size of the loop of film, the arms 42 and 42' (Fig. 52) which are supported by the hollow shaft 41 are arranged to swing the solenoids 43 and 43' back and forth slightly as the size of the loop changes. The arms 42 and 42' are caused to hunt in response to the dancer arm 13 to which they are connected through the gear 52 keyed to the dancer arm shaft 41. The gear 52 meshes with gears 53 which turn on the stub shafts 44 and 44' mounted on the casing 9 of the memory device and the internally geared arcuate segments 54 which are adjustably mounted by bolts 54' on the arms 42 and 42'. The arms 42 and 42' therefore dance over a sector of the memory wheel which is proportional to the change in the loop or to a length of cut film. It follows that the sector over which the arms 42 and 42' dance while the memory wheel is dwelling in any given position represents some one of the lengths of film. The arms 42 and 42' are spread apart over a sector which is in the same proportion to the distance along the strip of film between the two inspection points.

At or near the ends of the arms 42 and 42' are mounted the small bell crank levers 44 connected at one end to the connecting rods 45 which are connected at their inner ends to the armatures of the solenoids 43 and 43'. Solenoids 43 and 43' are energized by a suitable source of alternating current (Fig. 56) and are connected in the external circuit thereof in series with the normally closed inspector operated switches which make and break the connections between leads 48—48' and 49—49'. These switches may be opened manually by inspectors to give the signals of defects or mechanically by other defect detectors.

The connecting rods 45 are operated back and forth in response to the energization and deenergization of their corresponding solenoids 43 and 43' which are in the circuit of leads 48—48' and 49—49' and a source of power. At their outer ends, each crank 44 bears on a spring receptacle 46 in which a spring 47 is compressed by the crank 44 as long as the solenoids 43 and 43' are energized. The end of the crank which operates on the spring receptacle 46 bears upon the axially slidable pin operators 48a which carry the pin contact rollers 49a at their outer ends. The cranks 44 are mounted to reciprocate on the stub shafts 50 which are secured to the arms 42 and 42'. At their other ends the cranks are connected to the connecting rods 45 by the pins 51.

The solenoids 43 and 43' are desirably arranged to remain energized as long as no signal is sent out from the inspection station that a defect on the film has been detected. As long as the solenoid 43 or 43' is energized, the corresponding connecting rod 45 is retracted toward the solenoid so that the outer end of the crank 44 depresses the spring 47 and the plunger 48a is retracted into position where the rollers 49a are out of engagement with the retractable pins 55. When the solenoid 43 or 43' is deenergized by the signal of a defect, the corresponding spring 47 is released, thereby displacing the outer end of the crank toward the memory wheel and thrusting the pin operating rollers 49a into engagement with the pins 55 on the rotatable indexable memory wheel 56. The memory wheel is moved or indexed only when the film is indexed.

The deenergization of the normally energized solenoids 43 and 43' occur when a defect is registered in response to the inspectors in the inspection station. Thus when one of the inspectors observes a fault in the film, one of the switches is operated, such as switch 48 or 49 (Fig. 4), opening the circuit of solenoid 43 or 43' depending upon which inspector registers the fault. This permits the spring 47 to throw the free end of crank 44 against the pin 48a and to move the roller 55' outwardly into position to depress the pins 55 as the rollers are brought past the pins 55. The pins 55 have two grooves 49a and 55'' in which the balls 55a are impressed by springs 55b for retaining the pins 55 in predetermined normal and displaced positions. The pins remain in displaced position until they are reset after the memory wheel is indexed for operating the switch lever 65. The resetting is done as the displaced pins pass the cam 59 which is integrally attached to the casing 9 by the bolts 59a. The cam 59 has an inclined track 59b which engages the ends of the displaced pins as the memory wheel turns and forces the pins into normal position shown in Figs. 52 and 53.

In Fig. 52 the arms 42 and 42' are displaced clockwise in order to show other parts more clearly. In normal position the outer ends of arms 42 and 42' reciprocate back and forth in an arc somewhat smaller than the abutting members 104 which are secured to the casing by bolts 104' on the opposite side of the memory wheel from the arms 42 and 42'. Abutments 104 are spaced from the memory wheel 56 in order to regulate and make uniform the displacement of the pins 55 and so that a ball 55a will always be secure in the depression 55'' of a displaced pin. This displacement of the pins is regulated and made uniform in order to assure the operation of the switch 65 at an accurate relative displacement of the memory wheel or moment in the time cycle. This time cycle is fixed by placing the switch 65 at the point where the sector of the memory wheel 56 between the arm 42' and the switch will bear the same proportion to the distance between arms 42 and 42' as the average length of film from the inspection point nearer the chopper bears to the length of film between the two inspection points. The memory wheel is indexed clockwise each time a length of film is chopped off as described in the section hereof

entitled The Film Chopper a distance which bears the same proportion to a length of cut film.

Thus the arms **42** and **42'** are separated from each other a distance such that a point on the wheel **56** will pass from arm **42** to arm **42'** while a point on the film is passing from the inspection line in one inspection booth to the inspection line in the other booth, so that the pins in a given arc which are depressed by arm **42** represent defects on one side of the film and the pins in the same arc depressed by the arm **42'** represent the defects on the other side of the film. The pins are thus depressed so long as, or whenever the solenoid circuit is opened by the action of the inspector. The circuit of solenoid **43** may be broken by the inspector assigned to the inspection of one side of the film who is located for breaking the connection **48—48'**. The other inspector inspects the other side of the film and operates the reject switch which opens and closes the circuit **49—49'** of solenoid **43'**. The arms **42** and **42'** are spread apart so that a point on the memory wheel **56** will move from one arm to the other in clockwise direction while a point on the film is moving from one inspection station to the other.

The stationary switch **66** is fixed to the wall of the memory wheel so that its switch lever **65** will be engaged by displaced pins **55** when the momory wheel is operated through its index which corresponds to the indexing of the corresponding section of film between the chopper knives into position to be severed from the strip. The switch arm **65** is thus located so that it will require a pin **55** on memory wheel **56** corresponding to the leading cut edge of a film as long to travel from arm **42** to a point where the pin **55** will just engage switch arm **65**, as the time elapsing from the moment the corresponding point on the film passes the inspection line of the booth **37** farther from the chopping station to travel to the chopper knife, or to the beginning of the cutting cycle or zero point indicated in Fig. 57, the zero point being when the end of the film starts to feed into the cutting position. It follows that all pins **55** representative of a given length of cut film will be indexed past the switch lever **65** as the same length of film is being indexed into cutting position and any and all displaced pins **55** representing defects on either side of that length of film will engage and actuate switch lever **65** to open position during that period of the film feeding cycle. Switch **66** is a self-resetting switch and it will close as soon as any displaced pins **55** have passed beyond the switch lever **65**. The opening of switch **66** breaks the pilot circuit of the sequence control circuit which carries the impulse through the remainder of the operation of the machine.

For example, the memory wheel **56** may be provided with 300 pins arranged in a circle. The gear ratio of the train (gears **93—63—62'—62** shaft **57**) which indexes the memory wheel is then arranged so that the 300 pins represent a strip of film longer than that between the first inspection station and the chopper knife. The gear ratio may be made so that the 300 pins represent 600 inches of film where the distance from the first inspection station to the chopping knife is 500 inches. In this case, each pin on the memory wheel represents two inches of film. The distance between arms **42** and **42'** is then adjusted so that the circumferential distance along the centers of pins **55** between the arms represents the length of film between the inspection points and so that in consequence of the indexing of the memory wheel the same set of pins **55** underneath the pin operating device of arm **42** represents a given length of film passing through the first inspection station, and the same set of pins will be under arm **42'** when that section of film passes through the second inspection station, or station nearer the chopper knives. Therefore one set of pins representing a length of film is carried around on the memory wheel **56** in timed relation to the progress of the film through the inspection stations and loop to the cutter.

In case of an observed defect in this given length of film, one or more of the pins **55** in the series representing that length is displaced by arm **42** or arm **42'** depending upon which side of the film the defect is observed. After passing beyond the range of arm **42'**, the series of pins representing the length in question continues to be carried around the memory wheel as the memory wheel continues to be indexed. When the series of pins has been indexed a distance corresponding to the average length of film between the second inspection point and the chopper knife, a switch lever **65** of the switch **66** is located so that if the pin representing the leading edge of the length of film then to be indexed into chopping position is displaced the pin will contact the switch lever, and so that upon the next indexing of the wheel all the pins representing that length will be indexed past the switch lever **65**. If any of the pins representing this length of film to be cut off have been displaced in response to an observed defect in the film the switch lever **65** will be operated during this indexing while the end of the film is being indexed into cutting position.

Following the switch lever **65** in the direction of rotation of the memory wheel, a reset device is located for resetting any displaced pins **55**. The arm **42** is located to operate at a point beyond where the pins are reset in which interleaving, rejection and stacking take place.

The memory wheel **56** is indexed clockwise by the operation of the one way clutch **139** (Fig. 13) which drives the film chopping knife **11** through a train of gears and levers. The shaft **57** is extended to one side of the memory wheel casing and is mounted in bearings **60** on the casing **9**, and the casing **9** is mounted on the upright **61** of the chopper frame. On the far end of the shaft **57** from the memory wheel the gear wheel **62** is keyed (Fig. 13). This gear wheel meshes with the gear wheel **62'** which is driven by gear wheel **63** and the gear wheel **63** is driven by gear wheel **93** which is keyed to the output shaft **64** of the one way clutch **139**. The one way clutch **139** is driven by the gear wheel **92'** which meshes with the rack **91** and rack **91** is reciprocated by the crank **90**. The crank **90** receives its power from motor **20** through a train which is described in connection with the description of the film chopper.

The arms **42** and **42'** are adjustably mounted on the collar **58** by bolts **42*a*** and the spread between them is adjusted so that the time that it takes a point on the memory wheel to travel from one arm to the other can be regulated to be the same as the time it takes for the continuously moving film to pass from one inspection point to the other. The arms **42** and **42'** are secured to the collar **58** by the bolts **42*a*** which pass through the slots **42*b*** in the base of the arms **42** and **42'** and screw into the collar **58**.

The sequence circuit control

Both the memory wheel 56 and the film feeding rolls 14 are driven from the output of the one-way clutch 136 (Fig. 13) which receives its power from a sprocket wheel 92' which is driven by a rack 91. The rack is reciprocated by a propelling or chopper crank 90 (Fig. 14) which is driven ultimately from the main motor 20 (Fig. 10) through the drive sprocket 70 on the main motor 20, chain 74, input sprocket 75 of the cycloidal drive 15, integrally driven sprocket 76, chain 77, sprocket 78, integrally driven sprocket 79, chain 80, and sprocket 81 which drives the rack 91 and knife crank 126. The sprocket 82 (Figs. 10 and 13) on the same shaft as sprocket 81 drives the transfer turret through chain 83, sprocket 84 and shaft 85. The transfer turret comprises the pedestal 22 and the pallet or table 101 (Fig. 2).

The knife propelling crank 126 causes the chopper knife to travel from rest through a cutting position and back to rest during one-half of a revolution of the crank 90 while the intermittently driven rolls 14 and 14' are at rest. This is considered in the present specification and claims as only a portion of a cycle. During an entire cycle which covers the period from the time that the film starts from rest into the chopping station (the points in the rotation of the sequence control cams designated 0° and 360° in Fig. 57) until it starts from rest to advance the next succeeding length of film into position to be cut is one complete cycle. While the film is being fed into position to be severed during the first half of a cycle, the loop of film in which the dancer roll 12 rests, continually diminishes and the dancer roll 12 changes its vertical position thereby effecting a corresponding change in position in clockwise direction of the dancer arms 42 and 42' of the memory device. At the same time the memory wheel 56 is being proportionally indexed clockwise. During the dwell of the feed rolls 14 and 14' (between points designated 180° and 360° in Fig. 57) the loop increases and the dancer arms move gradually in the opposite direction.

It is therefore apparent that momentary positions of the ends of the dancer arms 42 and 42' correspond to momentary positions of points in the film passing through the inspection booths 37' and 37 respectively. Consequently when a defect in the film is detected by an inspector such as 6a in the inspection booth (at the left in Fig. 4), the intelligence is transmitted to the memory wheel 56 by opening contacts in line 49—49' and causing solenoid 43' to be deenergized, and thereby causing displacement of one or more of the pins 55 which are in the position where the reciprocating arm 42' happens to be disposed at the moment. It is evident that the defect will be recorded in its proper location on the memory wheel by reason of the dancer arm connection just described, the displaced pin 55 will therefore be in a position on the memory wheel which corresponds to the relative position of the defect on one side of the section of film then passing the inspection area of the second inspection booth.

An integration of the signals of defects or pieces of intelligence recorded on the memory wheel takes place when the length of film is indexed into chopping position simultaneously with the indexing past the switch lever 65 of the series of displaced pins. This integration results

in a single signal or impulse which is passed to the sequence control device by opening contacts 66 (Figs. 56 and 57) and deenergizing pilot relay coil CR1S. The sequence control device carries the integrated signal of defects or electrical impulse in sequence with the indexing of the film from station to station after the section of film is severed from the strip so that a defective piece of cut film may be rejected by a device actuated by the impulse at any predetermined desired subsequent period or index.

In the case illustrated the sequence control retains or carries the integrated signal or impulse through one cycle for the purpose of rejecting a defective film and to the beginning of a second cycle for preventing the action of the stacker counter or until the beginning of the third cycle after the film is chopped. At the beginning of the second cycle, the signal is applied to bring into operation the reject device which comprises means for disengaging the film from the machine and deflecting it into a reject hopper. In the illustrated embodiment the integrated signal or impulse is carried by the sequence control relays in sequence with the indexing of the folder conveyor as well as with the indexing of the cut film from station to station since both devices are synchronized.

The folder or separator on the folder conveyor is indexed into a station preceding the interleaving station, then into the interleaving station, then into the reject station and then into the stacker station. The corresponding synchronized operations on the film indexing line are the latter part of the operation at the chopper station, the interleaving operation and the reject operation, the last two stations being identical for the film and the folder.

The sequence control comprises a gang of rotated cams which make and break contacts on switches in the circuits of a series of corresponding relay coils and means for resetting the series of relays into normal or non-rejecting position so that the resetting will be completed at the end of the cycle when a rejection is taking place and the following film is not to be rejected. During the first rotation of the cams of the cycle wherein the integrated signal opens the contacts 66, the sequence control carries the impulse during the next or interleaving cycle. At the beginning of the second cycle or reject cycle of that section of film, the signal has been carried through the sequence control device and it deenergizes the reject solenoid for affecting the deflector of the reject device. During this second cycle as the signal is being progressed to the reject station, the relays at the beginning of the series are being reset so that the resetting operation is completed by the time that the next succeeding cycle starts provided switch 66 has remained closed. This operation prevents succeeding non-rejectable films from being rejected.

Included in the pilot circuit besides switch 66 is an alternative means for setting the reject device in operation when the folder conveyor fails to bring up a folder for interleaving with the cut film. This device comprises the cam operated self-resetting switch 345a (Fig. 11) containing contacts G and a mercury switch 350 containing contacts M (Fig. 56), respectively. Contacts G and M (Figs. 47 and 56) are connected in parallel with each other and in series with the coil CR1S of the pilot relay. At station D, which station precedes the interleaving station on the folder conveyor, the folders are engaged at their

leading edges by the folder clamps which are elevated above the level of the bed of the folder carrier so that the elevated leading edges of the folders grasped by the clamps will engage and displace the operating finger **351** of the mercury switch **350** and move the switch into closing position. During the time that this mercury switch is closed by the presence of a folder at this point, the contacts G in switch **345***a* are opened momentarily by the positively driven cam **345** and then the switch resets itself to close the circuit. Thus the finger of the mercury switch is arranged to engage the leading edge of a folder when the leading edge comes into its dwell point which immediately precedes the interleaving dwell point of that folder to close contacts M of the mercury switch. The period that the mercury switch contacts M are closed by the folder is during a dwell of the folder conveyor. In the rotation of the gang of sequence control cams this is about 225° after the cams have started a cycle until about 45° after the beginning of the next cycle as indicated by the bracket **68** in Fig. 57. After the end of this period the folder starts to be advanced into the next or interleaving position. The cam switch **345***a* is arranged to operate and break the connection between contacts G for a short time during the interval that the mercury switch **350** is closed, as for example, from about the beginning of a cycle to about the 40° point of the cycle of the gang of holding cams. The cam 345 should be set to open switch **345***a* and permit it to close during the interval indicated by the bracket **69** (Fig. 57), and in any event the switch must be closed before the next film length starts to be fed into the chopping station at the beginning of the next cycle, so that the new length of film will not be rejected by reason of the simultaneous opening of contacts M and G in case the film is perfect.

The gang of rotating sequence control cams is located in the box **234** (Fig. 55), consisting of cams C1, C2, C3, C4, C5, C6, C7, C8 and C9 which make one revolution per cycle of the film chopper. These cams are driven from shaft **299** through sprocket wheel **332**, chain **333**, sprocket wheel **334** and shaft **331**. The cams are cut and arranged on the rotating shaft **331** to close switch contacts C1C, C2C, C3C, C4C, C5C, C6C, C7C, C8C and C9C (Fig. 56), respectively, when the cams are rotated into circuit closing positions. The heavy horizontal lines in Fig. 57 indicate the parts of the cycles when the cam controlled contacts are closed. These contacts are closed during the periods of angular rotation of the cams indicated by the vertical lines. For example, the first cam C1 closes the connection between contacts C1C from the time the system of cams rotates from 270° to about 315° of each cycle and cam C2 effects closure of the connection across contacts C2C from 180° to about 240° of the rotation. The zero point in the rotation of the cams is considered to be the same as the zero point in the film cutting cycle, i. e. the points marked 0° and 360° in Fig. 57 are the amounts of angular rotation of the cams from their predetermined or set position when the film starts to enter the cutting cycle.

It follows that the mercury switch finger closes the circuit between the contacts M by engagement with the folder which is next to be advanced into the interleaving position for receiving the length of film which will be advanced into cutting position when the next leading folder is being placed in the interleaving position. During this period or part of a cycle when the folder gripper is in station D, the lack of a folder intended for a given length of cut film will result in the simultaneous breaking of the circuits connecting both contacts G and M as indicated by the overlapping of brackets **68** and **69**, and during the cycle corresponding to the same film and folder the switch **66** will be opened by extended pins **55** on the memory wheel if the same film has a defect as indicated by the point indicated **102** in Fig. 57 which also overlaps the bracket **69**. That is to say, the folder conveyor is so timed with reference to the indexing of the film that the folder conveyor brings the folder into the station where contacts M are opened during the same cycle that the records of defects on the memory wheel are integrated and these messages or impulses are passed to the pilot circuit of the sequence control. Since (Fig. 57) the circuits containing contacts G and M are both opened during the cycle that contacts **66** would be opened if the film had a defect, then the simultaneous opening of the cam switch and the mercury switch is equivalent to the opening of contacts **66** by the memory wheel pins **55** in its effect upon the reject device as of the time when the folder and the film to be enclosed in that folder reach the reject station. The simultaneous opening of contacts M and G, therefore, breaks the circuit of the solenoid coil CR1S and initiates the rejection of the film which lacks a folder, the same as the opening of contacts **66** affects the coil in the case of a recorded defective film.

In the sequence control device the rotating cams C1 to C9 close the contacts C1C to C9C as the cut film is advanced by the folder conveyor toward the stacking station. The coils of the relays corresponding to cams C1 to C5 and contacts C1C to C5C are CR1S to CR5S. The contacts closed by these relays are CR1C and CR1 by the energization of relay coil CR1S, CR2C and CR2 by the energization of relay coil CR2S, contacts CR3C and CR3 by coil CR3S, CR4C and CR4 by coil CR4S, CR5C and CR5 by coil CR5S.

The relays containing coils CR1S to CR5S of the sequence control device indicated in Fig. 56 are normally open double contact relays. Such relays are illustrated in Fig. 61 in which the parts corresponding to the relay used in the pilot circuit is shown. Referring to Fig. 61 the relay, mounted upon a base **550** of insulating material comprises two pairs of contacts CR1 and CR1C and the solenoid or coil CR1S. The conductive members **551** and **552** bearing the contacts CR1 are normally open and are connected by the wires **553** and **554** to the opposite sides of the line. Similar conductive members **555** and **556** bearing the contacts CR1C are connected to opposite sides of the line by wires **557** and **558**. The conductive members **551** and **555** are mounted stationary on the base **550** and members **552** and **556** are insulated from each other and mounted on a cross bar **559** which carries an operating finger **560**. The cross bar **559** is mounted to rock on the shaft **561** which is carried at its ends by posts **562** mounted on the base **550**. A coil spring **563** is suitably mounted in tension between the finger **560** and the base **550** for maintaining the contacts normally open when the solenoid CR1S is not energized. The core of the solenoid CR1S is suitably connected to the conductive members **552** and **556** so that when the solenoid is energized the conductors will be drawn down in opposition to the spring **563** and the contacts CR1 and CR1C closed.

Relay coil (Fig. 56) is caused to be energized by closing contacts CR3C across the leads TT1 and TT2, and this coil closes contacts WL1C in the circuit of the reject solenoid. Relay coil WL2 is energized when relay contacts CR5 are closed and this coil controls the closing of contacts WL2C in the circuit of the counter solenoid 457. These relays are normally open single contact relays similar in construction to the double contact relays above described.

At the beginning of an operation the machine is commonly run while feeding film and folders with the manual switch 67 in the pilot circuit of the relay coil CR1S or the contacts WTD in the inspection circuit in open position so that the coil CR1S will be continuously deenergized, the reject solenoid will be deenergized and the films in their folders will be rejected whether they are perfect films or imperfect films. At this time, all of the contact relay coils, the reject solenoid and the counter solenoid will be deenergized. When this operation has come to equilibrium the manual switch 67 and contacts WTD are closed to put the pilot and inspection circuits in normal running condition. Assuming that all of the films entering the cutting station are perfect for the time being and that the separators or folders are brought forward regularly, cam C1 (Fig. 55) will close the circuit between contacts C1C when the cam has revolved 270° from the beginning of its cycle as indicated in Fig. 57. The circuit of the contact relay coil CR1S will therefore be closed between the current supply leads TT1 and TT2 which are connected to the opposite terminals of a suitable alternating current source. The energization of the relay coil CR1S will close the circuit across the holding contacts CR1C and the contacts CR1 so that when the gang of cams has passed beyond 270°+ about 45°, the circuit between contacts C1C will be opened by the turning of the cam C1 but the circuit between the holding contacts CR1C being closed, the coil CR1S will remain energized and the circuits between contacts CR1C and CR1 will remain closed until the line is broken by opening switch 66, the hand operated switch 67 or the simultaneous opening of the parallel connected cam switch G and mercury switch M in this pilot circuit.

When the gang of cams has completed 180° of the second revolution or cycle, cam C2 closes the circuit between contacts C2C. Since the circuit across the relay contacts CR1 is already closed, the circuit of the coil CR2S of the second contact relay will therefore be closed. The energization of coil CR2S closes the circuits across the holding contacts CR2C and contacts CR2.

Just before the second cam opens the connection between contacts C2C or at about 200°, the third cam C3 closes contacts C3C so that when the connection between contact C2C is opened by cam C2, the circuit of the second coil CR2S will remain closed across the closed contacts C3C and CR2C. When the gang of cams has revolved through about 45° of the third cycle, the fourth cam C4 closes the circuit between contacts C4C. Since contacts CR2 were previously closed by the energization of coil CR2S of the second relay the circuit through the coil of the third contact relay CR3S will be closed, coil CR3S will be energized, closing the circuits between holding contacts CR3C and contacts CR3. Before the circuit between contacts C4C will have been opened by the cam C4 at about the 100° point of the next or third revolution of the cams, the fifth cam C5 will have closed contacts C5C at about the 80° point. This closes the circuit through CR3S, C5C and CR3C holding the circuit through coil WL1 and CR3C. The coil WL1 being energized, the connection through contacts WL1C will be closed, thereby closing the circuit which contains the reject solenoid and energizing the reject solenoid. The energization of this solenoid maintains the reject station in a non-reject or normal running condition.

At about the 315° point of this third revolution of the cams, the sixth cam HC6 closes the connection between contacts C6C. Since the contacts CR3 are already closed, the circuit through the coil CR4S of the fourth contact relay will be held closed until the seventh cam C7 closes the contacts C7C at a point slightly less than 45° of the fourth revolution of the cams. The seventh cam is cut to maintain contacts C7C closed until about the 350° point of the revolution of the same cycle, but at about the 250° point of this cycle of the cams the eighth cam C8 is arranged to close the connection between contacts C8C thereby closing the circuit of the coil CR5S through the contact points C8C, thereby closing the circuit of the coil CR5S through the contact points C8C and CR4 of the fourth contact relay. The energization of the coil CR5S closes the holding contacts CR5C and the contacts CR5. During the latter part of the closure of contacts C8C, the contacts C9C are closed by the ninth cam C9 at about the 310° point of the revolution of the cams. Since the relay contacts CR5C are already closed, the energization of solenoid CR5S will be held although contacts C8C are opened by the eighth cam.

The closing of the circuit through relay contacts CR5 previously mentioned closes the circuit through relay coil WL2 which controls the contacts WL2C. The latter are closed upon energization of the coil WL2 and this results in closing the circuit of the counter pawl solenoid and energizinng the coil 457 of the counter pawl solenoid. This puts the counting device at the stacking station in normal running condition so that the stacking conveyor will be indexed a short distance each time a predetermined number or series of assembled films and separators are deposited and then given a long index for the start of a new series. In subsequent revolutions of the gang of cams, or in other words in the subsequent cycles, the reject solenoid and the count solenoid will remain energized as long as switch 66 and manual switch 67 or their equivalent, such as the simultaneous breaking of the parallel circuits containing contacts G and M remain closed, and coil CR1S will remain energized, even though the contacts C1C to C9C continue to be periodically opened and closed each cycle by the revolution of the cams C1 to C9.

When, however, the circuit of the pilot relay coil CR1S is opened for any reason during the feeding of the film to the chopper which coincides with the integration of the record of defects on the memory wheel, with the dwell of a folder at station D and with the first 90° of revolution of the cams, as by the opening of manual switch 67 (or switch WTD which is in series with both inspection switches 48 and 49), the contacts of switch 66 open by reason of a displaced pin 55 which is displaced by the signal of a defect from the inspection station, or when in a prior cycle by the failure to supply a folder at station D the parallel circuits containing contacts G and M are simultaneously broken, then coil CR1S will

be deenergized and contacts CR1C and CR1 will be opened. Thus for a given film the coil CR1S will be deenergized during the first 180° of revolution of the cams, if there is the lack of a folder, or a defective film severed from the strip, or if a test switch WTD or 67 is opened; and the first holding circuit of the sequence control will become ineffective.

For example, in case a defective film length is fed into the cutting position, during the integrating period or first 180° of revolution of the cams, a displaced pin or pins 55 on the memory wheel corresponding to a defect in the film length encounter switch lever 65, open contacts 66 and cause coil CR1S to deenergize. The relay then operates to break the circuit containing contacts CR1C and CR1. When the third cam C3 has rotated to its circuit-breaking position, say 10° beyond 180°, the circuit through contacts C3C will be broken so that coil CR2S will deenergize because the contact at CR1 is already broken. The deenergization of relay coil CR2S results in opening the contact at CR2C and CR2. When the fifth cam has turned to its open position between about 45° and 70° of the next cycle, the circuit through contacts C5C is broken thereby deenergizing coil CR3S because the parallel circuit through contact CR2 is already broken. This opens the circuit through contacts CR3C and CR3. The circuit through CR3S, C5C and coil WL1 being broken, coil WL1 will deenergize breaking the circuit through contacts WL1C and causing the reject coil to deenergize. This permits the intercepter at the reject station to be raised into its film-rejecting position at about 80° of the second cycle of the cams where it remains until it closes at about 265° of the revolution of the cams by reason of the resetting of the relays and reenergization of the solenoid.

When cam C7 has turned to its contact opening position between about 320° of the second cycle and about 45° of the third revolution of the cams, the circuit through contacts C7C will be broken. This connection and the parallel connection through contacts CR3 being broken, the coil CR4S will deenergize breaking the circuits through contacts CR4C and CR4. When the cam C9 has turned to its circuit-breaking position between about 260° and about 320° of the third revolution of the cams, the circuit through contacts C9C will be broken. The parallel circuit through contacts CR4 having been previously broken, the coil CR5S will deenergize and break the circuit through contacts CR5C and CR5. The circuit through contacts CR5 being broken, contact relay coil WL2 will deenergize breaking the circuit between the contacts WL2C of this contact relay. This circuit being broken, the counter pawl solenoid 457 will deenergize and prevent the stacking conveyor from indexing forward as it would have indexed if the film had not been intercepted, rejected and removed from the normal course that a perfect film would have taken. On this third cycle of the cams, the counter pawl will have been made inoperative before power input which indexes the stacker conveyor will have been applied. Therefore the stacker conveyor will not be indexed for counting.

The stacker conveyor, the reject station and the interleaving station are located so that the cut film will be transferred to them in turn during three successive cycles of the folder conveyor and the cams, the folder conveyor being indexed and the cams turning continuously. The driving devices for the folder conveyor which transports the folders into station D thereof prior to the interleaving station for operating the mercury switch arm which opens and closes the connection between contacts M, and for carrying the folders or folders and film into the successive interleaving, reject and stacking stations is described in connection with the description of the folder conveyor.

Motor drive and correlation of the motors

The main motor 20 drives the film chopper, the folder conveyor with its intermediately connected cycloidal drive, the reject device and the stacking conveyor. The driving connections are shown in Figs. 10, 11, and 12. The strip of film which is brought through the inspection device to the chopper is continuously advanced forwardly by the pinch rolls 7 which are driven by the unwind motor 8 (Fig. 2). A loop of film is maintained between the continuously driven rolls 7 and the intermittently driven rolls 14 which latter tell out the film to the film chopper. The dancer roll which reciprocates the memory wheel arms 42 and 42' rests in the concave loop of the film, like a weight in a hammock. The main motor 20 and unwind motor 8 may desirably be direct current electric motors of suitable power and speed, which are supplied with power from any suitable source. These motors are desirably interconnected to a single starter which simultaneously starts both motors. Suitable starters of well-known design for this purpose are available and are not described in detail.

In the modification shown, the unwind motor 8 drives the pinch rolls 7 for bringing the continuous supply of film through the inspection device to the dancer loop from which the strip is told out to the intermittently driven rolls 14 of the chopping machine which are driven by the motor 20. The motor 8 is a direct current motor, the normal speed of which is correlated with the speed of main motor 20, and regulated by the device now to be described so that the continuous feed of film to the dancer loop will be maintained equal to the paying out of the film to the chopper.

This maintenance of a loop is desired in order that the predetermined limiting positions of the dancer will be maintained, and in order that the relative position of the arms 42 and 42' with respect to the memory wheel 56, the switch 66 and the film at the inspection stations will be maintained as originally adjusted. As long as the motor 8 which is supplied with power from a suitable direct current source through leads 185 and 186 (Fig. 2), which drives the continuously driven rolls 7, and the motor 20 which is supplied with power from a suitable current source through leads 188 and 189 (Fig. 1), drives the rolls 14 and pays out the film intermittently from the loop to the chopper, continue to run at their proper operating and predetermined speeds, the loop will increase and decrease through the same cycle and the arms 42 and 42' will likewise bear a constant relation to a fixed point, such as the fixed position of the switch lever 65.

It is necessary to maintain this predetermined relation in order to assure that a given set of pins 55 of the memory device will correspond exactly to a given length of film passing through the inspection station, and consequently to be assured that a given set of pins 55 will corre-

spond to a given cut film length and that any displaced pin among the given set of pins 55 will be in position to operate the switch lever 65 when the leading end of the film is in position to start advancing into the chopping station at the beginning of a cutting cycle. When this state of equilibrium or correlation is upset by reason of one or the other of the motors 8 or 20 running at a relatively excessive speed, the relative position of the arms 42 and 42' with respect to the switch 66 will be nearer or farther from switch 66 than the predetermined or normal position thereof, depending upon which of the motors 8 or 20 is running ahead of the other. Correction of the speed of these motors is needed since, as a practical matter, the power input to the several motors is not constant and numerous conditions met in practice may vary the relative speeds of the motors temporarily.

The device for correlating the speed of the motors (Figs. 52 and 53) comprises the gear wheel 145 which is keyed to the dancer shaft 41 and rotates back and forth as the arms 42 and 42' are rotated by this shaft in response to the inclination of the dancer arms 13 and the size of the film loop. Meshing with the gear wheel 145 is gear wheel 146 which is mounted to rotate on the stub shaft 147. The stub shaft 147 is threaded at one end and affixed to a panel 148 by the nut 147'. The bed plate 148 is attached to and spaced from the casing wall 9 by the stud 150. The gear wheel 151 is also mounted to rotate on the shaft 147 and is coupled to the gear wheel 146 so that there will be lost motion in the rotation of gear wheel 146 before wheel 151 is rotated, the lost motion corresponding to the normal oscillation of the arms 42 and 42'. This lost motion may desirably be provided by mounting two bosses or stops 157 on the wheel 151 which are separated from each other on an arc so that pin 156 which projects from the facing surface of wheel 146 will just engage the bosses at the limits of its normal reciprocation when the motors are running at normal speeds and normal maximum and minimum film loops are being produced. The bosses are thus spaced apart so that the pin 156 will not displace either of the pins 157 or turn wheel 151 during normal reciprocation of the wheel 146; but when the normal reciprocation is exceeded in either direction by reason of a faulty film loop, abnormal displacement of arms 42 and 42' and consequent abnormal displacement of pin 156 in one direction or the other, the pin 156 will engage the boss 157 and turn the wheel 151 one way or the other, depending upon whether the loop is too long or too short. One or both of the stops 157 may desirably be mounted in arcuate slots in the wheel 151 so that accurate adjustment of the bosses may be made to suit the normal adjustment of the arms 42 and 42' and the positions of the dancer arm and loop.

The wheel 146 therefore rotates back and forth in unison with the oscillatory movement of the arms 42 and 42' but wheel 151 is displaced one way or the other only when there is an abnormal displacement of arms 42 and 42' which ultimately results from one of the drive motors getting ahead of the other and forming an abnormally long or abnormally short loop. The stub shaft 147 is flanged at one end to retain the wheel 146 and at the other the nut 147' secures the stud to the panel 148. The wheel 151 meshes with and drives the pinion 149 which is attached integrally to the operating shaft 152 of the potentiometer 153. The potentiometer 153 is connected to vary the voltage of the direct current supplied to motor 8. The potentiometer 153 is mounted on the panel 148 by means of bracket 154 which is secured to the panel by the stud 155.

The unwind motor 8 (Fig. 1) which unwinds the film from the roll, draws the film through the inspection booths and delivers it continuously to the loop, is a direct current compound wound motor powered from an alternating current power line by means of a standard thyratron signal controlled rectifier, such as the apparatus designated CR–7507–F–101–A16 in the catalog of the General Electric Co., for 1947, the details and layout of which are well known to the art. The negative main power output line 185 (Fig. 58) is connected to the motor 8. The other or positive lead 186 is connected to the output of a pair of parallel connected thyratrons through the relay contacts 189 which are caused to be closed by a relay (not shown) when the starter circuit of the motor 20 is closed.

A desirable rectifier is one in which the output voltage is about three times the signal input and linearly proportional to it in reference to the signal voltage. The signal voltage is derived from a tachometer generator 176 (Figs. 10 and 58) which is driven from the main motor 20. The negative side of the tachometer output is connected to the negative signal lead through a potentiometer 179. The other side of the tachometer generator completes the loop to the negative lead through the manually operated calibrating potentiometer 177, the dancer-arm-controlled potentiometer 153 and the manually operated resistor 163. The movable arm of resistor 163 is the terminal of the positive signal lead.

The voltage from the tachometer motor which is utilized for the signal is first manually regulated by the potentiometers 177 and 179 and by regulation of the resistor 163. This, however, permits of a maximum error in the speed of motor 20 of about 1%. In order to correct this 1% possible error in speed, the dancer potentiometer 153 continually modulates the part of the voltage used as signal voltage by momentary adjustments. The shaft 152 of the potentiometer 153 is connected to the dancer arms of the memory wheels so that a displacement caused by an excessively large film loop will cause the speed of motor 8 to be reduced until the dancer arms have returned to normal position, and so that an abnormally small loop will speed the motor 8 to restore a normal loop.

For example, with a given speed of the main motor 20 and tachometer generator 176 and a relatively excessive speed of the unwind motor 8, the loop of film will increase until the arms 42 and 42' are in an abnormal position and the potentiometer 153 is moved to a position of increased resistance so that the total voltage impressed on the armature and series field 162 of the motor 8 will be decreased and the speed of the motor decreased until a normal loop and a normal position of the arms 42 and 42' will have been reestablished. Whenever the unwind motor 8 gets behind motor 20 in its relative speed, resulting in an insufficient feed of film to the loop and an abnormally small loop, the potentiometer resistance 153 is decreased so that the resistance in the tachometer output will be decreased, the voltage on the series winding 162 of the motor 8

will be increased and the speed of the motor 8 will be increased to reestablish the normal loop. In case the motor 20 varies its speed relative to the speed of motor 8 by reason of the power impressed upon it from the main source of supply and as a consequence the film loop becomes abnormally short or long so as to operate the potentiometer 153, it follows that a similar effect on the motor 8 will be produced until a state of normal equilibrium will have been established, a normal loop will be maintained and a normal relative position of the arms 42 and 42' with respect to the switch 66 will be established.

The threading device

In starting a new length of film into the inspection booth and in emergencies, it is desirable to energize motor 8 for threading the film without running motor 20. For this purpose (Fig. 59) a relay circuit across the alternating current power supply line is arranged to be closed and opened by the manually operated switch 190 for energizing coil 191 and closing contacts 189 and 192, the latter being in a loop with the threading speed adjusting potentiometer 193. The loop is completed by connecting it to the positive side between the motor and the signal controlled power rectifier 184. By varying the voltage on the positive side by manipulation of the resistance in potentiometer 193, the speed of the motor 8 for threading is adjusted. This wiring may be combined with the signal circuit of Fig. 58 by including the potentiometer 179 as indicated.

The starter relay and emergency stop device

Both the main motor 20 for driving the chopper, the memory wheel and the assembly units, and the unwind motor 8 for supplying the film for driving the strip of film through the inspection booths and supplying it to the loop are started by a single starter arrangement (Fig. 60) having a relay circuit which may be manually closed by a starter switch 210. The circuit includes two relays connected in parallel which may be alternating current actuated relays having the solenoid coils F and WL3 for operating switches for making and breaking connection across contact points 211 and 189 of the direct current power supply circuits for motors 20 and 8, respectively. The starter relays are of the kind which make the connections across contact points 211 and 189 of the motor circuits upon a first closing of the alternating current relay circuit through the starter button 210 and then open the connections upon a second closing of the relay circuits or manual operation of the starter button.

In the starter relay circuit are three parallel connected contacts 342, 343 and 344. Contacts 342 and 343 are contacts of mercury switches 347 and 348 which are operated to close whenever separators or folders are brought into stations B and C (Fig. 34), respectively, of the folder conveyor. The third parallel connected contact 344 in this relay circuit is opened and closed periodically by cam 349 which is mounted on shaft 299 (Fig. 11) to operate the switch lever of the self-resetting switch 346 (Fig. 55) and is driven continuously from motor 20. The cam 349 is timed to open contacts 344 during some of the time that contacts 342 and 343 (Fig. 60) of the mercury switches 347 and 348 (Fig. 34) are closed by the folders which are brought into stations B and C, and to remain closed the rest of the time. Thus when both or only one of the stations B and C contains a folder and the relay starting circuit is closed and in running position, the starter relay circuit will be maintained and the power supply lines to motors 8 and 20 will remain closed. When, however, there is a failure of two consecutive folders in stations B and C, as for example when there are no folders supplied by the folder hopper, both contacts 342 and 343 will be open and as soon as the cam operated contacts 344 are opened in switch 346, both coils F and WL3 will be deenergized, contacts 211 and 189 in the direct current power supply circuits of motors 8 and 20 will be opened and the entire machine will stop. In this way, assurance is provided for preventing the continued operation of the machine when there is a failure in supplying two or more folders. By providing one or more folder operated mercury switches with contacts in the starter relay circuit in parallel with the cam operated contacts 344, the machine may be automatically stopped when there is a failure in the delivery of folders equal to the number of switches. For this purpose the number of no-folder stations, such as stations B and C, would be provided which corresponds to the number of contacts, such as 342 and 343 that are in parallel with contacts 344, and a corresponding rearrangement in the span of the conveyor chains would be provided.

From the foregoing disclosure it will be recognized that the invention is susceptible of modification without departing from the spirit and scope thereof and it is to be understood that the invention is not restricted to the specific illustrations thereof herein set forth.

We claim:

1. A device for assembling predetermined lengths of sheet form material which comprises means for inspecting the material; means for interleaving individual lengths of the material with separators; and means for collecting acceptable lengths of said material in bundles of predetermined size; said inspection means comprising means for separately recording defects in areas constituting individual lengths of the material, a device for rejecting defective interleaved lengths of the material, and means for delaying the record of defects in a given individual length while the same is being interleaved with a separator.

2. A device for assembling predetermined lengths of sheet form material derived from a strip thereof and for separating defective lengths from acceptable lengths which comprises means for cutting the strip into lengths; a separator conveyor for conveying separators into interleaving position; a transfer device for transferring the lengths from said cutter means into interleaving juxtaposition with the separators; means for carrying the interleaved lengths and separators away from the transfer device; means for collecting the interleaved lengths and separators from said carrying means; a reject device located to receive defective lengths from said carrier, said reject device comprising a releasor for releasing the length from said carrier and a deflector for diverting the same from said carrier.

3. A device in accordance with claim 2 in which said collecting means comprises an indexed conveyor having means correlated with said interleaving means for indexing the same a relatively short distance corresponding to a predetermined number of interleaving operations; means for indexing the same a relatively long distance for starting a new bundle when a predetermined

number of units has been collected; and means for preventing the indexing of the conveyor whenever a length is rejected by said rejecting means.

4. A device in accordance with claim 2 in which said conveyor has grippers for carrying separators into interleaving position with said lengths of material; means for opening the grippers and releasing the separator during the interleaving of a length and separator, and then gripping the interleaved length and separator; and other means for retaining the separator in interleaving position during the release thereof by the grippers.

5. A device in accordance with claim 2 in which the separator conveyor has means for carrying separators in the form of extensible folders between the leaves of which the lengths are to be interleaved; means for advancing the conveyor by cycles consisting of alternate indexes and dwells whilst the length to be cut from the strip is being advanced into the cutter and held there for cutting during cycles of advancing and dwelling of like duration; said means for carrying the folders including releasable grippers provided with closing means for gripping the interleaved lengths and separators for carrying them away from the transfer device; means for opening the grippers for releasing said folders during the interleaving part of the cycle; and means for maintaining the folders in place during the interleaving operation of the transfer device.

6. A device in accordance with claim 2 in which the separator conveyor has means for carrying separators in the form of extensible folders between the leaves of which the lengths are to be interleaved; means for advancing the conveyor by cycles consisting of alternate indexes and dwells whilst the length to be cut from the strip is being advanced into the cutter and held there for cutting during cycles of advancing and dwelling of like duration; said means for carrying the folders including releasable grippers provided with closing means for gripping the interleaved lengths and separators for carrying them away from the transfer device; means for opening the grippers for releasing said folders during the interleaving; means for separating the leaves of the folders during the interleaving operation of the transfer device; and means for actuating a gripper for clamping the length and folder together with the interleaving operation is completed.

7. A device in accordance with claim 2 in which the separator conveyor is an endless conveyor having clamps mounted thereon for gripping the leading edge of a separator; means for indexing said clamps and dwelling the same momentarily at loading, interleaving, reject and stacking stations; means at the loading station for opening the clamps for receiving the leading edge of a separator during the dwell at said station; a separator receptacle; and means for extracting a single separator from the separator receptacle and placing its leading edge in position to be gripped while a clamp is opened at the loading station which comprises an open ended suction arm supported by a carrier having a horizontal slot therein; a bearing member engaging said horizontal slot for permitting a horizontal movement of the carrier on said bearing member and a horizontal movement of the end of said suction arm toward and away from the clamp in a vertical plane; and means for reciprocating the carrier through a curved path in said vertical plane and the open end of said suction arm through a similar curved path, the said arm and clamp being disposed so that the lower surface of a separator is engaged by the open end of said suction arm when the end of the arm is in an extreme upward and forward position, and said operating means being connected so that after engagement of the separator the arm will first draw the separator backwardly and downwardly until the leading edge of the separator is disengaged from a leading lower edge of the separator receptacle, then forwardly and downwardly until said edge of the separator is disposed in clamping position in the gripper, and then upwardly into contact with the lower surface of another separator after said clamp is closed and the first separator is indexed out of said lowering position.

8. A device in accordance with claim 2 in which the separator conveyor is an endless conveyor having clamps mounted thereon for gripping the leading edges of separators; means for indexing the said clamps and dwelling the same momentarily in loading, interleaving, reject, stacking and another station immediately preceding the interleaving station; said reject device including a pilot relay circuit and means connected to said pilot relay circuit which is operable by a separator at said other station for preventing the rejection of said separator when it is indexed into the reject station, said means being connected to cause the rejection of a length of said material when a clamp destined to carry a separator for said length is indexed into said other station and it is devoid of said separator.

9. A device in accordance with claim 2 in which the separator conveyor is an endless conveyor having clamps mounted thereon for gripping the leading edges of separators; means for indexing said clamps and dwelling the same in loading, interleaving, reject, stacking and two other stations immediately succeeding the loading station; an electrical motor connected to a power supply line for driving said indexing means; said reject device including a pilot relay circuit connected to maintain the power supply line closed when the pilot relay circuit is in normal running position; and means operable by separators when the same are positioned at said two other stations for maintaining said pilot relay circuit in normal running position and preventing said conveyor from stopping, said means being operable for discontinuing the power supply to said motor when both of said stations are devoid of separators.

10. A device in accordance with claim 2 in which the separator conveyor is an endless conveyor having releasable clamps mounted thereon for gripping the leading edges of separators; means for indexing said clamps and dwelling the same in loading, interleaving, reject and stacking stations; means for releasing the clamps whenever they are disposed at the interleaving and stacking stations; and means at the interleaving station for retaining the separator in interleaving position while the clamp is released.

11. A device in accordance with claim 2 in which the separator conveyor is an endless conveyor having clamps mounted thereon for gripping the folded edges of separators which have upper and lower leaves; means for indexing the said clamps and dwelling the same momentarily in loading, interleaving, reject and stacking stations; means for releasing the clamps whenever they are disposed at the interleaving station; and means at the interleaving station for opening the leaves of a folder for interleaving a length of material therebetween and for retaining the

folder in interleaving position while the clamp is released.

12. A device in accordance with claim 2 in which the separator conveyor is an endless conveyor having clamps mounted thereon for gripping the folded edges of separators which have upper and lower leaves; means for indexing the said clamps and dwelling the same momentarily in loading, interleaving, reject and stacking stations; means for releasing the clamps whenever they are disposed at the interleaving station; and means at the interleaving station for opening the leaves of a folder for interleaving a length of material therebetween and for retaining each folder in interleaving position while being released, said means for retaining the folder including a suction header having an upwardly facing perforated wall over which the folder is drawn for closing said perforations when it is indexed into the interleaving station; said means for opening the leaves of said folder comprising an open ended suction arm; means for lowering the open end of said arm into contact with the upper leaf of said folder for closing the open end of said arm; means for raising the arm for separating the upper leaf from said lower leaf before said clamp is released at the interleaving station and for retaining said arm in raised position until after the length is interleaved.

13. An apparatus for assembling lengths of sheet form material which comprises an inspection device for identifying defects as a strip of said material passes said device; means for maintaining continuous and uninterrupted passage of the strip through said inspection device; a chopper for cutting the strip into lengths; means for interleaving said chopped-off lengths with separator; means located between said inspection device and said chopper for intermittently feeding to the chopper in predetermined cycles lengths of the strip of given length, said cycles consisting of alternate dwells and feedings of the strip at an average speed such that each length fed to the chopper in unit time is the same as the length of strip which continuously and uninterruptedly passes said inspection device in unit time whereby a given loop of said strip is formed between the inspection device and said intermittent chopper feed; a memory device including a rotatable element having a record means thereon for recording the relative position of a defect on said strip; recording means for impressing said record on said rotatable element; said recording means including an impulse receiver and a reciprocating arm carrying said recording means; means for indexing said rotatable means coincidentally with the indexing of the strip into the chopper a distance bearing a given proportion to the length of strip indexed; means for reciprocating said reciprocating arm in response to changes in the size of the loop a distance which bears the same ratio to the changes of length in the loop that the said indexing of the rotatable member bears to said length, whereby the length of said record on the rotatable member will bear the same ratio to the length of strip indexed; an impulse activator operable by said record; a reject device having means including said impulse activator for rejecting defective strips, the distance along said strip of material from the point of inspection to the cut off end thereof bearing the same ratio to the distance on said rotatable member from the beginning of the record of the length to the impulse activator; and means for indexing all records of the given length on the rotatable member past the impulse activator when the length of sheet material is indexed into the chopper; said reject device comprising a time delay means for delaying the operation of the reject device until after the operation of said interleaving means, said time delay means being set in operation for rejecting a length of cut off material when said impulse activator is engaged by the record of a defect on said rotatable member, whereby a length or sheet material having a defect observed at the inspection station will be rejected whether or not it is interleaved with a separator.

14. A device for assembling lengths of the sheet form material which comprises means for inspecting the material for identifying defects therein; means for combining said lengths of material with separators; means for collecting acceptable interleaved lengths of said material in bundles of predetermined size; and means for rejecting all lengths of the material which are not interleaved with separators and all interleaved lengths which are defective; said combining means comprising a transfer station having a transfer pallet for receiving the lengths of material to be interleaved, means for turning the transfer pallet through an angle for bringing a length of material disposed thereon into interleaved juxtaposition with a separator and to return the pallet to its initial position for the deposit thereon of another length of said material; means for depositing lengths of the material in a predetermined fixed position on the transfer pallet; means for clamping said lengths in said fixed position on the pallet; and means for delivering the interleaved acceptable lengths to said collecting means for collecting the same into bundles.

15. A device for assembling predetermined lengths of sheet material which comprises an inspection station; means for continuously and uninterruptedly feeding a strip of said sheet material through the inspection station at a predetermined rate; a chopper for subdividing the strip into predetermined lengths to be assembled; an interleaving station; a reject station; means for maintaining a loop of the strip between the inspection station and chopper; means for intermittently feeding out lengths of said strip to the chopper directly from the loop; said means for maintaining a loop comprising a feeder for continuously and uninterruptedly supplying the strip of material to said loop at a rate equal to the average rate of the intermittent feeding of the continuous strip from the loop to the chopper, thereby to fix the limits of changes in said loop; means for sending out reports from the inspection station when a defect in said strip of material is identified; a memory device comprising a rotatable member and a recording means for receiving said reports of defects detected at the inspection station and recording them on said rotatable member; means for indexing said rotatable member coincidentally with the feeding out of the strip from the loop and proportional in amount to each length of film fed out from said loop; said means for recording the reports of defects in said strip comprising a carrier therefor and means for reciprocating the carrier relative to said rotatable member and proportionally to the changes in said loop whereby a given length of strip later to be subdivided will be represented on said rotatable member by a given section thereof wherein reports of defects in the given length are recordable; a time delay initiator operable by

said record of a defect on said rotatable member, said means for recording the reports of defects on the rotatable member being located to make a unitary record of a defect on the rotatable member located at a point removed from said time delay initiator a distance which bears the same proportion to the length along the strip from the defect reported to the end of the strip at the chopper that the proportionate length of the strip on the rotatable member bears to the length which is to be cut from the end of the strip; an interleaving station; a transfer device for transferring a cut off length of strip from the chopper into said interleaving station; a conveyor carrying releasable grippers for gripping and transferring the chopped off lengths of said strip from the interleaving station to said reject station; a reject device disposed at a reject position to receive defective lengths released from said conveyor and having gripper releasing means and a deflector means for deflecting cut off lengths at the reject station; and a time delay device having means operable for initiating the operation of said gripper releasing and film deflector means, said time delay device having means for delaying the opening of a gripper until the defective film is indexed into said reject position.

16. The device in accordance with claim 15 in which the reject device comprises means for interposing the deflector means in the path of a defective film before said film is indexed into said reject station.

17. The device in accordance with claim 15 in which the gripper releasing and deflector means of the reject device comprises a mounting carrying a solenoid electrically connected and controlled by the time delay device for receiving relayed reject signals, a solenoid armature operable into normal and discharge positions in response to the signals received by said solenoid, a latching member mechanically operable by said armature for latching a gripper release cam, a connector for interposing said cam in the path of a gripper release lever in response to a reject signal received by the solenoid, a cam lever having one end operatively connected to a rotating cam which is arranged for operating the lever into reject position each cycle, means including said latching member for uniting said cam lever and said connector in response to a reject signal received by said solenoid for actuating said connector and gripper release cam into reject position, and means uniting said connector and said deflector for interposing said deflector in the path of a defective length of the sheet material in response to said reject signal.

18. A device for assembling predetermined lengths of sheet material derived from a strip thereof which comprises an inspection station; means including a continuously driven motor for feeding a strip of said sheet material through the inspection station continuously at a predetermined rate; a chopper for subdividing the strip into said predetermined lengths to be assembled; means for maintaining a loop of the strip between the inspection station and chopper; means including another continuously driven motor for intermittently feeding out said lengths of said strip to the chopper directly from the loop; a memory device comprising a rotatable member and means for indexing the same in one direction a predetermined distance which is proportional to said length of sheet material when said length is intermittently fed out of said loop; said memory device comprising an arm radially disposed with respect to said rotatable member and mounted for angular reciprocation on a shaft; means actuated by changes in said loop for angularly reciprocating said shaft around the axis thereof; a variable speed regulator connected for varying the speed of one of said motors; and means actuated by said shaft for varying said variable speed regulator, thereby to maintain said loop and the predetermined relative speeds of said motors.

19. A device for interleaving predetermined lengths of sheet material derived from a strip thereof and for separating defective lengths from acceptable lengths which comprises a cutter for cutting the strip into said lengths; a separator conveyor for conveying said separators into interleaving position; a transfer device for transferring said lengths from the cutter and placing the lengths in interleaving juxtaposition with the separators and means for delivering the lengths to the transfer device; said transfer device including an upright rotatable spindle having a platen mounted on one end thereof which is transverse to the axis of said spindle; means for reciprocating said platen back and forth on the axis of said spindle for rotating the platen from a position in which a receiving edge thereof is near said delivery means to a position where one edge of a length carried by said platen originally transverse to the line of the delivery means is brought into interleaving juxtaposition with a separator; a spatulate clamping member mounted on a spindle having an axis coextensive with the axis of said first named spindle and a receiving edge adapted to be placed near said cutter; means for raising and lowering said clamping member for clamping a length on said platen after said length is in position to be severed from the strip and for maintaining the same in said lowered position until after the length is placed in interleaving position; said means being operable to move the clamping member for releasing the length after it is placed in interleaving position and to retain the same in said releasing position until after the platen and spatula are returned for receiving another length to be cut.

20. A device in accordance with claim 19 which comprises upper and lower stationary guide members disposed to guide said receiving edges of the platen and spatulate members and provide a narrow space therebetween at a fixed level for receiving the length to be severed from the strip; said guide having a series of arcuately shaped bars having their facing surfaces substantially in the plane of the facing surfaces of said platen and spatula when the same are in open position; said platen and spatula having arcuate slots arranged to freely receive the arcuate portions of said guide members when the platen and spatulate member are rotated into receiving position; the inner ends of said arcuate portions of the guide members being discontinued at different distances from the line of said cutter and extending therefrom along straight lines to points nearer the cutter, said inner ends of the arcuate portions which are farther from the axis of rotation of said platen and spatula being relatively close to the line of the cutter and the inner ends of the other arcs being relatively farther from the line of the cutter as their location from said axis is relatively nearer.

21. A device for assembling lengths of sheet form material with separators, said lengths being derived by repeatedly advancing a strip of

said material endwise a predetermined distance, dwelling and then cutting off from the end of the strip a length thereof, a single advancing and an immediately succeeding dwelling constituting a cutting cycle, said device comprising means for cutting said strip into lengths including means for intermittently advancing the end of the strip into said cutting means at regulated intervals; an endless conveyor having grippers mounted thereon for clamping the leading edges of said separators; means for indexing said conveyor for dwelling said grippers during a part of said cutting cycle at predetermined stations for loading said separators onto successive grippers which are indexed into a loading station, for actuating a means for identifying the lack of a separator in a gripper at a dwell position prior to the interleaving position, for interleaving the chopped-off lengths with said separators at an interleaving station, for rejecting defective lengths and non-interleaved lengths at a reject station and for stacking unrejected interleaved lengths at a stacking station; means for inspecting said strip for defects including means for transmitting reports of the defects; a record support and a recorder for recording said reports on said support in the relative position that said defects occur with reference to the location of said lengths to each other; means initiated by an electrical signal for thereafter diverting the defective lengths at the reject station; means for indexing said reports on said record support past said initiating means and for actuating the same; and means for opening said grippers at said reject station in response to said initiating means.

22. A device in accordance with claim 21 in which the means for indexing the endless conveyor includes a planetary gear device arranged to transmit intermittently to said endless conveyor a movement which is cycloidal in character; power supply means for driving said planetary gear device; a clutch operable for discontinuing and resuming the supply of power to said device; and means driven by said power supply means for manipulating said clutch whereby the supply of power to said endless conveyor is discontinued for said dwells between certain cycloidal cycles and resumed for said moving the endless conveyor between other such cycles.

23. A device in accordance with claim 21 in which the means for indexing the conveyor comprises a driven shaft operatively connected to the endlless conveyor; a planetary gear device arranged to transmit intermittently to the endless conveyor a movement which is cycloidal in character; a power drive shaft for supplying power to the planetary gear device; a clutch operable for discontinuing and resuming the supply of power to said conveyor; said planetary gear device having a planet gear and a crank pin driven by said planet gear, the radii of rotation of said planet gear and crank pin being arranged to provide short dwells at the ends of the cycles; a cam wheel mounted on said drive shaft, said cam wheel having a cam track; and means connected with said clutch and operable in response to said cam track for manipulating said clutch during certain of said short dwells for disconnecting the supply of power and during other of said short dwells for resuming the supply of power to said conveyor.

24. A device for assembling lengths of sheet form material with separators, said lengths being derived by subdividing a strip of said material which comprises means for cutting said strip into lengths including means for intermittently advancing an end of the strip into the cutting means at regulated intervals; an endless conveyor having grippers mounted thereon for clamping the leading edges of said separators; means for indexing said conveyor for dwelling said grippers during a part of a cutting cycle at stations for loading the separators onto successive grippers at a loading station, actuating means for identifying the lack of a separator in a gripper at a dwell position prior to the interleaving position, for interleaving the lengths and separators at an interleaving station, for rejecting defective lengths and non-interleaved lengths at a reject station and for stacking interleaved lengths at a stacking station; means for inspecting said strip of material for defects including a record support means for transmitting reports of the defects and a recorder for recording the relative position of said defects on said record support with reference to the location of said lengths to each other; means for identifying the lack of a separator in a gripper at said dwell position prior to said interleaving station including means for reporting said lack and recording the intelligence of such lack on said record support with reference to the length which said gripper is destined to convey a separator; means initiated by an electrical signal for diverting at the reject station defective lengths and lengths which are not interleaved with separators; means for indexing said reports on said recorder past said initiating means and actuating the same; and means for opening said grippers at said reject station in response to said initiating means, said means for cutting lengths from the end of the strip being regulated to supply said lengths at the rate which the separators are indexed into said interleaving station.

25. A device for assembling lengths of sheet form material with separators, said lengths being derived by subdividing a strip of said material which comprises means for cutting said strip into lengths including means for intermittently advancing an end of the strip into the cutting means at regulated intervals; an endless conveyor having grippers mounted thereon for clamping the leading edges of said separators; means for indexing said conveyor for dwelling said grippers during a part of a cutting cycle at stations for loading the separators onto the grippers at a loading station, actuating means for identifying the lack of a separator in a gripper at a dwell position prior to the interleaving position, for interleaving the lengths and separators at an interleaving station, for rejecting defective lengths and non-interleaved lengths at a reject station and for stacking interleaved lengths at a stacking station; means for inspecting said strip for defects including means for transmitting reports of the defects, a record support and a recorder for recording the relative position of said defects on said support with reference to the location of said lengths to each other; means for identifying the lack of a separator in a gripper at said dwell position prior to said interleaving station including means for reporting and recording the intelligence of such lack on said record with reference to the length which said gripper is destined to convey a separator; means initiated by an electrical signal for diverting at the reject station defective lengths and lengths which are not interleaved with separators; means for indexing said reports on said recorder past

said initiating means and actuating the same; a stacking means including an endless stacking conveyor upon which to deposit the unrejected interleaved units and means for moving said conveyor forward through a predetermined number of relatively short indexes corresponding to the number of said units to be assembled in a bundle; and means actuated in response to said reject initiating means for preventing said short indexing of the stacking conveyor when a gripper devoid of an interleaved unit is indexed into the stacking station, said means for cutting lengths from the end of the strip being regulated to supply said lengths at the rate which the separators are indexed into said interleaving station.

26. A device for assembling lengths of sheet form material with separators, said lengths being derived by subdividing a strip of said material which comprises means for cutting said strip into lengths including means for intermittently advancing an end of the strip into the cutting means at regulated intervals; an endless conveyor having grippers mounted thereon for clamping the leading edges of said separators; means for indexing said conveyor for dwelling said grippers during a part of a cutting cycle at stations for loading the separators onto the grippers at a loading station, actuating means for identifying the lack of a separator in a gripper at a dwell position prior to the interleaving position, for interleaving the lengths and separators at an interleaving station, for rejecting defective lengths and non-interleaved lengths at a reject station and for stacking interleaved lengths at a stacking station; means for inspecting said strip for defects including means for transmitting reports of the defects, a record support and a recorder for recording the relative position of said defects on said support with reference to the location of said lengths to each other; means for identifying the lack of a separator in a gripper at said dwell position prior to said interleaving station including means for reporting and recording the intelligence of such lack on said record with reference to the length which said gripper is destined to convey a separator; means initiated by an electrical signal for diverting at the reject station defective lengths and lengths which are not interleaved with separators; means for indexing said reports on said recorder past said initiating means for actuating the same; a stacking means including an endless stacking conveyor upon which to deposit the unrejected interleaved units, means for moving said conveyor forward through a relatively long index after a predetermined number of interleaved units have been stacked for forming a bundle; and means actuated in response to said reject initiating means for preventing said long indexing of the stacking conveyor when a gripper devoid of an interleaved unit is indexed into the stacking station immediately after a bundle is stacked, said means for cutting lengths from the end of the strip being regulated to supply said lengths at the rate which the separators are indexed into said interleaving station.

27. A device for assembling lengths of sheet form material with separators, said lengths being derived by subdividing a strip of said material which comprises means for cutting said strip into lengths including means for intermittently advancing an end of the strip into the cutting means at regulated intervals; an endless conveyor having grippers mounted thereon for clamping the leading edges of said separators; means for indexing said conveyor for dwelling said grippers during a part of a cutting cycle at stations for loading the separators onto the grippers at a loading station, actuating means for identifying the lack of a separator in a gripper at a dwell position prior to the interleaving position, for interleaving the lengths and separators at an interleaving station, for rejecting defective lengths and non-interleaved lengths at a reject station and for stacking interleaved lengths at a stacking station; said grippers having normally closed jaw members secured to a shaft for engaging the edge of a separator and a cam lever secured to the shaft for actuating said jaws to open position; and a cam positioned to engage said cam lever when said grippers are indexed into the stacking station for actuating said jaws to open position.

28. A device for assembling lengths of sheet form material with separators, said lengths being derived by subdividing a strip of said material which comprises means for cutting said strip into lengths including means for intermittently advancing an end of the strip into the cutting means at regulated intervals; an endless conveyor having grippers mounted thereon for clamping the leading edges of said separators; means for indexing said conveyor for dwelling said grippers during a part of a cutting cycle at stations for loading the separators onto the grippers at a loading station, actuating means for identifying the lack of a separator in a gripper at a dwell position prior to the interleaving position for interleaving the lengths and separators at an interleaving station, for rejecting defective lengths and non-interleaved lengths at a reject station and for stacking interleaved lengths at a stacking station; said grippers having normally closed movable jaw members for engaging the edges of separators, said grippers being mounted in groups so that a separator will be engaged by a group thereof; each of said groups being mounted on a transverse gripper bar having forwardly and backwardly extending arms at each end and roll means at the ends of the arms; rails extending along the upper and lower horizontal flights of the conveyor, said rails having roll ways engaged by the roll means on the ends of said forwardly and backwardly extending arms and inwardly opening longitudinal slots extending therethrough from end to end; said transverse gripper mounting bar having roll means at each end thereof which are spaced from the roll means which engage said roll ways for traversing said longitudinal slots and preventing the tilting of said gripper and gripper mounting when the grippers are given an upward thrust; said conveyor comprising endless chains which pass freely through said slots and which have means of attachment to said transverse gripper supporting bars; a gripper jaw operating bar secured to the jaws of each group of grippers; and a cam engaging lever at one end of said jaw operating bar for engaging cams for opening said grippers.

29. A device for interleaving predetermined lengths of sheet material with separators which comprises means for conveying said separators into interleaving position, said conveying means comprising grippers for grasping the leading edges of the separators while they are being conveyed into interleaving position and means for releasing the grippers during an interleaving period while the separators are in interleaving position; a transfer device for placing said

lengths into interleaving juxtaposition with the separators; and means for delivering said lengths to said transfer device; said transfer device including an upright rotatable spindle having a platen mounted thereon transversely to the axis of the spindle, means for reciprocating said platen back and forth on the axis of said spindle for rotating the platen from a position in which a receiving edge thereof is near said delivery means to a position where an edge transverse to said first named edge is brought into interleaving juxtaposition with one edge of said separator, said conveying means comprising means for grasping both the separator and the length after interleaving has been accomplished and means for transporting the interleaved units into a stacking position.

30. A device in accordance with claim 29 in which the transfer device comprises a clamp for retaining the length on the platen, said clamp including means for releasing the length after one edge of the length is placed into interleaving juxtaposition with the separator.

31. A device in accordance with claim 29 in

which the transfer device comprises means for retaining the separator in interleaving position until after the length is placed into interleaving juxtaposition with the separator.

32. A device in accordance with claim 29 in which the transfer device comprises means for retaining the lower member of a folder in interleaving position until after the length is placed into interleaving juxtaposition with the separator and means for lifting a portion of the upper member said said folder above the plane of rotation of the platen for facilitating the interleaving operation.

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