December 27, 1956

Mr. Max Kortlander
Imperial Industrial Company
781 East 136th Street
New York 54, New York

Dear Max:

On November 2nd and 3rd, 1956, I made a complete survey of the roll cutting equipment presently operating in your plant.

As you know, we have recently purchased four Ampico and two Duo-Art Cutting machines from The Aeolian American Piano Co., which equipment is located here at our plant.

After returning from New York last month, we have completed a similar survey of the Ampico and Duo-Art machines and feel that we now have a pretty good cross-section of these three types of equipment.

The purpose of this letter is to acquaint you with the various features of the three systems and to submit a proposed plan for your consideration, in connection with the design and manufacture of new equipment for you.

In addition to the detailed examination of the three types of equipment, we have had our attorneys make a complete patent search on piano roll cutting machines and methods, which disclosed patents dating as far back as 1881 and as recently as 1929.

New York, N. Y.

The search disclosed over 150 patents covering this art, which gives a pretty good picture of almost everything that was done along that line. All of these patents, of course, have expired and are now public property.

In the following discussion, I will refer to your type of equipment as "Imperial", the equipment used by The Aeolian Co., as "Duo-Art" and the equipment used by The American Piano Co., as "Ampico".

GENERAL HISTORY -

IMPERIAL -

Our patent search shows Patent No. 1,148,147 issued to Ernest G. Clark on July 27, 1915, (application filed June 8th, 1914) and assigned to The Melville Clark Piano Co., of Chicago, Illinois.

This patent shows your equipment in detail and would indicate that the first machines were built around 1914.

DUO-ART -

Patent 1,085,989 issued to August De Kleist and Frank L. McCormick. Patent issued February 3rd, 1914, (application filed April 5th, 1911). This patent was assigned to The Rudolph Wurlitzer Mfg. Co., of North Tonawanda, New York.

New York, N. Y.

This patent shows the Duo-Art machines that I have, pretty much in detail, though the actual patent pertains to an improvement on the equipment rather than being the basic patent on the machine. This would indicate that the original design may have been somewhat earlier than 1911.

The people at East Rochester could give me no detailed information as to the history of the Duo-Art machines, as they are all mostly Ampico people, but Mr. J. Wells Benedict, who was in charge of the Ampico Service Department for many years, said that they had been taken over from The Aeolian Co., when the companies merged in the early 1930's and were moved to East Rochester where they were used considerably, up until the end of Duo-Art production, in the late 30's.

It is entirely possible that these machines were built by Wurlitzer, for Aeolian, at the time the Duo-Art rolls were first produced.

One of the machines had been converted to punch Ampico rolls; that is, it has all .072 punches instead of the two pairs .040 theme punches used by Duo-Art.

This change had been made some time in the early 30's after the equipment was moved to East Rochester.

AMPICO -

No specific patents have been found covering the actual punching equipment, but I found two patents; numbers 1,294,845 and 1,323,61[illegible], issued

respectively on February 18, 1919, (application filed April 19, 1915) and December 2, 1919, (application filed August 14, 1914), to Mr. Charles F. Stoddard of New York City.

These patents do not show the Ampico punching equipment that we have here at the plant, but do show a system of controlling the master sheet that is used on this equipment.

I have been unable to locate any specific patent showing the mechanical system used in the Ampico equipment, however, Mr. Benedict of Aeolian-American tells me that these Ampico machines were bought new in either 1915 or 1916, at the time that Ampico first started cutting their own rolls. Before that, they had another company make the rolls for them. He also advises that these machines were used right on through to the end of Ampico production in 1939 or 1940.

Nameplates on the Ampico machines show that they were manufactured by The Taft-Pierce Manufacturing Company of Woonsocket, Long Island. Taft-Pierce is a contract machinery manufacturer and they are still in business in this type of work. As they are not otherwise connected with the piano roll punching industry, I assume that the machines were manufactured by them under contract from The American Piano Company. Mr. Stoddard and members of The American Piano Company probably developed the original designs.

Mr. Hill, President of Aeolian-American and an Ampico man, tells me that they produced around 30,000 rolls per month during the 20's and also that there were a few more machines besides the four that we got from them, that were never brought to East Rochester.

Indications are that there were six or eight machines in their production setup. These machines are single-course machines and were normally used in pairs, with one master controlling each pair.

The 30,000 rolls per month would be roughly equal to your present production and would represent about 50 to 60% of capacity of six machines based on an 8 hour day and 5 day week.

I assume that the four machines we have, were used more or less continuously over the period from 1915 to 1940 and, particularly, through the 1920's.

No one at Aeolian-American can recall any mechanical difficulties with the equipment, in fact, they all said that they were pretty nice machines.

The reason I have gone into this history to such an extent is that neither you nor we can afford the vast engineering and developing expense that would be entailed in the design and development of such equipment from scratch.

The only practical solution to the design and building of such equipment today, is to try to pick out the best and most practical features of these three remaining examples that we have available for inspection.

New York, N. Y.

Figure 1 is a schematic lay-out of all of the elements of a roll cutting system. A "section" number is shown on each element, for identification in the following discussion.

With each section, I will discuss the mechanical features, the history and any other pertinent details of each of the three makes of machines and then follow this with my proposal for the treatment of that element in the new design.

SECTION I. - PAPER STOCK RACK

IMPERIAL -

Wooden, Double Rack, 18 rolls each side, (36 total). Sixteen rolls each side used for production with two each for spares. Rolls supported on steel spindles with cast iron flanges, set screws for slide adjustment. Spindles turn in cast iron open top bearings.

DUO-ART - Unknown - (no equipment obtained).

AMPICO - Individual floor stands, two rolls to each stand. Ball bearing spindles, supported from one side only. Each spindle has 10" brake wheel, but apparently brake was not used.

PROPOSAL -

Welded steel pipe framework, 1-1/4" I.P.S., floor flange mounting with individual, removable, bronze, open top spindle bearings, adjustable

both for spindle end play and position on frame.

Spindles would be 5/8" steel with cast iron flanges adjustably positioned on the spindles by means of set screws.

This stock rack would be substantially equal to your present rack except for the steel frame work and adjustable bearings.

Individual stock racks would be supplied for each course and would carry 18 spindles for operation with your conventional number of stock rolls.

The reason for a single course system will be explained later in Section 4 covering the punch actuating system.

SECTION 2. - PAPER ASSEMBLY MEANS.

IMPERIAL - Two flanges spools in the end of each stock rack, Figure 2.

DUO-ART - Unknown (no equipment obtained).

AMPICO - Paper aligning rack for 15 courses, using 13 and with 2 for spares, Figure 3. This sytem has individual hold downs and guides for each sheet of paper at the entrance of the assembly and flanged spools for each sheet at the exit end. Two flanged grouping rolls are used beyond the rack.

A lot of unused bearing supports indicate that originally there were many more grouping rolls used, but apparently these had been discarded and

only two were in use at the time the machines were taken out of service.

PROPOSAL -

This rather elaborate system used by Ampico appears to be one of those things that was designed into the equipment originally as an anticipated requirement and no one ever tried to use the equipment without this device.

The two flanged spools used in your Imperial system seem to be entirely satisfactory for this purpose, as I could determine no difficulty either by observation or discussion with your operator.

It would appear that two such flanged rolls are all that is actually necessary to accomplish this assembly of the several sheets of stock paper and would represent a considerable saving in cost over the Ampico system.

SECTION 3. - PAPER PULL-OFF MEANS

IMPERIAL - A clamping type of paper conveyor is used to pull the paper off the stock rack. The conveyor is driven from the punching unit and feeds into a slack loop ahead of the punching unit. Manual control of speed is used to maintain the slack loop.

DUO-ART - Unknown, (no equipment obtained). Indications are that the paper was pulled directly from the stock rack by the metering conveyor outlined in Section 7.

New York, N. Y.

AMPICO - No pull-off conveyor was used, the paper was apparently pulled directly from the stock rack and through the punching machine by the metering system of Section 7.

PROPOSAL -

It may be entirely possible that the pull-off conveyor used on the Imperial machine was another one of those unnecessary items. If so, a considerable saving can be made by its elimination.

The metering conveyor of Section 7 must be of sufficient capacity to advance the paper properly through the punching machine.

With a properly designed stock rack, the force required to draw off the 18 courses of paper is small compared to the force required to accurately maintain the paper advance through the punching unit. However, I would propose the use of two Neoprene covered assisting rolls, as shown in Figure 4.

These rolls would be constantly driven at a speed 5% faster than the maximum intermittent advance speed imparted to the paper by the paper metering conveyor system of Section 7.

By this means, the slight over-driving friction of these assisting rolls would take over the frictional drag required to pull the paper from the stock rack and would basically duplicate the function of the presently

used conveyor and slack loop of the Imperial system.

These two assisting rolls would be far cheaper to make than the clamping type conveyor presently being used in your system, and would eliminate the inconvenience of maintaining the slack loop which requires periodic adjustment.

SECTION 4 - PUNCH ACTUATING SYSTEM

IMPERIAL - The drawing in Figure 5 is a schematic arrangement of the system used by Imperial. This is a double course arrangement requiring a punching ram of twice the length of a single course system.

The drive shaft "A" is underneath mounted, and carries the two driving eccentrics outboard of the main drive shaft bearings. Connection from the eccentrics to the punching ram is through adjustable length connecting rods, connected to the ram, outboard of the ram slides.

DUO-ART - Figure 6 is a schematic drawing of the Duo-Art system. This system being of the single course type has a punch ram approximately one half the length of the Imperial system.

The drive shaft is mounted above the punch ram and carries driving eccentrics outboard of the main drive shaft bearings.

New York, N. Y.

Connection to the punch ram is through fixed length connecting rods, adjustment of the ram being obtained by eccentric bushings at the lower ends of the rods where they connect to the ends of the punch ram.

Connecting rod connections to the punch ram are outboard of the punch ram slides.

AMPICO - Figure 7 is a schematic drawing of the Ampico system. In this system the main drive shaft is also above the punches, but the driving eccentrics are mounted inboard of the main drive shaft bearings.

There are no connecting rods as such in this system, the eccentric bearing housing acting as both connecting rod and punch ram. Roller guides at the lower end of this punch ram assembly replace the conventional ram slides of the other two types.

Because of the lack of a connecting rod system as used in the other machines, adjustment of the punches is made by wedges below the die set.

PROPOSAL -

At this point it must be decided whether a single or double course type of machine is to be used.

The purpose, of course, in using the double course machine, was to double the output without doubling the machine cost.

In doing this, however, it becomes necessary to have an extremely heavy punch ram which adds materially to the vibration of the unit when running.

It is my feeling that the saving in machinery cost is doubtful, as it is more or less offset by the much heavier construction required, and only a very few simple parts, are actually eliminated. Advantages of the single course type of machine would include easier maintenance, lighter machine units for transportation and installation, easier operation and much lower engineering cost.

While I am proposing the single course type of equipment, all of these mechanical principles can readily be utilized in a double course system, if so desired.

The Ampico design of Figure 7 makes an extremely compact and simple mechanism and as it is full ball bearing equipped, would require the minimum of maintenance.

Included are photographs of the Imperial punching system, (Figure 8); the Duo-Art punching system, (Figure 9); and the Ampico punching system, (Figure 10).

SECTION 5 - DIE SET

IMPERIAL - Figure 11 is a schematic cross-section of the Imperial die set.

New York, N. Y.

Rectangular, bar-type punches are used with a conventional slide latch.

A retaining notch "A" of Figure 11 serves as a punch puller. There is no positive means to prevent punches from working up into the notch "B" of the slide latch and thereby failing to function.

The perforating end "B" of the punch is ground cylindrical for producing round holes in the music sheet.

DUO-ART - Figure 12 is a schematic cross-section of the Duo-Art die set.

This system employes a conventional slide latch but uses a cold-headed music wire punch 2" long and .072 in diameter. The head of the punch is approximately .110 in diameter.

The head of this punch, acting against the punch puller block, provides positive punch withdrawal.

In the punch guide, there are clamp bars (a) with a resilient facing and clamp screws to provide friction to prevent the punches from working up.

AMPICO - Figure 13 is a schematic cross-section of the Ampico die set.

This system like the Duo-Art, uses a cold-headed music wire punch which is approximately 1-1/2" long and .080 in diameter.

The fact that the press ram is also the connecting rod, means that this ram acts against the punch head with a slightly rocking motion and, therefore, the punch puller is a separate floating bar, as shown in the drawing at "A".

Unlike the Imperial and Duo-Art systems, however, a positive punch stop "B" is provided that laps over about 25% of the punch head to positively prevent punches from working up and thus failing to engage properly with the slide latch.

Because of the fact that this punch stop overlaps 25% of the punch head, the slide latch only engages 75% of the punch head when in operating position.

Connecting linkage to the slide latch is by means of ball end links to allow for the rocking motion of the ram.

PROPOSAL -

The die set of the Imperial Machine, while of very sturdy construction, appears to be difficult to service and extremely expensive to manufacture. The wire type of punches of both the Duo-Art and Ampico systems, lend themselves to relatively low cost die construction.

The matter of a positive punch stop deserves consideration. Apparently both Imperial and Duo-Art got by without this feature, using only frictional drag, and in the case of Duo-Art, the additional drag of the clamping bars at "A" in Figure 12.

Theoretically, there is a possibility for punches to work up out of engaging position with the slide latch, particularly if the punch guide block becomes worn.

In the rectangular type of punch as used by Imperial and shown in Figure 11, they have ample opportunity to use such a punch stop in the notch "A", but have not done so. Such a notch or other projection cannot be provided in the wire type of punch as used by Duo-Art and Ampico.

Duo-Art has provided friction to partially overcome this tendency by means of the clamping bars at "A" - Figure 12.

Ampico has provided a positive stop at "B" - Figure 13, but does so at a sacrifice of contact area between the punch head and the slide latch.

It would appear that the lighter the punch, the more need for such a punch stop.

For this reason, I have made a particular effort to determine whether or not any problems resulted from the Ampico method, where the slide latch engages only a part of the punch head.

No one at Ampico can recall any difficulty resulting from this feature and a microscopic examination of both the punch heads and the corners of the slide latches that engage the punch heads, shows only normal wear with no indication whatsoever that the parts were deteriorating rapidly.

There is no way of determining whether or not these parts have been replaced recently, but with this equipment, we received several boxes of miscellaneous extra parts both new and used, that had collected through the years and nowhere could I find a single slide latch or punch, either new or used. My guess would be that the slide latches and punches in these machines are the original parts.

I assume that the arrangement did work satisfactorily and would plan on using this system both because of its lower manufacturing cost and easier servicing.

SECTION 6 - PAPER TRIMMING

IMPERIAL - Figure 14 shows the method used in the Imperial machine. It is a pair of progressive shear arrangements for edge trimming, which are attached directly to the press ram.

DUO-ART - Figure 16 shows the system used by Ampico. This is also actuated from the press ram but is of a nibbling type rather than the shear type of the other two machines. The nibbling punches are approximately 1/2" in diameter and because they are actuated at each stroke of the press ram, produce a straight edge that is in every way equal to the sheared edge.

PROPOSAL -

Comparing the Imperial and Duo-Art shear types of mechanism, the Duo-Art seems to be a little easier to adjust and service than the equipment

on the Imperial machine, and is also much lighter, thereby reducing vibration.

The Ampico, nibbling type of edge trimming device is also of light weight and is probably cheaper to manufacture and service than either of the other two. It produces small particles of paper rather than long strips. These small particles can be disposed of in the same manner as the note punchings, which may or may not be of any advantage. I would prefer the lighter weight Duo-Art or Ampico types and would lean a little toward the Ampico nibbler because of its simpler construction, but there is not too much difference one way or the other.

SECTION 7 - PAPER METERING METHOD

IMPERIAL - The Imperial system employes a "clamping type" paper conveyor, Figure 17, similar to that used in their Section 3, but intermittently advanced, to provide the correct advance for each perforating stroke of the punching machine.

Change gears are provided to give two degrees of advance.

DUO-ART - This system also uses a "clamping type" conveyor, Figure 18, and is intermittently driven at two different rates of advance.

AMPICO - The Ampico system uses a pair of pinch rolls, Figure 19, that are intermittently driven at a fixed rate for one degree only of advance.

New York, N. Y.

The gearing to these rolls in such that a change in advance could be made by changing the gearing system, however, they were apparently used at only one rate.

PROPOSAL -

The pinch roll system as used by Ampico, Figure 19, is interesting because of the fact that the conventional clamping type paper conveyor is shown extensively throughout the patent history of roll punching machines, without even a reference to pinch rolls. On the other hand, pinch rolls are extensively on other types of paper transporting machinery with a high degree of success.

As far as I can determine, the Ampico machines worked fine and the pinch roll system is certainly simpler and far lower in cost than any of the clamping type of conveyors.

One of the prime requirements of a successful pinch roll system is that the roll faces must be very much narrower than the paper stock being pulled. This is to allow the paper to "steer" under the rolls, much the same as a very narrow lawn roller would steer easier than a very wide one.

It is possible that early experimenters in roll punching machines did not know this and tried the obvious means of using pinch rolls as wide as the paper, which would have caused them a lot of trouble.

As the Ampico machines were designed and built somewhat later than the

others, they may have been the ones who first made successful use of the narrow type of pinch rolls in piano roll perforating machines.

Because of its extreme complexity and considerable cost of manufacture, the clamping type of conveyor should be definitely avoided, if at all possible.

The pinch roll system is small and compact and has basically only two moving parts and is thus much lower in manufacturing cost than the other systems and I would strongly recommend its use.

It must be remembered that methods and systems in commonplace use today may have seemed impossible at the time some of these machines were built and in the case of pinch rolls, where the full width roll will not work at all, the narrow roll works very nicely and I can see no reason why it would not perform on this application.

SECTION 3 - INTERMITTENT MOTION DRIVE

IMPERIAL - Intermittent motion to the paper metering conveyor is obtained by means of a varying angle worm gear, Figure 20.

DUO-ART - Intermittent motion obtained through ratchet wheels and pawls driven from an eccentric on the main shaft. Two ratchet wheels are provided for two different rates of advance, Figure 21.

AMPICO - Intermittent motion to the pinch rolls obtained through a varying angle worm, similar to that use by Imperial, Figure 22.

New York, N. Y.

PROPOSAL -

The present day method of achieving an intermittent motion of this type is through the use of two opposing, free wheeling clutches, actuated from an eccentric or crank.

Such free wheeling clutches are very quiet in operation and absolutely precise in degree of advance; also, they lend themselves to easy change in rate of advance through infinite degrees of variation.

I would suggest their use in new equipment in place of either of the older systems.

SECTION 9 - MASTER READING METHOD

IMPERIAL - Pneumatic pick-off through conventional tracker bar from sprocket-driven master sheet, Figure 23.

DUO-ART - Mechanical pick-off through sensing pins from sprocket-driven master sheet, Figure 24.

AMPICO - Pneumatic pick-off through conventional tracker bar from pneumatically controlled master sheet, (Stoddard Patents) Figure 25.

PROPOSAL -

Because of your inventory of standard master sheets, the design of the master reader assembly is more or less established along very similar lines to the equipment that you are now using on the Imperial machines.

We would, however, provide much larger master drive sprockets than used on your machines so as to minimize master edge perforation damage.

At some later date, it might be well to consider an adaptation of the Stoddard System as used by Ampico.

In this system, the master sheets have sprocket perforations along the edge, but no sprockets are used. These sprocket perforations, react pneumatically, with corresponding ports in a rotating control drum, so that the perforations in the edge of the master sheet, follow the ports in the rotating control drum, just as if there were sprocket teeth to drive the sheet.

Because there are no sprocket teeth, there is no perforation wear and consequently the masters can be of standard music roll thickness and stored and used on standard roll spools.

This greatly facilitates storage and use of the masters, particularly, with regards to rewinding technique.

SECTION 10 - PRIMARY VALVES

PROPOSAL -

The design of these valves would be substantially the same as you are presently using on your Imperial machines. The Ampico system is almost identical to the Imperial, and of course, the Duo-Art system being mechanical, had no pneumatic system.

SECTION 11 - PNEUMATIC ACTUATOR

PROPOSAL -

The pneumatic systems on both the Imperial and Ampico machines are very similar and seem to be pretty well worked out.

I note that the pneumatic system of the Ampico is mounted vertically with the primary valves along the back side with their valving elements working vertically, rather than mounted horizontally as in the Imperial machine.

I would think that mounting the primary valves with the valving elements working vertically would be much better. In fact, the horizontal valve arrangements on the Imperial machine is the only time I have ever seen valves, either on punching machines or pianos, mounted any other way than vertically.

The vertical mounting allows the internal valve part to be always in mechanical balance, where it would not be if mounted horizontally.

This, however, is merely a matter of mechanics and makes very little difference in the cost of construction.

SECTION 12 - SUCTION LINES

PROPOSAL -

All of the earlier machines, of course, used rubber tubing for their control lines, but today, this would all be done with vinyl plastic tubing which

costs no more than rubber and will last indefinitely.

SECTION 13 - SUCTION REGULATOR

A conventional, unloading type of suction regulator would be used.

SECTION 14 - SUCTION PUMP

PROPOSAL -

The Ampico machines were operated by "Roots type" blowers, rather than the conventional bellows type of suction pump used by Imperial.

The Ampico blowers were pretty well worn out, but great improvements have been made in this type of blower since that time and I would strongly recommend this as a suction source, rather than the more or less fragile bellows type of mechanism.

SUMMARY

A general arrangement of a system using some of these ideas is shown in Figure 26.

The two flanged assembly spools are shown at "A". The course of assembled sheets, passes through a pan "B" with side guides and a light wood block weight, to even out the tension on the several sheets of paper, as they are supplied to the assisting rolls "C" and "D".

These rolls, as previously mentioned, are continuously supplying paper to the punching unit about five percent faster than the maximum intermittent speed of the pinch rolls.

When the pinch rolls advance the paper course, the paper in the sag pan "E" will lift to a position "F", which will apply a slight tension to the assisting roll surfaces. The force thus generated, will draw paper from the stock rack, sufficient to lower the paper in the sag pan, until it contacts the bottom of the pan as at "G", at which point the tension around the rolls is relieved and further pull-off ceases.

Because of this, the greatest load at the pinch rolls "H", will be only that required to lift the paper off the bottom of the sag pan.

A second wood block weight would be used at "J".

After the paper passes through the punching and trimming stations, it would enter another pan "K" having an open grid type of weight "L".

The pan "K" has a rectangular opening "M" through which the bottom pinch roll projects slightly and then carries the paper past the rolls into a tote bin.

As mentioned before, Ampico apparently got by without the assisting rolls or any other means of paper pull-off except the power supplied by the pinch rolls.

Also, Ampico did not use a pan and weight as I have shown at "K" and "L",

however, I feel that this last would be an improvement.

The punching unit is of course, the heart of the whole system and if you decide on this type of equipment, I would recommend that it be copied more or less in detail, as any variation from the basic design, not only entails additional engineering cost but opens up the possibility of failure in service of unproven features.

As I told you in November, the main unresolved problem in my mind is how to do a job of this size, at a price that makes economic sense in this day and age.

When all of those machines were designed and built, forty years or more ago, manufacturing costs were not only much lower, but there was many times the volume of production to absorb engineering and tooling costs.

I have made no detailed cost analysis yet, as that in itself is an expensive procedure, but as you will need some idea of costs, I have completed a rough estimate of the total costs in connection with production of six single course machines, one master unit, the pneumatic systems, pumps, stock racks, motor drives, etc., including all of the engineering and development work, and special tools and patterns that must be built, and come up with a figure of somewhat over $150,000.00.

This is a rather jarring result and yet I can see no means of any considerable reduction in such costs, either by us or any other manufacturer.

All of which makes me wonder if, in the final analysis, your best solution does not lie along the lines of a complete overhaul of your existing equipment, which I'm sure could be put in first-class shape for from 15 to 20% of the above figure.

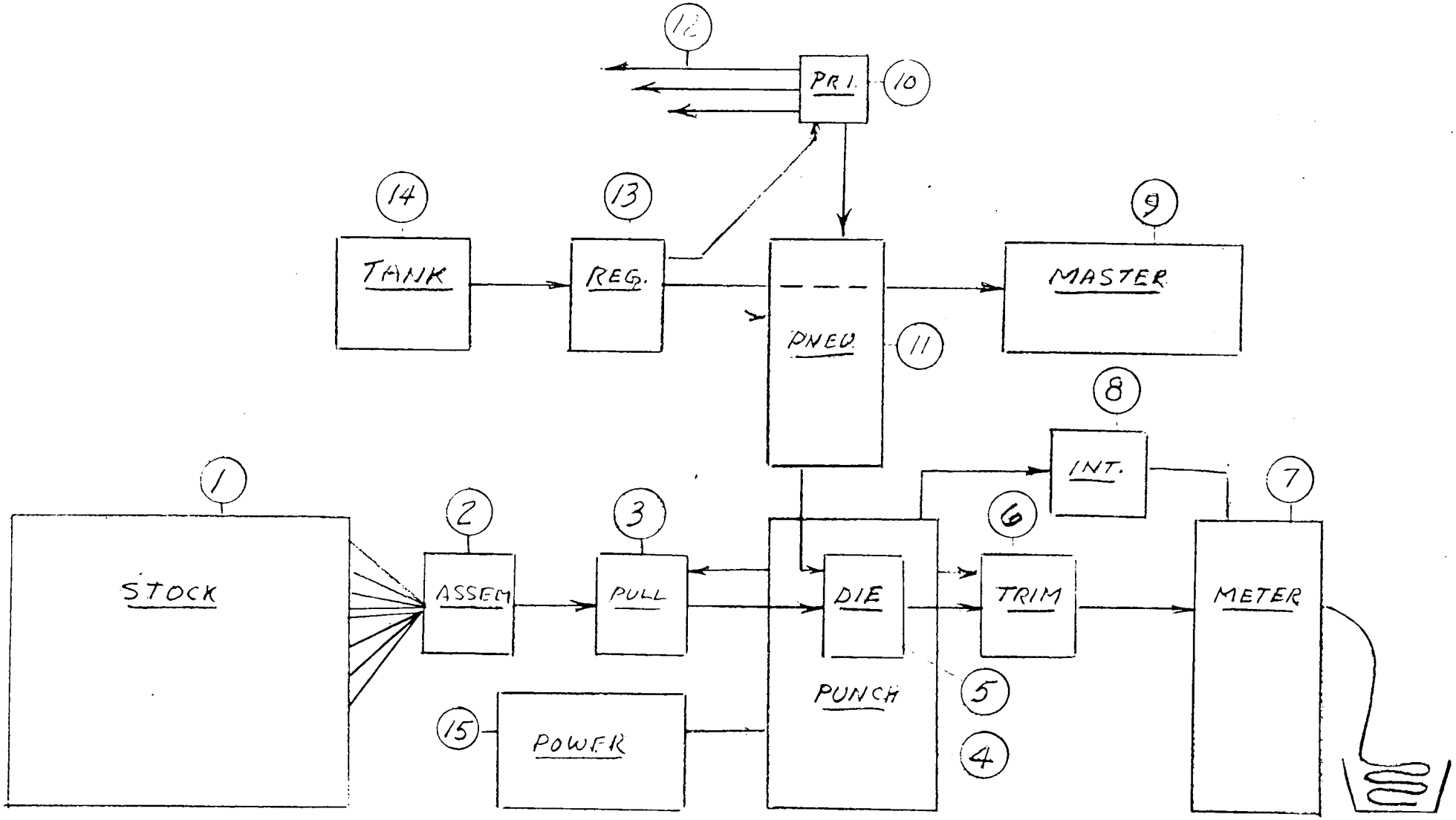
After you have had a chance to hash this over for a while, I'd like to receive your comments.

I'm expecting to be in New York during the week of January 20th for the Boat Show and will stop in at that time.

Sincerely yours,

John F. Morse
President

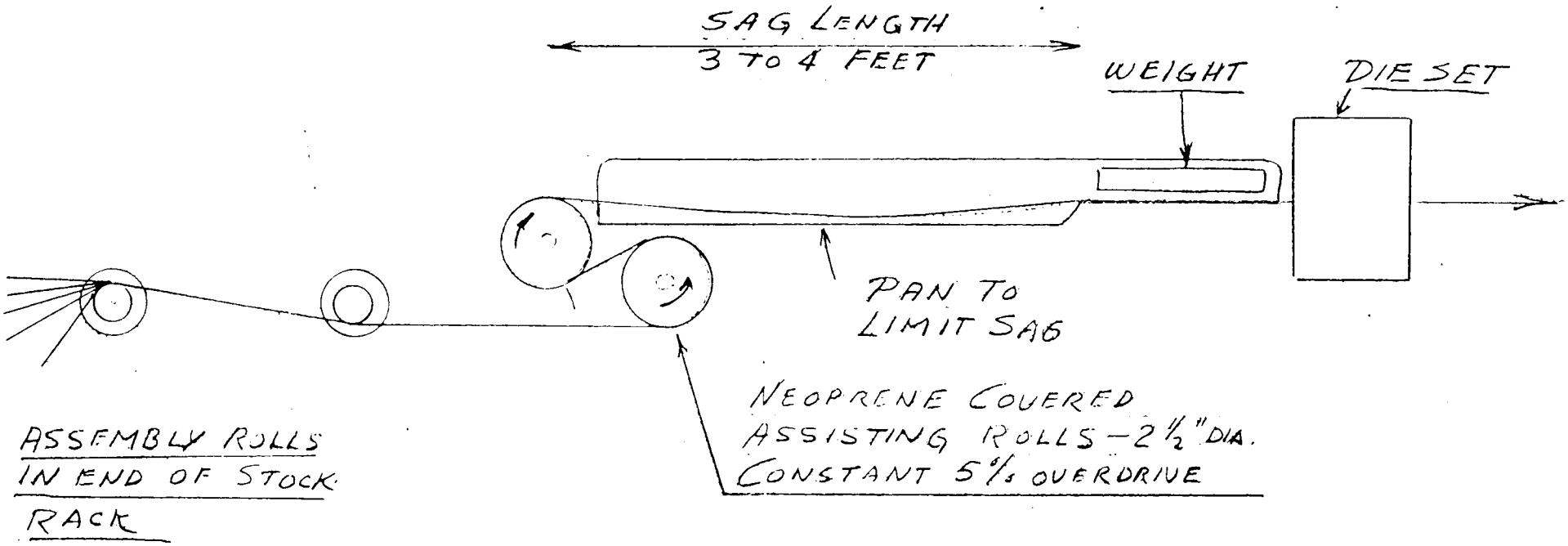
JFM/cfa



SCHEMATIC LAYOUT OF ELEMENTS OF ROLL CUTTING SYSTEM

FIG. 1

MICO 12-8-56



PROPOSED METHOD OF
PAPER PULL-OFF

FIG. 4

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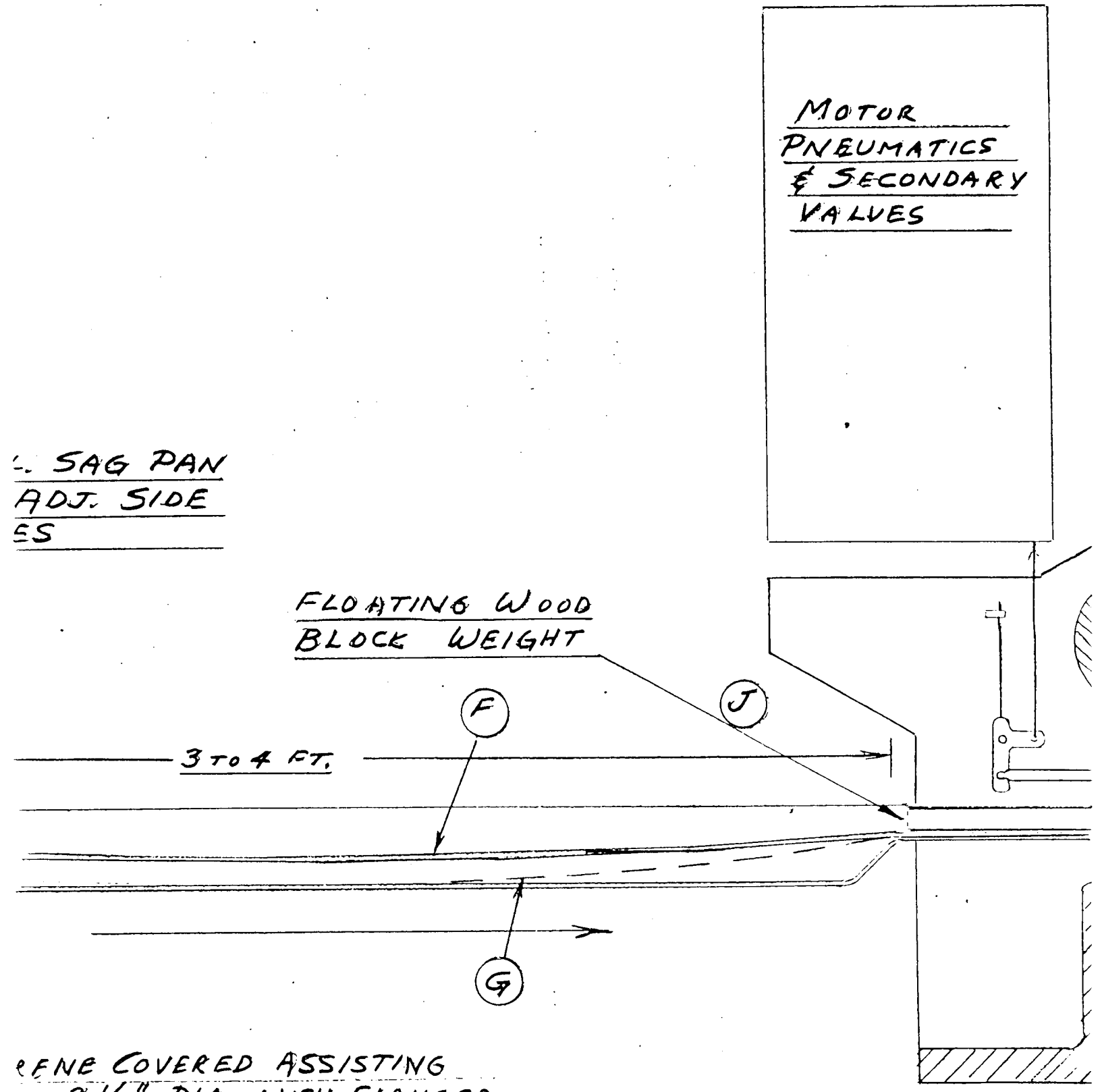


SAG PAN
ADJ. SIDE
ES

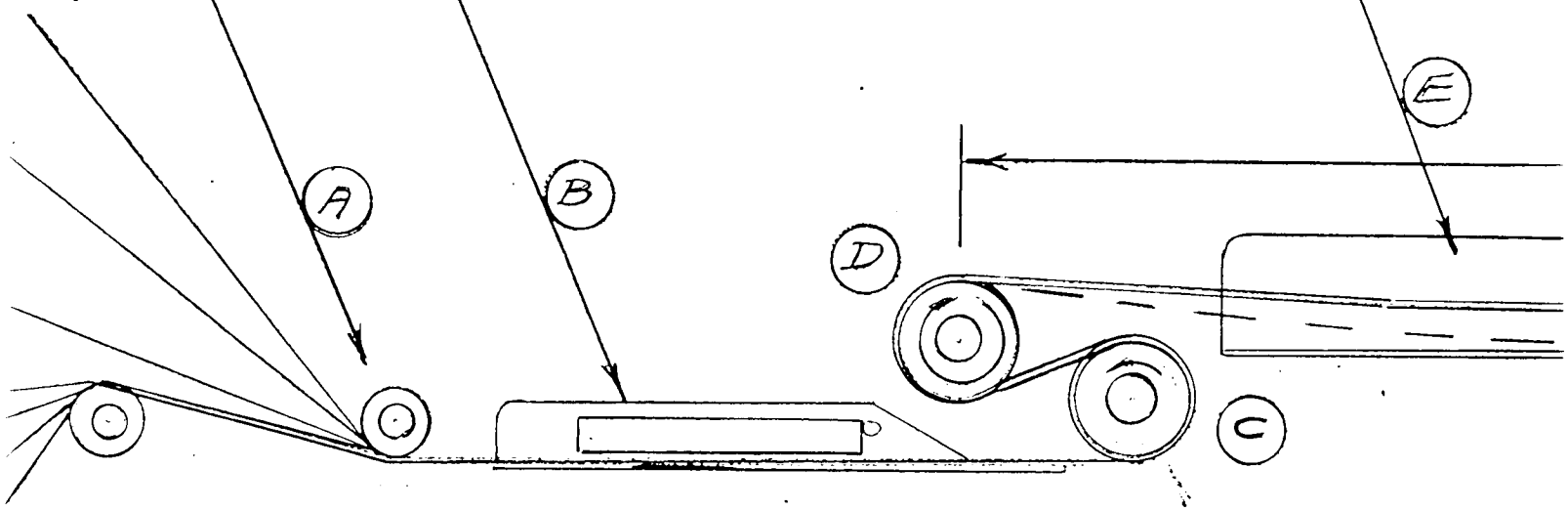
FNE COVERED ASSISTING
2 1/2" DIA. WITH FLANGED
CONSTANT 5% OVER-DRIVE

POSED LAYOUT OF ROLL CUTTING SYSTEM

ASSEMBLY ROLLS IN END OF STOCK RACK

ST. STL. PAN WITH ADJ. SIDE GUIDES - FLOATING WOOD BLOCK WEIGHT

ST. STL. ... WITH ... GUIDES



NEOPREN ROLLS - ... ENDS - C...

PROPC...

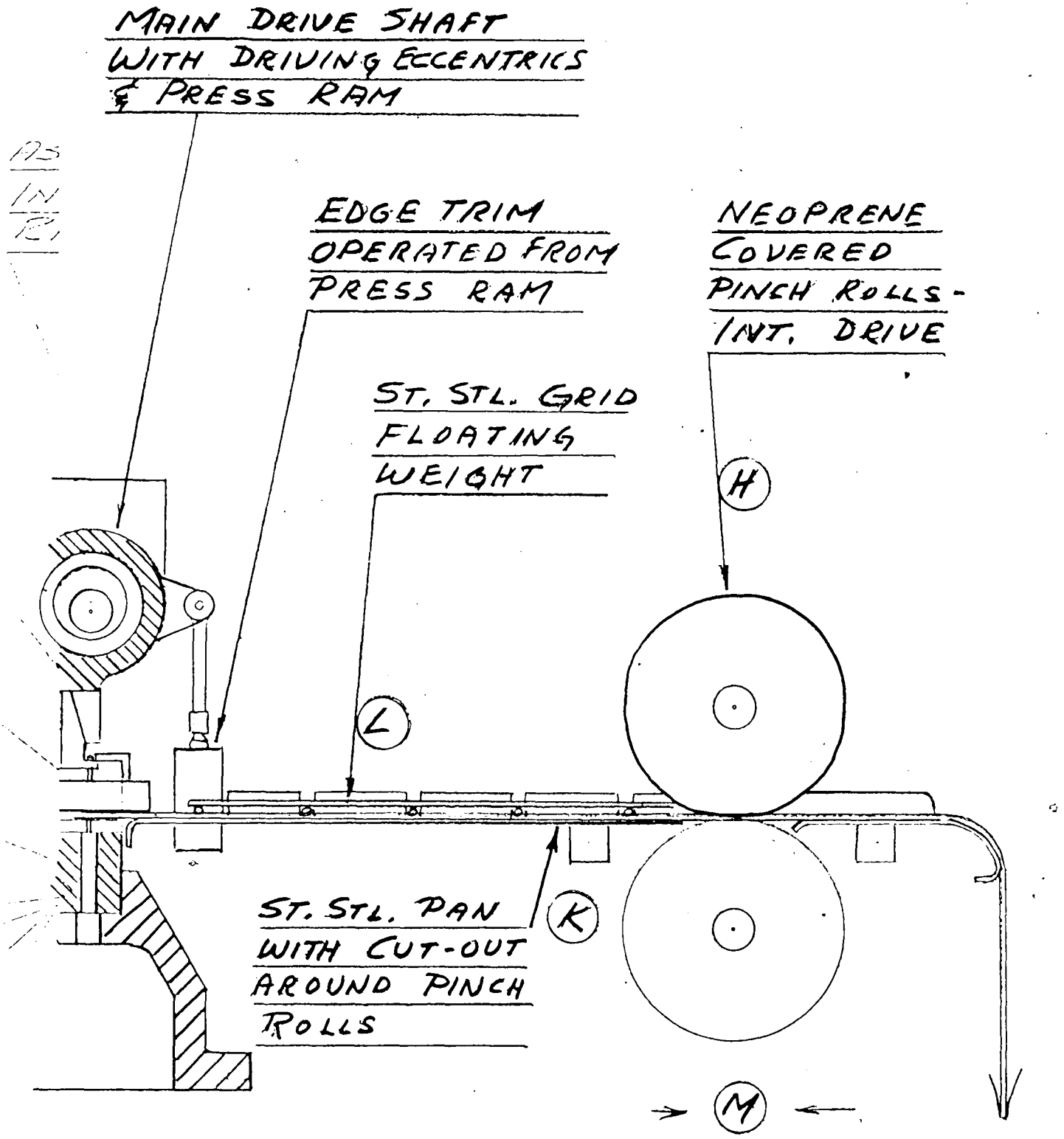


FIG 26

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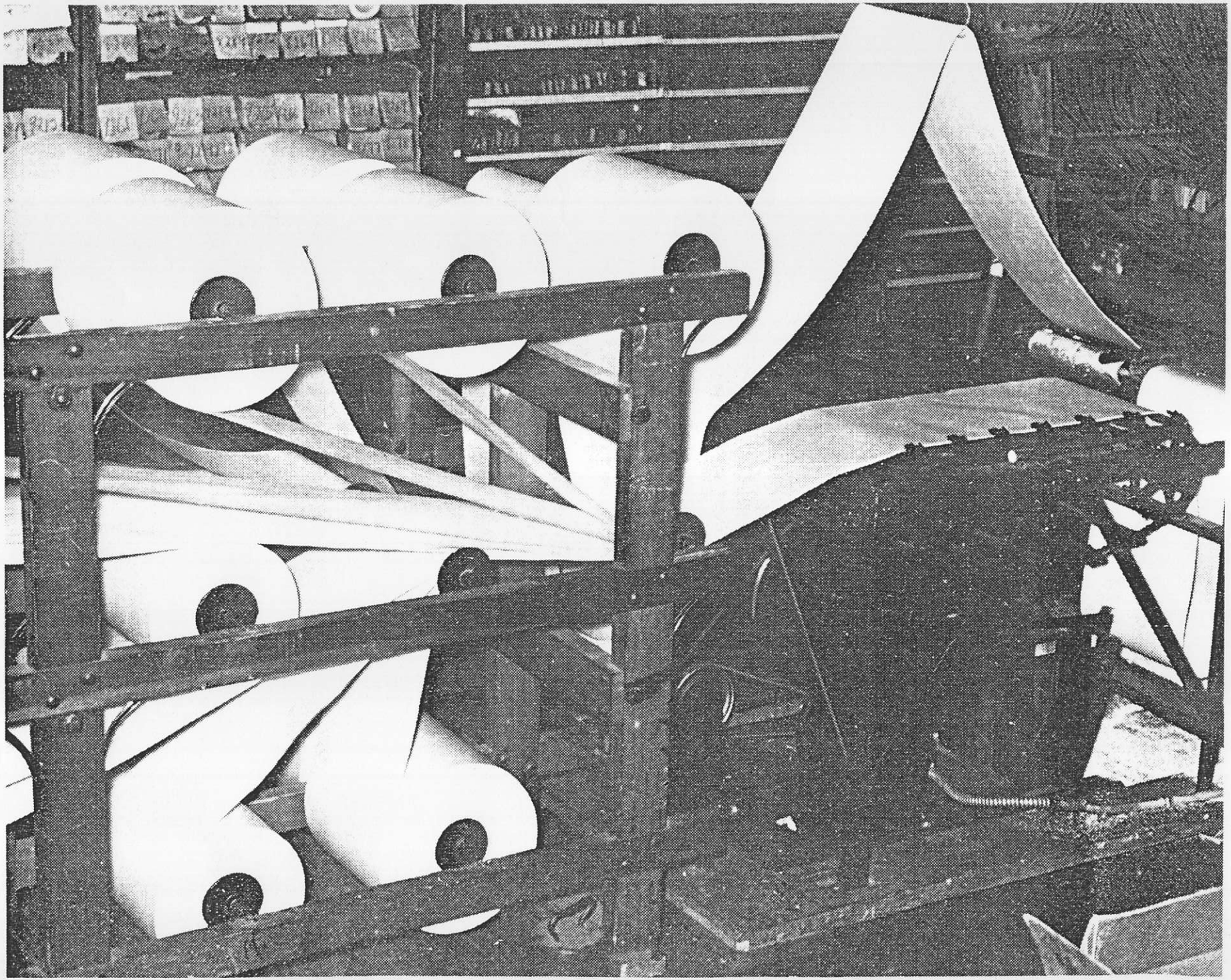
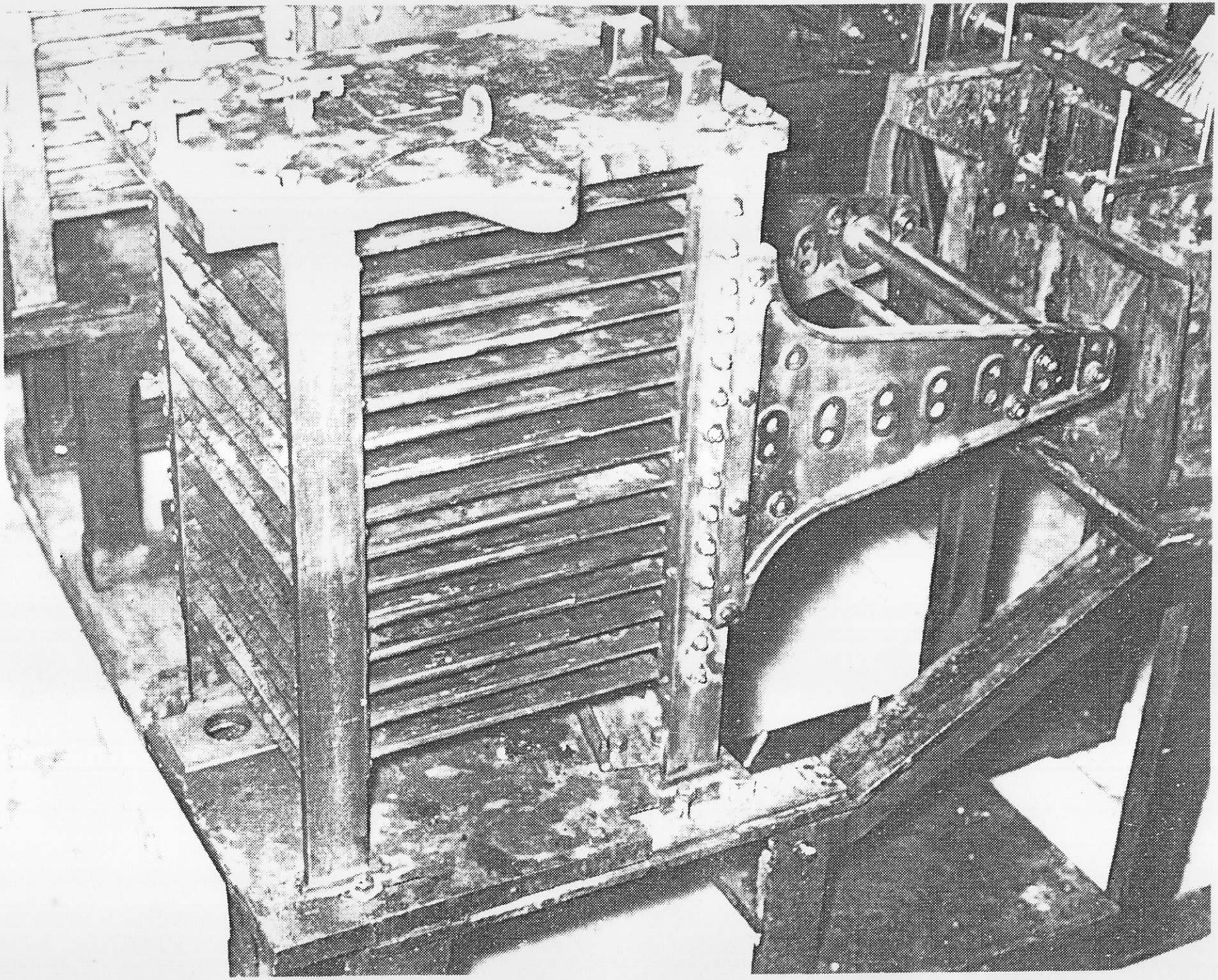
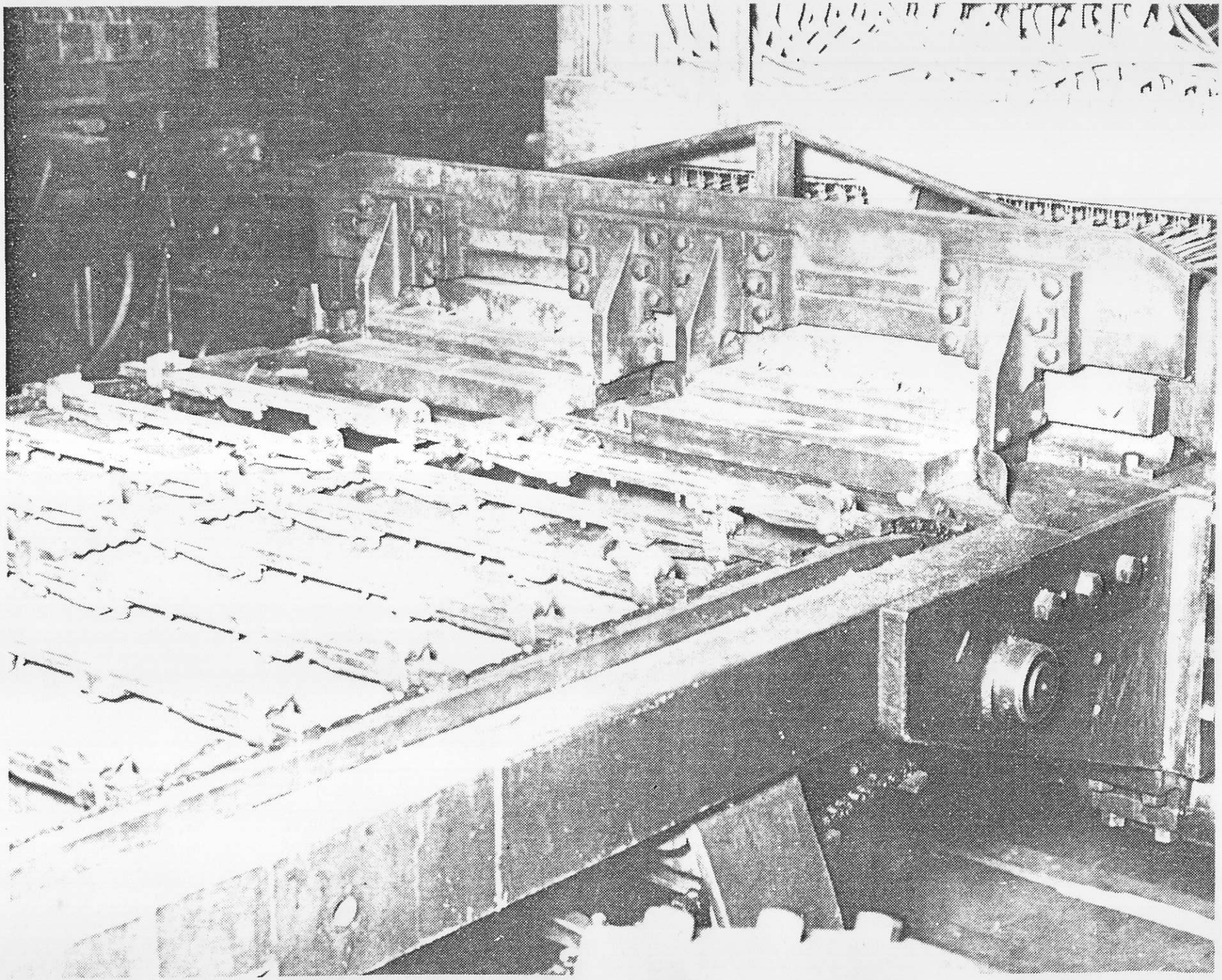
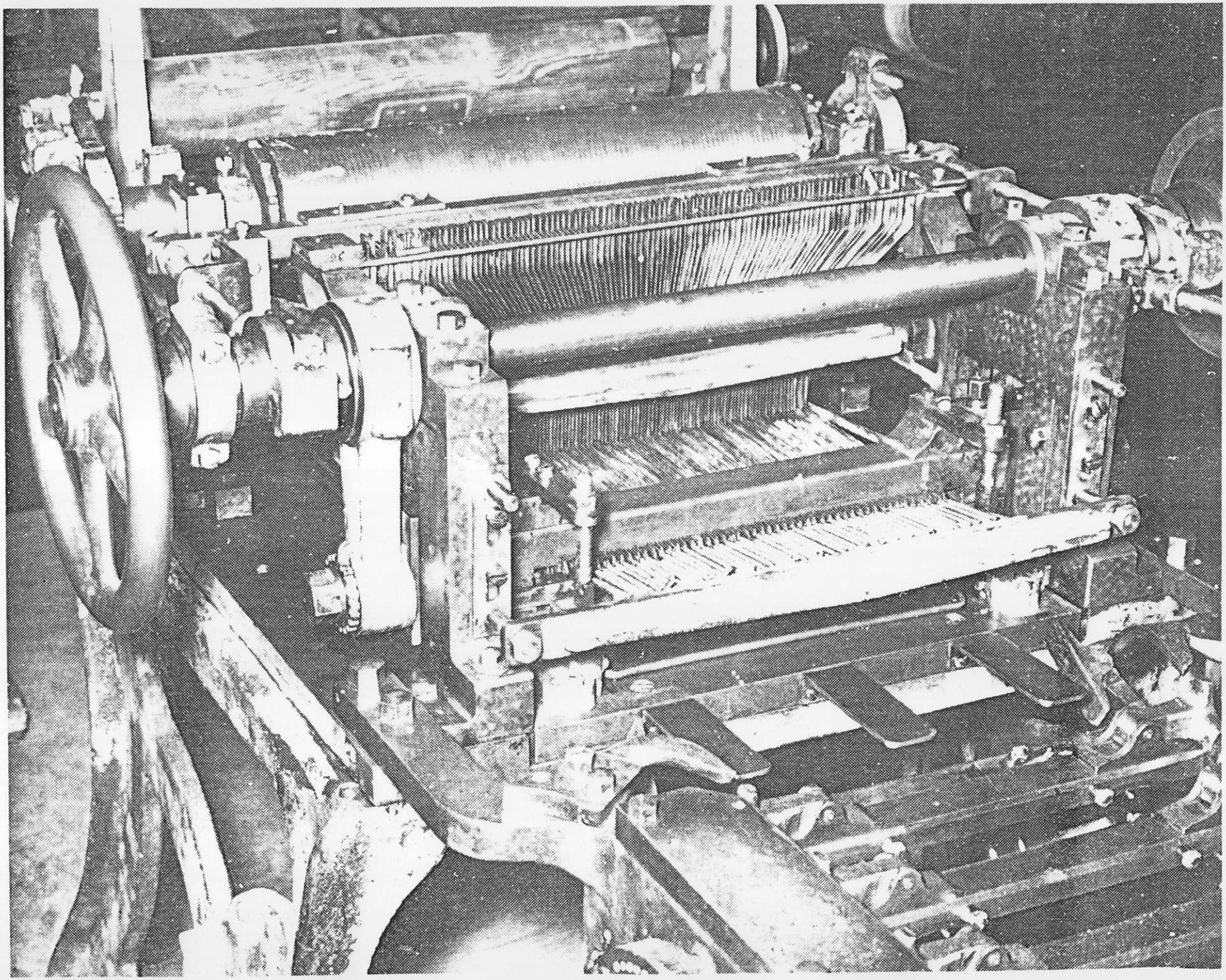
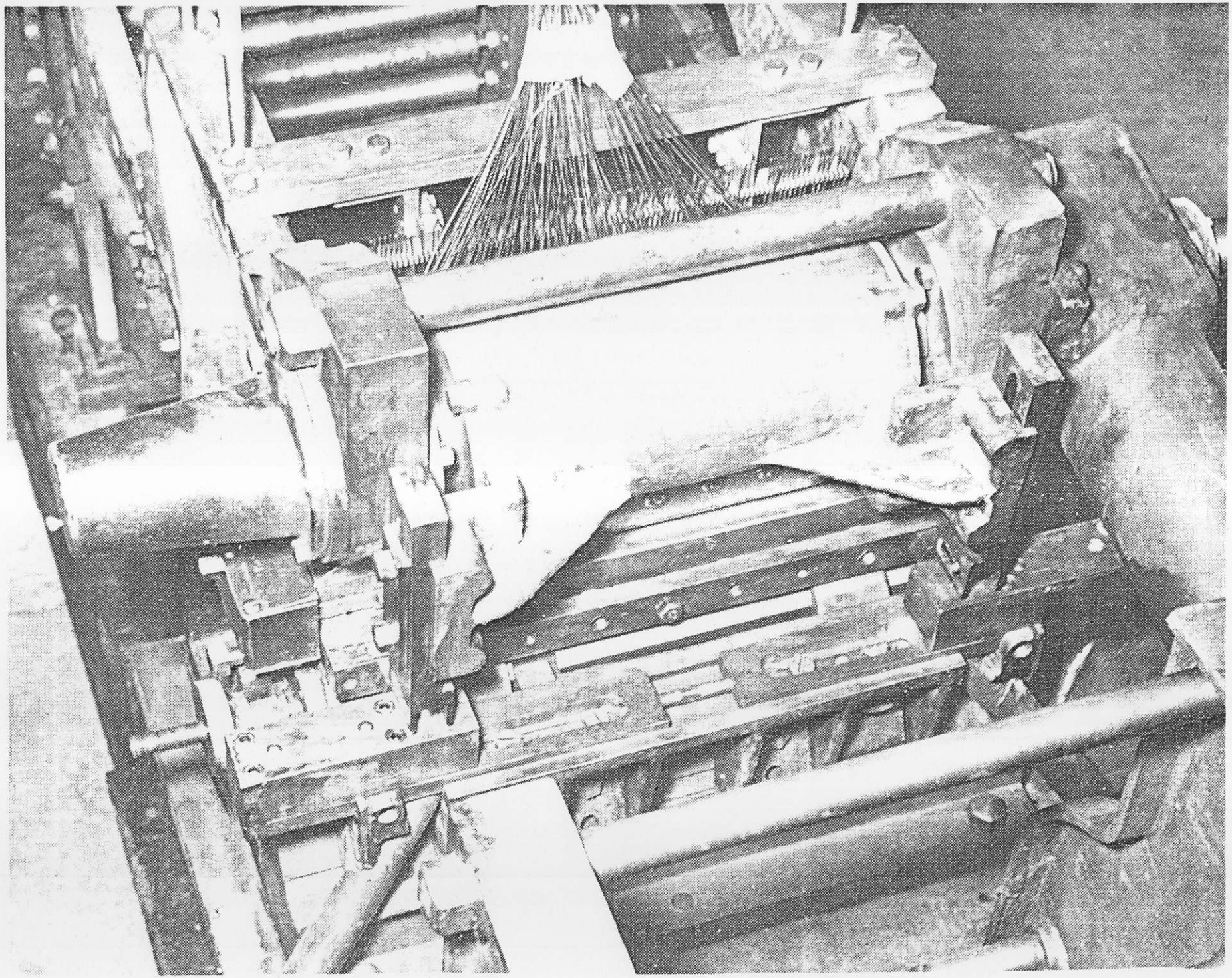


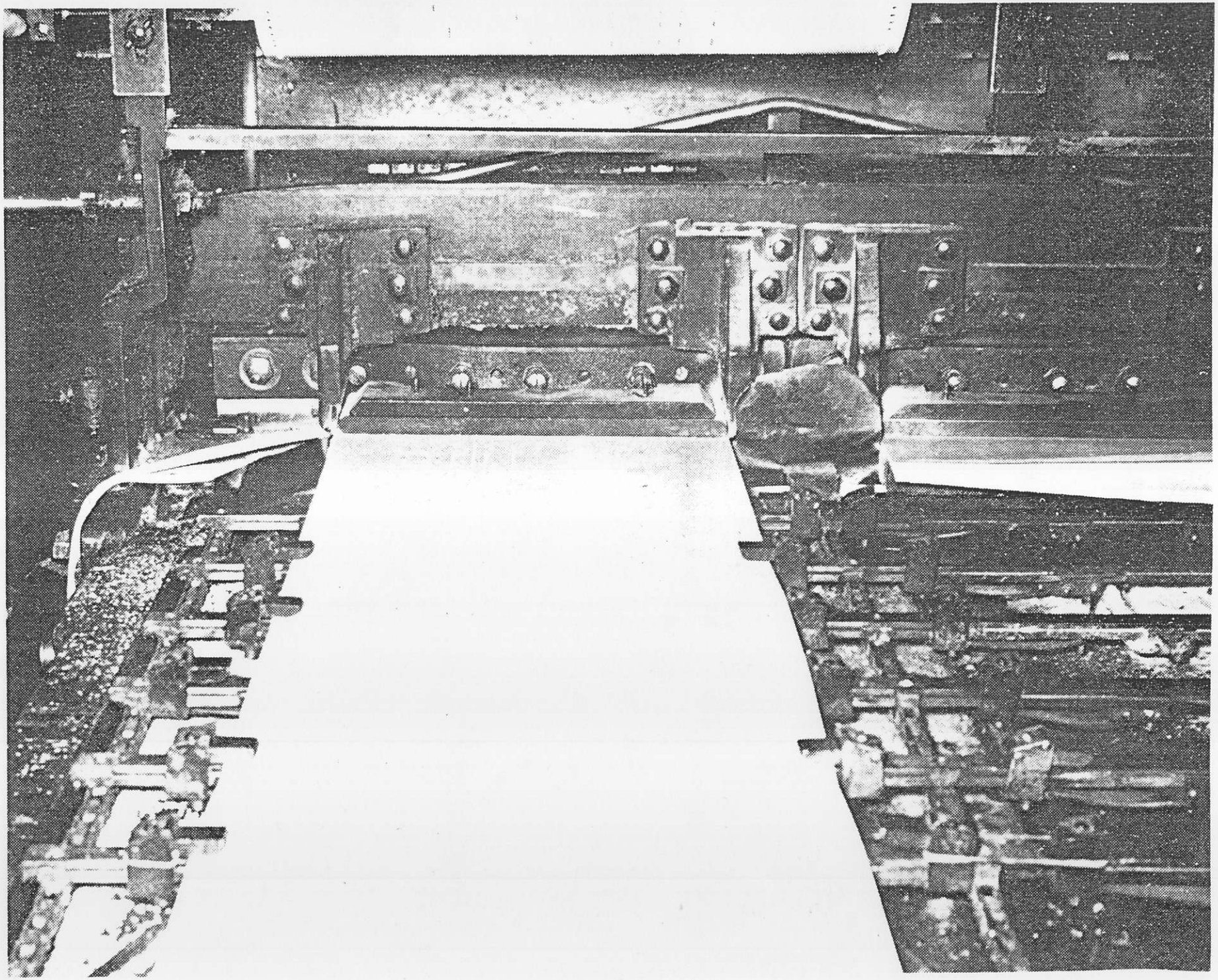
Fig.

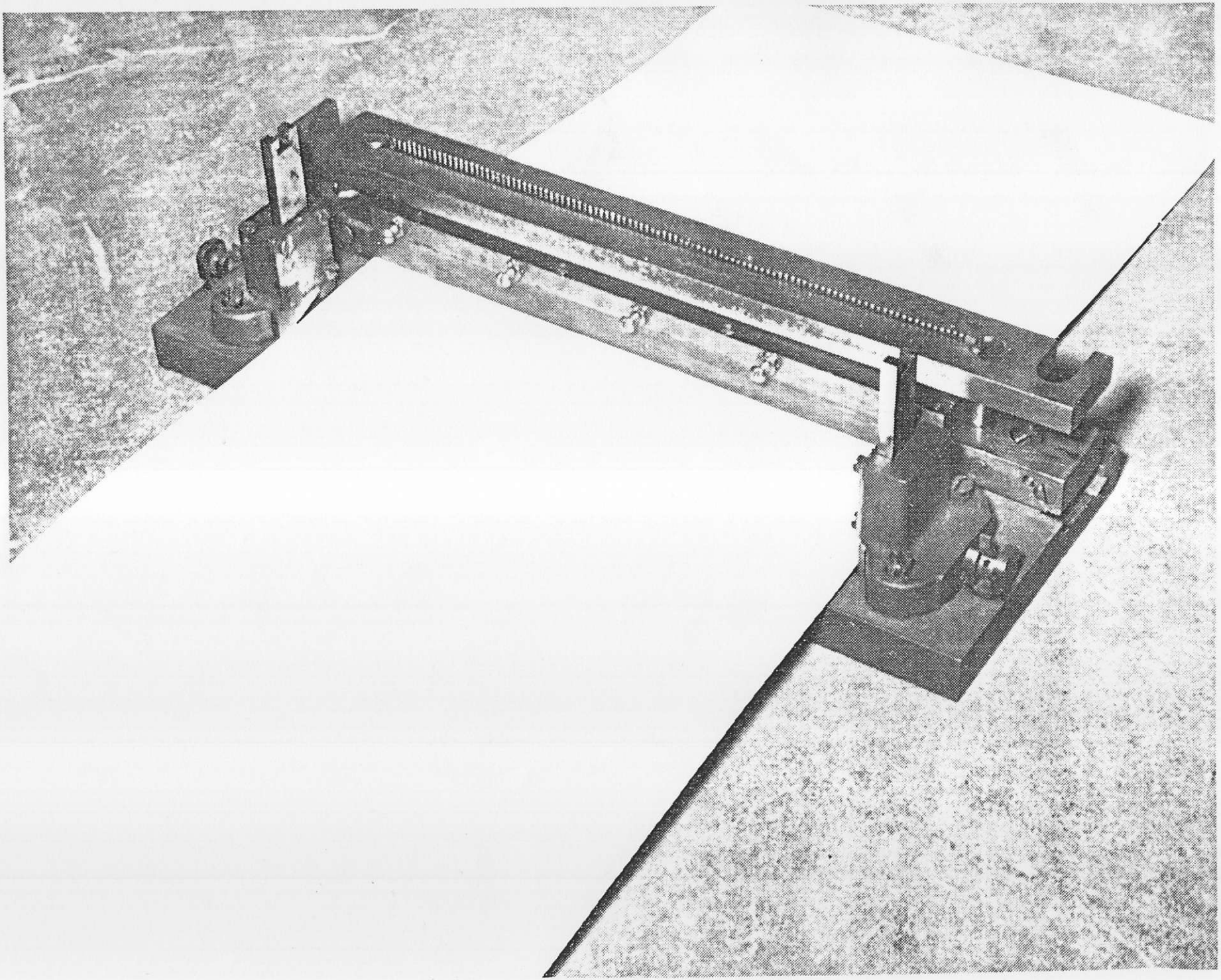


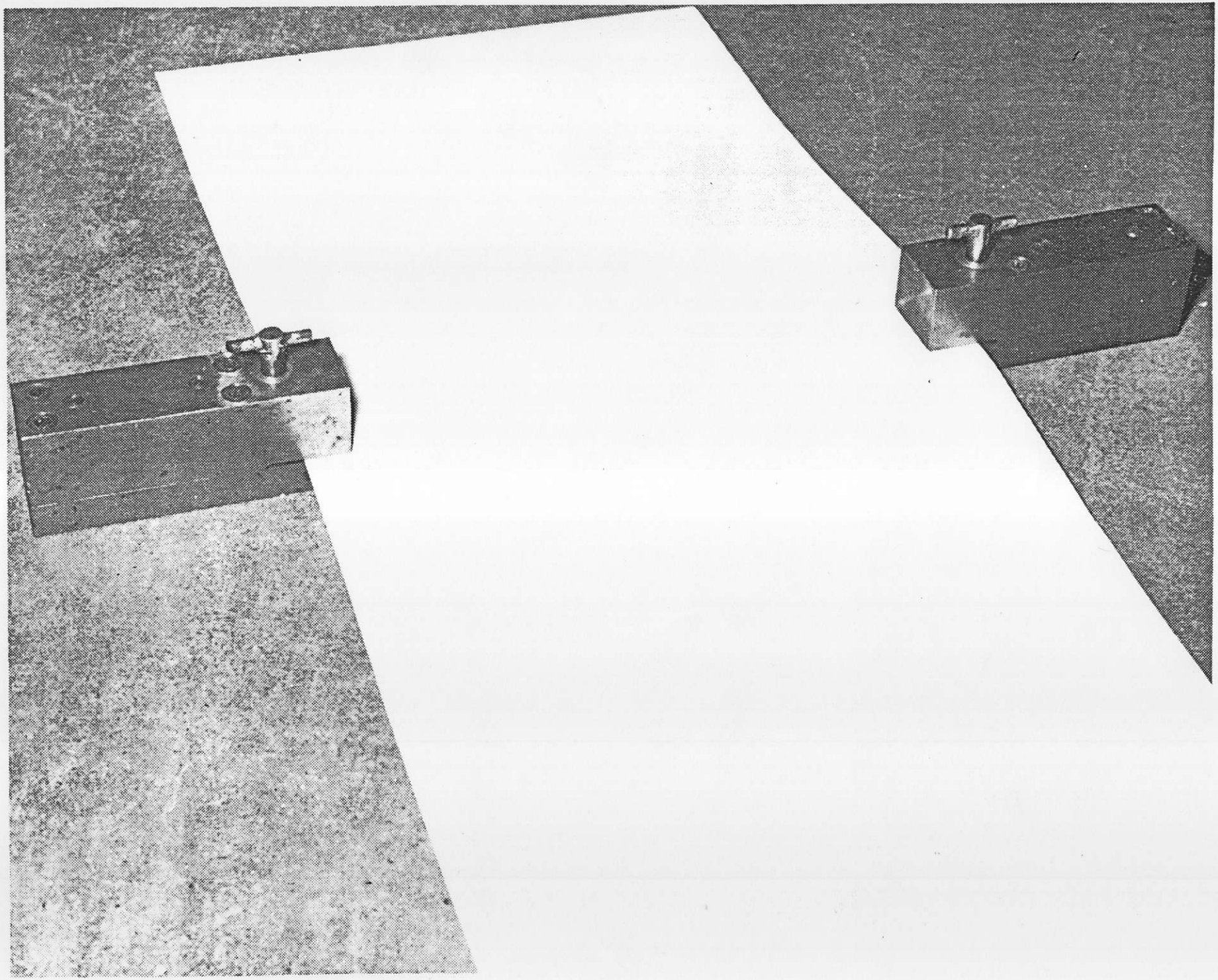


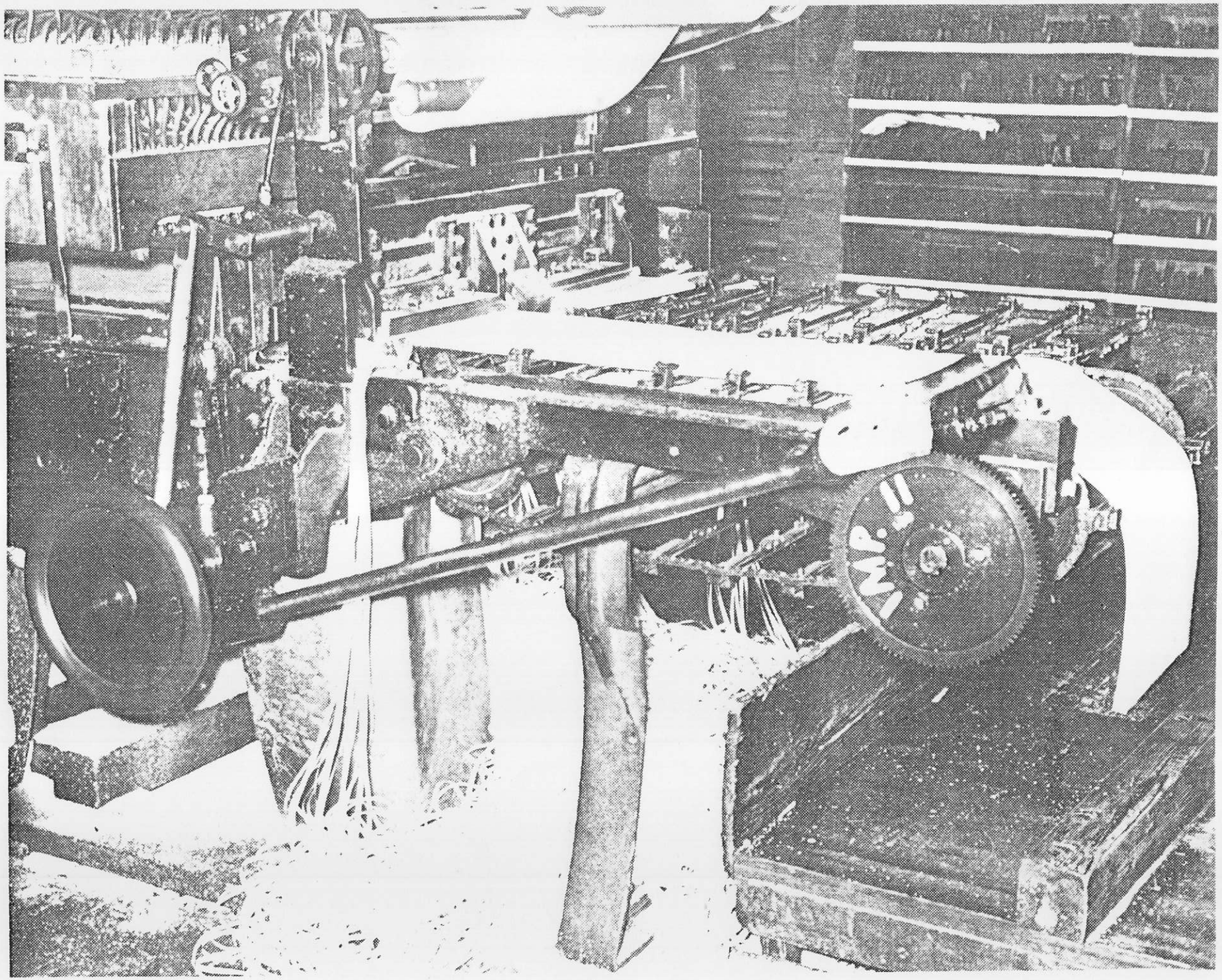


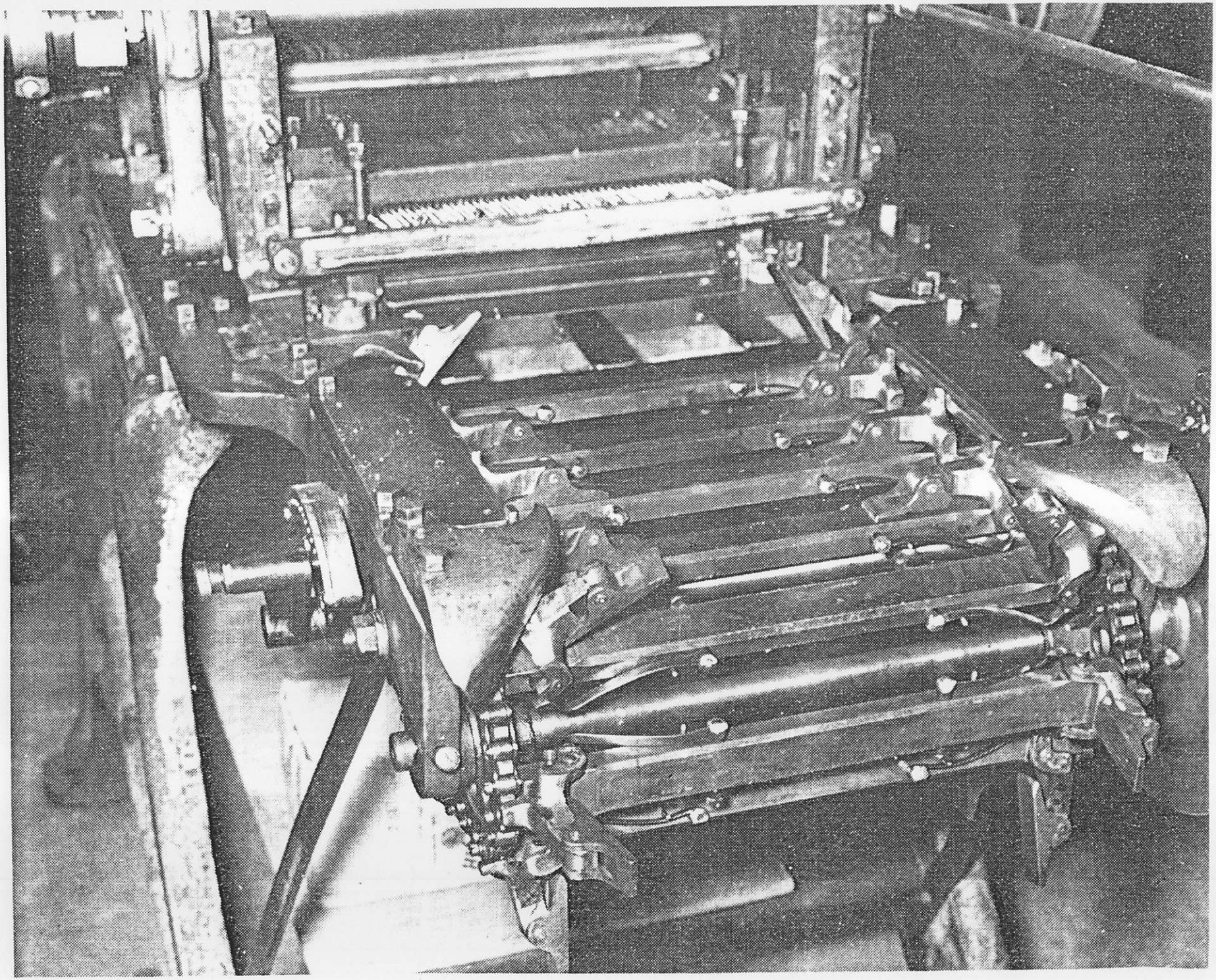


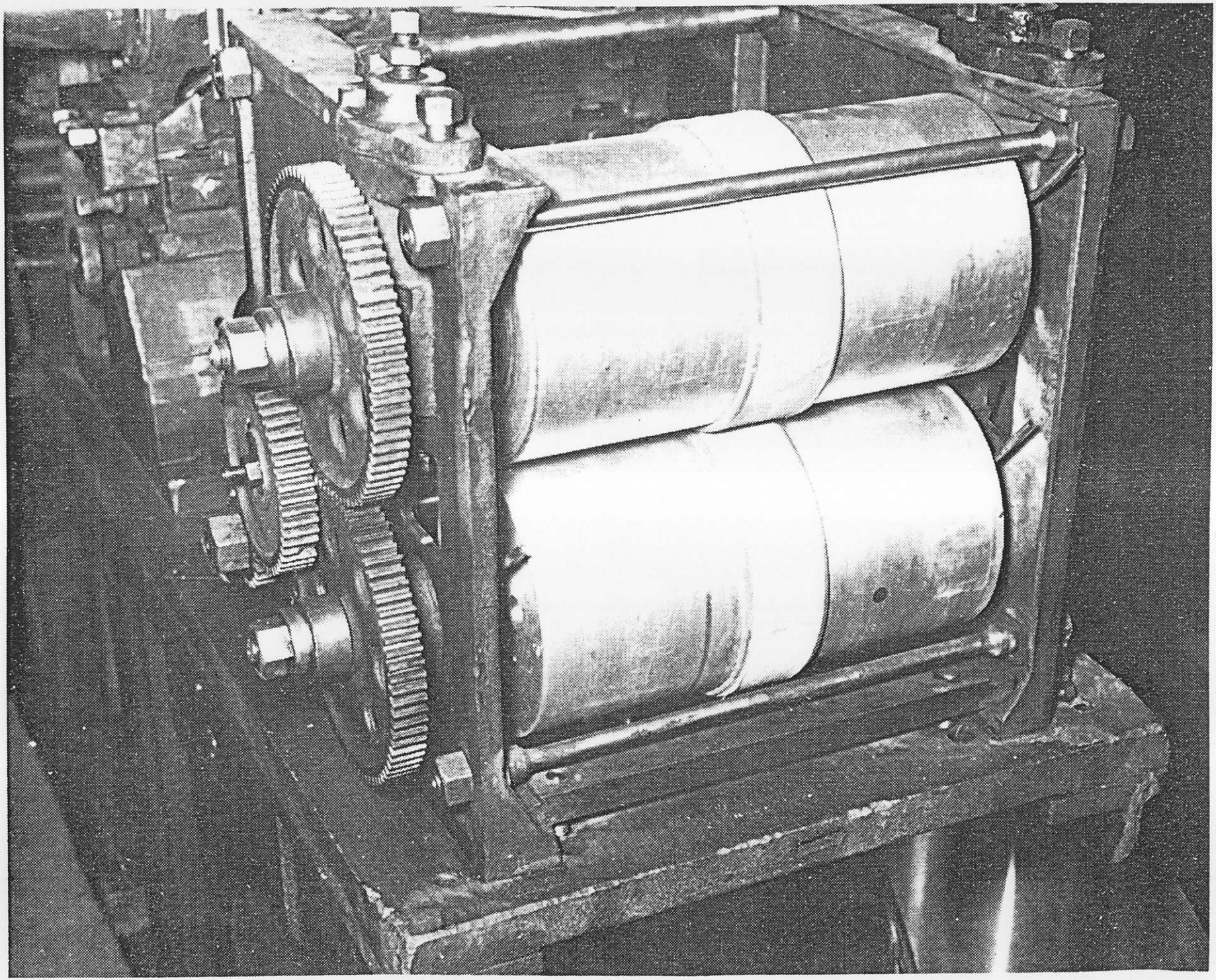


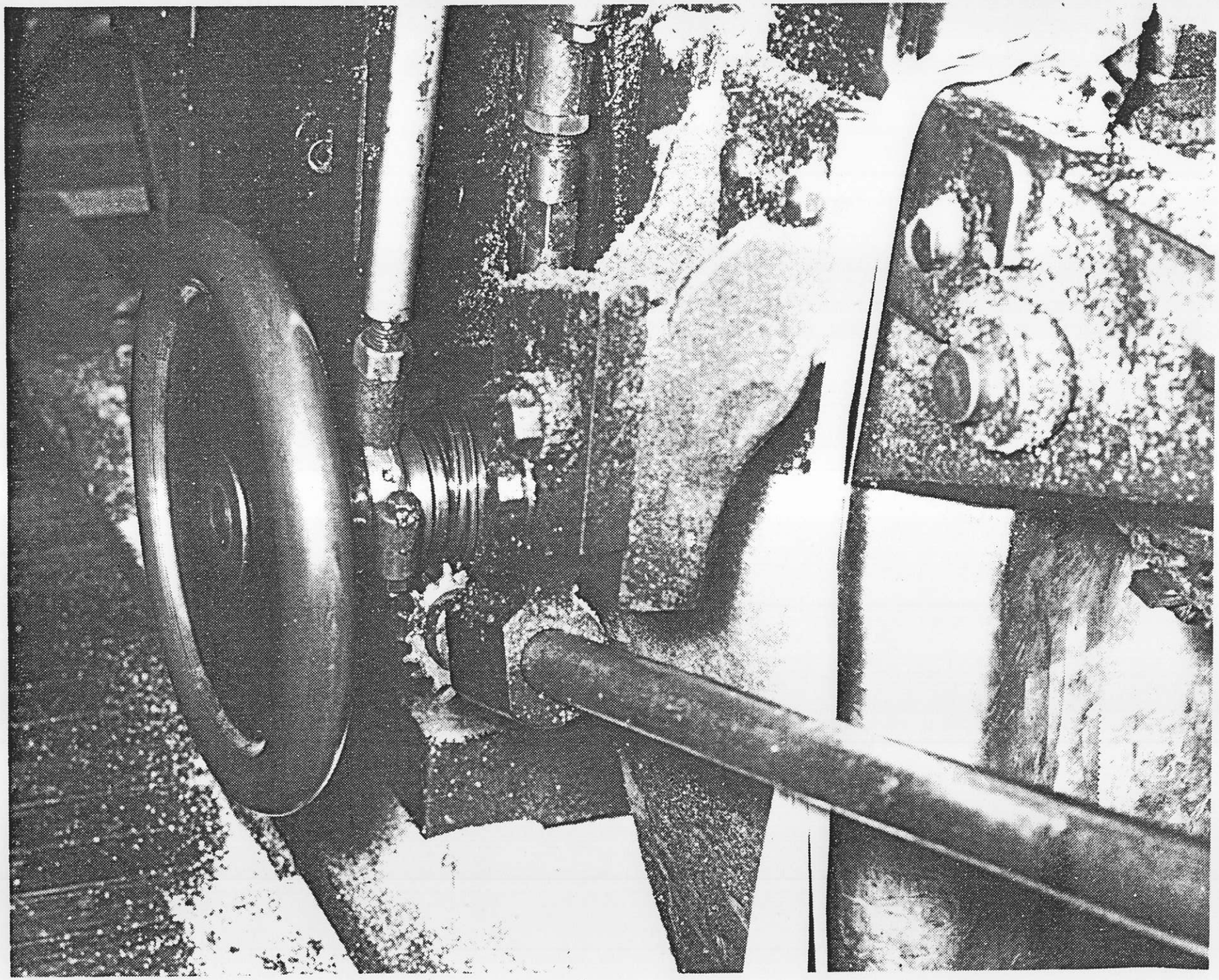


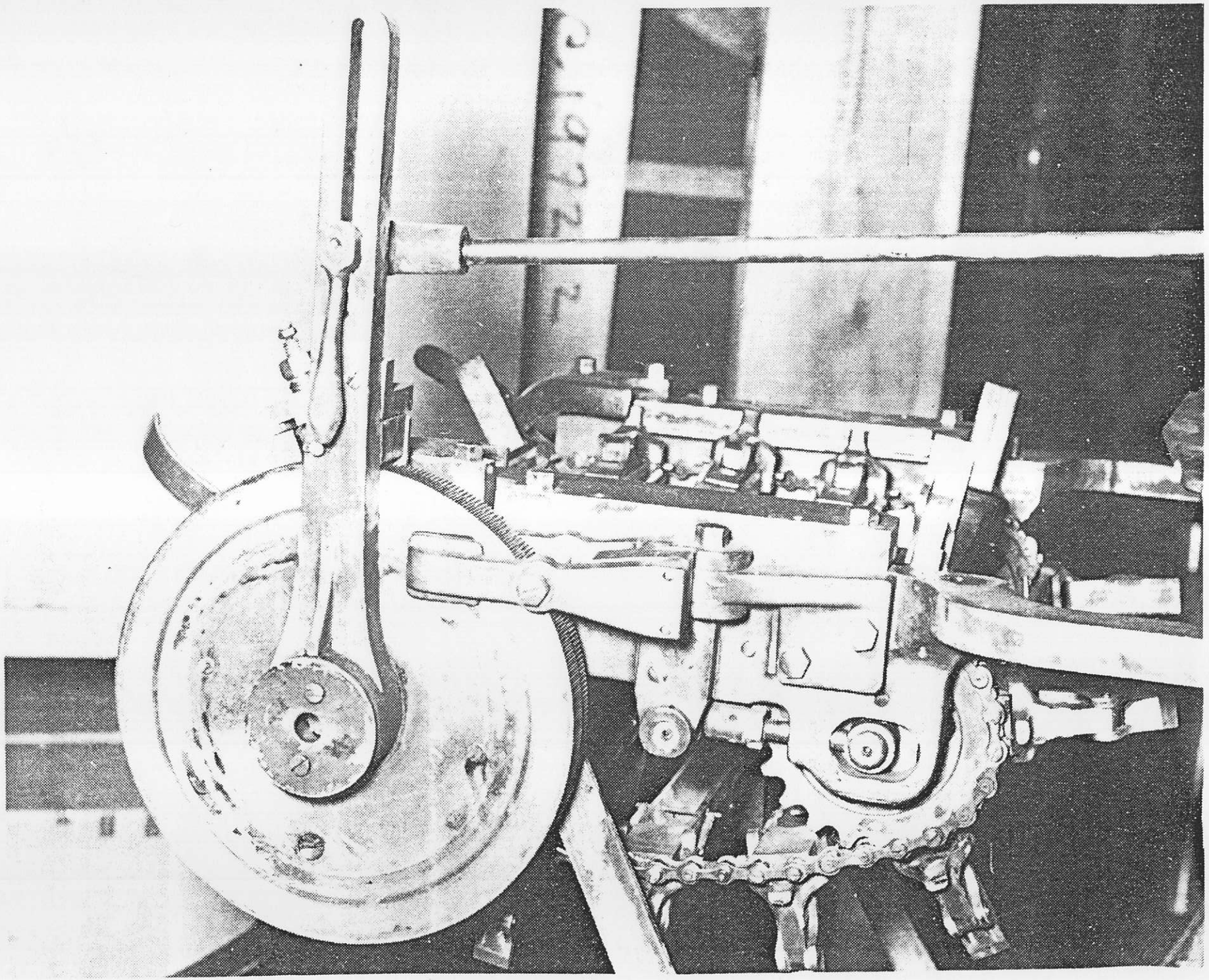


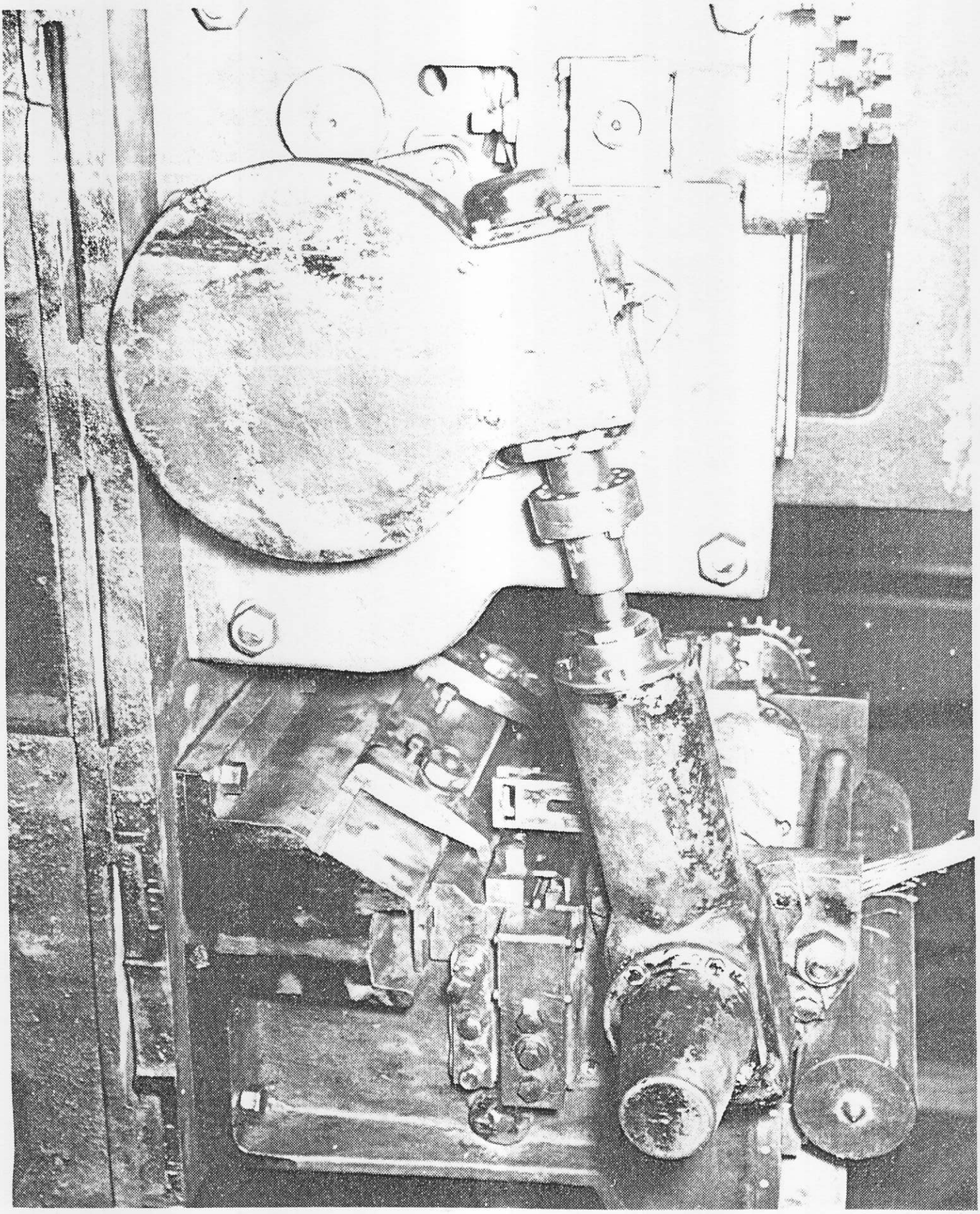


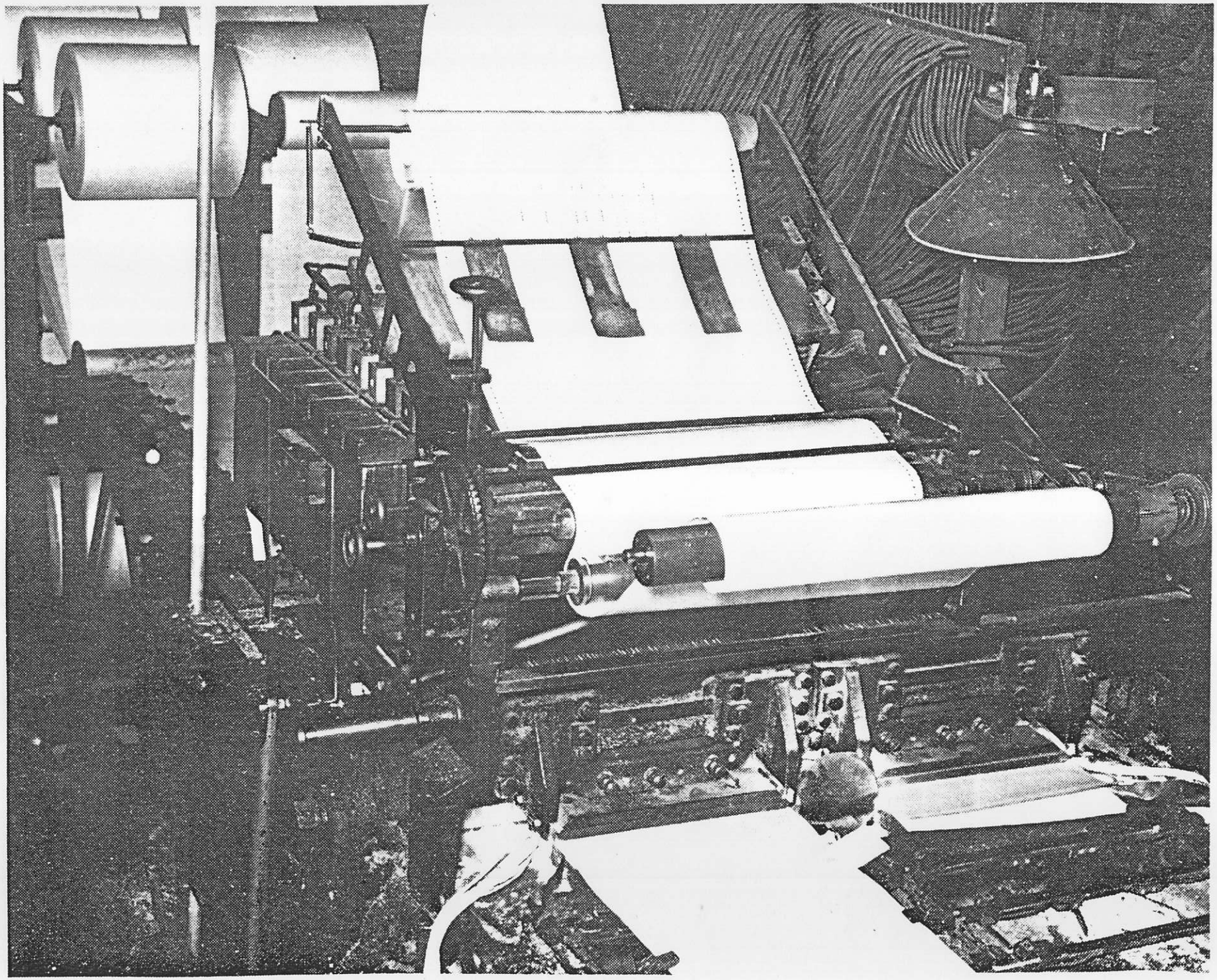


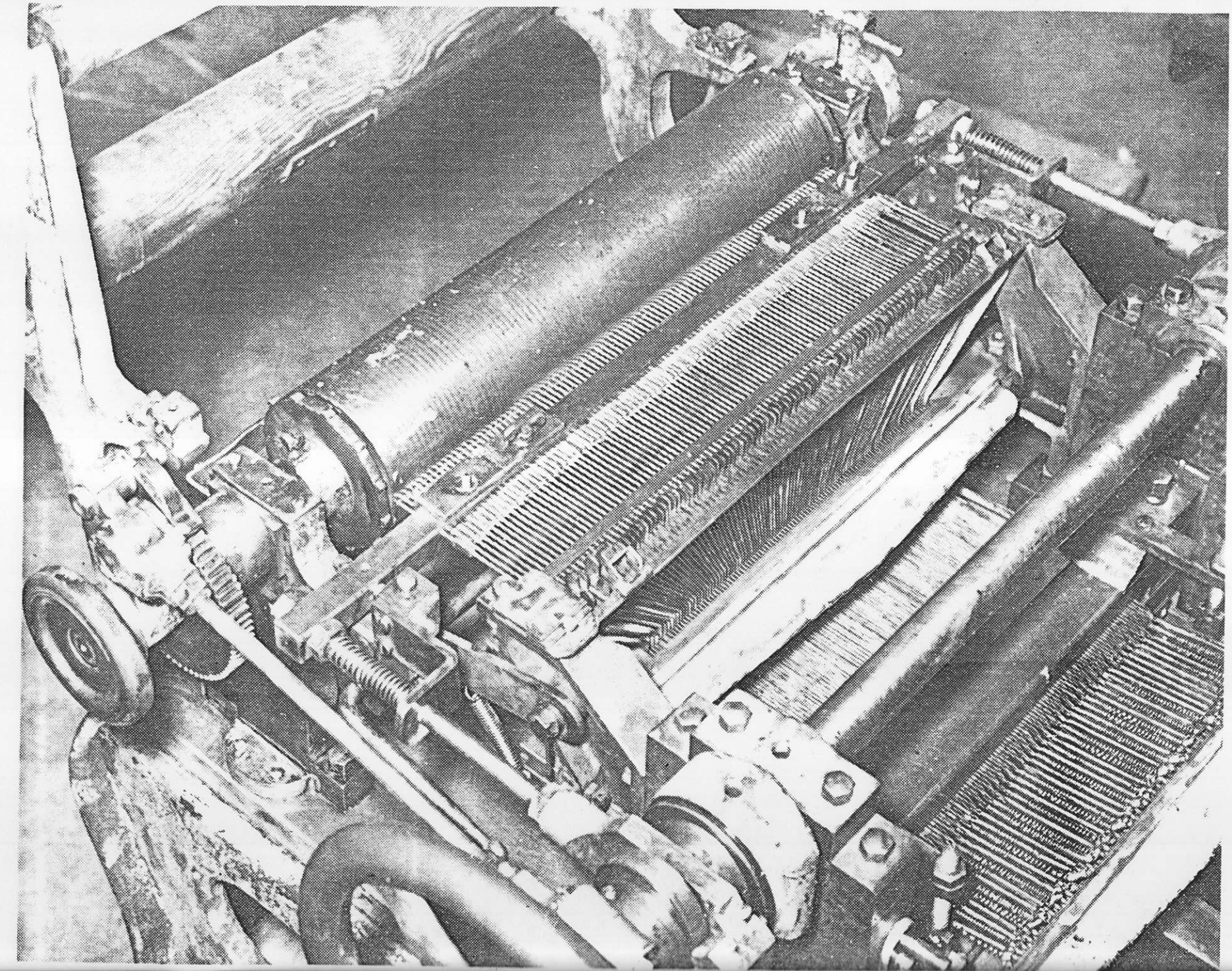


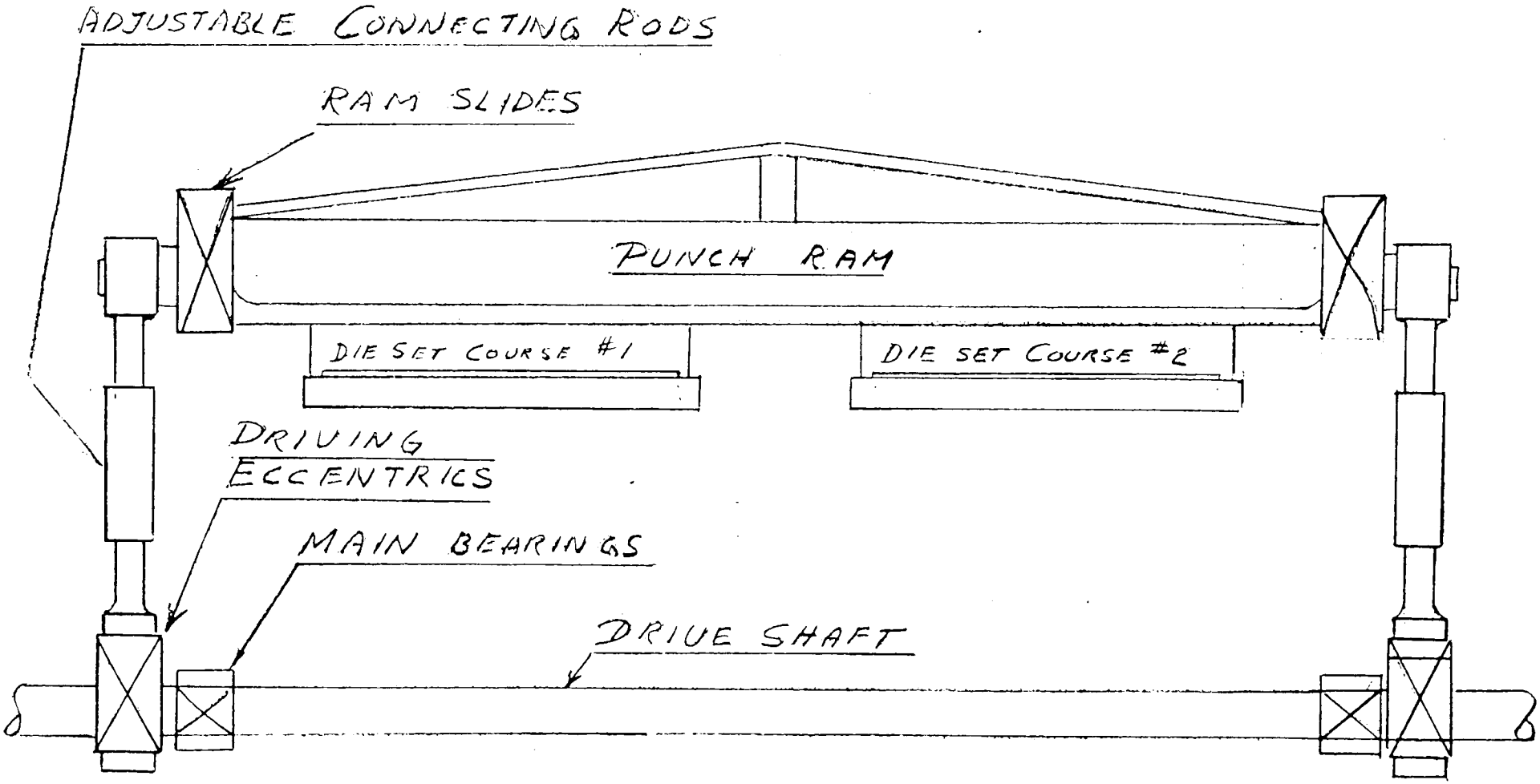








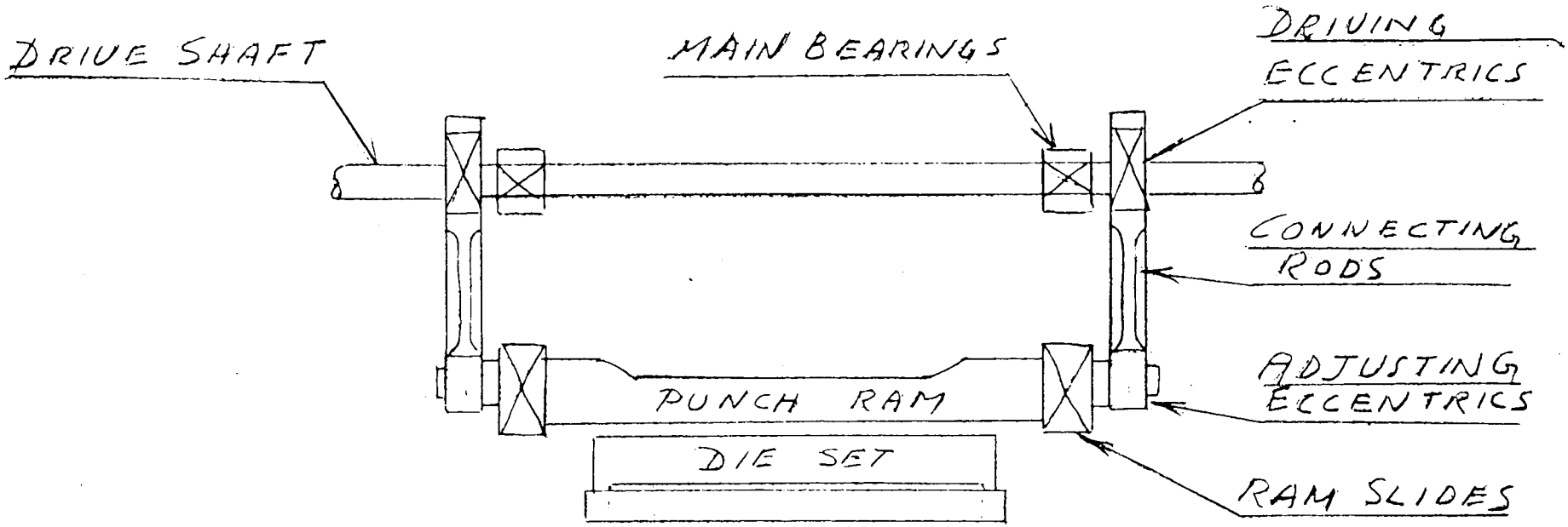




IMPERIAL PUNCH
ACTUATING SYSTEM

FIG. 5

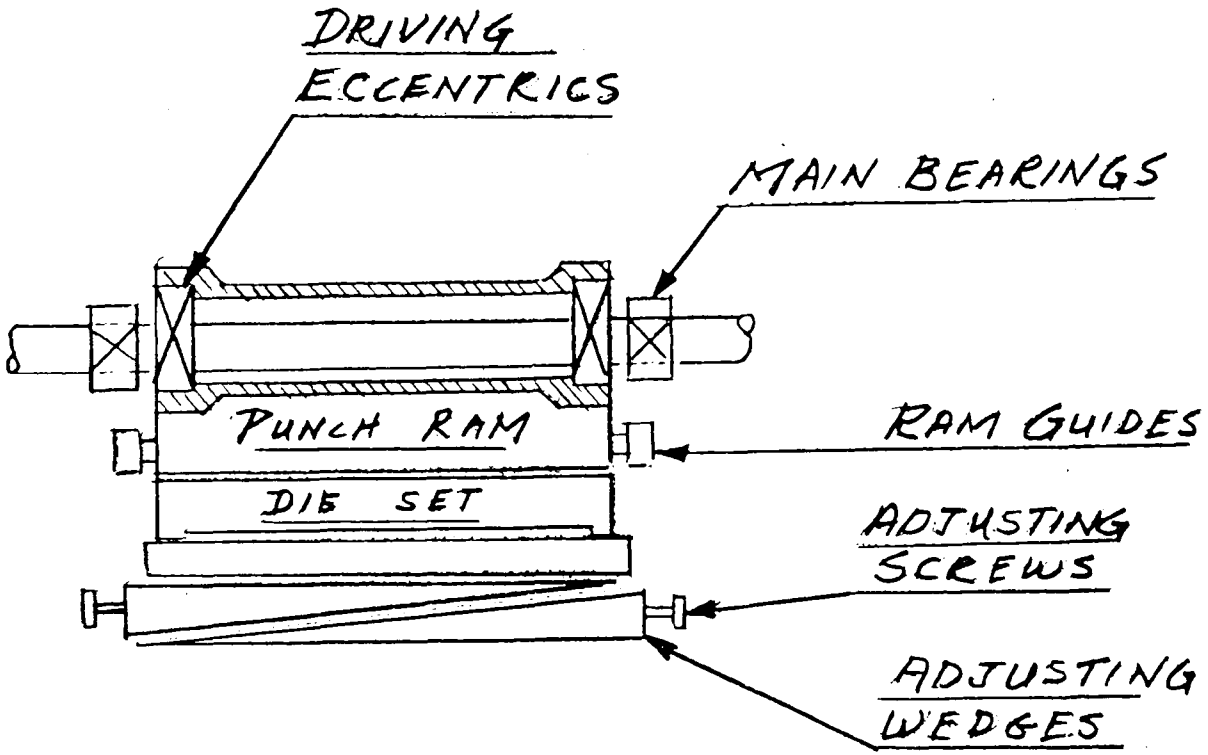
MICO 12-8-50



DUO-ART PUNCH ACTUATING SYSTEM

FIG. 6

MICo 12-8-56



AMPICO PUNCH ACTUATING SYSTEM

FIG. 7

M.I.Co. 12-8-56

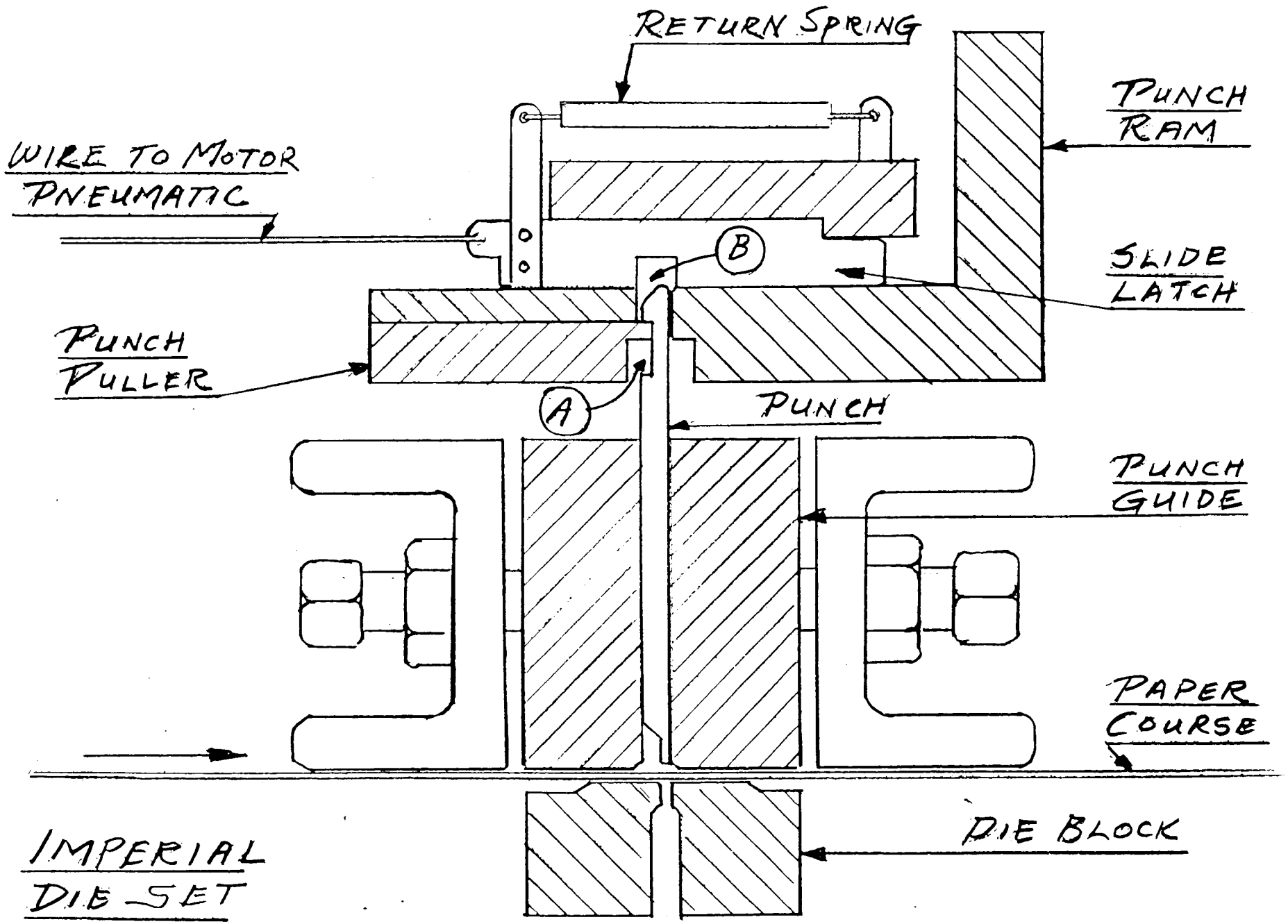
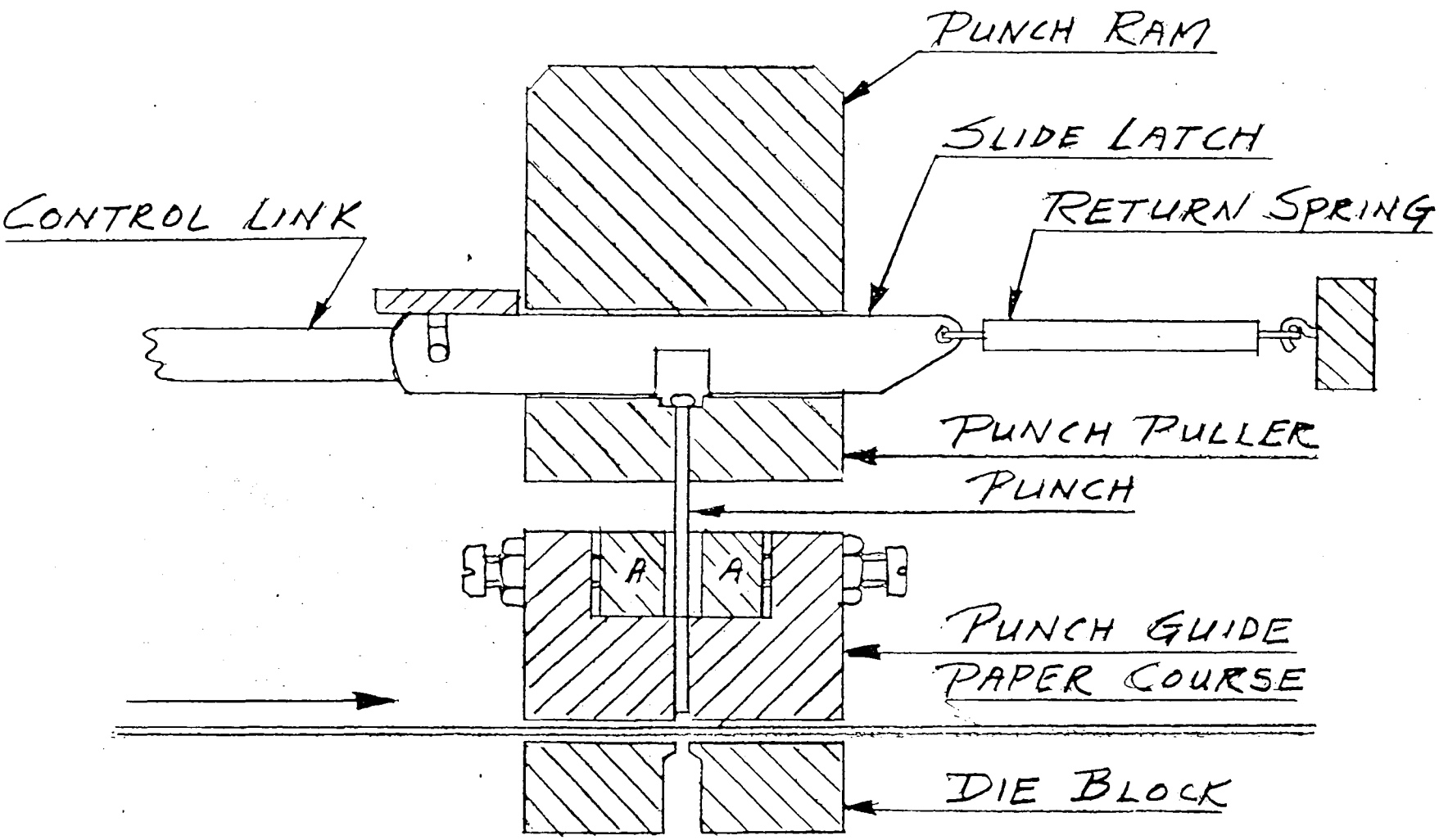


FIG. 11

M.I.Co 12-8-



DUO-ART
DIE SET

FIG. 12

M.I.CO. 12-8-56

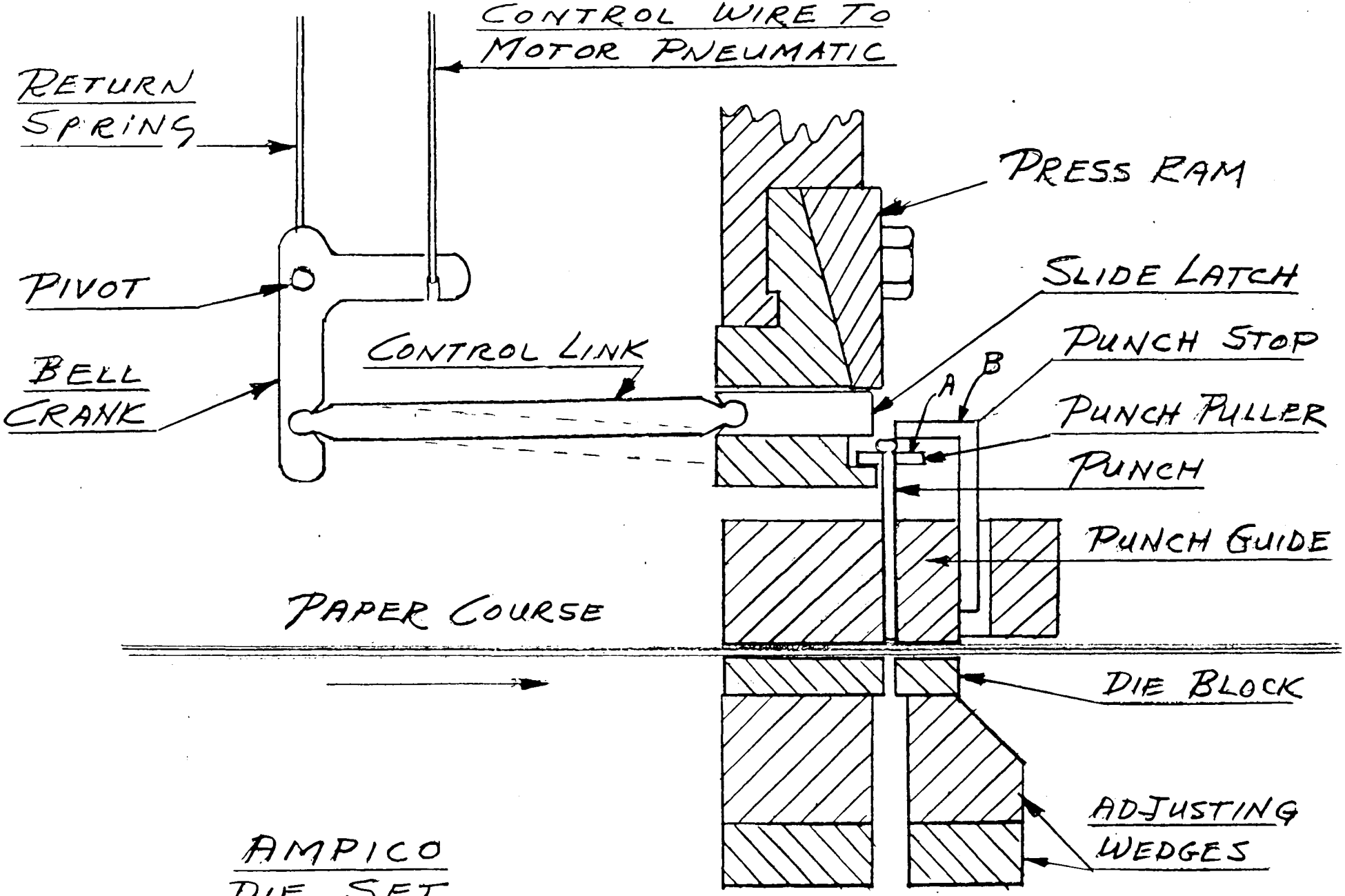


FIG. 13

M.I.Co. 12-8-56