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ROLL ASSEMBLY FOR CONTINUOUS STRIP PICKLING TANKS

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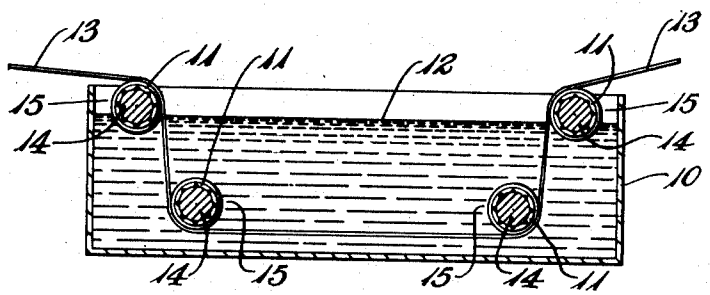


Fig - 1

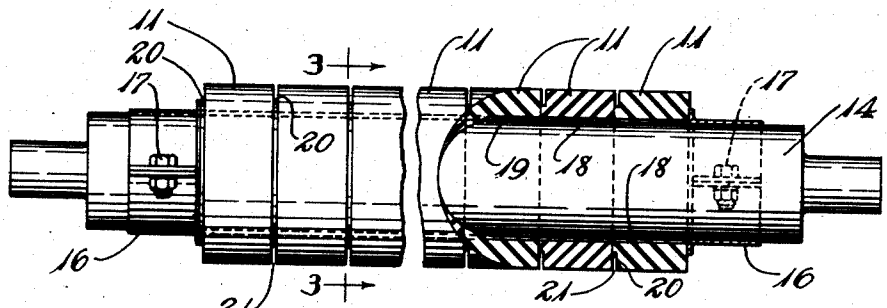


Fig - 2

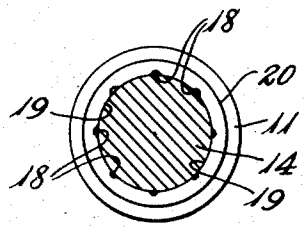


Fig - 3

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ROLL ASSEMBLY FOR CONTINUOUS STRIP PICKLING TANKS

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7 Claims. (Cl. 134—122)

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This invention relates to rolls and especially to idler rolls which are used for guiding and supporting sheet material while it is immersed in a liquid bath. Rolls of this type including hold-down rolls are useful in acid pickling tanks for guiding sheet metal strips through acid baths during the cleaning of the sheet metal in preparation for plating or other processing.

It is necessary in the pickling operations to protect the parts of the rolls and roll assemblies including bearings from the deteriorating effects of the acid solution. In constructions proposed heretofore for such operations a high degree of care in manufacturing and servicing the rolls has been necessary. The prior rolls have not been readily adaptable to variations in the speed of the sheet metal strip or strips passing over the rolls and to variations in the forces exerted upon the rolls by the strip or strips. As a result the metal surfaces at times have been scratched, marred or otherwise damaged. Variations in speed on the rolls occur when the feeding mechanism causes one strip of sheet metal to move at a speed greater or lesser than another strip, or in the case where one edge of a wide strip tends to move at a speed different than the speed of the other edge.

It is important that the sheet metal be free from surface defects because those defects which are formed in the sheet material by the rolls may affect the plating or future processing of the sheet metal surfaces and usually appear in the finished product. In the past, difficulties have been encountered in lubricating the roll bearings because of the fact that if they were submerged it would be extremely difficult to maintain the bearings. It has usually been necessary to use rolls with large diameters in a position in which the bearings are not submerged. In this position it has also been necessary to protect the bearings from acid with slinger rings and other apparatus carried by the rolls.

Objects of the invention are to provide for eliminating or avoiding the foregoing and other difficulties; to provide a roll assembly effectively cushioned by resilient material at the surface for simultaneously receiving and guiding one or more sheet material strips of different widths over the rolls without damaging the sheet material surface; to provide a roll assembly having a plurality of independently rotatable rolls and for lubrication of the rolls by the liquid in which they are immersed, even though the liquid be strong acid; to provide for cushioning and support by adjacent rolls without interference with

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independent rotation of the rolls; to provide an axial relation of the rolls in order that the rolls may rotate independently of each other under load; to provide a roll assembly which is acid-resisting in all of its parts; to provide simplicity of construction, ease of installation and adjustment and to provide for a minimum of maintenance.

These and other objects will be apparent from the following description, reference being had to the drawings in which:

Fig. 1 is a side view in section of rolls constructed in accordance with and embodying the invention, the rolls being shown in position in a pickling tank.

Fig. 2 is a longitudinal view of an assembly of rolls, parts being broken away and sectioned.

Fig. 3 is a section taken along line 3—3 of Fig. 2.

The pickling tank 10 shown in Fig. 1 is an example of the installations in which rolls 11, 11 of the invention may be used to advantage. The tank 10 contains an acid solution or other liquid 12 used for cleaning the surface of a sheet metal strip 13 while it is moving through the liquid. The rolls 11, 11 guide and support the sheet metal strip 13 through the solution 12 and may be entirely immersed in the solution or only partly submerged as shown in Fig. 1.

The rolls 11, 11 may be of a suitable acid-resisting material such as rubber or other rubber-like material and are grouped in roll assemblies 15, 15. Each roll assembly 15 as shown in Fig. 2 has a shaft 14 of acid-resisting material such as Monel metal which may be mounted non-rotatably in the pickling tank 10. The rolls 11, 11 are journaled on the shaft 14 and are mounted in a manner such that they may rotate independently of each other while they are prevented from undue movement along the shaft 14 by flanged collars 16, 16 of acid-resisting material such as Monel metal which are mounted on the shaft adjacent the end rolls. The rolls 11, 11 may be added to the shaft 14 or taken away to provide roll assemblies 15, 15 capable of handling sheet material of various widths. It is also possible to guide several strips of sheet material over the same roll assemblies 15, 15 at the same time without rubbing of the strips against the rolls even though the strips are moving at different speeds. Each strip may be guided by a single roll of each roll assembly or if the width of the strip is greater than the width of a roll 11 it may be guided by two or more rolls. Each collar 16, 16 may be split with the halves held together by bolts 17, 17 also of an acid-resisting material

such as Monel metal in a manner such that the collars may be secured at any position along the shaft 14 to limit the axial separating movement of the rolls 11, 11 longitudinally along the shaft.

The rolls 11, 11 may be formed by suitable means such as molding to produce bearing portions having alternating liquid conducting grooves 18, 18 and roll bearing surfaces 19, 19. The grooves 18, 18 may be disposed longitudinally of the rolls 11, 11 as shown in the drawings and serve to lubricate the intervening roll bearing surfaces 19, 19 with the liquid 12 in which the roller 11 is immersed.

Protruding separating portions 20, 20 at the end faces of the rolls 11, 11 are disposed in a manner such that when one roll abuts an adjacent roll there will be formed a channel 21 between the outer portion of the rolls into which the resilient rubber-like material of the rolls may spread when radially compressed by the sheet metal strips 13, 13. The channels 21, 21 prevent excessive interference of one roll 11 with the rotation of an adjacent roll 11 and also serve to maintain spaces between the rolls for conducting the liquid 12 to the grooves 18, 18 and shaft 14 for lubricating the rolls 11, 11.

When the sheet metal strips 13, 13 are drawn through the pickling tank 10 as shown in Fig. 1 they will move over the rolls 11, 11 and tend to rotate the rolls because of the friction between the outer supporting surfaces of the rolls and the surfaces of the sheet metal strips. The rolls 11, 11 rotate about the shaft 14 and on the roll bearing surfaces 19, 19 of the roll bearing portions. Lubrication is facilitated by the grooves 18, 18 which conduct the liquid 12 in which the roll assembly 15 is immersed to the relatively turning surfaces of the rolls and shaft 14. Each roll 11 is lubricated individually by its respective set of grooves 18, 18 and as long as the shaft 14 upon which it is journaled is immersed or partially submerged in the liquid 12, the liquid will be spread over the bearing surfaces by the action of the grooves upon rotation of the rolls.

It is not always possible to feed the sheet metal strip 13 into the pickling tank 10 at a constant rate and consequently at times the strip will exert more force in compression on the rolls 11, 11 than at other times. As the rolls 15, 15 are of resilient rubber-like material which yields upon increases in the pressure upon the rolls, and expands upon decreases in pressure, contact with the sheet metal strip is maintained during the ordinary changes in pressure which occur and thus reduce or prevent rubbing of the strip surfaces against the roll surfaces which might cause scratches or other defects in the surfaces of the strip 13.

As each roll 11 is rotatable independently of the others it can adapt its speed to the speed of the metal strip 13 or strips passing over it. With the plurality of independently rotatable rolls 11, 11 along the shaft 14 variations in speed of the different strips of the sheet metal over the rolls 11, 11 does not result in objectionable rubbing motion of the metal surfaces on the roll surfaces and marring of the metal surfaces is reduced or eliminated.

The rolls 11, 11 are useful especially for pickling tank operation and other applications where a roll must be used in a submerged or partly submerged position because the lubricant is supplied by the liquid 12 in which the rolls are immersed. A greater depth of immersion of the strips may be obtained and the rolls 11, 11 may be of smaller diameter and occupy less space than rolls which require the bearings to be above the liquid 12 and must necessarily be near the liquid surface. Also, every part of the roll assembly 15 is of an acid-resisting material and there is no danger of deterioration by the action of the acid solution in which the roll assembly is submerged. A large number of the sheet material strips may be accommodated by the rolls 11, 11 even though the speeds of the strips are different. The simplicity of the construction and effectiveness in operation of the roll assembly 15 embodying the invention reduces the cost of manufacture and maintenance to provide economical and efficient idler rolls for use in immersed and partly submerged positions.

Variations may be made without departing from the scope of the invention as it is defined in the following claims.

I claim:

1. An acid-resisting idler roll assembly for guiding and supporting strips of sheet material through an acid-pickling solution, said roll assembly comprising a shaft of acid-resisting material, a plurality of rolls consisting of yieldable resilient acid-resisting rubber-like material, each journaled for independent rotation on said shaft at positions longitudinally along said shaft providing a supporting surface, collars of acid-resisting material adjustably secured on said shaft and disposed at positions adjacent the ends of the roll assembly for limiting axial separating movement of said rolls, each of said rolls having a protruding separating portion at an end face providing a channel between the outer edge of each roll and the outer edge of the adjacent roll to permit movement of the material of said rolls into said channel upon radial compression, and the bearing portion of each of said rolls being capable of lubrication by said solution and formed with a series of alternating longitudinal roll bearing surfaces and solution conducting lubricating grooves in said rubber-like material.

2. A liquid-covered roll assembly for guiding in cushioning relation traveling sheet material in a liquid bath, said roll assembly comprising a shaft having a substantially smooth cylindrical bearing surface, a roll disposed around said shaft and having an inner bearing surface journaled for rotation relative to said shaft and having a substantially cylindrical outer sheet-supporting surface, said roll from said inner bearing surface to said outer sheet-supporting surface and including said surfaces consisting of yieldable resilient rubber-like material effective throughout the radial thickness of the roll wall to cushion the forces exerted by the sheet material against the outer surface of the roll, and the inner bearing surface of said roll having bearing portions of said yieldable resilient rubber-like material separated by grooves therein for conducting liquid of the bath to said bearing portions for lubrication thereof to facilitate rotation of the roll about said shaft under the turning forces exerted on the roll by the traveling sheet material.

3. An acid-covered roll assembly for guiding in cushioning relation traveling sheet material in an acid bath, said roll assembly comprising a shaft having a substantially smooth cylindrical bearing surface of acid-resisting material, a roll disposed around said shaft and having an inner bearing surface journaled for rotation relative to said shaft and having a substantially cylindrical outer sheet-supporting surface, said roll from said inner bearing surface to said outer sheet-supporting surface thereof and including said

surfaces consisting of yieldable resilient acid-resisting rubber-like material effective throughout the radial thickness of the roll wall to cushion the forces exerted by the sheet material against the outer surface of the roll, and the inner bearing surface of said roll having bearing portions of said yieldable resilient acid-resisting rubber-like material separated by grooves therein for conducting acid of the bath to said bearing portions for lubrication thereof to facilitate rotation of the roll about said shaft under the turning forces exerted on the roll by the traveling sheet material.

4. A liquid-covered roll assembly for guiding in cushioning relation traveling sheet material in a liquid bath, said roll assembly comprising a shaft having a substantially smooth cylindrical bearing surface, a plurality of rolls disposed around said shaft and having inner bearing surfaces journaled for independent rotation relative to said shaft and together providing substantially cylindrical outer sheet-supporting surfaces, each roll from inner bearing surface to outer sheet-supporting surface thereof and including the said surfaces consisting of yieldable resilient rubber-like material effective throughout the radial thickness of the roll wall to cushion the forces exerted by the sheet material against the outer surface of the roll, and the inner bearing surface of each roll having bearing portions of said yieldable resilient rubber-like material separated by grooves therein for conducting liquid of the bath to said bearing portions for lubrication thereof to facilitate rotation of the roll about said shaft under the turning forces exerted on the roll by the traveling sheet material.

5. An acid-covered roll assembly for guiding in cushioning relation traveling sheet material in an acid bath, said roll assembly comprising a shaft having a substantially smooth cylindrical bearing surface of acid-resisting material, a plurality of rolls disposed around said shaft and having inner bearing surfaces journaled for independent rotation relative to said shaft and together providing substantially cylindrical outer sheet-supporting surfaces, each roll from inner bearing surface to outer sheet-supporting surface thereof and including the said surfaces consisting of yieldable resilient acid-resisting rubber-like material effective throughout the radial thickness of the roll wall to cushion the forces exerted by the sheet material against the outer surface of the roll, and the inner bearing surface of each roll having bearing portions of said yieldable resilient acid-resisting rubber-like material separated by grooves therein for conducting acid of the bath to said bearing portions for lubrication thereof to facilitate rotation of the roll about said shaft under the turning forces exerted by the traveling sheet material.

6. A roll assembly for guiding in cushioning relation traveling sheet material in a liquid bath, said roll assembly comprising a shaft having a rounded surface, a plurality of rolls having inner bearing surfaces journaled for independent rotation on said shaft and together providing substantially cylindrical outer sheet-supporting surfaces, each roll from inner bearing surface to outer sheet-supporting surface thereof and including said surfaces consisting of yieldable resilient rubber-like material effective throughout the radial thickness of the roll wall to cushion the forces exerted by the sheet material against the outer surface of the roll, at least one of said rolls having a protruding separating portion at an end face providing a space between adjacent rolls into which material of said rolls may move upon radial compression and the inner bearing surface of each roll having bearing portions of said yieldable resilient rubber-like material separated by grooves therein for conducting liquid of the bath to said bearing portions for lubrication thereof to facilitate rotation of the roll about said shaft under the turning forces exerted on the roll by the traveling sheet material.

7. A liquid-covered roll assembly comprising a shaft non-rotatably mounted and having a substantially smooth cylindrical bearing surface, a roll disposed around said shaft and being journaled for rotation relative to said shaft, said roll having a supporting surface at the periphery and consisting of yieldable resilient rubber-like material throughout the radial thickness of the roll wall to cushion forces exerted against said supporting surface and said roll having a bearing portion at the radially inner face formed in alternating bearing surfaces and liquid-conducting grooves for lubrication by said liquid.

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