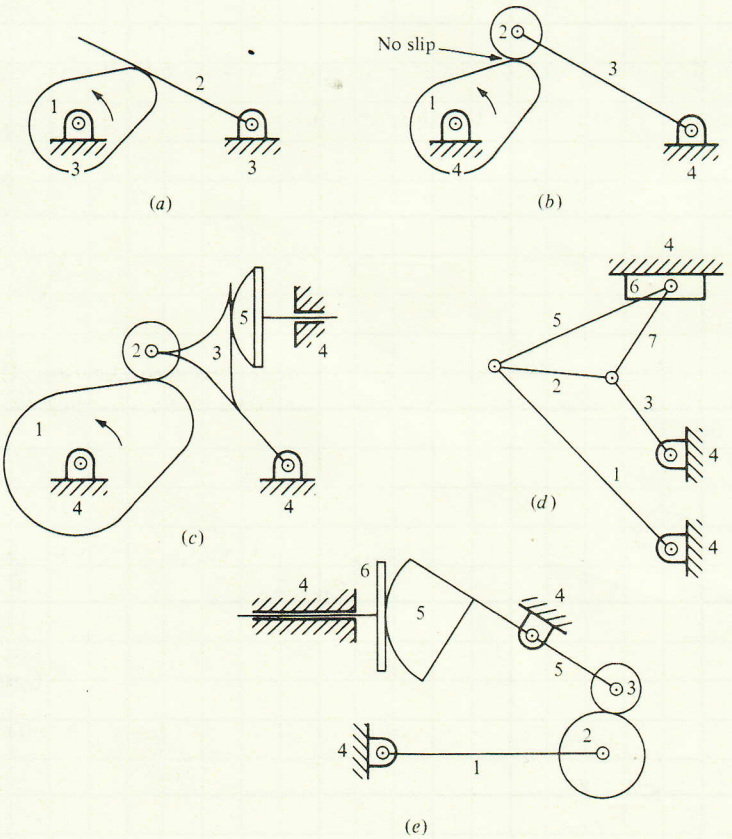
PROBLEM: USING THE MECHANISMS BELOW, DRAW THE ASSOCIATED ISOMER AND USING THE LIBRARY OF ISOMERS IN THE LECTURE NOTES IDENTIFY THE ISOMER DESIGNATION (NUMBER).

GIVEN:
1. MECHANISMS BELOW
2. LECTURE NOTES LIBRARY OF ISOMERS

ASSUMPTIONS:
1. ALL MECHANISMS ARE PLANAR
2. ALL LINKS ARE RIGID
3. ALL JOINTS ARE FRICTIONLESS

FIND:
1. DRAW THE APPROPRIATE ISOMER FOR EACH MECHANISM
2. IDENTIFY THE ISOMER'S DESIGNATION IN THE LIBRARY OF ISOMERS FROM THE LECTURE NOTES.

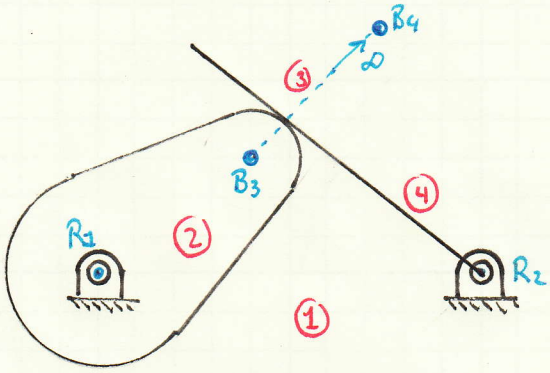
FIGURE:

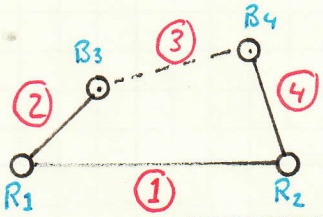


LINKS ARE IDENTIFIED BY RED NUMBERS
JOINTS / KINEMATIC PAIRS ARE IDENTIFIED IN BLUE

SOLUTION:

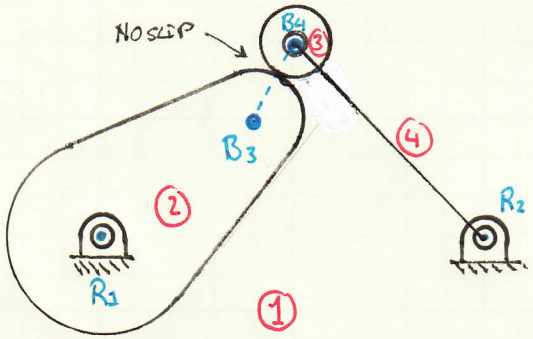
(a)

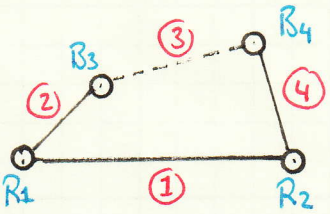




DESIGNATION: $M = {}^{+}1, I-1$

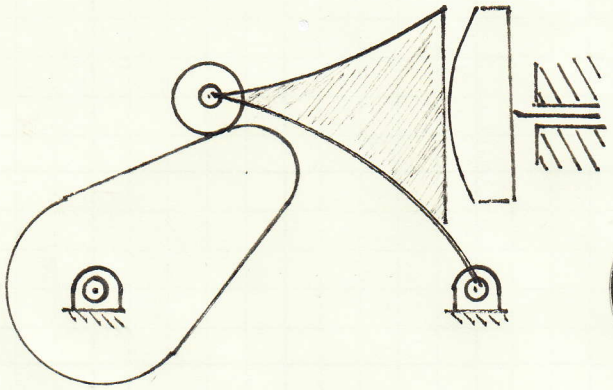
(b)

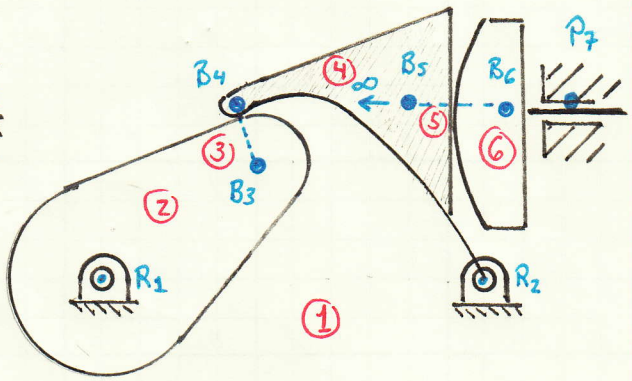




DESIGNATION: $M = {}^{+}1, I-1$

(c)

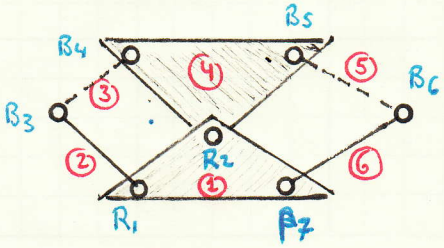




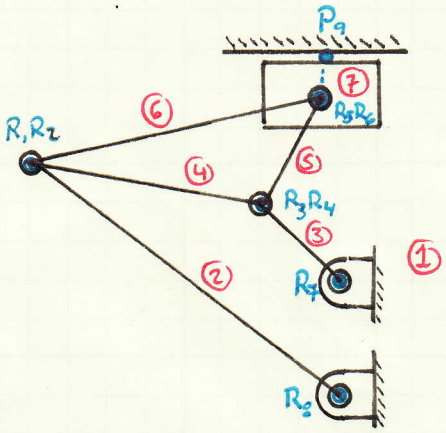
TO FIND THE APPROPRIATE ISOMER THE REDUNDANT KINEMATIC ELEMENTS NEED TO BE REDUCED.

DESIGNATION: $M = {}^{+}1, II-1$

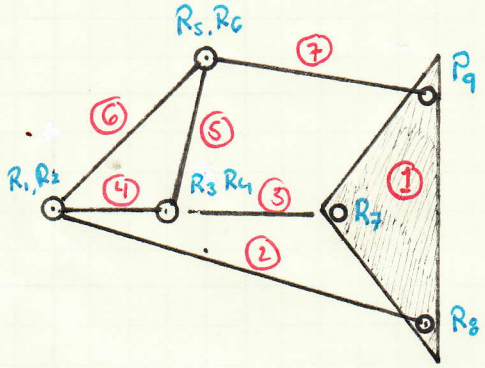
WATTS LINKAGE



(d)

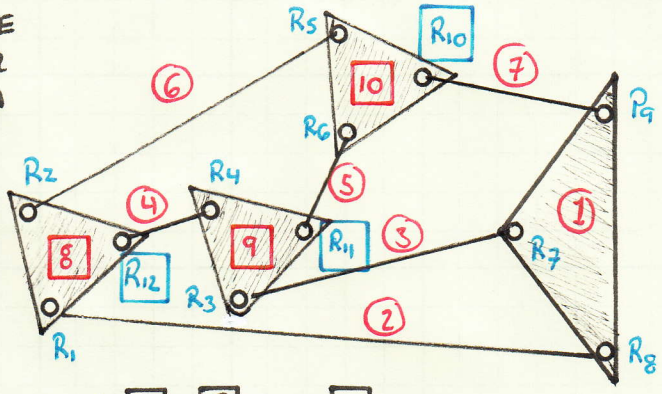


TO FIND THE APPROPRIATE ISOMER THE HIGHER ORDER JOINTS NEED TO BE EXPANDED.



THE ISOMER CATALOG IN THE LECTURE DOES NOT INCLUDE HIGHER ORDER JOINTS, THUS THEY WILL HAVE TO BE EXPANDED. THE STRUCTURE SHOWN HAS A MOBILITY OF M = 0

SINCE THE CATALOG IN THE LECTURE DOES NOT CONTAIN HIGHER ORDER JOINTS (JOINTS WITH MORE THAN TWO LINKS), EACH HIGHER ORDER LINK NEEDS TO BE EXPANDED SUCH THAT THERE ARE ONLY TWO LINKS ATTACHED AT EACH JOINT.



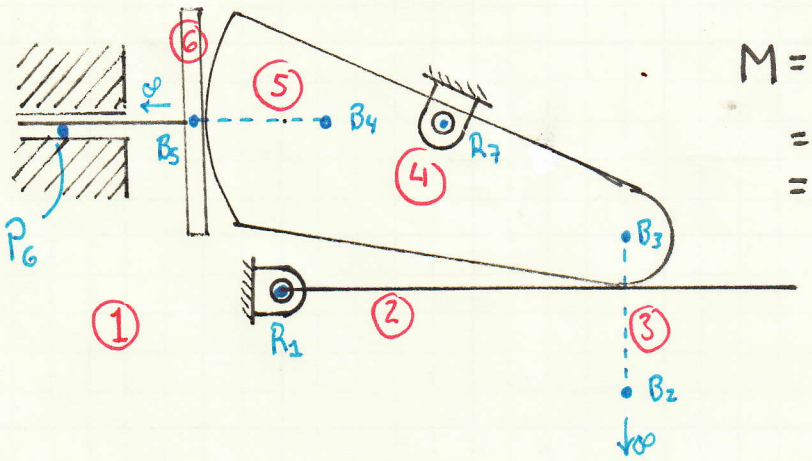
EXPANSION OF THE HIGHER ORDER JOINTS ADDS TERNARY LINKS [8], [9], AND [10] ALONG WITH JOINTS [R_{10}], [R_{11}], AND [R_{12}]. THE MOBILITY OF THIS MECHANISM IS

$$M = 3(L-1) - 2\cdot J = 3(10-1) - 2\cdot(12) = 3\cdot 9 - 2\cdot 12 = 27 - 24 = 3$$

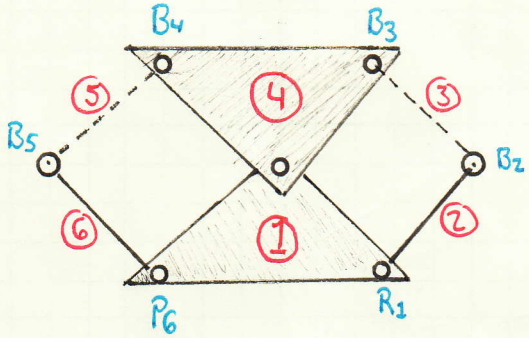
THIS MAKES SENSE SINCE FROM LINKAGE TRANSFORMATION RULE 6 A "COMPLETE" SHRINKAGE OF A LINK TAKES AWAY 1 DoF, SO A "COMPLETE" EXPANSION WOULD ADD 1.

THE LIBRARY IN THE LECTURE DOES NOT GO UP TO M=3

(e) STARTING WITH THE REDUNDANT LINKS (ROLLERS) REMOVED.



$$M = 3(L-1) - 2J$$
$$= 3(6-1) - 2(7)$$
$$= 3\cdot(5) - 2(7) = 15-14$$
$$= 1$$



DESIGNATION M=+1, II-1

SUMMARY: THE SOLUTION TO THIS EXERCISE REQUIRED SEVERAL STEPS TO GET THE MECHANISM INTO A COMPATIBLE FORM WITH THE ISOMERS CATALOGED IN THE LECTURE NOTES.

1. ALL REDUNDANT COMPONENTS NEED TO BE REMOVED FROM THE MECHANISM IN ORDER TO INSURE THAT THE ISOMER WILL HAVE THE DESIRED MOBILITY.
2. AN ISOMER IS DRAWN DIRECTLY FROM THE MECHANISM THAT RESULTED FROM STEP 1.
3. USING THE LINKAGE TRANSFORMATION RULES, TRANSFORM THE ISOMER THAT WAS CONSTRUCTED IN (2) INTO AN ISOMER WITH ONLY LOWER ORDER JOINTS (JOINTS THAT REMOVE 2 DoF, LEAVING 1 DoF) AND ALL FIRST ORDER JOINTS (ONLY TWO LINKS CONNECTING AT EACH POINT)

ONLY AFTER THE ISOMERS HAVE BEEN REDUCED TO A COMPATIBLE FORM CAN THE BE FOUND IN THE CATALOG. WHEN LOOKING FOR ISOMERS IN THE CATALOG FOCUS ON THE ORDER OF THE LINKS (BINARY, TERNARY, ETC) AND HOW THEY ARE CONNECTED.